Final Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada – Nevada Rail Transportation Corridor DOE/EIS-0250F-S2

and

Final Environmental Impact Statement for a Rail Alignment for the Construction and Operation of a Railroad in Nevada to a Geologic Repository at Yucca Mountain, Nye County, Nevada DOE/EIS-0369

Volume III

Rail Alignment EIS - Chapter 4

U.S. Department of Energy
Office of Civilian Radioactive Waste Management

June 2008

TABLE OF CONTENTS

Section **Page**

VOLUME I

CHAPTER 1. PURPOSE AND NEED FOR AGENCY ACTION

CHAPTER 2. PROPOSED ACTION AND ALTERNATIVES

VOLUME II

CHAPTER 3. AFFECTED ENVIRONMENT

VOLUME III

CHAPTER 4. ENVIRONMENTAL IMPACTS

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

Section **Page**

TABLE OF CONTENTS (continued)

Section **Page**

TABLE OF CONTENTS (continued)

Section **Page**

LIST OF TABLES

LIST OF TABLES (continued)

Section **Page**

LIST OF TABLES (continued)

Section **Page**

LIST OF TABLES (continued)

Section **Page**

LIST OF TABLES (continued)

Section **Page**

LIST OF TABLES (continued)

Section **Page**

LIST OF TABLES (continued)

Section **Page**

LIST OF TABLES (continued)

Section **Page**

LIST OF TABLES (continued)

Section **Page**

LIST OF TABLES (continued)

Section **Page**

LIST OF TABLES (continued)

Section **Page**

LIST OF TABLES (continued)

Section **Page**

LIST OF FIGURES

Figure **Page**

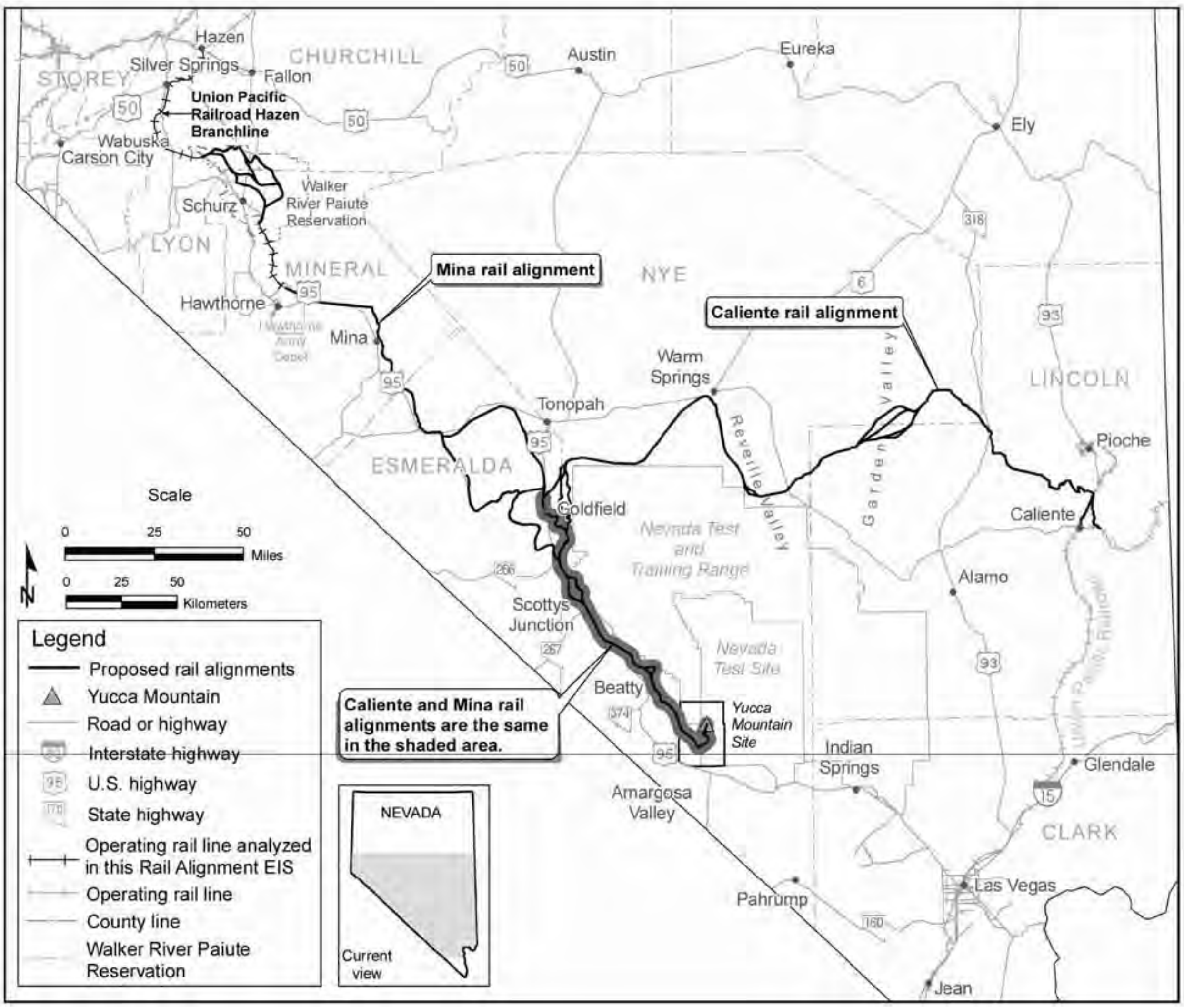
LIST OF FIGURES (continued)

Figure **Page**

4. ENVIRONMENTAL IMPACTS

This chapter describes the potential environmental impacts of constructing and operating a railroad along the Caliente rail alignment or the Mina rail alignment. An impact would be any change, positive or negative, from the existing (baseline) conditions described in Chapter 3 for each environmental resource area. The No-Action Alternative represents a continuation of baseline conditions.

Glossary terms are shown in ***bold italics***.



4.1 Introduction

This chapter begins with a description of ***impacts*** associated with the ***No-Action Alternative*** (Section 4.1.1). As described in Section 2.3, under the No-Action Alternative, the U.S. Department of Energy (DOE or the Department) would not select a ***rail alignment*** or build a ***railroad*** within the Caliente ***rail corridor*** or the Mina rail corridor and would relinquish public lands withdrawn or segregated from surface and mineral entry. The description of impacts associated with the No-Action Alternative applies to both rail corridors and all ***rail line alternative segments*** and ***common segments***. Section 4.1.2 introduces descriptions of impacts associated with the ***Proposed Action.***

Sections 4.2 and 4.3 describe potential impacts associated with construction and operation of the proposed railroad along the Caliente rail alignment and the Mina rail alignment under the Proposed Action, including a ***Shared-Use Option***.

Proposed Action: To determine a rail alignment within a rail corridor in which to construct and operate a railroad to transport spent nuclear fuel, high-level radioactive waste, and other materials from an existing railroad in Nevada to a repository at Yucca Mountain, Nye County, Nevada. The Proposed Action includes the construction of railroad construction and operations support facilities.

This Rail Alignment EIS analyzes two alternatives that would implement the Proposed Action: the Caliente rail alignment and the Mina rail alignment.

This Rail Alignment EIS also analyzes a Shared-Use Option for each implementing alternative, under which DOE would allow commercial shippers to use the rail line for transportation of general freight.

No-Action Alternative: DOE would not implement the Proposed Action within the Caliente rail corridor or the Mina rail corridor.

4.1.1 IMPACTS ASSOCIATED WITH THE NO-ACTION ALTERNATIVE

The No-Action Alternative establishes a ***baseline*** for comparison with the Proposed Action to determine potential impacts of constructing and operating the proposed railroad.

Under the No-Action Alternative, DOE would not implement the Proposed Action within the Caliente rail corridor or the Mina rail corridor and would relinquish public lands withdrawn from surface and mineral entry (see Section 1.5.1). Under the No-Action Alternative, there would be no impacts to natural, human-health, social, economic, or cultural resources from construction and operation of a railroad in Nevada for shipments of ***spent nuclear fuel***, ***high-level radioactive waste***, and ***other materials*** from an existing railroad to a ***geologic repository*** at Yucca Mountain.

Under the No-Action Alternative, DOE would not cause changes in current public land uses such as grazing and recreation; uses of public land would remain subject to Bureau of Land Management (BLM) administration under applicable resource management plans. The BLM would continue to manage resources, such as biological and cultural resources and scenic values. Under the No-Action Alternative, DOE would not cause changes to existing conditions on the Walker River Paiute Reservation or at the Hawthorne Army Depot.

The location and extent of new mining claims and the associated development of mineral commodities, although not known with any certainty, would no longer be limited by the Public Land Orders described in Section 1.5.1.

4.1.2 IMPACTS ASSOCIATED WITH THE PROPOSED ACTION

Chapter 3 describes the ***affected environment*** for 16 environmental resource areas that could be affected if DOE were to construct and operate the proposed railroad along the Caliente rail alignment or the Mina rail alignment under the Proposed Action.

The description of potential environmental impacts focuses on environmental resources within and adjacent to the Caliente rail alignment (Section 4.2) and the Mina rail alignment (Section 4.3), and the locations of railroad ***construction and operations support facilities*** outside the ***nominal*** width of the rail line ***construction right-of-way***.

This chapter describes potential impacts by environmental resource area and identifies potential impacts as either ***direct*** or ***indirect***, and either ***short-term*** or ***long-term***.

Direct impact: An effect that results solely from the construction or operation of a proposed action without intermediate steps or processes. Examples include habitat destruction, soil disturbance, air emissions, and water use.

Indirect impact: An effect that is related to but removed from a proposed action by an intermediate step or process. Examples include surface-water quality changes resulting from soil erosion at construction sites, and reductions in productivity resulting from changes in soil temperature.

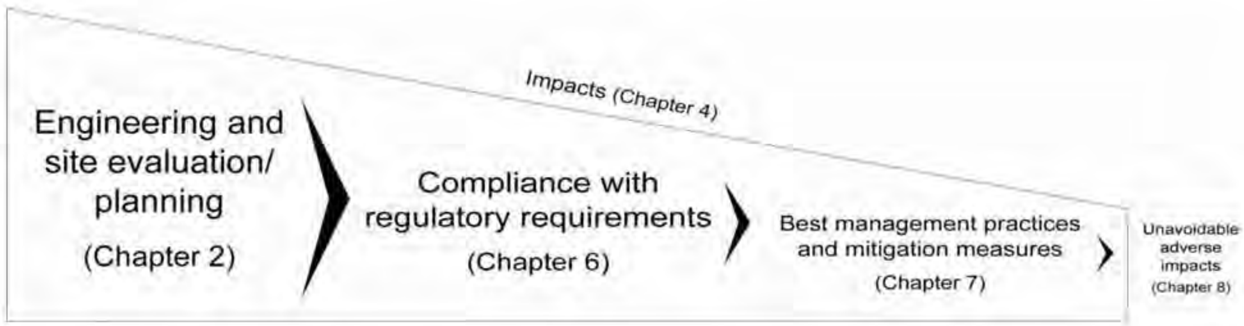
Short-term impacts: In this Rail Alignment EIS, impacts limited to the construction phase (4 to 10 years).

Long-term impacts: In this Rail Alignment EIS, impacts that could occur throughout and beyond the life of the railroad operations phase (up to 50 years).

The chapter is organized as follows:

- Physical setting (Sections 4.2.1 and 4.3.1)
- Land use and ownership (Sections 4.2.2 and 4.3.2)
- Aesthetic resources (Sections 4.2.3 and 4.3.3)
- Air quality and climate (Sections 4.2.4 and 4.3.4)
- Surface-water resources (Sections 4.2.5 and 4.3.5)
- Groundwater resources (Sections 4.2.6 and 4.3.6)
- Biological resources (Sections 4.2.7 and 4.3.7)
- Noise and vibration (Sections 4.2.8 and 4.3.8)
- Socioeconomics (Sections 4.2.9 and 4.3.9)
- Occupational and public health and safety (Sections 4.2.10 and 4.3.10)
- Utilities, energy, and materials (Sections 4.2.11 and 4.3.11)
- Hazardous materials and waste (Sections 4.2.12 and 4.3.12)
- Cultural resources (Sections 4.2.13 and 4.3.13)
- Paleontological resources (Sections 4.2.14 and 4.3.14)
- Environmental justice (Sections 4.2.15 and 4.3.15)

During the engineering and site evaluation and planning phase for the proposed railroad, DOE considered many factors to avoid or minimize potential environmental impacts (see Chapter 2), and would continue to consider these factors during the final design phase. As part of the Proposed Action, DOE would meet all applicable regulatory requirements during construction and operation of the proposed railroad (see Chapter 6), and would implement best management practices to ensure compliance with requirements (see Chapter 7). DOE could also implement measures to mitigate (see Chapter 7) any impacts remaining after final design and compliance with regulatory requirements and implementation of best management practices. The impacts analyses in this chapter considered the foregoing to arrive at predictions of potential impacts, as illustrated in the following graphic. Each phase shown in the graphic reduces impacts. Ultimately, there could be unavoidable impacts (see Chapter 8).



Where possible, DOE has quantified potential impacts. For example, for the air quality analysis DOE used emissions inventories to determine existing air quality at the county level, and performed air quality simulations to determine potential changes in air-pollutant concentrations at specific receptor locations. Thus, the Department is able to provide a numerical assessment of potential impacts.

In other cases (such as the analysis of impacts to aesthetic resources), it is not possible to quantify impacts and DOE provides a ***qualitative*** assessment of potential impacts. The Department has used the following descriptors to qualitatively characterize impacts where quantification of impacts was not practical:

- **Small** - For the issue, environmental effects would not be detectable or would be so minor that they would neither destabilize nor noticeably alter any important attribute of the resource.
- **Moderate** - For the issue, environmental effects would be sufficient to alter noticeably, but not to destabilize, important attributes of the resource.
- **Large** - For the issue, environmental effects would be clearly noticeable and would be sufficient to destabilize important attributes of the resource.

Analyses used throughout this Rail Alignment EIS are designed to provide conservative estimates of the impacts that may occur. Where appropriate, cautious but reasonable assumptions are employed; thus, the analyses have a tendency to overestimate impacts. Unless otherwise noted, potential impacts described in this and other chapters would be adverse.

Each environmental resource section in this chapter describes the methodology DOE used to assess potential impacts for that resource. Each section provides a ***quantitative*** or qualitative description of potential impacts, and, where appropriate, tables summarize and compare the identified impacts for alternative segments, common segments, and construction and operations support facilities for each rail alignment.

4.1.3 PERCEIVED RISK AND STIGMA

In the *Final Environmental Impact Statement for* a *Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (Yucca Mountain FEIS; DIRS 155970-DOE 2002, Section 2.5.4), DOE evaluated ***perceived risk and stigma*** associated with construction and operation of a ***repository*** at Yucca Mountain and from the transportation of spent nuclear fuel and high-level radioactive waste. As stated in the Yucca Mountain FEIS, DOE recognizes that nuclear facilities can be perceived to be either positive or negative, depending on the underlying value systems

Perceived risk and stigma: DOE uses the term risk perception to mean how an individual perceives the amount of risk from a certain activity. Studies show that perceived risk varies with certain factors, such as whether the exposure to the activity is voluntary, the individual's degree of control over the activity, the severity of the exposure, and the timing of the consequences of the exposure. DOE uses stigma to mean an undesirable attribute that blemishes or taints an area or locale.

of the individual forming the perception. Thus, perception-based impacts would not necessarily depend on the actual physical impacts or risk of repository operations, including transportation. A further complication is that people do not consistently act in accordance with negative perceptions; thus, the connection between public perception of risk and future behavior would be uncertain or speculative at best.

DOE concluded that, although public perception regarding the proposed geologic repository and transportation of spent nuclear fuel and high-level radioactive waste could be measured, there is no valid method to translate these perceptions into quantifiable economic impacts. Researchers in the social sciences have not found a way to reliably forecast linkages between perceptions or attitudes reported in surveys and actual future behavior. At best, only a qualitative assessment is possible about what broad outcomes seem most likely. The Yucca Mountain FEIS did identify some studies that report, at least temporarily, a small relative decline in residential property values might result from the designation of transportation corridors in urban areas.

The Yucca Mountain FEIS presents the following conclusions regarding perceived risk and stigma:

- While in some instances risk perceptions could result in adverse impacts on portions of a local economy, there are no reliable methods whereby such impacts could be quantified with any degree of certainty.
- Much of the uncertainty is irreducible.
- Based on a qualitative analysis, adverse impacts from perceptions of risk would be unlikely or relatively small.

The more detailed discussion of perceived risk and stigma related to the Yucca Mountain FEIS Proposed Action is incorporated into this Rail Alignment Environmental Impact Statement (EIS) by reference (DIRS 155970-DOE 2002, pp. 2-95 and 2-96).

An independent economic impact study (DIRS 172307-Riddel, Boyett, and Schwer 2003, all) conducted since DOE completed the Yucca Mountain FEIS examined, among other things, the social costs of perceived risk to Nevada households living near transportation routes. The study developed such an estimate in terms of households having a willingness to accept compensation for different levels of perceived risk and a willingness to pay to avoid risk. The results of the study indicated that during the first year of transport, net job losses (and associated drop in residential real estate demand and decreases in gross state product) in relation to the baseline would occur in response to people moving to protect themselves from transport risk. However, the initial impact would be offset rapidly, as the population shifted to a more risk-tolerant base. The results of this study are similar to the studies identified in the Yucca Mountain FEIS.

Other conclusions of this study are that the public and DOE have widely divergent risk beliefs and that the public is very uncertain about the risks they face. At the same time, more than 40 percent of the respondents in a public survey conducted as part of this study felt that DOE information is reliable or very reliable, while another 40 percent felt that DOE information is somewhat reliable. These results suggest social costs could be mitigated by reducing the risk people perceive from transport through information and education programs that are well researched and effectively presented.

While stigmatization of southern Nevada can be envisioned under some scenarios, it is not inevitable or numerically predictable. Any such stigmatization would likely be an aftereffect of unpredictable future events, such as serious accidents, which might not occur. Therefore, DOE did not attempt to quantify any potential for impacts from risk perceptions or stigma in this Rail Alignment EIS.

4.1.4 CONSISTENCY WITH BUREAU OF LAND MANAGEMENT RESOURCE MANAGEMENT PLANS

During the preparation of this Rail Alignment EIS, DOE and BLM reviewed resource management plans for lands that would be affected by the Caliente and Mina rail alignments to identify potential inconsistencies with the plans. An inconsistency is defined as a component of the Proposed Action or alternatives that would not be allowed by the BLM without preparation and approval of an amendment to the resource management plan.

The resource management plans address the types of land uses the BLM considers to be allowable so that various resources (such as soils, wildlife, and recreation) are protected and multiple-use land-management objectives would be achieved. The following plans were reviewed: Proposed Ely Resource Management Plan, Tonopah Resource Management Plan, Las Vegas Resource Management Plan, and Carson City Consolidated Resource Management Plan. These plans are referenced in many sections of Chapters 3 and 4 for resource areas managed by the BLM. Additional information about the plans are included in sections 3.2.2.4.1, 3.3.2.4.1, 4.2.2.2.3.1, 4.3.2.2.3.1, 5.2.1.2.3, and 5.3.1.2.3. DOE and BLM did not identify any inconsistencies with the resource management plans as a result of the review.

4.2 Caliente Rail Alignment

4.2.1 PHYSICAL SETTING

This section describes potential impacts to physical setting from constructing and operating the proposed railroad along the Caliente rail alignment. Section 4.2.1.1 describes the methodology DOE used to assess potential impacts to physical setting; Section 4.2.1.2 describes potential impacts of constructing the railroad; Section 4.2.1.3 describes potential impacts of operating the railroad; Section 4.2.1.4 describes potential impacts under the Shared-Use Option; and Section 4.2.1.5 summarizes potential impacts to physical setting.

As described in Section 3.2.1, physical setting includes physiography, geology, and soils. Section 3.2.1.1 describes the ***region of influence*** for physical setting along the Caliente rail alignment.

4.2.1.1 Impact Assessment Methodology

To assess potential impacts to physical setting along the Caliente rail alignment, DOE considered whether railroad construction and operations would:

- Result in soil erosion or loss of topsoil
- Result in the direct conversion of prime farmland to nonagricultural uses
- Result in the loss of availability of a known mineral resource that would be of value to the region or residents of Nevada
- Generate unstable slope conditions that could result in an on-site or off-site landslide or collapse
- Expose construction workers, DOE personnel, and structures to amplified or unique adverse effects from seismic activity

Where possible, DOE quantified impacts using data from Nevada soils surveys, geological maps, ***earthquake fault*** maps and records, and the total area of disturbance that would result from constructing and operating the proposed railroad.

The total area of disturbance would be the sum of disturbed areas within the nominal width of the rail line construction right-of-way and areas outside the nominal width of the construction right-of-way (railroad operations support facilities, quarry sites, some water-well sites, and access roads). The nominal width of the construction right-of-way would encompass the rail line, alignment access roads, some wells, ***construction camps***, and ***cuts*** and ***fills*** required to attain an appropriate ***grade***. While the nominal width of the construction right-of-way would be 300 meters (1,000 feet) across BLM lands, the width could vary in certain locations along the rail alignment. For example, it could be wider to accommodate additional earthwork, or narrower to avoid a sensitive environmental resource. Section 4.2.1.2.3 describes potential impacts from constructing the railroad operations support facilities; the number and size of those facilities would not vary among alternative segments.

Some potential impacts to physical setting along the Caliente alignment are more specifically addressed under other ***environmental resource areas***. Section 4.2.2, Land Use and Ownership, describes potential impacts to ***mining districts*** and mineral and energy resources; Section 4.2.4, Air Quality and Climate, describes soil loss from ***fugitive dust*** emissions; Section 4.2.5, Surface-Water Resources, describes potential erosion due to surface-water flow; and Section 4.2.10, Occupational and Public Health and Safety, describes impacts to worker safety from geologic hazards.

4.2.1.2 Construction Impacts

Direct impacts to physical setting along the Caliente rail alignment would occur primarily during the construction phase. Section 4.2.1.2.1 describes potential construction impacts common to the entire rail alignment. Section 4.2.1.2.2 describes impacts specific to alternative segments and common segments. Tables in Section 4.2.1.2.2 list the key information DOE used to analyze potential impacts to physical setting for the common and alternative segments.

4.2.1.2.1 Construction Impacts Common to the Entire Caliente Rail Alignment

4.2.1.2.1.1 Physiography. To the extent practicable, the Caliente alignment would avoid uneven topography and rugged terrain by following valleys and skirting mountain ranges, as described in Section 3.2.1.2.1 and illustrated in Figure 3-1. Where it is necessary to cross mountain ranges, the rail line would be located in gaps and passes. The rugged natural terrain surrounding the mountain ranges would, however, contribute to the potential for impacts to topography and soils. The ruggedness of an area is represented by the "rise and fall" calculation, which is the absolute elevation change measured at a fixed distance along the alignment. The rise and fall calculation provides a context for determining the amount of disturbance that would be required to establish the appropriate grades.

Depending on the combination of alternative segments and common segments along the Caliente rail alignment, the total area that would be disturbed during the construction phase would range from approximately 55 to 61 square kilometers (14,000 to 15,000 acres) (DIRS 182825-Nevada Rail Partners 2007, p. B-3). Construction impacts to physical setting would be centered along the rail alignment and would decrease with distance from the alignment.

Cuts and fills would be required to level steep slopes and provide a suitable grade for the rail ***roadbed***. The estimated volume of cuts along the Caliente rail alignment is 22.7 to 26.3 million cubic meters (29.7 to 34.4 million cubic yards), and the estimated volume of fill is 16.5 to 20.8 million cubic meters (21.6 to 27.2 million cubic yards) (DIRS 180916-Nevada Rail Partners 2007, Appendix E). Cut and fill activities would occur within the construction right-of-way. DOE would use the material excavated from the cuts to supply the required fill. Any excess cut material not used as fill would be used to smooth topography disturbed by construction and in reclamation efforts. Most of the earthwork would be along Caliente common segment 1 (see Section 4.2.1.2.2.2) and the selected Goldfield alternative segment (see Section 4.2.1.2.2.7). There would also be major cut, fill, and other earthwork processes around Bennett Pass, the Goldfield Hills, Beatty, and Yucca Mountain.

DOE would build up to 12 construction camps along the rail alignment. Each camp would include housing, support facilities, office space, utilities, contractor work areas, roadways, and parking, and would disturb approximately 0.10 square kilometer (25 acres) inside the nominal width of the construction right-of-way (DIRS 180922-Nevada Rail Partners 2007, p. 4-1).

There are six potential quarry sites along the Caliente rail alignment, and DOE would develop up to four of these sites. Each site would be expected to disturb an area from 1.3 to 3.8 square kilometers (320 to 930 acres) outside the nominal width of the construction right-of-way (DIRS 180922-Nevada Rail Partners 2007, pp. 3-1 and 3-2).

Construction of the ***Interchange Yard*** along the Caliente alternative segment could disturb 0.061 square kilometer (15 acres); the Interchange Yard along the Eccles alternative segment would disturb 0.12 square kilometer (30 acres). Construction of the ***Staging Yard*** would disturb 0.2 square kilometer (50 acres). Construction of the Maintenance-of-Way Trackside and Headquarters Facility would disturb 0.061 square kilometer (15 acres) and the ***Rail Equipment Maintenance Yard*** would disturb the largest area (0.41 square kilometer [100 acres]) (DIRS 182825-Nevada Rail Partners 2007, p. A-5).

Construction activities that would disturb topsoil include, but are not limited to, cut excavation; quarry-pit excavation and borrow-pit stockpiles; placement of compacted fill, ***ballast***, and ***subballast***; road development and grading; and building facility foundations. During the construction phase, the soil column would be disturbed and topsoil would be removed. The areas with disturbed soils would have an increased potential for erosion by wind and water. DOE would implement best management practices (see Chapter 7) to control erosion, minimize soil loss, and conserve topsoil for grading after construction was completed. After construction was completed, disturbed areas away from the rail line would be leveled to a grade that would blend with the terrain, covered with reserved topsoil, and to the extent practicable, revegetated.

4.2.1.2.1.2 Geology.

Faulting and Seismic Activity Seismic-related hazards in the project area include ground shaking, rock falls and landslides, soil liquefaction, and fault displacement. The potential for humans or structures to be exposed to seismic hazards is generally uniform across the entire rail alignment and consistent with the rest of southern Nevada, as shown on Figure 3-4. Construction activities would not induce earthquakes or reactivate any faults. The general east-west configuration of the Caliente rail alignment would minimize the contact between the rail alignment and the linear range-bounding faults, which have the greatest potential for reactivation. At a minimum, DOE would design and operate the proposed railroad to be consistent with American Railway Engineering and Maintenance-of-Way Association seismic guidelines (DIRS 162040-AREMA 2001, Chapter 9) and could decide to implement additional, more stringent standards.

During the construction and operations phases, DOE would monitor earthquake activity using U.S. Department of the Interior, Geological Survey, and Yucca Mountain seismic networks. The response level of the maintenance-of-way authority would depend on the earthquake magnitude and distance to the rail line (see Table 4-1). DOE would develop an inspection protocol that would outline the procedures that would be used to inspect the track, rail roadbed, bridges, and other structures along the rail line. If required after a seismic event, construction would halt, trains would run at reduced speeds, and qualified inspectors would verify the safety of the track.

The rail line and transportation casks would be constructed to be consistent with the American Railway Engineering and Maintenance-of-Way Association seismic guidelines. The inspection protocol and acceptance of the seismic guidelines would ensure that the risks associated with operating in a seismically active area would be minimized. Section 4.2.10, Occupational and Public Health and Safety, describes potential impacts to transportation safety and worker and public health and safety from seismic hazards.

Rock-Slope Hazards Several sections of the Caliente rail alignment would pass through steep and rugged terrain where unstable rock slopes would be a hazard (DIRS 183639-Shannon & Wilson 2007, pp. 42 to 44). Rock-slope failures typically occur where rock discontinuities (such as joints, bedding, foliation, and faults) are adversely oriented in relation to natural or constructed slope faces. Slope stability could be further reduced by natural weathering processes, which contribute to the mechanical breakdown of the rock mass within the rock ***matrix*** and along the discontinuities (DIRS 183639-Shannon & Wilson 2007, p. 41).

Rail line construction activities such as blasting and other cut procedures would have the potential to induce rock falls and landslides. Blasting could be required to excavate bedrock and would occur in strict compliance with existing regulations. Impacts resulting from construction and construction-related blasting are expected to be small, due to safety measures DOE would employ during blasting activities.

Debris Flows Debris flows are rapidly moving mixtures of water, soil, rock, and organic material. A debris flow can begin during or after heavy precipitation, and is especially dangerous if the debris dams a

Table 4-1. American Railway Engineering and Maintenance-of-Way Association seismic guidelines.[a]

Earthquake magnitude (Richter scale)	Response radii (miles)[b]	Response level[c]	Response protocol
0.0-4.9	d	I	Resume maximum operating speed. The need for the continuation of inspections will be determined by the proper maintenance-of-way authority.
5.0-5.9	100	II	All trains and engines will run at restricted speed within a specified radius of the epicenter until inspections have been made and appropriate speeds established by proper authority.
6.0-6.9	200	III	All trains and engines within the specified radius of the epicenter must stop and may not proceed until inspections have been performed and appropriate speed restrictions established by proper authority.
	300	II	All trains and engines will run at restricted speed within a specified radius of the epicenter until inspections have been made and appropriate speeds established by proper authority.
7.0 or greater	As directed, but not less than for 6.0 to 6.9	III	All trains and engines within the specified radius of the epicenter must stop and may not proceed until inspections have been performed and appropriate speed restrictions established by proper authority. The radius shall not be less than that specified for earthquakes between magnitudes 6.0 and 6.9.
		II	All trains and engines will run at restricted speed within a specified radius of the epicenter until inspections have been made and appropriate speeds established by proper authority. The radius shall not be less than that specified for earthquakes between magnitudes 6.0 and 6.9.

a. Source: DIRS 162040-AREMA 2001, Table 9-1.1 and p. 9-1.5.
b. To convert miles to kilometers, multiply by 1.6093.
c. Response level as defined by the American Railway Engineering and Maintenance-of-Way Association.
d. Radii not applicable.

stream channel. If the dam fails, the saturated debris can travel downslope for several miles in a confined channel. Debris flows lose their energy and begin to deposit material when the stream gradient flattens or when the channel widens (DIRS 183639-Shannon & Wilson 2007, pp. 45 and 46).

There would be a potential for debris flows along portions of the rail alignment during the construction and operations phases. Such flows would be most common in areas where there is evidence of prior activity (DIRS 183639-Shannon & Wilson 2007, p. 45). Debris flows could bury the rail line in sediment, destroy portions of the line, or weaken bridge pylons as a result of excessive erosion. It would not be possible to completely avoid debris flows in the area around the rail alignment.

Mineral and Energy Resources The rail line could cross surface or subsurface mineral or energy resources not part of identified mining districts or mineral leases. During construction, previously unknown resources could be identified in areas with large cuts. In 2005, the BLM generated a Mineral Potential Report for the Caliente rail corridor, using degrees to estimate areas with geologic favorability for particular mineral and energy resources (DIRS 182762-Shannon & Wilson 2007, all). The report graded each Caliente rail alignment alternative segment and common segment on the potential for metallic and nonmetallic minerals, geothermal resources, and oil and gas resources in the area surrounding the rail alignment. The report rated each segment with high, medium, low, or no potential for each mineral resource type. However, a rating of high potential is only used as a guide in this impact analysis, and does not indicate the actual locations of commercial minerals.

During the construction phase, some minerals could be rendered inaccessible because they would be within the construction right-of-way. However, the ***operations right-of-way*** would be smaller than the construction right-of-way, so these restricted areas would become available during the operations phase. The Caliente rail alignment would not cross any known mineral deposits unique to the region. Therefore, any impacts related to restricted access to local mineral resources would be temporary and limited to the construction phase. Sections 4.2.1.2.2.1 through 4.2.1.2.2.12 provide more segment-specific information on the potential impacts to individual mineral and energy resources along alternative segments and common segments. Section 4.2.2, Land Use and Ownership, describes potential impacts to local mining districts.

Local Sources of Construction Materials Construction of a rail line along the Caliente rail alignment would require from 3.12 to 3.19 million metric tons (3.44 to 3.52 million tons) of crushed-rock ballast and from 2.72 to 2.81 million metric tons (3 to 3.1 million tons) of subballast for rail roadbed construction (DIRS 180922-Nevada Rail Partners 2007, p. 3-1). Soil and rock excavated from construction cuts would not be suitable for ballast; DOE would use this material for subballast and embankment fill (DIRS 183643-Shannon & Wilson 2007, pp. 15, 19, and 20). All of the subballast requirements would be met using excavated materials from construction cuts supplemented with bedrock extracted from the ballast quarries and if needed, alluvial ***borrow sites***.

DOE has identified six potential sites for ballast quarries along the Caliente rail alignment in the Caliente, Reveille Valley, and Goldfield areas (DIRS 183641-Shannon & Wilson 2007, p. 52). Of these potential locations, DOE would develop up to four sites to supply rock for ballast and subballast during the construction phase. Each quarry pit would be approximately 24 meters (80 feet) deep, with an anticipated ***footprint*** of approximately 0.04 square kilometer (10 acres). However, depending on the number of open quarries and the quality of the mineral materials, a quarry pit footprint could be as large as 2.1 square kilometers (530 acres). A waste-rock pile at each quarry site would disturb approximately 0.06 square kilometer (14 acres). ***Overburden*** material and rock not suitable for ballast or subballast gravel would be stored at this location until the end of quarry operations. A railroad ***siding*** to accommodate the ballast cars would be included in the total quarry disturbance area (DIRS 180922-Nevada Rail Partners 2007, pp. 3-1 and 3-2). When adding all of the maximum areas of the quarry site that could be disturbed during the construction phase (quarry pit, production plant, ballast storage, and waste pile), and including a temporary construction buffer area, a quarry site could disturb between 1.3 and 3.8 square kilometers (320 to 930 acres). These quarry-site values are considered to be maximum calculations, in the event of irregular topography and poor-quality excavated mineral materials. Section 4.2.1.2.4 describes potential impacts from the quarry facilities in more detail.

The quarries would remain open through the construction phase. Afterward, DOE would reclaim disturbed areas in accordance with the post-construction and maintenance best management practices described in Chapter 7. Such practices would include grading the disturbed area, reshaping quarry-pit walls to stabilized slopes, replacing reserved topsoil, and revegetating.

DOE could use other local materials for rail line construction. Subballast would be generated from excavated cuts, crushed quarry rock, and if needed, borrow sites on certain ***alluvial fans***. Blasted bedrock from slope excavations and excess ballast rock would also be suitable for use to protect rail roadbed embankments from erosion. Some natural sand and gravel excavated from cuts and crushed rock from the quarries could be used to make concrete aggregate (DIRS 183643-Shannon & Wilson 2007, pp. 24 to 26). DOE would determine the prime sand and gravel deposits to be used before beginning construction.

Using local materials for ballast, subballast, embankment fill, and concrete aggregate would result in the consumption of construction resources (such as rock, sand, and gravel) often used for other construction projects in the area. However, alluvial deposits are plentiful in the region, and their use to construct the rail line would not substantially reduce the area supply of these resources. Because the potential impact to sand and gravel resources would be small along the entire alignment, this resource is not discussed further in Sections 4.2.1.2.2.1 through 4.2.1.2.2.12. Section 4.2.11, Utilities, Energy, and Materials, describes impacts to regional supply chains for other construction materials.

4.2.1.2.1.3 Soils. This section describes potential impacts to soils, including the removal of prime farmland from productive use. Rock excavation and land clearing would cause soil loss, surface erosion, and disruption of soil structure on previously undisturbed land.

During the construction phase, most soils would be excavated using conventional earthmoving equipment such as bulldozers, scrapers, rubber-tired backhoes, and track-mounted excavators. Solid rock encountered along the rail alignment would require drilling and blasting (DIRS 183639-Shannon & Wilson 2007, p. 47).

Soil Loss and Erosion There would be soil loss and erosion at all places where construction activities disturbed the ground surface. The severity of soil loss would depend on the extent of the disturbance, the erodibility of the soil, and the steepness of the terrain.

Land disturbed along the rail alignment would be most susceptible to soil loss and erosion during heavy rains and high winds. Areas where fine-textured soil and sand (such as on alluvial fans, lake-bed terraces, valleys, and flats) and where soils exhibited the ***erodes easily*** or ***blowing soil*** characteristics would be most susceptible to erosion. The Caliente rail alignment would be in an area with an ***arid*** climate that does not normally experience prolonged rainfall. Rainfall is typically brief, but can be very intense and form washouts in low-lying areas. Elevated water velocities during heavy rainfalls would increase erosion and scouring in areas where there is no vegetation, in areas dominated by sandy soils on steep slopes, along channel banks, and at bridge crossings (DIRS 183639-Shannon & Wilson 2007, p. 50). Construction of the proposed railroad would result in the loss of some topsoil and soil erosion. During and after construction, DOE would implement best management practices (see Chapter 7) to reduce the potential for additional soil loss due to erosion. In areas of temporary surface disturbance, the topsoil would be reserved and replaced, where practicable.

Disturbed soils would also be susceptible to wind erosion, because wind speeds greater than 19 kilometers (12 miles) per hour are sufficient to move sand grains (DIRS 183639-Shannon & Wilson 2007, p. 52). Disturbed soils with the blowing soil characteristic tend to generate sand dunes, increase fugitive dust in the air, and contribute to the loss of topsoil. Wind and water erosion could also impact ***air quality***, surface-water quality, and biological resources, as discussed in Sections 4.2.4, 4.2.5, and 4.2.7, respectively.

Prime Farmland The Farmland Protection Policy Act (7 United States Code [U.S.C.] 4201 *et seq.*) seeks to minimize the extent to which federal programs contribute to the unnecessary and irreversible conversion of farmlands to nonagricultural uses. As discussed in Section 3.2.1.2.3, 3 percent of soils along the Caliente rail alignment are classified as prime farmlands. The Caliente and Eccles alternative segments, Caliente common segment 1, and Garden Valley alternative segments 1, 2, and 8 would cross prime farmland soils (see Figures 3-6 and 3-8). DOE calculated the amount of potentially disturbed prime farmland soils by multiplying the total area of disturbance by the calculated percentage of prime farmland that would be within the rail line construction right-of-way. In Lincoln County, there is 0.16 square kilometer (40 acres) of prime farmland soils along the Caliente alternative segment and 0.1 square kilometer (24 acres) of prime farmland along the Eccles alternative segment.

Along these alternative segments, DOE would limit disturbance within the construction right-of-way to minimize potential impacts to private lands and thus minimize impacts to farmland. The 1.13 square kilometer (280 acres) of prime farmland soils along Caliente common segment 1 is in relatively isolated areas in Lincoln and Nye Counties (see DIRS 182843-DOE 2007, all, plates 55 to 60, 79, and 107 to 109), and at present is not being used for agricultural production. The Garden Valley alternative segments would disturb between 0 square kilometers (0 acres) along Garden Valley alternative segment 3 up to 0.4 square kilometer (99 acres) along Garden Valley alternative segment 2. Construction of the proposed railroad along the Caliente rail alignment would result in the loss of a total of 1.8 square kilometers (440 acres) of prime farmland soils. Lincoln and Nye Counties contain approximately 2,200 square kilometers (540,000 acres) of prime farmland soils; thus, the proposed railroad would remove less than 0.1 percent of the prime farmland soils from productive use. Esmeralda County does not contain prime farmland soils.

In addition to using the Nevada soil survey database classification, DOE also requested assistance from the Nevada Natural Resources Conservation Service office to identify prime, unique statewide, or locally important farmland along the Caliente rail alignment (DIRS 181388-Arcaya 2007, all). The Conservation Service office identified two segments that would potentially cross farmland, centered around the junction between the end of the Caliente and Eccles alternative segments and the beginning of Caliente common segment 1. About 2 to 2.4 kilometers (1.2 to 1.5 miles) of the northern portion of the Eccles alternative segment would cross private land with the potential to be farmed. There are historical traces of irrigation north of the origin of Caliente common segment 1 (DIRS 181388-Arcaya 2007, all).

Soil Stability Excavation and grading activities would disturb the natural structure of the soil by breaking plant roots and natural mineral cements that bind soils. Soils disturbed along cut slopes would have a higher risk of becoming unstable and creating mudflows or landslides in steep topography because water-bearing properties would have changed, and the soil structure would have been altered. However, DOE would revegetate or otherwise stabilize these areas and would reclaim them to the extent practicable, which would reduce the potential for increased erosion (see Chapter 7).

DOE would erect up to 12 construction camps along the rail alignment to house workers. Although the camps would be temporary and used only during the construction phase, soil could become compacted at these sites. After construction was complete, DOE would grade the terrain and revegetate these areas with ***native plant species*** (see Chapter 7), which would minimize the effects of soil compaction.

Studies have shown that, if left to natural ***soil recovery***, the return of soil to pre-disturbed conditions and natural succession of vegetation in the Yucca Mountain area could take decades or more, creating an increased potential for erosion, landslides, and mudslides (DIRS 104837-DOE 1989, p. 17). Impacts due to soil disruption would be large within the construction right-of-way and immediate region of influence until new vegetation was established and the natural succession was reestablished. DOE would reduce the impacts related to the increased potential for erosion, landslides, and mudslides through the implementation of best management practices, such as revegetating disturbed sites, establishing proper roadbed grades, and using stormwater erosion control measures (see Chapter 7).

4.2.1.2.2 Construction Impacts along Alternative Segments and Common Segments

4.2.1.2.2.1 Alternative Segments at the Interface with the Union Pacific Railroad Mainline. The Caliente and Eccles alternative segments would gradually increase in elevation as they traveled northward. The Caliente alternative segment would have a total rise and fall of approximately 87 meters (290 feet) over 18 kilometers (11 miles). The Eccles alternative segment would have a rise of 190 meters (630 feet) over 19 kilometers (12 miles) (DIRS 180916-Nevada Rail Partners 2007, Appendix E).

Table 4-2 summarizes the key information DOE considered to assess construction impacts to physical setting along the Caliente and Eccles alternative segments.

The Caliente and Eccles alternative segments would result in the disturbance of approximately 3.1 square kilometers (770 acres) and 1.9 square kilometers (480 acres), respectively. More extensive cuts and fills would be required for the Eccles alternative segment, which would result in more permanent changes to

Table 4-2. Summary of key information for assessing impacts from constructing the Caliente or Eccles alternative segment.

Attribute	Caliente alternative segment	Eccles alternative segment
Length (miles)[a,b]	11	12
Rise and fall (feet)[a,c]	290	630
Earthwork cut quantities (cubic yards)[a,d]	0.63 million	2.39 million
Earthwork fill quantities (cubic yards)[a]	0.22 million	1.29 million
Construction[e]	Cuts up to 80 feet and fills up to 30 feet.	Cuts up to 80 feet and fills up to 50 feet high.
Number of construction camps[f]	1 (no. 1)	1 (no. 1)
Number of well sites outside nominal width of construction right-of-way[f]	1 (no. 3)	3 (nos. 1, 2, 3)
Disturbed area (acres)[g]		
• Rail alignment[h]	370	470
• Quarries[f]	400 (CA-8B)	Not applicable
• Well sites outside nominal width of construction right-of-way[f]	1.4	4.2
• Access roads to construction camps/well sites/quarries[f]	1.8 (to well site 3)	3.7 (to well sites 1, 2, and 3)
Total disturbed area (acres)[f,i]	770	480
Percent soil characteristics[j]	74 erodes easily 0 blowing soils 5.2 prime farmland	71 erodes easily 0 blowing soils 4.8 prime farmland
Soil characteristic area (acres)[k]	570 erodes easily 0 blowing soils 40 prime farmland	340 erodes easily 0 blowing soils 23 prime farmland

a. Source: DIRS 180916-Nevada Rail Partners 2007, Appendix E.
b. To convert miles to kilometers, multiply by 1.6093.
c. To convert feet to meters, multiply by 0.3048.
d. To convert cubic yards to cubic meters, multiply by 0.76456.
e. Source: DIRS 182854-Shannon & Wilson 2006, Table 5.
f. Source: DIRS 180922-Nevada Rail Partners 2007, pp. 3-2 to 3-4 and 4-11, Table 4-7, and Appendices G and H.
g. To convert acres to square kilometers, multiply by 0.0040469.
h. Source: DIRS 182825-Nevada Rail Partners 2007, p. B-3.
i. Totals might not equal sums of values due to rounding.
j. Source: DIRS 184079-Natural Resources Conservation Service 2007, all.
k. Soil area calculated by multiplying total disturbed area by the percent soil characteristic.

the topography than for the Caliente alternative segment. Soil disturbance from construction activities along either alternative segment would result in localized impacts from the loss of topsoil and an increase in the potential for erosion. However, these impacts would be temporary and would be reduced through a combination of erosion control measures (see Chapter 7).

There is a high probability for perlite (a volcanic glass commercially mined south of the City of Caliente) deposits in the area around the Caliente and Eccles alternative segments. When heated very quickly, the grains of perlite expand into cellular particles, which can be incorporated into insulation, light-weight concrete, and acoustical tiles. There would be no depletion or removal of perlite; however, excavation could preclude mining of the deposits within the construction right-of-way. Because of the width of the rail line construction right-of-way in relation to the presence of this mineral resource, impacts to the perlite deposits would be small. There are some hot heat-flow wells in use around the City of Caliente;

construction activities would not affect these geothermal resources because the rail alignment would not come close to the wells.

Approximately 0.16 square kilometer (40 acres) and 0.091 square kilometer (23 acres) of prime farmland would be disturbed along the Caliente or Eccles alternative segment, respectively (see Table 4-2). Disturbance of these soils, particularly if fill were added, would change their prime farmland soil classification and remove them from agricultural use. Along the Caliente alternative segment, a portion of the prime farmland soils are within the Caliente city limits, primarily on private land. A review of the prime, unique statewide, or locally important farmland by the Natural Resources Conservation Service identified land that is currently idle, but with a potential to produce alfalfa as a crop (DIRS 181388-Arcaya 2007, p. 1). Along the alternative segments, DOE would limit the area of disturbance within the construction right-of-way to minimize potential impacts to private lands. Because the Caliente alternative segment would primarily travel along the ***berm*** of an abandoned rail line, the Natural Resources Conservation Service did not identify any prime or ***unique farmland*** along that portion of the alternative segment.

More than 70 percent of soils along both the Caliente and the Eccles alternative segments have the erodes easily characteristic. Disturbance from construction along the rail alignment would disrupt the soil structure and increase the potential for erosion. DOE would implement best management practices (such as stockpiling topsoil and revegetating the area) to reduce the potential for additional soil loss due to erosion (see Chapter 7).

4.2.1.2.2.2 Caliente Common Segment 1 (Dry Lake Valley Area). Caliente common segment 1 would cross four major mountain ranges and three valleys. To maintain a rail grade of less than 2 percent, DOE would excavate and level high points along the alignment and, to the extent practicable, use this material to raise the low points. Table 4-3 lists the anticipated cut and fill requirements and other important information used in the impact analysis for Caliente common segment 1. The grading procedures would be greatest through Bennett Pass and around the North Pahroc Mountains. A total of 11 square kilometers (2,800 acres) of land would be disturbed during construction of the rail line (rail roadbed, alignment access roads, and a construction camp, water wells, and their access roads). These activities would cause topsoil loss and local erosion. Caliente common segment 1 would also travel through badland topography, erodible land created by excessive erosion. Sections of the rail alignment requiring large cuts could also increase the potential for rock falls or landslides. DOE would use erosion control measures (see Chapter 7) to control excessive loss of topsoil and local erosion along the segment, particularly in these areas. Sections of the rail alignment requiring large cuts could also increase the potential for rock falls or landslides. To minimize the chance of landslides, DOE would vary cut slope dimensions, depending on the strength and stability of the bedrock.

Limestone bedrock occurs widely along Caliente common segment 1 (DIRS 182762-Shannon & Wilson 2005, Figure E2). Limestone is found in the Burnt Springs, Highland, and North Pahroc Ranges, and might extend under the rail alignment in those areas. Rail line construction would have a small impact on the availability of limestone because this resource is widely available in mountain ranges throughout the region. There is one warm spring in the vicinity of Bennett Pass, approximately 1.6 kilometers (1 mile) from the construction right-of-way. Construction activities would not affect this spring. There is also a high potential for additional geothermal resources around the eastern portion of Caliente common segment 1. Rail line construction would not affect these potential resources because DOE would not use or otherwise disturb the subsurface geothermal resource.

Construction of Caliente common segment 1 would disturb approximately 1.1 square kilometer (280 acres) of prime farmland soils, which would be removed from agricultural use (see Table 4-3). These soils are on ***public lands*** and are not being used for agricultural production at present. A review of the

Table 4-3. Summary of key information for assessing potential impacts from constructing the proposed railroad along Caliente rail alignment common segments (page 1 of 2).

Key information	Caliente common segment 1	Caliente common segment 2	Caliente common segment 3	Caliente common segment 4	Common segment 5	Common segment 6
Length (miles)[a,b]	71	31	70	7	25	32
Rise and fall (feet)[a,c]	4,300	1,400	2,400	60	560	1,400
Earthwork cut quantities (cubic yards)[a,d]	12.2 million	1.56 million	3.05 million	0.3 million	0.59 million	7.69 million
Earthwork fill quantities (cubic yards)[a]	7.7 million	0.68 million	2.53 million	0.26 million	1.32 million	3.85 million
Construction[e]	Generally, cuts and fills ranging 40 to 70 feet high; cut in rock to 70 feet high at Bennett Pass; 40-foot cuts and 65-foot-high fill at the crossing of Black Canyon; fills up to 30 feet and cuts in rock to 100 feet high along White River.	Cuts up to 40 feet and fills up to 80 feet.	Cuts up to 50 feet and fills up to 30 feet.	Cuts up to 15 feet and fills up to 35 feet.	Cuts up to 50 feet; fills generally up to 10 feet.	Cuts up to 140 feet and fills up to 110 feet.
Number of construction camps[f]	2 (nos. 2, 3)	1 (no. 5)	3 (nos. 6, 7, 8)	1 (no. 9)	1 (no. 10)	1 (no. 12)
Number of well sites outside nominal width of construction right-of-way[f]	4 (nos. 4, 5, 6, 7)	2 (nos. 8, 9)	0	0	0	2 (nos. 14, 15)

Table 4-3. Summary of key information for assessing potential impacts from constructing the proposed railroad along Caliente rail alignment common segments (page 2 of 2).

Key information	Caliente common segment 1	Caliente common segment 2	Caliente common segment 3	Caliente common segment 4	Common segment 5	Common segment 6
Disturbed area (acres)[g]						
• Rail alignment[h]	2,700	1,000	2,400	250	770	1,300
• Quarries[f]	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
• Well sites outside nominal width of construction right-of-way[f]	5.6	2.8	Not applicable	Not applicable	Not applicable	2.8
• Access roads to construction camps/well sites/quarries[f]	114 (to construction camps 2, 3) 8.7 (to well sites 4, 5, 6, 7)	Not applicable 8.4 (to well sites 8, 9)	130 (to construction camps 6, 7, 8)	21 (to construction camp 9)	5 (to construction camp 10)	46 (to construction camp 12) 11 (to well sites 14, 15)
Total disturbed area (acres)[i]	2,800	1,000	2,500	270	780	1,400
Percent soil characteristics[j]	18 erodes easily 0 blowing soils 10 prime farmland	16 erodes easily 10 blowing soils 0 prime farmland	17 erodes easily 32 blowing soils 0 prime farmland	41 erodes easily 1.4 blowing soils 0 prime farmland	0 erodes easily 2.6 blowing soils 0 prime farmland	0 erodes easily 0 blowing soils 0 prime farmland
Soil characteristic area (acres)[k]	500 erodes easily 0 blowing soils 280 prime farmland	160 erodes easily 100 blowing soils 0 prime farmland	430 erodes easily 800 blowing soils 0 prime farmland	110 erodes easily 3.8 blowing soils 0 prime farmland	0 erodes easily 20 blowing soils 0 prime farmland	0 erodes easily 0 blowing soils 0 prime farmland

a. Source: DIRS 180916-Nevada Rail Partners 2007, Appendix E.
b. To convert miles to kilometers, multiply by 1.6093.
c. To convert feet to meters, multiply by 0.3048.
d. To convert cubic yards to cubic meters, multiply by 0.76456.
e. Source: DIRS 182854-Shannon & Wilson 2006, Table 5.
f. Source: DIRS 180922-Nevada Rail Partners 2007, pp. 3-2 to 3-4 and 4-11, Table 4-7, and Appendices G and H.
g. To convert acres to square kilometers, multiply by 0.0040469.
h. Source: DIRS 182825-Nevada Rail Partners 2007, p. B-3.
i. Totals might not equal sums of values due to rounding.
j. Source: DIRS 184079-Natural Resources Conservation Service 2007, all.
k. Soil area calculated by multiplying total disturbed area by the percent soil characteristic.

prime, unique statewide, or locally important farmland by the Natural Resources Conservation Service identified evidence of past irrigation north of the beginning of Caliente common segment 1. This land has been out of production for more than 10 years (DIRS 181388-Arcaya 2007, p. 1). Although the Natural Resources Conservation Service office does not consider the current land as farmland, if it were to become irrigated again, it would be considered farmland of statewide importance. Caliente common segment 1 would disturb approximately 0.064 square kilometer (16 acres) of this land. DOE would limit the area of disturbance within the construction right-of-way to minimize impacts to private lands.

4.2.1.2.2.3 Garden Valley Alternative Segments. The Garden Valley alternative segments would generally cross moderately hilly terrain, and most of the cuts and fills would occur in gaps of the Golden Gate Range. Table 4-4 summarizes the key information DOE used to assess impacts to physical setting from construction of any of the Garden Valley alternative segments.

Garden Valley 3 would be the longest of the Garden Valley alternative segments, but would require the least total amount of cut and fill. Garden Valley 1 would be the shortest of the Garden Valley alternative segments and would require the least amount of cuts, but would require more fill to obtain the appropriate grade. Garden Valley alternative segments 3 and 8 would disturb a total of 3.6 square kilometers (890 acres) and 3.7 square kilometers (910 acres), respectively, and Garden Valley 1 would disturb a total of 3.4 square kilometers (830 acres). Garden Valley alternative segment 2 would disturb 3.6 square kilometers (880 acres) (see Table 4-4). Surface disturbance during construction would remove topsoil and increase the potential for erosion around the rail alignment. These impacts would be temporary and reduced by erosion control measures (see Chapter 7).

All of the Garden Valley alternative segments would cross the Golden Gate fault. However, the few earthquakes that have occurred in the area were low magnitude and not associated with the faults that the Garden Valley alternative segments would cross (see Figure 3-3).

Limestone is present in the bedrock of the Golden Gate Range where Garden Valley alternative segments 1 and 3 would cross (DIRS 182762-Shannon & Wilson 2007, Figure E2). However, rail line construction would not adversely impact the limestone resources because limestone is abundant in the mountains around the Golden Gate Range.

Garden Valley alternative segments 1, 2, and 8 would cross between 0.29 and 0.4 square kilometer (70 and 97 acres) of prime farmland soils. The prime farmland soils are in the southern section of Garden Valley, in isolated areas where there are no irrigation or farming practices (see DIRS 182843-DOE 2007, all, plates 144 to 147, 155 to 163, and 501 to 503). Garden Valley alternative segment 2 would have a larger percentage of soils with the erodes easily characteristic than Garden Valley alternative segments 1, 3, and 8 (see Table 4-4). When disturbed by construction, these soils would have a higher potential for erosion than other soil types. During and after construction, DOE would implement best management practices (see Chapter 7) to reduce the potential for additional soil loss due to erosion.

4.2.1.2.2.4 Caliente Common Segment 2 (Quinn Canyon Range Area). Caliente common segment 2 would cross several valleys and one pass. Table 4-3 summarizes the key information DOE considered to assess impacts to physical setting from the construction of Caliente common segment 2. Excess excavation material not needed for fill purposes would be graded and revegetated with native species, or reused as fill along other parts of the rail alignment. In total, construction along Caliente common segment 2 would disturb 4.1 square kilometers (1,000 acres). The disturbed areas would lose topsoil and have an increased potential for erosion. In addition, 0.66 square kilometer (160 acres) of common segment 2 would contain soils with the erodes easily characteristic, which would locally increase the potential for soil erosion. DOE would implement best management practices (see Chapter 7) to reduce these impacts.

Table 4-4. Summary of key information for assessing impacts from constructing Garden Valley alternative segment 1, 2, 3, or 8.

Attribute	Garden Valley 1	Garden Valley 2	Garden Valley 3	Garden Valley 8
Length (miles)[a,b]	22	22	23	23
Rise and fall (feet)[a,c]	1,200	860	1,200	990
Earthwork cut quantities (cubic yards)[a,d]	0.36 million	0.94 million	0.65 million	1.16 million
Earthwork fill quantities (cubic yards)[a]	1.1 million	0.69 million	0.69 million	0.84 million
Construction[e]	Low embankment fills less than 10 feet deep; cuts and fills up to 40 feet high.	Shallow cuts and fills.	Cuts to 30 feet and fills up to 35 feet.	Shallow cuts and fills.
Number of construction camps[f]	1 (no. 4b)	1 (no. 4c)	1 (no. 4a)	1 (no. 4c)
Number of well sites outside nominal width of construction right-of-way[f]	0	0	0	0
Disturbed area (acres)[g]				
• Rail alignment[h]	720	770	780	800
• Quarries[f]	Not applicable	Not applicable	Not applicable	Not applicable
• Well sites outside nominal width of construction right-of-way[f]	Not applicable	Not applicable	Not applicable	Not applicable
• Access roads to construction camps/well sites/quarries[f]	110 (to construction camp 4b)	110 (to construction camp 4c)	110 (to construction camp 4a)	110 (to construction camp 4c)
Total disturbed area (acres)[i]	830	880	890	910
Percent soil characteristics[j]	13 erodes easily 5.7 blowing soils 8.4 prime farmland	22 erodes easily 6.1 blowing soils 11 prime farmland	12 erodes easily 2.1 blowing soils 0 prime farmland	14 erodes easily 6 blowing soils 9.8 prime farmland
Soil characteristic area (acres)[k]	100 erodes easily 47 blowing soils 70 prime farmland	190 erodes easily 54 blowing soils 97 prime farmland	100 erodes easily 19 blowing soils 0 prime farmland	130 erodes easily 55 blowing soils 89 prime farmland

a. Source: DIRS 180916-Nevada Rail Partners 2007, Appendix E.
b. To convert miles to kilometers, multiply by 1.6093.
c. To convert feet to meters, multiply by 0.3048.
d. To convert cubic yards to cubic meters, multiply by 0.76456.
e. Source: DIRS 182854-Shannon & Wilson 2006, Table 5.
f. Source: DIRS 180922-Nevada Rail Partners 2007, pp. 3-2 to 3-4 and 4-11, Table 4-7, and Appendices G and H.
g. To convert acres to square kilometers, multiply by 0.0040469.
h. Source: DIRS 182825-Nevada Rail Partners 2007, p. B-3.
i. Totals might not equal sums of values due to rounding.
j. Source: DIRS 184079-Natural Resources Conservation Service 2007, all.
k. Soil area calculated by multiplying total disturbed area by the percent soil characteristic.

Caliente common segment 2 would not cross known Quaternary faults. There have been some earthquakes in the area of Caliente common segment 2, but they had magnitudes of 4.0 or lower. Potential hazards to people and structures from earthquakes of this magnitude would be very small.

A low to medium potential exists for undiscovered mineral, oil, and geothermal resources along Caliente common segment 2 (DIRS 182762-Shannon & Wilson 2007, all). Potential impacts to any undiscovered resources along this segment would be very small because the narrow footprint of the rail line would allow the extraction of most types of mineral and energy deposits.

4.2.1.2.2.5 South Reveille Alternative Segments. South Reveille alternative segments 2 and 3 would cross a relatively uniform valley with a rise and fall of 150 meters (490 feet) and 190 meters (630 feet), respectively, over 19 kilometers (12 miles) (DIRS 180916-Nevada Rail Partners 2007, Appendix E). Although there would be more cuts along South Reveille 3, it would require less earthwork to attain an appropriate grade. Table 4-5 summarizes the key information DOE considered to assess impacts to physical setting from construction of either South Reveille alternative segment.

Table 4-5. Summary of key information for assessing impacts from constructing South Reveille alternative segment 2 or 3.

Attribute	South Reveille 2	South Reveille 3
Length (miles)[a,b]	12	12
Rise and fall (feet)[a,c]	490	630
Earthwork cut quantities (cubic yards)[a,d]	0.66 million	0.43 million
Earthwork fill quantities (cubic yards)[a]	0.29 million	0.19 million
Construction[e]	Cuts up to 30 feet and fills up to 40 feet.	Cuts up to 50 feet and fills up to 80 feet.
Number of construction camps[f]	0	0
Number of well sites outside nominal width of construction right-of-way[f]	0	0
Disturbed area (acres)[g]		
• Rail alignment[h]	360	420
• Quarries[f,i]	820 (NN-9A and NN-9B)	820 (NN-9A and NN-9B)
• Well sites outside nominal width of construction right-of-way[f]	Not applicable	Not applicable
• Access roads to construction camps/well sites/quarries[f]	Not applicable	Not applicable
Total disturbed area (acres)[f,j]	1,200	1,200
Percent soil characteristics[k]	19 erodes easily 6.3 blowing soils 0 prime farmland	15 erodes easily 0 blowing soils 0 prime farmland
Soil characteristic area (acres)[l]	230 erodes easily 76 blowing soils 0 prime farmland	180 erodes easily 0 blowing soils 0 prime farmland

a. Source: DIRS 180916-Nevada Rail Partners 2007, Appendix E.
b. To convert miles to kilometers, multiply by 1.6093.
c. To convert feet to meters, multiply by 0.3048.
d. To convert cubic yards to cubic meters, multiply by 0.76456.
e. Source: DIRS 182854-Shannon & Wilson 2006, Table 5.
f. Source: DIRS 180922-Nevada Rail Partners 2007, pp. 3-2 to 3-4 and 4-11, Table 4-7, and Appendices G and H.
g. To convert acres to square kilometers, multiply by 0.0040469.
h. Source: DIRS 182825-Nevada Rail Partners 2007, p. B-3.
i. Assuming that both NN-9A and NN-9B would be developed.
j. Totals might not equal sums of values due to rounding.
k. Source: DIRS 184079-Natural Resources Conservation Service 2007, all.
l. Soil area calculated by multiplying total disturbed area by the percent soil characteristic.

Construction of the rail roadbed, quarries, and access roads would disturb an area of approximately 4.8 square kilometers (1,200 acres) along South Reveille alternative segment 2; South Reveille 3 would disturb slightly more surface area (5 square kilometers [1,200 acres]). In addition, a larger percentage of soils along South Reveille alternative segment 2 have the erodes easily characteristic (see Table 4-5). Surface disturbance would result in topsoil loss and a potential increase in erosion. However, DOE would implement best management practices (see Chapter 7) to reduce the potential for additional soil loss due to erosion. Overall, potential impacts from either South Reveille 2 or South Reveille 3 would be similar except that South Reveille 3 would result in more land disturbance than South Reveille 2.

Neither South Reveille 2 nor South Reveille 3 would cross known faults. North of the alternative segments, Quaternary faults are identified on the east and west sides of the Reveille Range. However, these faults do not extend into the southern edge of Reveille Valley. Therefore, the potential hazards to people and structures from seismic activity would be very small.

There would be no impacts to mineral resources along South Reveille alternative segments 2 and 3 because there is a low potential for metallic and nonmetallic minerals, gas, or geothermal resources within the construction right-of-way. In addition, the bedrock is covered by more than 91 meters (300 feet) of recent alluvial deposits (DIRS 182762-Shannon & Wilson 2007, p. 53).

4.2.1.2.2.6 Caliente Common Segment 3 (Stone Cabin Valley Area). Caliente common segment 3 would cross the Kawich Range, Cow Canyon, and part of Reveille and Hot Creek Valleys. Bridges might be required in the areas of Cow Canyon and Warm Springs Summit, where the rail line would pass through steep and rugged terrain. Cuts up to 15 meters (50 feet) and fills to 9 meters (30 feet) would also be required through the pass through the Kawich Range. The rugged topography and bridge construction would require total earthwork to include 2.33 million cubic meters (3.05 million cubic yards) in cuts and 1.93 million cubic meters (2.53 million cubic yards) in fills. Table 4-3 summarizes the key information DOE considered to assess impacts to physical setting from construction of Caliente common segment 3.

East of Warm Springs, the rail line would cross the northern portion of the Kawich-Hot Creek Fault zone. While this fault zone was active at least 130,000 years ago, its slip rate is consistent with other large faults in the region (DIRS 174194-USGS 2005, all). In areas with high topographic relief, construction of the rail line would result in an increased potential for rock-slope failure and landslides along Caliente common segment 3, which could also be induced by earthquakes (DIRS 182854-Shannon & Wilson 2006, Table 6). DOE would incorporate appropriate engineering features (see Chapter 2) during construction to stabilize these areas and prevent rock-slope failure and landslides. There is a high potential for some metallic and nonmetallic minerals in the bedrock below sections of Caliente common segment 3. The Warm Springs Summit area in the Kawich Range has a high potential for barite and metallic minerals such as gold and silver. Barite is found in small deposits in the Kawich range, and the rail alignment would cross a portion of the Clifford Mining District, which extracts metallic minerals (DIRS 183644-Shannon & Wilson 2007, p. 83). However, barite is not mined within the rail line construction right-of-way, and generally the bedrock is too deep for construction activities to affect the metallic minerals. There is also a high potential for traces of silver and gold east of the Kawich Range. Due to the size and location of the construction right-of-way, the impact to these mineral resources would be small. Section 4.2.2, Land Use and Ownership, provides more information about potential impacts to local mining districts.

The Warm Springs Summit area is also a well-known location for warm springs and other geothermal resources (DIRS 182762-Shannon & Wilson 2007, p. 23). The rail line would not cross any known warm springs; therefore, there would be no impacts to geothermal resources in the area.

Rail line construction along Caliente common segment 3 would disturb approximately 10 square kilometers (2,500 acres). There would be a loss of topsoil and an increased potential for erosion in the disturbed areas. In addition, terrain along Caliente common segment 3 consists of alluvial and ***playa*** deposits that are susceptible to water and wind erosion. Approximately 1.7 square kilometers (430 acres) of soils along Caliente common segment 3 have the easily eroded characteristic, and 3.2 square kilometers (800 acres) are considered to be blowing soils (see Table 4-3). The impacts from increased erosion would be small along most of the rail alignment, and moderate in Stone Cabin Valley and Cactus Flat, where there is a concentration of blowing soils (see Figure 3-5).

4.2.1.2.2.7 Goldfield Alternative Segments. Passing through the Goldfield Hills, the three Goldfield alternative segments would have similar rises and falls. To obtain the appropriate grade, Goldfield alternative segment 3 would require the most cuts and fills. Table 4-6 lists these values and the key information DOE considered to assess impacts to physical setting from construction of the Goldfield alternative segments.

Rail line construction would disturb from 6.5 square kilometers (1,600 acres) along Goldfield alternative segment 4 to 10.1 square kilometers (2,500 acres) along Goldfield alternative segment 3. Cuts and fills associated with construction of any of the Goldfield alternative segments would result in the loss of topsoil, and an increased potential for erosion. DOE would implement best management practices (see Chapter 7) to reduce the effects of these impacts.

Less than 10 percent of soils along each of the Goldfield alternative segments are considered to be blowing soils, which have a potential to be displaced easily by wind (see Table 4-6). DOE would implement best management practices to reduce the potential for additional soil loss due to wind erosion.

Section 4.2.4, Air Quality and Climate, includes more discussion of impacts related to blowing soils and fugitive dust emissions.

The southern sections of the Goldfield alternative segments would cross the Stonewall Flat fault sequences; however, the area surrounding the alternative segments has felt few earthquakes compared to other sections of the Caliente rail alignment. As shown in Figure 3-3, events in the magnitude 4.0 to 5.9 range have occurred around Ralston, Stonewall Mountain, and Tonopah. Where the selected Goldfield alternative segment would pass through rugged areas, DOE would employ stabilization measures (such as surface bolting and applying shotcrete) to ensure slope stability (see Chapter 7).

There is a high potential for metallic resources below all of the Goldfield alternative segments, each of which would cross the Goldfield Mining District, which has produced gold, silver, lead, and copper. Extraction of metallic minerals occurs in subsurface mines; therefore, there would be no impact to these mineral resources from construction of any of the Goldfield alternative segments.

There is also a high potential for the mineral zeolite to occur around the Goldfield alternative segments. Zeolite can be used as an antimicrobial agent and forms when saline ***groundwate***r reacts with certain volcanic deposits. Construction of the rail line could uncover zeolite deposits. Construction would be confined to the nominal width of the construction right-of-way, which would reduce the potential for additional disturbance. Therefore, potential impacts to local mineral resources would be small. Section 4.2.2, Land Use and Ownership, also addresses impacts to the Goldfield Mining District.

4.2.1.2.2.8 Caliente Common Segment 4 (Stonewall Flat Area). Crossing the Stonewall Flat area, Caliente common segment 4 would have a relatively low rise and fall amount and low cut and fill requirements (see Table 4-3). Caliente common segment 4 would cross the eastern portion of the Stonewall Flat fault zone, northwest of Ralston. However, there have been few earthquakes in the area.

Table 4-6. Summary of key information for assessing impacts from constructing Goldfield alternative segment 1, 3, or 4.

Attribute	Goldfield 1	Goldfield 3	Goldfield 4
Length (miles)[a,b]	29	31	33
Rise and fall (feet)[a,c]	2,000	2,200	2,200
Earthwork cut quantities (cubic yards)[a,d]	4.01 million	3 million	2.45 million
Earthwork fill quantities (cubic yards)[a]	2.54 million	5.9 million	4.36 million
Construction[e]	Cuts up to 120 feet and fills up to 50 feet.	Generally, cuts and fills up to 50 feet; local cuts and fills up to 110 feet.	Generally, cuts and fills up to 50 feet; 6,000-foot-long, 100-foot-high cut.
Number of construction camps[f]	0	0	0
Number of well sites outside nominal width of construction right-of-way[f]	1 (no. 12)	1 (no. 12)	3 (nos. 10, 11, 13)
Disturbed area (acres)[g]			
• Rail alignment[h]	1,100	1,200	1,200
• Quarries[f,i]	1,300 (NS-3A, NS-3B)	1,300 (NS-3A, NS-3B)	360 (ES-7)
• Well sites outside nominal width of construction right-of-way[f]	1.4	1.4	4.2
• Access roads to construction camps/well sites/quarries[f]	2.9 (to well site 12)	2.9 (to well site 12)	14 (to well sites 10, 11, 13)
Total disturbed area (acres)[f,j]	2,400	2,500	1,600
Percent soil characteristics[k]	0 erodes easily 8.8 blowing soils 0 prime farmland	0 erodes easily 9.5 blowing soils 0 prime farmland	0 erodes easily 7.7 blowing soils 0 prime farmland
Soil characteristic area (acres)[l]	0 erodes easily 210 blowing soils 0 prime farmland	0 erodes easily 240 blowing soils 0 prime farmland	0 erodes easily 120 blowing soils 0 prime farmland

a. Source: DIRS 180916-Nevada Rail Partners 2007, Appendix E.
b. To convert miles to kilometers, multiply by 1.6093.
c. To convert feet to meters, multiply by 0.3048.
d. To convert cubic yards to cubic meters, multiply by 0.76456.
e. Source: DIRS 182854-Shannon & Wilson 2006, Table 5.
f. Source: DIRS 180922-Nevada Rail Partners 2007, pp. 3-2 to 3-4 and 4-11, Table 4-7, and Appendices G and H.
g. To convert acres to square kilometers, multiply by 0.0040469.
h. Source: DIRS 182825-Nevada Rail Partners 2007, p. B-3.
i. Assuming that both NS-3A and NS-3B would be developed.
j. Totals might not equal sums of values due to rounding.
k. Source: DIRS 184079-Natural Resources Conservation Service 2007, all.
l. Soil area calculated by multiplying total disturbed area by the percent soil characteristic.

In the southern portion of the Goldfield Hills, one earthquake of magnitude 4.0 has been recorded within the past 150 years.

There is a high potential for metallic minerals along the central portion of Caliente common segment 4. Gold and silver deposits have been mined from the Stonewall and Cuprite Mining Districts (DIRS 183644-Shannon & Wilson 2007, pp. 56 to 59). However, impacts to these areas would be small because the minerals have not been found within the rail line construction right-of-way. Section 4.2.2, Land Use and Ownership, further describes impacts related to access to and use of such minerals and energy resources. There are also warm heat-flow wells near Caliente common segment 4. DOE would avoid these wells during rail line construction; therefore, impacts would be small.

Construction along Caliente common segment 4 would disturb approximately 1.1 square kilometers (270 acres). The surface area disruption would result in a loss of topsoil and the potential for increased erosion. The rail alignment would disturb 0.45 square kilometer (110 acres) of soils along Caliente common segment 4 with the erodes easily characteristic, soils that would be especially susceptible to erosion during construction, particularly from wind and water (see Table 4-3). DOE would implement best management practices (see Chapter 7) to reduce the potential for loss of topsoil and additional soil loss due to erosion.

There are also soils characterized as ***soft soils*** in playa deposits present along Caliente common segment 4. The saline conditions of these soils limit the chemical and physical potentials of the soil and could have negative effects on the vegetation-bearing capacity of the soil. Reclamation of these soils following construction would be more difficult than on non-saline soils, and would require more maintenance and care than on more productive soils. These soils would have a higher potential for erosion until revegetation was complete. DOE might need to implement additional reclamation measures and erosion control measures until the vegetation could be established (DIRS 174296-Shannon & Wilson 2005, pp. 13 and 14).

4.2.1.2.2.9 Bonnie Claire Alternative Segments. The two Bonnie Claire alternative segments would pass through Lida Valley and Sarcobatus Flat. The alternative segments would require similar amounts of fill, but Bonnie Claire alternative segment 2 would require excavation of twice as much cut material as Bonnie Claire alternative segment 3. Table 4-7 summarizes the key information DOE considered to assess impacts to physical setting from construction of either of the Bonnie Claire alternative segments.

Bonnie Claire alternative segment 2 would result in a total land disturbance of 1.9 square kilometers (470 acres) and Bonnie Claire alternative segment 3 would result in a total land disturbance of 1.9 square kilometers (460 acres) (see Table 4-7). Areas disturbed during construction would result in a loss of topsoil and increase the potential for erosion. However, these impacts would be temporary and would be reduced through the implementation of best management practices (see Chapter 7).

Although the alternative segments would pass through areas that have experienced recent low-level ***seismicity*** (magnitude 3.0 to 3.9) events, neither Bonnie Claire 2 nor Bonnie Claire 3 would cross known Quaternary fault traces. The primary seismic activity within the past 150 years occurred in 1999, when a magnitude 5.3 earthquake triggered many aftershocks over a series of days. Since then, earthquakes in the immediate vicinity of the Bonnie Claire alternative segments have been below magnitude 3.0 (DIRS 183639-Shannon & Wilson 2007, Plate 4). Seismic hazards in the area are considered consistent with the rest of southern Nevada. There is a potential for metallic mineral deposits along both Bonnie Claire alternative segments. Each segment would travel around the Wagner Mining District, which has produced low-tonnage mixed oxide and sulfide copper ore (DIRS 183644-Shannon & Wilson 2007, p. 54). DOE would position the rail alignment to avoid the mining district and to reduce the potential forimpacts to mineral deposits. Section 4.2.2, Land Use and Ownership, addresses potential impacts to the Wagner Mining District. The rail alignment would travel along the low sections of Stonewall Flat; therefore, impacts to metallic mineral deposits would be small.

About 0.48 to 0.51 square kilometer (120 to 130 acres) of the soils along Bonnie Claire alternative segment 3 and Bonnie Claire alternative segment 2, respectively, have soils with the erodes easily

Table 4-7. Summary of key information for assessing impacts from constructing Bonnie Claire alternative segment 2 or 3.

Attribute	Bonnie Claire 2	Bonnie Claire 3
Length (miles)[a,b]	13	12
Rise and fall (feet)[a,c]	540	570
Earthwork cut quantities (cubic yards)[a,d]	0.6 million	0.31 million
Earthwork fill quantities (cubic yards)[a]	1.24 million	0.92 million
Construction[e]	Cuts to 100 feet high in ***tuff***; cuts and fills to 45 feet deep in ***alluvium***.	Cuts to 50 feet high in tuff; cuts and fills to 20 feet deep in alluvium; low strength rock; broken rock expected because of faults visible in outcrop.
Number of construction camps[f]	0	0
Number of well sites outside nominal width of construction right-of-way[f]	0	0
Disturbed area (acres)[g]		
• Rail alignment[h]	470	460
• Quarries[f]	Not applicable	Not applicable
• Well sites outside nominal width of construction right-of-way[f]	Not applicable	Not applicable
• Access roads to construction camps/well sites/quarries[f]	Not applicable	Not applicable
Total disturbed area (acres)[f,i]	470	460
Percent soil characteristics[j]	27 erodes easily 0 blowing soils 0 prime farmland	25 erodes easily 0 blowing soils 0 prime farmland
Soil characteristic area (acres)[k]	130 erodes easily 0 blowing soils 0 prime farmland	120 erodes easily 0 blowing soils 0 prime farmland

a. Source: DIRS 180916-Nevada Rail Partners 2007, Appendix E.
b. To convert miles to kilometers, multiply by 1.6093.
c. To convert feet to meters, multiply by 0.3048.
d. To convert cubic yards to cubic meters, multiply by 0.76456.
e. Source: DIRS 182854-Shannon & Wilson 2006, Table 5.
f. Source: DIRS 180922-Nevada Rail Partners 2007, pp. 3-2 to 3-4 and 4-11, Table 4-7, and Appendices G and H.
g. To convert acres to square kilometers, multiply by 0.0040469.
h. Source: DIRS 182825-Nevada Rail Partners 2007, p. B-3.
i. Totals might not equal sums of values due to rounding.
j. Source: DIRS 184079-Natural Resources Conservation Service 2007, all.
k. Soil area calculated by multiplying total disturbed area by the percent soil characteristic.

characteristic (see Table 4-7). Thus, there would be a high potential for erosion along these alternative segments. DOE would implement best management practices (see Chapter 7) to reduce the potential for additional soil loss due to erosion. Overall, the potential impacts from constructing a rail line along either Bonnie Claire 2 or Bonnie Claire 3 would be similar.

4.2.1.2.2.10 Common Segment 5 (Sarcobatus Flat Area). Passing through Sarcobatus Flat, common segment 5 would have a low rise and fall. Table 4-3 summarizes the key information DOE considered to assess impacts to physical setting from construction of common segment 5.

The potential to expose people or structures to seismic hazards would be small because common segment 5 would not cross any known Quaternary fault traces, and would travel over relatively level terrain.

There is a high potential for metallic mineral resources where common segment 5 would pass near the Clarkdale Mining District. Small gold and silver deposits have been mined in Clarkdale, and are hypothesized to extend below portions of common segment 5 (DIRS 183644-Shannon & Wilson 2007, Table 1). However, construction activities would not uncover the bedrock and disturb the mineral resources. The area of common segment 5 also has a generally high potential for geothermal resources; there are several thermal springs near U.S. Highway 95 that would be parallel to the rail line (DIRS 183644-Shannon & Wilson 2007, p. 23). However, because DOE would avoid these resources during rail line construction, the potential for impacts would be small.

Construction of this common segment would disturb a total of 3.1 square kilometers (780 acres) of land. Surface disturbance related to construction activities would remove topsoil and increase the potential for erosion along the rail alignment. These impacts would be temporary and would be reduced through the use of best management practices (see Chapter 7).

Approximately 0.081 square kilometer (20 acres) of common segment 5 has the blowing soils characteristic, which would increase the potential for soil loss from wind. DOE would implement best management practices to minimize any additional soil loss from erosion. Section 4.2.4, Air Quality and Climate, addresses impacts related to construction-generated fugitive dust emissions.

4.2.1.2.2.11 Oasis Valley Alternative Segments. Oasis Valley alternative segments 1 and 3 would have a similar profile throughout the valley. Table 4-8 summarizes the key information DOE considered to assess impacts to physical setting from construction of either Oasis Valley alternative segment.

The Oasis Valley alternative segments would not cross known fault traces. Within the past 150 years of seismic records, there has been generally low earthquake activity in the area, so the potential seismic-related impacts to humans and structures would be small.

There is a low potential for commercial metallic, nonmetallic, and oil resources in the area of the Oasis Valley alternative segments (DIRS 182762-Shannon & Wilson 2007, Appendix E). The minerals present in the area around the alternative segments are found in small veins in the surrounding hills. There would be small impacts to such resources because the rail alignment would remain in the valley, away from mineral-bearing ***outcrops***. There is a high potential for geothermal deposits in the area; however, neither Oasis Valley alternative segment would approach any known hot springs or wells.

Oasis Valley alternative segment 3 would require more earthwork than Oasis Valley alternative segment 1 to obtain the appropriate grade (see Table 4-8) and would disturb 0.3 square kilometer (80 acres) more land area than Oasis Valley alternative segment 1. Construction activities would remove topsoil in the area and increase the potential for erosion along the rail alignment. Oasis Valley alternative segment 1 also contains about twice as much blowing soils as Oasis Valley alternative segment 3. DOE would implement best management practices (see Chapter 7) to reduce the potential for additional soil loss due to erosion.

Overall, potential impacts along either Oasis Valley alternative segment would be small. Oasis Valley alternative segment 3 would be longer and would require more land disturbance than Oasis Valley alternative segment 1, and Oasis Valley alternative segment 1 would contain more soils with a high potential for erosion.

Table 4-8. Summary of key information for assessing impacts from constructing Oasis Valley alternative segment 1 or 3.

Attribute	Oasis Valley 1	Oasis Valley 3
Length (miles)[a,b]	6	9
Rise and fall (feet)[a,c]	230	220
Earthwork cut quantities (cubic yards)[a,d]	0.066 million	0.16 million
Earthwork fill quantities (cubic yards)[a]	0.72 million	1.34 million
Construction[e]	Cuts up to 20 feet and fills up to 30 feet.	Cuts up to 50 feet and fills up to 40 feet.
Number of construction camps[f]	1 (no. 11)	1 (no. 11)
Number of well sites outside nominal width of construction right-of-way[f]	0	0
Disturbed area (acres)[g]		
• Rail alignment[h]	240	320
• Quarries[f]	Not applicable	Not applicable
• Well sites outside nominal width of construction right-of-way[f]	Not applicable	Not applicable
• Access roads to construction camps/well sites/quarries[f]	10 (to construction camp 11)	10 (to construction camp 11)
Total disturbed area (acres)[f,i]	250	330
Percent soil characteristics[j]	0 erodes easily 13 blowing soils 0 prime farmland	0 erodes easily 4.8 blowing soils 0 prime farmland
Soil characteristic area (acres)[k]	0 erodes easily 33 blowing soils 0 prime farmland	0 erodes easily 16 blowing soils 0 prime farmland

a. Source: DIRS 180916-Nevada Rail Partners 2007, Appendix E.
b. To convert miles to kilometers, multiply by 1.6093.
c. To convert feet to meters, multiply by 0.3048.
d. To convert cubic yards to cubic meters, multiply by 0.76456.
e. Source: DIRS 182854-Shannon & Wilson 2006, Table 5.
f. Source: DIRS 180922-Nevada Rail Partners 2007, pp. 3-2 to 3-4 and 4-11, Table 4-7, and Appendices G and H.
g. To convert acres to square kilometers, multiply by 0.0040469.
h. Source: DIRS 182825-Nevada Rail Partners 2007, p. B-3.
i. Totals might not equal sums of values due to rounding.
j. Source: DIRS 184079-Natural Resources Conservation Service 2007, all.
k. Soil area calculated by multiplying total disturbed area by the percent soil characteristic.

4.2.1.2.2.12 Common Segment 6 (Yucca Mountain Approach). Approaching Yucca Mountain, common segment 6 would pass through rugged terrain and along fault blocks. To achieve an appropriate grade, cuts up to 43 meters (140 feet) and fills up to 34 meters (110 feet) would be required (see Table 4-3). Some of the fill would be required to build the bridge over Beatty Wash.

There is a low potential for ground rupture associated with the eastern and western Yucca Fault systems (DIRS 182854-Shannon & Wilson 2006, Table 6). In areas with high topographic relief, construction of this common segment would also result in an increased potential for rock-slope failure and landslides (DIRS 182854-Shannon & Wilson 2006, Table 6). DOE would incorporate appropriate engineering features (see Chapter 2) during construction to stabilize these areas and prevent rock-slope failure and landslides. Construction activities would not be expected to result in off-site rock falls and landslides.

There is a high potential for the occurrence of some metallic and nonmetallic minerals along common segment 6. The rail alignment would cross the northeastern portion of the Bare Mountain Mining District, which has extracted a variety of minerals commodities over its period of operation, including fluorspar, silica, limestone, and trace amounts of gold and mercury (DIRS 183644-Shannon & Wilson 2007, p. 40). Construction impacts to mineral resources in this area would be small because the width of the construction right-of-way would allow for the extraction of the mining district's resources. Section 4.2.2, Land Use and Ownership, further describes impacts to the Bare Mountain Mining District.

There is a potential for geothermal resources in the northern portions of common segment 6. There are several warm and hot springs around Beatty, some of which are used as warm bathing pools. The rail alignment would bypass the springs; therefore, there would be no impact to local geothermal resources (DIRS 182762-Shannon & Wilson 2007, p. 23).

Construction activities along common segment 6 would disturb an estimated 5.5 square kilometers (1,400 acres). These activities could cause topsoil loss and increase erosion potential. DOE would implement best management practices (see Chapter 7) to minimize these impacts. There are no special soil characteristics along this common segment.

4.2.1.2.3 Facilities

4.2.1.2.3.1 Facilities at the Interface with the Union Pacific Railroad Mainline. There would be two facilities at the Interface with the Union Pacific Railroad Mainline: the Staging Yard and the Interchange Yard. The Staging Yard would be constructed on one of two potential locations along the Caliente alternative segment (Caliente-Indian Cove or Caliente-Upland) or on the Eccles alternative segment (Eccles-North).

The Staging Yard would disturb approximately 0.2 square kilometer (50 acres) and consist of a 610-square-meter (6,600-square-foot) office, a 560-square-meter (6,000-square-foot) Satellite Maintenance-of-Way Facility, and a paved access road (DIRS 180919-Nevada Rail Partners 2007, pp. 5-1 and 5-2).

The Interchange Yard would disturb 0.061 square kilometer (15 acres) at the Caliente location or 0.12 square kilometer (30 acres) at the Eccles location. The total amount of earthwork required would be 15,000 cubic meters (20,000 cubic yards) for Caliente and 120,000 cubic meters (150,000 cubic yards) for Eccles (DIRS 182825-Nevada Rail Partners 2007, p. A-5). There would be no buildings in the Interchange Yard.

Construction of these facilities would result in the removal of topsoil and an increased potential for erosion within the disturbed areas. DOE would implement best management practices (see Chapter 7) to minimize potential erosion impacts. There would be a permanent loss of topsoil in the areas under the buildings and paved roads.

4.2.1.2.3.2 Maintenance-of-Way Facilities. If DOE were to select Goldfield alternative segment 1 or 3, then it would construct a Maintenance-of-Way Headquarters Facility south of Tonopah and a Maintenance-of-Way Trackside Facility along Caliente common segment 3. If DOE were to select Goldfield alternative segment 4, then it would construct a single Maintenance-of-Way Facility along Goldfield alternative segment 4, north of Goldfield.

The Maintenance-of-Way Headquarters and Trackside Facilities options associated with Goldfield alternative segment 1 or 3 would disturb 0.013 square kilometer (3.2 acres) and 0.061 square kilometer

(15 acres), respectively (DIRS 182825-Nevada Rail Partners 2007, Appendix B). The option associated with Goldfield alternative segment 4 would disturb 0.061 square kilometer (15 acres).

Construction of these facilities would result in topsoil loss and increased erosion potential. DOE would implement best management practices to minimize potential erosion impacts. During construction, the topsoil would be sequestered and stabilized to prevent its permanent loss.

4.2.1.2.3.3 Rail Equipment Maintenance Yard. Construction of the Rail Equipment Maintenance Yard would disturb approximately 0.41 square kilometer (100 acres) (DIRS 182825-Nevada Rail Partners 2007, p. A-5). This area could include the ***Cask Maintenance Facility***, and ***escort-car*** and locomotive light-repair garages. It could also house the ***Nevada Railroad Control Center*** and the National Transportation Operations Center. Construction of these facilities would result in topsoil loss and increased erosion potential. DOE would implement best management practices to minimize potential erosion impacts. During construction, the topsoil would be sequestered and regraded to prevent its permanent loss.

4.2.1.2.3.4 Cask Maintenance Facility. The Cask Maintenance Facility would be used to house the transportation casks, and would process them during routine inspections, cleaning, and repair. The facility would disturb 0.081 square kilometer (20 acres), which would include buildings, a rail yard, and track siding (DIRS 180919-Nevada Rail Partners 2007, p. 1-3). The facility could be in one of three locations: collocated with the Rail Equipment Maintenance Yard, along one of the rail alignment segments outside the ***Yucca Mountain Site boundary***, or at a currently undetermined location outside Nevada.

4.2.1.2.4 Quarries

DOE would develop up to four of six potential quarry sites along the Caliente rail alignment. Each quarry site would contain an operations plant, quarry and production area, access roads, a railroad siding with loading facility, and could contain a conveyor belt (see Figure 2-33). The operations plant would include administrative offices, a parking area, sanitary facilities, and an equipment fueling and service area. The quarry and production area would include the pit, which would vary in size depending on quarry location, a waste-rock pile with a rectangular footprint of 0.057 square kilometer (14 acres), a ballast stockpile, settling ponds, a water well, and emergency generators.

The maximum disturbance area for each quarry was calculated from the areas that would be disturbed from excavating the quarry pit and building the associated plant facilities, roads, railroad siding, and conveyor belts. A construction buffer was also included, and would be reclaimed once construction was completed. The quarry pit would create the largest disturbance area, so if less ballast was needed, or high-quality minerals were excavated, the total disturbance area for the quarry site would likely be much smaller. Depending on the topography, the relative positions of the facilities, and quality and amount of extracted rock, the total area of disturbance from a quarry site would range from 1.3 to 3.8 square kilometers (320 to 930 acres).

Construction and operation of quarries would modify the physical setting in multiple ways. Construction of the buildings, access roads, and conveyer belts would disturb topsoil. During quarry operation, rock extraction would require the removal of the thin soil overburden. The result would be some topsoil loss during quarry construction and operation. Construction and operation of the quarries would also increase the potential for erosion. These impacts would be temporary, limited to the area around the quarry facilities, and DOE would implement best management practices (see Chapter 7) to reduce the impacts. Where practicable, the topsoil would be reserved for reclamation and revegetation. Excavation of bedrock from the pit would result in permanent loss of the mineral resources and change the local topography. However, the quarries would be in areas with abundant mineral resources; therefore, impacts to the overall availability of minerals suitable for quarrying would be small.

After construction, DOE would implement reclamation activities to reduce permanent impacts. The Department would demolish quarry access roads by removing the roadway materials and regrading the area. Terrain restoration around the quarry facility and pit would include restoring quarry-pit walls to more stable slopes, grading and replacing topsoil, and revegetating the area (DIRS 180922-Nevada Rail Partners 2007, p. 3-4). Reclamation activities would reduce the direct and indirect topsoil loss and increased erosion impacts caused by quarry construction and operation.

Sections 4.2.1.2.4.1 through 4.2.1.2.4.6 describe potential impacts related to each potential quarry site along the Caliente rail alignment.

4.2.1.2.4.1 Quarry CA-8B. Potential quarry CA-8B would be in hilly terrain west of the Caliente alternative segment. The quarry pit (see Figure 2-24) would be mined from the side of a hill with a vertical relief of 61 meters (200 feet). The ballast produced from this quarry could be a portion of the 2.15 million metric tons (3.47 million tons) required for railroad construction and maintenance. At most, this quarry pit could occupy an area of 0.093 square kilometer (23 acres) to a depth of 61 meters, which would produce approximately 14.5 million metric tons (16 million tons) of ballast (DIRS 180922-Nevada Rail Partners 2007, p. A-2). The actual quarry dimensions would likely be much smaller – approximately 0.04 square kilometer (10 acres) to a depth of 24 meters (80 feet) (DIRS 180922-Nevada Rail Partners 2007, p. 3-2). The entire quarry footprint, including roads, conveyer belt, quarry and production area, and its construction buffer zones would disturb 1.6 square kilometers (400 acres).

Access to quarry CA-8B would be by existing and new roads (DIRS 180922-Nevada Rail Partners 2007, Appendix I). DOE would construct 5.4 kilometers (3.4 miles) of new roadway and would improve 4.3 kilometers (2.7 miles) of existing roadway to access the quarry pit and facilities (DIRS 180922-Nevada Rail Partners 2007, Table 4-7). Excavated ballast would be trucked to the quarry plant, which would be on a nearby plateau. Once the ballast was separated, it would be transported to the Caliente alternative segment by one of two proposed conveyer-belt options. One option would be for the conveyer belt to travel northeast from the processing plant to a railroad siding that would service the Upland Staging Yard. Under the other option, it would travel south and service the Indian Cove Staging Yard. The railroad siding and conveyer belt option would be chosen based on which Staging Yard would be developed. The conveyer belt and service road would disturb a 15-meter (50-foot)-wide path from the processing plant to the rail loading facility. Existing roads would be updated by grading and adding a gravel roadbed.

4.2.1.2.4.2 Quarry NN-9A. Quarry NN-9A is one of two potential quarries along the South Reveille alternative segments. When operational, this quarry could supply a portion of the 3.15 million metric tons (3.47 million tons) of ballast required for railroad construction and maintenance (DIRS 180922-Nevada Rail Partners 2007, p. 3-1). The quarry pit and associated facilities would be east of the junction of South Reveille alternative segments 2 and 3 shown on Figure 2-25. Two 12-meter (40-foot)-high hills would be mined for the ***basalt*** bedrock. For quarry NN-9A, DOE would construct 7.1 kilometers (4.4 miles) of new roadway and would update 15 kilometers (9.5 miles) of existing roads (DIRS 180922-Nevada Rail Partners 2007, Table 4-7). Quarry NN-9A would be able to produce a maximum of 36.3 million metric tons (40 million tons) of ballast excavated out of a 1.3-square-kilometer (330-acre) pit 11 meters (36 feet) deep. There would be two potential plant facilities to the north and south of the quarry pit. Ballast would be trucked along existing County Road 525 to the loading facility on Caliente common segment 3. The disturbance area for the entire quarry footprint would be 2 square kilometers (490 acres).

4.2.1.2.4.3 Quarry NN-9B. Potential quarry NN-9B would be smaller than NN-9A and would be east of the quarry NN-9A location shown on Figure 2-25. Although either quarry would be at the junction of the two South Reveille alternative segments, quarry NN-9B would be closer to South Reveille 2 and would require less road construction and shorter transport routes. This quarry could supply a portion of the 3.15 million metric tons (3.47 million tons) of required ballast (DIRS 180922-Nevada Rail Partners 2007, p. 3-1).

Quarry NN-9B would excavate a 37-meter (120-foot)-high ridge. For quarry NN-9B, DOE would construct 7.1 kilometers (4.4 miles) of new roadway and would update 15 kilometers (9.1 miles) of existing roads (DIRS 180922-Nevada Rail Partners 2007, Table 4-7). Quarry NN-9B would produce 2.72 million metric tons (3 million tons) of ballast from a 0.23-square-kilometer (60-acre) pit 4.6 meters (15 feet) deep. These dimensions would likely be smaller to satisfy the ballast requirements for construction. The ballast from quarry NN-9B would be trucked on new unnamed roads to the loading facility on the selected alternative segment. The disturbance area for the quarry NN-9B construction footprint would be 1.3 square kilometers (320 acres).

4.2.1.2.4.4 Quarry ES-7. Potential quarry ES-7 would be west of Goldfield alternative segment 4 and could be developed if DOE selected Goldfield alternative segment 4 (see Figure 2-26). The quarry pit and plant facilities would be on a 49-meter (160-foot)-high mesa with access to two basalt deposits. DOE could extract a maximum of 8.49 million metric tons (9.36 million tons) of basalt ballast from the 0.11-square-kilometer (27-acre) pit with a depth of 30 meters (100 feet). Depending on the amount of ballast required, the footprint of this quarry would likely be smaller. There could also be a secondary quarry of variable-quality rock in the area. It would be able to produce a maximum of 2.9 million metric tons (3.2 million tons) of ballast from a 37,000-square-meter (9.2-acre) pit 30 meters deep. However, the final dimensions of this secondary quarry would likely be smaller. This quarry could supply a portion of the required 3.15 million metric tons (3.47 million tons) of ballast (DIRS 180922-Nevada Rail Partners 2007, p. 3-1).

Access to the quarry pit and production plant would be via an existing road off U.S. Highway 95, with new roadway construction to extend into the quarry site (DIRS 180922-Nevada Rail Partners 2007, Appendix I). DOE would construct approximately 6.6 kilometers (4.1 miles) of new roadway and would improve approximately 8.4 kilometers (5.2 miles) of existing roadway to access the quarry pit and facilities (DIRS 180922-Nevada Rail Partners 2007, Table 4-7). A conveyer belt would carry the ballast from the production facility to the rail siding. The conveyer belt and correlating service road would be 15 meters (50 feet) wide. The total disturbance area of the quarry footprint would be 1.5 square kilometers (360 acres).

4.2.1.2.4.5 Quarry NS-3A. Potential quarry NS-3A would be on basalt hills in a valley along the eastern side of Goldfield alternative segment 3 (see Figure 2-27) and could be constructed if DOE selected Goldfield alternative segment 1 or 3. The quarry pit might have to be split into two locations because of the large quantities of overburden in the area (DIRS 180922-Nevada Rail Partners 2007, p. D-1). The quarry would be able to produce a maximum of 99.8 million metric tons (110 million tons) of basalt rock from two pits totaling 21 square kilometers (530 acres) with depths ranging from 12 to 30 meters (40 to 100 feet). However, rail line construction would require 3.15 million metric tons (3.47 million tons) of ballast. The ballast would be processed at one of the two potential quarry plant facilities and trucked to the loading facilities along 13 kilometers (8 miles) of existing roads and 3.5 kilometers (2.2 miles) of new road (DIRS 180922-Nevada Rail Partners 2007, Table 4-7). The total quarry footprint disturbance area would be 3.8 square kilometers (930 acres).

4.2.1.2.4.6 Quarry NS-3B. Potential quarry NS-3B would also be on basalt hills along Goldfield alternative segment 3 (see Figure 2-27) (DIRS 180922-Nevada Rail Partners 2007, Appendix I) and could be constructed if DOE selected Goldfield alternative segment 1 or 3. The quarry area would be south of the quarry NS-3A potential location. Basalt rock would be quarried on either side of the rail alignment in 21- to 30-meter (69- to 100-foot) cuts, which would produce a maximum of 27.2 million metric tons (30 million tons) of ballast. The cuts would occupy an area of 12 square kilometers (2,900 acres). The ballast from quarry N3-3B would be trucked on new unnamed roads to the loading facility on Goldfield alternative segment 3. If chosen, this quarry could supply a portion of the required 3.15 million metric tons (3.47 million tons) of ballast. The total quarry footprint disturbance area would be 1.5 square kilometers (370 acres).

4.2.1.3 Operations Impacts

The proposed railroad would operate for up to 50 years (DIRS 182826-Nevada Rail Partners 2007, p. 4-1). The operations right-of-way would be nominally 61 meters (200 feet) on either side of the centerline of the rail line. By definition, the operations right-of-way would be within the construction right-of-way; therefore, use of the completed rail line to Yucca Mountain would have no additional impact to physical setting beyond the permanent alterations resulting from construction.

Rail line maintenance would require periodic inspections to verify the condition of the track, drainage structures, and rock-wall surfaces. When necessary, rock faces on cuts would be repaired to minimize the potential for rockfall or landslide. Areas along the rail line would also be monitored for evidence of erosion, particularly where there is a high percentage of soils classified as erodes easily (Caliente alternative segment [74 percent], Eccles alternative segment [71 percent], Bonnie Claire alternative segment 2 [27 percent], Bonnie Claire alternative segment 3 [25 percent], and Caliente common segment 4 [41 percent]).

Eroded areas encroaching on the track bed would be repaired, which could include replacement of ballast and subballast to reduce erosion of exposed soils. Although there would be a potential for erosion and landslides along the rail line, the potential would be substantially similar to baseline conditions, and would be attributed to natural occurrences after construction was completed, not to due to train operations. In addition, DOE would use appropriate slope-stabilizing engineering practices (see Chapter 2) during the construction phase that would reduce hazards from rockfalls and landslides during the operations phase. Section 4.2.8, Noise and Vibration, describes potential impacts from vibration in more detail.

During the operations phase, DOE would continue to monitor seismic activity in the region. DOE would also continue to follow the procedures based on the American Railways Engineering and Maintenance-of-Way Association seismic guidelines it adopted during the construction phase (see Section 4.2.1.2.1.2 and Table 4-1). These measures, also outlined in Chapter 7, would reduce the potential for structural damage and human exposure to seismic hazards.

4.2.1.4 Impacts under the Shared-Use Option

The Shared-Use Option would include the construction and operations activities described in Sections 4.2.1.2 and 4.2.1.3, and private companies would use the rail line for shipment of general freight. Under the Shared-Use Option, potential construction and operations impacts would be very similar to those identified in Sections 4.2.1.2 and 4.2.1.3 for the Proposed Action without shared use.

The Shared-Use Option would require the construction of more rail sidings within the rail line construction right-of-way in areas of relatively flat terrain. A commercial-use interchange facility at the beginning of the line and a facility at the termination point of commercial use to support the Shared-Use Option would also be constructed within the construction right-of-way. Implementation of the Shared-Use Option would increase the area of surface disturbance by less than 0.1 percent (see Chapter 2). There would be a potential for topsoil loss and increased erosion in this area.

Under the Shared-Use Option, the rail line would likely be in use for more than 50 years, compared to the railroad operations life under the Proposed Action without shared use. Shared use of the proposed rail line would add no impacts to physical setting beyond the permanent alterations already described.

4.2.1.5 Summary

Table 4-9 summarizes potential impacts to physical setting from constructing and operating the proposed railroad along the Caliente rail alignment. With the exception of topsoil loss, the overall impacts would be small because of the best management practices or ***mitigation*** measures DOE would implement (see Chapter 7). There would be a potential for increased erosion because relatively undisturbed land would be extensively graded. Impacts related to soil erosion or loss of topsoil would be small, because implementation of best management practices would effectively reduce the potential for increased erosion and sedimentation that could occur during construction activities. In addition, soil disturbance would be distributed throughout several counties, reducing the concentration of increased soil erosion.

The Caliente rail alignment would cross faults in Nevada, a seismically active area. However, DOE would adopt the American Railway Engineering and Maintenance-of-Way Association seismic guidelines. Additional seismic monitoring procedures would also be implemented during the construction and operations phases. Construction of the rail alignment would avoid known commercial mineral deposits, and would not remove them from permanent use. The quarries and borrow sites that would be opened and used for supplying the ballast and subballast would remove mineral resources from the area. However, construction would consume only a small percentage of the total available supply of these materials over several counties. There would be no additional impacts to the physical setting from the railroad operations under the Proposed Action or the Shared-Use Option.

Table 4-9. Summary of impacts to physical setting from constructing and operating the proposed railroad along the Caliente rail alignment[a] (page 1 of 4).

Rail line segment/ facilities (county)	Construction impacts	Operations impacts
Rail line segment		
Caliente alternative segment (Lincoln County)	Total surface disturbance: 770 acres, would result in topsoil loss and increased potential for erosion. Loss of prime farmland soils: 40 acres; less than 0.1 percent of prime farmland soils in Lincoln County. Small impact to local mineral resources due to potentially disturbed perlite deposits near the alternative segment.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.
Eccles alternative segment (Lincoln County)	Total surface disturbance: 480 acres, would result in topsoil loss and increased potential for erosion. Loss of prime farmland soils: 23 acres; less than 0.1 percent of prime farmland soils in Lincoln County. Small impact to local mineral resources due to potentially disturbed perlite deposits near the alternative segment.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.
Caliente common segment 1 (Lincoln County and Nye County)	Total surface disturbance: 2,800 acres, would result in topsoil loss and increased potential for erosion. Loss of prime farmland soils: 280 acres; less than 0.1 percent of prime farmland soils in Lincoln and Nye Counties. Small impact to limestone resources.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.

Table 4-9. Summary of impacts to physical setting from constructing and operating the proposed railroad along the Caliente rail alignment[a] (page 2 of 4).

Rail line segment/ facilities (county)	Construction impacts	Operations impacts
Rail line segment (continued)		
Garden Valley alternative segments 1, 2, 3, and 8 (Lincoln County and Nye County)	Total surface disturbance would result in topsoil loss and increased potential for erosion: Garden Valley 1 = 830 acres Garden Valley 2 = 880 acres Garden Valley 3 = 890 acres Garden Valley 8 = 910 acres Loss of prime farmland soils: Garden Valley 1 =70 acres Garden Valley 2 = 97 acres Garden Valley 8 = 89 acres Less than 0.1 percent of prime farmland soils in Lincoln and Nye Counties. No impacts to limestone resources due to location.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.
Caliente common segment 2 (Lincoln County and Nye County)	Total surface disturbance: 1,000 acres, would result in topsoil loss and increased potential for erosion. No impact to mineral or geothermal resources.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.
South Reveille alternative segments 2 and 3 (Nye County)	Total surface disturbance would result in topsoil loss and increased potential for erosion: South Reveille 2 = 1,200 acres South Reveille 3 = 1,200 acres No impact to mineral or geothermal resources.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.
Caliente common segment 3 (Nye County)	Total surface disturbance: 2,500 acres, would result in topsoil loss and increased potential for erosion. Small potential impact to barite, gold, silver, and geothermal resources due to location of common segment.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.
Goldfield alternative segments 1 and 4 (Nye County and Esmeralda County) Goldfield alternative segment 3 (Nye County)	Total surface disturbance would result in topsoil loss and increased potential for erosion: Goldfield 1 =2,400 acres Goldfield 3 = 2,500 acres Goldfield 4 = 1,600 acres Potential impacts to metallic and nonmetallic resources would be small.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.
Caliente common segment 4 (Nye County and Esmeralda County)	Total surface disturbance: 270 acres, would result in topsoil loss and increased potential for erosion. Small impacts to metallic and geothermal resources.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.

Table 4-9. Summary of impacts to physical setting from constructing and operating the proposed railroad along the Caliente rail alignment[a] (page 3 of 4).

Rail line segment/ facilities (county)	Construction impacts	Operations impacts
Rail line segment (continued)		
Bonnie Claire alternative segments 2 and 3 (Nye County)	Total surface disturbance would result in topsoil loss and increased potential for erosion: Bonnie Claire 2 = 470 acres Bonnie Claire 3 = 460 acres Small impacts to metallic mineral resources.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.
Common segment 5 (Nye County)	Total surface disturbance: 780 acres, would result in topsoil loss and increased potential for erosion. Small impact to metallic mineral and geothermal resources.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.
Oasis Valley alternative segments 1 and 3 (Nye County)	Total surface disturbance would result in topsoil loss and increased potential for erosion: Oasis Valley alternative segment 1 = 250 acres Oasis Valley alternative segment 3 = 330 acres Small impacts to mineral resources.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.
Common segment 6 (Nye County)	Total surface disturbance: 1,400 acres, would result in topsoil loss and increased potential for erosion. Small impacts to mineral and geothermal resources.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.
Facilities		
Access roads (included in total surface disturbance in individual segments) (Lincoln, Nye, and Esmeralda Counties)	Total surface disturbance: 990 acres, would result in topsoil loss and increased potential for erosion. Alteration of prime farmland soils (see table entries for Caliente alternative segment, Eccles alternative segment, and Caliente common segment 1)	Potential for soil erosion in localized areas along access roads; implementation of erosion prevention methods would reduce impacts.
Facilities at the Interface with the Union Pacific Railroad Mainline (includes the Interchange Yard, the Staging Yard, and the Satellite Maintenance-of-Way Facility) (Lincoln County)	Total surface disturbance: 65 acres for Caliente alternative segment and 80 acres for Eccles alternative segment, would result in topsoil loss and increased potential for erosion.	Potential for soil erosion in localized areas around the facilities; implementation of erosion prevention methods would reduce impacts.

Table 4-9. Summary of impacts to physical setting from constructing and operating the proposed railroad along the Caliente rail alignment[a] (page 4 of 4).

Rail line segment/ facilities (county)	Construction impacts	Operations impacts
Facilities (continued)		
Maintenance-of-Way Facilities (includes the Maintenance-of-Way Headquarters Facility, the Maintenance-of-Way Trackside Facility, and the consolidated option) (Lincoln, Nye, and Esmeralda Counties)	Total surface disturbance: For the options associated with Goldfield alternative segment 1 or 3: 18 acres. For the option associated with Goldfield alternative segment 4: 15 acres. Both options would result in topsoil loss and increased potential for erosion.	Potential for soil erosion in localized areas around the facilities; implementation of erosion prevention methods would reduce impacts.
Rail Equipment Maintenance Yard (includes Cask Maintenance Facility) (Nye County)	Total surface disturbance: 100 acres, would result in topsoil loss and increased potential for erosion.	Potential for soil erosion in localized areas around the facility; implementation of erosion prevention methods would reduce impacts.
Water wells (Lincoln, Nye, and Esmeralda Counties)	Total surface disturbance: 28 acres, would result in topsoil loss and increased potential for erosion. (137 potential well sites with 231 potential wells; 117 well sites would be within the nominal width of the construction right-of-way; 20 well sites would be outside the nominal width of the construction right-of-way, at 1.4 acres surface disturbance at each well site)	Potential for soil erosion in localized areas around the well sites; implementation of erosion prevention methods would reduce impacts.
Quarries		
Potential quarry CA-8B (Lincoln County)	Total surface disturbance: 400 acres, would result in topsoil loss and increased potential for erosion. Extraction of all 16 million tons of rock would reduce the availability of local construction mineral materials.	Potential for soil erosion in localized areas around the quarry; implementation of erosion prevention methods would reduce impacts.
Potential quarries NN-9A and NN-9B (Nye County)	Total surface disturbance: 820 acres, would result in topsoil loss and increased potential for erosion. Extraction of all 16 million tons of rock would reduce the availability of local construction mineral materials.	Potential for soil erosion in localized areas around the quarry; implementation of erosion prevention methods would reduce impacts.
Potential quarry ES-7 (Nye County)	Total surface disturbance: 360 acres, would result in topsoil loss and increased potential for erosion. Extraction of all 12.6 million tons from two pits would reduce the availability of local construction mineral materials.	Potential for soil erosion in localized areas around the quarry; implementation of erosion prevention methods would reduce impacts.
Potential quarries NS-3A and NS-3B (Esmeralda County)	Total surface disturbance: 930 (NS-3A) to 370 (NS-3B) acres, would result in topsoil loss and increased potential for erosion. NS-3A: Extraction of all 110 million tons would reduce the availability of local construction mineral materials. NS-3B: Extraction of all 30 million tons would reduce the availability of local construction mineral materials.	Potential for soil erosion in localized areas around the quarry; implementation of erosion prevention methods would reduce impacts.

a. To convert acres to square kilometers, multiply by 0.0040469; to convert tons to metric tons, multiply by 0.90718.

4.2.2 LAND USE AND OWNERSHIP

This section describes impacts to land use and ownership from constructing and operating the proposed railroad along the Caliente rail alignment. Section 4.2.2.1 describes the methods DOE used to assess potential impacts; Section 4.2.2.2 describes potential impacts to land use during the construction phase; Section 4.2.2.3 describes potential railroad operations impacts; Section 4.2.2.4 describes potential impacts under the Shared-Use Option; and Section 4.2.2.5 summarizes potential impacts to land use and ownership.

Section 3.2.2.1 describes the region of influence for land use and ownership.

4.2.2.1 Impact Assessment Methodology

Table 4-10 lists factors DOE considered to determine potential impacts to land use and ownership from project-related construction and operations activities.

DOE assessed potential impacts to land use and ownership along the rail line based on the nominal width of the construction right-of-way.

Table 4-10. Impact assessment considerations for land use and ownership.

Land use	Potential for impact
General	Nonconformance with applicable general and regional plans and approved or adopted policies, goals, or operations of communities or governmental agencies
Private land	Change in current land use
	Permanent displacement of existing, developing, or approved urban/industrial buildings or activities (residential, commercial, industrial, non-federal governmental, or institutional)
	Loss of ownership or title to private land
American Indian land	Conflict with existing land-use plans or cause incompatible land uses
Department of Defense land	Conflict with existing land-use plans or cause incompatible land uses
Livestock grazing lands	Loss of grazing land and associated animal unit months
	Alteration of livestock operations or disruption of livestock movement
	Change to the amount or distribution of existing stockwater sources
	Potential human disturbance to livestock (such as loss of livestock due to collisions with trains)
Mineral and energy resources	Potential to preclude mining operations or the extraction of oil, gas, and geothermal resources within the rail line construction right-of-way
	Disturbance to existing or proposed mining operations with an approved mining plan
	Potential to cause the collapse of active underground mines, tunnels, or shafts
Recreational areas and access to public or private lands	Potential disturbance to any land designated as recreational sites
	Potential alteration of routes for large, recurring organized off-highway vehicle events and races
	Restricted or altered access to any recreational sites or public land
	Restricted or altered access to private land
Utility and transportation corridors and rights-of-way	Interference with an existing or planned utility or transportation right-of-way
	Need for a new right-of-way within a BLM-designated right-of-way avoidance area, such as an Area of Critical Environmental Concern

For railroad construction and operations support facilities, this section describes potential impacts to land use and ownership in conjunction with each facility's nearest segment, based on the current land use at the site. Table 4-11 describes the required support facilities and the current land uses at their proposed locations. Chapter 2 describes the facilities and their locations in more detail.

Table 4-11. Land use associated with railroad construction and operations support facilities.

Facilities	Number of facilities under the Proposed Action[a,b]	Within the nominal width of the rail line construction right-of-way	Land ownership
Construction camps	Up to 12	Yes	BLM-administered public land, except for a portion of camp 1 that would be on private land
Construction wells	Maximum of 107 well sites Area of disturbance for each would be 62,500 square feet	All but 14	Construction wells outside the nominal width of the construction right-of-way would be on BLM-administered land
Quarries	Up to four needed out of six potential sites	No	All on BLM-administered land except for quarry CA-8B, portions of which would be on private land
Interchange Yard	One on either the Caliente or Eccles alternative segment 15 acres of land at Caliente or 30 acres at Eccles	No	Would fall within existing Union Pacific Railroad right-of-way
Upland or Indian Cove Staging Yard	One if DOE selected the Caliente alternative segment 110 acres at Upland or 180 acres at Indian Cove	Yes	Private land
Eccles-North Staging Yard	Required if DOE selected the Eccles alternative segment, occupying 70 acres	Yes	BLM-administered public land
Maintenance-of-Way Trackside Facility	One required (two location options)	Yes	BLM-administered public land
Maintenance-of-Way Facility	One if Goldfield alternative segment 4 is selected, two if Goldfield alternative segment one or three is selected	Goldfield alternative segment 4 option – Yes Goldfield alternative segments 1 and 3 option – No	BLM-administered public land
Rail Equipment Maintenance Yard	Includes the Satellite Maintenance-of-Way Facility, possibly the Nevada Railroad Control Center and National Transportation Operations Center	No	DOE-managed land (Yucca Mountain Site)[c]
Cask Maintenance Facility	One This facility has three location options: (1) collocated with the Rail Equipment Maintenance Yard, (2) anywhere along the rail line outside the Yucca Mountain Site boundary, or (3) anywher outside Nevada	No	For purposes of analysis, collocated with the Rail Equipment Maintenance Yard

a. To convert square feet to square meters, multiply by 0.092903.
b. To convert acres to square kilometers, multiply by 0.0040469.
c. DOE would implement the Proposed Action only after the proposed public land withdrawal for the Yucca Mountain Site was completed, when control of the land would be transferred to DOE.

Construction camps, some construction wells, and some facilities would lie within the nominal 300-meter (1,000-foot)-wide area that supports the construction of the rail line and service road. Where this occurs, these facilities are included in the analysis of their respective rail segment and are not addressed separately. However, just as rail segments are analyzed individually, facilities that are located outside the nominal construction footprint of the rail line, as shown in Table 4-11, are also individually addressed.

Although not all the well locations identified would be used for the project, for purposes of analysis and to conservatively estimate impacts to land use and ownership, DOE assumes that it would develop all the well locations outside the nominal rail line construction right-of-way and footprints of the quarry sites.

4.2.2.2 Construction Impacts to Land Use and Ownership

Sections 4.2.2.2.1 through 4.2.2.2.8 discuss potential land-use impacts during the construction phase. Because potential impacts to land use would occur primarily from the presence of the rail line, the construction timeframe (which could range from 4 to 10 years) would have little effect on the resulting land-use impacts, other than to provide greater lead time to implement mitigation measures, establish land-use agreements, and revise ***grazing allotment*** permits where applicable. Therefore, DOE did not assess potential land-use impacts for different construction timeframes.

Table 4-12 provides an overview of land ownership within the rail line construction right-of-way and the locations of support facilities.

Table 4-12. Land ownership by alternative segment and common segment within the rail line construction right-of-way and facilities outside the construction right-of-way[a] (page 1 of 2).

Rail line segment or facility	Land ownership	Area (square kilometers)[b]	Area (acres)
Caliente alternative segment	Private	0.64	160
	Public (BLM-administered)	0.1	24
Staging Yard, Caliente-Indian Cove	Private	0.73	180
Staging Yard, Caliente-Upland	Private	0.45	110
Potential quarry CA-8B – Indian Cove option	Private	0.16	39
	Public (BLM-administered)	1.2	300
Potential quarry CA-8B – Upland option	Private	0.20	49
	Public (BLM-administered)	1.1	290
Eccles alternative segment	Private	0.3	74
	Public (BLM-administered)	4.9	1,200
Staging Yard, Eccles-North	Public (BLM-administered)	0.30	73
Caliente common segment 1	Public (BLM-administered)	34	8,510
Garden Valley alternative segment 1	Public (BLM-administered)	11	2,590
Garden Valley alternative segment 2	Public (BLM-administered)	11	2,620
Garden Valley alternative segment 3	Public (BLM-administered)	11	2,830
Garden Valley alternative segment 8	Public (BLM-administered)	10	2,550
Caliente common segment 2	Public (BLM-administered)	15	3,690
South Reveille alternative segment 2	Public (BLM-administered)	5.6	1,370
South Reveille alternative segment 3	Public (BLM-administered)	6.0	1,490
Caliente common segment 3	Public (BLM-administered)	33	8,270
Goldfield alternative segment 1	Private	0.59	150
	Public (BLM-administered)	13	3,260

Table 4-12. Land ownership by alternative segment and common segment within the rail line construction right-of-way and facilities outside the construction right-of-way[a] (page 2 of 2).

Rail line segment or facility	Land ownership	Area (square kilometers)[b]	Area (acres)
Maintenance-of-Way Headquarters Facility – Goldfield alternative segment 1 or 3 option	Public (BLM-administered)	0.013	3.2
Goldfield alternative segment 3	Private	0.19	46
	Public (BLM-administered)	15	3,700
Goldfield alternative segment 4	Private	0.49	120
	Public (BLM-administered)	14	3,570
Caliente common segment 4	Public (BLM-administered)	3.5	870
Bonnie Claire alternative segment 2	Public (BLM-administered)	6.1	1,520
Bonnie Claire alternative segment 3	Public (BLM-administered)	6.1	1,500
Common segment 5	Public (BLM-administered)	12	2,950
Oasis Valley alternative segment 1	Private	0.004	0.9
	Public (BLM-administered)	2.9	720
Oasis Valley alternative segment 3	Public (BLM-administered)	4.4	1,100
Common segment 6	Public (BLM-administered)	12	2,880
	Public (DOE)	4.1	1,020

a. Source: DIRS 185440-BSC 2008, all.
b. Values are rounded to two significant figures, except for areas larger than 1,000 acres, which are rounded to nearest value of 10.

4.2.2.2.1 Private Land

4.2.2.2.1.1 County and Local Land-Use Plans. In general, DOE developed the Caliente rail alignment to avoid private land. There would be no land-use conflicts in terms of county land uses, projects, or planning.

- *Lincoln County Master Plan* (DIRS 185538-Lincoln County 2007, all)

  This plan addresses the proposed Yucca Mountain Repository and discusses the potential impacts of the repository on the county, which include an anticipated increase in demand for housing, schools, medical services, police and fire protection, and highway patrols due to rail or facility workers in Caliente. Lincoln County also proposes to revise its Emergency Management Plan to address the issue of hazardous cargo transport along U.S. Highway Route 93 and other roads in the county (DIRS 185538-Lincoln County 2007, p. 38). The plan also states that new industrial development should be encouraged along the highway and railway corridors with future public land disposals if services can be provided. The Meadow Valley Industrial Park in Caliente is promoting the use of the existing Union Pacific rail corridor. The plan's aim to increase industrial development along railway corridors could increase new industrial development along any new railway constructed by DOE if the Shared-Use Option were selected. The plan also states that amendments to the master plan will be required for large project applicants for any areas more than 0.04 square kilometer (10 acres) in size (DIRS 185538-Lincoln County 2007, p. 19). Both the Caliente and Eccles alternative segment would require access to more than 0.04 square kilometer (10 acres) of private land, and could require an amendment to the Lincoln County Master Plan. The plan states that Lincoln County should help facilitate the exchange of federal lands into private ownership and that land disposals shall strive to diversify the local economy and meet land-use needs of the community plans. The Caliente and Eccles alternative segments, the eastern portion of Caliente common segment 1, and a portion of quarry CA-8B would occupy lands identified in the Ely Proposed Resource Management Plan for disposal. The Eccles alternative segment would occupy 4.2 square kilometers (1,030 acres), while the Caliente alternative segment would occupy approximately 0.10 square kilometer (24 acres) of lands identified for disposal. Caliente common segment 1 would occupy 0.6 square kilometer (140 acres) and quarry CA-8B would occupy 0.8 square kilometer (200 acres) of lands identified for disposal. While the use of land for the proposed railroad would supersede potential disposal of affected land, the county would still lose the opportunity to use potentially disposed land within the right-of-way to meet future land-use needs and facilitate economic growth. Current planned large growth areas are in the southern portion of Lincoln County, at Coyote Springs and Toquop, which would not be affected by the proposed rail line. Therefore, the project would not substantially alter current land uses or impact future land-use plans in Lincoln County.

- *Nye County Comprehensive Plan* (DIRS 147994-McRae 1994, all)

  This plan addresses the proposed Yucca Mountain Repository and states that the repository could affect the county's future economy and the quality of life of its residents. The plan does not address the proposed railroad. The rail line would not cross private land within Nye County except for patented ***mining claims*** along Goldfield alternative segments 1 and 3, and a small amount of private land along Oasis Valley alternative segment 1. Therefore, a rail line along the Caliente rail alignment would not substantially alter current land uses or impact future land-use plans in Nye County.

- *Esmeralda County Master Plan* (DIRS 176770-Duval et al. 1976, all)

  This plan predates plans for a repository at Yucca Mountain; therefore, it does not address the project. The plan states that the county must be consulted on all proposed federal projects. DOE continues to consult Esmeralda County (and other affected counties) on the Proposed Action. DOE has determined that a rail line along the Caliente rail alignment would not substantially alter current land uses or impact future land-use plans in Esmeralda County. The only private land that would be affected within an established town in Esmeralda County would be along Goldfield alternative segment 4 (see discussion in Section 4.2.2.2.1.2).

None of the three county plans discusses proposed or existing land uses along the Caliente rail alignment. Although there are no land-use plans at the county level, DOE does not anticipate potential land-use conflicts in relation to future county projects and planning.

- *City of Caliente Master Plan* (DIRS 157312-Sweetwater and Anderson 1992, all)

  This plan acknowledges that railroad operations will continue to be a primary economic activity in the City of Caliente. The Caliente alternative segment would utilize the former Pioche and Prince Branchline of the Union Pacific Railroad and the proposed Staging Yard on the alternative segment would be north of the city at either Indian Cove or Upland. Locating the Staging Yard north of the city would reduce disruption to the community due to noise, traffic, dust, and trains blocking the vehicle crossing, in accordance with the provisions of the master plan (DIRS 157312-Sweetwater and Anderson 1992, p. 54). The master plan also directs new residential development and "major economic centers" to the north of the city, but does not indicate exact locations. Possible future residential clustering near the Caliente alternative segment within or north of the city may be deemed an incompatible land use due to train noise. However, the Caliente alternative segment would not pose a direct conflict with current land zoning within the City of Caliente. The lands encompassing the former Pioche and Prince Branchline within the City of Caliente do not have any zoning designation. Current land zoning surrounding the Caliente alternative segment in the city is largely commercial or industrial, although the Lincoln County Hospital, senior citizen apartments, and a trailer court are immediately west of U.S. Highway 93; all of these locations are well outside the proposed construction right-of-way. While there is no zoning within the former branchline right-of-way within the city, adjacent property owners, such as the Caliente Hot Springs Motel, have come to use portions of this land. Section 4.2.2.2.1.2 discusses impacts to individually owned private parcels.

Although there is no zoning designation in the community of Goldfield, the designation of its historic district is a consideration for determining potential adverse impacts to land use. The historic district would be approximately 0.6 kilometer (0.4 mile) from the Goldfield alternative segment 4 construction right-of-way. Goldfield has been historically linked with both mining and railroad activity. Therefore, a new rail line adjacent to the town would not be a wholly incompatible feature with its historic characteristics. The BLM, DOE, and the Surface Transportation Board (STB) signed a programmatic agreement regarding the Yucca Mountain rail alignment project with the Nevada State Historic Preservation Office on April 17, 2006, to formalize the consultation process (DIRS 176912-Wenker et al. 2006, all). Appendix M is a copy of the programmatic agreement. As for any other potential cultural resources along the rail alignment, DOE would consult with the State Historic Preservation Office to determine potential impacts and possible mitigation measures (see discussion in Section 4.2.13, Cultural Resources).

4.2.2.2.1.2 Private Parcels. DOE would need to gain access to private land that falls within the Caliente rail line construction right-of-way and the locations of support facilities. Chapter 7 Best Management Practices and Mitigation, discusses the process DOE would employ to minimize impacts to private land. Segments that would cross private lands include the Caliente alternative segment, the Eccles alternative segment, Caliente common segment 1, Goldfield alternative segment 4, and Oasis Valley alternative segments 1, 3, and 4. None of the other segments would cross private land.

While the nominal width of the rail line construction right-of-way would be 300 meters (1,000 feet), DOE would reduce the area of disturbance in some areas to minimize impacts to private land. For example, along the Caliente alternative segment, the width of disturbance would be 17 meters (55 feet). Where practicable, DOE would also reduce the width of disturbance (variable widths) adjacent to private lands near Goldfield to avoid individual parcels.

Land uses along the Caliente and Eccles alternative segments construction rights-of-way and facilities locations consist of private residential, commercial, and industrial uses concentrated along U.S. Highway 93, and ranch lands and residential uses dispersed beyond the municipal jurisdiction of the City of Caliente. There would be direct impacts to private property within the Caliente rail alignment construction right-of-way, resulting in changes of land use.

The Caliente alternative segment construction right-of-way would encompass or cross 30 parcels and three other areas within the former Pioche and Prince Branchline right-of-way totaling 0.64 square kilometer (160 acres) (see Table 4-12 and Figure 3-14). The 30 parcels have 23 property owners. The Eccles alternative segment would cross five parcels and one additional area within the former Pioche and Prince Branchline right-of-way totaling 0.29 square kilometer (74 acres) (see Table 4-13). The five parcels have four property owners.

The parking lot and access road to the Caliente Hot Springs Motel would lie within the Caliente alternative segment construction right-of-way. While the ownership of this land along the former Pioche and Prince Branchline is uncertain, the motel has used this land for many years. The motel could be adversely affected because of the rail line's proximity. If DOE selected the Caliente alternative segment, the Department would work with the landowner to mitigate the impacts to the motel through the process described in Chapter 7, Best Management Practices and Mitigation. Through this process, DOE would develop specific measures that could avoid, reduce, or mitigate impacts to this property, including measures to maintain access to the motel during construction. Finally, DOE could also negotiate compensation with the landowner if the design, construction, or operations accommodations were not sufficient to mitigate the impacts.

Table 4-13. Uses of private land along the Caliente and Eccles alternative segments.[a]

Alternative segment and land use	Number of parcels within the construction right-of-way	Area of parcels within the construction right-of-way (acres)[b]
Caliente alternative segment		
Vacant	15	18
Residential	2	1.6
Commercial	1	0.064
Industrial	1	0.02
Rural	10	93
Unknown[c]	1	1.5
Former Pioche and Prince Branchline existing right-of-way[d]	3	45
Eccles alternative segment		
Vacant	1	0.001
Residential	1	2.7
Rural	3	69
Former Pioche and Prince Branchline existing right-of-way[d]	1	2.6

a. Source: DIRS 185440-BSC 2008, all.
b. To convert acres to square meters, multiply by 4046.9.
c. According to the Land Ownership Geographic Information System datasets for the Caliente rail alignment, one parcel of land has a land-use code listed as "0."
d. Land within the former Pioche and Prince Branchline is not found in the tax parcel maps for the City of Caliente nor in the county's landowners files. However, for purposes of analysis, this land is considered private land and the number of parcels indicated are actually the number of geographically distinct areas of intersection with the proposed rail line construction right-of-way.

In addition, there are three structures on residential properties that would be within the Caliente alternative segment construction right-of-way. DOE would need to gain access to these private lands, and the structures could be demolished or relocated.

The Caliente alternative segment would also pass through the location of existing Union Pacific Railroad buildings, requiring their demolition or relocation.

Construction of the Staging Yard at the Caliente-Indian Cove location would require access to 0.73 square kilometer (180 acres) of land across 6 parcels west of the rail alignment with four owners and at present used for ranching and farming. Construction of the Staging Yard at Caliente-Upland would require acquisition of approximately 0.45 square kilometer (110 acres) across 17 parcels with 12 owners.

Section 4.2.2.2.3.2 discusses the Eccles-North location for the Staging Yard, which would be on public land.

Portions of potential quarry CA-8B – Indian Cove option would be on private land, across three parcels (three landowners) occupying 0.16 square kilometer (39 acres) of land. Portions of potential quarry CA-8B – Upland option would be on private land, across two parcels (two landowners) occupying 0.20 square kilometer (49 acres) of land.

Goldfield alternative segment 1 would cross the most private land of the Goldfield alternative segments (0.59 square kilometer [150 acres] of land). Goldfield alternative segment 3 would cross the least amount of private land (0.19 square kilometer [46 acres]) among the Goldfield alternative segments. Goldfield alternative segment 4 would pass to the immediate west and south of the community of Goldfield, which is clustered along U.S. Highway 95. The Goldfield alternative segment 4 construction right-of-way would intersect 33 privately owned parcels (with at least 20 individual landowners according to tax records) and at least two areas containing patented mining claims (0.49 square kilometer [120 acres]) (see Table 4-14 and Figure 3-23). Esmeralda County owns 12 of the 33 parcels, and the Nevada Department of Highways owns one parcel (while state and county entities own 13 parcels, they are non-federal lands and still considered private land in this Rail Alignment EIS). DOE would gain access to portions of privately owned land if the Department selected Goldfield alternative segment 4. This would result in direct impacts to private land within the construction right-of-way, resulting in change of land use.

Table 4-14. Uses of private land along the Goldfield alternative segments.

Segment and land use	Number of parcels within the construction right-of-way	Area of parcels within the construction right-of-way (acres)[a]
Goldfield alternative segment 1[b]	At least 2 claims	1,150
Goldfield alternative segment 3	2 (both patented mining claims)	46
Goldfield alternative segment 4		
Vacant	27	19
Residential	1	0.12
Commercial	1	0.02
Utilities	4	2.4
Patented mining claims[b]	At least 2	99

a. To convert acres to square meters, multiply by 4046.9.
b. Geographic information system files for patented mining claims indicate the overall areal extent of these claims, although individual claim boundaries are not drawn. Therefore, this table reflects the geographically distinct areas of patented mining claims instead of the actual number of individual claims intersected by the construction right-of-way.

The Oasis Valley alternative segment 1 construction right-of-way would cross one parcel owned by a cattle company (see Figure 3-25), impacting 0.004 square kilometer (0.9 acres) of land. DOE would need to gain access to this land, causing a change in land use.

4.2.2.2.2 American Indian Land

During the first scoping period for this Rail Alignment EIS in 2004, DOE received comments from the Western Shoshone Nation indicating that a rail line crossing Timbisha Shoshone Trust Lands would be incompatible with current and planned land uses. The opposition was based, in part, on treaty issues involving land in the vicinity of the Caliente rail alignment (see Section 3.4). The Department subsequently eliminated Bonnie Claire alternative segment 1, which would have crossed onto Timbisha Shoshone Trust Lands, from analysis. Interests and concerns expressed by the various American Indian tribes and organizations within or near the Caliente rail alignment are discussed in Section 3.4, American Indian Interests in the Proposed Action.

4.2.2.2.3 BLM-Administered Public Land

4.2.2.2.3.1 Consistency with BLM Resource Management Plans. Some portions of the Caliente rail alignment would cross federal land the BLM has identified for potential disposal (sale). The ***withdrawal*** of these lands along the rail alignment for other federal use would take precedence over potential land disposals.

While this federal use would not pose a conflict with BLM ***resource management plans***, the community or public would lose the ability to use affected land for future economic or private development.

DOE reviewed existing documentation to determine whether construction and operation of the proposed railroad along the Caliente rail alignment would be consistent with existing land-use plans and policies.

- *Ely Proposed Resource Management Plan/Final Environmental Impact Statement* (DIRS 184767-BLM 2007, all)

  The Ely Proposed Resource Management Plan proposes to dispose of public lands surrounding and north of Caliente through which portions of the Caliente and Eccles alternative segments would pass. The lands within the proposed rail alignment are withdrawn under Public Land Order 7653 (70 *Federal Register* [*FR*] 76854), and the withdrawal supersedes the planned land disposal on affected property; therefore, the proposed railroad project does not currently conflict with the plan. The Eccles alternative segment would occupy 4.2 square kilometers (1,030 acres), and the Caliente alternative segment would occupy 0.10 square kilometer (24 acres) of public land proposed for disposal. Caliente common segment 1 would occupy 0.58 square kilometer (140 acres) proposed for disposal. Lastly, quarry CA-8B would occupy 0.8 square kilometer (200 acres) proposed for disposal. The rail line would pass through designated ***Areas of Critical Environmental Concern***. These areas were designated after the issuance of the Draft Rail Alignment EIS and would be finalized after further study by the BLM. The Eccles alternative segment would establish 0.3 square kilometer (74 acres) of new right-of-way within the Lower Meadow Wash Valley Area of Critical Environmental Concern, which is a right-of-way avoidance area. Caliente common segment 1 would establish 0.13 square kilometer (32 acres) of new right-of-way within the Schlesser Pincushion Area of Critical Environmental Concern, which is also a right-of-way avoidance area. In consultation with the BLM, DOE would conduct pre-construction surveys of the areas to catalog vegetation and habitat and then develop strategies to avoid, minimize, or mitigate impacts to their resource values. Such strategies could include, but would not be limited to, narrowing the construction and operations right-of-way and implementing site-specific best management practices during construction to further minimize disturbance to protected resources in these areas. While there could be a conflict with the resource management plan with regard to these two areas, the results of DOE's surveys and implementation of measures described in Chapter 7, Best Management Practices and Mitigation, could result in a finding of minimal conflict with their resource values. Under such a finding, the railroad right-of-way could be approved by the BLM. If the right-of-way is approved by the BLM through one or both of these areas, DOE would work with the BLM to develop specific measures to avoid, reduce, or mitigate resource value impacts from the construction and operation of the proposed rail line.

  Portions of common segment 1 and quarry CA-8b would fall within the Chief Mountain Special Recreation Management Area outlined in the Ely Proposed Resource Management Plan. Special Recreation Management Areas do not preclude other land uses and are not right-of-way avoidance areas. As discussed in Section 4.2.2.2.7.1, neither this segment nor the quarry would interfere with the primary trails and access to the area. Subsequently, the proposed rail line would not conflict with the recreation aspects of the Ely Proposed Resource Management Plan. In conformance with the plan, the rail alignment construction right-of-way would be less than 0.8 kilometer (0.5 mile) wide. Although the rail alignment would not be located entirely within the existing designated corridors, under the plan's preferred alternative, the BLM can grant rights-of-way on a case-by-case basis. Section 4.2.11 of this Rail Alignment EIS describes potential impacts on utilities.

- *Tonopah Resource Management Plan and* ***Record of Decision*** (Tonopah Resource Management Plan; DIRS 173224-BLM 1997, all)

  The Tonopah Resource Management Plan designates 1,075 kilometers (668 miles) for transportation and utility corridors (DIRS 173224-BLM 1997, p. 2). It also allows rights-of-way on more than 600 square kilometers (149,000 acres) if the land use is compatible with existing land values. The plan identifies areas for potential disposal at Goldfield, Scottys Junction, and Beatty. The Tonopah

Resource Management Plan does not specifically address the portions of land released from withdrawal in 1999 adjacent to (on the western border of) the Nevada Test and Training Range. Because withdrawal for other federal use has precedence over potential land disposals, there would be no conflict with the Tonopah Resource Management Plan. The rail corridor would be much narrower than and be in conformance with the 5-kilometer (3-mile) width criteria for corridors outlined in the Tonopah Resource Management Plan.

- *Record of Decision for the Approved Las Vegas Resource Management Plan and Final Environmental Impact Statement* (Las Vegas Resource Management Plan; DIRS 176043-BLM 1998, all)

  The Las Vegas Resource Management Plan designates corridors within its planning area to avoid Areas of Critical Environmental Concern. The proposed rail alignment would not pass through or near any right-of-way avoidance areas, such as Areas of Critical Environmental Concern. The portion of the rail alignment (common segment 6) that would pass through this district would be on land for which DOE already has a temporary right-of-way and a portion of which is slated for future land withdrawal for the Yucca Mountain Project. Therefore, there would be no conflict with the Las Vegas Resource Management Plan.

BLM-administered lands encompassing the Caliente rail alignment have been withdrawn from surface and mineral entry to avoid land-use conflicts in the near term (70 *FR* 76854, December 28, 2005). Furthermore, this withdrawal takes precedence over potential land disposals that might be planned in and around the rail alignment. Under the terms of the BLM land-disposal policy, identification of the lands for another federal purpose, such as the proposed railroad, would disqualify the land for disposal for other uses.

It is BLM's mineral and national energy policy that public lands shall remain open and available for mineral exploration and development unless withdrawal or other administrative action is justified in the national interest. As discussed in Section 4.2.2.2.6, the rail line would cross some areas of the unpatented mining claims and some geothermal resources. However, right-of-way authorizations across mineral claims and energy leases on public land are common, although the BLM requires notification of claim and lease holders and stipulations to avoid adverse impacts to these resources. Therefore, the proposed rail line right-of-way would not be inconsistent with BLM mineral and energy policy. DOE would work with the BLM and stakeholders to implement strategies to allow public lands near or within the railroad right-of-way to remain open and available to mineral exploration to the extent it could be conducted safely.

4.2.2.2.3.2 Construction Impacts to BLM Grazing Allotments. Construction of the rail line and support facilities would result in surface disturbance across up to 20 active grazing allotments. To characterize this impact, DOE quantified the potential loss in ***animal unit months*** associated with this disturbance for each active grazing allotment crossed by each rail segment.

In order to calculate potential loss of animal unit months, DOE evaluated the proportion of land within each grazing allotment that would fall within the footprints of the rail line construction right-of-way and support facilities. For this analysis, DOE assumed that the entire land area within the rail line construction right-of-way would be unavailable for forage and would no longer support grazing. The Department did not consider site-specific allotment characteristics. In fact, this calculation method assumes that there is uniform forage distribution across the entire allotment, which would be unlikely. Because the proposed rail line would generally follow flatter terrain, such as valley floors (due to grade limitations of the railroad), the rail alignment would likely transect those areas that typically sustain a greater proportion of high-quality forage. Furthermore, where the rail line would bisect allotments or isolate portions of allotments or pastures, additional land and possibly water features such as springs may be inaccessible for grazing and there could be substantially greater losses of animal unit months unless mitigation measures are employed. The BLM would work with affected permittees to develop Interim

Grazing Managements Plans and revise their allotment management plans to address impacts of the rail alignment. The BLM would determine actual loss of animal unit months for each affected allotment, based on these interim and revised plans, in association with the issuance of a ***right-of-way grant***.

Chapter 7, Best Management Practices and Mitigation, describes measures DOE, in consultation with the BLM, would use to minimize or compensate for the loss of animal unit months. The goal of the measures described in Chapter 7 would be to reduce impacts to both grazing operations and existing range improvements. Mitigation measures could include:

- Relocating existing infrastructure and water resources
- Providing temporary feed, water, and assistance in cattle movement during rail line construction
- The construction of culverts, bridges, and cattle guards to facilitate or prevent the movement of livestock

The presence of a rail line could require livestock on some allotments to adjust to new routes to access water and forage. Generally, livestock could adapt to new routes and should be able to cross the rail line in most areas. The revised allotment management plans developed by the BLM and the affected permittees would be designed to address forage and water accessibility problems introduced by the presence of the rail line. The railroad could result in additional impacts to ranching operations because livestock could be struck by passing trains. DOE could provide mitigation to reduce the likelihood of livestock collisions through measures such as relocating stockwater sources further from the rail line and preventing the ponding of water near the rail line. These measures would be site-specific, determined through coordination with permittees and the BLM. DOE or the commercial user (under the Shared-Use Option) would reimburse ranchers for livestock losses due to train strikes, as per Nevada law.

The rail line would also intersect 16 existing fences on active grazing allotments. DOE would coordinate with permittees and the BLM when determining a fencing plan to promote livestock safety and management while considering the need to prevent the segmenting of wildlife habitat. For allotments that are divided into pastures that would be bisected by the rail line, permittees may choose to alter pasture boundaries to coincide with the rail line under revised allotment management plans. If this approach was taken, it would necessitate the removal of old pasture fences and the installation of miles of new fence along the rail line. DOE would provide mitigation in the form of compensation or range improvements as described in Chapter 7, Best Management Practices and Mitigation.

The Caliente rail alignment would cross up to 12 stockwater pipelines on active grazing allotments, some of which convey water that is base property owned by the permittee. During the construction phase, DOE would sleeve these pipelines within a casing pipe under the rail roadbed to protect them and keep them operational. The casing pipe would be capable of withstanding the load of the roadbed, track, and rail traffic. DOE would also ensure that permittees retained access to pipelines and other range improvements within the rail line right-of-way for maintenance activities.

It is important to note that DOE collected information on range improvements (pipelines and fences) based on BLM records in November 2004 (DIRS 185440-BSC 2008, all). Therefore, there could be range improvements authorized on allotments since that time that are not reflected in this Rail Alignment EIS. Similarly, DOE did not include the locations of troughs, tanks, corrals, and other range infrastructure in the geographic information system baseline dataset. Therefore, DOE would coordinate with the BLM and allotment permittees to verify the location of potentially affected range improvements prior to construction. The mitigation measures and best management practices outlined in Chapter 7 would apply to all affected improvements, including those that were not specifically addressed in this Rail Alignment EIS.

There would also be a number of new construction wells on grazing allotments outside the construction right-of-way. The well footprints would be small (approximately 0.0057 square kilometer [0.4 acre] each) and would not affect grazing patterns except for the presence of human activity during the construction phase.

If DOE were to select Goldfield alternative segment 1 or 3, the Maintenance-of-Way Headquarters Facility would be located in Esmeralda County, approximately 8 kilometers (5 miles) southeast of Tonopah along U.S. Highway (95) (see Figure 2-50). It would occupy approximately 0.013 square kilometer (3.2 acres) of vacant, BLM-administered public land. The facility would be within the Silver King Grazing Allotment, which at present is unused (DIRS 176942-Metscher 2006, all). Although there is no active grazing on this land, because a permanent structure would be constructed, there would be long-term changes in land use. The associated Maintenance-of-Way Trackside Facility would be located along Caliente common segment 3, within the construction right-of-way of the rail line across both the Stone Cabin and Ralston Grazing Allotments. If DOE were to select Goldfield alternative segment 4, then a single Maintenance-of-Way Facility would be constructed along that segment north of Goldfield, within the construction right-of-way within the inactive Montezuma Grazing Allotment. Where the facilities fall within the construction right-of-way, their impacts are not addressed separately as described in Section 4.2.2.1.

Alternative Segments at the Interface with the Union Pacific Railroad Mainline

Caliente Alternative Segment: This alternative segment would run along the former Union Pacific Railroad Pioche and Prince Branchline, generally parallel and east of U.S. Highway 93 (see Figure 3-27). It would cross the Comet Allotment. There would be no stockwater sources within the Caliente alternative segment construction right-of-way. Overall, using the width of the construction right-of-way, the Caliente alternative segment would encompass approximately 0.10 square kilometer (24 acres) of grazing allotment land. The loss of this amount of grazing land could result in the loss of one animal unit month (see Table 4-15). This segment would intersect allotment fences in two locations.

Approximately 1 square kilometer (250 acres) of grazing land on the Highway Allotment would be affected if DOE developed potential quarry CA-8A – Indian Cove option. Quarry CA-8B – Indian Cove option would impact 5.9 percent of the allotment. Assuming a direct correlation between allotment size and animal unit months, the quarry could reduce the animal unit months on this allotment by 7. Quarry CA-8B would also impact 0.18 square kilometer (44 acres) of grazing land on the Peck Allotment, which could reduce animal unit months on the Peck Allotment by 1. Approximately 1.2 square kilometers (280 acres) of grazing land on the Highway Allotment would be affected if DOE developed potential quarry CA-8B – Upland option. Quarry CA-8B – Upland option would impact 6.6 percent of the allotment. Assuming a direct correlation between allotment size and animal unit months, the quarry could reduce the animal unit months on this allotment by eight. Quarry CA-8B – Upland option would also impact 0.03 square kilometer (8 acres) of grazing land on the Rocky Hills Allotment, which is inactive.

Eccles Alternative Segment: The Eccles alternative segment would cross the Clover Creek, Little Mountain, Peck, and Comet Allotments (see Figure 3-27). At present, the Little Mountain Allotment is not active. The rail alignment would intersect fences that separate the Peck and Comet Allotments and the Peck and Little Mountain Allotments. There would be no stockwater sources within the Eccles alternative segment construction right-of-way. Overall, the Eccles alternative segment would encompass approximately 3.0 square kilometers (751 acres) of active grazing allotment land. Assuming a direct correlation between allotment size and animal unit months, the Eccles alternative segment could reduce animal unit months by 17 (see Table 4-15). This segment would intersect allotment fences in two locations.

Table 4-15. Potential loss of animal unit months associated with the Caliente and Eccles alternative segments.

Alternative segment/facility/ allotment	Construction right-of-way or impact area (acres)[a]	Current animal unit months (maximum) and allotment area[b]	Calculated loss of animal unit months (as a direct correlation with land area removed)	Percent loss of animal unit months
Caliente alternative segment				
Comet	24	214 on 9,150 acres	1	0.5
Eccles alternative segment				
Clover Creek	38	613 on 22,880 acres	1	0.2
Peck[c]	670	397 on 17,740 acres	15	3.8
Comet	43	214 on 9,150 acres	1	0.5
Totals	751	1,224 animal unit months	17	1.4
Potential quarry CA-8B				
Indian Cove option				
Highway	250	118 on 4,250 acres	7	5.9
Peck	44	397 on 17,740 acres	1	0.3
Upland option				
Highway	280	118 on 4,250 acres	8	6.6
Eccles-North Staging Yard				
Peck	73	397 on 72 square kilometers	2	0.5

a. Source: DIRS 184767-BLM 2007, Tables 2.4-15 and 2.4-16.
b. To convert acres to square kilometers, multiply by 0.0040469.
c. Includes construction camp 1.

The Eccles alternative segment Interchange Yard would fall within the current Union Pacific Railroad right-of-way within the Clover Creek Allotment, running parallel to the north side of the existing Union Pacific tracks. Because the Interchange Yard would be within the existing Union Pacific Railroad right-of-way, there would no additional impacts to grazing uses on this land. The Eccles-North location for the Staging Yard would also fall within the construction right-of-way of the Eccles alternative segment, resulting in no additional impacts to grazing uses on the Peck Allotment.

Caliente Common Segment 1 (Dry Lake Valley Area): Caliente common segment 1 would cross the Comet, Rocky Hill, Bennett Spring, Black Canyon, Ely Springs Cattle, Rattlesnake, Wilson Creek, Timber Mountain, Sunnyside, and Needles Allotments. Figures 3-27 and 3-28 show these grazing allotments and their stockwater features. Overall, using the width of the construction right-of-way, common segment 1 would encompass approximately 34 square kilometers (8,450 acres) of grazing allotment land and could result in an overall loss of up to 452 animal unit months (see Table 4-16) across the nine affected active allotments (a potential 0.7-percent loss overall). Caliente common segment 1 would intersect three pipelines (two on Ely Springs Cattle and one on Wilson Creek). The Ely Springs Cattle Grazing Allotment is divided into four pastures. Caliente common segment 1 would pass through three of these pastures. Therefore, it is likely that a revised allotment management plan would be necessary to address any potential changes in pasture boundaries that would help minimize the impacts of the rail line.

Table 4-16. Potential loss of animal unit months associated with Caliente common segment 1.

Allotment	Construction right-of-way area or impact area (acres)[a,b]	Current animal unit months (maximum) and allotment area[c]	Potential loss of animal unit months (as a direct correlation with land area removed)	Percent loss of animal unit months
Comet	240	214 on 9,150 acres	6	2.8
Bennett Spring	1,250	3,498 on 48,260 acres	91	2.6
Black Canyon	390	1,105 on 8,440 acres	51	4.6
Ely Springs Cattle	1,420	4,248 on 55,170 acres	109	2.6
Rattlesnake	130	1,180 on 28,430 acres	5	0.4
Wilson Creek	1,830	48,250 on 1,077,990 acres	82	0.2
Timber Mountain	770	2,373 on 43,840 acres	42	1.8
Sunnyside	1,360	5,402 on 219,520 acres	33	0.6
Needles	1,060	2,679 on 85,500 acres	33	1.2
Totals	8,450[c]	68,949 animal unit months	452	0.7[d]

a. To convert acres to square kilometers, multiply by 0.0040469.
b. Land area values are rounded to two significant figures except for allotment areas over 1,000 acres, which are rounded to the nearest 10.
c. Source: DIRS 184767-BLM 2007, Tables 2.4-15 and 2.4-16.
d. This is not column total; it is a value calculated using the totals from columns 3 and 4.

Garden Valley Alternative Segments: Garden Valley alternative segments 1 and 3 would cross the Needles, Batterman Wash, Pine Creek, Cottonwood, and McCutcheon Springs Allotments. Garden Valley 2 and 8 would cross the Needles, Coal Valley Lake, Pine Creek, Cottonwood, and McCutcheon Springs Allotments. Figure 3-29 shows the grazing allotments along the Garden Valley alternative segments. Table 4-17 lists the potential reduction in animal unit months for allotments the Garden Valley alternative segments would cross. The Garden Valley alternative segments 1, 2, and 8 would intersect fences in five locations and Garden Valley alternative segment 3 would intersect four fences. Garden Valley alternative segments 1 and 3 would intersect one pipeline on the Pine Creek Allotment.

Caliente Common Segment 2 (Quinn Canyon Range Area): Caliente common segment 2 would cross the McCutcheon Springs, Sand Springs, and Reveille Allotments (see Figures 3-29 and 3-30). The Sand Springs Allotment has two permittees. Overall, using the width of the construction right-of-way, common segment 2 would encompass approximately 15 square kilometers (3,690 acres) of allotment land and could reduce animal unit months across the three allotments by 0.4 percent (117 animal unit months total) (see Table 4-18). The Sand Springs Grazing Allotment is divided into three pastures, where the rail line would pass through or bisect the northwest pasture. Therefore, it is likely that a revised allotment management plan would be necessary to address any potential changes in pasture boundaries that would help minimize the impacts of the rail line.

South Reveille Alternative Segments: The South Reveille alternative segments (see Figure 3-30) would be on the southern portion of the Reveille Allotment. A portion of South Reveille alternative segment 2 may coincide with the Reveille Peak pipeline extension approved by the BLM in 2006. DOE would mitigate potential adverse impacts to this pipeline as described in Chapter 7, Best Management Practices and Mitigation. There are no other stockwater features within the South Reveille alternative segments construction rights-of-way. South Reveille alternative segments 2 and 3 could reduce animal unit months on the Reveille Allotment by 54 and 58, respectively (see Table 4-19).

Table 4-17. Potential loss of animal unit months associated with the Garden Valley alternative segments.

Alternative segment/allotment	Construction right-of-way area or impact area (acres)[a]	Current animal unit months (maximum) and allotment area[b]	Potential loss of animal unit months (as a direct correlation with land area removed)	Percent loss of animal unit months
Garden Valley 1				
Needles	720	2,679 on 85,500 acres	23	0.9
Batterman Wash	640	2,093 on 39,880 acres	34	1.6
Pine Creek	580	2,667 on 34,690 acres	46	1.7
Cottonwood	540	1,177 on 42,170 acres	15	1.3
McCutcheon Springs	110	446 on 450 acres	3	1.8
Totals	2,590[c]	9,062 animal unit months	121	1.3
Garden Valley 2				
Needles	670	2,679 on 85,500 acres	21	1.4
Coal Valley Lake	93	4,821 on 115,180 acres	4	0.1
Pine Creek	1,130	2,667 on 34,690 acres	87	3.1
Cottonwood	640	1,177 on 42,170 acres	18	0.2
McCutcheon Springs	95	446 on 18,280 acres	2	1.8
Totals	2,628[c]	11,790 animal unit months	132	1.1
Garden Valley 3				
Needles	730	2,679 on 85,500 acres	23	0.9
Batterman Wash	1,100	2,093 on 39,880 acres	58	2.8
Pine Creek	340	2,667 on 34,690 acres	26	1.0
Cottonwood	490	1,177 on 42,010 acres	14	1.2
McCutcheon Springs	170	446 on 18,280 acres	4	0.9
Totals	2,830[c]	9,062 animal unit months	125	1.4
Garden Valley 8				
Needles	660	2,679 on 85,500 acres	21	0.8
Coal Valley Lake	100	4,821 on 115,180 acres	4	0.1
Pine Creek	1,050	2,667 on 34,690 acres	81	3.0
Cottonwood	640	1,177 on 42,010 acres	18	1.5
McCutcheon Springs	95	446 on 18,280 acres	2	0.5
Totals	2,545[c]	11,790 animal unit months	126	1.1[d]

a. To convert acres to square kilometers, multiply by 0.0040469.
b. Land area values are rounded to two significant figures, except for allotment areas over 1,000 acres, which are rounded to the nearest 10.
c. Source: DIRS 184767-BLM 2007, Tables 2.4-15 and 2.4-16.
d. This is not column total; it is a value calculated using the totals from columns 3 and 4.

Potential quarry sites NN-9A and NN-9B would also be on the Reveille Allotment. These quarries would occupy 2 and 1.3 square kilometers (490 and 320 acres), respectively. Individually, either quarry would result in less than a 0.1-percent reduction in land area on the Reveille Allotment and between 19 and 13 lost animal unit months (see Table 4-19).

Table 4-18. Potential loss of animal unit months associated with Caliente common segment 2.

Allotment	Construction right-of-way area or impact area (acres)[a,b]	Current animal unit months (maximum) and allotment area[c,d]	Potential loss of animal unit months (as a direct correlation with land area removed)	Percent loss of animal unit months
McCutcheon Springs	620	446 on 18,280 acres	15	3.4
Sand Springs	1,650	7,005 on 249,690 acres	46	0.7
Reveille	1,420	25,730 on 657,520 acres	56	0.2
Totals	3,690[d]	33,181 animal unit months	117	0.4[e]

a. To convert acres to square kilometers, multiply by 0.0040469.
b. Source: DIRS 184767-BLM 2007, Tables 2.4-15 and 2.4-16.
c. Source: DIRS 173224-BLM 1997, p. A-12.
d. Land area values are rounded to two significant figures, except for allotment areas over 1,000 acres, which are rounded to the nearest 10.
e. This is not column total; it is a value calculated using the totals from columns 3 and 4.

Table 4-19. Potential loss of animal unit months on the Reveille Allotment associated with the South Reveille alternative segments.

Alternative segment/quarry	Construction right-of-way area or impact area (acres)[a,b]	Current animal unit months (maximum) and allotment area (Reveille)[c]	Potential loss of animal unit months (as a direct correlation with land area removed)	Percent loss of animal unit months
South Reveille 2	1,370	25,730 animal unit months on 657,520 acres	54	0.2
South Reveille 3	1,490	25,730 animal unit months on 657,520 acres	58	0.2
Potential quarry NN-9A	490	25,730 animal unit months on 657,520 acres	19	0.07
Potential quarry NN-9B	320	25,730 animal unit months on 657,520 acres	13	0.05

a. To convert acres to square kilometers, multiply by 0.0040469.
b. Land area values are rounded to two significant figures, except for allotment areas over 1,000 acres, which are rounded to the nearest 10.
c. Source: DIRS 173224-BLM 1997, p. A-12.

Caliente Common Segment 3 (Stone Cabin Valley Area): Caliente common segment 3 would pass through the Reveille, Stone Cabin, and Ralston Allotments (see Figures 3-30 and 3-31). At present, the Ralston Allotment is not occupied (DIRS 176942-Metscher 2006, all).

Common segment 3 would encompass approximately 25 square kilometers (6,130 acres) of active allotment land. The loss of this amount of grazing land could reduce assigned animal unit months by 229, a potential 0.6-percent loss overall (see Table 4-20). Common segment 3 would intersect six pipelines over two allotments (five on Reveille and one on Stone Cabin).

Goldfield Alternative Segments*:* All of the Goldfield alternative segments would cross the northern portion of the Montezuma Allotment (see Figure 3-31). At present, this allotment has no permittees. The northernmost parts of Goldfield alternative segments 1 and 4 would pass through the Ralston Allotment, which is also inactive (DIRS 176942-Metscher 2006, all). Goldfield alternative segment 4 would intersect six pipelines on the inactive Montezuma Allotment.

Table 4-20. Potential loss of animal unit months associated with Caliente common segment 3.

Allotment	Construction right-of-way area or impact area (acres)[a,b]	Current animal unit months (maximum) and allotment area[c,d]	Potential loss of animal unit months (as a direct correlation with land area removed)	Percent loss of animal unit months
Reveille	2,730	25,730 on 657,520 acres	107	0.4
Stone Cabin	3,400	13,963 on 389,500 acres	122	0.9
Totals	6,130	39,693 animal unit months	229	0.6[e]

a. To convert acres to square kilometers, multiply by 0.0040469.
b. Land area values are rounded to two significant figures except for allotment areas over 1,000 acres, which are rounded to the nearest 10.
c. Source: DIRS 173224-BLM 1997, p. A-12.
d. Source: DIRS 176942-Metscher 2006, all.
e. This is not column total; it is a value calculated using the totals from columns 3 and 4.

Potential quarry sites NS-3A, NS-3B, and ES-7 would all be within the Montezuma Allotment. These quarries would require up to 3.7, 1.5, and 1.5 square kilometers (920, 370 and 360 acres), respectively. Because the allotment is inactive, there would be no impacts to grazing associated with any of these quarries.

Caliente Common Segment 4 (Stonewall Flat Area): Caliente common segment 4 would also pass through the inactive Montezuma Allotment (see Figures 3-31 and 3-32). Because the allotment is inactive, there would be no impacts to grazing activities or stockwater resources during rail line construction along common segment 4.

Bonnie Claire Alternative Segments: The Bonnie Claire alternative segments would cross a narrow stretch of the inactive Montezuma Allotment west of the Nevada Test and Training Range and east of the Magruder Mountain Allotment (see Figure 3-32). Because the Montezuma Allotment is inactive, there would be no impacts to grazing activities or stockwater resources during rail line construction along either of the Bonnie Claire alternative segments.

Common Segment 5 (Sarcobatus Flat Area): Common segment 5 would pass through the southern portion of the inactive Montezuma Allotment near the southwestern boundary of the Nevada Test and Training Range (see Figures 3-32 and 3-33). Because the Montezuma Allotment is inactive, rail line construction along common segment 5 would not impact grazing activities or stockwater resources.

Oasis Valley Alternative Segments: The Oasis Valley alternative segments would cross the inactive Montezuma Allotment and the active Razorback Allotment (see Figure 3-33). The Razorback Allotment has one permittee. Oasis Valley alternative segment 1 would pass near the northeastern corner of the small Springdale 2 Allotment, but its construction right-of-way would not fall within the allotment. There are no stockwater features within the construction right-of-way of either of the Oasis Valley alternative segments.

Oasis Valley alternative segments 1 and 3 could result in the loss of 8 and 12 animal unit months, respectively, within the Razorback Allotment (see Table 4-21).

Common Segment 6 (Yucca Mountain Approach): Common segment 6 would cross a corner of the inactive Montezuma Allotment near the beginning of the common segment. At present, there are no permittees on this allotment (DIRS 176942-Metscher 2006, all). Common segment 6 would also pass through the Razorback Allotment (see Figure 3-33) and encompass approximately 5.4 square kilometers (1,320 acres) of the allotment. This would correspond to a potential loss of 17 animal unit months (1.8-percent loss of the grazing allotment) (see Table 4-22).

Table 4-21. Potential loss of animal unit months associated with the Oasis Valley alternative segments.

Alternative segment/allotment	Construction right-of-way area or impact area (acres)[a,b]	Current animal unit months (maximum) and allotment area[c]	Potential loss of animal unit months (as a direct correlation with land area removed)	Percent loss of animal unit months
Oasis Valley 1 – Razorback	590	959 animal unit months on 72,880 acres	8	0.8
Oasis Valley 3 – Razorback	940	959 animal unit months on 72,880 acres	12	1.3

a. To convert acres to square kilometers, multiply by 0.0040469.
b. Land area values are rounded to two significant figures, except for allotment areas over 1,000 acres, which are rounded to the nearest 10.
c. Source: DIRS 173224-BLM 1997, p. A-14.

Table 4-22. Potential loss of animal unit months associated with common segment 6.

Allotment	Construction right-of-way area or impact area (acres)[a]	Current animal unit months (maximum) and allotment area[b]	Potential loss of animal unit months (as a direct correlation with land area removed)	Percent loss of animal unit months
Razorback	1,320	959 animal unit months on 72,880 acres	17	1.8

a. To convert acres to square kilometers, multiply by 0.0040469.
b. Source: DIRS 173224-BLM 1997, p. A-14.

4.2.2.2.4 Department of Defense-Managed Land

The Department of Defense provided comments during the first scoping period for this Rail Alignment EIS in 2004, which resulted in DOE modifying Bonnie Claire alternative segment 2 and proposing Bonnie Claire alternative segment 3 as a new alternative segment to avoid crossing the Nevada Test and Training Range. Specifically, the Air Force commented that the earlier proposed rail segments were “within the weapons safety footprint for test and training munitions” and that the rail line would “impinge on Range testing and training activities.”

The closest segments to the Nevada Test and Training Range would be South Reveille alternative segment 3 and Bonnie Claire alternative segment 2, the centerlines of which would be approximately 100 meters (330 feet) from the Range boundary. DOE has narrowed the proposed construction right-of-way along these 2 segments to specifically avoid entering Range land. Other segments that would be closer to the Range boundary and the distances from the edge of the construction right-of-way to the boundary include Goldfield alternative segment 3 (485 meters [1,600 feet]), common segment 5 (560 meters [1,800 feet]), and Oasis Valley alternative segment 3 (280 meters [920 feet]). While the Caliente rail alignment would not directly affect land use on the Nevada Test and Training Range, portions of Bonnie Claire alternative segment 2 and common segment 5 would cross land formerly within the western border of the Range. The land released by the Range now falls under the BLM Tonopah planning area. Portions of the rail line (common segment 5 and common segment 6) would be beneath restricted air space or military operations areas associated with the Range. However, testing and training activities within the restricted air spaces would generally not exceed the western boundary of the Range and the Department of Defense would institute controls so that activities across all related air spaces would not pose harm to the rail line. The proposed railroad would not interfere with Range activities and would not conflict with the Range’s Resource and Management Plan.

4.2.2.2.5 DOE-Managed Land

The Rail Equipment Maintenance Yard, Cask Maintenance Facility, and a portion of common segment 6 would be within the Yucca Mountain Site boundary. These proposed maintenance facilities would be on land that is currently part of the Nevada Test Site, and used for Yucca Mountain Project characterization. Because the proposed railroad project would proceed only after control of the Yucca Mountain Site was transferred to DOE, the Rail Equipment Maintenance Yard and Cask Maintenance Facility and portions of common segment 6 within the Yucca Mountain Site boundary would not conflict with future land uses on the Nevada Test Site.

4.2.2.2.6 Construction Impacts to Mineral and Energy Resources (Public and Private Land)

Because of the relatively high mineral and energy potential to lands along the Caliente rail alignment, DOE evaluated potential impacts to these resources. To construct the rail line, DOE would need to gain access to lands that contain patented or ***unpatented mining claims*** or have active energy leases (oil, gas, or geothermal). DOE would also need substantial quantities of ballast and subballast that would be obtained from existing or new quarry and borrow sites (see Sections 2.2.2.4.2 and 2.2.2.4.3). Section 4.2.11, Utilities, Energy, and Materials, describes the impacts on regional material availability of removing material from the proposed quarries and ballast sites.

The land encompassing the Caliente rail corridor was withdrawn through ***public land orders*** from surface and mineral entry through December 2015 so DOE could evaluate the land for the rail alignment. If the BLM granted DOE a right-of-way for the rail line before the public land orders expired, the surface and mineral entry prohibitions would be removed from lands not part of the right-of-way. Therefore, the BLM could issue new unpatented mining claims and energy leases on lands near the rail line during the construction and operations phases. While the presence of the rail line would not necessarily preclude non-surface resources extraction activities, the applicant would be required to work closely with the BLM and DOE to ensure they would not interfere with the safe operation of the railroad. Engineering solutions for the safe extraction of mineral and energy resources near or beneath the rail line could include directional (lateral) drilling of wells or ensuring all mine shafts or tunnels were sufficiently deep and reinforced to prevent subsidence.

DOE expects that it could obtain all necessary sand and gravel for construction of the rail line from within the construction right-of-way of the rail alignment. If sand and gravel borrow sites were needed outside the construction right-of-way, DOE would need a ***free-use permit*** from the BLM to use common varieties of sand, stone, and gravel from BLM-administered public lands during the construction phase, pursuant to the regulations implementing the Materials Act of 1947 (30 U.S.C. 601 through 603) as codified in 43 CFR Part 3600. The location of any new sites would be coordinated with the BLM to minimize impacts to existing and future public land uses and conform to applicable resource management plans.

4.2.2.2.6.1 Alternative Segments at the Interface with the Union Pacific Railroad Mainline. A commercial hotel and spa in Caliente uses a hot spring just outside the Caliente alternative segment construction right-of-way (DIRS 183644-Shannon & Wilson 2007, p. 112). Because the Caliente alternative segment would utilize the footprint of the former Pioche and Prince Branchline, there would be no additional disruption to these geothermal resources. There are no energy leases (oil, gas, or geothermal) that would be in the construction right-of-way of either alternative segment at the interface with the Union Pacific Railroad Mainline.

There would be no patented mining claims or underground mines, tunnels, or shafts within the construction right-of-way for either the Caliente or Eccles alternative segment (see Figure 3-35).

Potential quarry CA-8B would be within the Chief Mining District, which was organized in 1870. There is no active mining and there are no patented mining claims within this district; therefore, there would be no impacts to mining from the introduction of a quarry in this area.

4.2.2.2.6.2 Caliente Common Segment 1 (Dry Lake Valley Area). Caliente common segment 1 would cross the northernmost portion of the Seaman Range Mining District (see Figure 3-36). Most of the past mining activity in this district occurred more than 5 kilometers (3 miles) south and southwest of the common segment. Therefore, there would be no impacts to mining from the construction of common segment 1. Common segment 1 would not affect energy leases (oil, gas, or geothermal) or resources.

4.2.2.2.6.3 Garden Valley Alternative Segments. The western junction of Garden Valley alternative segments 2 and 3 is approximately 0.8 kilometer (0.5 mile) north of the Freiberg Mining District (see Figure 3-37). Most of the past mining activity in this district occurred more than 5 kilometers (3 miles) south of this point (DIRS 183644-Shannon & Wilson 2007, p. 96). Mineralization does not appear to trend toward the alternative segments, and the distance of the Freiberg mining activities from the Garden Valley alternative segments would preclude construction-related impacts to mining in this area. There are no energy leases (oil, gas, or geothermal) that would be in the construction right-of-way for any of the Garden Valley alternative segments.

4.2.2.2.6.4 Caliente Common Segment 2 (Quinn Canyon Range Area). There would be no mining districts or areas, or patented mining claims within the Caliente common segment 2 construction right-of-way (see Figure 3-37 and 3-38). The closest mining district would be the Quinn Canyon Mining District, 0.8 kilometer (0.5 mile) north of Caliente common segment 2, and the vast majority of historic mining has occurred more than 6.4 kilometers (4 miles) north and northwest of the rail line (DIRS 183644-Shannon & Wilson 2007, p. 98). Therefore, construction of Caliente common segment 2 would not impact mining in this area. There are no energy leases (oil, gas, or geothermal) that would be in the common segment 2 construction right-of-way.

4.2.2.2.6.5 South Reveille Alternative Segments. There would be no mining districts or areas, energy leases, or patented mining claims within the construction rights-of-way of the South Reveille alternative segments (see Figure 3-38). In terms of unpatented mining claims within or near the construction right-of-way, South Reveille alternative segments 2 and 3 would intersect two Township and Range Sections containing 63 mining claims. Because information is available only at the section level (where the area of a section is several times larger than a nominal area of a rail line segment that would fully bisect it), the actual number of claims within the construction right-of-way would likely be fewer. DOE would negotiate surface rights across affected unpatented mining claims with claim holders.

The closest ***mining area*** is the Reveille Valley mining area, approximately 0.8 kilometer (0.5 mile) from South Reveille alternative segment 3 and 3 kilometers (2 miles) from South Reveille alternative segment 2. Although exploration and drilling in this mining area were observed in June 2004 and the existence of a 90-year lease agreement under the Alien Gold Project indicates that exploration efforts will be ongoing, this area would not be directly impacted by the South Reveille segments (DIRS 183644-Shannon & Wilson 2007, p. 93). There are no energy leases (oil, gas, or geothermal) that would be in the construction right-of-way for either South Reveille alternative segment.

4.2.2.2.6.6 Caliente Common Segment 3 (Stone Cabin Valley Area). Only the Clifford Mining District would be near Caliente common segment 3 (see Figures 3-38 and 3-39). The Clifford Mining District is approximately 3 kilometers (2 miles) south of U.S. Highway 6 in Stone Cabin Valley, about 10 kilometers (6 miles) southwest of Warm Springs. Numerous claims have been staked in the area and exploration and mining are underway (DIRS 183644-Shannon & Wilson 2007, pp. 81 and 82). There are no patented mining claims that would be within the common segment 3 construction right-of-way, although the common segment construction right-of-way would intersect 10 Township and Range Sections containing 133 unpatented mining claims. Because data related to unpatented mining claims are available only at the section level, the actual number of unpatented claims within the construction right-of-way would likely be many fewer. DOE would negotiate the surface rights across unpatented claims that fall within the construction right-of-way. There is one underground mine (now abandoned) that would be outside the construction right-of-way, approximately 240 meters (790 feet) from common segment 3. As discussed in Chapter 2, DOE would conduct further investigations, including drilling ***boreholes***, ground-penetrating radar, and seismic analysis, to determine the extent of nearby underground features. The Department would then develop appropriate engineered solutions to address underground features.

There are no energy leases (oil, gas, or geothermal) that would be in the common segment 2 construction right-of-way.

4.2.2.2.6.7 Goldfield Alternative Segments. The only patented mining claims that would be within the rail line construction right-of-way are associated with the three Goldfield alternative segments (see Figure 3-39). Although DOE would reduce the area of disturbance to minimize impacts to these claims, Goldfield alternative segment 1 would intersect six patented mining claims; Goldfield 3 would intersect two; and Goldfield 4 would intersect four. The area of these parcels is reflected in the private land impacts in Section 4.2.2.2.1.2. Goldfield alternative segment 1 would intersect 14 sections containing 375 unpatented mining claims; Goldfield 3 would intersect 14 sections containing 205 unpatented mining claims; and Goldfield 4 would intersect 19 sections containing 374 unpatented mining claims (see Table 3-8). Because data related to unpatented mining claims are available only at the section level, the actual number of unpatented claims within the construction right-of-way would likely be many fewer. The proposed mining activities by Metallic Ventures Gold, Inc., for the Gemfield deposit, if they occur, could pose a direct conflict with the Goldfield alternative segment 4 route and Maintenance-of-Way Facility. Under Phase 2 of this project, Metallic Ventures Gold would relocate U.S. Highway 95 to the west, which could similarly necessitate DOE to relocate its rail line and Maintenance-of-Way Facility further west on public land. While there could be a direct land-use conflict, DOE would be prepared to revise its right-of-way grant and move its rail line infrastructure to the degree necessary to accommodate this mineral exploration. The land section to the immediate west is public land, within the inactive Montezuma Grazing Allotment, that does contain some unpatented mining claims. Subsequently, DOE would need to review nearby mining claims to develop a revised route to minimize impacts to active mining. DOE would also employ mitigation and avoidance strategies as discussed in Chapter 7, Best Management Practices and Mitigation. There is adequate area to move both the alignment and the Maintenance-of-Way Facility to the vacant public land west of the proposed alignment. The vacant public land to the west has favorable topography (DIRS 185098-Gehner 2008, p. 2). There are no energy leases (oil, gas, or geothermal) that would be in the construction right-of-way for any of the Goldfield alternative segments.

There are a number of recorded underground tunnels, shafts, and mines that would be within the construction right-of-way of these alternative segments, and those could pose construction challenges or operational safety issues. There is one tunnel along Goldfield alternative segment 1; four associated with Goldfield 3; and one associated with Goldfield 4. Railroad construction and operations could affect these features and vice versa. As discussed in Chapter 2, DOE would conduct further investigations, including drilling boreholes, ground-penetrating radar, and seismic analysis, to determine the extent of nearby underground features. The Department would then develop appropriate engineered solutions to address underground features. This process for addressing underground mine shafts and tunnels is also described in Chapter 7, Best Management Practices and Mitigation.

4.2.2.2.6.8 Caliente Common Segment 4 (Stonewall Flat Area). Caliente common segment 4 would cross the westernmost portion of the Stonewall Mining District (see Figures 3-39 and 3-40).

However, most of the past mining activity in this district occurred approximately 5 kilometers (3 miles) east of common segment 4. The Cuprite Mining District would be west of common segment 4 but outside the construction right-of-way. Caliente common segment 4 would intersect five Township and Range Sections containing 22 unpatented mining claims. Because information is available only at the section level (where the area of a section is several times larger than a nominal area of a rail line segment that would fully bisect it), the actual number of claims within the construction right-of-way would likely be less. DOE would negotiate surface rights across affected unpatented mining claims with claim holders. There would be no patented mining claims, geothermal occurrences, or energy leases within the common segment 4 construction right-of-way. Therefore, common segment 4 would not affect mining activity or energy resources.

4.2.2.2.6.9 Bonnie Claire Alternative Segments. The Wagner Mining District would lie between the two Bonnie Claire alternative segments, just to the west of Bonnie Claire 3 (see Figure 3-40). There are patented mining claims in this district, but they would all be outside the construction right-of-way of each alternative segment. There are no geothermal or oil and gas leases within the construction right-of-way of either alternative segment. Therefore, there would be no direct impacts to mining or energy resource extraction along either alternative segment. Section 4.2.2.2.7.2 describes potential impacts associated with road access to the patented mining claims in the Wagner Mining District.

4.2.2.2.6.10 Common Segment 5 (Sarcobatus Flat Area). The southwestern portion of the Clarkdale Mining District would be approximately 0.8 kilometer (0.5 mile) northeast of common segment 5, outside the construction right-of-way (see Figure 3-40 and 3-41). Almost two-thirds of the Clarkdale Mining District is on the Nevada Test and Training Range, and the historically mined areas of the district are far enough away from common segment 5 that there would be no impacts to mining activities as a result of rail line construction (DIRS 183644-Shannon & Wilson 2007, p. 49). Section 4.2.2.2.7.2 describes potential impacts to access to this mining district.

There are geothermal resources along U.S. Highway 95 in Sarcobatus Valley, but none would be within the rail line construction right-of-way. There is one warm spring that would be approximately 0.8 kilometer (0.5 mile) northeast of common segment 5, and a geothermal well that would be approximately 0.4 kilometer (0.25 mile) northeast (DIRS 183644-Shannon & Wilson 2007, p. 48). There are no identified uses of these geothermal resources, and they would be far enough away from common segment 5 that they would not be affected by the rail line. The common segment 5 construction right-of-way would not cross any oil or gas lease areas.

4.2.2.2.6.11 Oasis Valley Alternative Segments. The Oasis Valley alternative segments would intersect two sections containing seven unpatented mining claims; DOE would negotiate surface rights across affected unpatented mining claims with claim holders for either alternative segment. There are oil and gas leases north of Beatty along the southwest flank of Pahute Mesa in southern Nye County (see Figure 3-41). Oasis Valley alternative segments 1 and 3 would cross portions of this oil and gas lease block (DIRS 173837-Sweeney 2005, pp. 49 and 50). At present, the lease is not in production, and records show that there has been no exploration in these areas since the 1970s (DIRS 183644-Shannon & Wilson 2007, p. 48). Therefore, the Oasis Valley alternative segments would not affect ongoing operations associated with this oil and gas lease. Furthermore, directional drilling and other techniques could be employed to facilitate oil and gas exploration or extraction near or within the proposed right-of-way, resulting in no adverse impacts to future oil and gas activities.

4.2.2.2.6.12 Common Segment 6 (Yucca Mountain Approach). Common segment 6 would cross the northern section of the Bare Mountain Mining District. Most past mining activity in the district occurred more than 3 kilometers (2 miles) south of the common segment (see Figure 3-41). There are recently active gold mining operations within the district, approximately 6 to 8 kilometers (4 to 5 miles) from common segment 6. The Silicon Mine and Thompson Quicksilver Mine would be north of common segment 6. The Silicon Mine would be approximately 800 meters (2,500 feet) and the Thompson Quicksilver Mine would be approximately 1,400 meters (4,500 feet) outside the construction right-of-way. Recent mining activity in these areas would be outside the rail line construction right-of-way, and would not be directly affected by common segment 6. The common segment 6 construction right-of-way would intersect four sections containing 19 unpatented mining claims. DOE would negotiate the surface rights across unpatented mining claims with claim holders. Common segment 6 would not affect energy leases (oil, gas, or geothermal) or resources.

4.2.2.2.7 Construction Impacts to Recreation and Access (Private and Public Land)

DOE developed the Caliente rail alignment alternative segments and common segments to avoid crossing sensitive areas, such as Wilderness Areas, ***Wilderness Study Areas***, state and national forests and parks, and other prominent recreational and scenic areas (see Figures 3-42 through 3-49). DOE would maintain access for all existing roads the rail line would cross at or near their current location by constructing ***at-grade crossings*** (the road and the rail line would cross paths at the same elevation) or ***grade-separated crossings*** (the road and the rail line would cross paths via an overpass or an underpass), resulting in no long-term adverse impacts to traffic patterns and land access. However, there could be temporary small impacts to access to these areas during rail line construction due to temporary road closures and detours.

At locations where there would be several road crossings close to one another (generally over a distance of 0.8 kilometer [0.5 mile] or less), there could be some minor rerouting and consolidation of crossings, but these would not prevent crossing the rail line. The regulatory authority to make decisions regarding roads, road closures, and rail line crossings rests with the BLM and county and local governments. DOE would work in close consultation with these groups to ensure access would be maintained.

Although many undeveloped recreation opportunities exist over much of the public lands surrounding the rail alignment (such as off-highway vehicle use and dispersed hunting), descriptions of potential impacts in Sections 4.2.2.2.7.1 through 4.2.2.2.7.3 are limited to defined recreation areas. While impacts to non-designated recreation areas are not specifically addressed, individuals might have to alter their access routes to particular recreation areas near the rail line. Construction of the rail line might also cause some dispersed recreationists (such as hunters) who use non-designated areas nearby to temporarily relocate. Future Special Recreation Permits issued by applicable BLM offices would take the presence of the rail line into consideration to minimize impacts to both the applicant and the construction and operation of the railroad. Most organized off-highway vehicle events with previously approved race routes are on existing roads and trails, and access across the rail line for these events would not be compromised. However, some previously permitted routes that the rail line would cross might need to alter their crossing locations in areas where crossings are consolidated.

4.2.2.2.7.1 Lincoln County. Rail line alternative segments and common segments crossing through Lincoln County would intersect a number of roads that provide access to nearby public and private lands (see Table 3-9).

Both the Caliente and Eccles alternative segments would cross the Rainbow Canyon ***Back Country Byway*** (see Figure 3-43). However, DOE would install at-grade crossings at these points; thus, there would be no long-term impacts to the Byway. The Caliente alternative segment would be 3.2 kilometers (2 miles) northeast of Kershaw-Ryan State Park. The rail line would not affect the park or access thereto from existing roads.

Potential quarry CA-8B along the Caliente alternative segment would occupy 1.2 square kilometers (300 acres) and a portion of Caliente common segment 1 would occupy 6.4 square kilometers (1,580 acres) within the 450-square-kilometer (111,200-acre) Chief Mountain Special Recreation Management Area, outlined within the Ely Proposed Resource Management Plan (DIRS 184767-BLM 2007, Map 2.4.15-1). This recreation area has three primary trails – the Red Rhyolite Trail, the Grey Dome Rim Trail, and portions of the Silver State Trail. Access to these trails is primarily at Oak Springs Summit on the north side of U.S. Highway 93, 8 kilometers (5 miles) west of the City of Caliente. Common segment 1 would traverse the northern boundary of the Chief Mountain area and would not pose a conflict with these trails' primary access points. At their closest points, these trails would be more than 10 kilometers (6 miles) away from the quarry. Because the quarry would not interfere with the primary access to these trails and it would be many miles from active trails, the proposed Action would not be inconsistent with the BLM objective of designating this Special Recreation Management Area for broad spectrum recreational use.

The Silver State Trail would be the only trail the rail alignment would intersect within the Chief Mountain area (see Figure 3-44). Bennett Pass Road, the Silver State Trail, and the rail line would all occupy the same route for approximately 1 kilometer (0.6 mile) on the west side of Bennett Pass. There is a 0.3-kilometer (0.2-mile) section on the east side of the pass where the road and the rail line would occupy the same route (DIRS 176796-Winslow 2006, p. 1).

Caliente common segment 1 would pass within 1.6 kilometers (1 mile) of the Weepah Spring Wilderness. However, there would be no impact to access to this area because access would be primarily south of the rail line along State Highway 318. Common segment 1 would be 5.3 kilometers (3.3 miles) southwest of Cathedral Gorge State Park and would not impact access to this park.

The Humboldt-Toiyabe National Forest would lie north of Garden Valley alternative segment 3, 3.2 kilometers (2 miles) from the Garden Valley alternative segments where they converge at the easternmost end of common segment 2. Access to this national forest is by unimproved roads, which would be north of and would not intersect the rail alignment. Therefore, the rail line would not impact access to the Humboldt-Toiyabe National Forest.

Caliente common segment 2 would pass the Worthington Range Wilderness within 0.9 kilometer (0.6 mile) at its closest point. Primary access to this wilderness area is to travel on State Highway 375 northwest toward the town of Rachel and approximately 2.4 kilometers (1.5 miles) before reaching Rachel, and then turn right on an unnamed county road northbound for approximately 29 kilometers (18 miles). This primary route to the Worthington Range Wilderness includes roads that would be south of and would not intersect the rail alignment. Therefore, there would be no impacts to access to the Worthington Range Wilderness.

There are a number of privately owned parcels of land between Garden Valley alternative segments 1 and 2, but they would be outside the rail line construction right-of-way. Access to private property in Garden Valley would be through existing county roads. DOE would maintain access where the rail line would cross existing roads.

4.2.2.2.7.2 Nye County. Rail line alternative segments and common segments crossing through Nye County would intersect a number of roads that provide access to nearby public and private lands (see Table 3-9).

South Reveille alternative segment 2 would follow the southern boundary of the South Reveille Wilderness Study Area and would be 30 meters (100 feet) from the study area at its closest point. Rail line workers would be instructed not to trespass into the area. In addition, DOE would use institutional markers, such as temporary fencing, ropes, or other markers, to limit access. DOE would consult with the BLM about construction practices that could be used to minimize impacts to Wilderness Study Areas.

The easternmost portion of Caliente common segment 3 would pass between the South Reveille Wilderness Study Area and the Kawich Wilderness Study Area. Primary access to the South Reveille Wilderness

Study Area is from roads off State Highway 375, which would be approximately 16 kilometers (10 miles) north of the rail alignment. Common segment 3 could cross access roads to the Kawich Wilderness Study Area near U.S. Highway 6 near Warm Springs, and networks of roads from the east or west of the Study Area. DOE would instruct rail line workers not to trespass into the area. In addition, DOE would use institutional markers, such as temporary fencing, ropes, or other markers, to limit access. The road between the common segment 3 construction right-of-way and the Kawich Wilderness Study Area could also serve as a visual guide for workers to avoid trespass. DOE would consult with the BLM about construction practices that could be used to minimize impacts to Wilderness Study Areas.

Bonnie Claire alternative segments 2 and 3 would cross few roads or trails (see Figure 3-48 and Table 3-9). There is no active grazing on the land surrounding these alternative segments. However, Bonnie Claire 3 would be west of and Bonnie Claire 2 would be east of patented mining claims within the Wagner Mining District (see Figure 3-48). If DOE selected Bonnie Claire 3, the rail line would cross one access road to these mining claims.

There are more than a dozen privately owned properties that would be west of common segment 5 clustered at Scottys Junction. These properties lie on either side of U.S. Highway 95. Because the rail line would be to the east of these properties and not interfere with access from U.S. Highway 95, it would not impact access to land near Scottys Junction. Common segment 5 would cross one road that provides primary access from U.S. Highway 95 to oil and gas leases that would be north of the rail line and provides access to the Nevada Test and Training Range. DOE proposes an active at-grade crossing for this location (DIRS 180916-Nevada Rail Partners 2007, pp. D-1 and D-2). However, temporary small impacts to access could occur during the construction phase.

Each of the Oasis Valley alternative segments would cross a limited number of roads (see Figure 3-49 and Table 3-9). Roads in this area provide access to private property owned by a cattle company; the northern portion of the Razorback Allotment; oil and gas leases; and the northwestern portion of the Nevada Test and Training Range. Oasis Valley alternative segment 3 would pose minimal restriction to road access from U.S. Highway 95 to the oil and gas leases and privately owned land, and access within the Razorback Allotment because it would be farthest away from these established areas.

Common segment 6 would cross six public roads, some of which provide access to the Nevada Test and Training Range and the northern portion of the Razorback Allotment (see Figure 3-49). The only privately owned properties in the vicinity of common segment 6 are west of the rail alignment at its northernmost point. These properties are adjacent to U.S. Highway 95 and the rail line would not impact access thereto.

4.2.2.2.7.3 Esmeralda County. Rail line alternative segments and common segments crossing through Esmeralda County would intersect a number of roads that provide access to nearby public and private lands (see Table 3-9).

There is privately owned land, primarily within the community of Goldfield, where access to the community is chiefly from U.S. Highway 95. Only Goldfield alternative segment 4 would cross U.S. Highway 95, and it would cross twice. If DOE selected this alternative segment, the Department would construct a grade-separated road crossing at both these intersections (DIRS 180916-Nevada Rail Partners 2007, p. D-2).

There are a number of patented and unpatented mining claims near Goldfield alternative segments 1 and 4, with a large network of roads between the two alternative segments (see Figure 3-47). If DOE selected Goldfield alternative segment 4, there would be no impacts to access to the claims east of the rail alignment. If DOE selected Goldfield alternative segment 1, the rail line would cross six roads in Esmeralda and Nye County that are not considered primary access routes.

Common segment 4 would cross a number of roads and trails (see Figure 3-47 and Table 3-9).

4.2.2.2.8 Land-Use Conflicts with Utility Corridors and Rights-of-Way

Where the rail line would cross an existing utility right-of-way, DOE would take precautions to minimize disturbance and disruption of the utilities. Section 4.2.11, Utilities, Energy, and Materials, describes measures the Department would implement to protect existing utilities.

Of the 543 kilometers (337 miles) of rail line proposed under the longest possible alignment, only 134 kilometers (83 miles), or 25 percent, would fall within corridors designated by the applicable resource management plans. However, the resource management plans allow for transportation rights-of-way outside these designated corridors if no other option is feasible and the right-of-way would not substantially conflict with other land-use goals and designations. DOE would perform field verifications of utility right-of-way locations and would incorporate the information into the final rail line design.

Because final engineering design for utility connections is not complete, DOE does not know the exact tie-in locations for electricity along the rail alignment. While the Department expects that transmission lines could be tapped where they currently cross the proposed rail line location, there is a possibility that the project could require additional utility rights-of-way for small feeder lines.

4.2.2.3 Operations Impacts

Land-use and ownership impacts would occur before or during the railroad construction phase. The nominal width of the operations right-of-way would be narrower than the nominal width of the construction right-of-way, and some of the land could therefore be returned to its previous uses.

Topics related to the quality-of-life aspects of land use include visual quality, air quality, and noise and vibration, as described in other sections of this Rail Alignment EIS (see Section 4.2.3, Aesthetic Resources; Section 4.2.4, Air Quality and Climate; and Section 4.2.8, Noise and Vibration).

Railroad operations could affect the use of grazing land. For example, the presence of a rail line could require livestock on some allotments to adjust to new routes to access water and forage. Generally, livestock could learn these new routes after construction of the rail line was complete and could acclimate to and cross the rail line in most areas. The revised allotment management plans developed by the BLM and the affected permittees would be designed to address forage and water accessibility problems introduced by the presence of the rail line.

Nevada is an open-range state, where it is the responsibility of private landowners to fence their properties to prevent livestock from damaging their property and where ranchers could be compensated for the loss of their livestock killed by vehicles and trains. If DOE trains struck and killed livestock, DOE or the commercial carrier (under the Shared-Use Option) would reimburse ranchers for such losses, as per Nevada law. DOE would implement measures to prevent the congregation of livestock near the rail line, such as fencing, relocating stockwater sources further from the rail line, and preventing the ponding of water near the rail line. These measures would be site-specific, determined through coordination with permittees and the BLM.

As discussed in Section 4.2.2.2.6, the BLM could issue new unpatented mining claims and energy leases on lands near the rail line during the construction and operations phases. While the presence of the rail line would not necessarily preclude non-surface resources extraction activities, the applicant would be required to work closely with the BLM and DOE to ensure they would not interfere with the safe operation of the railroad. Engineering solutions for the safe extraction of mineral and energy resources near or beneath the rail line could include directional (lateral) drilling of wells or ensuring all mine shafts or tunnels were sufficiently deep and reinforced to prevent subsidence.

The parallel rail alignment access roads (unpaved) could improve land access along most of the rail alignment. While most of the rail alignment would follow or be within a few kilometers of existing unpaved roads and trails that are currently open for public use, the new access roads could be of better quality in some areas than nearby existing roads, increasing the likelihood of use. Off-road vehicle use, hunting intensity, and other recreational activities could increase along the rail alignment access roads. Improved human and vehicle access to surrounding areas could result in indirect impacts to vegetation and wildlife, as described in Section 4.2.7, Biological Resources. Recreational uses of public land along the access roads (as with other similar roads on public land) would be monitored by the BLM to ensure compliance with its land management goals, as stated in applicable BLM resource management plans. It is important to note that DOE would not maintain the access roads as public roads, except in locations where they would be used for rerouting to consolidate rail line crossings, and the Department would post signs indicating potential users would proceed on the roads at their own risk.

Lastly, future Special Recreation Permits issued by applicable BLM offices would take the presence of the rail line into consideration to minimize impacts to both the applicant and operation of the rail line. This might require new routes to minimize or avoid crossing the rail line and greater manpower to implement and monitor these new routes during recreation events.

4.2.2.4 Impacts under the Shared-Use Option

Impacts to land use and ownership under the Shared-Use Option would be similar to those described for the Proposed Action without shared use, with a small addition of impacts from the construction and operation of commercial sidings. Under the Shared-Use Option, commercial trains would haul a range of products to and from businesses, including stone and other nonmetallic minerals, oil and petroleum products, and nonradioactive waste materials (see Section 2.2.6.3). DOE cannot predict the exact locations of these possible commercial-use sidings, but they could include Caliente, Panaca/Bennett Pass, the Warm Springs Summit area, Tonopah, Goldfield, and the Beatty Wash/Oasis Valley area. The sidings would likely be constructed within the railroad operations right-of-way; if so, there would be no additional impacts to land use and ownership (see Figure 2-54). Because only approximately 1 percent of land within the rail line construction right-of-way is privately owned, any commercial sidings or commercial facilities that would be outside the construction right-of-way would likely be on BLM-administered land, and implemented under a separate BLM-issued right-of-way.

Implementation of the Shared-Use Option could facilitate the expansion or introduction of industrial (mining) or commercial operations in the region. This could have future, long-term impacts on land use, such as new or revised land-use zoning plans to accommodate industrial and commercial land uses within Lincoln, Nye, and Esmeralda Counties in the vicinity of the rail line. The expansion of industrial or commercial activity from shared use of the rail line could also indirectly result in land-use changes in relation to additional residential development. Increased rail traffic could also increase the likelihood of livestock mortality along the rail line within active grazing allotments.

4.2.2.5 Summary

The Caliente rail alignment construction right-of-way would occupy between 153 and 162 square kilometers (37,900 and 40,100 acres) of land. Most of the land would be public land, although DOE would need to gain access to up to 1.25 square kilometers (310 acres) of private land for the rail alignment and another possible 0.93 square kilometer (230 acres) required to accommodate support facilities. This amount of private land would be very small (about 1 percent) compared to the total amount of land that would be required for the project.

The Caliente rail alignment would not displace existing or planned land uses over a substantial area, nor would it substantially conflict with applicable land-use plans or goals. A portion of the Eccles alternative segment and common segment 1 would cross through Areas of Critical Environmental Concern under the Ely Proposed Resource Management Plan. These areas were designated after the issuance of the Draft Rail Alignment EIS and would be finalized after further study by the BLM. In consultation with the BLM, DOE would conduct pre-construction surveys and implement avoidance, minimization, and mitigation strategies to protect the resource values of these areas. If the BLM finds that through these strategies there would be minimal conflict with the areas' resource values, then the right-or-way could be authorized.

The areas with the highest densities of private land the rail alignment would cross are near Caliente and Goldfield. If DOE selected the Caliente alternative segment, some structures at the existing Union Pacific Railroad train yard and three structures or residences along the former Pioche and Prince Branchline would need to be demolished or relocated. This alternative segment would also occupy portions of the Caliente Hot Springs Motel access road and parking lot. DOE would work with the property owner to develop specific measures that could avoid, reduce, or mitigate impacts to this property, including measures to maintain access to the motel during construction. Finally, DOE could also negotiate compensation with the landowner if the design, construction, or operations accommodations were not sufficient to mitigate the impacts. Alternative segments near Goldfield would cross private (although vacant) land, including patented mining claims and state and county land. DOE would work with affected landowners to develop specific measures to avoid, reduce, or mitigate impacts to private land as described in Chapter 7, Best Management Practices and Mitigation.

DOE developed the Caliente rail alignment to avoid American Indian lands. The closest rail line segment, common segment 5, would be approximately 3 kilometers (2 miles) east of the Timbisha Shoshone Trust Lands near Scottys Junction.

The Caliente rail alignment would use up to 161.9 square kilometers (40,000 acres) of BLM-administered land. Some of the rail line segments would pass through lands the BLM has identified for potential disposal (sale). However, the land withdrawals already in place for the rail alignment and the potential use by another federal agency would take precedence over disposal actions that could affect the project.

Where the rail line segments and facilities would cross active grazing allotments on BLM-administered land, some grazing land would be lost or may be isolated by the rail line. Assuming all the vegetation in the construction right-of-way or support facilities was unavailable for forage, the Caliente rail alignment would directly result in less than a 1-percent loss of animal unit months across all affected allotments. The greatest percentage loss of animal unit months for any one grazing allotment would occur on the Black Canyon Allotment under common segment 1 (4.6-percent loss). Of the potential quarries, quarry CA-8B would result in the highest percentage loss of animal unit months (6.6 percent on the Highway Allotment). While DOE would coordinate with permittees and the BLM to institute mitigation measures and allotment management plans to minimize impacts associated with the rail line, additional animal unit months could be lost due to the inaccessibility of forage where the rail line acts as a barrier.

The presence of a rail line and the implementation of revised allotment management plans could require livestock on some allotments to adjust to new routes to access water and forage. Generally, livestock could learn these new routes and acclimate to and cross the rail line in most areas. DOE would provide temporary feed, water, and assistance in livestock movement during rail line construction to assist with the adjustment of cattle to the presence of the rail line. The rail line could affect ranching operations because livestock could be struck by passing trains. DOE would coordinate with permittees and the BLM to provide mitigation measures to prevent congregation of livestock near the rail line. DOE or the railroad's commercial operator (under the Shared-Use Option) would reimburse ranchers for such losses, as appropriate. DOE would consult with permittees and the BLM to determine where fences should be restored or constructed on specific allotments to facilitate grazing operations, while minimizing impacts to wildlife movement.

Construction wells located on grazing allotments outside the construction right-of-way would have small and temporary impacts in terms of loss of grazing area. Once each well was drilled, DOE would reclaim the site in accordance with DOE and BLM requirements. The Department would construct a 10- to 15-centimeter (4- to 6-inch)-diameter temporary pipeline on top of the ground along access roads to transport water to the construction right-of-way. Wells not needed for railroad operations would be properly abandoned in compliance with State of Nevada regulations, and sites and access roads would be reclaimed (DIRS 180922-Nevada Rail Partners 2007, p. 4-12).

Most of the local mining activity would be outside the rail line construction right-of-way. DOE would need to negotiate the surface rights to cross the few affected unpatented mining claims the rail line would cross. All the Goldfield and Oasis Valley alternative segments and common segment 6 would cross several sections that contain many unpatented mining claims. The actual number of claims the rail line construction right-of-way would cross would need to be determined through additional record searches and field verification. DOE would negotiate surface rights across affected unpatented mining claims with the claim holders. The proposed mining activities by Metallic Ventures Gold, Inc., for the Gemfield deposit, if they occur, could pose a direct conflict with the Goldfield alternative segment 4 route and its associated Maintenance-of-Way Facility location. Under Phase 2 of this project, Metallic Ventures Gold would relocate U.S. Highway 95 to the west, and could similarly necessitate DOE to relocate its rail line and Maintenance-of-Way Facility further west on public land. While there could be a direct land-use conflict, DOE would employ mitigation and avoidance strategies as discussed in Chapter 7.

There is also the possibility that the rail line could be affected by or affect underground mining tunnels or shafts. During the final engineering design phase of the project, DOE would perform a survey to verify the locations of tunnels and shafts to avoid adverse impacts, as described in Chapter 7, Best Management Practices and Mitigation.

DOE developed the Caliente rail alignment to avoid Wilderness Areas and other scenic and recreational areas. Road crossings would be constructed to prevent the rail line from obstructing access to private and public land. While there could be temporary road closures or detours during the rail line construction phase, there would be no impact to land access during the operations phase. In addition, organized off-highway vehicle events permitted in the past by BLM might need to alter their routes to avoid the rail line.

Depending on the alternative segments selected, the rail line would cross between 12 and 34 known utility lines. DOE would negotiate crossing agreements with the right-of-way holders and the BLM to determine the duration of use, access needs, mitigation, and compensation, as applicable. DOE would protect existing utilities from damage so that disruption to utility service or damage to lines would be at most small and temporary. The project would require a new BLM right-of-way outside the existing planning corridors, which would be outside of right-of-way avoidance areas. Under the longest potential route, approximately 25 percent of the Caliente rail alignment would fall within existing planning corridors. In addition, to avoid the proliferation of new rights-of-way, the BLM may elect to grant future rights-of-way for new utilities adjacent to the proposed rail line.

Construction and operation of a railroad along the Caliente rail alignment could result in the following general impacts to land use and ownership along the entire alignment:

- Changes in land uses on private and public lands within the construction and operations rights-of-way
- Possible increase in livestock mortality (collisions with trains)
- Reduced animal unit months on affected grazing allotments as determined by the BLM

- Reduction in land available for BLM disposal
- Alteration of past routes for BLM-permitted off-highway vehicle events
- Possible expansion of mining, manufacturing, industrial, or commercial land uses under the Shared-Use Option

Tables 4-23 through 4-30 summarize potential impacts to land use and ownership for each rail line segment and construction and operations support facility. As discussed in Section 4.2.2.2.3.2, the loss of animal unit months reflected in these tables are potential direct losses within the construction right-of-way due to possible vegetation loss. Potential changes to permitted animal unit months for each grazing allotment due to the presence of the rail line would be influenced by the possible isolation of forage where the rail line acts as a barrier, the degree to which mitigation measures can offset adverse impacts, and the degree to which revised allotment management plans can be implemented to sustain or improve grazing operations.

Table 4-23. Summary of potential impacts to land use and ownership – Caliente and Eccles alternative segments (Lincoln County).

Construction impacts	Caliente	Eccles
Private parcels the alignment would cross (construction right-of-way)	At least 30	At least 5
Affected property owners	At least 23	At least 4
Land area of private land affected (including patented mining claims)	160 acres[a]	74 acres
Active grazing allotments the alignment would cross	1	3
Stockwater pipelines the alignment would cross	0	0
Animal unit months lost (estimated) or percent of allotment(s)	1 or 0.5 percent	17 or 1.4 percent
Active allotment land that would be within the construction right-of-way	24 acres	751 acres
Unpatented mining claims the alignment would cross	0	0
Underground mines, shafts, and tunnels the alignment would cross	0	0
Linear distance outside BLM utility corridors	11 miles[b]	12 miles
Roads and trails the alignment would intersect	7	8
Utility lines/rights-of-way the alignment would cross or overlap	13	1

a. To convert acres to square kilometers, multiply by 0.0040469.
b. To convert miles to kilometers, multiply by 1.6093.

Table 4-24. Summary of potential impacts to land use and ownership – Caliente common segments 1 through 6 (Lincoln and Nye Counties) (page 1 of 2).

Construction impacts	Common segment 1	Common segment 2	Common segment 3	Common segment 4	Common segment 5	Common segment 6
Private parcels the alignment would cross (construction right-of-way)	0	0	0	0	0	0
Affected property owners	0	0	0	0	0	0
Land area of private land affected (including patented mining claims)	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
Active grazing allotments the alignment would cross	9	3	2	0	0	1
Stockwater pipelines the alignment would cross	3	2	6	0	0	0

Table 4-24. Summary of potential impacts to land use and ownership – Caliente common segments 1 through 6 (Lincoln and Nye Counties) (page 2 of 2).

Construction impacts	Common segment 1	Common segment 2	Common segment 3	Common segment 4	Common segment 5	Common segment 6
Animal unit months lost (estimated) or percent of allotment(s)	452 or 0.7 percent	117 or 0.4 percent	229 or 0.6 percent	Not applicable (grazing allotment inactive)	Not applicable (grazing allotment inactive)	17 or 1.8 percent
Active allotment land that would be within the construction right-of-way	8,450 acres[a]	3,690 acres	6,130 acres	Not applicable (grazing allotment inactive)	Not applicable (grazing allotment inactive)	1,320
Unpatented mining claims the alignment would cross	0	0	10 sections with 133 claims	5 sections with 22 claims	0	4 sections with 19 claims
Underground mines, shafts, and tunnels the alignment would cross	0	0	1	0	0	0
Linear distance outside BLM utility corridors	70 miles	26 miles	20 miles	7 miles	13 miles	24 miles
Roads and trails the alignment would intersect	39	13	30	14	14	7
Utility lines/rights-of-way the alignment would cross or overlap	4	0	4	0	1	0

a. To convert acres to square kilometers, multiply by 0.0040469.
b. To convert miles to kilometers, multiply by 1.6093.

Table 4-25. Summary of potential impacts to land use and ownership – Garden Valley alternative segments (Lincoln and Nye Counties).

Construction impacts	Garden Valley 1	Garden Valley 2	Garden Valley 3	Garden Valley 8
Private parcels the alignment would cross (construction right-of-way)	0	0	0	0
Affected property owners	0	0	0	0
Active grazing allotments the alignment would cross	5	5	5	5
Stockwater pipelines the alignment would cross	1	0	1	0
Animal unit months lost (estimated) or percent of allotment(s)	121 or 1.3 percent	132 or 1.1 percent	125 or 1.4 percent	126 or 1.1 percent
Active allotment land that would be within the construction right-of-way	2,590 acres[a]	2,628 acres	2,830 acres	2,545 acres
Unpatented mining claims the alignment would cross	0	0	0	0
Underground mines, shafts, and tunnels the alignment would cross	0	0	0	0
Linear distance outside BLM utility corridors	22 miles[b]	22 miles	23 miles	23 miles
Roads and trails the alignment would intersect	8	12	10	14
Utility lines/rights-of-way the alignment would cross or overlap	1	2	1	1

a. To convert acres to square kilometers, multiply by 0.0040469.
b. To convert miles to kilometers, multiply by 1.6093.

Table 4-26. Summary of potential impacts to land use and ownership – South Reveille alternative segments (Nye County).

Construction impacts	South Reveille 2	South Reveille 3
Private parcels the alignment would cross (construction right-of-way)	0	0
Affected property owners	0	0
Active grazing allotments the alignment would cross	1	1
Stockwater pipelines the alignment would cross	1	0
Animal unit months lost (estimated) or percent of allotment(s)	54 or 0.2 percent	58 or 0.2 percent
Active allotment land that would be within the construction right-of-way	1,370 acres[a]	1,490 acres
Unpatented mining claims the alignment would cross	2 sections with 63 claims	2 sections with 63 claims
Underground mines, shafts, and tunnels the alignment would cross	0	0
Linear distance outside BLM utility corridors	12 miles[b]	12 miles
Roads and trails the alignment would intersect	1	1
Utility lines/rights-of-way the alignment would cross or overlap	0	0

a. To convert acres to square kilometers, multiply by 0.0040469.
b. To convert miles to kilometers, multiply by 1.6093.

Table 4-27. Summary of potential impacts to land use and ownership – Goldfield alternative segments (Nye and Esmeralda Counties).

Construction impacts	Goldfield 1	Goldfield 3	Goldfield 4
Private parcels the alignment would cross (construction right-of-way)	At least 2 patented mining claims	2	At least 35
Affected property owners	0	0	20
Land area of private land affected (including patented mining claims)	150 acres[a]	46 acres	120 acres
Active grazing allotments the alignment would cross	0	0	0
Stockwater pipelines the alignment would cross	0	0	6 (unused)
Animal unit months lost (estimated) or percent of allotment(s)	Not applicable	Not applicable	Not applicable
Active allotment land that would be within the construction right-of-way	Not applicable	Not applicable	Not applicable
Unpatented mining claims the alignment would cross	14 sections containing 375 claims	14 sections containing 205 claims	19 sections containing 374 claims
Underground mines, shafts, and tunnels the alignment would cross	14	4	5
Linear distance outside utility corridors	27 miles[b]	29 miles	30 miles
Roads and trails the alignment would intersect	15	5	44
Utility lines/rights-of-way the alignment would cross or overlap	0	0	8

a. To convert acres to square kilometers, multiply by 0.0040469.
b. To convert miles to kilometers, multiply by 1.6093.

Table 4-28. Summary of potential impacts to land use and ownership – Bonnie Claire alternative segments (Nye County).

Construction impacts	Bonnie Claire 2	Bonnie Claire 3
Private parcels the alignment would cross (construction right-of-way)	0	0
Affected property owners	0	0
Land area of private land affected (including patented mining claims)		
Active grazing allotments the alignment would cross	0	0
Stockwater pipelines the alignment would cross	0	0
Animal unit months lost (estimated)	Not applicable	Not applicable
Active allotment land that would be within the construction right-of-way	Not applicable	Not applicable
Unpatented mining claims the alignment would cross	0	0
Underground mines, shafts, and tunnels the alignment would cross	0	0
Linear distance outside utility corridors	13 miles[a]	11 miles
Roads and trails the alignment would intersect	1	4
Utility lines/rights-of-way the alignment would cross or overlap	0	0

a. To convert miles to kilometers, multiply by 1.6093.

Table 4-29. Summary of potential impacts to land use and ownership – Oasis Valley alternative segments (Nye County).

Construction impacts	Oasis Valley 1	Oasis Valley 3
Private parcels the alignment would cross (construction right-of-way)	1	0
Affected property owners	1	0
Land area of private land affected (including patented mining claims)	0.9 acre[a]	Not applicable
Active grazing allotments the alignment would cross	1	1
Stockwater pipelines the alignment would cross	0	0
Animal unit months lost (estimated) or percent of allotment(s)	8 or 0.8 percent	12 or 1.3 percent
Active allotment land that would be within the construction right-of-way	590 acres	940 acres
Unpatented mining claims the alignment would cross	2 sections containing 7 claims	2 sections containing 7 claims
Underground mines, shafts, and tunnels the alignment would cross	0	0
Linear distance outside BLM utility corridors	0.1 mile[b]	2 miles
Roads and trails the alignment would intersect	3	3
Utility lines/rights-of-way the alignment would cross or overlap	0	0

a. To convert acres to square kilometers to acres, multiply by 0.0040469.
b. To convert miles to kilometers, multiply by 1.6093.

Table 4-30. Summary of potential impacts to land use and ownership – railroad construction and operations support facilities (Lincoln, Nye, and Esmeralda Counties) (page 1 of 2).

Facility	Construction impacts
Interchange Yard	The Interchange Yard would be within existing Union Pacific Railroad right-of-way. Thus, there would be no impacts.
Staging Yard at Caliente-Indian Cove	The Staging Yard would be on 180 acres of private land (across 6 parcels). There would be direct changes to land use on this property.
Staging Yard at Caliente-Upland	The Staging Yard would be on 110 acres of private land (across 17 parcels). There would be direct changes to land use on this property.

Table 4-30. Summary of potential impacts to land use and ownership – railroad construction and operations support facilities (Lincoln, Nye, and Esmeralda Counties) (page 2 of 2).

Facility	Construction impacts
Staging Yard at Eccles-North	The Staging Yard would be on public land, on the Peck Grazing Allotment, within the planned construction right-of-way of the Eccles alternative segment.
Maintenance-of-Way Headquarters Facility – Goldfield alternative segment 1 or 3 option	Building would be on vacant BLM-administered land and would use 3.2 acres of land. This would be a permanent change in land use.
Maintenance-of-Way Trackside Facility	Facility would be within the rail line construction right-of-way, within either the inactive Montezuma Grazing Allotment or across the Stone Cabin and Ralston Grazing Allotments.
Rail Equipment Maintenance Yard, Cask Maintenance Facility, Nevada Railroad Control Center and National Transportation Operations Center	These facilities would be on DOE-controlled land on the Yucca Mountain Site. There would be no change in land use or ownership.
Potential Quarries	
CA-8B – Indian Cove option	This quarry would result in the loss of 250 acres[a] of grazing land on the Highway Allotment, and the loss of 7 animal unit months (5.9-percent loss). The quarry would also use 44 acres of land on the Peck Allotment, resulting in a loss of 1 animal unit month. Portions of the quarry would be on private land and would impact at least 49 acres across three parcels (three owners).
CA-8B – Upland option	This quarry would result in the loss of 280 acres of grazing land on the Highway Allotment, and the loss of 8 animal unit months (6.6 percent loss). Portions of the quarry would be on private land and would impact at least 49 acres across two parcels (two landowners).
NN-9A	This quarry would be within the Reveille Allotment, and would result in the loss of 490 acres of grazing land and 19 animal unit months (less than 0.1-percent loss).
NN-9B	This quarry would be within the Reveille Allotment, and would result in the loss of 320 acres of grazing land and 13 animal unit months (less than 0.1-percent loss).
ES-7	This quarry would be on 360 acres of public land within an inactive grazing allotment.
NS-3A	This quarry would be on 920 acres of public land within an inactive grazing allotment.
NS-3B	This quarry would be on 370 acres of public land within an inactive grazing allotment.

a. To convert acres to square kilometers, multiply by 0.0040469.

4.2.3 AESTHETIC RESOURCES

This section describes potential impacts to aesthetic (visual) resources from constructing and operating the proposed railroad along the Caliente rail alignment. Section 4.2.3.1 describes the methods DOE used to assess potential impacts; Section 4.2.3.2 describes potential impacts during the construction phase; Section 4.2.3.3 describes potential impacts during the operations phase; Section 4.2.3.4 describes potential impacts under the Shared-Use Option; and Section 4.2.3.5 summarizes potential impacts to aesthetic resources.

Section 3.2.3.1 describes the region of influence for aesthetic resources along the Caliente rail alignment.

4.2.3.1 Impact Assessment Methodology

4.2.3.1.1 Approach

Most of the lands along the Caliente rail alignment are BLM-administered public lands. For this reason, DOE utilized BLM methods to evaluate potential impacts to visual resources.

The BLM uses a process to rate visual resource contrast and evaluate the magnitude of a project's impact on existing visual resources (DIRS 173053-BLM 1986, all). The BLM evaluates the contrast between existing conditions and conditions expected during a project, drawing on information from the BLM visual resource management inventory, which the BLM uses to classify the aesthetic value of BLM-administered lands (DIRS 101505-BLM 1986, all). BLM management objectives allow different levels of project-related contrast for each visual resource management class (DIRS 101505-BLM 1986, Section VB). Figure 3-58 in Section 3.2.3 shows the visual resource management classes for lands surrounding the Caliente rail alignment. DOE used the BLM methodology to assign visual resource management classes to non-BLM public and private land.

To identify potential impacts to aesthetic resources, DOE applied the process for rating visual resource contrast specified in BLM Manual Handbook 8431-1. This process involved comparing the existing and proposed conditions in relation to:

- Landform, vegetative features, and structural features (such as existing and proposed rail roadbeds, power distribution lines, buildings, and communication towers)
- Form, line, color, and texture
- Other factors including distance, angle of observation, how long the project feature would be visible, relative size or scale, season of use, light conditions, recovery time for vegetation after construction, spatial relationships, and atmospheric conditions

DOE developed contrast ratings using the methodology in BLM Manual Handbook 8410-1 (DIRS 101505-BLM 1986, all) from the key observation points identified in Section 3.2.3 (see Figure 3-58). DOE prepared simulations to illustrate the expected project-related contrast at some key observation points. Appendix D, Aesthetics, Section D.1, provides baseline photographs and simulations for the Caliente rail alignment.

4.2.3.1.2 Criteria for Determining Impacts

DOE used the criteria listed in Table 4-31 to rank the contrast between existing conditions and conditions expected during the railroad construction and operations phases at each key observation point. DOE then considered contrast ratings against the BLM visual resource management objectives listed in Table 4-32,

Table 4-31. Criteria for determining degree of visual contrast.[a]

Degree of contrast	Criteria
None	The element contrast is not visible or perceived.
Weak	The element contrast can be seen but does not attract attention.
Moderate	The element contrast begins to attract attention and begins to dominate the characteristic landscape.
Strong	The element contrast demands attention, will not be overlooked, and is dominant in the landscape.

a. Source: DIRS 173053-BLM 1986, Section III.D.2.a.

Table 4-32. BLM visual resource management classes and objectives.[a]

Visual resource class	Objective	Acceptable changes to land
Class I	Preserve the existing character of the landscape.	Provides for natural ecological changes but does not preclude limited management activity. Changes to the land must be small and must not attract attention.
Class II	Retain the existing character of the landscape.	Management activities may be seen but should not attract the attention of the casual observer. Changes must repeat the basic elements of form, line, color, and texture of the predominant natural features of the characteristic landscape.
Class III	Partially retain the existing character of the landscape.	Management activities may attract attention but may not dominate the view of the casual observer. Changes should repeat the basic elements in the predominant natural features of the characteristic landscape.
Class IV	Provides for management activities that require major modifications of the existing character of the landscape.	Management activities may dominate the view and be the major focus of viewer attention. An attempt should be made to minimize the impact of activities through location, minimal disturbance, and repeating the basic elements.

a. Source: DIRS 101505-BLM 1986, Section V.B.

where applicable. In general, the BLM manages areas of high visual value (Classes I and II) to minimize contrast, while allowing more contrast in areas of lower visual value (Classes III and IV).

In this analysis, the primary basis for identifying potential adverse impacts to aesthetic resources is inconsistency with BLM management objectives for a ***viewshed***. This includes consideration of effects on the visual values of parks, recreation areas, and other scenic resources (recognized at the national, state, or local level) and visual intrusions or contrasts affecting the quality of landscapes. Along much of the Caliente rail alignment, where the landscape is sparsely populated and undeveloped, the visual impact of equipment, facilities, and activities could create a weak or moderate contrast, according to the criteria listed in Table 4-31. That is, from key observation points that are within a few miles, equipment, facilities, and activities could be seen (weak contrast) or would begin to attract attention and begin to dominate the viewshed (moderate contrast). However, as noted in BLM guidance, distance and duration of project activities affect perceptions of contrast (DIRS 173053-BLM 1986, Section III.D.2.b).

Distance of an observer from project activities and facilities would greatly affect the observer's perception of project-related contrasts with the landscape. The likelihood that activities or facilities would divert an observer's attention away from the landscape would decrease as distance increased. Thus, views from observation points where the project would appear in the foreground or middleground ***distance zone*** would usually be affected more than views from observation points where the project was in the background.

Duration of activities also affects conclusions about a project's consistency with BLM visual resource management objectives in a particular location. For example, visible construction activities over 18 months could cause a moderate degree of contrast and be inconsistent with Class II objectives. Such activities would be recognized as a moderate adverse impact of construction in Class II areas, although BLM methodology recognizes that "few projects meet the VRM [visual resource management] management objectives during construction" (DIRS 173053-BLM 1986, Section III.D.2.b.7). In contrast, passage of a train on a track more than approximately 1.6 kilometers (1 mile) from observers for a few minutes three times a day for up to 50 years might comply with Class II objectives if the rail line itself did not attract attention or dominate the view of a casual viewer, thus creating only a weak degree of contrast. In such a case, presence of the rail line would be recognized as a small adverse impact of operation.

4.2.3.2 Construction Impacts

Table 4-33 lists contrast ratings for views from each key observation point along the Caliente rail alignment and consideration of project consistency with BLM management objectives. In cases where construction and operations activities would cause different levels of contrast, the table identifies the phase for each rating; otherwise, a single rating applies to both construction and operations. Figure 4-1 is the same as Figure 3-58 in Section 3.2.3, showing visual resource management classifications of lands around each key observation point. It is a useful reference when reading impact discussions in this section. Appendix D, Section D.1, provides photographs of views from each key observation point and simulations of views including the rail line, trains, or other features.

4.2.3.2.1 Construction Impacts Common to the Entire Caliente Rail Alignment

Construction-related equipment, facilities, and activities would be potential sources of short-term (temporary) impacts to visual resources during the construction phase. Most of the equipment, facilities, and activities would be situated within the nominal width of the construction right-of-way. From some viewpoints, the presence of workers, vehicles, equipment, supply trains, borrow sites, quarries, laydown yards, well pads, construction camps, and electric distribution lines, and the generation of dust and vehicle exhaust, might be seen or might attract the attention of a casual observer during construction. These would result in small impacts to visual setting except in areas discussed in Section 4.2.3.2.2.

New cut and fill slopes could temporarily result in a weak to strong contrast with adjacent soils and vegetation. The short-term (construction phase) level of impact to the visual setting from this contrast would be small to large, and would decrease with the reestablishment of vegetation post-construction, which could take many years, or decades in some cases. In some places, differences in density and type of vegetation would be visible as a weak to strong contrast for many years or decades, resulting in long-term, small to large impacts to the visual setting. Cuts in virgin rock would initially show a weak to strong contrast between freshly exposed rock and previously weathered rock. Without mitigation, this contrast would result in long-term small to large impacts to the visual setting.

Construction supply trains consisting of eight to 20 cars would pass eight times per day, at most (loaded on the trip out, empty on the return), along rail line segments under active construction. Construction trains would likely be visible for between 5 and 20 minutes from a single vantage point, depending on

Table 4-33. Contrast ratings along the Caliente rail alignment and consistency with BLM objectives (page 1 of 8).

Key observation point	Location	Visual resource management classes in viewshed[a]	Contrast rating[b]	Consistent with visual resource management class rail line would cross?[c]	Impact level[d]	Notes
1	U.S. Highway 93 at Dry Lake Valley, views toward common segment 1	Surrounding lands (III and IV), Highland and Chief Ranges (II and III)	None	Yes	Small	Rail line would not be visible to viewers.
2	Staging Yard Caliente-Indian Cove option, view north	Surrounding lands (III)	Moderate	Yes	Moderate	
3	Conveyer crossing U.S. Highway 93 to feed Staging Yard Caliente-Indian Cove option, view north-northwest	Surrounding lands (II)	Construction: strong Operations: weak	No Yes	Construction: large Operations: small	DOE would dismantle the quarry conveyor system after construction was complete. Only the siding would be source of operations impact.
4	Conveyor crossing U.S. Highway 93 to feed Staging Yard Caliente-Upland option, view north-northeast	Surrounding lands (III)	Construction: strong Operations: weak	No Yes	Construction: large Operations: small	DOE would dismantle the quarry conveyor system after construction was complete. The siding would be the only source of operations impacts.
5	Staging Yard Caliente-Upland option, view north-northeast	Surrounding lands (III, II)	Weak to none	Yes	Small	Presence of other structures would minimize contrast.
6	Rail line crossing of U.S. Highway 93, view north-northeast to common segment 1	Surrounding lands (III)	Weak	Yes	Small	
7	U.S. Highway 93 north of rail line crossing, view west toward common segment 1	Surrounding lands (III), Big Hogback (II)	Weak	Yes	Small	Rail line would not be visible in view toward Big Hogback.

Table 4-33. Contrast ratings along the Caliente rail alignment and consistency with BLM objectives (page 2 of 8).

Key observation point	Location	Visual resource management classes in viewshed[a]	Contrast rating[b]	Consistent with visual resource management class rail line would cross?[c]	Impact level[d]	Notes
8	U.S. Highway 93 at State Route 319	Surrounding lands (III, II)	None to weak	Yes	Small	Class II lands of Cathedral Gorge would not be visible to the north; rail line could be faintly visible to the south.
9	Miller Point - Cathedral Gorge, view south toward common segment 1	Surrounding lands (III, II), Cathedral Gorge State Park (II)	Weak	Yes	Small	Rail line would barely be visible from the park.
10	State Route 318 crossing, view northwest toward common segment 1	Surrounding lands (III), Weepah Springs Wilderness (I)	Moderate	Yes	Moderate	
11	Off county road west of State Route 318 north of rail line crossing, view west toward common segment 1	Surrounding lands (III), Timber Mountain (II), Weepah Springs Wilderness (I)	Weak	Yes	Small	Distance from key observation point would reduce contrast.
12	Rail line crossing Timber Mountain Pass Road, view east-northeast	Surrounding lands (III), Timber Mountain (II), Weepah Springs Wilderness (I)	Moderate	Yes	Moderate	

Table 4-33. Contrast ratings along the Caliente rail alignment and consistency with BLM objectives (page 3 of 8).

Key observation point	Location	Visual resource management classes in viewshed[a]	Contrast rating[b]	Consistent with visual resource management class rail line would cross?[c]	Impact level[d]	Notes
13 and 15	County road on south side of Garden Valley, views toward Garden Valley alternative segments	Garden Valley (II), Golden Gate Range (III), Quinn Canyon Range (III), Quinn Canyon Wilderness (I), Grant Range Wilderness (I), Worthington Mountains (II), Worthington Mountains Wilderness (I)	Construction of Garden Valley 1 or Garden Valley 3: weak to none	Yes	Small	Contrast would be reduced with increased distance from viewer and would not detract from views of surrounding mountains.
			Construction of Garden Valley 2 or Garden Valley 8: strong to none	No	Large to small	Contrast would be reduced with increased distance from viewer and would not detract from views of surrounding mountains.
			Operation of Garden Valley 1 or Garden Valley 3: weak to none	Yes	Small	
			Operation of Garden Valley 2 or Garden Valley 8: weak to none	Yes	Small	Contrast would be reduced with increased distance from viewer; an earthwork berm with soil and vegetation consistent with surrounding landscape would reduce contrast of nearby track to weak.

Table 4-33. Contrast ratings along the Caliente rail alignment and consistency with BLM objectives (page 4 of 8).

Key observation point	Location	Visual resource management classes in viewshed[a]	Contrast rating[b]	Consistent with visual resource management class rail line would cross?[c]	Impact level[d]	Notes
14	County road in middle of Garden Valley, view south to Garden Valley alternative segments 1, 2, and 8	Garden Valley (II), Golden Gate Range (III), Quinn Canyon Range (III), Quinn Canyon Wilderness (I), Grant Range Wilderness (I), Worthington Mountains (II), Worthington Mountains Wilderness (I)	Construction of Garden Valley 1: strong to none	No	Large to small	Would demand attention where close to viewer and would be less noticeable with increasing distance from viewer.
			Construction of Garden Valley 3: moderate to none	No	Moderate to small	Contrast would be reduced with increased distance from viewer.
			Construction of Garden Valley 2 or Garden Valley 8: weak to none	Yes	Small	
			Operation of Garden Valley 1: weak to none	Yes	Small	Contrast would be reduced with increased distance from viewer; an earthwork berm with soil and vegetation consistent with surrounding landscape would reduce contrast of nearby track to weak.
			Operation of Garden Valley 2 3, or 8: weak to none	Yes	Small	

Table 4-33. Contrast ratings along the Caliente rail alignment and consistency with BLM objectives (page 5 of 8).

Key observation point	Location	Visual resource management classes in viewshed[a]	Contrast rating[b]	Consistent with visual resource management class rail line would cross?[c]	Impact level[d]	Notes
16 to 18	Top of *City* structure element, views toward Garden Valley alternative segments	Garden Valley (II), Golden Gate Range (III), Quinn Canyon Range (III), Quinn Canyon Wilderness (I), Grant Range Wilderness (I), Worthington Mountains (II), Worthington Mountains Wilderness (I)	Construction of Garden Valley 1: moderate to weak	No	Moderate to small	Contrast would be reduced with increased distance from viewer.
			Construction of Garden Valley 2 or Garden Valley 8: strong to none	No	Large to small	Contrast would be reduced with increased distance from viewer.
			Construction of Garden Valley 3: weak to none	Yes	Small	Contrast would be reduced with increased distance from viewer.
			Operation of Garden Valley 1, Garden Valley 2, or Garden Valley 8: weak to none	Yes	Small	Track and train would cause weak contrast; contrast would be reduced with increased distance from viewer.
			Operation of Garden Valley 3: none	Yes	Small	
19	State Route 375 near rail line crossing, view south-southwest toward common segment 2 and construction camp	Surrounding lands (IV)	Weak	Yes	Small	Construction camp and grade-separated crossing would be visible but would not draw attention.

Table 4-33. Contrast ratings along the Caliente rail alignment and consistency with BLM objectives (page 6 of 8).

Key observation point	Location	Visual resource management classes in viewshed[a]	Contrast rating[b]	Consistent with visual resource management class rail line would cross?[c]	Impact level[d]	Notes
20	Cedar Pipeline Ranch, view northeast toward common segment 2	Surrounding lands (IV), Kawich Range (II), Quinn Canyon Range (III), South Reveille Wilderness Study Area (I)	Moderate to weak	Yes	Moderate to small	
21 and 22	Near intersection of U.S. Highway 6 and State Route 375, views toward common segment 3	Surrounding lands (IV), Kawich Range (II), Kawich and Rawhide Wilderness Study Areas (I)	Weak	Yes	Small	Rail line would cross Class IV; contrast against Class II; distance would reduce contrast against Class II background or topography would impede view of rail line.
23	U.S. Highway 6 on east side of Warm Springs Summit, view south-southwest toward common segment 3	Surrounding lands (IV), Kawich Range (II), and Rawhide Wilderness Study Area (I)	Weak	Yes	Small	Rail line would cross Class IV; hilly topography would reduce contrast against Class II background.
24	Warm Springs Summit, view east-southeast toward common segment 3	Surrounding lands (IV), Kawich Range (II), and Rawhide Wilderness Study Area (I)	None	Yes	Small	Rail line would be in a cut, not visible from highway; no contrast with Class II background.
25	U.S. Highway 6 at a mine access road, view southeast toward common segment 3	Surrounding lands (IV), Kawich Range (II), Kawich and Rawhide Wilderness Study Areas (I)	None	Yes	Small	Rail line would be in a cut, not visible from highway; no contrast with Class II background.

Table 4-33. Contrast ratings along the Caliente rail alignment and consistency with BLM objectives (page 7 of 8).

Key observation point	Location	Visual resource management classes in viewshed[a]	Contrast rating[b]	Consistent with visual resource management class rail line would cross?[c]	Impact level[d]	Notes
26	Nevada Test and Training Range Road near rail line crossing, view east-northeast toward common segment 3	Surrounding lands (IV), Kawich Wilderness Study Area (I)	Weak	Yes	Small	
27	Nevada Test and Training Range Road, view east-northeast toward common segment 3	Surrounding lands (IV), Kawich Wilderness Study Area (I)	Weak	Yes	Small	Distance would eliminate contrast with Class I background.
28	U.S. Highway 6 at Nevada Test and Training Range Road, view southwest toward common segment 3	Surrounding lands (IV), Monitor Range (III)	Weak	Yes	Small	
29	U.S. Highway 95 north of Goldfield, view east-northeast toward quarry	Surrounding lands (IV)	Weak	Yes	Small	Distance of quarry facilities would minimize contrast.
30	U.S. Highway 95 at north end of Goldfield, view south-southeast toward Goldfield 4	Surrounding lands (IV)	Weak	Yes	Small	Topography and distance would minimize contrast.
31	Rail line crossing U.S. Highway 95 south of Goldfield, view south-southeast toward Goldfield 4	Surrounding lands (IV)	Weak	Yes	Small	
32	U.S. Highway 95 at State Route 266, view east to common segment 4	Surrounding lands (IV), State Route 266 (III), Stonewall Mountain (II)	Weak	Yes	Small	Rail line would be distant from Class II feature, which would be in background; Class III lands would not be visible in views from highway over the track.

Table 4-33. Contrast ratings along the Caliente rail alignment and consistency with BLM objectives (page 8 of 8).

Key observation point	Location	Visual resource management classes in viewshed[a]	Contrast rating[b]	Consistent with visual resource management class rail line would cross?[c]	Impact level[d]	Notes
33	U.S. Highway 95 at State Route 267, view north-northeast over common segment 5	Surrounding lands (IV), State Route 267 (III)	Weak	Yes	Small	
34	U.S. Highway 95 (typical cut), view toward common segment 5 hill cuts	Surrounding lands (IV)	Strong to moderate	Yes	Large to moderate	
35	U.S. Highway 95 north of Oasis Valley (typical landscape)	Surrounding lands (IV)	Weak	Yes	Small	Rail line would be visible but would not attract attention away from topography in background.
36	U.S. Highway 95 and Beatty Wash access road, view northeast to construction access road	Surrounding lands (IV)	None to weak	Yes	Small	Rail line would not be visible from key observation point; increased traffic along access road would be visible but would not attract attention.
37	U.S. Highway 95 at proposed Maintenance-of-Way Headquarters Facility for Goldfield 1 and 3, view northeast to facility	Surrounding lands (IV)	Weak	Yes	Small	
38	U.S. Highway 95 at proposed Maintenance-of-Way combined Headquarters and Trackside Facility for Goldfield 4, view northwest to facility	Surrounding lands (IV)	Weak	Yes	Small	

a. Sources: DIRS 155970-DOE 2002, pp. 3-158 and 3-159; DIRS 173224-BLM 1997, pp. 6, 7, and 27, and Map 8; DIRS 103079-BLM 1998, Map 2-9; DIRS 101811-DOE 1996, pp. 4-152 to 4-154; DIRS 184767-BLM 2007, Map 2.4.11-1.
b. Contrast rating definitions from DIRS 173053-BLM 1986, Section III.D.2.a; see Table 4.4-1.
c. BLM methodology recognizes that "few projects meet the VRM [visual resource management] management objectives during construction" (DIRS 173053-BLM 1986, Section III.D.2.b.7).
d. Impact level definitions from Section 4.1.

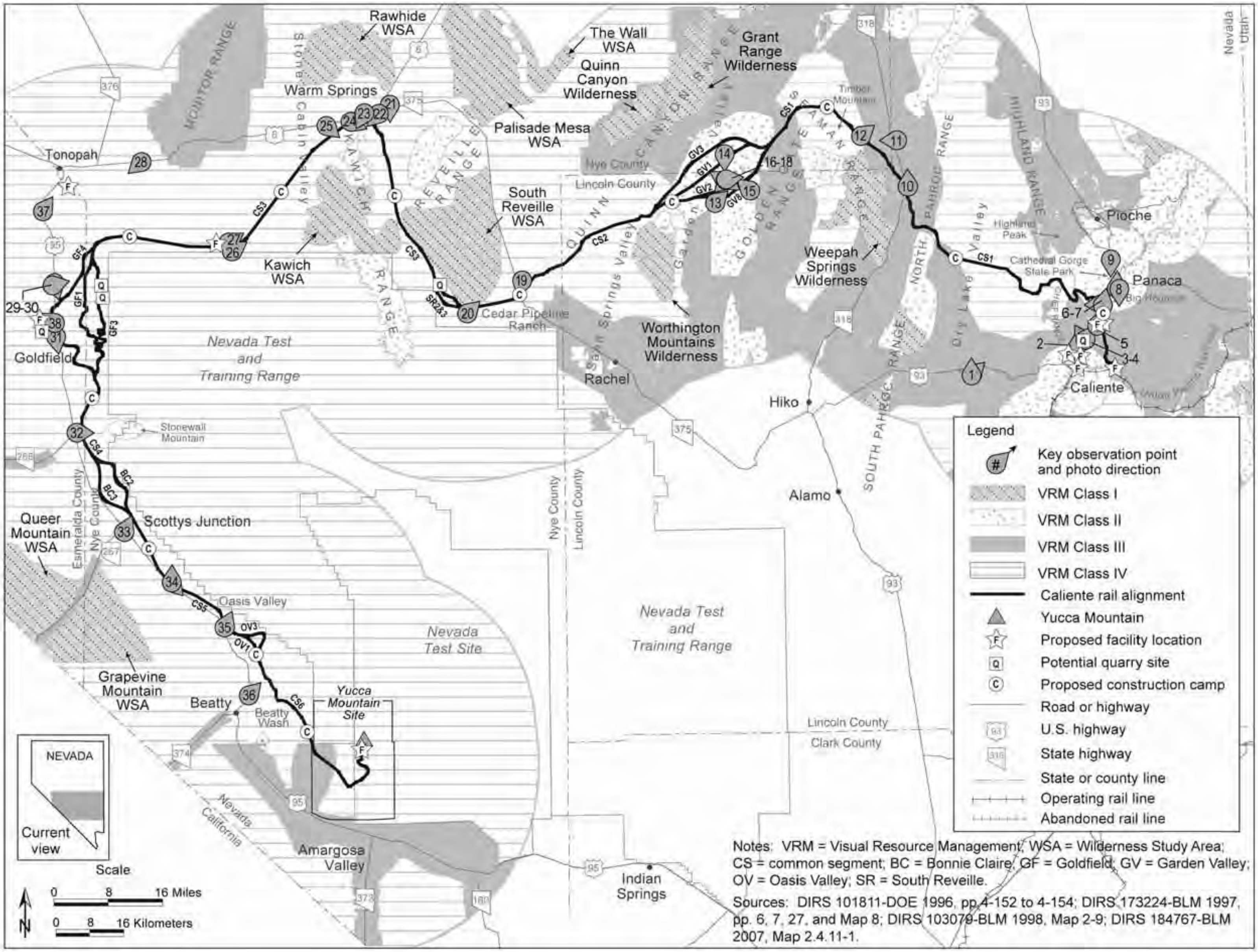


Figure 4-1. Visual resource management classifications and key observation points along the Caliente rail alignment.

train speed and terrain. In addition, small pieces of equipment such as track tampers, ballast regulators, tie handlers, rail-clip applicators, and ballast consolidators would pass two to eight times per day (DIRS 180874 -Nevada Rail Partners 2007, Appendix A). The level of impact to visual resources would be small.

Activities associated with five of the potential quarry sites would be visible from highways or county roads. One, quarry NS-3A (see Figure 2-9) northeast of Goldfield, would be in Class IV lands more than 8 kilometers (5 miles) from U.S. Highway 95. Because of their distance from the viewer, the quarry and ballast production facilities would cause weak or no contrast from the nearest key observation point (29); see Figure D-68 in Appendix D. A potential quarry site north of Caliente, CA-8B (see Figure 2-24), would not be visible to passersby on U.S. Highway 93. For viewers traveling west on Beaver Dam Road toward U.S. Highway 93, parts of the quarry would be visible and would begin to attract attention in the road segment between 2.4 and 1.2 kilometers (1.5 and 0.75 miles) before the road intersects the highway, resulting in a weak to moderate contrast compatible with the management objectives for the Class III lands in which the quarry would be located. Quarry CA-8B would also be visible from Beaver Dam Road at distances greater than 4 kilometers (2.5 miles) from the road-highway intersection, but viewers would only notice a weak contrast at this distance. A conveyor to carry material from the quarry to the Staging Yard, either at Caliente-Indian Cove or Caliente-Upland, would be visible and cause strong contrast from U.S. Highway 93 at key observation point 3 or 4 (see Figure 4-2, and Figures D-7 through D-9 in Appendix D) while it was under construction and during quarry operation. A strong contrast is incompatible with the Class II and Class III lands surrounding these conveyor locations. DOE would remove the conveyor once quarry operations ended. Activities associated with potential quarry sites NN-9A or NN-9B between the Reveille and Kawich Ranges would cause moderate to strong contrast to viewers on a lightly traveled county road. This level of contrast is compatible with objectives for the Class IV lands in which the quarries would be located. The quarry siding and conveyor belt for potential quarry site ES-7 west of Goldfield would be visible from both U.S. Highway 95, where they would represent a weak contrast that would not attract attention, and from primitive roads north of Goldfield Cemetery, where they would cause a moderate to strong contrast that would attract the viewer’s attention. The level of contrast created by the ES-7 siding and conveyor would be compatible with objectives for the surrounding Class IV areas. Potential quarry sites ES-7 west of Goldfield and NS-3B east of Goldfield would not be visible from highways or county roads.

In situations where water wells could not be constructed within the nominal width of the construction right-of-way (see Figure 2-3), they would lie within a 23-square-meter (250-square-foot) drilling area, connected to the construction right-of-way by small pipelines feeding temporary 9.3-square-meter (100-square-foot) reservoirs. These would cause localized short-term weak-to-moderate contrast, compatible with BLM management objectives in surrounding lands, except for Class II lands in Garden Valley.

Up to 12 temporary construction camps would be situated along the rail alignment at intervals of approximately 50 kilometers (30 miles) (see Figure 2-22). The camps, which would each average 0.1 square kilometer (25 acres) in size, would have a long and narrow layout of approximately 730 meters by 120 meters (2,400 feet by 400 feet) and would be within the nominal width of the rail line construction right-of-way as close as possible to intersections of existing public roads and the rail alignment access roads. Each camp would consist of single-story housing, offices, support facilities (commissary, kitchen, cafeteria, recreation facilities, service station, fueling area, and medical facilities), utilities (power lines, water- and ***wastewater-treatment*** facilities, and trash storage), a contractor work area (sections for maintenance and parts and materials storage), and parking (DIRS 180922-Nevada Rail Partners 2007, Chapter 4). The most visible structures at each construction camp would be the housing facilities. The camps would contrast weakly against the landscape as observed by passing motorists, resulting in short-term small impacts to the visual setting. See Figure 4-3 for a simulation showing a construction camp.

Figure 4-2. Simulation of rock conveyor and construction trains on the Caliente alternative segment (closest to viewer) and quarry siding in view north-northeast from key observation point 4 on U.S. Highway 93.

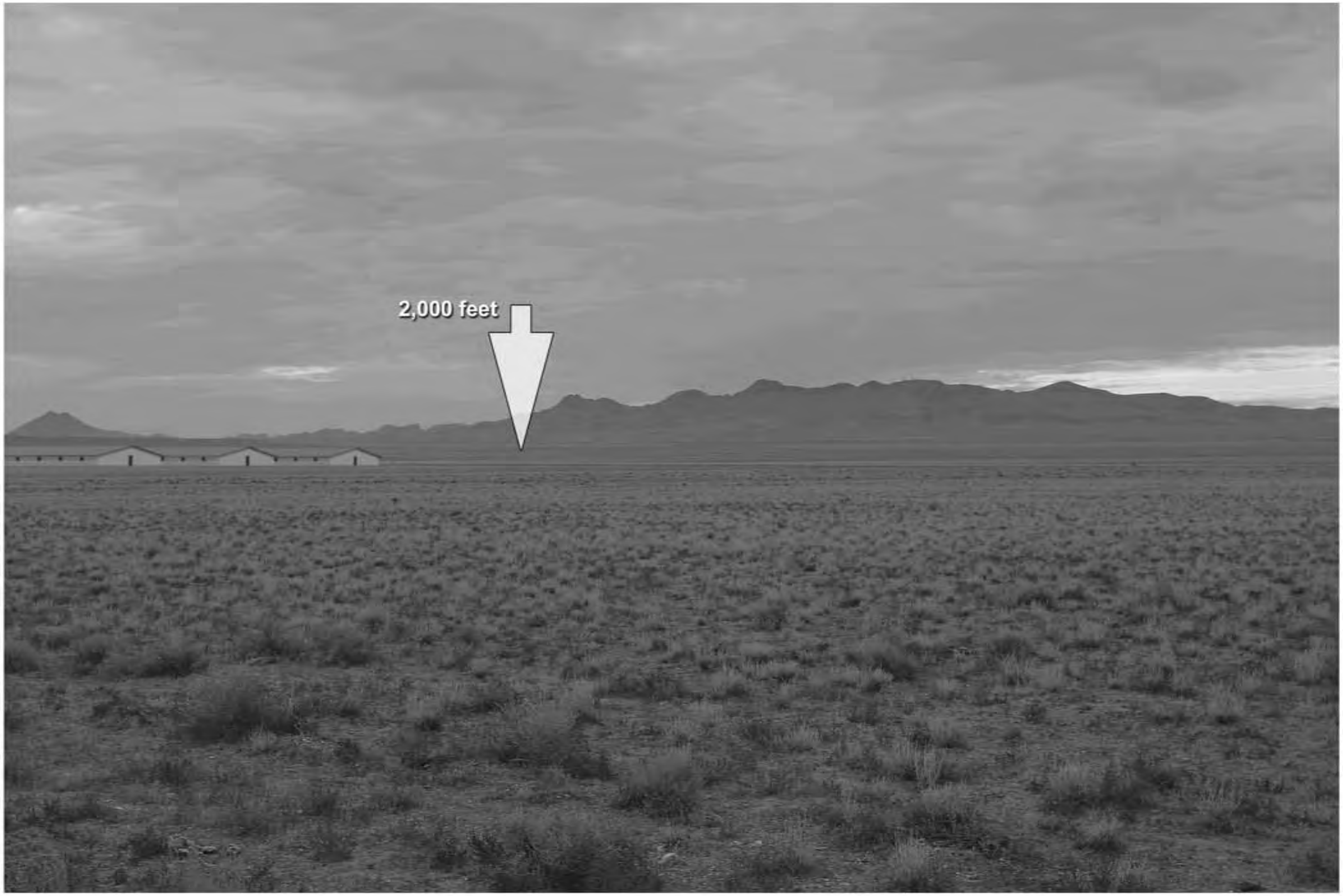


Figure 4-3. Simulation of track and construction camp in view south-southwest from key observation point 19 on State Route 375.

Electricity distribution lines would be buried within the operations right-of-way over the length of the rail line. Where the lines connected to the commercial power grid, an electrical substation and a line of power poles extending from the substation to the rail line would be visible. These would cause weak contrast against the existing transmission lines of the commercial power grid, with corresponding small impacts to the visual setting. Temporary poles would also be visible carrying power to facilities within construction camps, contributing to short-term small impacts to the visual setting around the camps.

Construction duration at most individual locations along the rail line would be a period of weeks or a few months under a 4-year construction schedule. Under a 10-year schedule, there would be multiple phases of work (of weeks or a few months) separated by years of inactivity. Active construction would be longer at locations of major structures, such as bridges and railroad operations support facilities, but nowhere would construction be expected to exceed 18 continuous months except at the bridge over Beatty Wash, which DOE expects would take 2 years to construct. DOE would withdraw construction camps from service and keep them in reserve during periods of construction inactivity, and would close camps and reclaim the land as sections of the rail line were completed.

Thus, a longer construction schedule would not increase the level of visual impact because inactivity would minimize the visual contrast at individual locations where construction was halted, although the impact of disturbed soil and vegetation would be prolonged. Under either construction schedule, DOE would consider requests by local governments to leave individual construction camp sites (the cleared and hardened site the camp occupied) in place after permanent closure of the facility for possible use by these governments or their designees. The visual impacts from these sites would likely be small because the Department would remove equipment and structures prior to transfer, and rail line-related construction activities would cease.

Considering the effects of distance and duration, construction activities or facilities would either not be visible or would be noticeable during the construction phase but would not dominate the attention of a viewer. That is, they would create no contrast or a weak degree of contrast at key observation points, with the exception of those discussed in Section 4.2.3.2.2. A weak degree of contrast, even where Class I and II lands are present in the viewshed, is compatible with BLM management objectives for all classes of land. Thus, there would be small, temporary project-related impacts to the visual setting during construction of any of the Caliente rail alignment alternative segments and common segments, except as described in Section 4.2.3.2.2. As noted in Section 4.2.3.1.2, BLM methodology recognizes that "few projects meet the VRM [visual resource management] management objectives during construction" (DIRS 173053-BLM 1986, Section III.D.2.b.7).

4.2.3.2.2 Construction Impacts along Alternative Segments and Common Segments

The aesthetic resources impact analysis identified moderate or strong contrast ratings associated with construction along six portions of the Caliente rail alignment, as described in Sections 4.2.3.2.2.1 through 4.2.3.2.2.6.

4.2.3.2.2.1 Facilities at the Interchange with the Union Pacific Railroad Mainline. The Staging Yard, Caliente-Indian Cove option, would be within non-BLM-administered lands that would be considered as Class III with application of the BLM methodology (DIRS 176988-Quick 2006, all). Because it would lie so close to U.S. Highway 93, construction of the Staging Yard in these Class III lands would likely draw the attention of passing motorists, resulting in a moderate contrast rating from key observation point 2 (see Figures D-4 through D-6 in Appendix D). Construction and use of a rock conveyor across the highway to bring ballast from potential quarry site CA-8B to the north end of the Staging Yard would cause strong contrast from adjacent key observation point 3 against the Class II BLM-administered lands north of the Staging Yard (see Figure D-7 in Appendix D). If DOE selected the Caliente-Upland option for the Staging Yard, the conveyor would cross the highway farther north, near key observation point 4; construction and use of a conveyor there would cause a strong contrast, but against Class III lands (see Figure 4-2, and Figures D-8 and D-9 in Appendix D). These contrast ratings of moderate and strong mean that construction activity would not meet BLM management objectives for the Class II lands in the Indian Cove area, nor the Class III lands in the Upland area. Viewers on one segment of Beaver Dam Road would see a moderate contrast of the quarry site CA-8B against the surrounding Class III lands; a moderate contrast is consistent with Class III management objectives.

4.2.3.2.2.2 Common Segment 1. Caliente common segment 1 would pass through the Chief and Highland Ranges, where portions of the landscape are Class II. Construction activities would attract the attention of viewers, if any, and result in a moderate contrast rating if a key observation point existed within the area. However, because the Caliente common segment 1 crossing of the Class II lands in this area would not be visible from public roads there would be no contrast from key observation points (see Appendix D, Figures D-2 and D-15 through D-17, which show views from key observation points 1 and 7), and construction would be consistent with BLM management objectives for this Class II area. Where Caliente common segment 1 would cross State Route 318, a grade-separated crossing, and Timber Mountain Pass Road, an at-grade crossing, the viewer would notice a moderate degree of contrast during construction (see Appendix D, Figures D-21, D-22, and D-26 through D-28, which shows views of these crossings from key observation points 10 and 12). This level of contrast would be compatible with the Class III management objectives for these areas.

4.2.3.2.2.3 Garden Valley Alternative Segments. The rail line would cross the Class II lands of Garden Valley. To evaluate impacts, DOE established contrast ratings from key observation points (13 and 15) on a county road in the south of Garden Valley, from a key observation point (14) on a county road in the middle of Garden Valley, and from key observation points (16 to 18) on top of one of the structures comprising *City*, a sculpture. Appendix D, Figures D-29 through D-50, provide views across the Garden Valley alternative segments from these key observation points. In rating contrast, DOE assumed that construction activities would be confined to laying track along one of the alternative segments, with one construction camp near the west end of the valley and with laydown yards situated within the construction right-of-way. One general finding from all key observation points was that the contrast expected from construction activities would decrease with distance from the viewer.

Views from key observation points 13 and 15, on a county road in the south of Garden Valley, would show strong to moderate contrast of construction activities along Garden Valley alternative segment 2 and Garden Valley alternative segment 8 within approximately 10 kilometers (6 miles), especially where Garden Valley alternative segment 8 would run parallel and immediately adjacent to one of the county roads. Construction would show moderate contrast against foothills to the east and west when viewed from these county roads, diminishing to weak or none when construction activities reached approximately more than 20 kilometers (12 miles) to the west. Views to the north and northwest would show weak contrast along Garden Valley alternative segment 1, diminishing to none with distance; and weak contrast, if any, with activities along Garden Valley alternative segment 3.

From key observation point 14, on a county road in the middle of Garden Valley, the view across the immediately adjacent portion of Garden Valley alternative segment 1 would show strong contrast during construction, but construction along more distant portions would show less contrast. From key observation point 14, activities along Garden Valley alternative segment 2, Garden Valley alternative segment 3, and Garden Valley alternative segment 8 would cause weak contrast, except where Garden Valley alternative segment 3 would be within approximately 10 kilometers (6 miles), where the construction activities would contrast moderately with the surroundings.

These findings indicate that construction along any of the Garden Valley alternative segments, when viewed from county roads near the construction activities, would not meet the BLM Class II objectives for the area over a period of a few months under the 4-year construction schedule, or for several periods of a few months under a longer construction schedule, because the BLM objectives provide only for management activities that "may be seen but should not attract the attention of the casual observer."

Views toward Garden Valley alternative segment 1 from key observation points 16 to 18 on top of a structure within *City* would show moderate to weak contrast between construction activities and the landscape. Activities would be visible from the tops of *City* structures, though not visible from portions of the sculpture that are below grade. Project construction would be more visible along the flat lands of Garden Valley, especially along portions of Garden Valley alternative segment 1 within a few kilometers of the key observation point. Construction would be less visible against the foothills to the east and west, both because of distance and because of a more complex visual background. The distance of the construction from the observer would help to minimize visual impacts. The construction camp at the west end of the valley would not be discernible. The resulting contrast rating of moderate to weak would not meet BLM Class II management objectives over a period of a few months under the 4-year construction schedule, or for several periods of a few months under a longer construction schedule.

Views toward Garden Valley alternative segment 2 and Garden Valley alternative segment 8 from the key observation points on top of a structure within *City* would show strong to moderate contrast of construction activities against the landscape, diminishing to weak or none with distance. Construction activities along Garden Valley alternative segment 2 and Garden Valley alternative segment 8 would be visible from the tops of *City* structures though not visible from portions of the sculpture that are below grade. Construction activities would be highly visible along the nearby flat lands of Garden Valley and less visible in the more distant and more variegated foothills to the east and west. Because Garden Valley alternative segment 8 is farther away from the *City* key observation points than Garden Valley alternative segment 2 for most of its length, construction activities would be less noticeable on Garden Valley 8 than on Garden Valley 2. The resulting contrast rating of strong to none for Garden Valley alternative segment 2 and Garden Valley alternative segment 8 would not meet BLM Class II management objectives during construction of parts of Garden Valley alternative segment 2 or Garden Valley alternative segment 8 in the flat lands over a period of a few months under the 4-year construction schedule or several periods of a few months under a longer construction schedule.

Construction of Garden Valley alternative segment 3 would barely be visible from key observation points within *City* and at most would create a weak level of contrast. The contrast rating of weak to none would meet BLM management objectives for Class II.

4.2.3.2.2.4 Caliente Common Segment 2. Caliente common segment 2 would remain exclusively in Class IV lands along its entire length as it travels from north of the Worthington Mountains to the southern end of the Reveille Range. Construction activities would be visible and attract the attention of viewers in the Cedar Pipeline Ranch area, and would result in a weak to moderate degree of contrast (see Figures D-53 and D-54 in Appendix D). This contrast rating would be compatible with BLM management objectives for Class IV lands.

4.2.3.2.2.5 South Reveille Alternative Segments. Activities associated with potential quarry sites NN-9A or NN-9B would cause moderate to strong contrast visible to viewers on the lightly traveled county road that passes within a few hundred meters of the potential quarry sites. The sites and surrounding area between them and the county road all fall on Class IV lands. The contrast rating of moderate to strong would meet BLM Class IV management objectives.

4.2.3.2.2.6 Goldfield Alternative Segments. The siding and conveyor associated with potential quarry site ES-7 would cause a moderate to strong contrast from lightly traveled primitive roads north of Goldfield Cemetery. Such a contrast is compatible with BLM management objectives for the Class IV lands in this area.

4.2.3.3 Operations Impacts

4.2.3.3.1 Operations Impacts Common to the Entire Caliente Rail Alignment

Sources of potential impacts to the visual setting during the operations phase would be the presence of the rail line and the operations support facilities in the landscape, and the passage of trains to and from the repository. There would be less impact to the visual setting during the operations phase than during the construction phase, because there would be less activity (fewer, shorter trains and equipment, and fewer people), the operations right-of-way (nominally 61 meters [200 feet] on either side of the centerline of the rail line) would be narrower in some areas, and disturbed areas outside the operations right-of-way would be reclaimed (see Chapter 7 for a discussion of best management practices).

The primary visual impact of railroad operations would be the existence of the linear track for up to 540 kilometers (340 miles), with ***wayside signals*** and communications towers visible from short distances. In addition to the impact of the track itself, the passage of a train would attract the attention of a casual observer, both because of the sound associated with the train and its appearance on the track, but this would be an infrequent, short-duration visual distraction. DOE anticipates an approximate peak frequency of 17 one-way trips per week (DIRS 180874-Nevada Rail Partners 2007, Appendix C). This would average fewer than three one-way trips per day. Trains would be up to 19 cars long, and would likely be visible for between 5 and 20 minutes from a single vantage point, depending on train speed and terrain. Passage of these trains would create a small impact to the visual setting.

DOE would install 4.6-meter (15-foot)-tall wayside signals to control train movements along the rail alignment at intervals sufficient to connect each by line-of-sight. DOE would place 23-to-30-meter (75- to-100 foot)-tall radio communications towers at the beginning and the end of the line and at intervals along the rail line as needed to ensure signal transmission (DIRS 182826-Nevada Rail Partners 2007, Chapter 6). See Figures 4-4 and 4-5 for simulations showing signals and communications towers. The wayside signals, radio communication towers, and distribution lines all would create small impacts to the visual setting unless placed in visually sensitive areas close to observers, where impacts could be moderate or large. DOE established contrast ratings at key observation points considering the view of the rail line or operations support facilities and the nature and extent of operations activities that would be visible. The Department compared ratings with BLM visual resource management objectives for the lands in the viewshed. Contrast ratings at all key observation points confirmed that the presence of the rail line itself, while noticeable in some cases, would not dominate a viewer’s attention and would result in a weak level of contrast (see Figure 4-6), except in some cases where the rail line would be within approximately 1.6 kilometers (1 mile) of the viewer and the linear track would cause a moderate contrast (see Section 4.2.3.3.2). A weak level of contrast is compatible with BLM management objectives for all classes of land; a moderate level of contrast is compatible with BLM management objectives for Class III and IV lands, but not for Class II lands. Ratings from key observation points with views of operations support facilities found contrasts would range from moderate to none, compatible with the Class III and IV lands that would surround the locations of the facilities. These include the grade-separated crossings of U.S. Highways 93 and 95 and State Routes 318 and 375 (see Figures 4-7 and 4-8, and Figures D-13, D-14, and D-22 in Appendix D). As transportation structures familiar to motorists, these would not draw attention away from the surrounding landscape.

Contrast ratings confirmed that the level of contrast between a passing train and the landscape would be strong (demanding a viewer’s attention) or moderate (beginning to attract attention) where the rail line would fall in the foreground or middleground of the viewshed. Contrast between the landscape and a passing train would be less where the rail line would be in the background. In such cases, the level of contrast would be moderate or weak, where the passing of a train could be noticeable but would not demand attention (see Figure 4-6). The extremely short duration of the passage would diminish the effect, so that BLM management objectives would be met for Class II, III, and IV lands, even if the rail

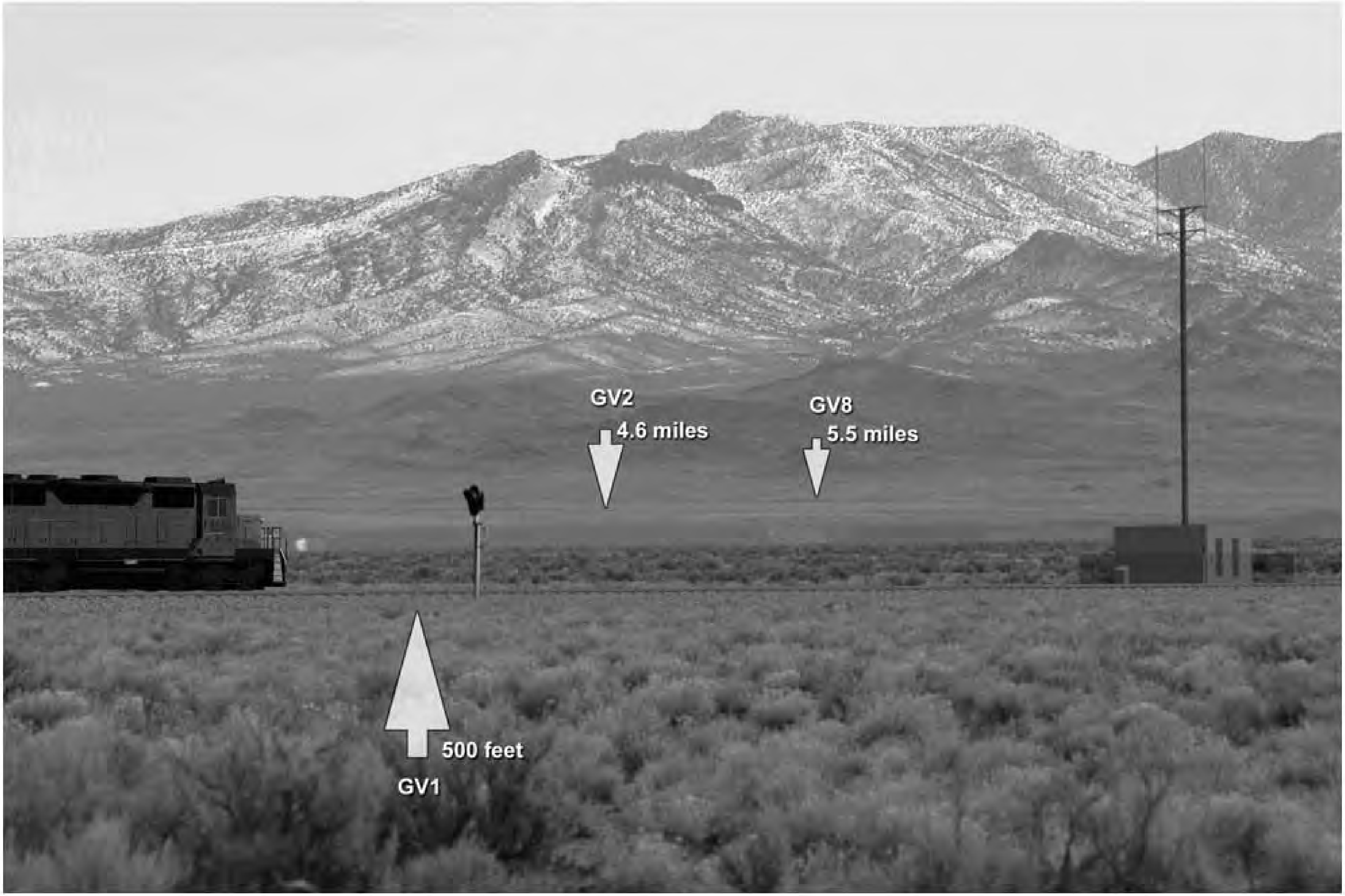


Figure 4-4. Simulation of view south from key observation point 14 on a county road in the middle of Garden Valley, showing track on three alternative segments, and a train and signal and communications tower along Garden Valley 1.

Figure 4-5. Simulation of train, track, and communications tower in view south-southwest from key observation point 23 on U.S. Highway 6 east of Warm Springs Summit (power poles in photo are not related to proposed project).

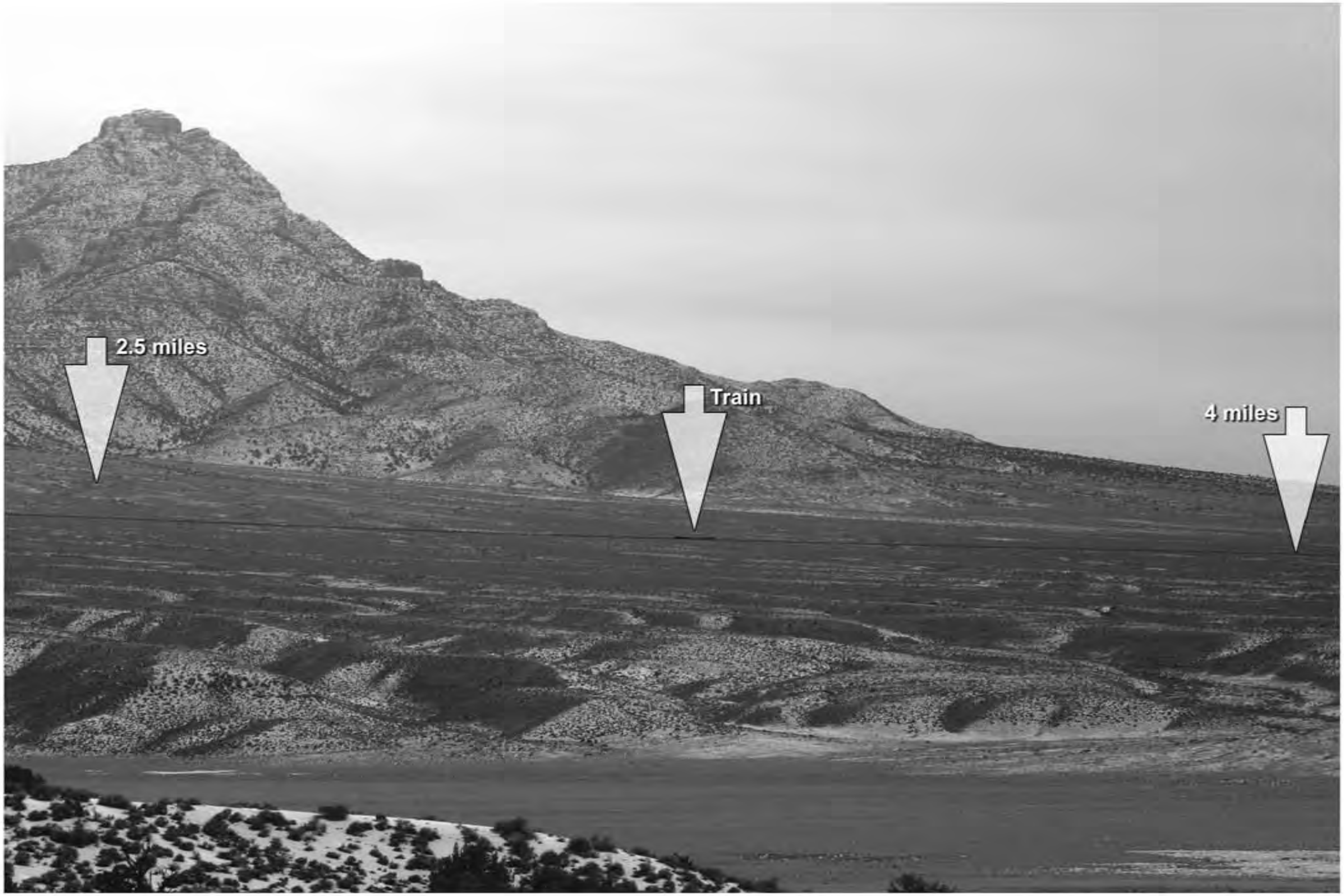


Figure 4-6. Simulation of train and track in view west from key observation point 11 off county road west of State Route 318.

Figure 4-7. Simulation of U.S. Highway 93 crossing over rail line in view north-northeast from key observation point 6 (power poles in photo are not related to proposed project).

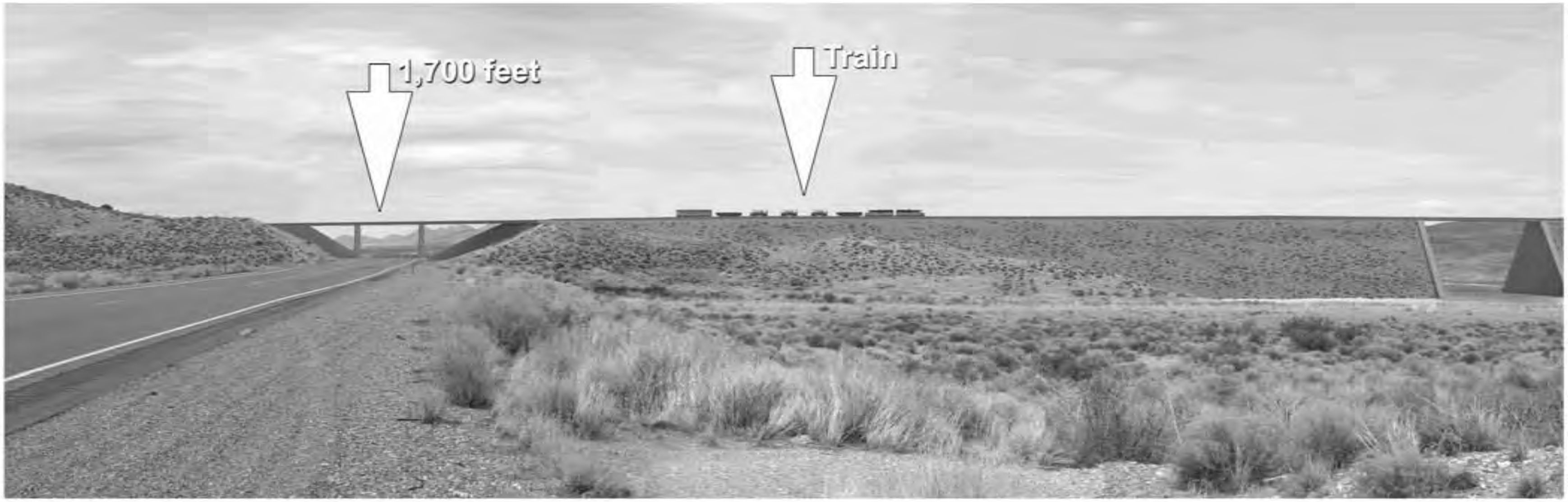


Figure 4-8. Simulation of crossing structure and train on rail line in view northwest to northeast from key observation point 10 on State Route 318.

line were to fall in the foreground or middleground of the viewshed, as long as it would not create a linear feature across the landscape that would attract attention or would begin to dominate the landscape.

4.2.3.3.2 Operations Impacts along Alternative Segments and Common Segments

The analysis of impacts to aesthetic resources identified moderate contrast ratings associated with railroad operations along two portions of the Caliente rail alignment, as discussed in Sections 4.2.3.3.2.1 and 4.2.3.3.2.2.

4.2.3.3.2.1 Facilities at the Interface with the Union Pacific Railroad Mainline. Operation of the Staging Yard, Caliente-Indian Cove option, would likely draw the attention of passing motorists on U.S. Highway 93, resulting in a moderate contrast rating from key observation point 2. This moderate adverse impact would be consistent with BLM Class III management objectives, applicable to the non-BLM-administered lands here that would be considered Class III with application of the BLM methodology (DIRS 176988-Quick 2006, all). Presence of the track north of the Staging Yard would create only a weak contrast because it would follow the line of a former rail roadbed that is currently visible as a linear berm near the highway. This weak contrast would be consistent with BLM Class II management objectives applicable to these lands.

4.2.3.3.2.2 Common Segment 1. Where Caliente common segment 1 would cross State Route 318, a grade-separated crossing, and Timber Mountain Pass Road, an at-grade crossing, the viewer would notice a moderate degree of contrast during operations due to the proximity of the rail line to the viewer and the design of the crossings (see Appendix D, Figures D-21, D-22, and D-26 through D-28, which show views of these crossings from key observation points 10 and 12). This level of contrast would be compatible with the Class III management objectives for these areas.

4.2.3.3.2.3 Garden Valley Alternative Segments. Views toward all four Garden Valley alternative segments from the key observation points on county roads show weak contrast of the rail line against the landscape, depending on the distance and intervening topography and vegetation. The communications tower would be much less noticeable at a distance of approximately 0.8 kilometer (0.5 mile) in Figure 4-9 than at approximately 150 meters (500 feet) in Figure 4-4. At short distances, passage of a train would increase the contrast to strong for the short duration of the passage, but not enough to raise the overall contrast rating.

Based on views from the key observation points and the simulations for Figures D-29 through D-37 in Appendix D of track, train, and communications signals in the views, it can be concluded that where the track would be more than approximately 1.6 kilometers (1 mile) from a viewer on a county road in Garden Valley, it would not create a new linear feature that would begin to attract attention or begin to dominate the landscape; that is, it would not create a moderate level of contrast.

While observations would be necessary along the entire length of each county road to determine the precise places where an alternative segment within 1.6 kilometers or less would cause a moderate contrast, Table 4-34 provides a conservative approximation. The table lists the total length of each alternative segment that would fall within 1.6 kilometers of a county road in Garden Valley. Portions of three of the alternative segments would lie immediately adjacent and parallel to a county road; along these portions, the rail line would not create a new linear feature because the road itself is a linear feature; therefore, this distance is excluded from the total distance where the alternative segment could create a moderate contrast. Table 4-34 indicates that Garden Valley alternative segment 8 and Garden Valley alternative segment 1 would cause moderate contrast in views from county roads to a lesser degree than Garden Valley alternative segment 2 or Garden Valley alternative segment 3. In locations in Garden Valley where the track would otherwise cause a moderate contrast in Class II lands, DOE would construct low, rolling earthwork berms with soils and vegetation that match the surroundings to mask the linear

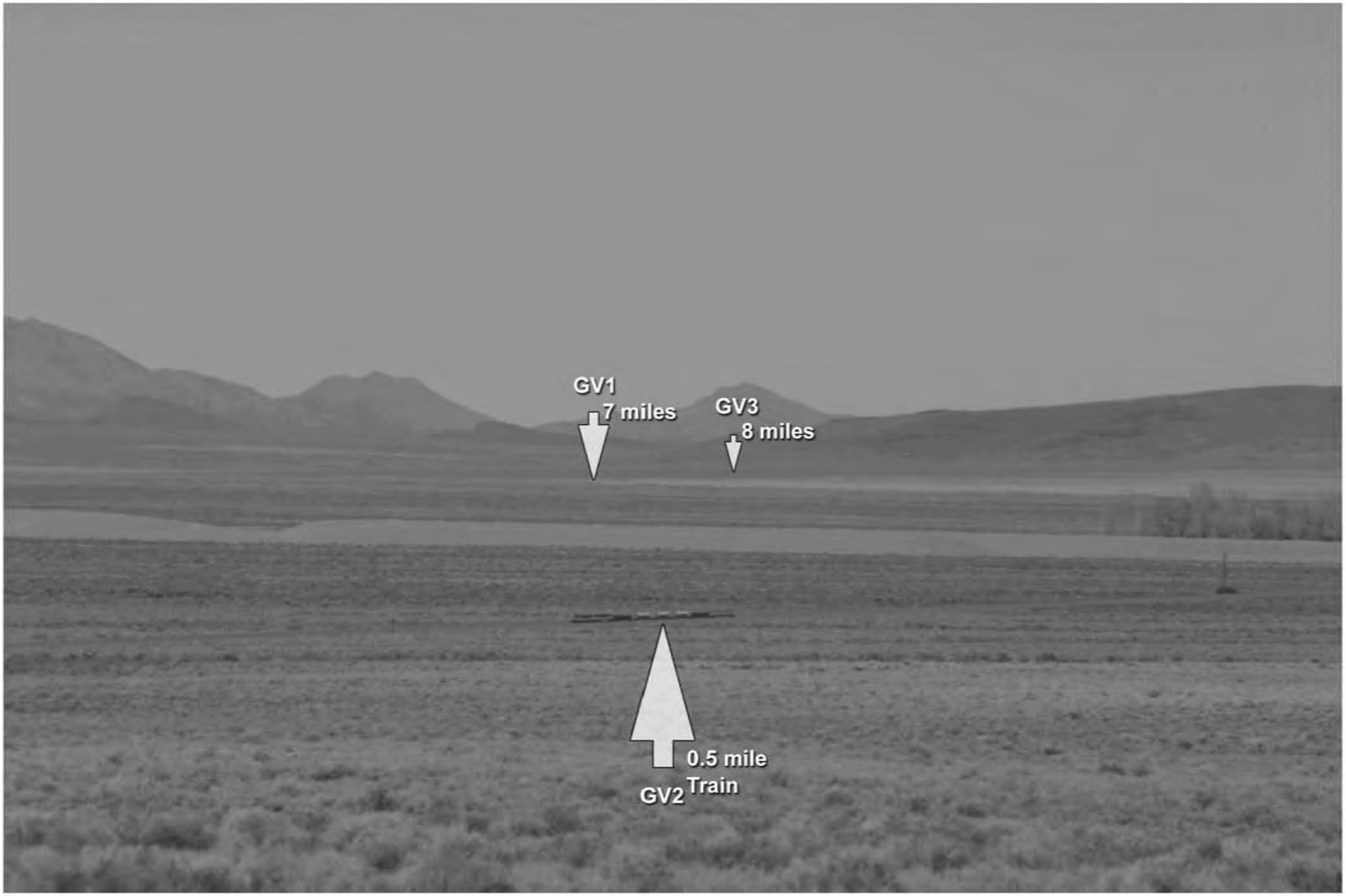


Figure 4-9. Simulation of track in view northeast from key observation point 13 on a county road south of Garden Valley. (Not in picture is an earthwork berm that would mask the linear feature of Garden Valley 2.)

Table 4-34. Lengths of Garden Valley alternative segments near county roads.

Alternative segment	Length within 1.6 kilometers of county road (kilometers)[a]	Length immediately adjacent and parallel to county road (kilometers)	Length where new linear feature could cause moderate contrast (kilometers)
Garden Valley 1	15	3	12
Garden Valley 2	22	3	19
Garden Valley 3	18	0	18
Garden Valley 8	21	11	11

a. To convert kilometers to miles, multiply by 0.62137.

track from viewers. Construction of these berms would reduce the level of contrast to weak. If DOE could not avoid placing communications towers in such areas, the Department would use non-contrasting, non-reflective paint on the towers and associated buildings and place them as far from public viewpoints as feasible.

Views toward Garden Valley alternative segment 2 and Garden Valley alternative segment 8 from the key observation points on top of a structure within *City* would show weak contrast of the rail line against the landscape (see Figure 4-10 and simulations shown in Figures D-43 through D-50 in Appendix D). Because of distance, views toward Garden Valley alternative segment 1 would show weaker contrast and, toward Garden Valley alternative segment 3, no contrast (see simulations in Figures D-38 through D-42). None of the alternative segments would be visible from portions of the sculpture that are below grade. Garden Valley alternative segments 1, 2, and 8 would be more noticeable along the nearby flat lands of Garden Valley and less so in the more distant flat lands and the more variegated foothills to the east and west. Passage of a train would create a greater degree of contrast between the rail line and the surrounding landscape, especially along the nearby flat lands, but this would be an infrequent, short-duration contrast. The resulting contrast ratings of weak to none for Garden Valley alternative segment 1, 2, and 8, and none for Garden Valley alternative segment 3 would meet BLM Class II management objectives.

4.2.3.3.2.4 Caliente Common Segment 2. Caliente common segment 2 would remain exclusively in Class IV lands along its entire length. During operations, some portions of the track would cause a weak to moderate contrast due to its proximity to viewers in the Cedar Pipeline Ranch area (see Figures D-53 and D-54 in Appendix D). This contrast rating would be compatible with BLM management objectives for Class IV lands.

4.2.3.4 Impacts under the Shared-Use Option

Impacts to aesthetic resources during the construction phase under the Shared-Use Option would be the same as those under the Proposed Action without shared use (see Section 4.2.3.2.1). Construction of additional sidings or short spurs would create small impacts to the visual setting because of the short duration of construction.

Impacts to the visual setting during the operations phase under the Shared-Use Option would be the same as those under the Proposed Action without shared use (see Section 4.2.3.3.1). Under the Shared-Use Option, there would be three additional round-trip trains per week, but this would not substantially increase the assumed three trains per day DOE used to establish visual contrast ratings under the Proposed Action without shared use.

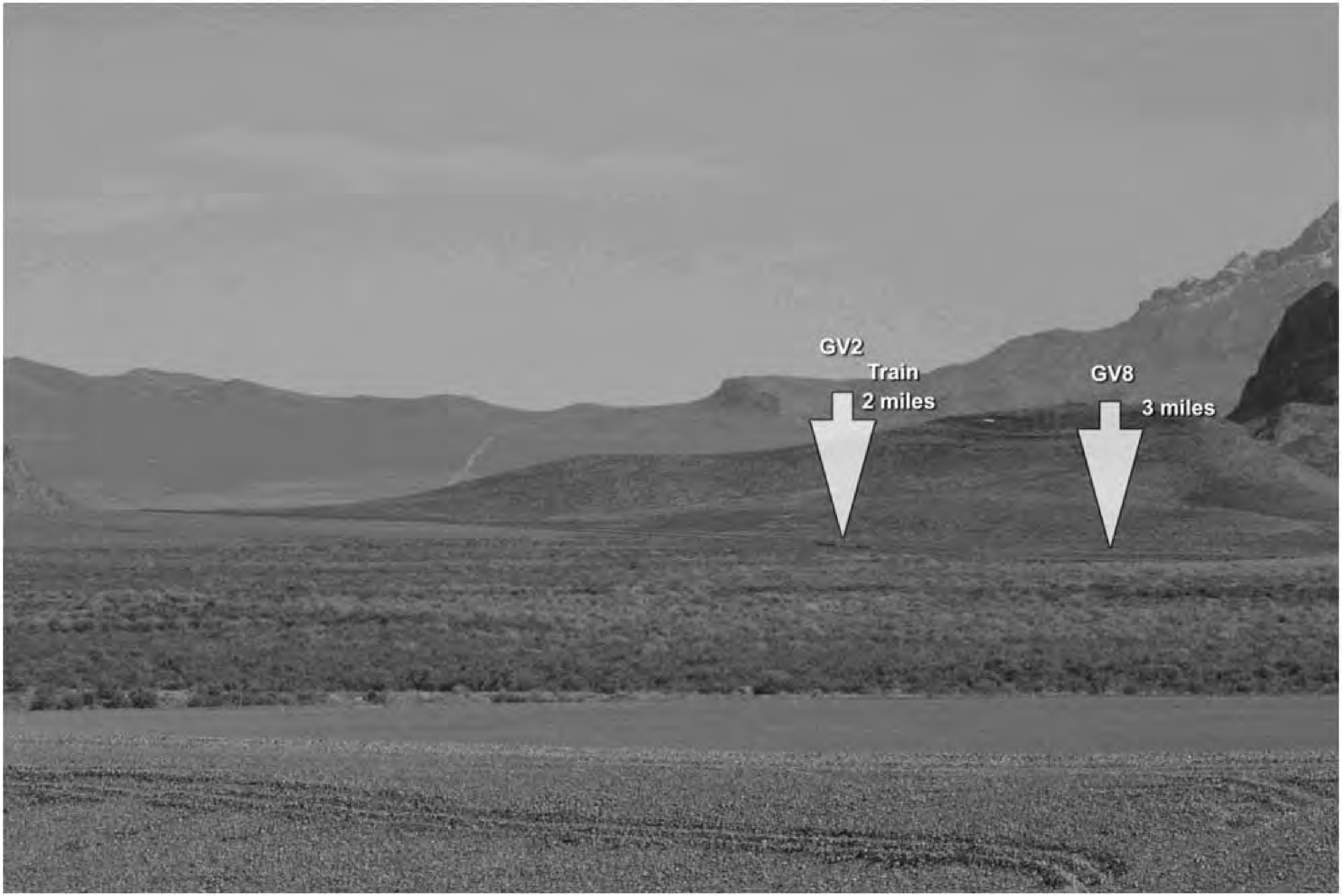


Figure 4-10. Simulation of train along Garden Valley alternative segment 2 and track along Garden Valley alternative segment 8 in view slightly northeast from key observation point 18 on top of a *City* structure.

4.2.3.5 Summary

Table 4-35 summarizes potential impacts to aesthetic resources from constructing and operating the proposed railroad along the Caliente rail alignment.

Table 4-35. Summary of potential impacts to aesthetic resources – Caliente rail alignment (page 1 of 2).[a]

Location (county)	Construction impacts[b]	Operations impacts
Rail alignment		
Impacts common to all portions of the Caliente rail alignment	Small impact. Weak to moderate contrast in the short term from dust and exhaust; lighting, temporary power poles, construction camps, and material laydown yards; operation of supply trains. Small to large impact. Weak to strong contrast in the short term from visible construction equipment either operating or in storage. Weak to strong contrast from scars on soil and vegetated landscape from cuts, fills, and well pads; contrast may be visible in the long term where revegetation is slow or contrasts with the surrounding vegetation types. Small to large impact. Weak to strong contrast in the long term from scars on rock from cuts, and from access roads.	Small to moderate impact. No to moderate contrast in the long term from the installation of linear track, signals, communications towers, power poles connecting to the grid, and access roads. Small impact. No to strong contrast in the short term from passing trains.
Caliente common segment 1	Moderate impact. Moderate contrast due to proximity to viewers during construction and road crossings of State Route 318 and Timber Mountain Pass Road; would meet BLM Class III management objectives.	Moderate impact. Moderate contrast due to proximity to viewers and road crossings of State Route 318 and Timber Mountain Pass Road; would meet BLM Class III management objectives.
Garden Valley alternative segments 1, 2, 3, and 8 (Lincoln County and Nye County)	Small to large, but temporary, impact. Weak to strong contrast in the short term, which would not meet BLM management objectives for Class II visual resources.	Small impact. Track on some parts of Garden Valley alternative segments 1, 2, 3, and 8 could create a new linear feature. Vegetated earthwork berms would mask the linear feature and reduce the contrast to levels consistent with Class II.
Caliente common segment 2	Small to moderate impact. Weak to moderate contrast due to proximity to viewers in the Cedar Pipeline Ranch area; would meet BLM Class IV management objectives.	Small to moderate impact. Weak to moderate contrast due to proximity to viewers in the Cedar Pipeline Ranch area; would meet BLM Class IV management objectives.

Table 4-35. Summary of potential impacts to aesthetic resources – Caliente rail alignment (page 2 of 2).[a]

Location (county)	Construction impacts[b]	Operations impacts
Operations support facilities		
Staging Yard, Caliente-Indian Cove option (Lincoln County)	Moderate impact. Moderate contrast during the installation and construction of the facility, consistent with surrounding non-BLM-administered lands treated as Class III, but inconsistent with BLM management objectives for Class II visual resources on the BLM lands at the north end of the yard.	Moderate impact. Moderate contrast from the operation of the facility in the Class III non-BLM lands, weak contrast from the track on BLM Class II lands at the north end; in each area, consistent with applicable BLM management objectives.
Quarries		
Potential CA-8B quarry (Lincoln County)	Large impact. Strong contrast in the short term from installation and use of the conveyor from the quarry across U.S. Highway 93, inconsistent near Upland Staging Yard with surrounding non-BLM-administered lands treated as Class III; inconsistent near Indian Cove with surrounding BLM Class II lands.	Moderate impact under the Proposed Action. Although conveyor would be removed at end of construction phase, quarry would cause moderate contrast for viewers on Beaver Dam Road, consistent with surrounding non-BLM-administered lands treated as Class III.
Potential NN-9A and NN-9B quarries (Nye County)	Moderate impact. Moderate to strong contrast in the short term from quarrying, ballast production facilities, and conveyor close to viewers on lightly traveled road. Contrast levels would meet BLM Class IV management objectives.	Small to no impact. Production facilities and conveyor would be removed and quarried areas restored after closure of quarry at end of construction phase.
Potential ES-7 quarry (Esmeralda County)	Moderate to small impact. Moderate to strong contrast to viewers on a secondary road in the short term from conveyor and siding; weak contrast for these facilities from U.S. Highway 95. Contrast levels would meet BLM Class IV management objectives.	Small to no impact. Conveyor would be removed at end of construction phase.

a. Unless noted otherwise, impacts under the Shared-Use Option would be similar to those under the Proposed Action without shared use.
b. BLM methodology recognizes that "few projects meet the VRM [visual resource management] management objectives during construction" (DIRS 173053-BLM 1986, Section III.D.2.b.7).

4.2.4 AIR QUALITY AND CLIMATE

This section describes potential impacts to air quality from constructing and operating a railroad along the Caliente rail alignment. Section 4.2.4.1 describes the methodology DOE used to assess potential impacts; Section 4.2.4.2 discusses conformity with the appropriate State Implementation Plan(s); Section 4.2.4.3 describes potential construction and operations impacts; Section 4.2.4.4 describes potential impacts under the Shared-Use Option; Section 4.2.4.5 discusses greenhouse gas emissions; and Section 4.2.4.6 summarizes potential impacts to air quality.

Section 3.2.4.1 describes the region of influence for the air quality impacts analysis.

4.2.4.1 Impact Assessment Methodology

DOE examined emissions inventories to determine county-level increases in air pollutant emissions, and performed air quality simulations to determine potential changes in air pollutant concentrations at specific receptors (population centers). Appendix E, Air Quality Assessment Methodology, is a more detailed description of the approach DOE used to perform the air quality assessment.

For areas along the Caliente rail alignment for which no local air quality data are available, DOE compared projected emissions under the Proposed Action with the U.S. Environmental Protection Agency county-level emissions data in the National Emission Inventory database (DIRS 177709-MO0607NEI2002D.000). DOE compared emissions from proposed railroad construction and operations in Lincoln, Nye, and Esmeralda Counties to existing emissions in three categories: highway emissions, off-highway emissions, and all area sources. Section 4.2.4.3.1 describes projected emissions associated with construction of the proposed railroad and Section 4.2.4.3.2 describes emissions from railroad operations.

To assess potential impacts to air quality in the region of influence, DOE modeled air quality at two population centers that would be near the proposed railroad (Caliente in Lincoln County and Goldfield in Esmeralda County) and compared the modeling results to the Nevada and National ***Ambient Air Quality Standards*** (NAAQS). These two standards are nearly identical (Section 3.2.4 explains differences), but DOE primarily references the NAAQS in this section with noted exceptions. The Department also modeled air quality to assess potential impacts for railroad construction and operations (using both minimum and maximum rail line lengths in each county) and railroad facilities for locations in Caliente and for construction-related activities at potential quarry site CA-8B northwest of Caliente and potential quarry site NN-9B in South Reveille Valley. Appendix E provides a detailed description of the air quality modeling methodology and assumptions.

There would be an adverse impact to air quality if the Proposed Action:

- Would conflict with or obstruct implementation of a state or regional air quality management plan
- Would violate a NAAQS primary standard or contribute to existing or projected violations

4.2.4.2 The Conformity Rule

Section 176(c) of the Clean Air Act (42 U.S.C. 7401 *et seq.*) requires that federal actions conform to the appropriate State Implementation Plan. The final rule for "Determining Conformity of General Federal Actions to State or Federal Implementation Plans" (called the Conformity Rule) is codified in 40 Code of Federal Regulations (CFR) Parts 6, 51, and 93. This Conformity Rule established the conformity criteria and procedures necessary to ensure that federal actions conform to the State Implementation Plans and meet the provisions of the Clean Air Act. In general, this rule ensures that all emissions of ***criteria***

pollutants and ***volatile organic compounds*** are specifically identified and accounted for in the State Implementation Plan's attainment or maintenance demonstration, and conform to the State Implementation Plan's purpose of eliminating or reducing the severity and number of violations of the NAAQS and achieving expeditious attainment of such standards.

The provisions of the Conformity Rule apply only where the action is undertaken in a federally classified ***nonattainment*** or maintenance ***area***. Apart from Clark and Washoe Counties, the rest of the State of Nevada is classified as ***in attainment*** for all criteria pollutants. There are no nonattainment or maintenance areas in the proposed rail alignment's host counties of Lincoln, Nye, and Esmeralda. Hence, the provisions of the Conformity Rule do not apply to the Proposed Action.

4.2.4.3 Impacts to Air Quality

4.2.4.3.1 Construction Impacts

Potential impacts to air quality from construction of a rail line and railroad construction and operations support facilities along the Caliente rail alignment would include (1) exhaust emissions from construction equipment and (2) fugitive dust ***particulate matte***r emissions resulting from construction activities. These impacts would be small, except in the vicinity of potential South Reveille quarry NN-9B.

Appendix E describes the modeling approach and methodology DOE used to estimate emissions and air quality impacts that would result from these activities.

DOE evaluated emissions and air quality impacts by county because the most complete and comprehensive annual emissions data available from the U.S. Environmental Protection Agency National Emission Inventory are at the county level (DIRS 177709-MO0607NEI2002D.000). DOE assessed emissions impacts by comparing construction/design emissions with 2002 annual county-wide emissions for ***nitrogen oxides*** (NO_x), particulate matter with aerodynamic diameters equal to or less than 10 micrometers (***PM_{10}***) and 2.5 micrometers (***$PM_{2.5}$***), ***sulfur dioxide*** (SO_2), ***carbon monoxide*** (CO), and volatile organic compounds (VOCs). DOE assessed air quality impacts by comparing resulting concentrations of these air pollutants against the NAAQS.

Nye, Esmeralda, and Lincoln Counties are all in attainment for ***ozone (O_3)***. Ozone is generally recognized as a regional-scale air quality problem. The potential increase in the emissions of VOCs (a precursor to ozone formation) associated with rail line construction would be small in relation to the existing regional emissions of VOCs. Thus, the impact on ozone formation would not be anticipated to cause a violation of the ozone standard. (This conclusion was presented in the Draft Rail Alignment EIS, published in October 2007, relative to then-current primary and secondary 8-hour ozone standards of 0.08 parts per million, and remains unchanged relative to revised primary and secondary 8-hour ozone standards of 0.075 parts per million, effective on May 27, 2008 [see 3.2.4.2].)

Sections 4.2.4.3.1.1 through 4.2.4.3.1.3 describe potential exhaust emissions and air quality impacts from constructing the proposed rail line and railroad construction and operations support facilities along the Caliente rail alignment in Lincoln, Nye, and Esmeralda Counties.

4.2.4.3.1.1 Lincoln County.

Emissions Appendix E describes the methodology DOE used to determine construction-related emissions. Section E.2.1.2.1 provides additional detail on the Lincoln County emissions inventory.

Table 4-36 compares the highest modeled annual total emissions under a 4-year construction schedule in Lincoln County to the county's 2002 emissions estimates in the National Emission Inventory database (DIRS 177709-MO0607NEI2002D.000). The table lists potential project-related emissions as a

Table 4-36. Maximum and minimum peak annual emissions anticipated from construction of a railroad along the Caliente rail alignment through Lincoln County, Nevada, compared to 2002 existing county emissions.

	Total emissions (tons per year)[a,b]											
	VOCs		CO		NO_x		PM_{10}		$PM_{2.5}$		SO_2	
Emissions source	Max. length[c]	Min. length[d]	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length
Construction exhaust	470	420	3,460	3,120	4,060	3,650	240	220	230	210	3	2
Construction fugitive dust	-	-	-	-	-	-	2,700	2,560	490	470	-	-
Totals	470	420	3,460	3,120	4,060	3,650	2,940	2,780	720	680	3	2
Off highway (2002)[e]	37		211		777		22		20		46	
Highway vehicles (2002)[e]	442		4,792		387		13		10		10	
All county sources (2002)[e]	554		5,152		1,175		2,072		342		62	

a. To convert tons to metric tons, multiply by 0.90718.

b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.

c. Maximum (Max.) length of rail alignment in Lincoln County would be 148 kilometers (92 miles). (The maximum and minimum lengths along the complete rail alignment are not equal to the sum of the possible maxima or the minima in individual counties.)

d. Minimum (Min.) length of rail alignment in Lincoln County would be 132 kilometers (82 miles).

e. Only includes anthropogenic (the influence of humans on the environment) source of emissions (DIRS 177709-MO0607NEI2002D.000).

maximum and minimum range according to the possible lengths of the rail line through the county, and increased equipment activity that would be necessary when construction was in rugged terrain.

Estimated construction-related emissions for VOCs, CO, and SO_2 are less than the county's 2002 annual emissions for these air pollutants. PM_{10} emissions during the construction phase would be approximately 790 metric tons (870 tons) per year higher than the 2002 county-wide emissions and $PM_{2.5}$ 340 metric tons (380 tons) per year higher, while emissions of NO_x would be 2,600 metric tons (2,900 tons) per year greater than the 2002 county-wide emissions. However, these emissions would be distributed over the entire length of the rail alignment in Lincoln County (132 to 148 kilometers [82 to 92 miles]) and would not lead to a localized problem; thus, no air quality standard would be exceeded, as shown below for construction near Caliente.

As shown in Table 4-36, fugitive dust would be the principal source of particulate matter emissions. More than half of these fugitive dust emissions would be directly associated with rail line construction. About 40 percent of the overall fugitive dust emissions from roads associated with the alignment (including the alignment service road) would occur in Lincoln County, or 1,350 metric tons (1,490 tons) per year. Construction of the Interchange Yard would contribute about 1 percent, construction camps 1, 2, 3, 4, and 5 would contribute about 0.4 percent each, and all of the wells less than 1 percent of the overall fugitive dust emissions within the county.

Air Quality Impacts, Construction Activities DOE modeled air quality to determine how construction of the proposed railroad would be likely to impact air pollutant concentrations in Caliente, Nevada. Air quality modeling efforts included the impact from constructing the rail line and the Interchange Yard in Caliente. Because the Staging Yard would be outside town, either at Indian Cove, Upland, or Eccles-North, the Department did not model air quality for the Staging Yard. Appendix E, Section E.2.1.2.2.1, summarizes the modeling methodology DOE used to assess construction-related air quality impacts in Lincoln County.

Table 4-37 shows the modeled maximum concentrations at any receptor point within the modeled domain of criteria pollutants that could be emitted during the construction phase. DOE modeled a 3-year period using 3 years of actual meteorological data. The table also lists the highest background concentration since 1991 of each air pollutant (see Section 3.2.4 for the basis of the background concentration) and the relevant NAAQS for each air pollutant, and the maximum resulting concentration as a fraction of the NAAQS. The maximum concentrations during the construction phase in Caliente would be below the NAAQS for all air pollutants. The modeled maximum fraction of the NAAQS was 40 percent for $PM_{2.5}$.

Table 4-38 shows the modeled maximum concentrations at any receptor point of criteria pollutants that would be emitted over the 3-year modeling period and that would result from construction of the Interchange Yard. The table also shows the highest background concentration since 1991 (second highest for 24-hour PM_{10}) of each air pollutant (see Section 3.2.4 for the basis of the background concentration) and the relevant NAAQS for each air pollutant, and the maximum resulting concentration as a fraction of the NAAQS. The maximum concentrations from construction of the Interchange Yard at Caliente would be below NAAQS for all air pollutants. Figure 4-11 shows the predicted 24-hour PM_{10} concentration near the proposed site of the Interchange Yard in Caliente to illustrate construction-related air pollutant concentrations in this area. The modeled maximum fraction of the NAAQS would be 36 percent for $PM_{2.5}$.

DOE did not model other construction activities (at access roads, construction camps, and wells) because emissions from those construction activities would be smaller than construction of the rail line and the Interchange Yard and would be expected to show even lower concentrations; therefore, emissions would be well below NAAQS for all air pollutants.

Table 4-37. Maximum air pollutant concentrations during the construction phase along the Caliente rail alignment near Caliente, Nevada.

Averaging period	Air pollutant[a]		Background concentration[b]	Maximum project impact[c]	Maximum resulting concentration	NAAQS[d]	Maximum concentration (percent of standard)
1-hour	CO	ppm	0.2	0.41	0.61	35	2
3-hour	SO_2	ppm	0.002	0.0001	0.002	0.5	< 1
8-hour	CO	ppm	0.2	0.07	0.27	9	3
24-hour	PM_{10}	$\mu g/m^3$	39	5.5	45	150	30
	$PM_{2.5}$	$\mu g/m^3$	12	1.4	13	35	38
	SO_2	ppm	0.002	0.005	0.007	0.14	5
Annual	NO_2	ppm	0.002	0.001	0.003	0.053	6
	PM_{10}	$\mu g/m^3$	12	2.1	14	50[e]	28
	$PM_{2.5}$	$\mu g/m^3$	3.6	0.6	4.2	15	28
	SO_2	ppm	0.002	< 0.0001	0.002	0.03	6

a. CO = carbon monoxide; NO_2 = nitrogen dioxide; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; ppm = parts per million; SO_2 = sulfur dioxide; $\mu g/m^3$ = micrograms per cubic meter.
b. Sources: DIRS 147771-CRWMS M&O 1996, p. 13; DIRS 102877-CRWMS M&O 1999, p. 14; DIRS 147780-SAIC 1992, p. 13; DIRS 168842-DOE 2003, all; DIRS 173738-DOE 2002, all; DIRS 173740-DOE 2004, all; DIRS 176996-DOE 2005, p. 38; DIRS 179948-DOE 2006, p. 40; CFR 50.4 through 50.11.
c. < = less than.
d. NAAQS = National Ambient Air Quality Standards.
e. The U.S. Environmental Protection Agency revoked the annual PM_{10} standard effective December 18, 2006 (71 *FR* 60853, October 17, 2006), but the Nevada annual average PM_{10} standard remains in effect.

Table 4-38. Maximum air pollutant concentrations from construction of the proposed Interchange Yard in Caliente, Nevada.

Averaging period	Air pollutant[a]		Background concentration[b]	Maximum project impact	Maximum resulting concentration	NAAQS[c]	Maximum concentration (percent of standard)
1-hour	CO	ppm	0.2	0.18	0.38	35	1
3-hour	SO_2	ppm	0.002	0.002	0.004	0.5	1
8-hour	CO	ppm	0.2	0.03	0.23	9	3
24-hour	PM_{10}	$\mu g/m^3$	39	2	41	150	27
	$PM_{2.5}$	$\mu g/m^3$	12	1	13	35	36
	SO_2	ppm	0.002	0.003	0.005	0.14	4
Annual	NO_2	ppm	0.002	0.001	0.003	0.053	5
	PM_{10}	$\mu g/m^3$	12	1.2	13	50[d]	26
	$PM_{2.5}$	$\mu g/m^3$	3.6	0.37	4	15	26
	SO_2	ppm	0.002	0.0001	0.002	0.03	7

a. CO = carbon monoxide; NO_2 = nitrogen dioxide; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; ppm = parts per million; SO_2 = sulfur dioxide; $\mu g/m^3$ = micrograms per cubic meter.
b. Sources: DIRS 147771-CRWMS M&O 1996, p. 13; DIRS 102877-CRWMS M&O 1999, p. 14; DIRS 147780-SAIC 1992, p. 13; DIRS 168842-DOE 2003, all; DIRS 173738-DOE 2002, all; DIRS 173740-DOE 2004, all; DIRS 176996-DOE 2005, p. 38; DIRS 179948-DOE 2006, p. 40; CFR 50.4 through 50.11.
c. NAAQS = National Ambient Air Quality Standards.
d. The U.S. Environmental Protection Agency revoked the annual PM_{10} standard effective December 18, 2006 (71 *FR* 60853, October 17, 2006), but the Nevada annual average PM_{10} standard remains in effect.

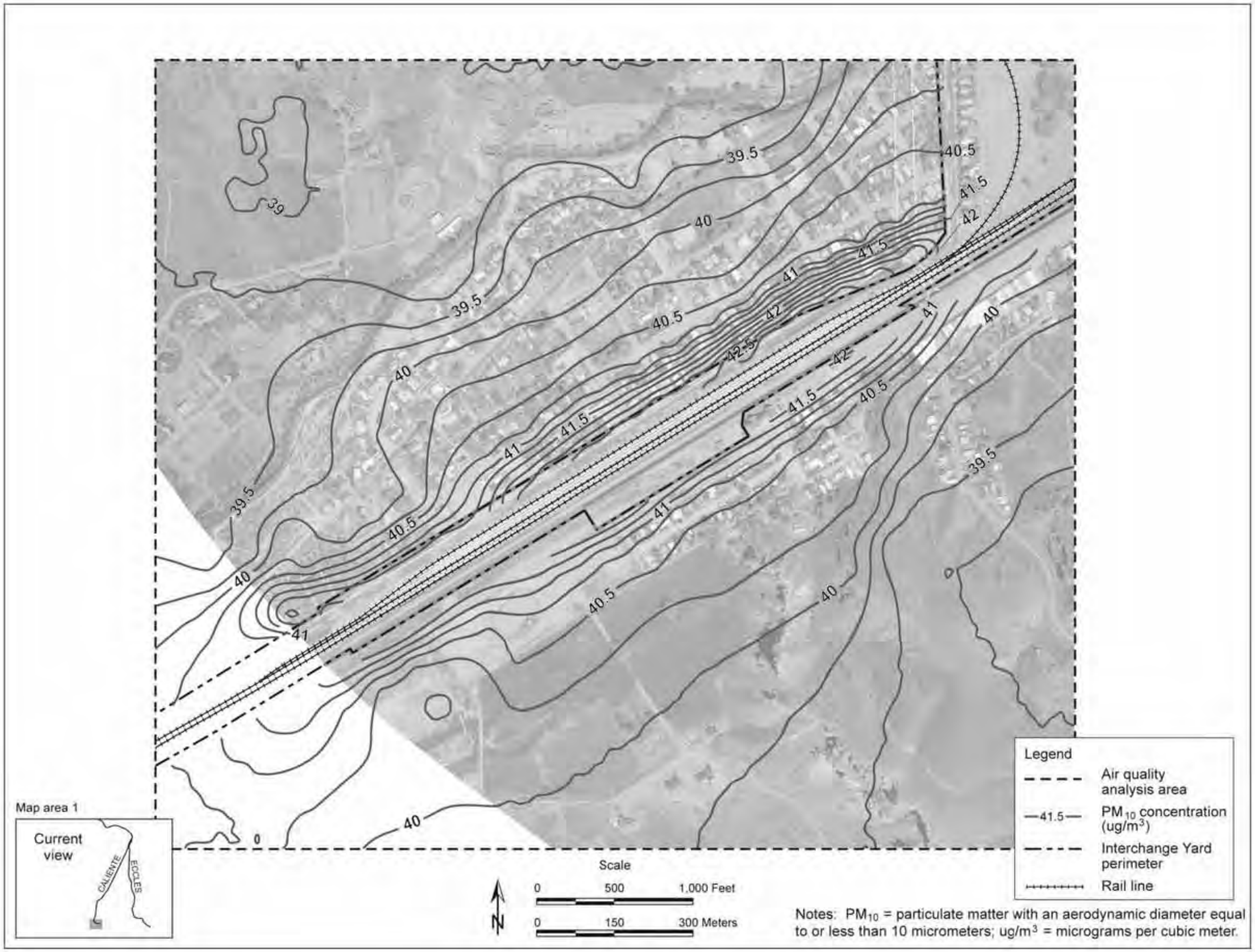


Figure 4-11. Maximum 24-hour PM_{10} concentration (maximum background plus modeled maximum project impact) from construction of the proposed Interchange Yard in Caliente, Nevada.

Air Quality Impacts, Quarry Activities DOE also performed simulations to determine potential impacts to air quality associated with activity at potential quarry site CA-8B northwest of the City of Caliente (DIRS 180922-Nevada Rail Partners 2007, Appendix A; DIRS 183641-Shannon & Wilson 2007, pp. 43 to 45). Appendix E, Section E.2.1.2.2.2, describes the methodology DOE used to simulate quarry-related impacts to air quality.

Table 4-39 shows the modeled maximum concentrations at any receptor point of criteria pollutants that would be emitted over the 3-year period and that would result from quarry-related activities. The table also shows the highest background concentration since 1991 of each air pollutant (see Section 3.2.4 for the basis of the background concentration) and the relevant NAAQS for each air pollutant, and the maximum resulting concentration as a fraction of the NAAQS. The modeled maximum fraction of the NAAQS would be 45 percent for PM_{10}.

Table 4-39. Maximum air pollutant concentrations from construction and operation of potential quarry CA-8B near Caliente, Nevada.

Averaging period	Air pollutant[a]		Background concentration[b]	Maximum project impact[c]	Maximum resulting concentration	NAAQS[d]	Maximum concentration (percent of standard)
1-hour	CO	ppm	0.2	0.43	0.64	35	2
3-hour	SO_2	ppm	0.002	0.0001	0.002	0.5	<1
8-hour	CO	ppm	0.2	0.11	0.31	9	3
24-hour	PM_{10}	$\mu g/m^3$	39	26[e]	65	150	44
	$PM_{2.5}$	$\mu g/m^3$	12	1.2[f]	13	35	38
	SO_2	ppm	0.002	0.0001	0.002	0.14	1
Annual	NO_2	ppm	0.002	0.0001	0.002	0.053	4
	PM_{10}	$\mu g/m^3$	12	2.6	15	50[g]	29
	$PM_{2.5}$	$\mu g/m^3$	3.6	0.38	4	15	27
	SO_2	ppm	0.002	< 0.00001	0.002	0.03	6

a. CO = carbon monoxide; NO_2 = nitrogen dioxide; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; ppm = parts per million; SO_2 = sulfur dioxide; $\mu g/m^3$ = micrograms per cubic meter.
b. Sources: DIRS 147771-CRWMS M&O 1996, p. 13; DIRS 102877-CRWMS M&O 1999, p. 14; DIRS 147780-SAIC 1992, p. 13; DIRS 168842-DOE 2003, all; DIRS 173738-DOE 2002, all; DIRS 173740-DOE 2004, all; DIRS 176996-DOE 2005, p. 38; DIRS 179948-DOE 2006, p. 40; CFR 50.4 through 50.11.
c. < = less than.
d. NAAQS = National Ambient Air Quality Standards.
e. Maximum second highest high over any 1-year period.
f. Maximum 3-year average of the 98th percentile of 24-hour concentrations.
g. The U.S. Environmental Protection Agency revoked the annual PM_{10} standard effective December 18, 2006 (71 *FR* 60853, October 17, 2006), but the Nevada annual average PM_{10} standard remains in effect.

For all air pollutants and all averaging periods, the peak concentrations under conservative modeling assumptions (see Appendix E, Section E.1) would be below the NAAQS levels, with most values well below NAAQS.

4.2.4.3.1.2 Nye County.

Emissions Appendix E describes the methodology DOE used to determine construction-related emissions. Section E.2.1.3 provides additional detail on the Nye County emissions inventory.

Table 4-40 compares the modeled highest annual total emissions during the 4-year construction phase in Nye County (including construction of the Rail Equipment Maintenance Yard and Maintenance-of-Way Trackside Facility) with the county's 2002 National Emission Inventory database emissions estimates

Table 4-40. Maximum and minimum peak annual emissions anticipated during the construction phase along the Caliente rail alignment through Nye County, Nevada, compared to 2002 existing county emissions.

Emissions source	Total emissions (tons per year)[a,b]											
	VOCs		CO		NO_x		PM_{10}		$PM_{2.5}$		SO_2	
	Max. length[c]	Min. length[d]	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length
Construction exhaust	1,230	1,060	8,960	7,750	10,580	9,140	630	540	610	520	8	7
Construction fugitive dust	-	-	-	-	-	-	5,510	5,030	1,020	930	-	-
Totals	1,230	1,060	8,960	7,750	10,580	9,140	6,140	5,570	1,630	1,450	8	7
Off highway (2002)[e]	372		1,967		219		30		28		24	
Highway vehicles (2002)[e]	1,469		15,375		1,155		35		28		31	
All county sources (2002)[e]	2,507		18,778		1,582		3,664		716		261	

a. To convert tons to metric tons, multiply by 0.90718.
b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.
c. Maximum (Max.) length of rail alignment in Nye County would be 398 kilometers (247 miles). (The maximum and minimum lengths along the complete rail alignment are not equal to the sum of the possible maxima or the minima in individual counties.)
d. Minimum (Min.) length of rail alignment in Nye County would be 342 kilometers (213 miles).
e. Only includes anthropogenic (the influence of humans on the environment) source of emissions (DIRS 177709-MO0607NEI2002D.000).

(DIRS 177709-MO0607NEI2002D.000). The table lists project-related emissions as a maximum and minimum range according to the possible lengths of the rail alignment through the county, and increased equipment activity that would be necessary for construction in rugged terrain.

Construction-related emissions of VOCs, CO, and SO_2 would be less than half the county's 2002 annual emissions of these air pollutants. During the construction phase, emissions of $PM_{2.5}$ and PM_{10} could increase by as much as 830 and 2,270 metric tons (910 and 2,500 tons) per year, respectively, over the 2002 county annual emission values, and NO_x emissions could be as much as 8,160 metric tons (9,000 tons) per year over the county's 2002 annual emissions. However, these emissions would be distributed over the entire length of the rail alignment in Nye County (342 to 398 kilometers [213 to 247 miles]) and would not lead to a localized problem; thus, no air quality standard would be exceeded during the construction phase in Nye County.

As shown in Table 4-40, construction fugitive dust would be the principal source of particulate matter emissions. More than half of these fugitive dust emissions would be directly associated with construction of the rail line. About 60 percent of the overall fugitive dust emissions from roads associated with the alignment (including the alignment service road) would occur in Nye County, or 2,000 metric tons (2,200 tons) per year. Construction of the Maintenance-of-Way Trackside Facility would contribute about 1 percent, the Rail Equipment Maintenance Yard and Cask Maintenance Facility would contribute less than 1 percent, construction camps 6, 7, 8, 10, 11, and 12 about 0.4 percent each, and all of the wells less than 1 percent of the overall fugitive dust emissions within the county.

Air Quality Impacts, Quarry Activities DOE performed simulations to determine potential impacts to air quality associated with construction and operations activity at potential quarry site NN-9B in South Reveille Valley (DIRS 183641-Shannon & Wilson 2007, pp. 35 and 37; DIRS 180922-Nevada Rail Partners 2007, Appendix C). Appendix E, Section E.2.1.3.2.1, describes the methodology DOE used to simulate quarry-related air quality impacts.

Table 4-41 lists the maximum concentrations at any receptor point within the modeled domain of criteria pollutants that could be emitted from quarry-related activities (or peak 3-year average 98th percentile values for $PM_{2.5}$ and the maximum second highest high over a 1-year period for PM_{10}). The maximum concentrations from operation of the potential South Reveille quarry occurs during the construction of the quarry. DOE modeled two consecutive 3-year periods using 4 years of meteorological data. The table also lists the highest (second highest for 24-hour PM_{10}) background concentration of each air pollutant (see Section 3.2.4 for the basis of the background concentration) and the relevant NAAQS for each air pollutant, and the maximum resulting concentration as a fraction of the NAAQS.

Under conservative modeling assumptions (see Appendix E, Section E.1) peak air pollutant concentrations would be below the NAAQS levels, except for 24-hour average PM_{10}. The 24-hour PM_{10} NAAQS would be met if the NAAQS level of 150 micrograms per cubic meter was not exceeded more than once a year. However, under the conservative modeling assumptions used here, in each modeled year at least one receptor beyond the quarry fence line had a 24-hour PM_{10} concentration greater than the NAAQS level of 150 micrograms per cubic meter; therefore, the NAAQS could be exceeded. However, under Nevada Administrative Code 445B.22037, DOE would be required to prepare a Surface Area Disturbance Permit Dust Control Plan, which would address in detail the best types of fugitive dust control methods to be used. Specifics about the best control methods would depend on the specific layout, operation, and activity level at the quarry. These details are not fully available at this time, but would be when DOE filed the Surface Disturbance Permit Dust Control Plan with the State of Nevada. More than one method to control fugitive dust could be necessary to prevent fugitive dust generation, and use of multiple methods to control fugitive dust must be addressed, if needed. The Permit Plan could

Table 4-41. Maximum air pollutant concentrations from construction and operation of potential quarry NN-9B in South Reveille Valley.

Averaging period	Air pollutant[a]		Background concentration[b]	Maximum project impact[c]	Maximum resulting concentration	NAAQS[d]	Maximum concentration (percent of standard)
1-hour	CO	ppm	0.2	1.5	1.7	35	5
3-hour	SO_2	ppm	0.002	0.0001	0.002	0.5	<1
8-hour	CO	ppm	0.2	0.29	0.49	9	5
24-hour	PM_{10}	$\mu g/m^3$	39	200[e]	239	150	160
	$PM_{2.5}$	$\mu g/m^3$	12	14[f]	26	35	74
	SO_2	ppm	0.002	0.0001	0.002	0.14	1
Annual	NO_2	ppm	0.002	0.001	0.003	0.053	6
	PM_{10}	$\mu g/m^3$	12	23	35	50[g]	71
	$PM_{2.5}$	$\mu g/m^3$	3.6	2.8	6.4	15	43
	SO_2	ppm	0.002	< 0.00001	0.002	0.03	6

a. CO = carbon monoxide; NO_2 = nitrogen dioxide; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; ppm = parts per million; SO_2 = sulfur dioxide; $\mu g/m^3$ = micrograms per cubic meter.
b. Sources: DIRS 147771-CRWMS M&O 1996, p. 13; DIRS 102877-CRWMS M&O 1999, p. 14; DIRS 147780-SAIC 1992, p. 13; DIRS 168842-DOE 2003, all; DIRS 173738-DOE 2002, all; DIRS 173740-DOE 2004, all; DIRS 176996-DOE 2005, p. 38; DIRS 179948-DOE 2006, p. 40; CFR 50.4 through 50.11.
c. < = less than.
d. NAAQS = National Ambient Air Quality Standards.
e. Maximum second highest high over any 1-year period.
f. Maximum 3-year average of the 98th percentile of 24-hour concentrations.
g. The U.S. Environmental Protection Agency revoked the annual PM_{10} standard effective December 18, 2006 (71 *FR* 60853, October 17, 2006), but the Nevada annual average PM_{10} standard remains in effect.

require such measures as paving quarry access roads, and cessation of operations when winds make control of fugitive dust difficult. DOE anticipates that these measures would greatly reduce the PM_{10} emissions, making an exceedance of the 24-hour PM_{10} NAAQS highly unlikely. During quarry operations, PM_{10} emissions would be more than 80 percent lower than during construction and no exceedance of the 24-hour PM_{10} NAAQS would be expected. Further, DOE could reduce this concern by acquiring additional land and moving public access (the fence line) farther away from the quarry activity (see Chapter 7, Best Management Practices and Mitigation).

Maintenance-of-Way Trackside Facility This facility would occupy about 0.06 square kilometer (15 acres) in Nye County (DIRS 182825-Nevada Rail Partners 2007, Appendix B, p. B-11), and would be located approximately 18 miles south from U.S. Highway 6 on AR 504 in Nye County (DIRS 180919-Nevada Rail Partners 2007, p. 7-10). DOE did not model air quality for construction of this facility because construction activities would be similar to those for the Interchange Yard modeled in Lincoln County. Because DOE would expect air pollutant concentrations resulting from construction of the Interchange Yard to be below the NAAQS, the Department considers it unlikely that air pollutant concentrations resulting from construction of the Maintenance-of-Way Trackside Facility, which would have greater restricted public access (enclosed fence), would exceed the NAAQS. Similarly, DOE did not perform air quality modeling for construction of the Rail Equipment Maintenance Yard and Cask Maintenance Facility inside the Yucca Mountain Site boundary, because the distance from the facilities to the nearest public access point would be more than 11 kilometers (7 miles). At that distance, emissions from construction of the facilities would be small. However, DOE performed this analysis for the Repository SEIS (DOE/EIS-0250F-S1), and results are included in the combined impacts table in Chapter 5 of this Rail Alignment EIS.

DOE did not model other construction activities (at access roads, construction camps, and wells) because emissions from those construction activities would be smaller than emissions during rail line construction and would be expected to show even lower concentrations; therefore, those emissions would be well below NAAQS for all air pollutants.

4.2.4.3.1.3 Esmeralda County.

Emissions Appendix E describes the methodology DOE used to determine construction-related emissions. Section E.2.1.4.1 contains additional detail on the Esmeralda County emissions inventory.

For each air pollutant considered in this analysis, Table 4-42 compares the peak annual emissions associated with construction of the proposed rail line and railroad construction and operations support facilities in Esmeralda County with the county's 2002 National Emission Inventory database emissions estimates (DIRS 177709-MO0607NEI2002D.000). The table lists potential project-related emissions as a maximum and minimum range according to the possible lengths of the rail alignment through Esmeralda County, and increased equipment activity necessary for construction in rugged terrain.

Construction-related emissions of VOCs, CO, PM_{10}, $PM_{2.5}$, and SO_2 would be less than the 2002 county-level emissions estimates for each pollutant. The emissions of oxides of NO_x during the construction phase could increase emissions by 910 metric tons (1,000 tons) per year over the county's 2002 annual emissions. However, these emissions would be distributed over the entire length of the rail alignment in Esmeralda County (22 to 44 kilometers [14 to 27 miles]) and would not lead to a localized problem; thus, no air quality standard would be exceeded during the construction phase in Esmeralda County, as shown in Table 4-43 for Goldfield.

As shown in Table 4-42, rail line fugitive dust would be the principal source of particulate matter emissions. More than half of these fugitive dust emissions would be directly associated with rail line construction. About 1 percent of the overall fugitive dust emissions from roads associated with the alignment (including the alignment service road) would occur in Esmeralda County, or 36 metric tons (40 tons) per year. Construction of the Maintenance-of-Way Headquarters Facility or the Maintenance-of-Way Facility would contribute less than 1 percent, construction camp 9 about 0.4 percent, and wells less than 1 percent of the overall fugitive dust emissions within the county.

Air Quality Impacts DOE modeled air quality to determine how construction would be likely to impact air pollutant concentrations at Goldfield, Nevada. Appendix E, Section E.2.1.4.2, describes the modeling methodology DOE used to assess construction-related air quality impacts in Esmeralda County.

Table 4-43 lists the maximum concentrations at any receptor point within the modeled domain of criteria pollutants that could be emitted during the construction phase. DOE modeled two consecutive 3-year periods using 4 years of meteorological data. The table also lists the highest background concentration since 1991 (second highest for 24-hour PM_{10}) of each air pollutant (see Section 3.2.4 for the basis of the background concentration) and the relevant NAAQS for each air pollutant, and the maximum resulting concentration (or peak 3-year average 98th percentile values for $PM_{2.5}$ and the maximum second highest high over a 1-year period for PM_{10}) as a fraction of the NAAQS. In all cases, the maximum concentrations during the construction phase near Goldfield would be below NAAQS for all air pollutants. The maximum fraction of the NAAQS would be 87 percent for PM_{10}.

DOE did not model air pollutant concentrations resulting from the construction of the Maintenance-of-Way Headquarters Facility south of Tonopah or the Maintenance-of-Way Facility north of Goldfield in Esmeralda County. Construction emissions associated with these facilities would be less than those modeled for the Interchange Yard in Lincoln County. Therefore, because the Department expects air pollutant concentrations resulting from construction of the Interchange Yard to be below the NAAQS, the

Table 4-42. Maximum and minimum peak annual emissions anticipated from construction of a railroad along the Caliente rail alignment through Esmeralda County, Nevada, compared to 2002 existing county emissions

	Total emissions (tons per year)[a,b]											
	VOCs		CO		NO_x		PM_{10}		$PM_{2.5}$		SO_2	
Emissions source	Max. length[c]	Min. length[d]	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length
Construction exhaust	130	70	990	490	1,170	590	70	35	67	33	1	0
Construction fugitive dust	-	-	-	-	-	-	380	180	70	40	-	-
Totals	130	70	990	490	1,170	590	450	215	140	73	1	0
Off highway (2002)[e]	10		75		29		3		3		3	
Highway vehicles (2002)[e]	144		1,372		118		3		3		3	
All county sources (2002)[e]	264		1,487		164		1,216		213		61	

a. To convert tons to metric tons, multiply by 0.90718.

b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.

c. Maximum (Max.) length of rail alignment in Esmeralda County would be 44 kilometers (27 miles). (The maximum and minimum lengths along the complete rail alignment are not equal to the sum of the possible maxima or the minima in individual counties.)

d. Minimum (Min.) length of rail alignment in Esmeralda County would be 22 kilometers (14 miles).

e. Only includes anthropogenic (the influence of humans on the environment) source of emissions (DIRS 177709-MO0607NEI2002D.000).

Table 4-43. Maximum air pollutant concentrations from construction of a railroad along the Caliente rail alignment near Goldfield, Nevada.

Averaging period	Air pollutant[a]		Background concentration[b]	Maximum project impact[c]	Maximum resulting concentration	NAAQS[d]	Maximum concentration (percent of standard)
1-hour	CO	ppm	0.2	2.5	2.7	35	8
3-hour	SO_2	ppm	0.002	0.003	0.005	0.5	1
8-hour	CO	ppm	0.2	0.32	0.52	9	6
24-hour	PM_{10}	µg/m³	39	92	131	150	87
	$PM_{2.5}$	µg/m³	12	14	26	35	74
	SO_2	ppm	0.002	0.0001	0.002	0.14	1
Annual	NO_2	ppm	0.002	0.006	0.008	0.053	15
	PM_{10}	µg/m³	12	23	35	50[e]	70
	$PM_{2.5}$	µg/m³	3.6	4.9	9	15	57
	SO_2	ppm	0.002	< 0.00001	0.002	0.03	7

a. CO = carbon monoxide; NO_2 = nitrogen dioxide; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; ppm = parts per million; SO_2 = sulfur dioxide; µg/m³ = micrograms per cubic meter.
b. Sources: DIRS 147771-CRWMS M&O 1996, p. 13; DIRS 102877-CRWMS M&O 1999, p. 14; DIRS 147780-SAIC 1992, p. 13; DIRS 168842-DOE 2003, all; DIRS 173738-DOE 2002, all; DIRS 173740-DOE 2004, all; DIRS 176996-DOE 2005, p. 38; DIRS 179948-DOE 2006, p. 40; CFR 50.4 through 50.11.
c. < = less than.
d. NAAQS = National Ambient Air Quality Standards.
e. The U.S. Environmental Protection Agency revoked the annual PM_{10} standard effective December 18, 2006 (71 *FR* 60853, October 17, 2006), but the Nevada annual average PM_{10} standard remains in effect.

Department considers it unlikely that air pollutant concentrations resulting from construction of the Maintenance-of-Way Headquarters Facility or the Maintenance-of-Way Facility would exceed the NAAQS.

DOE did not model other construction activities (at access roads, construction camps, and wells) because emissions from those construction activities would be smaller than emissions during rail line construction and would be expected to show even lower concentrations; therefore, these emissions would be well below NAAQS for all air pollutants.

4.2.4.3.2 Operations Impacts

Exhaust emissions during the operations phase would impact air quality. However, these impacts would be small.

Appendix E describes the modeling approach and methodology DOE used to estimate operations exhaust emissions and impacts to air quality.

DOE evaluated exhaust emissions and impacts to air quality by county because the most complete and comprehensive emissions data are available only at the county level. To assess emissions impacts, DOE compared modeled operations emissions with 2002 annual county-wide emissions for NO_x, PM_{10}, $PM_{2.5}$, SO_2, CO, and VOCs. To assess impacts to air quality, DOE compared modeled concentrations of these air pollutants to the NAAQS. Nye, Esmeralda, and Lincoln Counties are all in attainment for ozone. Ozone is generally recognized as a regional-scale air quality problem. The potential increase in the emissions of VOCs (a precursor to ozone formation) associated with the operations phase would be small in relation to the existing regional emissions of VOCs. Thus, the impact on ozone formation would not cause a violation of the ozone standard. (This conclusion was presented in the Draft Rail Alignment EIS, published in October 2007, relative to then-current primary and secondary 8-hour ozone standards of 0.08 parts per million, and remains unchanged relative to revised primary and secondary 8-hour ozone standards of 0.075 parts per million, effective on May 27, 2008 [see 3.2.4.2].)

Sections 4.2.4.3.2.1 through 4.2.4.3.2.3 detail the potential emissions and air quality impacts during the railroad operations phase in Lincoln, Nye, and Esmeralda Counties.

4.2.4.3.2.1 Lincoln County.

Emissions Appendix E describes the methodology DOE used to assess operations-related emissions. Appendix E, Section E.2.2.2.1, provides additional detail on the Lincoln County emissions inventory.

Table 4-44 compares the modeled highest annual total emissions during operation of the rail line and Facilities at the Interchange with the Union Pacific Railroad Mainline in Lincoln County to the county's 2002 National Emission Inventory database emissions estimates (DIRS 177709-MO0607NEI2002D.000, all). The table lists project-related emissions as a maximum and minimum range according to the possible lengths of the rail alignment through Lincoln County.

The projected operations-related emissions for all air pollutants considered in this analysis would be less than 20 percent of the county's 2002 annual emissions for these air pollutants. These emissions would be distributed over the entire length of the rail alignment through Lincoln County (132 to 148 kilometers [82 to 92 miles]; thus, no air quality standard would be exceeded.

Air Quality Impacts DOE modeled air quality to determine how railroad operations would be likely to impact air pollutant concentrations at Caliente. Air quality modeling efforts included the impact from operation of (1) the rail line and (2) the Interchange Yard in Caliente. Because the Staging Yard would be outside town, either at Indian Cove, Upland, or Eccles-North, the Department did not model air quality for the Staging Yard. Appendix E, Section E.2.2.2.2, describes the modeling methodology DOE used to assess operations-related impacts to air quality in Lincoln County.

Table 4-45 lists the maximum concentrations at any receptor point within the modeled domain of criteria pollutants that could be emitted during operation of the proposed rail line. DOE modeled a 3-year period using 3 years of meteorological data. The table also lists the highest background concentration since 1991 of each air pollutant (see Section 3.2.4 for the basis of the background concentration) and the relevant NAAQS for each air pollutant, and the maximum resulting concentration as a fraction of the NAAQS. The maximum concentrations from operation of the proposed railroad near Caliente would be well below NAAQS for all air pollutants. The maximum fraction of the NAAQS would 34 percent for $PM_{2.5}$.

DOE modeled emissions from operation of the 0.06-square-kilometer (15-acre) Interchange Yard (DIRS 180919-Nevada Rail Partners 2007, p. 4-2) in the City of Caliente, Nevada. Table 4-46 lists the maximum resulting concentrations for all criteria pollutants at any receptor in the modeled domain during all modeled years as a result of operating this facility. The table also lists the highest background concentration since 1991 of each air pollutant (see Section 3.2.4 for the basis of the background concentration) and the relevant NAAQS for each air pollutant, and the maximum resulting concentration as a fraction of the NAAQS. The maximum concentrations from operation of the Interchange Yard at the Caliente, Nevada, site would be well below NAAQS for all air pollutants. The maximum fraction of the NAAQS would be 36 percent for $PM_{2.5}$. Figure 4-12 shows the modeled 24-hour PM_{10} concentration in the vicinity of the Interchange Yard in Caliente to illustrate the air pollutant impacts in this area.

Table 4-44. Maximum and minimum peak annual emissions anticipated from operation of a railroad along the Caliente rail alignment through Lincoln County, Nevada, compared to 2002 existing county emissions.

	Total emissions (tons per year)[a,b]											
	VOCs		CO		NO_x		PM_{10}		$PM_{2.5}$		SO_2	
Emissions source	Max. length[c]	Min. length[d]	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length
Operations exhaust	14	14	56	55	205	201	6	6	6	6	< 1	< 1
Off highway (2002)[e]	37		211		777		22		20		46	
Highway vehicles (2002)[e]	442		4,792		387		13		10		10	
All county sources (2002)[e]	554		5,152		1,175		2,068		341		62	
Percent increase (projected emission/county emission × 100)	3	3	1	1	17	17	< 1	< 1	2	2	< 1	< 1

a. To convert tons to metric tons, multiply by 0.90718; < = less than.

b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.

c. Maximum (Max.) length of rail alignment in Lincoln County would be 148 kilometers (92 miles). (The maximum and minimum lengths along the complete rail alignment are not given by the sum of the possible maxima or the minima in individual counties.)

d. Minimum (Min.) length of rail alignment in Lincoln County would be 132 kilometers (82 miles).

e. Only includes anthropogenic (the influence of humans on the environment) source of emissions (DIRS 177709-MO0607NEI2002D.000).

Table 4-45. Maximum air pollutant concentrations from operation of the proposed railroad near Caliente, Nevada.

Averaging period	Air pollutant[a]		Background concentration[b]	Maximum project impact[c]	Maximum resulting concentration	NAAQS[d]	Maximum concentration (percent of standard)
1-hour	CO	ppm	0.2	< 0.001	0.2	35	1
3-hour	SO_2	ppm	0	< 0.001	0.002	0.5	< 1
8-hour	CO	ppm	0.2	< 0.001	0.2	9	2
24-hour	PM_{10}	μg/m^3	39	0.01	39	150	26
	$PM_{2.5}$	μg/m^3	12	0.01	12	35	34
	SO_2	ppm	0.002	< 0.0001	0.002	0.14	1
Annual	NO_2	ppm	0.002	< 0.0001	0.002	0.053	4
	PM_{10}	μg/m^3	12	0.01	12	50[e]	24
	$PM_{2.5}$	μg/m^3	3.6	0.01	3.6	15	24
	SO_2	ppm	0.002	< 0.00001	0.002	0.03	6

a. CO = carbon monoxide; NO_2 = nitrogen dioxide; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; ppm = parts per million; SO_2 = sulfur dioxide; μg/m^3 = micrograms per cubic meter.
b. Sources: DIRS 147771-CRWMS M&O 1996, p. 13; DIRS 102877-CRWMS M&O 1999, p. 14; DIRS 147780-SAIC 1992, p. 13; DIRS 168842-DOE 2003, all; DIRS 173738-DOE 2002, all; DIRS 173740-DOE 2004, all; DIRS 176996-DOE 2005, p. 38; DIRS 179948-DOE 2006, p. 40; CFR 50.4 through 50.11.
c. < = less than.
d. NAAQS = National Ambient Air Quality Standards.
e. The U.S. Environmental Protection Agency revoked the annual PM_{10} standard effective December 18, 2006 (71 *FR* 60853, October 17, 2006), but the Nevada annual average PM_{10} standard remains in effect.

Table 4-46. Maximum air pollutant concentrations from operation of the proposed Interchange Yard in Caliente, Nevada.

Averaging period	Air pollutant[a]		Background concentration[b]	Maximum project impact[c]	Maximum resulting concentration	NAAQS[d]	Maximum concentration (percent of standard)
1-hour	CO	ppm	0.2	0.11	0.31	35	1
3-hour	SO_2	ppm	0.002	< 0.0001	0.002	0.5	< 1
8-hour	CO	ppm	0.2	0.03	0.23	9	3
24-hour	PM_{10}	μg/m^3	39	1	40	150	27
	$PM_{2.5}$	μg/m^3	12	0.65	13	35	36
	SO_2	ppm	0.002	< 0.0001	0.002	0.14	1
Annual	NO_2	ppm	0.002	0.002	0.004	0.053	7
	PM_{10}	μg/m^3	12	0.44	12	50[e]	25
	$PM_{2.5}$	μg/m^3	3.6	0.4	4	15	27
	SO_2	ppm	0.002	< 0.001	0.002	0.03	6

a. CO = carbon monoxide; NO_2 = nitrogen dioxide; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; ppm = parts per million; SO_2 = sulfur dioxide; μg/m^3 = micrograms per cubic meter.
b. Sources: DIRS 147771-CRWMS M&O 1996, p. 13; DIRS 102877-CRWMS M&O 1999, p. 14; DIRS 147780-SAIC 1992, p. 13; DIRS 168842-DOE 2003, all; DIRS 173738-DOE 2002, all; DIRS 173740-DOE 2004, all; DIRS 176996-DOE 2005, p. 38; DIRS 179948-DOE 2006, p. 40; CFR 50.4 through 50.11.
c. < = less than.
d. NAAQS = National Ambient Air Quality Standards.
e. The U.S. Environmental Protection Agency revoked the annual PM_{10} standard effective December 18, 2006 (71 *FR* 60853, October 17, 2006), but the Nevada annual average PM_{10} standard remains in effect.

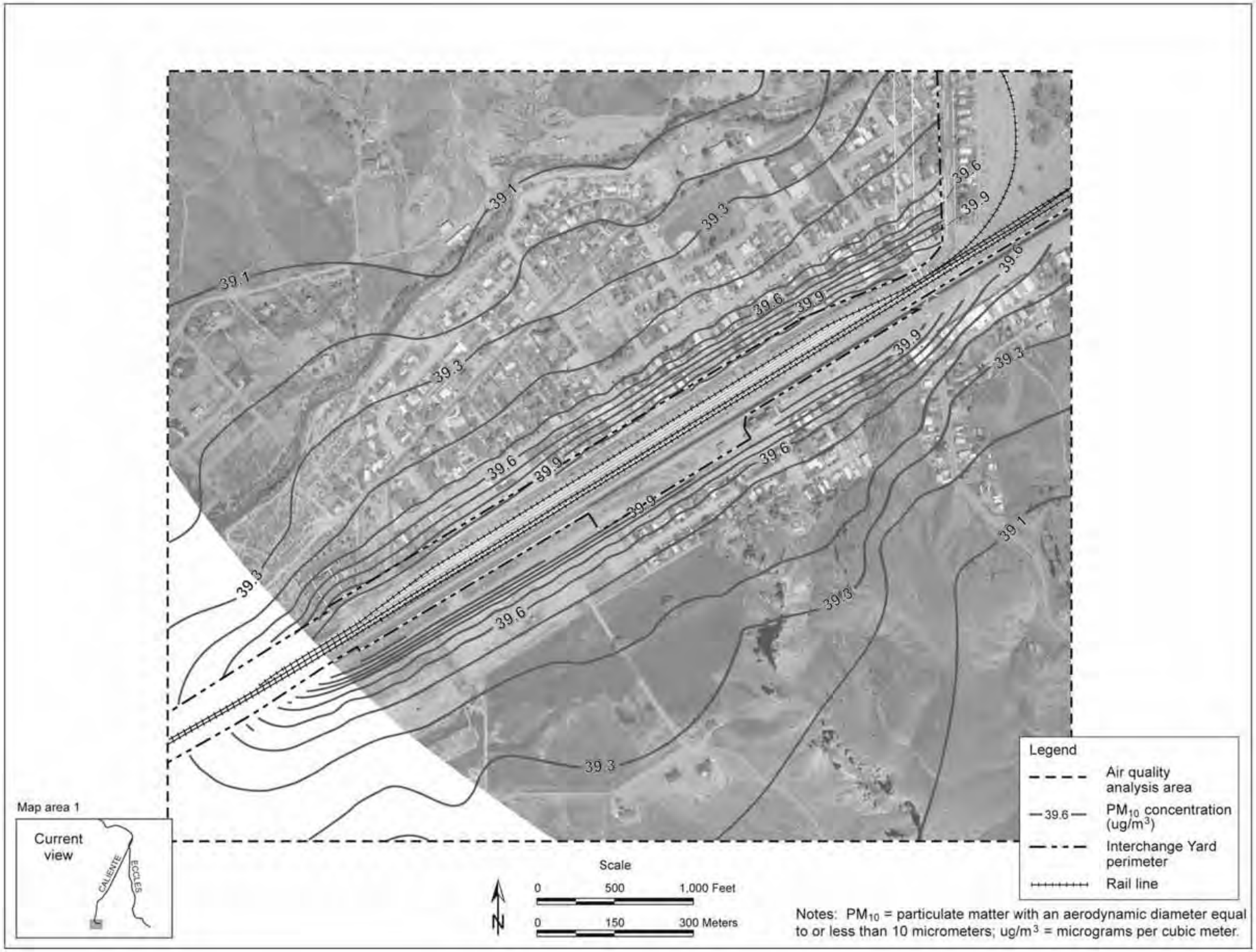


Figure 4-12. Maximum 24-hour PM_{10} concentration (maximum background plus modeled maximum project impact) from operation of the proposed Interchange Yard in Caliente, Nevada.

4.2.4.3.2.2 Nye County.

Emissions Appendix E describes the methodology DOE used to assess operations-related emissions. Section E.2.2.3.1 provides additional detail on the Nye County emissions inventory.

Table 4-47 compares the modeled highest annual total emissions during operation of the proposed rail line, the Rail Equipment Maintenance Yard, and the Maintenance-of-Way Trackside Facility in Nye County to the county's 2002 National Emission Inventory database emissions estimates (DIRS 177709-MO0607NEI2002D.000). Project-related emissions are presented as a maximum and minimum range according to the possible lengths of the rail alignment through Nye County. Operations-related emissions for all air pollutants considered in this analysis represent a fraction of the county's 2002 annual emissions. The highest percentage increase is projected for NO_x at between 34 and 35 percent over the county's 2002 annual emissions. However, these emissions increases would not be expected to cause an exceedance of any air quality standard because most of the emissions would be distributed over the 342- to 398-kilometer (213- to 247-mile) length of the rail line through Nye County.

Air Quality Impacts The Maintenance-of-Way Trackside Facility would occupy about 0.06 square kilometer (15 acres) in Nye County, about 30 miles southeast of Tonopah (DIRS 180919-Nevada Rail Partners 2007, pp. 7-1 and 7-10). DOE did not model air quality for the operation of this facility because the Department expects that emissions associated with operation of this facility would be similar to those for the Interchange Yard in Lincoln County. Because DOE expects that air pollutant concentrations resulting from operation of the Interchange Yard would be well below the NAAQS, air pollutant concentrations resulting from operation of the Maintenance-of-Way Trackside Facility, which would have greater restricted public access (enclosed fence), would not be likely to exceed the NAAQS.

Similarly, DOE did not perform air quality modeling for operation of the Cask Maintenance Facility and Rail Equipment Maintenance Yard within the Yucca Mountain Site boundary, because the distance from those facilities to the nearest point of public access would be more than 11 kilometers (7 miles). At that distance, there would be no to small impacts on air quality from operation of the facilities.

4.2.4.3.2.3 Esmeralda County.

Emissions Appendix E describes the methodology DOE used to assess operations-related emissions under the Proposed Action. Section E.2.2.4.1 provides additional detail on the Esmeralda County emissions inventory.

Table 4-48 compares the annual total emissions during the railroad operations phase in Esmeralda County to the county's 2002 National Emission Inventory database emissions estimates (DIRS 177709-MO0607NEI2002D.000). Project-related emissions are presented as a maximum and minimum range according to the possible lengths of the rail alignment through the county. The highest percentage increase is projected for NO_x at between 4 and 8 percent over the county's 2002 annual emissions. However, these emissions increases would not be expected to cause an exceedance of any air quality standard because most of the emissions would be distributed over the 22- to 44-kilometer (14- to 27-mile) length of the rail line through Esmeralda County.

Air Quality Impacts DOE modeled air quality to determine how the operations phase would be likely to impact air pollutant concentrations at Goldfield, Nevada, because a portion of Goldfield alternative segment 4 (see Figure 2-9 in Chapter 2) would pass to the south and west of Goldfield. Appendix E, Section E.2.2.4.2, summarizes the modeling methodology DOE used to assess operations-related impacts to air quality in Esmeralda County.

Table 4-47. Maximum and minimum peak annual emissions anticipated from operation of a railroad along the Caliente rail alignment through Nye County, Nevada, compared to 2002 existing county emissions.

	Total emissions (tons per year)[a,b]											
	VOCs		CO		NO_x		PM_{10}		$PM_{2.5}$		SO_2	
Emissions source	Max. length[c]	Min. length[d]	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length
Operations exhaust	41	40	152	149	560	542	18	17	16	16	2	1
Off highway (2002)[e]	372		1,967		219		30		28		24	
Highway vehicles (2002)[e]	1,469		15,375		1,155		35		28		31	
All county sources (2002)[e]	2,507		18,778		1,580		3,656		715		261	
Percent increase (projected emission/county emission ×100)	2	2	1	1	35	34	0.5	0.5	2	2	< 1	< 1

a. To convert tons to metric tons, multiply by 0.90718.
b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.
c. Maximum (Max.) length of rail alignment in Nye County would be 398 kilometers (247 miles). (The maximum and minimum lengths along the complete rail alignment are not equal to the sum of the possible maxima or the minima in individual counties.)
d. Minimum (Min.) length of rail alignment in Nye County would be 342 kilometers (213 miles).
e. Only includes anthropogenic (the influence of humans on the environment) source of emissions (DIRS 177709-MO0607NEI2002D.000).

Table 4-48. Maximum and minimum peak annual emissions anticipated from operation of a railroad along the Caliente rail alignment through Esmeralda County, Nevada, compared to 2002 existing county emissions.

	Total emissions (tons per year)[a,b]											
	VOCs		CO		NO_x		PM_{10}		$PM_{2.5}$		SO_2	
Emissions source	Max. length[c]	Min. length[d]	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length
Operations exhaust	1	< 1	3	1	14	7	< 1	< 1	< 1	< 1	< 1	< 1
Off highway (2002)[e]	10		75		29		3		3		3	
Highway vehicles (2002)[e]	144		1,372		118		3		3		3	
All county sources (2002)[e]	264		1,487		164		1,216		213		61	
Percent increase (projected emission/ county emission × 100)	< 1	< 1	< 1	< 1	8	4	< 1	< 1	< 1	< 1	< 1	< 1

a. To convert tons to metric tons, multiply by 0.90718; < = less than.
b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.
c. Maximum (Max.) length of rail alignment in Esmeralda County would be 44 kilometers (27 miles). (The maximum and minimum lengths along the complete rail alignment are not equal to the sum of the possible maxima or the minima in individual counties.)
d. Minimum (Min.) length of rail alignment in Esmeralda County would be 22 kilometers (14 miles).
e. Only includes anthropogenic (the influence of humans on the environment) source of emissions (DIRS 177709-MO0607NEI2002D.000).

Table 4-49 lists the maximum concentrations at any receptor point of the criteria pollutants that would result from operation of the proposed railroad near Goldfield. DOE modeled a 4-year period using 4 years of actual meteorological data. The table also lists the highest background concentration since 1991 of each air pollutant (see Section 3.2.4 for the basis of the background concentration), the relevant NAAQS for each air pollutant, and the maximum resulting concentration as a fraction of the NAAQS. The maximum concentrations during the operations phase near Goldfield would be below NAAQS for all air pollutants. The modeled maximum fraction of the NAAQS was 34 percent for $PM_{2.5}$. DOE did not model the Maintenance-of-Way Headquarters Facility south of Tonopah in Esmeralda County because the operations emissions associated with this facility would be much smaller (less than 1 percent) than for operation of the Interchange Yard in Lincoln County. Because DOE expects air pollutant concentrations resulting from operation of the Interchange Yard to be below the NAAQS, the Department considers it unlikely that air pollutant concentrations resulting from operation of the Maintenance-of-Way Headquarters Facility would exceed the NAAQS.

Table 4-49. Maximum air pollutant concentrations from operation of the proposed railroad near Goldfield, Nevada.

Averaging period	Air pollutant[a]		Background concentration[b]	Maximum project impact[c]	Maximum resulting concentration	NAAQS[d]	Maximum concentration (percent of standard)
1-hour	CO	ppm	0.2	< 0.001	0.2	35	1
3-hour	SO_2	ppm	0.002	< 0.0001	0.002	0.5	< 1
8-hour	CO	ppm	0.2	< 0.001	0.20	9	2
24-hour	PM_{10}	μg/m³	39	0.06	39	150	26
	$PM_{2.5}$	μg/m³	12	0.05	12	35	34
	SO_2	ppm	0.002	< 0.0001	0.002	0.14	1
Annual	NO_2	ppm	0.002	< 0.0001	0.002	0.053	4
	PM_{10}	μg/m³	12	0.02	12	50[e]	24
	$PM_{2.5}$	μg/m³	3.6	0.02	3.6	15	24
	SO_2	ppm	0.002	< 0.000001	0.002	0.03	7

a. CO = carbon monoxide; NO_2 = nitrogen dioxide; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; ppm = parts per million; SO_2 = sulfur dioxide; μg/m³ = micrograms per cubic meter.
b. Sources: DIRS 147771-CRWMS M&O 1996, p. 13; DIRS 102877-CRWMS M&O 1999, p. 14; DIRS 147780-SAIC 1992, p. 13; DIRS 168842-DOE 2003, all; DIRS 173738-DOE 2002, all; DIRS 173740-DOE 2004, all; DIRS 176996-DOE 2005, p. 38; DIRS 179948-DOE 2006, p. 40; CFR 50.4 through 50.11.
c. < = less than
d. NAAQS = National Ambient Air Quality Standards.
e. The U.S. Environmental Protection Agency revoked the annual PM_{10} standard effective December 18, 2006 (71 *FR* 60853, October 17, 2006), but the Nevada annual average PM_{10} standard remains in effect.

4.2.4.4 Shared-Use Option

Impacts to air quality along the Caliente rail alignment under the Shared-Use Option would be similar to those under the Proposed Action without shared use.

Under the Shared-Use Option, commercial entities could construct additional sidings of 300 meters (980 feet) in length at a number of locations along the rail alignment in Lincoln and Nye Counties. Operationally, the Shared-Use Option would consist of up to 60 railcars pulled by three or four locomotives at a frequency of up to three round trips per week.

The additional sidings would be placed parallel to track within the construction right-of-way and would not require additional rail roadbed foundation, only additional laying of track. Overall, additional construction-related emissions in Lincoln and Nye Counties would be very small. Appendix E, Section E.2.3, describes the rationale for not conducting additional emissions inventory calculations or air quality simulations to assess construction-related impacts under the Shared-Use Option.

Appendix E, Section E.2.3, also describes the methodology DOE used to calculate potential emissions that would result from the three additional round trips per week of commercial train activity associated with the Shared-Use Option.

For Lincoln County, Nye County, and Esmeralda County, Tables 4-50 through 4-52 compare the maximum annual incremental emissions expected from operation of commercial trains under the Shared-Use Option with each county's 2002 National Emission Inventory database emissions (DIRS 177709-MO0607NEI2002D.000). Also shown is the range of peak county-wide emissions that would result from the Proposed Action, as discussed in Section 4.2.4.3, and the resulting range of peak emissions totals by county. In both Lincoln and Esmeralda counties and for all air pollutants, the Shared-Use Option would increase emissions by less than 20 percent over the Proposed Action. The relative increase in Nye County would be larger (as much as 41 percent). However, both the Proposed Action and Shared-Use Option still would produce a relatively small increase over 2002 county-wide emissions totals. In all cases, after adding emissions associated with the Shared-Use Option to those predicted for the Proposed Action, emissions associated with railroad operations under the Shared-Use Option would remain less than 50 percent of 2002 county-wide emissions for all air pollutants in all counties.

As shown in Tables 4-50, 4-51, and 4-52, under the Shared-Use Option, total emissions would be increased marginally (as discussed above) beyond those associated with railroad operations under the Proposed Action. Likewise, the maximum air pollutant concentrations expected under the Shared-Use Option would be marginally increased. These levels have been shown to be low (see Tables 4-45, 4-46, and 4-49). Therefore, DOE did not perform additional and separate air quality modeling of air pollutant concentrations for the Shared-Use Option.

4.2.4.5 Greenhouse Gases

Emissions, Construction Activities Appendix E, Section E.2.1, describes the methodology DOE used to determine construction-related emissions. Sections E.2.1.2 through E.2.1.4 provide detail on the inventory for each of the three counties through which the Caliente rail alignment would pass. There are several atmospheric gases with the ability to contribute to global climate change, including carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and ozone (O_3). Of these, only CO_2 would contribute meaningful quantities from construction activities along the rail line and is thus the only gas considered in this analysis.

The methodology used to determine CO_2 emissions from construction activity along the rail line is identical to that described in Appendix E for other products of combustion. Emission factors for CO_2 from the Environmental Protection Agency's MOBILE6.2 and NONROAD (for Tier 1 equipment) models were coupled with construction activity values for each type of equipment associated with construction of the rail line. Running totals of emissions for each year of activity within each county were developed. Unlike criteria pollutants, however, CO_2 emissions are relevant only in aggregate. Thus, the emissions were aggregated into a single value for construction activity along the entire alignment for each of the 4 years of construction activity. Table 4-49a shows the highest annual emissions and the total emissions for construction of the entire Caliente rail alignment under a 4-year construction schedule. The same total amount would be released under a longer construction schedule.

Table 4-49a. Carbon dioxide emissions from construction of the Caliente rail alignment.

	Total CO_2[a] emissions	
Activity	Maximum length	Minimum length
Peak annual (tons[b] per year)	1,219,000	1,033,000
Total 4-year construction phase (tons)	3,643,000	3,085,000

a. CO_2 = carbon dioxide.
b. To convert tons to metric tons, multiply by 0.90718.

These values may be compared to the most recent (2005) overall U.S. emissions of CO_2 of 6,089,500,000 metric tons (6,712,525,000 tons) (DIRS 185248-EPA 2007, all). Thus, the peak year for the annual construction-related activity would increase the overall national CO_2 emissions by less than 0.02 percent over 2005 levels. U.S. emissions represent about 24 percent of the total global $C0_2$ emissions.

Emissions, Operations Activities Appendix E, Section E.2.2, describes the methodology DOE used to determine the operations emissions impact of the rail line over the life of the project. Sections E.2.2.2 through E.2.2.4 provide detail on the inventory for each of the three counties through which the Caliente rail alignment would pass. There are several atmospheric gases with the ability to contribute to anthropogenic global climate change, including carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and ozone (O_3). Of these, only CO_2 would be released in meaningful quantities from operations activities along the rail line and is thus the only gas considered in this analysis of operations emissions. Appendix E, Section E.2.2.5, provides additional information on the calculation methodology for CO_2 operations emissions.

Running totals of emissions for each year of activity within each county were maintained. Unlike criteria pollutants, however, CO_2 impacts are relevant only in aggregate. Thus, the emissions were aggregated into a single value for operations activity along the entire alignment for each of the maximum 50 years of rail operations activity. Table 4-49b shows the average annual emissions and the total emissions for operations over the entire Caliente rail alignment assuming a maximum operations period of 50 years.

Table 4-49b. Carbon dioxide emissions from operation of the Caliente rail alignment.

	Total CO_2[a] emissions	
	Maximum length	Minimum length
Operations average annual (tons[b] per year)	94,000	89,000
Total 50-year operations phase (includes shared use) (tons)	2,249,000	2,135,000

a. CO_2 = carbon dioxide.
b. To convert tons to metric tons, multiply by 0.90718.

These values may be compared to the most recent (2005) overall U.S. emissions of CO_2 of 6,089,500,000 metric tons (6,712,525,000 tons) (DIRS 185248-EPA 2007, all). Thus, the average operational year would increase overall national CO_2 emissions by about 85,275 metric tons (about 94,000 tons) (0.001 percent) over 2005 levels.

Air Quality Impacts Unlike criteria pollutants, impacts of greenhouse gas emissions are global and cannot be attributed to any particular source, because greenhouse gases are well mixed throughout the global lower atmosphere such that anthropogenic climate change is directly related to the global concentration of CO_2 in the atmosphere. Local emissions are quantifiable and contribute to cumulative climate change impacts. Construction and operation of the Caliente rail alignment would increase the state's CO_2 emissions as well as global CO_2 concentrations. Neither the State of Nevada nor the Federal Government has CO_2 emissions caps, thresholds, or targets. CO_2 emissions from the Proposed Action would add to state and national emissions, making a relatively small incremental contribution to cumulative emissions of CO_2. DOE is not aware of any methodology to correlate CO_2 emissions from specific projects to any specific impact on global climate change.

The potential impacts from climate change have most recently been identified and discussed by the Intergovernmental Panel on Climate Change (IPCC) in its fourth assessment report (DIRS 185132-IPCC 2007, all). This report describes an extensive peer review of analyses and a high degree of consensus on climate change issues among an international panel of contributing scientists. Studies such as the IPCC report support the premise that CO_2 emissions from the proposed project, together with global greenhouse gas emissions, would very likely have a cumulative impact on climate change. IPCC Working Group II identified the predicted consequences of climate change – specific to the project area, these include more frequent and intense heat waves and droughts; extended periods of high fire risk; and a decrease in mountain snow packs and an increase in winter flooding.

4.2.4.6 Summary

Potential impacts to air quality from construction and operation of the proposed railroad along the Caliente rail alignment would be as follows:

- The project would not cause conflicts with state or regional air quality management plans.
- The highest increase in air emissions from railroad operations would occur in the vicinity of the operations support facilities.
- Air pollutant concentrations would not exceed the NAAQS during the construction or operations phase, with the possible exception of the 24-hour NAAQS for PM_{10} that could be exceeded from quarry operations in South Reveille Valley during the construction phase. However, DOE would be required to obtain a Surface Area Disturbance Permit Dust Control Plan prior to quarry development and it would be likely that this would greatly reduce fugitive dust emissions, thus reducing the possibility of NAAQS exceedances.
- The highest increase in air pollutant emissions would occur during the construction phase.
- The highest increase in emissions would be for NO_x in Nye County, where construction emissions could be as much as 8,100 metric tons (8,900 tons) per year over the county's 2002 annual NO_x emissions.
- The Shared-Use Option would result in a slightly higher increase in air pollutant emissions and air pollutant concentrations than the Proposed Action.

Emissions for all air pollutants projected to be released during the construction phase would be greater than during the operations phase. Projected ambient concentrations of all air pollutants would be below the NAAQS, except possibly during quarry operations in South Reveille Valley. Therefore, the projected impacts throughout the region of influence, during both the construction and operations phases, would be small, except in the vicinity of the quarry. Under the Shared-Use Option, there would be an increase in emissions over those of the Proposed Action without shared use, but impacts to air quality would still be small. Table 4-53 summarizes impacts to air quality.

Table 4-50. Maximum and minimum peak annual emissions anticipated from operation of commercial trains along the Caliente rail alignment under the Shared-Use Option through Lincoln County, Nevada, and county-wide total railroad operations emissions compared to 2002 existing county emissions.

	Total emissions (tons per year)[a,b]											
	VOCs		CO		NO_x		PM_{10}		$PM_{2.5}$		SO_2	
Emissions source	Max length[c]	Min. length[d]	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length
Commercial trains/shared-use operations exhaust	3	3	11	10	61	54	2	2	2	2	< 1	< 1
Proposed railroad operations exhaust	14	14	56	55	205	201	6	6	6	6	< 1	< 1
Totals	17	17	67	65	270	255	8	8	8	8	< 1	< 1
Off highway (2002)[e]	37		211		777		22		20		46	
Highway vehicles (2002)[e]	442		4,792		387		13		10		10	
All county sources (2002)[e]	554		5,152		1,175		2,068		341		62	
Percent increase (projected emission/county emission × 100)	3	3	1	1	23	22	< 1	< 1	2	2	< 1	< 1

a. To convert tons to metric tons, multiply by 0.90718; < = less than.
b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.
c. Maximum (Max.) length of rail alignment in Lincoln County would be 148 kilometers (92 miles). (The maximum and minimum lengths along the complete rail alignment are not equal to the sum of the possible maxima or the minima in individual counties.)
d. Minimum (Min.) length of rail alignment in Lincoln County would be 132 kilometers (82 miles).
e. Only includes anthropogenic (the influence of humans on the environment) source of emissions (DIRS 177709-MO0607NEI2002D.000).

Table 4-51. Maximum and minimum peak annual incremental emissions anticipated from operation of commercial trains along the Caliente rail alignment under the Shared-Use Option through Nye County, Nevada, and county-wide total railroad operations emissions compared to 2002 existing county emissions.

	Total emissions (tons per year)[a,b]											
	VOCs		CO		NO_x		PM_{10}		$PM_{2.5}$		SO_2	
Emissions source	Max. length[c]	Min. length[d]	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length
Commercial trains/shared use operations exhaust	9	8	30	26	160	140	6	5	6	5	< 1	< 1
Proposed railroad operations exhaust	41	40	150	150	560	540	18	17	16	16	2	1
Totals	50	48	180	170	720	680	24	22	22	21	2	1
Off highway (2002)[e]	372		1,967		219		30		28		24	
Highway vehicles (2002)[e]	1,469		15,375		1,155		35		28		31	
All county sources (2002)[e]	2,507		18,778		1,580		3,656		715		261	
Percent increase (projected emission/county emission ×100)	2	2	1	1	45	43	< 1	< 1	3	3	< 1	< 1

a. To convert tons to metric tons, multiply by 0.90718; < = less than.
b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.
c. Maximum (Max.) length of rail alignment in Nye County would be 398 kilometers (247 miles). (The maximum and minimum lengths along the complete rail alignment are not equal to the sum of the possible maxima or the minima in individual counties.)
d. Minimum (Min.) length of rail alignment in Nye County would be 342 kilometers (213 miles).
e. Only includes anthropogenic (the influence of humans on the environment) source of emissions (DIRS 177709-MO0607NEI2002D.000).

Table 4-52. Maximum and minimum peak annual incremental emissions anticipated from operation of commercial trains along the Caliente rail alignment under the Shared-Use Option through Esmeralda County, and county-wide total railroad operations emissions compared to 2002 existing county emissions.

	Total emissions (tons per year)[a,b]											
	VOCs		CO		NO_x		PM_{10}		$PM_{2.5}$		SO_2	
Emissions source	Max. length[c]	Min. length[d]	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length
Commercial trains/shared-use operations exhaust	1	1	3	2	18	9	1	< 1	1	< 1	< 1	< 1
Proposed railroad operations exhaust	1	< 1	3	1	14	7	< 1	< 1	< 1	< 1	< 1	< 1
Totals	2	1	6	3	32	16	1	< 1	1	< 1	< 1	< 1
Off highway (2002)[e]	10		75		29		3		3		3	
Highway vehicles (2002)[e]	144		1,372		118		3		3		3	
All county sources (2002)[e]	264		1,487		164		1,216		213		61	
Percent increase (projected emission/ county emission multiplied by 100)	< 1	< 1	< 1	< 1	20	10	< 1	< 1	< 1	< 1	< 1	< 1

a. To convert tons to metric tons, multiply by 0.90718; < = less than.

b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.

c. Maximum (Max.) length of rail alignment in Esmeralda County would be 44 kilometers (27 miles). (The maximum and minimum lengths along the complete rail alignment are not equal to the sum of the possible maxima or the minima in individual counties.)

d. Minimum (Min.) length of rail alignment in Esmeralda County would be 22 kilometers (14 miles).

e. Only includes anthropogenic (the influence of humans on the environment) source of emissions (DIRS 177709-MO0607NEI2002D.000).

Table 4-53. Summary of potential impacts to air quality – Caliente rail alignment[a,b] (page 1 of 4).

County/rail line segment/facility	Construction impacts	Operations impacts
Rail line		
Lincoln County		
Caliente alternative segment; Eccles alternative segment; Caliente common segment 1; Garden Valley alternative segments 1, 2, 3, and 8; and Caliente common segment 2	Construction activities would add less than the 2002 county-wide burden of SO_2, CO, and VOCs. PM_{10}, $PM_{2.5}$, and NO_x would each have increases greater than the 2002 county-wide burden. However, these emissions would be distributed over the entire length of the rail line in the county; thus, no air quality standard would be exceeded.	Operations activities would add less than about 20 percent to the 2002 county-wide burden of all criteria pollutants and would not lead to a violation of air quality standards.
	Modeling of emissions from construction of the rail line near Caliente showed no air pollutant would exceed 40 percent of the NAAQS for any averaging period.	Modeling of emissions from operation of the rail line near Caliente showed no air pollutant would exceed 40 percent of the NAAQS for any averaging period.
Nye County		
Caliente common segment 1, Garden Valley alternative segments 1, 2, and 3; Caliente common segment 2; South Reveille alternative segments 2 and 3; Caliente common segment 3; Goldfield alternative segments 1, 3, and 4; Caliente common segment 4; Bonnie Claire alternative segments 2 and 3; common segment 5; Oasis Valley alternative segments 1 and 3; common segment 6	Construction activities would add less than the 2002 county-wide burden of VOCs, CO, and SO_2. $PM_{2.5}$, PM_{10}, and NO_x would each have an increase greater than the 2002 county-wide burden. However, these emissions would be distributed over the entire length of the rail line in the county; thus, no air quality standard would be exceeded.	Operations activities would add less than about 40 percent to the 2002 county-wide burden of all criteria pollutants and would not lead to a violation of air quality standards.
Esmeralda County		
Goldfield alternative segments 1 and 4; common segment 4	Construction activities would add less than the 2002 county-wide burden of SO_2, CO, VOCs, PM_{10}, and $PM_{2.5}$. NO_x would have an increase greater than the 2002 county-wide burden. However, emissions would be distributed over the entire length of the rail line in the county; thus, no air quality standard would be exceeded.	Operations activities would add less than 6 percent to the 2002 county-wide burden of all criteria pollutants and would not lead to a violation of air quality standards.
	Modeling of emissions from construction of the rail line near Goldfield showed no air pollutant would exceed 90 percent of the NAAQS for any averaging period.	Modeling of emissions from operation of the rail line near Goldfield showed no air pollutant would exceed 34 percent of the NAAQS for any averaging period.

Table 4-53. Summary of potential impacts to air quality – Caliente rail alignment[a,b] (page 2 of 4).

County/rail line segment/facility	Construction impacts	Operations impacts
Rail line (continued)		
Construction and operations support facilities		
Lincoln County		
Access roads (including alignment service road)	About 40 percent of PM_{10} construction fugitive dust emissions would be from access roads. In no case would this be expected to lead to an exceedance of any air quality standards.	Operations would result in very small emissions from access roads.
Interchange Yard	Modeling of emissions from construction at the Interchange Yard in Caliente showed no air pollutant would exceed 36 percent of the NAAQS for any averaging period.	Modeling of emissions from operation of the Interchange Yard in Caliente showed no air pollutant would exceed 36 percent of the NAAQS for any averaging period.
Quarries	Using conservative modeling assumptions, no exceedances of the NAAQS would be expected at potential quarry CA-8B, with most values expected to be well below the NAAQS.	Quarries would be reclaimed following rail line construction and would have no emissions during the operations phase.
Other facilities	Construction dust and exhaust emissions would be very small.	Operations would result in very small emissions from other facilities.
Construction camps 1, 2, 3,4, and 5	Only about 2 percent of the fugitive dust emissions would be due to construction of the construction camps. In no case would construction camp emissions be expected to cause an exceedance of any air quality standards.	Construction camps would be reclaimed following the construction phase and would have no emissions during the operations phase.
Wells	Well construction would be responsible for less than 1 percent of the fugitive dust emissions. In no case would construction of the wells be expected to cause an exceedance of any air quality standards.	Operation of the wells would result in very small emissions because only a few wells would continue to operate after the completion of construction to serve as the water source for facility operations.
Nye County		
Access roads (including alignment service road)	About 40 percent of fugitive dust emissions would be from the access roads. In no case would this be expected to lead to an exceedance of any air quality standards.	Operations would result in very small emissions from access roads.
Maintenance-of-Way Trackside Facility	Construction of the Maintenance-of-Way Trackside Facility would account for less than 1 percent of fugitive dust emissions. In no case would this be expected to cause an exceedance of any air quality standards.	The Maintenance-of-Way Trackside Facility would be responsible for less than 1 percent of the operations emissions in Nye County.

Table 4-53. Summary of potential impacts to air quality – Caliente rail alignment[a,b] (page 3 of 4).

County/rail line segment/facility	Construction impacts	Operations impacts
Construction and operations support facilities (continued)		
Rail Equipment Maintenance Yard and Cask Maintenance Facility	Combined, construction of the Rail Equipment Maintenance Yard and Cask Maintenance Facility would account for less than 1 percent of fugitive dust emissions. In no case would this be expected to cause an exceedance of any air quality standards.	Combined, the Rail Equipment Maintenance Yard and Cask Maintenance Facility would be responsible for about 84 percent of the operations emissions in Nye County.
Quarries	Modeling of emissions from potential quarry NN-9B indicates that the 24-hour PM_{10} NAAQS could be exceeded. However, the required Surface Disturbance Permit would greatly reduce PM_{10} emissions, making an exceedance of the NAAQS unlikely.	Quarries would be reclaimed following the construction phase and would have no emissions during the operations phase.
Nevada Railroad Control Center and National Transportation Operations Center	Construction dust and exhaust emissions would be very small.	Operation of these facilities would result in very small emissions.
Construction camps 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, and 12	Only about 2 percent of the fugitive dust emissions would be from construction camps. In no case would this be expected to cause an exceedance of any air quality standards.	Construction camps would be reclaimed following the construction phase and would have no emissions during the operations phase.
Wells	Well construction would be responsible for about 2 percent of fugitive PM_{10} emissions. In no case would this be expected to cause an exceedance of any air quality standards.	Operation of the wells would result in very small emissions because only a few wells would continue to operate after the construction phase to serve as the water source for facility operations.
<u>Esmeralda County</u>		
Access roads (including alignment service road)	About 40 percent of fugitive dust emissions would be from the access roads. In no case would this be expected to lead to an exceedance of any air quality standards.	Operations would result in very small emissions from access roads.
Maintenance-of-Way Headquarters Facility	Construction emissions associated with the Maintenance-of-Way Headquarters Facility would account for less than 1 percent of construction fugitive dust emissions. In no case would Headquarters Facility construction emissions be expected to cause an exceedance of any air quality standards.	Operation of the Maintenance-of-Way Headquarters Facility would result in very small emissions.

Table 4-53. Summary of potential impacts to air quality – Caliente rail alignment[a,b] (page 4 of 4).

County/rail line segment/facility	Construction impacts	Operations impacts
Construction and operations support facilities (continued)		
Maintenance-of-Way Facility	Construction emissions associated with the Maintenance-of-Way Facility would account for less than 1 percent of construction fugitive dust emissions. In no case would facility construction emissions be expected to cause an exceedance of any air quality standards.	Operation of the Maintenance-of-Way Facility would result in very small emissions.
Construction camp 9	Only about 0.4 percent of the fugitive dust emissions would be due to construction of this construction camp. In no case would the construction camp emissions be expected to cause an exceedance of any air quality standards.	Construction camps would be reclaimed following the construction phase and would have no emissions during the operations phase.
Wells	Well construction would be responsible for less than 1 percent of the fugitive PM_{10} emissions. In no case would construction of the wells be expected to cause an exceedance of any air quality standards.	Operation of the wells would result in very small emissions because only a few wells would continue to operate after the construction phase to serve as the water source for facility operations.

a. Impacts to air quality under the Shared-Use Option would be similar to those under the Proposed Action without shared use.
b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds; NAAQS = National Ambient Air Quality Standards.

4.2.5 SURFACE-WATER RESOURCES

This section describes potential impacts to surface-water resources (***washes***, playas, ***floodplains***, and ***wetland*** areas) from constructing and operating the proposed railroad along the Caliente rail alignment. Section 4.2.5.1 describes the methodology DOE used to analyze potential impacts; Section 4.2.5.2 describes potential construction impacts; Section 4.2.5.3 describes potential operations impacts; Section 4.2.5.4 describes potential impacts under the Shared-Use Option; and Section 4.2.5.5 summarizes potential impacts to surface-water resources.

4.2.5.1 Impact Assessment Methodology

As described in Section 3.2.5.1, the region of influence for surface-water resources would be limited in most cases to the nominal width of the rail line construction right-of-way. In some cases the region of influence would extend beyond the construction right-of-way. Construction and operations activities along the rail line could impact a larger area in cases where surface-water drainages could carry pollutants (such as petroleum-based lubricants and fuels) and eroded soil downstream of the rail line or in cases where floodwaters backed up on the upstream side of the rail line.

DOE evaluated potential impacts to surface-water resources based on a series of criteria, as listed in Table 4-54. There would be an impact if railroad construction and operations would cause any of the conditions listed in Table 4-54. To avoid or limit adverse impacts to surface-water resources, the Department would comply with applicable laws, regulations, policies, standards, and directives, and implement best management practices (see Chapter 7). Most importantly, careful pre-planning of construction and operations activities would allow the Department to assess and minimize potential impacts before they occurred (see Section 2.1).

Table 4-54. Impact assessment criteria for surface-water resources (page 1 of 2).

Resource criteria	Basis for assessing adverse impact
Stormwater drainage	Would railroad construction or operations: • Alter stormwater discharges, which could adversely affect drainage patterns, flooding, and/or erosion and sedimentation • Alter infiltration rates, which could adversely affect (increase or decrease) the volume of surface water that flows downstream • Conflict with applicable stormwater management plans or ordinances
Surface-water quality	Would railroad construction or operations: • Contaminate public water supplies and other surface waters, exceeding water quality criteria or standards established in accordance with the Clean Water Act, state regulations, or permits • Conflict with regional water quality management plans or goals
Surface-water availability and uses	Would railroad construction or operations: • Alter the capacity of available surface-water resources, such that human health, the environment, or personal property would be adversely affected • Conflict with established water rights or regulations protecting surface-water resources for future beneficial uses
Wetlands and waters of the United States	Would railroad construction or operations: • Cause filling of wetlands or otherwise alter drainage patterns such that wetlands or waters would be adversely affected

Table 4-54. Impact assessment standards for surface-water resources (page 2 of 2).

Resource criteria	Basis for assessing adverse impact
Floodplains and floodwaters	Would railroad construction or operations: • Alter floodway or floodplain or otherwise impede or redirect flows such that human health, the environment, or personal property would be adversely affected • Conflict with applicable flood management plans or ordinances
Springs	Would railroad construction or operations: • Alter or contaminate springs such that human health, the environment, or personal property would be adversely affected

The areas where surface-water impacts would be greatest and where DOE would implement direct controls (such as erosion and sedimentation controls) would be within the construction right-of-way. The Department expects that the numbers and types of surface-water features within the construction right-of-way would have a direct relationship to the degree of impacts within this area. To evaluate potential impacts to surface water, the Department identified areas where there are drainage channels, floodplains, springs, and wetlands along the rail alignment (including those it would cross or cover) and identified the activities associated with construction or operations that would have the potential to impact these surface-water resources.

4.2.5.2 Construction Impacts

Section 3.2.5 describes surface-water resources along the Caliente rail alignment. Table 4-55 lists the numbers of surface-water features within the nominal width of the rail line construction right-of-way and support facilities. The table includes estimates of the number of drainage channels the Caliente rail alignment alternative segments and common segments would cross. DOE identified drainage channels using the National Hydrological Dataset, a U.S. Geological Survey dataset of hydrologic features. The table also identifies two subsets of the total number of drainage channel crossings. The first is the notable channels described in Section 3.2.5.2.1. The second subset is the washes DOE classified as ***waters of the United States*** during field studies in support of this Rail Alignment EIS.

This section also addresses impacts to surface-water quality, and water availability and usage. Springs are also evaluated because they are a significant source of surface water within and near the Caliente rail alignment region of influence.

Floodplains and wetlands are two other important surface-water features the Department evaluated as part of this analysis. Appendix F, Floodplain and Wetlands Assessment, provides additional information on wetlands and floodplains the Caliente rail alignment could encounter. Appendix F includes figures showing the locations of these surface-water features and provides more detail on their characteristics.

4.2.5.2.1 Impacts Common to the Entire Rail Alignment

The following sections describe common impacts identified and assessed for activities associated with construction of the proposed railroad along the Caliente rail alignment. DOE would minimize impacts through the engineering design (see Section 2.2) and the implementation of best management practices (see Chapter 7).

4.2.5.2.1.1 Stormwater Drainage. Construction of the proposed railroad could result in both direct and indirect impacts to surface-water resources. Direct impacts would result from the temporary or permanent grading, dredging, rerouting, or filling of ***ephemeral*** or ***intermittent streambeds***. Indirect

Table 4-55. Summary of drainages the rail line and support facilities would cross – Caliente rail alignment.

Rail line segments/facilities	Total[a]	Notable drainages[b]	Waters of the United States[c]
Caliente alternative segment	15	10	5
Staging Yard (Indian Cove option)	10	7	1 (bridged)
Staging Yard (Upland option)	13	9	1 (bridged)
North quarry siding (Upland option)	0	0	0
Eccles alternative segment	15	8	11
Interchange Yard	1	0	1
Staging Yard (Eccles-North)	10	7	4
Caliente common segment 1	144	33	17
Garden Valley alternative segment 1	25	13	0
Garden Valley alternative segment 2	19	13	0
Garden Valley alternative segment 3	28	12	0
Garden Valley alternative segment 8	18	10	0
Caliente common segment 2	35	12	0
South Reveille alternative segment 2	9	5	0
South Reveille alternative segment 3	11	6	0
Caliente common segment 3	92	31	0
Maintenance-of-Way Trackside Facility	1	1	0
Goldfield alternative segment 1	25	9	0
Goldfield alternative segment 3	15	6	0
Goldfield alternative segment 4	26	6	0
Maintenance-of-Way Headquarters Facility	1	0	0
Caliente common segment 4	9	1	0
Bonnie Claire alternative segment 2	31	11	0
Bonnie Claire alternative segment 3	23	9	0
Common segment 5	124	84	0
Oasis Valley alternative segment 1	24	15	2 (bridged)
Oasis Valley alternative segment 3	28	11	1 (bridged)
Common segment 6	43	20	14
Rail Equipment Maintenance Yard	1	0	0

a. All drainages identified in National Hydrologic Dataset (DIRS 177714-MO0607NHDFLM06.000).
b. Only includes drainages with stream order equal to or greater than two from the National Hydrologic Dataset (DIRS 177714-MO0607NHDFLM06.000).
c. Source: DIRS 183595-PBS&J 2006, Figures 3A through 3E.

impacts would include increases in ***nonpoint source pollution*** resulting from runoff from construction areas where surface grades and characteristics had been changed (such as the rail roadbed, facilities, and access roads). Cut and fill operations during rail line construction would cause the alteration of natural drainage patterns and runoff rates in some areas that could affect downgradient resources. Construction activities that could temporarily block surface drainage channels include moving large amounts of soil and rock to develop the track platform and constructing temporary access roads to reach construction initiation points and major structures, such as bridges, and movement of equipment to the construction initiation points. Depending on site conditions, construction could include regrading so that a number of minor drainage channels would collect in a single ***culvert*** or pass under a single bridge, resulting in water flowing from a single location on the downstream side rather than across a broader area. As a result, there would be some localized changes in drainage patterns.

Regrading and rerouting washes through channelization, including the installation of culverts and stabilization of existing stream banks, could increase the flow rate in relation to natural flow conditions. Culverts and improved channels would provide less resistance to flow so that the flow rate of runoff could increase as it passed through such a structure. The speed by which water flows through a drainage structure (a culvert, a bridge, or a stream channel) affects the erosive potential of the flow; therefore, the design of drainage structures must account for the potential for scour and erosion and incorporate outlet protection and velocity-dissipating devices that calm the flow and lessen its erosive potential. Without such protective measures, scour might occur, especially around bridge piers and abutments, where water flowing past a pier or abutment could erode the supporting soil and sediment around these structures. As the speed of flow increased, the chances for the entire streambed and bank to be exposed to scour and erosion would increase.

DOE would incorporate hydraulic modeling into the final design process to ensure that crossings are properly engineered so that they would not contribute to erosion and sediment pollution, and impacts to surface-water resources downstream of the rail line would be greatly minimized. Therefore, impacts associated with surface-water drainage patterns from rail line construction would be small.

DOE would employ standard engineering design practices to size and place culverts to move runoff water from one side of the track to the other. These culverts or other means of runoff control would be put in place as part of subgrade construction to prevent surface water from backing up or impeding flow. Preliminary rail line design includes various structures to accommodate drainage features the rail line would cross (DIRS 182824-Nevada Rail Partners 2007, p. i). These structures include slab bridges with multiple piers spaced at 4-meter (13-foot) intervals; double cell bridges with multiple piers spaced at 10-meter (33-foot) intervals; shaft-supported bridge structures with spans between end shafts of 14 to 24 meters (45 to 80 feet); precast reinforced concrete box culverts with a maximum cross-section size of 3.7 meters by 3.7 meters (12 feet by 12 feet); and corrugated metal pipe culverts of various diameters.

Except in areas where drainage structures would cross a Federal Emergency Management Agency-designated 100-year floodplain, hydraulic design would be based on typical Class 1 freight railroad standard design criteria. Floodplain crossings are described in Section 4.2.5.2.1.6. Class 1 freight railroad standard criteria require that the ***50-year flood*** should not come into contact with the top (crown) of the culvert or the lowest point of the bridge, whichever is applicable. For the ***100-year flood***, these criteria require that the floodwaters should not rise above the ***subgrade elevation*** at the structure. To conform to these standards, DOE would use circular culverts where flow rates would be small (less than 4 cubic meters per second [140 cubic feet per second]). For larger flows (up to 28 cubic meters per second [1,000 cubic feet per second]), DOE would use box culverts. The Department would construct bridges where flows were larger and where the rail surface would not be tall

50-year flood is a flood that has a 2-percent chance of being equaled or exceeded in any given year.

100-year flood is a flood that has a 1-percent chance of being equaled or exceeded in any given year. A base flood may also be referred to as a 100-year storm and the area inundated during the base flood is sometimes called the 100-year floodplain.

500-year flood is a flood that has a 0.2-percent chance of being equaled or exceeded in any given year.

Subgrade elevation of the rail line is the elevation of the top of the ***subballast***.

Subballast is a layer of crushed gravel that is used to separate the ***ballast*** and roadbed for the purpose of load distribution and drainage.

Ballast is crushed stone used to support the railroad ties and provide drainage.

enough to accommodate a sufficiently sized culvert, and would install the culverts with ***riprap*** around the exposed ends to protect the fill material from erosion (DIRS 182824-Nevada Rail Partners 2007, p. ii). Bridge abutments and piers would be similarly protected. In some places, training dikes or berms would be required to redirect flow and ensure that the flow would be conveyed through the structure. In places, channel improvements might be necessary for a short distance upstream and downstream of the rail line to intercept and effectively redirect flows through drainage structures.

DOE would analyze crossings on a case-by-case basis and propose culverts whenever feasible. Where there would be very wide and shallow depths of flow during a 100-year flood, or the flow would be divided into multiple natural channels that would cross the rail line, the Department would use a series of multiple culverts, potentially in concert with small bridges to span the main flow channel. In locations where there were very high fill conditions, it would be more economical to use multiple culverts than to construct a bridge (DIRS 182824-Nevada Rail Partners 2007, p. ii). Because DOE would design stormwater conveyance systems to safely convey design floods (50-year and 100-year) and would minimize concentration of flow to the greatest extent practicable, impacts on stormwater conveyance associated with construction of the rail line would be small.

Construction activities that disturbed the land surface, such as grading, excavation, or stockpiling, would have the potential to alter the rate at which water could infiltrate the disturbed areas. Depending on the type of disturbance, the infiltration rate could increase (for example, in areas with loosened soil) or decrease (for example, in areas where construction activities had compacted the soil or involved the installation of impermeable surfaces like asphalt pads, concrete surfaces, or buildings). Most of the land disturbance during the construction phase would result in surfaces with lower infiltration rates; that is, the surfaces would be less permeable than natural soil conditions and would cause an increase in runoff. The change in the amount of runoff that would actually reach the drainage channels would be minor, because construction would affect a small amount of the overall natural drainage area (DIRS 155970-DOE 2002, p. 4-24). Therefore, adverse impacts associated with changes in stormwater infiltration and runoff rates would be small.

DOE would construct a rail alignment service road (up to 7.3 meters [24 feet] wide) along most of the rail line within the rail line construction right-of-way to support operations. Additional access roads could be needed to provide access to the construction support facilities, such as construction camps, wells, and quarries. DOE would improve all access roads as necessary in accordance with the parameters for rural roads as defined by the Nevada Department of Transportation and the American Association of State Highway and Transportation Officials (DIRS 180922-Nevada Rail Partners 2007, p. 4-20). The Department would excavate roadside ditches on both sides of the roadway as necessary to direct stormwater to drainage features and washes. Most access roads would likely have gravel surfaces, except for those to wells. Dip sections (depressions in a road that allow stormwater to flow across the road surface) would be used to convey ephemeral flows across the road surfaces (DIRS 180922-Nevada Rail Partners 2007, p. 4-20).

DOE would locate most wells along the two alignment access roads or adjacent to existing roads; however, construction of new access roads to distant wells might be required in four cases (total distance of less than 5.5 kilometers [3.5 miles]). These roads would be needed to reach the well sites and to accommodate temporary pipelines constructed to convey water to the construction right-of-way. DOE would construct temporary pipelines on top of the ground next to an existing road or a new access road (DIRS 180922-Nevada Rail Partners 2007, p. 4-12). The Department would position the temporary pipelines so they would not obstruct or redirect surface runoff or natural drainage channels. Therefore, there would be no adverse impacts to surface-water resources from construction of temporary pipelines.

Water would be required for compaction of fill material to construct the embankment areas of the rail roadbed. Compaction of fill would require approximately 6.8 billion liters (1.8 billion gallons) of water (DIRS 180922-Nevada Rail Partners 2007, p. 4-10). To stay within the plastic limits of the soil, fill would not be completely saturated, and runoff will be intentionally avoided. DOE would use standard erosion-control practices during compaction activities. Water would also be required for dust control along roads used to access the rail alignment during construction activities. Approximately 250 million liters (65 million gallons) of water would be required for dust control over a 3-year period. DOE would use standard construction dust-control measures. Water quantities used for dust suppression in these areas would not be expected to result in runoff.

DOE would minimize construction impacts to stormwater drainage through engineering design (see Section 2.2) and implementation of best management practices (see Chapter 7). A National Pollutant Discharge Elimination System General Construction Permit would be required for construction activities. In accordance with this permit, construction contractors would be required to prepare and submit a Stormwater Pollution Prevention Plan, which would be prepared consistent with state and federal standards for construction activities and would detail the best management practices that would be employed to minimize soil loss and degradation to nearby water resources. Design of the best management practices program would be based on practices listed in the *Best Management Practices Handbook* developed by the Nevada Division of Environmental Protection and the Nevada Division of Conservation Districts (DIRS 176309-NDEP 1994, all) and the *Storm Water Quality Manuals Construction Site Best Management Practices Manual* developed by the Nevada Department of Transportation (DIRS 176307-NDOT 2004, all).

Best management practices are structural and nonstructural controls that would be used to control nonpoint source pollution such as sedimentation and stormwater runoff. Structural controls are those best management practices that need to be constructed (such as detention or retention basins). Nonstructural controls refer to best management practices that typically do not require construction, such as planning, education, revegetation, or other similar measures. Stormwater runoff and sedimentation are typically addressed through the use of temporary and permanent best management practices, including techniques such as grading that would induce positive drainage; silt fences; and revegetation to minimize or prevent soil exposed during construction from becoming sediment to be carried offsite. Best management practices would be implemented, inspected, and maintained to minimize the potential for adverse impacts to downstream water quality. Chapter 7 describes best management practices in more detail.

4.2.5.2.1.2 Surface-Water Quality. Construction activities could adversely impact surface-water quality due to the potential for erosion and sediment during precipitation events. Sediment would generally be contained onsite through the use of best management practices, including erosion- and sedimentation-control measures. DOE would take appropriate and applicable measures during construction to minimize alteration of natural drainage patterns, erosion, and sediment loading. These measures would reduce potential for increased erosion and subsequent sedimentation and ensure that any downstream water did not experience increases in sediment loading or turbidity that would threaten the beneficial use of that water. Standard engineering design practices would be employed and hydraulic modeling would be incorporated into the final design process to ensure that crossings are properly engineered so that they would minimize impacts to surface-water resources from erosion and sediment pollution. Therefore, the potential for off-site impacts to surface water from increased sediment loads would be small.

Water-quality impacts are also possible from potential release and spread of ***contaminants*** (materials potentially harmful to human health or the environment), which could be released through an accidental spill or discharge. These types of releases could be localized if there was a small spill or widespread if precipitation or intermittent runoff carried contaminants away from the site of the spill. For the areas of the Caliente rail alignment near surface-water bodies, contaminants could be released directly to surface water; however, there are only a few places where there are surface-water bodies along the rail alignment.

Section 4.2.12, Hazardous Materials and Waste, describes construction materials that could be mishandled (spilled), including petroleum products (such fuels and lubricants) and coolants (such as antifreeze). Incidental spills could also include solvents used for cleaning or for degreasing equipment. The construction camps would include some bulk storage of hazardous materials, and supply trucks would routinely bring new materials and remove used materials and wastes (such as lubricants and coolants) from the construction sites (see Section 4.2.12). These activities would present some potential for incidental spills and releases, the significance of which would depend largely on the nature and volume of the material spilled and its location. A release or spill of pollutants to a stream or river, or stormwater runoff carrying pollutants to such receptors, would have the greatest potential to adversely impact surface-water quality.

The potential for water-quality impacts during the construction phase would be small because the environment along the Caliente rail alignment is arid and there is little flowing water. To avoid or limit adverse impacts to surface-water resources, the Department would comply with applicable laws, regulations, policies, standards, and directives, and implement best management practices (see Chapter 7). Also, construction contractors would be required to comply with regulatory requirements for spill-prevention measures, reporting and remediating spills, and properly disposing of or recycling used materials (as described in Chapter 7). Common stormwater pollution control practices mandate that hazardous materials be stored inside facilities or have secondary containment or other protective devices and that spill control and containment equipment be stationed close to hazardous material (for example, fuel) storage. Thus, construction and operation of the railroad would not result in the violation of any applicable State of Nevada water-quality standards.

Sanitary sewage generated at construction camps would be treated onsite or collected and trucked to a ***wastewater treatment*** plant. A portable wastewater treatment facility could be installed at each construction camp. As a water conservation measure, the Department would use treated wastewater effluent (***gray water***) produced at the camps for dust suppression and soil compaction. These water conservation measures would help reduce the demands placed on groundwater wells. The portable wastewater treatment plants would be designed and operated so that generated effluent would not adversely impact the quality of surface water with which it comes in contact; therefore, impacts to surface-water quality from wastewater treatment operations during the construction phase would be small. There would be no on-site discharges of industrial wastewater during the construction phase.

The wastewater treatment process would result in the production of biosolids (sludge). DOE would store biosolids on the sites and allow them to dry until the conditions specified in federal regulations (40 CFR Part 503) and state regulations are met. DOE would dispose of biosolids at a licensed facility in accordance with all applicable state and federal laws (DIRS 180922-Nevada Rail Partners 2007, p. 4-7).

4.2.5.2.1.3 Surface-Water Availability and Uses. See Section 4.2.2, Land Use and Ownership, for a discussion of impacts to manmade water systems.

4.2.5.2.1.4 Waters of the United States. Jurisdictional waters of the United States subject to Section 404 of the Clean Water Act include interstate waters and intrastate waters with a connection to interstate commerce, tributaries to such waters, and wetlands that are adjacent to waters of the United States. Section 404 prohibits discharge of dredged or fill material into jurisdictional waters if a practicable alternative exists that would be less damaging to the aquatic environment, or if the Nation's waters would be significantly degraded. In other words, it must be demonstrated that, to the extent practicable, steps have been taken to avoid impacts and that potential impacts on waters of the United States have been minimized and mitigation is provided for any remaining unavoidable impacts (if required). See Chapter 6, Statutory, Regulatory, and Other Applicable Requirements, for further discussion of the Clean Water Act Section 404 requirements.

The U.S. Army Corps of Engineers is responsible for determining whether drainages and wetlands along the rail alignment are regulated under Section 404; therefore, all conclusions in this analysis about the classification of washes and wetlands as waters of the United States are tentative. On June 5, 2007, the U.S. Environmental Protection Agency and U.S. Army Corps of Engineers released interim guidance that addresses the jurisdiction over waters of the United States under the Clean Water Act. Based on this guidance, it is likely that many of the drainages along the rail alignment that DOE currently considers to be waters of the United States might not be considered as such. If DOE selected the Caliente rail alignment for construction of the proposed railroad, the Department would request that the U.S. Army Corps of Engineers determine the limits of jurisdiction under Section 404 along the rail alignment before beginning construction.

Estimates for potential fill area and quantity of fill for waters of the United States are provided in this section to support an understanding of compliance with Section 404 (see Table 4-56). These estimates were calculated based on the depth and width of the water body that would be crossed and the type of engineered structure planned for each crossing. For crossings with culverts, DOE assumed that culverts would be extended 12 meters (40 feet) on either side of the cut/fill boundary for the rail roadbed. For bridges over waters of the United States having a width of less than 3 meters (10 feet), DOE assumed that no fill would be placed in the channel. For bridges over wider channels, DOE assumed that there would be one bridge pier every 6 meters (20 feet) and that each pier would cover a surface area of 1.9 square meters (20 square feet). Fill estimates calculated for these crossings depend on channel depths. These fill estimates represent an upper bound estimate, because the drainages currently identified during this analysis as waters of the United States might not be considered waters of the United States under the new U.S. Army Corps of Engineers guidance.

Table 4-56 also provides the estimated total amount of wetlands (jurisdictional and nonjurisdictional) requiring fill along the Caliente rail alignment. The actual amount of wetlands classified as jurisdictional wetlands subject to regulation under Section 404 of the Clean Water Act will be made by the U.S. Army Corps of Engineers.

If DOE constructed the railroad along the Caliente rail alignment, there would be no practicable alternative to crossing some ***ephemeral streams*** in the Meadow Valley Wash and Amargosa River drainage systems that are waters of the United States. In those areas, there are numerous ephemeral waters of the United States that flow perpendicular to the general direction of the rail line, and the rail line would have to cross them. DOE would construct bridges across many of the ephemeral waters of the United States along the rail line, and very little or no fill in regulated stream channels would be required for those crossings. The Department would place culverts in the smaller ephemeral streams. Because the size of these regulated channels is generally less than 1 to 2 meters (3.3 to 6.6 feet), the area filled per crossing would typically be less than about 100 square meters (0.03 acre). The crossings would be designed so that they would not alter stream flow, and the Department would implement best management practices (see Chapter 7) to minimize sedimentation during and after construction.

4.2.5.2.1.5 Wetlands. Executive Order 11990, *Protection of Wetlands*, requires that federal agencies "…take action to minimize the destruction, loss, or degradation of wetlands…" The Executive Order requires consideration of all wetlands regardless of whether they are regulated under Section 404 of the Clean Water Act. DOE regulations at 10 CFR Part 1022 direct that impacts to wetlands be avoided wherever possible and minimized to the extent practicable during construction projects. In accordance with Executive Order 11990 and 10 CFR Part 1022, this Rail Alignment EIS examines impacts to all

Table 4-56. Summary of waters of the United States and wetlands – Caliente rail alignment common and alternative segments.[a]

Rail line segment/facility	Waters of the United States crossings[b]	Waters of the United States fill area (acres)[c]	Waters of the United States fill volume (cubic feet)[d]	Wetlands fill area (acres)
Caliente alternative segment				
Upland Staging Yard option				
Roadbed construction	5	0.01	99	7.1
Interchange Yard	0	0	0	0
Staging Yard	1 (bridged)	0	0	0
North quarry siding	0	0	0	1.6
Quarry	0	0	0	0
Totals	6	0.01	99	8.7
Indian Cove Staging Yard option				
Roadbed construction	5	0.01	99	7.1
Interchange Yard	0	0	0	0
Staging Yard	1 (bridged)	0	0	47
Quarry	0	0	0	0
Totals	6	0.01	99	54.1
Eccles alternative segment				
Roadbed construction	11	0.21	1,400	0
Interchange Yard	1	11[e]	459,000[e]	0
Staging Yard (Eccles-North)	4	0.03	390	0
Totals	16	11.2	461,000	0
Caliente common segment 1	17	0.14	790	0
Oasis Valley alternative segment 1	2 (bridged)	0	0	0
Oasis Valley alternative segment 3	1 (bridged)	0	0	0
Common segment 6	14	0.14	1,300	0

a. Source: DIRS 183595-PBS&J 2006, Figures 3A through 3C.
b. Any water of the United States within 12 meters (40 feet) of the construction footprint is considered to be crossed.
c. To convert acres to square meters, multiply by 4,046.9.
d. To convert cubic feet to cubic meters, multiply by 0.028317.
e. The total area to be filled in Clover Creek for construction of the siding would range from approximately 0.033 to 0.043 square kilometer (8.2 to 11 acres). Additional fill within Clover Creek would also be required to create dikes to protect the Interchange Yard from flooding.

wetlands regardless of whether they are considered jurisdictional under Section 404 of the Clean Water Act.

DOE conducted jurisdictional determinations of waters of the United States and adjacent wetlands as described in the *Waters of the U.S. Jurisdictional Determination Report for Yucca Mountain Project – Caliente Rail Corridor* (DIRS 183595-PBS&J 2006, all). The jurisdictional determinations were conducted on public and accessible private lands pursuant to Section 404 of the Clean Water Act and Executive Order 11990, *Protection of Wetlands*, and in compliance with U.S. Army Corps of Engineers guidance. The delineation of wetlands along the proposed Caliente rail alignment was submitted to the U.S. Army Corps of Engineers in October 2007 with a request that a jurisdictional determination be made to identify which wetlands are regulated under Section 404 of the Clean Water Act. Table 4-56 provides the estimated total amount of wetlands (jurisdictional and nonjurisdictional) requiring fill along the Caliente rail alignment.

Under 10 CFR 1022, the Department is required to preserve and enhance the natural and beneficial values of wetlands. The values of wetlands are a function of the importance or worth of the functions that wetlands serve to society. Functions of wetlands include storage of water (floodwater protection), water filtration (wetlands can trap nutrients, sediment, and pollutants), and biological productivity (plant and animal ***habitat***). Impacts to these functions can eliminate or diminish the value of wetlands (DIRS 176797-EPA 2001, p. 1). Temporary or permanent filling or draining of wetlands would result in direct impacts to those resources. Actions in and around wetlands could result in indirect impacts, such as potential degradation of water quality and disruption of water flow. DOE would employ standard engineering design practices to move runoff water from one side of the track to the other. Culverts, channelization, or other means of runoff control would be put in place as part of subgrade construction to prevent surface water from backing up or impeding flow, and to minimize water level changes in wetland areas.

A **functional assessment** is used to evaluate current wetland functions and predict potential changes to a wetland's functions that may result from proposed activities. A wetland is compared to similar wetlands that are relatively unaltered.

Hydrogeomorphic relates to the form or surface features of the land.

DOE conducted the functional assessment of wetlands along the Caliente rail alignment in February 2008 to better characterize potential impacts (direct, indirect, and cumulative) to the functions served by wetlands in this area. Wetland functions are generally assessed to document functional losses that could occur due to a proposed impact. By assessing wetland functions, mitigation can be designed to provide wetland functions in a manner and capacity that offset proposed losses. The results of the assessment are documented in the *Rail Alignment for Geologic Repository at Yucca Mountain, Nevada Project, Wetland Technical Memorandum: Functional Assessment, Impacts, and Conceptual Mitigation* (DIRS 185340-URS 2008, all). Appendix F, Floodplain and Wetlands Assessment, of this Rail Alignment EIS further describes the wetland delineation and functional assessment, and provides a discussion of potential impacts and an alternatives analysis for the Caliente rail alignment.

DOE would minimize impacts to wetlands by constructing the rail line on an abandoned Union Pacific Railroad roadbed, where possible, keeping the new rail line footprint to a minimum and without a permanent service road where crossing wetland areas, shifting the location of the roadbed away from the edge of the washes in locations, and constructing bridges that span stream channels and adjacent wetlands. DOE would also incorporate avoidance into rail line engineering and design to the extent practicable. DOE would mitigate loss of wetlands, as required under Section 404 of the Clean Water Act, by enhancing existing wetlands adjacent to or near the rail line that have been degraded by grazing and other impacts, or by creating new wetlands adjacent to or near the rail line. The exact acreage of wetlands to be enhanced or created would be determined in coordination with the U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency and would be based in part on the amount of wetlands that would have to be filled to construct the rail line, the function and quality of the wetlands that would be lost, and the likelihood of success of the methods used to enhance or replace wetlands. This section describes impacts to wetlands in the segment-specific sections.

4.2.5.2.1.6 Floodplains and Floodwaters. DOE has prepared a floodplain assessment (see Appendix F) for the area along the Caliente rail alignment in accordance with the requirements of 10 CFR Part 1022. Appendix F includes figures that show the Federal Emergency Management Agency floodplain maps that cover the Caliente rail alignment region of influence. DOE obtained floodplain data from the Agency, which has published Flood Insurance Rate Maps that, depending on the combination of alternative segments, cover between 58 and 62 percent of the Caliente rail alignment. The Agency has not mapped areas that are uninhabited. These floodplain maps depict, as applicable, the lateral boundaries or spread of water that could be expected in drainage channels or around collection basins from a 100-year and a ***500-year flood***.

DOE overlaid a map of the Caliente rail alignment on the available floodplain maps and estimated the crossing distances for each alternative segment and common segment. Table 4-57 lists the crossing distances and the percentage of the area for which floodplain map coverage is available. Areas with little or no floodplain map coverage could contain floodplains not listed in the table. Appendix F discusses floodplains in more detail.

Table 4-57. Floodplains the Caliente rail alignment would cross (page 1 of 3).

		Floodplain crossing distance (miles)[a]		
Rail line segment	Percent covered by FEMA[b] floodplain maps	Mapped	Additional estimated	Floodplain description
Caliente alternative segment	28	1.6	1.6	Starting from the southern end of the alternative segment with the Clover Creek floodplain to its junction with the Meadow Valley Wash floodplain and up the alternative segment approximately 2.5 miles. No FEMA floodplain map available above Caliente city limit. Used shaded relief map to extend floodplain and estimate additional floodplain. Crossing distance for Meadow Valley Wash is based on the width of the floodplains further south where there is floodplain map coverage.
Eccles alternative segment	0	0	0.62	FEMA floodplain map coverage is not available for the Eccles alternative segment. Estimated the crossing distance from the width of the 100-year floodplain along Clover Creek near its confluence with Meadow Valley Wash where there is floodplain map coverage.
Caliente common segment 1	14	0	1.2	Floodplain of Dry Lake Playa estimated using shaded relief maps.
Garden Valley alternative segment 1	0	0	2.4	No FEMA floodplain map coverage; floodplain estimated as area adjacent to Coal Valley Playa.
Garden Valley alternative segment 2	0	0	5.9	No FEMA floodplain map coverage; floodplain estimated as area adjacent to Coal Valley Playa.
Garden Valley alternative segment 3	0	0	2.4	No FEMA floodplain map coverage; floodplain estimated as area adjacent to Coal Valley Playa.
Garden Valley alternative segment 8	0	0	5.9	No FEMA floodplain map coverage; floodplain estimated as area adjacent to Coal Valley Playa.
Caliente common segment 2	26	0	0	No floodplains identified.

Table 4-57. Floodplains the Caliente rail alignment would cross (page 2 of 3).

Rail line segment	Percent covered by FEMA[b] floodplain maps	Floodplain crossing distance (miles)[a] Mapped	Additional estimated	Floodplain description
South Reveille alternative segment 2	100	14	0	Reveille Valley braided wash floodplain extending from Railroad Valley around southern tip of Reveille Range.
South Reveille alternative segment 3	100	0	0	No floodplains identified.
Caliente common segment 3	79	17	0	The floodplain extends from Mud Lake Playa up through Ralston Valley Wash, Saulsbury Wash, Willow Creek (also called Stone Cabin Creek), and a tributary of Willow Creek and a western tributary of Mud Lake Playa. There are no floodplain maps for parts of eastern common segment 3-west; however, the topography in that area suggests that it is not in floodplain.
Goldfield alternative segment 1	58	0.62	0	Floodplains from Mud Lake Playa and Stonewall Flat extending up minor tributaries of Mud Lake Playa and Jackson Wash and China Wash, respectively.
Goldfield alternative segment 3	55	0.62	0	Floodplains from Mud Lake Playa and Stonewall Flat extending up minor tributaries of Mud Lake Playa and Jackson Wash and China Wash, respectively.
Goldfield alternative segment 4	43	0.93	0	Floodplains from Mud Lake Playa, Alkali Lake Playa, and Stonewall Flat extending up minor tributaries of Mud Lake Playa, tributaries of Big Wash, and tributaries of Jackson Wash and China Wash, respectively. There is no floodplain map coverage for Alkali Lake Playa.
Caliente common segment 4	100	0.81	0	Floodplain extends downgradient of Stonewall Flat Playa to the Lida Valley Alkali Flat Playa.
Bonnie Claire alternative segment 2	30	0	0	No floodplains identified.
Bonnie Claire alternative segment 3	78	1.2	0	Floodplains extending up tributaries of the Lida Valley Alkali Flat Playa and up the Stonewall Pass wash from the Bonnie Claire Flat area of Sarcobatus Flat.
Common segment 5	74	0.19	0	Floodplain extending from Sarcobatus Flat up to Tolicha Wash.
Oasis Valley alternative segment 1	100	0.68	0	Floodplain of the Amargosa River within Thirsty Canyon.

Table 4-57. Floodplains the Caliente rail alignment would cross (page 3 of 3).

		Floodplain crossing distance (miles)[a]		
Rail line segment	Percent covered by FEMA[b] floodplain maps	Mapped	Additional estimated	Floodplain description
Oasis Valley alternative segment 3	100	0.25	0	Floodplain of the Amargosa River within Thirsty Canyon.
Common segment 6	55	0.06	0	Beatty Wash floodplain extending from Amargosa River Floodplain.
		0.14[c]		Busted Butte Wash draining east side of Yucca Mountain to Fortymile Wash (rail line would cross wash and tributaries).

a. To convert miles to kilometers, multiply by 1.6093.
b. FEMA = Federal Emergency Management Agency.
c. There are no FEMA floodplain maps covering Busted Butte Wash on the eastern slope of Yucca Mountain. Estimates of floodplain crossings in this area are from DIRS 155970-DOE 2002, Figure 3-12 floodplain mapping efforts.

Construction activities would affect floodplains, either through direct alteration of the stream-channel cross section that would affect the flow pattern of the stream, or through indirect changes in the amount of impervious surfaces and additional water volume added to the floodplain. Based on Federal Emergency Management Agency floodplain maps and flood studies completed in the area of the Yucca Mountain Site, the Caliente rail alignment would cross more than 20 floodplains.

Construction impacts associated with these floodplains would be similar to any other identified drainage areas (the alteration of natural drainage patterns and possible changes in erosion and sedimentation rates or locations). Construction in washes or other flood-prone areas could reduce the area through which floodwaters would naturally flow, which could cause water levels to rise on the upstream side of crossings. Sedimentation would be likely to occur on the upstream side of crossings in areas where the flow of water was restricted enough to cause ponding. DOE would manage sedimentation of this type under a regular maintenance program (DIRS 155970-DOE 2002, p. 6-79). Therefore, impacts to floodplains from construction of the rail line that result in restrictions in flow and sedimentation would be small.

Construction within floodplains would cause direct impacts to floodplains. The Caliente rail alignment would be in a region where flash flooding is the primary concern. Although such flooding can be violent and hazardous, it is generally limited in its extent and duration, limiting the potential for impacts associated with the proposed railroad; that is, any damage would be expected to be confined to a small portion of the rail line.

Although DOE would generally design rail line features to accommodate 100-year floods, based on typical Class 1 freight railroad standard design criteria (see Section 4.2.5.2.1.1), the final design process could also consider a range of flood frequencies and include a cost-benefit analysis in the selection of a design frequency in accordance with standard rail line design guidelines and practices (DIRS 106860-AREA 1997, Volume 1, Section 3.3.2.2 c). In areas where drainage structures would cross a Federal Emergency Management Agency-designated 100-year floodplain, DOE would design the bridge to comply with Agency standards and appropriate county regulations. Federal Emergency Management Agency standards require that floodway surcharge (the difference between the 100-year flood elevation and the actual flood surface elevation) not exceed 0.3 meter (1 foot) at any location. These standards are designed to limit the impacts of floodwater to structures built in or adjacent to floodplains (DIRS 182824-Nevada Rail Partners 2007, p. ii). By adhering to these standards, the Department would substantially limit the potential for adverse impacts to the population and resources located adjacent to floodplains.

Bridge constructing usually involves placing a portion of the bridge abutment in the floodplain (called encroachment). For this reason, the abutment can have some impact on the height of floodwaters upstream of the bridge. Excessive encroachment can result in increased scour potential at the abutments, piers, and the stream bottom through the bridge opening due to increases in flow velocities. Based on the conceptual design for the Caliente rail alignment, there could be encroachments up to 30 percent of the floodplain width, which could result in an approximately 0.3-meter (1-foot) increase in water-surface elevation at the upstream side of the bridge where the floodplain is wide and shallow (DIRS 182824-Nevada Rail Partners 2007, p. ii).

DOE would reduce impacts to floodplains and the resources close to the floodplains by adhering to the design standards that limit the degree to which floodwaters would be allowed to rise. DOE used best available data to identify floodplains along the proposed Caliente rail alignment and floodplain analysis was conducted using currently accepted best practices. The Department would incorporate additional flood analysis and hydraulic modeling into the engineering design process to ensure that all crossings were designed to limit impacts to nearby populations and resources.

4.2.5.2.1.7 Springs. DOE designed the rail line to avoid springs and other surface-water resources whenever practicable. In the few cases where there would be springs within the construction right-of-way, the Department would incorporate avoidance and control measures into final engineering and design of the rail line in order to minimize impacts. To minimize temporary impacts, springs would be marked and avoided during rail line construction activities. A surface-water connection would be required for rail line construction activities to impact springs; therefore, springs located upgradient of the rail alignment would not be impacted. Springs located downgradient of the rail alignment could experience short-term, direct adverse impacts to water quality resulting from rail line construction activities and flooding and sedimentation resulting from extreme weather events. Straw bale barriers or silt fences would be placed around downgradient springs to reduce the potential for erosion and runoff of sediments toward them. These measures would also be taken as necessary for springs located downgradient and outside the construction right-of-way, but identified within 1.6 kilometers (1 mile) of the proposed rail line. Therefore, impacts to springs from construction activities would be small.

DOE used best available data to identify springs along the proposed Caliente rail alignment. Any additional springs identified during future design and construction would be addressed in the final design phase of the railroad.

Section 4.2.6, Groundwater Resources, addresses impacts to springs from a groundwater-supply perspective. Section 4.2.2, Land Use and Ownership, further addresses any impacts to short- or long-term access for livestock operations, and public or private use. Section 4.2.7, Biological Resources, addresses any impacts to short- or long-term access by wildlife.

4.2.5.2.2 Impacts along Alternative Segments and Common Segments

4.2.5.2.2.1 Interface with the Union Pacific Railroad Mainline. DOE would construct the Interchange Yard, the Staging Yard, a Satellite Maintenance-of-Way Facility, train crew facilities, and possibly the Nevada Railroad Control Center and National Transportation Operations Center at the Interface with the Union Pacific Railroad Mainline. DOE is considering two options for siting the Staging Yard along the Caliente alternative segment (Indian Cove and Upland) (see Figure 3-61). Section 4.2.5.2.3 addresses facilities. The starting points for both the Caliente and the Eccles alternative segments would either cross or be close to surface-water features, specifically Clover Creek and Meadow Valley Wash (see Table 4-55). This section describes site-specific impacts related to construction activities along the Caliente alternative segment or the Eccles alternative segment.

Other beginning-of-line options for the Caliente corridor were examined to determine whether a practicable alternative exists that would not require filling of wetlands or otherwise impact aquatic resources in Meadow Valley Wash or Clover Creek. These options and examination of practicability are further discussed in Section 4.2.5.5.3.

Caliente Alternative Segment The Caliente alternative segment would cross washes and streams, several of which are waters of the United States, as described in Section 3.2.5.3.1.1 and summarized in Table 4-55. In total, this segment would cross five waters of the United States, including Meadow Valley Wash, Clover Creek, Antelope Canyon Wash, and Bennett Springs Wash. Two additional waters of the United States would be adjacent to the alignment, but not crossed. Common impacts from surface-water crossings are addressed in Section 4.2.5.2.1.1. Of the five waters of the United States the Caliente alternative segment would cross, the amount of fill would range from no fill for the smallest drainage to 1.1 cubic meters (40 cubic feet) for the two largest drainages. The total amount of fill for waters of the United States the Caliente alternative segment would cross would be 2.8 cubic meters (99 cubic feet).

The Department has concluded that it would not be possible to construct a rail line heading north from Caliente into Meadow Valley that would completely avoid wetlands (see Section F.4.1.2 for further discussion of alternatives analysis). The only possible rail route north from Caliente is adjacent to Meadow Valley Wash and U.S. Highway 93 through Indian Cove. There is no possibility of designing an alignment in this area that would avoid all wetlands because the Indian Cove area and extreme southern Meadow Valley are narrow, surrounded by impassible terrain, and almost entirely covered with wetland and riparian habitat in some areas. As described below, the Department has developed a route and selected design options that would minimize the amount of wetlands filled along the Caliente alternative segment. DOE would minimize filling of wetlands by incorporating avoidance into engineering and design of the rail line to the maximum extent practicable.

The construction right-of-way along the Caliente alternative segment would be 30 meters (100 feet) wide, narrower than along most of the remainder of the Caliente rail alignment, to minimize impacts to private property and surface waters (see Figure 2-3). Along the entire length of the Caliente alternative segment, there is 0.096 square kilometer (23.8 acres) of wetlands within the proposed construction right-of-way. A majority (23.3 acres) of these wetlands are believed to be jurisdictional based on the wetland delineation completed by DOE.

Of the 0.096 square kilometer (23.8 acres) of wetlands within the proposed construction right-of-way, 0.01 square kilometer (2.6 acres) would be avoided in two areas where the abandoned Union Pacific Railroad roadbed is located immediately adjacent to Meadow Valley Wash (see wetlands WT-5/WT-6, and WT-1/PWT-1 shown in Figures 3-62 and 3-63), and one location where it is adjacent to Bennett Springs Wash (see wetlands PWT-2/WT-4 shown in Figures 3-62 and 3-63). All of these wetlands would be avoided by shifting the location of the roadbed away from the edge of the washes.

The Caliente alternative segment would cross washes with adjacent wetlands at five locations, including three crossings of the perennial Meadow Valley Wash (see wetlands WT5 at two locations and wetlands CC13/CC14 at one location shown in Figures 3-62 and 3-63), and one crossing each of the intermittent or ephemeral Clover Creek Wash (see wetland WT-5 shown in Figure F-5) and Bennett Springs Wash (see wetland WT-2 shown in Figure 3-62). There currently are old railroad bridges at each of these wash crossings that would be replaced with steel or precast concrete bridges. These new bridges will span the stream channels and avoid the adjacent wetlands. Although these wetlands would be avoided, construction activity (for example, pier placement) could cause direct impacts as a result of bridge placement over washes containing fringe/interspersed wetlands. The design goal, however, is to avoid direct wetland impacts to the maximum extent practicable in placement of bridge abutments and/or piers at such stream crossing points.

All of the remaining wetlands within the construction right-of-way of the Caliente alternative segment are along the first 8 kilometers (5 miles) of the alignment segment in and near Indian Cove and southern Meadow Valley. Approximately 0.027 square kilometer (6.7 acres) of those wetlands are located in a pasture at the south end of Indian Cove (see wetlands CC1 through CC9 shown in Figure 3-62). The other 0.057 square kilometer (14 acres) of wetlands within the construction right-of-way is adjacent to the abandoned Union Pacific Railroad roadbed in Indian Cove and southern Meadow Valley (see wetlands CC10 through CC26 shown in Figure 3-62).

There are extensive wetland and riparian habitats in southern Meadow Valley. For example, there are about 9.8 square kilometers (about 2,400 acres) of North American Arid West Emergent Marsh habitat and 4.5 square kilometers (1,100 acres) of Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland habitat within 8 kilometers (5 miles) of the Caliente alternative segment (Table 3-52). Much of the wetland and riparian habitat is in southern Meadow Valley and the Indian Cove area (Figure 3-91). Given that the amount of wetlands that would be filled (0.03 square kilometer [7.1 acres]) is small relative to the remaining wetlands in Indian Cove and southern Meadow Valley, it is expected that these impacts would have a small overall impact to the wetland functions served by these wetlands. Flood abatement impacts would be small because of the small area of wetlands filled and because in most cases the roadbed would run parallel with the primary floodwater flow direction. Impacts to the other functions served by these wetlands would be small as well, primarily due to the small area of wetlands that would be permanently filled. See Appendix F for additional information about the functions served by these wetlands.

To minimize impacts of roadbed construction on wetlands along the Caliente alternative segment, DOE would construct the rail line on the abandoned Union Pacific Railroad roadbed. That roadbed is an upland feature that generally is about 1 meter (3 feet) above the surrounding terrain and 8 to 14 meters (25 to 45 feet) wide (DIRS 183595-PBS&J 2006, p. 13 and Figure 4). In addition, where the alignment crosses wetlands, the new rail roadbed would be constructed with a 2:1 slope and without a permanent service road. That rail roadbed would have a maximum width of about 17 meters (55 feet). Constructing this narrow roadbed would reduce the amount of wetlands permanently filled from a total of about 0.096 square kilometer (23.8 acres) within the construction right-of-way in this area to 0.029 square kilometer (7.1 acres), 0.028 square kilometer (6.9 acres) of which are assumed to be jurisdictional. Those wetlands are all located along a continuous 6.4-kilometer (4-mile) stretch of the alignment starting at the south end of the pasture south of Indian Cove and ending approximately 0.9 kilometer (0.6 mile) south of Beaver Dam Road (see Figure 3-62). Although DOE evaluated the use of vertical retaining walls and other methods to further reduce the construction footprint and the amount of wetlands filled, those methods would be impractical due to cost (DIRS 180916-Nevada Rail Partners 2007, Appendix F).

Section 4.2.5.2.1.5 addresses common impacts to wetlands that would be crossed by and adjacent to the rail line and mitigation for wetlands.

The Federal Emergency Management Agency has performed detailed studies of Meadow Valley Wash, Antelope Canyon Wash, and Clover Creek Wash within the corporate limits of the City of Caliente and for some portions of Lincoln County, using detailed methods. The Agency has established 100-year floodwater-surface elevations and regulatory floodways for these watercourses within the area studied. Encroachment into the floodway is prohibited unless it can be determined that encroachment into the floodway portion of the floodplain would not cause more than a 0.3-meter (1-foot) increase in the water-surface elevations for these watercourses. Table 4-57 lists floodplain information for the Caliente alternative segment. Federal Emergency Management Agency floodplain mapping extends from Caliente to the southern end of a meadow at Indian Cove. The Agency has mapped the southern portion of the meadow as a 100-year floodplain. Section 4.2.5.2.1.6 addresses common impacts to floodplains that would be crossed by and adjacent to the rail line.

Caliente Hot Springs would be within the construction right-of-way 16 meters (52 feet) from the rail line, but outside of the cut and fill area (7.7 meters [25 feet] outside the toe of slope). The hot spring itself is inside a hotel located in the City of Caliente. Therefore, there would be no impacts to water quality. Section 4.2.5.2.1.7 describes common impacts to springs in the vicinity of the rail line.

Construction camp 1 would be along the Caliente alternative segment, but the camp would not impact surface-water features. There are no waters of the United States or wetlands in the area of construction camp 1.

Eccles Alternative Segment The Eccles alternative segment would cross several surface-water features (see Section 3.2.5.3.1.2). DOE would construct a large bridge at the beginning of the Eccles alternative segment to span Clover Creek. To construct the 300-meter (1,000-foot) bridge, the Department would have to install piers across the confluence of Clover Creek and an unnamed tributary to Clover Creek that flows from the north and joins Clover Creek in the area just to the north of the proposed bridge. Section 4.2.5.2.1.1 addresses common impacts from surface-water crossings.

Table 4-55 lists crossings of waters of the United States. These waters include Clover Creek and four of its tributaries and four tributaries of Meadow Valley Wash (DIRS 183595-PBS&J 2006, Figures 3A and 3B). Of the 11 waters of the United States the Eccles alternative segment would cross, the amount of fill would range from none for the smaller washes that would be bridged to 26 cubic meters (930 cubic feet) for the largest drainage. The total amount of fill for waters of the United States the Eccles alternative segment would cross would be 41 cubic meters (1,400 cubic feet).

The Eccles alternative segment would cross wetlands in northern Meadow Valley where the rail alignment would cross Meadow Valley Wash approximately 1.6 kilometers (1 mile) south of its intersection with Caliente common segment 1 (DIRS 183595-PBS&J 2006, Figure 4R). DOE would construct a bridge to cross Meadow Valley Wash and its associated wetlands, which is comprised of a 9- to 10-meter (30- to 33-foot)-wide wetland area adjacent to the wash. Minor direct impacts to these wetlands could occur resulting from bridge placement over Meadow Valley Wash, which contains fringe and interspersed wetlands. Direct wetland impacts would be avoided to the maximum extent practicable when placing bridge abutments and/or piers at such stream crossing points. There would be no permanent fill activities within this wetland; indirect impacts would still be possible, but such impacts, if any, would be minimized because of the best management practices the Department would use to prevent erosion, sedimentation, and incidental spills during construction of the bridge. Section 4.2.5.2.1.5 addresses common impacts to wetlands that would be crossed by and adjacent to the rail line and mitigation for wetlands.

There is no Federal Emergency Management Agency floodplain map coverage for the Eccles alternative segment. Although the Agency has not defined any floodplains in this area, the Eccles alternative segment would impact floodplains associated with Clover Creek and Meadow Valley Wash. Clover Creek and its associated floodplain, which encompasses Dutch Flat, ranges in width from 130 to 400 meters (430 to 1,300 feet) (see Appendix F). In January 2005, flooding in and around Clover Creek, Meadow Valley Wash, and Muddy River washed out and undermined portions of an existing rail line and worked out the rail bank in this area. DOE would minimize potential impacts from flooding through the use of erosion-control practices and hydraulic structural design standards (see Appendix F, Section F.4.4.3.4). Section 4.2.5.2.1.6 addresses common impacts to floodplains that would be crossed by and located adjacent to the rail line.

There are no springs along the Eccles alternative segment.

There are no construction camps planned along the Eccles alternative segment.

4.2.5.2.2.2 Caliente Common Segment 1 (Dry Lake Valley Area). Caliente common segment 1 would skirt the Coal Valley playa at its west end. The playa is expected to be an area subject to occasional flooding and standing water. Caliente common segment 1 would also cross several notable drainage features (see Section 3.2.5.3.2), including Coyote Wash and White River. Although the rail line would cross both of these features in areas where they are normally dry, bridges or culverts would be necessary to accommodate periods of high precipitation and runoff. Section 4.2.5.2.1.1 addresses common impacts from surface-water crossings.

Before the rail line crossed Bennett Pass on its way to Dry Lake Valley, it would cross waters of the United States in Meadow Valley (DIRS 183595-PBS&J 2006, Figures 3C and 3D). Table 4-55 summarizes crossings of waters of the United States. Caliente common segment 1 would cross 17 drainage channels that qualify as waters of the United States (DIRS 183595-PBS&J 2006, Figure 3C). The amount of fill for crossing these waters of the United States would range from no fill for the smaller washes that would be bridged to 7.5 cubic meters (260 cubic feet) for the largest drainage. The total amount of fill for waters of the United States that common segment 1 would cross would be 22 cubic meters (790 cubic feet). Construction activities would require work in these channels, including such actions as installing culverts or bridges and filling portions of the channel. In total, the preliminary rail line design includes bridges, culverts, and permanent fill used in these crossings. Section 4.2.5.2.1.1 addresses common impacts from surface-water crossings.

Caliente common segment 1 would pass within 600 meters (2,000 feet) of a small group of three isolated wetlands in the North Pahroc Range pass (between White River Valley to the west and Dry Lake Valley to the east). These isolated, nonjurisdictional wetlands were delineated in the field survey conducted in support of this Rail Alignment EIS (DIRS 183595-PBS&J 2006, Figure 4S). A lack of wildlife habitat was observed in this area. The shoreline of the ponds lacks the vegetation that would provide food, shelter, or reproductive habitat for a variety of species (DIRS 183595-PBS&J 2006, Photos 50 and 51, pp. B-25 and B-26). These wetlands, resulting from the development of an unnamed spring north of Black Rock Spring, would be uphill of and outside the rail line construction right-of-way; therefore, there would be no direct or indirect impacts to these wetlands.

There is no Federal Emergency Management Agency floodplain map coverage for most of Caliente common segment 1. Section 4.2.5.2.1.6 addresses common impacts to floodplains that would be crossed by and adjacent to the rail line.

There are six springs within the region of influence of Caliente common segment 1, with distances ranging from 620 to 1,400 meters (2,000 to 4,600 feet) from the rail line. All of these springs would fall at least 300 meters (1,000 feet) outside the construction right-of-way; therefore, there should be no impacts to these springs. Water-quality impacts are not expected due to distance, but these springs would still be marked and avoided during rail line construction activities. Some of the springs would be downgradient of construction activities, and flooding and sedimentation resulting from extreme weather events could result in short-term, direct adverse impacts to water quality. Straw bale barriers or silt fences would be placed around downstream springs to reduce the potential for erosion and runoff of sediments toward them. Section 4.2.5.2.1.7 describes common impacts to springs in the vicinity of the rail line.

Construction camps 2 and 3 would be along Caliente common segment 1, as described in Section 3.2.5.3.2. No surface-water features would be affected during construction of construction camp 2. However, there is one drainage channel that would cross the footprint of construction camp 3. The presence and location of this feature would be incorporated into the final design of the construction camp; however, the potential would exist for direct, long-term impacts. The range of potential adverse impacts is unknown without specific information regarding the facilities and their location at the construction camp; however, potential impacts include possible fill of the channel and impacts to water quality from increased sedimentation. The installation of appropriate drainage structures (such as culverts) or bridges would be used to minimize impacts, and DOE would implement erosion-control measures to reduce sediment loading into the drainage channel. Common impacts from surface-water crossings are described in Section 4.2.5.2.1.1. There would be no waters of the United States or wetlands within the footprints of construction camps 2 or 3.

4.2.5.2.2.3 Garden Valley Alternative Segments. There would be potential playa crossings along Garden Valley alternative segments 1, 2, 3, and 8. All four of these alternative segments would cross through the Golden Gate Range, but at two different locations. For the southerly alternative segments (Garden Valley 2 and 8), Water Gap is the surface-water outlet and the northerly alternative segments (Garden Valley 1 and 3) would cross an unnamed wash approximately 7.2 kilometers (4.5 miles) north of Water Gap. A bridge would be used for this crossing, and no use of fill is anticipated. These surface-water features are described in Section 3.2.5.3.3. Common impacts to drainages are addressed in Section 4.2.5.2.1.1.

No waters of the United States or wetlands were identified in the Garden Valley area (DIRS 183595-PBS&J 2006, pp. 6-9 and 11-14).

There are two springs in the vicinity of Garden Valley alternative segments 1, 3, and 8. These springs would be outside the construction right-of-way 460 meters (1,500 feet), 1,300 meters (4,300 feet), and 420 meters (1,400 feet) from the rail line, respectively. Common impacts to springs in the vicinity of the rail line are discussed in Section 4.2.5.2.1.7.

Construction camp 4, as described in Section 3.2.5.3.3, would be within the construction right-of-way near the junction of the Garden Valley alternative segments with Caliente common segment 2 and would be crossed by one drainage feature. The camp would not cross any waters of the United States or wetlands. Section 4.2.5.2.1.1 addresses common impacts from surface-water crossings.

4.2.5.2.2.4 Caliente Common Segment 2 (Quinn Canyon Range Area). Caliente common segment 2 would cross Davis Creek and Quinn Canyon Wash and several unnamed washes. These features are described in Section 3.2.5.3.4. Common impacts to drainages are addressed in Section 4.2.5.2.1.1.

There are no waters of the United States or wetlands identified along Caliente common segment 2 (DIRS 183595-PBS&J 2006, all).

There are no floodplains identified along common segment 2 in the limited area where there is floodplain map coverage; however, a floodplain is shown for an unnamed wash that would be parallel to the rail line. Section 4.2.5.2.1.6 addresses common impacts to floodplains that would be crossed by and adjacent to the rail line.

There are two springs along Caliente common segment 2, both significantly outside the rail line construction right-of-way. McCutcheon Spring would be 1,000 meters (3,400 feet) and Upper McCutcheon Spring 1,200 meters (4,000 feet) from the rail line. Common impacts to springs that would be near the rail line are discussed in Section 4.2.5.2.1.7.

Construction camp 5, as described in Section 3.2.5.3.4, would be within the construction right-of-way. The camp would not overlie any surface-water features and would not cross any waters of the United States or wetlands. Common impacts to surface-water crossings are addressed in Section 4.2.5.2.1.1.

4.2.5.2.2.5 South Reveille Alternative Segments. South Reveille alternative segments 2 and 3 would run adjacent to and cross unnamed washes. These features are described in Section 3.2.5.3.5. Common impacts to drainages are addressed in Section 4.2.5.2.1.1.

No wetlands or waters of the United States were identified along these short alternative segments that would be affected by rail line construction (DIRS 183595-PBS&J 2006, all).

South Reveille alternative segment 2 would cross floodplains associated with several tributaries of an unnamed wash, as indicated in Table 4-57. Section 4.2.5.2.1.6 addresses common impacts to floodplains that would be crossed by and adjacent to the rail line.

There are no springs identified or construction camps planned along the South Reveille alternative segments.

4.2.5.2.2.6 Caliente Common Segment 3 (Stone Cabin Valley Area). Caliente common segment 3 would cross numerous drainage channels. These features are described in Section 3.2.5.3.6. Common impacts to drainages are addressed in Section 4.2.5.2.1.1. Notably, Caliente common segment 3 would cross Willow Creek and six unnamed washes and skirt along the northern and western boundaries of Mud Lake Playa.

There are no waters of the United States along Caliente common segment 3 (DIRS 183595-PBS&J 2006, all).

The National Wetland Inventory lists Mud Lake Playa as a wetland; however, DOE field studies in support of this Rail Alignment EIS confirmed that there are no ***hydric soils***, plant species indicative of wetlands, or other indicators of wetlands on or adjacent to the playa near the alignment (DIRS 180696-Potomac-Hudson Engineering 2007, p. 3). These studies support the determination that Mud Lake Playa is not designated as wetlands.

There is no Federal Emergency Management Agency floodplain map coverage or identified floodplains for Caliente common segment 3. Section 4.2.5.2.1.6 addresses common impacts to floodplains that would be crossed by and adjacent to the rail line.

Black Spring would be outside but adjacent to the construction right-of-way, 300 meters (1,000 feet) from the rail line. Common impacts to springs that would be near the rail line are discussed in Section 4.2.5.2.1.7.

Construction camps 6, 7, and 8 (see Section 3.2.5.3.6) would be within the construction right-of-way and would not cross any surface-water features, waters of the United States, or wetlands.

4.2.5.2.2.7 Goldfield Alternative Segments. The Goldfield alternative segments would cross numerous drainages. These features are described in Section 3.2.5.3.7. Common impacts to drainages are addressed in Section 4.2.5.2.1.1. Goldfield alternative segment 3 would cross within 1.4 kilometers (0.87 mile) of Mud Lake Playa; therefore, it is possible that construction activities could indirectly impact the water quality of this playa.

There are no wetlands or waters of the United States along any of the Goldfield alternative segments (DIRS 183595-PBS&J 2006, all).

There are several springs within the regions of influence of all three Goldfield alternative segments. The spring nearest to the rail alignment would be Willow Spring, which would be within 96 meters (320 feet) of the rail alignment. Willow Spring would be inside the construction right-of-way, but outside the cut and fill area; therefore, this spring could experience short-term, direct adverse impacts to water quality resulting from rail line construction activities and flooding and sedimentation resulting from extreme weather events. Straw bale barriers or silt fences would be placed around this spring to reduce the potential for erosion and runoff of sediments toward them. The other springs would be outside the construction right-of-way and long-term impacts would not be expected. Common impacts to springs that would be near the rail line are discussed in Section 4.2.5.2.1.7.

4.2.5.2.2.8 Caliente Common Segment 4 (Stonewall Flat Area). Caliente common segment 4 would skirt two playas, Stonewall Flat Playa to the east and Alkali Flat Playa to the southwest, and cross seven drainage channels. These features are described in Section 3.2.5.3.8. Common impacts to drainages are addressed in Section 4.2.5.2.1.1.

There are no waters of the United States along Caliente common segment 4 (DIRS 183595-PBS&J 2006, all).

The National Wetland Inventory lists Stonewall Flat Playa as a wetland; however, DOE field studies in support of this Rail Alignment EIS confirmed that there are no hydric soils, plant species indicative of wetlands, or other indicators of wetlands on or adjacent to the playa near the alignment (DIRS 180696-Potomac-Hudson Engineering 2007, p. 6). There are no wetlands along Caliente common segment 4. These studies support the determination that Stonewall Flat Playa is not designated as wetlands.

Federal Emergency Management Agency floodplain maps show a floodplain associated with the Stonewall Flat Playa drainage path, as indicated in Table 4-57. Section 4.2.5.2.1.6 addresses common impacts to floodplains that would be crossed by and adjacent to the rail line.

There are no springs identified along Caliente common segment 4.

Construction camp 9, as described in Section 3.2.5.3.8, would be within the construction right-of-way and would not cross any surface-water features, waters of the United States, or wetlands.

4.2.5.2.2.9 Bonnie Claire Alternative Segments. Both of the Bonnie Claire alternative segments would cross an unnamed drainage channel that drains the area of Stonewall Mountain. Bonnie Claire alternative segment 3, the southwestern alternative segment, would also cross Alkali Flat Playa. These features are described in Section 3.2.5.3.9. Common impacts to drainages are addressed in Section 4.2.5.2.1.1.

There are no waters of the United States or wetlands identified along the Bonnie Claire alternative segments (DIRS 183595-PBS&J 2006, p. 7 and Table 3).

Floodplain maps of the area show floodplains associated with the unnamed drainage channel that drains the area of Stonewall Mountain and Alkali Flat Playa; however, map coverage of the unnamed wash terminates just downstream (southwest) of Bonnie Claire alternative segment 3. The coverage stops at an old boundary of the Nevada Test and Training Range, but is close enough to the alternative segment that a reasonable estimate of the crossing distance could be made and included in Table 4-57. The area where Bonnie Claire alternative segment 2, the northeastern alternative segment, would cross the unnamed wash is far enough away from the limit of the floodplain map coverage that a crossing distance was difficult to estimate, which is why no value is shown in Table 4-57. Common impacts to floodplains and floodwaters are addressed in Section 4.2.5.2.1.6.

There are no springs identified or construction camps planned along the Bonnie Claire alternative segments.

4.2.5.2.2.10 Common Segment 5 (Sarcobatus Flat Area). Common segment 5 would cross numerous drainage channels, including Tolicha Wash and several unnamed washes, and would skirt playa areas of Sarcobatus Flat. These features are described in Section 3.2.5.3.10. Common impacts to drainages are addressed in Section 4.2.5.2.1.1.

There are no waters of the United States or wetlands identified along common segment 5 (DIRS 183595-PBS&J 2006, all).

Where common segment 5 would cross the floodplain associated with Tolicha Wash, a drainage structure would be required that would not result in more than a 0.3-meter (1-foot) increase in water-surface elevations upstream of the crossing. Playa areas near common segment 5 would be subject to occasional flooding and standing water, but the Federal Emergency Management Agency floodplain maps do not show that 100-year flood levels would reach this rail line segment. Common impacts to floodplains and floodwaters are addressed in Section 4.2.5.2.1.6.

There are no springs identified along common segment 5.

Construction camp 10, as described in Section 3.2.5.3.10, would be within the construction right-of-way and would overlie two small ***ephemeral washes*** and three ***notable drainages***. The camp would not cross any waters of the United States or wetlands. Common impacts to surface-water crossings are addressed in Section 4.2.5.2.1.1.

4.2.5.2.2.11 Oasis Valley Alternative Segments. The Oasis Valley alternative segments would cross several washes and both would cross the Amargosa River, which is an ephemeral stream in this area. The northeastern alternative segment, Oasis Valley 3, would run within approximately 0.24 kilometer (0.15 mile) from Colson Pond. These features are described in Section 3.2.5.3.11. Common impacts to drainages are addressed in Section 4.2.5.2.1.1.

DOE field surveys of these areas identified two drainage channels along Oasis Valley alternative segment 1 and one drainage channel along Oasis Valley alternative segment 3 that would qualify as waters of the United States (DIRS 183595-PBS&J 2006, Figure 3D). Crossings of waters of the United States are summarized in Table 4-55. However, DOE likely would use bridges for these crossings. Therefore, the total amount of fill for waters of the United States the Oasis Valley alternative segments would cross would be very small. Common impacts to waters of the United States are addressed in Section 4.2.5.2.1.4.

DOE field surveys also identified a small isolated wetland, WT-15 (74 square meters [800 square feet]), that would be just outside the construction right-of-way, approximately 160 meters (530 feet) north of Oasis Valley alternative segment 1 (DIRS 183595-PBS&J 2006, Table 6 and Figure 4T). This wetland occurs within a slight topographic depression and does not have a surface-water connection to any nearby washes and would be regarded as isolated, and thus considered nonjurisdictional. There would be no direct impacts to this wetland during the construction phase because it would be outside the construction right-of-way and would be fenced or flagged. Indirect impacts such as sedimentation, erosion, and incidental spills would still be possible. Common impacts to wetlands are addressed in Section 4.2.5.2.1.5.

As shown in Table 4-57, both of these alternative segments would cross floodplains associated with Thirsty Canyon. Common impacts to floodplains and floodwaters are addressed in Section 4.2.5.2.1.6.

There are 25 springs within the region of influence of the Oasis Valley alternative segments, all of which would be outside the construction right-of-way. Oasis Valley alternative segment 3 would run within 200 to 520 meters (640 to 1,700 feet) of two unnamed springs. Oasis Valley alternative segment 1 would run within 480 to 610 meters (1,600 to 2,000 feet) of seven springs. Because the springs would be downstream of the rail line, there would be the potential for impacts from erosion and sedimentation during the construction phase. Common impacts to springs are addressed in Section 4.2.5.2.1.7.

Construction camp 11, as described in Section 3.2.5.3.11, would be within the Oasis Valley 1 construction right-of-way and would overlie one small ephemeral wash and two notable drainages. The camp would not cross any waters of the United States or wetlands. Common impacts from surface-water crossings are addressed in Section 4.2.5.2.1.1.

4.2.5.2.2.12 Common Segment 6 (Yucca Mountain Approach). Common segment 6 would cross several drainage features, including Beatty Wash, Tates Wash, Windy Wash, Busted Butte Wash (also known as Dune Wash), and unnamed tributaries of the Amargosa River and Drill Hole Wash. These features are described in Section 3.2.5.3.12. Common impacts to drainages are addressed in Section 4.2.5.2.1.1.

Common segment 6 would cross 14 channels that qualify as waters of the United States, including two tributaries of the Amargosa River, Beatty Wash, seven tributaries to Beatty Wash, and four tributaries to Fortymile Wash. Of the 14 waters of the United States that common segment 6 would cross, the amount of fill would range from none for the smallest drainage to 9.9 cubic meters (350 cubic feet) for the largest drainage. The total amount of fill for waters of the United States common segment 6 would cross would be 37 cubic meters (1,300 cubic feet).

There are no wetlands along common segment 6 (DIRS 183595-PBS&J 2006, p. 11, Table 4).

Federal Emergency Management Agency floodplain maps provide coverage for the western portion of common segment 6, but the coverage terminates at approximately the point where the rail line would reach the Yucca Mountain Site boundary. In the areas covered by floodplain maps, the only floodplain along common segment 6 is one associated with Beatty Wash. The maps also show a floodplain associated with the unnamed wash from Crater Flat, but it does not extend up the wash as far as where common segment 6 would cross. DOE would build a large (370-meter [1,200-foot]-long) special-condition railroad bridge across Beatty Wash. Although the floodplain maps do not provide coverage for the area of the repository site on the east side of Yucca Mountain, there have been flood studies performed on several washes in that area, as described in the Yucca Mountain FEIS (DIRS 155970-DOE 2002, Figure 3-12 and pp. 3-38 and 3-39). If the Caliente rail alignment is overlain on the figure of the floodplains in the Yucca Mountain FEIS (see Figure F-15 in Appendix F of this Rail Alignment EIS), it can be seen that common segment 6 would cross short stretches of 100-year floodplains associated with Busted Butte Wash and Drill Hole Wash before it terminated just prior to crossing a floodplain associated with Midway Valley Wash (also known as Sever Wash). Table 4-57 lists the estimated crossing distances for Beatty Wash, Busted Butte Wash, and Drill Hole Wash. Common impacts to floodplains and floodwaters are addressed in Section 4.2.5.2.1.6.

No springs have been identified along common segment 6.

Construction camp 12, as described in Section 3.2.5.3.12, would be within the common segment 6 construction right-of-way and would overlie one small ephemeral wash. The camp would not cross any waters of the United States or wetlands. Common impacts to surface-water crossings are addressed in Section 4.2.5.2.1.1.

4.2.5.2.3 Impacts from Constructing Facilities

4.2.5.2.3.1 Interchange Yard.

Caliente Alternative Segment Interchange Yard The Interchange Yard for the Caliente alternative segment would be located in the City of Caliente, directly across from the Caliente City Hall. Table 4-55 lists drainage crossing information for the Caliente Interchange Yard. Section 4.2.5.2.1.1 addresses impacts to drainages common to the entire Caliente rail alignment.

There would be no waters of the United States or wetlands within the footprint of the Interchange Yard at Caliente.

Federal Emergency Management Agency floodplain maps for this area show that a 240-meter (790-foot) section of the Interchange Yard would sit in a 100-year floodplain and the rest would be within a 500-year floodplain. Floodwaters from Meadow Valley Wash flow through the center of Caliente to the south where they merge with the runoff from three dry washes that flow to the southwest. In the area where the Interchange Yard would intersect the 100-year floodplain, DOE calculated that the floodwater depth would be 0.90 meter (3 feet) during the 100-year storm event (DIRS 176806-FEMA 1985, all). Because the interchange tracks would be in an area already occupied by an existing Union Pacific siding, the yard would not be likely to obstruct the flow of floodwaters to the point that floodwater depths would increase. Section 4.2.5.2.1.6 addresses impacts to floodplains and floodwaters common to the entire Caliente rail alignment.

There would be no springs within the footprint of the Interchange Yard.

Eccles Alternative Segment Interchange Yard The Interchange Yard on the Eccles alternative segment would be immediately adjacent to the Union Pacific Railroad Mainline within the confines of Clover Creek approximately 8 kilometers (5 miles) east of Caliente. Clover Creek is an ***ephemeral creek*** classified as a water of the United States and drains an area of about 970 square kilometers (240,000 acres) east of the site. Drainage through the site is from east to west, toward Meadow Valley Wash and Caliente. Table 4-55 lists drainage crossing information for the Eccles Interchange Yard. Construction of this yard would require dikes and riprap in Clover Creek to provide the necessary embankment, maintain stream bed characteristics, properly direct water, and protect the siding (DIRS 180919-Nevada Rail Partners 2007, p. 4-2).

Portions of the south bank of Clover Creek would be filled to a height of 2 meters (6 feet) or more to elevate the site out of the floodplain to the height of the existing tracks. For construction of the interchange tracks, the fill would extend approximately 15 to 23 meters (50 to 75 feet) into the creek for a length of approximately 1,400 meters (4,600 feet) along the creek. For construction of the interchange siding, the fill would extend approximately 7.6 meters (25 feet) into the ephemeral creek bed for a length of approximately 900 meters (3,000 feet) on the east end and 600 meters (2,000 feet) on the west end of the interchange tracks. The total area to be filled in Clover Creek for construction of the siding would be approximately 0.033 to 0.043 square kilometer (8.2 to 11 acres), depending on the width of the fill. Clover Creek is classified as a water of the United States under Section 404 of the Clean Water Act. The total area and volume of permanent fill of waters of the United States required for constructing the Eccles alternative segment Interchange Yard is provided in Table 4-56.

The active stream channel along this portion of Clover Creek is approximately 0.3 meter (1 foot) deep (DIRS 183595-PBS&J 2006, Table 3). The volume of fill placed in the stream floodplain would be approximately 10,000 to 13,000 cubic meters (13,000 to 17,000 cubic yards) and the total volume of fill required to extend and raise the south bank of Clover Creek 2 meters (6 feet) or more to the height of the existing track would be about 65,000 to 87,000 cubic meters (85,000 to 110,000 cubic yards). Additional fill within the jurisdictional channel of Clover Creek would also be required to create dikes to protect the siding from flood waters.

Fill material placed within the floodplain of Clover Creek to construct the Interchange Yard could have indirect impacts to Dutch Flat and to the downstream riparian areas and associated wetlands, including those within the Lower Meadow Valley Wash Area of Critical Environmental Concern (see Figure 3-84). Indirect impacts would be due to alterations in hydraulic properties that would occur as a result of placing fill in the active floodplain of Clover Creek. The velocity of flows in Clover Creek could be increased, which would cause erosion adjacent to the filled areas and subsequent deposition downstream of the filled area. In addition, placing fill, including dikes, in Clover Creek could cause the active channel to shift to the north, resulting in erosive flows through Dutch Flat and an additional increase in the downstream sedimentation. The additional downstream sedimentation, which would otherwise not occur, would alter the downstream riparian habitat (shown in Figure 3-91). Shifting the location of the active channel at the Interchange Yard could also cause changes in the location and other characteristics of that channel downstream, possibly resulting in less surface-water flow through some riparian areas.

Common impacts to drainages are addressed in Section 4.2.5.2.1.1; however, filling a long section of a stream bank has the potential to create greater adverse impacts than simply crossing a stream, because the structure of the stream itself would be modified to a much greater extent than for a bridge crossing or culvert that would have less presence within the steam channel. It is likely that Clover Creek would be disturbed along the entire length of the Interchange Yard, which could result in a permanent alteration of the localized hydraulic conditions. Such alterations to the hydraulic conditions of the stream bed would have the potential to increase flow velocity and result in a higher potential for erosion during flood events. Subsequently, Clover Creek and its floodplain would be directly impacted.

Field surveys identified five small wetlands along the section of Clover Creek where the Interchange Yard would be constructed (see Figure 3-65). Clover Creek has seasonal flow, with a widely meandering low-flow channel containing pockets of wetland formed on low terraces adjacent to the channel. The floodplain had been altered in the local area by railroad maintenance activities that had constricted the floodplain to protect the railroad embankment. The floodplain constrictions have been reversed following an Environmental Protection Agency enforcement action in response to unauthorized filling of waters of the United States. However, effects of the constriction were readily apparent in the redirection of the main channel and erosion of uplands adjacent to the north (known as Dutch Flat). Constructing the Eccles Interchange Yard would disrupt efforts to restore Clover Creek required by the enforcement action.

None of the wetlands would be permanently filled to construct the Interchange Yard; however, three of these wetlands are adjacent to or downstream of the section of Clover Creek that would have to be filled to construct the yard. DOE would not expect direct impacts to these wetlands during the construction phase because they would be outside the construction right-of-way for the Eccles Interchange Yard and would be fenced or flagged. Indirect impacts such as sedimentation, erosion, and incidental spills would still be possible; however, DOE would expect those impacts to be small because of the best management practices the Department would use to minimize construction-related impacts. DOE would use appropriate protection measures (such as lining the fill with riprap) along the entire length of the Interchange Yard to stabilize and protect the structure from floodwaters. Section 4.2.5.2.1.6 addresses impacts to floodplains and floodwaters common to the entire Caliente rail alignment.

No springs have been identified that would be within the boundary of the Eccles Interchange Yard.

4.2.5.2.3.2 Staging Yard.

Caliente Staging Yard There are two options for siting the Staging Yard along the Caliente alternative segment. One would be approximately 1.6 kilometers (1 mile) northeast of Caliente (the Indian Cove option); the other would be 6.4 kilometers (4 miles) northeast of Caliente (the Upland option).

The Indian Cove Staging Yard would be constructed in a pasture located north of the City of Caliente (see Figure 2-45). Meadow Valley Wash drainage through the site is from north to south toward the City of Caliente. Drainage of the site would be accomplished by constructing a channel along the eastern edge of the facility. The channel around the site would be approximately 1,680 meters (5,500 feet) long. The Department would determine final channel dimensions during final design of the Staging Yard. It is very likely that a system of drains would have to be constructed under the Staging Yard tracks. Fill could be needed to elevate portions of the site out of the floodplain.

Most of the pasture is covered with palustrine emergent wetlands that are frequently grazed by cattle. Those wetlands are supported by water diverted from Meadow Valley Wash to irrigate the pasture and possibly from groundwater flow from north of the pasture (DIRS 183595-PBS&J 2006, all). Construction of the Staging Yard in this area would require the wetlands to be drained and filled above the level of the floodplain. It might also require an active drainage system and a channel around the eastern edge of the site to keep the area dry and in a stable condition. Construction of the Staging Yard in Indian Cove would require filling up to 0.19 square kilometer (47 acres) of wetlands and the associated plant and animal habitat (see Section 4.2.7 for a discussion of impacts to biological resources). The filling of up to 0.19 square kilometer of wetlands in Indian Cove for the Staging Yard would have a large impact on the functions of the wet meadow, such as its ability to support wildlife and vegetation, retain flood flows, and filter water.

The Upland site of the Staging Yard is within and adjacent to an agricultural field in Meadow Valley (see Figure 2-46). One or more sets of tracks at the north end of this yard would cross Bennett Springs Wash, a water of the United States. A bridge would be constructed at that crossing and no fill would be placed in the wash. There is an isolated wetland immediately to the west of the Upland site, in a swale adjacent to the abandoned rail roadbed. That wetland is confined to the lower part of the swale where water ponds and it has no apparent surface connection to Meadow Valley Wash or its tributaries (DIRS 183595-PBS&J 2006, Table 6). Nonetheless, DOE would avoid filling this wetland by constructing the Staging Yard to the west of the abandoned rail roadbed; therefore, no fill of wetlands or other waters of the United States will be required and there would be no impacts to wetlands to construct the Staging Yard at the Upland site (see Section 4.2.5.2.1).

Eccles Staging Yard A Staging Yard on the Eccles alternative segment (Eccles-North) would be approximately 13 kilometers (8 miles) north of Eccles about 910 meters (3,000 feet) east of U.S. Highway 93. There are no wetlands or floodplains in this area; however, the southern portion of the Staging Yard would cross one ephemeral water of the United States. This is the only wash that would be within the fenceline of the Eccles-North Staging Yard; however, the access road to the site would cross three washes identified as waters of the United States (DIRS 183595-PBS&J 2006, Figure 3A). A total of 560 square meters (0.14 acre) of waters of the United States would be filled to construct this yard. There is no alternative location for this yard along the Eccles alternative segment in Meadow Valley that would not cross at least one water of the United States.

4.2.5.2.3.3 Maintenance-of-Way Facilities. If DOE were to select Goldfield alternative segment 1 or 3, the Maintenance-of-Way Trackside Facility would be on the north side of Caliente common segment 3 approximately 26 kilometers (16 miles) east of its junction with the Goldfield alternative segments. There is one notable drainage in the proposed location for the facility.

DOE would construct the Maintenance-of-Way Headquarters Facility south of Tonopah. Depending on the location the Department selected, ephemeral washes could be encountered in this area. Impacts on drainage patterns or changing erosion and sedimentation rates for drainages associated with construction of these proposed facilities would be small.

If DOE were to select Goldfield alternative segment 4, a combined Maintenance-of-Way Trackside and Headquarters Facility would be constructed along Goldfield alternative segment 4 north of Goldfield. There are three unnamed washes crossing the proposed location for the Maintenance-of-Way Trackside and Headquarters Facility. Impacts on drainage patterns or changing erosion and sedimentation rates for drainages associated with construction of the proposed facility would be small.

DOE would minimize any potential impacts from the storage of hazardous materials at both Maintenance-of-Way Trackside and Headquarters Facility options through the implementation of a Spill Prevention, Control, and Countermeasures Plan and best management practices related to the storage, use, and proper disposal of such products. Based on these conditions, impacts to surface-water quality from accidental spills of hazardous substances during rail line construction would be small.

4.2.5.2.3.4 Rail Equipment Maintenance Yard. Because there are no perennial surface waters in the area where the rail line would end at Yucca Mountain, potential impacts to surface-water features from the construction of rail line facilities in that area would be small (similar to the common impacts already described in Section 4.2.5.2.1). The Rail Equipment Maintenance Yard would overlie one ephemeral wash, but would not cross any waters of the United States. The Yard construction area would also include the train crew quarters, and could be the location for the Nevada Railroad Control Center and National Transportation Operations Center, and the Cask Maintenance Facility. Construction of the operations support facilities would include stormwater runoff control, as necessary, which would minimize the potential for contaminated runoff to reach any of the washes in the area; therefore, impacts related to construction of the Rail Equipment Maintenance Yard would be small.

4.2.5.2.4 Quarries

Each quarry facility would be comprised of three primary components: an operations plant, the quarry and production area, and possibly a railroad siding. The operations plant would include an office and administration complex, parking areas, services for fueling and maintenance, and sanitary facilities. Portable sanitary systems would be provided onsite; no water supply or wastewater treatment facilities would be provided at the quarry sites. The quarries would be close enough to construction camps that on-site residential facilities would not be necessary.

Ballast quarry operations would require the use of water, primarily to wash excavated rock during crushing and screening operations. Water usage quantities would vary depending on the specific quarry process selected to wash the rock during these operations. It is estimated that approximately 140,000 liters (38,000 gallons) of water would be needed per operational day at each quarry site (DIRS 180922-Nevada Rail Partners 2007, p. 3-2). Water used during these activities would also be used for dust suppression in quarry operational areas. The wash water would be contained and recirculated through settling ponds. Relatively small quantities of water would also be used for dust suppression during drilling and blasting, truck loading and unloading, ballast stockpile and waste rock pile operations, and along access roads and in the quarry pit to suppress dust from truck and heavy equipment operations. Water used for dust suppression in these areas would not be expected to result in runoff from the quarry operational areas.

Overburden and waste rock removed from quarry areas would be stockpiled and later used for reclamation of the quarry sites. These piles would be stabilized or, if necessary, covered (for example, with mulch, netting, or synthetic stabilizer) to reduce the potential for erosion and runoff of sediments from these areas. Other best management practices that would be implemented include filter berms, straw-bale barriers, silt fences, or revegetation, as necessary. The change in the amount of runoff that would actually reach drainage channels would be minor, because construction would affect a small amount of the overall natural drainage areas.

Three separate programs established by the Clean Water Act are significant when reviewing activities associated with potential quarries. These include the establishment of water-quality standards pursuant to Section 303(c) of the Clean Water Act, National Pollutant Discharge Elimination System permit requirements set forth in Section 402 of the Clean Water Act, and dredge and fill requirements set forth in Section 404 of the Clean Water Act. General National Pollutant Discharge Elimination System permits would require that best management practices (including inventorying, assessment, prioritization, and identification and implementation of best management practices) be employed to meet water quality standards. It is expected that any discharges associated with quarry operations would be managed with appropriate stormwater control systems that would effectively minimize off-site impacts from stormwater drainage. Thus, impacts to surface-water features associated with quarry operations would be small.

DOE identified two possible locations where ballast from quarry CA-8B would be loaded onto ballast trains (DIRS 180922-Nevada Rail Partners 2007, p. 3-6), which are dependent upon the location of the Staging Yard. If DOE were to select the Indian Cove Staging Yard, ballast would be loaded at that yard; therefore, wetland impacts are already addressed for the Indian Cove Staging Yard (see Figure 3-62).

If DOE were to select the Upland Staging Yard, it would construct a quarry siding immediately south of Beaver Dam Road and to the east of the mainline track (see Figure 3-62). The siding would be 1,500 meters (5,000 feet) long and 61 meters (200 feet) wide. DOE delineated a total of 0.005 square kilometer (1.24 acres) of wetlands in the western 30 meters (100 feet) of this proposed location (DIRS 183595 PBS&J-2006, p. 11). DOE conducted additional field studies in January and February 2008 at the proposed siding location and mapped potential wetlands in the eastern half of the site. A total of 0.001 square kilometer (0.35 acre) of wetlands was mapped; thus, the total area of wetlands within the site that would require fill is estimated to be 0.006 square kilometer (1.59 acres). The wetland mapping that DOE completed in 2008 should not be considered a formal delineation of wetlands conducted in accordance with methods approved by the U.S. Army Corps of Engineers.

DOE also examined possible sites for a staging yard south of Caliente near the wastewater-treatment facility and found that the slope in the area is too steep for construction of the yard. A potential location for the Staging Yard within Dry Lake Valley was not considered in this Rail Alignment EIS, because the site would be located too far away from both the Caliente alternative segment and the Union Pacific Railroad Mainline to be feasible.

4.2.5.3 Railroad Operations Impacts

Potential impacts during the operations phase are addressed in relation to the impact assessment standards for surface-water resources identified in Table 4-54, including stormwater drainage and surface-water quality. Section 4.2.5.2.1 addresses surface-water availability, and floodplains and wetlands.

4.2.5.3.1 Operations Impacts Common to the Entire Rail Alignment

Operation of the proposed railroad would result in a small impact to surface waters beyond the permanent drainage alterations from construction. The rail roadbed would be expected to have runoff rates different from those of the natural terrain but, given the small size of the potentially affected areas within the overall drainage system, the impact on overall runoff quantities would be small. Thus, impacts related to stormwater increases would be limited to those localized areas where drainage patterns would be altered to convey storm flows.

Accumulation of surface water on the upgradient sides of the rail line in some areas could result from cut and fill operations during rail line construction and during operation of the railroad. There would be alteration of some natural drainage patterns and a potential increase in erosion and sedimentation rates. Standard engineering design and construction practices would be employed to minimize impacts to changes in surface-water drainage patterns and surface-water accumulation during rail line operations. Culverts, channelization, and other means of runoff control would be implemented to minimize the alteration of flow patterns and potential for water backing up. Section 4.2.5.2.1.1 states that a number of minor drainage channels would collect in a single culvert or pass under a single bridge, resulting in water flowing from a single location to the downstream side rather than across a broader area. As a result, there would be some accumulation during and following storm events and localized changes in drainage patterns, but this would be minimized.

Rail line maintenance would require periodic inspections of flood-prone areas (particularly after flood events) to verify the condition of the track and drainage structures. When necessary, sediment accumulating in these areas would be removed and disposed of appropriately. Similarly, eroded areas encroaching on the rail roadbed would be repaired. If the eroded areas had to be repaired often, that would be an indication that flow patterns had been changed and sediment was being moved as the water was cutting out a new channel. Regular inspection and maintenance of the rail line would help ensure that erosion and sedimentation problems were identified and addressed in a timely manner so that they did not contribute to upstream or downstream impacts. Therefore, impacts during the operations phase from sediment buildup and floodwater activity would be small.

The primary sources of potential surface-water contamination during the operations phase would be fuels (diesel and gasoline) and lubricants (oils and greases) required for equipment operation and maintenance. DOE would minimize the potential for contamination by managing spills and implementing best management practices.

4.2.5.3.2 Facility Operations

The primary sources of potential surface-water ***contamination*** during operation of facilities would be fuels (diesel and gasoline) and lubricants (oils and greases) required for equipment operation and maintenance. DOE would minimize the potential for contamination by managing spills and leaks and implementing best management practices. Activities at the facilities (including quarries) would adhere to a Spill Prevention, Control, and Countermeasures Plan to comply with environmental regulations and would also include a number of best management practices. The plan would describe the actions the Department would take to prevent, control, and remediate spills of fuel or lubricants. It would also describe the reporting requirements that would accompany the identification of a spill (DIRS 155970-DOE 2002, p. 4-23). Therefore, impacts to surface waters from facilities operations would be small.

Sanitary sewage generated at facilities would be contained and removed, sent to treatment facilities, or in some cases, disposed of through on-site septic systems. No industrial wastewater discharges would be expected from the operation of facilities. All wastewater collection and transfer systems would be designed and operated such that untreated wastewater would not be released to the environment; therefore, impacts to surface-water resources from facilities operations would be small.

4.2.5.3.3 Quarry Operations

Quarries would be reclaimed following the construction phase, and would not be used during the operations phase. Therefore, there would be no impacts from quarry operations.

4.2.5.4 Shared-Use Option

4.2.5.4.1 Railroad Construction Impacts

Construction impacts to surface-water resources under the Shared-Use Option would be similar to those identified for the Proposed Action without shared use. The Shared-Use Option would involve the construction of additional sidings, which would be approximately 300 meters (980 feet) long and would be aligned parallel to the rail line within the construction right-of-way. Construction of these additional sidings would involve the same types of land disturbance as for the Proposed Action without shared use, but with minor additive impacts. As for the Proposed Action without shared use, potential impacts would be the release and spread of contaminants by precipitation or intermittent runoff events or, for portions of the rail line near surface-water bodies, possible release to the surface water; the alteration of natural drainage patterns or runoff rates that could affect downgradient resources; and the need for dredging or filling of perennial or ephemeral streams. However, the adverse impacts to surface-water resources from constructing additional sidings under the Shared-Use Option would add little to potential impacts described for the Proposed Action without shared use, because the same control measures would be in effect. Because construction of these additional sidings would not be a DOE action and there are uncertainties regarding the exact locations of needed commercial-use facilities, specific impacts of the Shared-Use Option to surface-water features were not analyzed.

4.2.5.4.2 Railroad Operations Impacts

Operations impacts under the Shared-Use Option would be similar to those identified for the Proposed Action without shared use. Use of a completed rail line from Caliente to Yucca Mountain, including additional sidings, would result in small impacts to surface waters beyond the permanent drainage alterations that would result from construction. The rail roadbed would likely have runoff rates different from those of the natural terrain but, given the small size of the potentially affected areas in a single drainage system, the impact from shared-use operations on overall runoff quantities would be small.

Maintenance of the rail line and shared-use sidings would require periodic inspections of flood-prone areas (particularly after floods) to verify the condition of the track and drainage structures. When necessary, sediment accumulating in these areas would be removed and disposed of appropriately. Similarly, eroded areas encroaching on the rail roadbed would be repaired. Therefore, impacts from rail line maintenance related to sedimentation and erosion under the Shared-Use Option would be small.

General freight shipped on the proposed rail line could include mineral products, petroleum, agricultural products, or other commodities shipped or received by private companies. Spills of oil or hazardous substances carried on the rail line as general freight could affect surface-water resources. If a spill occurred, the potential for contamination to enter flowing surface water would present the greatest risk of a large contaminant migration until spills were contained and remediated. If there was no routinely flowing surface water, as is the condition for most areas along the Caliente rail alignment, it is expected that released materials would not travel far or affect critical resources before corrective action could be taken. Compliance with regulatory requirements on reporting and remediating spills would result in a small probability of spills and, with specific regard to rail line operations, the overall risk of a transportation ***accident*** that could result in a release of a hazardous substance is considered to be small, as discussed in Section 4.2.10, Occupational and Public Health and Safety. Therefore, impacts to surface-water resources from potential accidental releases of contaminants from commercial rail shipments during operations under the Shared-Use Option would be small.

4.2.5.5 Summary

4.2.5.5.1 Impacts Common to the Entire Caliente Rail Alignment

Construction and operation of a railroad along the Caliente rail alignment could result in both direct and indirect impacts to surface-water resources (see Table 4-58). Direct impacts would include temporary or permanent grading, dredging, rerouting, or filling of surface-water resources. Indirect impacts would potentially increase or impede surface flow (see Sections 4.2.5.2 and 4.2.5.3). Also, nonpoint source pollution, primarily sedimentation, could result from stormwater runoff from areas where surface grades and characteristics were changed (such as the rail roadbed and access roads) (see Section 4.2.5.2.1.2). Impacts to surface-water resources from railroad construction and operations would be small, with the exception of impacts described below in Section 4.2.5.5.2.

To evaluate potential impacts to surface-water resources, DOE identified areas where there are surface-water resources along the rail alignment (including those that would be crossed, filled, or covered) and identified the activities associated with construction or operations that would have the potential to affect these surface-water resources. Because of their importance in influencing the types and magnitude of

Table 4-58. Summary of impacts to surface-water resources – Caliente rail alignment.

Rail line segment/facility (county)	Proposed Action[a]	
	Construction impacts[b,c]	Operations impacts
All alternative segments and common segments (Lincoln, Esmeralda, and Nye Counties)	Potential for increases in nonpoint source pollution, alteration of natural drainage patterns and runoff rates, temporary blockage of surface drainage channels, localized changes in drainage patterns, and increases in the flow rate in relation to natural flow conditions. Potential for release and spread of contaminants through an accidental spill or discharge. Potential impact from erosion and sediment loading and reduction of floodwater area flow.	Potential for fuel spills or release of contaminants. Drainage crossings (culverts and bridges) might cause floodwaters to back up.
Staging Yard and Maintenance-of-Way Facilities (Lincoln, Nye, and Esmeralda Counties)	Potential impact from erosion and sediment loading.	Potential for fuel spills or release of contaminants.
Potential quarries (Nye and Esmeralda Counties)	Potential impact from erosion and sediment loading.	Potential impact from erosion and sediment loading.
Rail Equipment Maintenance Yard; Cask Maintenance Facility; Nevada Railroad Control Center and National Transportation Operations Center (Nye County)	Potential impact from erosion and sediment loading.	Potential for fuel spills during fueling, fuel transfer, or storage tank failure. Drainage crossings (culverts and bridges) might cause floodwaters to back up.
Caliente alternative segment (Lincoln County)	0.029 square kilometer (7.1 acres) of wetlands would be filled to construct the rail line. 2.8 cubic meters (99 cubic feet) of waters of the United States would be filled.	Permanent loss of wetlands. Permanent loss of waters of the United States.
Eccles alternative segment (Lincoln County)	Wetland fill would be very small; crossing would be bridged. 41 cubic meters (1,400 cubic feet) of fill for waters of the United States.	Permanent loss of waters of the United States.
Goldfield alternative segment 3 (Nye County)	Short-term direct impacts to water quality for Willow Spring.	
Staging Yard – Indian Cove (Lincoln County)	0.19 square kilometer (47 acres) of wetlands would be filled.	Permanent loss of wetlands.
Interchange Yard at Eccles (Lincoln County)	0.033 to 0.043 square kilometer (8.2 to 11 acres) of Clover Creek would be filled.	Permanent loss and rerouting after filling of Clover Creek.
Potential quarry CA-8B (Lincoln County)	0.09 square kilometer (22 acres) of wetlands would be filled to construct the quarry siding.	Permanent loss of wetlands.
Staging Yard (Eccles-North)	11 cubic meters (390 cubic feet) of fill for waters of the United States.	Permanent loss of waters of the United States.
North quarry siding – south of Upland Staging Yard (Lincoln County)	0.006 square kilometer (1.59 acres) of wetlands would be filled to construct the quarry siding.	Permanent loss of wetlands.

a. Impacts under the Shared-Use Option would be similar to those under the Proposed Action without shared use.
b. Wetland filling estimates are based on the assumption that the construction right-of-way would be 21 meters (70 feet) wide.
c. Floodplain crossing distance is given as a range. The minimum crossing distance is represented by the length of the rail line crossing Federal Emergency Management Agency mapped floodplains. The maximum value represents the minimum value in addition to the estimated crossing distance over floodplains that have not been mapped.

potential impacts, Table 4-55 summarizes the numbers of surface-water features the Caliente rail alignment would encounter. The table includes estimates of the total number of surface-water features the rail line, facilities, and quarries would cross (that is, drainage channels). The table also identifies two subsets of the total number of drainage channel crossings. The first is the notable channels described in Section 3.2.5.2.1, and the second includes drainage channels that would be classified as waters of the United States. A summary of waters of the United States and wetlands impacted along the Caliente rail alignment is provided in Table 4-56. Table 4-57 lists the crossing distances and percentage of floodplain map coverage available for each common and alternative segment.

In all instances where the alignment would cross or come close to a surface-water feature, that feature could be affected to some degree by railroad construction and operations; however, impacts would be substantially minimized through the engineering design process and the implementation of best management practices prior to, during, and after construction. DOE would incorporate hydraulic modeling into the engineering design process to ensure that crossings were properly engineered so they would not contribute to erosion and sediment pollution. The design of drainage structures would account for scour and erosion and incorporate outlet protection and velocity-dissipating devices that would calm the flow and diminish its erosive potential. Because conveyance systems would be designed to safely convey increased flow during storm events (50-year and 100-year) and would minimize concentration of flow to the greatest extent practicable, impacts on stormwater drainage conveyance from construction of the rail line would be small.

DOE would minimize impacts to surface-water resources through the implementation of engineering design standards (as described above) and best management practices (see Chapter 7). Best management practices would include erosion-control measures, such as the use of silt fences and flow-control devices to reduce flow velocities and minimize erosion. Further, the Department would minimize filling of surface-water resources by incorporating avoidance into final engineering and design of the rail line, to the extent practicable. DOE would use a minimum-width rail line footprint whenever possible.

4.2.5.5.2 Alternative Segment-Specific Impacts

The Caliente alternative segment is adjacent to wetlands and some wetland fill would be unavoidable. To minimize impacts of roadbed construction on wetlands along the Caliente alternative segment, DOE would construct the rail line on the abandoned Union Pacific Railroad roadbed (such as the areas along the Caliente alternative segment) and avoid locating facility areas in wetlands. DOE would avoid surface-water resources by increasing the slope (2:1) of the new rail roadbed or by bridging across wetlands and not constructing access or service roads in wetlands. In areas where the Department could not completely avoid wetlands, DOE would reduce the rail line footprint to a minimum of 17 meters (55 feet). Also, the final position of the rail line would be shifted to avoid filling wetlands and other surface-water resources whenever practicable. By incorporating avoidance of these resources into final rail line engineering and design, adverse impacts to wetlands (and the functions of wetlands) and other surface-water resources from rail line construction would be small. Of the 0.096 square kilometer (23.8 acres) of wetlands delineated along the alignment, only 0.029 square kilometer (7.1 acres) would be filled to construct the rail line. Given that the amount of wetlands that would be filled is small relative to the remaining wetlands in Indian Cove and southern Meadow Valley, it is expected that these impacts would have a small overall effect on the functions served by these wetlands.

There are two options for siting the Staging Yard along the Caliente alternative segment. One would be approximately 1.6 kilometers (1 mile) northeast of Caliente (the Indian Cove option); the other would be 6.4 kilometers (4 miles) northeast of Caliente (the Upland option). Construction of the Staging Yard at Indian Cove would require filling an area of wetlands located in a pasture north of the City of Caliente. The wetland meadow area would be drained and built up above the level of the floodplain. The proposed channel around the site would be approximately 1,680 meters (5,500 feet) long. It is very likely that a system of drains would have to be constructed under the Staging Yard tracks. These actions would require compliance with Section 404 of the Clean Water Act for stormwater runoff control measures. Approximately 0.19 square kilometer (47 acres) of wetlands would be filled to construct the Staging Yard at Indian Cove.

The Upland site of the Staging Yard is within and adjacent to an agricultural field in Meadow Valley. One or more sets of tracks at the north end of this yard would cross Bennett Springs Wash, a water of the United States. A bridge would be constructed at that crossing and no fill would be placed in the wash. There is an isolated wetland immediately to the west of the Upland site, in a swale adjacent to the abandoned rail roadbed. Nonetheless, DOE would avoid filling this wetland by constructing the Staging Yard to the west of the abandoned rail roadbed; therefore, no fill of wetlands or other waters of the United States will be required and there would be no impacts to wetlands to construct the Staging Yard at the Upland site.

DOE identified two possible locations where ballast from quarry CA-8B could be loaded onto ballast trains, which are dependent upon the location of the Staging Yard. If DOE were to select the Indian Cove Staging Yard, ballast would be loaded at that yard; therefore, wetland impacts are already addressed for the Indian Cove Staging Yard. If DOE were to select the Upland Staging Yard, it would construct a quarry siding immediately south of Beaver Dam Road and to the east of the mainline track. A total area of wetlands within the site is estimated to be 0.006 square kilometer (1.59 acres).

The Eccles Interchange Yard would require portions of Clover Creek to be filled to elevate the site out of the floodplain. For a length of approximately 1,400 meters (4,600 feet) along the bed of this ephemeral creek, for the construction of the interchange tracks, the fill would extend approximately 7.6 to 15 meters (25 to 50 feet) into the creek bed. For a length of approximately 900 meters (2,900 feet) on the east end and 600 meters (2,000 feet) on the west end of the interchange tracks, for the construction of the interchange siding, the fill would extend approximately 7.6 meters (25 feet) into the creek. The total area to be filled in Clover Creek for construction of the siding would be approximately 0.033 to 0.043 square kilometer (8.2 to 11 acres), depending on the width of the fill. Clover Creek is classified as a water of the United States under Section 404 of the Clean Water Act.

The active stream channel along this portion of Clover Creek is approximately 0.3 meter (1 foot) deep (DIRS 183595-PBS&J 2006, Table 3). The volume of fill placed in the stream floodplain would be approximately 10,000 to 13,000 cubic meters (13,000 to 17,000 cubic yards) and the total volume of fill required to extend and raise the south bank of Clover Creek 2 meters (6 feet) or more to the height of the existing track would be about 65,000 to 87,000 cubic meters (85,000 to 110,000 cubic yards). Additional fill within the jurisdictional channel of Clover Creek would also be required to create dikes to protect the siding from flood waters.

Construction of Goldfield alternative segment 3 could adversely affect Willow Spring. The spring is within 96 meters (315 feet) of the alternative segment, which would be inside the construction right-of-way, but outside the cut and fill area. This spring could experience short-term, direct adverse impacts to water quality resulting from rail line construction activities and flooding and sedimentation resulting from extreme weather events. Straw bale barriers or silt fences would be placed around this spring to reduce the potential for erosion and runoff of sediments toward them.

4.2.5.5.3 Preferred Alignment

Council on Environmental Quality NEPA implementing regulations require an agency to identify its preferred alternative, if one or more exists (40 CFR 1502.14[e]). For this Rail Alignment EIS, the DOE preferred alternative is to construct and operate a railroad along the Caliente rail alignment and to implement the Shared-Use Option. DOE identified preferred alternative segments (Figure F-21) within the Caliente rail alignment based on an analysis of environmental impacts, engineering and cost factors, and regulatory compliance issues, including permit requirements and challenges, stakeholder preference, land-use conflicts, and uncertainties (see Table 2-30 of this Rail Alignment EIS).

The regulations that implement Section 404(b)(1) of the Clean Water Act (40 CFR Part 230) require a demonstration of the need to fill wetlands and other waters of the United States and a comparison among alternatives of the impacts to aquatic resources, so that the practicable alternative with the least impact to aquatic resources is selected. In addition, Executive Order 11990, *Protection of Wetlands*, requires federal agencies to avoid undertaking or providing assistance for new construction located in wetlands unless there is no practicable alternative to such construction and the proposed action includes all practicable measures to minimize harm to wetlands resulting from the proposed action.

For the Caliente Implementing Alternative, the only wetlands that could be directly or indirectly affected by construction and operation of the Caliente alignment are along the beginning-of-line alternative segments; therefore, the following discussion focuses on that portion of the alignment. See Sections 4.2.5.2.1.4 and 4.2.5.2.1.5 for a description of impacts to ephemeral streams and wetlands that may be regulated under Section 404 of the Clean Water Act.

Section 2.4 of this Rail Alignment EIS describes the preferred alignment identified by the Department. A preference has been identified for the Caliente alternative segment and associated facility locations in part to minimize impacts to wetlands and other aquatic resources. One reason the Caliente alternative segment was identified as preferred, rather than the Eccles alternative segment, was that construction of the Eccles Interchange Yard would require placing approximately 0.033 to 0.043 square kilometer (8 to 11 acres) of fill along about 2.9 kilometers (1.8 miles) of the south bank of Clover Creek (see Section 4.2.5.2.3.1). Additional fill would also be required if dikes must be placed in Clover Creek to direct the flow of water and maintain the track embankment. Channelizing the creek bank and filling of the creek bed would result in direct impacts to Clover Creek and its associated floodplain. It would also impact riparian restoration efforts in Clover Creek required by the Environmental Protection Agency. Indirect impacts would occur to the riparian areas and other aquatic resources downstream of the proposed Interchange Yard. The riparian areas that could be affected are within an Area of Critical Environmental Concern proposed by the BLM for protection of habitat for federally endangered, threatened, and candidate species such as the southwestern willow flycatcher (DIRS 185340-URS 2008, p. 33). The Eccles alternative segment also was not identified as preferred because operation of the railroad at that location is much less practicable than along the Caliente alternative segment because of the slope of the Eccles Interchange Yard, slope of the main track leaving the yard, lack of a wye track, and lack of a local source of ballast (see Section 2.4 of this Rail Alignment EIS).

Other beginning-of-line options for the Caliente corridor were examined to determine whether a practicable alternative exists that would not require filling of wetlands or otherwise impact aquatic resources in Meadow Valley Wash or Clover Creek. As described in Section C.4.1 of Appendix C, DOE considered but eliminated from detailed analysis two alternative segments, Crestline and Elgin, for the Interface with the Union Pacific Railroad Mainline (see Table C-3 of Appendix C). The required engineering criteria could not be met along the Crestline alternative because of rugged terrain and insufficient flat land for a rail yard and associated facilities at the Interface with the Union Pacific Railroad Mainline. The Eglin alternative was eliminated because it would exceed maximum allowable grade. An additional alternative segment, Garden Valley 6, was considered that would have tied into the Union Pacific Railroad Mainline at Caliente and extended west through the Delamar Mountains, avoiding Meadow Valley. That alternative was eliminated because it would have required extensive tunneling near Caliente and in the three mountain passes to the west (see Table C-5 in Appendix C).

The Department also examined other locations in eastern Nevada to interface with the Union Pacific Railroad Mainline, such as existing sidings between the Utah border and Caliente, but could not find a practicable location with sufficient flat terrain to construct an interchange yard or an associated alignment that would not exceed the maximum allowable grade or other design requirements. The Union Pacific Railroad Mainline from the Utah border to Caliente generally follows Sheep Springs Draw and Clover Creek through the Chief Range. Any alignment in that area would have to exit the slopes of those drainages, which are steep in most locations, and cross the rugged terrain of the Chief Range. Any alignment connecting to the Union Pacific Railroad Mainline south of Caliente would require construction of an interchange yard, and possibly a staging yard, in Meadow Valley Wash and would have to exit through the steep slopes of Rainbow Canyon.

Based on this analysis, DOE has concluded that the Caliente alternative segment is the practicable beginning-of-line alternative with the least adverse impacts to aquatic ecosystems. Construction of the rail roadbed for that alternative would result in the permanent filling of some wetlands in and near the Indian Cove area and southern Meadow Valley just north of the City of Caliente. There is no practicable alternative location for that alignment that would completely avoid those wetlands. Indian Cove and extreme southern Meadow Valley are narrow; surrounded by steep, impassible terrain; and almost entirely covered with wetlands and riparian habitat in some areas. Thus, any rail line extending north from Caliente into Meadow Valley would be restricted to the valley bottom adjacent to or near Meadow Valley Wash and U.S. Highway 93 and would have to cross some wetlands.

To avoid impacting wetlands during construction of facilities along the Caliente alternative segment, DOE has stated a preference for the Upland Staging Yard and has identified a new location for a ballast quarry siding that is just south of Beaver Dam Road. Construction of the Upland Staging Yard would not require filling of any wetlands, and would avoid filling about 0.19 square kilometer (47 acres) of wetlands for the Staging Yard at Indian Cove. The ballast quarry siding selected would require permanently filling about 0.0064 square kilometer (1.6 acres) of wetlands. There is no practicable alternative quarry siding location close enough to the source of ballast that would result in lesser impacts to wetlands, avoid interference with the operation of the Upland Staging Yard, or avoid blocking access to Beaver Dam Road (see Section 4.2.5.2.4).

To further minimize loss of wetlands, DOE has identified the following design and construction alternatives that would minimize the amount of wetlands permanently filled to construct the Caliente alternative segment (see Section 4.2.5.2.2.1).

- Construct the rail line on the abandoned Union Pacific Railroad roadbed.
- Design bridges to span wetlands adjacent to washes that are crossed.
- Avoid wetlands in the bottom of incised washes adjacent to the roadbed by shifting the roadbed away from the edge of the washes.
- Construct the rail roadbed with a 2:1 slope.
- Do not construct a service road adjacent to the track through wetlands.

Implementing these design alternatives would reduce the amount of wetlands permanently filled from a total of about 0.096 square kilometer (23.8 acres) within the construction right-of-way to 0.029 square kilometer (7.1 acres) for construction of the rail roadbed. The total amount of wetlands that would be permanently filled to construct the Caliente alternative segment, including the quarry siding, would be about 0.035 square kilometer (8.7 acres), 0.034 square kilometer (8.5 acres) of which probably is regulated under Section 404 of the Clean Water Act. DOE evaluated using vertical retaining walls and extensive bridging to further decrease the footprint of the rail roadbed and reduce the amount of wetlands filled in the Indian Cove area and southern Meadow Valley Wash. It was determined that those methods would not be practicable.

By identifying the Caliente alternative segment and the associated Upland Staging Yard as preferred alternatives, and committing to design and construction methods that minimize impacts to wetlands, DOE has identified the practicable beginning-of-line alternative that has the minimum adverse impact on the aquatic ecosystem and has taken available steps to avoid and minimize the loss of wetlands.

4.2.5.5.4 Mitigation Measures

In accordance with 10 CFR 1022.13(a)(3), DOE must address measures to mitigate the adverse impacts of actions in a floodplain or wetlands, including but not limited to, minimum grading requirements, runoff controls, design and construction constraints, and protection of ecologically sensitive areas. Whenever possible, DOE would avoid disturbing floodplains and wetlands and would minimize impacts to the extent practicable, if avoidance was not possible. Appendix F, Section F.4.4, discusses the floodplain and wetland mitigation measures that would be considered in the vicinity of the proposed rail alignment and, where necessary and feasible, implemented during railroad construction, operations, and maintenance. In general, DOE would minimize impacts to floodplains and wetlands through the implementation of engineering design standards and best management practices.

DOE has identified several measures to help avoid, minimize, or mitigate potential adverse impacts to floodplains and wetlands under the Proposed Action and Shared-Use Option. DOE has designed the rail alignment segments to avoid direct and indirect impacts to water resources wherever practicable. Due to the nature of rail line design and the construction activities that would be required to implement the design, the rail line cannot avoid crossing floodplains or wetlands. The engineering design process would ensure that the engineered structures used to pass water runoff from one side of the rail line to the other would do so in a way that would minimize impacts to floodplains and wetlands. Such impacts would be limited mostly to the construction phase and would be subject to Clean Water Act regulations. In most cases, DOE would minimize adverse impacts through the implementation of best management practices in concert with the permits and plans regulatory agencies would require. DOE would also develop a compensatory mitigation and monitoring plan for unavoidable impacts as part of its compliance with Section 404 of the Clean Water Act in coordination with the U.S. Army Corp of Engineers, U.S. Environmental Protection Agency, and applicable land-management agencies such as the BLM.

For the area of unavoidable impacts to wetlands and other waters proposed by either alternative, federal law (33 CFR Part 320.4 (r)) would require compensatory mitigation. To fully assess the mitigation opportunities for project alternatives and options, a design-level investigation of opportunities for mitigation will be necessary. This investigation would include an assessment of available properties with potential to provide mitigation, discussions with landowners, and input from state and federal regulatory agency representatives. DOE would use the design-level investigation to develop a compensatory mitigation and monitoring plan for unavoidable impacts as part of its compliance Section 404 of the Clean Water Act in coordination with the U.S. Army Corp of Engineers, U.S. Environmental Protection Agency, and applicable land-management agencies such as the BLM.

Temporary (short-term) impacts of construction, including vegetation trampling, soil compaction, and soil erosion, would be minimized by following best management practices, and would be mitigated by post-construction site restoration measures. Site restoration typically involves soil improvements, where necessary due to compaction, and revegetation using a native wetland seed mix (or woody plantings if such is impacted). DOE would stage equipment and supplies in upland areas and use construction mats or timber mats when heavy machinery must operate within wetlands. The majority of permanent direct wetland impacts would occur to pasture wetlands. More negligible impacts would occur at stream crossings if bridge piers cannot be designed outside of wetland riparian areas.

A variety of mitigation options exist for compensating wetland impacts. These include the following:

- On-site mitigation vs. off-site mitigation – On-site mitigation refers to conducting compensatory mitigation projects on the same parcel(s) where wetland impacts would occur. This is frequently the easiest option and may be the best one for minimizing the adverse impacts of developments in a given area. For example, if localized flooding is a problem, it is important to maintain local flood storage capability. Sometimes, however, on-site mitigation is not practicable (for example, for small wetland impacts) or is not the best option for replacing wetland functions. Off-site mitigation is when the mitigation site is not part of the development site. Instead, the mitigation project is constructed at some other appropriate site. Generally, off-site mitigation is located within the same basin as the impacted area such that overall functional mitigation is provided to the affected watershed. Mitigation banks are large wetland mitigation projects constructed by a public entity or private party to compensate for future wetland impacts. However, wetland mitigation banks are not considered an option due to the lack of available wetland mitigation bank servicing in this area of Nevada.
- Restoration, creation, and enhancement – Restoration is the reestablishment of wetland and/or other aquatic resource characteristics and function(s) at a site where they have ceased to exist, or exist in a substantially degraded state. Restoration activities generally garner the best mitigation ratio (such as acres restored for acres impacted) relative to creation or enhancement activities. Creation is the establishment of a wetland or other aquatic resource where one did not formerly exist. Enhancement activities can be conducted in existing wetlands or other aquatic resources that increase one or more aquatic functions. Enhancement generally provides higher mitigation ratios (more mitigation acreage needed) than restoration or enhancement activities.

When wetland impacts cannot be avoided, DOE would need to mitigate the loss of impacted wetland functions and area. This is typically done by restoring, creating, or enhancing wetlands. A majority of the impacted wetlands along the Caliente rail alignment are located near a busy roadway (U.S. Highway 93), and are within irrigated cow pastures with a low diversity of plant species and vegetation strata. For this reason, off-site and/or out-of-kind mitigation may be more beneficial to watershed-level wetland functioning, both in terms of compensating for hydrologic functional characteristics (for example, water storage and delay) and habitat support functions (for example, songbird habitat support).

Appendix F, Floodplain and Wetlands Assessment, Section F.4.4, describes in detail the best management practices and mitigation measures that would be implemented to minimize impacts from filling of wetlands that cannot be avoided. That section also describes the best management practices and conceptual mitigation measures that would be implemented along the preferred alignment to reduce the risk of flood damage; minimize the impacts of floods on human safety, health, and welfare; restore and preserve the natural and beneficial values served by floodplains; and reduce erosion and sedimentation.

4.2.6 GROUNDWATER RESOURCES

This section describes potential impacts to groundwater resources from constructing and operating the proposed railroad along the Caliente rail alignment. To analyze potential impacts, DOE considered whether constructing and operating the railroad would result in:

- Possible damage to existing wells as a result of construction work
- Possible declines in groundwater levels or groundwater production rates at existing groundwater production wells caused as a result of groundwater withdrawals to support rail alignment construction and operation
- Possible changes in discharge rates at existing springs, seeps, or other surface-water-right locations as a result of the proposed groundwater withdrawals
- Possible changes in infiltration rates in disturbed areas
- Possible changes in groundwater quality at wells, springs, seeps, or other surface-water-right locations or in shallow groundwater as a result of the proposed groundwater withdrawals
- Potential subsidence of the ground surface as a result of the proposed groundwater withdrawals

Section 4.2.6.1 and Appendix G describe the methods DOE used to assess potential impacts to existing groundwater resources; Section 4.2.6.2 describes potential construction impacts; Section 4.2.6.3 describes potential impacts of railroad operations; Section 4.2.6.4 describes potential impacts under the Shared-Use Option; and Section 4.2.6.5 summarizes potential impacts to groundwater resources.

Section 3.2.6.1 describes the region of influence for groundwater resources. The section includes a discussion of existing wells, springs, seeps, and other surface-water-right locations that fall within the Caliente rail alignment region of influence that could be affected by new groundwater wells that would furnish water to support construction and operation of the proposed railroad.

4.2.6.1 Impact Assessment Methodology

DOE considered a variety of methods for obtaining water that would be needed to support construction and operation of the proposed rail line and railroad construction and operations support facilities. These methods include, but are not limited to, construction of new water wells; purchasing water from municipalities or other existing water-rights holders; or importing water from other groundwater ***hydrographic areas***. A combination of such methods could reduce potential impacts to groundwater resources. However, the acquisition of all required water from new wells would place the greatest amount of increased water ***demand*** on existing groundwater resources. Therefore, to develop a conservative analysis or upper bound estimate of potential impacts to groundwater resources, DOE assumed that it would obtain all water required for construction and operation of the rail line and railroad construction and operations support facilities from newly constructed wells. This Rail Alignment EIS does not analyze the impacts of obtaining water through other methods.

In this Rail Alignment EIS, DOE evaluates the potential impacts associated with the following types and categories of new water wells that would be installed and utilized to obtain water required for construction and operation of the proposed rail line and associated facilities:

- Construction-water wells – These temporary wells (DIRS 182822-Converse Consultants 2006, Section 2.1 and Table 2-2) would furnish approximately 90 percent of the total project water demand. Wells in this category include wells that would provide water for earthwork compaction during rail roadbed construction and wells that would supply water for temporary construction camps. Nearly all water obtained from wells to support rail roadbed construction within each hydrographic area would be pumped within a 1-year period within that area. The average groundwater withdrawal (usage) rate for these wells would vary according to location. Water wells at construction camps would have average withdrawal rates of 76 liters (20 gallons) per minute.

- Quarry water wells – These wells would supply water to support start-up and operation of quarry operations, with each quarry being in operation over an estimated period of about 2 years, following an initial startup period. The average withdrawal rate for these wells would be approximately 91 liters (24 gallons) per minute.
- "Permanent" water wells – These wells would supply water to meet water requirements for rail sidings and railroad operations facilities and provide water for fire protection purposes. Average withdrawal rates for these wells would be very low (less than 3.8 liters [1 gallon] to approximately 16 liters [4.2 gallons] per minute). DOE would use these new wells during the 50 years of railroad operations.

DOE would submit applications to the Nevada State Engineer for approval of water rights for the new groundwater withdrawal wells. DOE would follow all applicable requirements under state water law in Nevada Revised Statute Section 533 in applying for and acquiring water rights for all phases of the Nevada rail line and ancillary facilities. Following approval of water-rights applications, DOE would then install most of the new water wells adjacent to new access roads that would be constructed on either side of the rail roadbed and within the rail line construction right-of-way. DOE assumes that if it could not obtain adequate volumes of water from any of these new wells because of limited ***aquifer*** productivity (less then the required productivity for that location based on the water demand at the associated construction location), it would obtain the additional water required from other new wells proposed for installation either within the typical maximum 300-meter (1,000-foot)-wide construction right-of-way or from one or more of the proposed new wells situated outside of that right-of-way. In these cases, the water would either be transported by truck or pumped through a temporary above-ground pipeline. Wells installed outside the construction right-of-way would be installed as near as reasonably possible to the right-of-way, based on ***hydrogeologic*** criteria, except for wells installed at the proposed quarry sites, which might or might not be at more remote locations.

DOE considered a number of factors to evaluate potential adverse impacts to groundwater resources. There could be an adverse impact if construction and operation of the rail line and railroad construction and operations support facilities would cause any of the conditions listed in Table 4-59.

Table 4-59. Impact assessment considerations for groundwater resources.

Resource criteria	Basis for assessing adverse impact
Groundwater availability and uses	• Adversely affect an existing aquifer. Adverse effects would include substantial depletion of groundwater supplies on a scale that would affect available capacity of a groundwater source for use by existing water-rights holders within the hydrographic area where groundwater withdrawal would occur or in any downgradient hydrographic area, interfere with groundwater recharge, or reduce discharge rates to existing springs, seeps, or other surface-water-right locations. • Conflict with established water rights, allotments, or regulations protecting groundwater resources.
Ground subsidence	• Cause subsidence of the ground surface (as a result of groundwater withdrawals).
Groundwater quality	• Contaminate a public water-supply aquifer and exceed federal, state, or local water-quality criteria.

To evaluate potential impacts to groundwater resources DOE considered:

- Potential changes to infiltration rates, with consequent changes to percolation rates of surface water to the groundwater system, that could be caused by the same disturbances evaluated in the surface-water impact analysis (also see Section 4.2.5, Surface-Water Resources).
- Potential changes to groundwater quality due to groundwater withdrawals or from accidental spills or releases
- Potential impacts to aquifer users and uses resulting from withdrawal of groundwater from new wells to support water needs for construction and operation of the rail line and railroad construction and operations support facilities. DOE focused the impact analysis on aquifers and the existing groundwater users who withdraw water from the groundwater hydrographic areas that would serve as sources of water for construction and operation of the railroad. DOE compared the amount of water that would be required for construction and operation of the railroad to the availability and existing uses of groundwater in those groundwater hydrographic areas. Existing groundwater resources addressed in these evaluations include existing wells, springs, groundwater seeps, and other surface-water-right locations. DOE considered potential impacts resulting from the following actions: (1) pumping from new wells to obtain water needed for rail roadbed construction (including water needed for earthwork, dust control, and construction camps), and (2) pumping from new wells installed to support quarry operations, rail sidings, and other railroad facilities.
- Potential for damage to existing wells from construction activities or potential ground subsidence as a result of the proposed groundwater withdrawals.

4.2.6.2 Construction Impacts

4.2.6.2.1 Construction Impacts Common to the Entire Rail Alignment

Impacts to groundwater or the land surface during the construction phase could include: (1) potential changes in infiltration rates in disturbed areas, with consequent changes in percolation rates of surface water to groundwater (addressed in Section 4.2.5, Surface-Water Resources); (2) reduced flow to springs, seeps, or other surface-water-right locations or a reduction in available flow rates to one or more existing wells within the ***radius of influence*** of, or the radius of the ***cone of depression*** surrounding, proposed new wells; (3) possible damage to, or loss of, use of existing wells within the construction right-of-way; (4) degradation of groundwater quality resulting from groundwater withdrawals; or (5) potential ground subsidence.

As described in Section 4.2.5, construction of the railroad and construction and operations support facilities would result in land-surface disturbance such as grading, excavation, or stockpiling that would alter the rate at which water could infiltrate the disturbed areas. Construction activities would disturb and temporarily loosen the ground, which could produce temporarily higher near-surface infiltration rates (see Section 4.2.5). This situation would typically be short lived; the rail roadbed materials and disturbed areas associated with railroad facilities and ballast areas would become compacted and less porous, with most of the land disturbance during railroad and facilities construction likely resulting in surfaces with lower infiltration rates causing an increase in runoff. Even in the short term, localized changes in infiltration would likely cause no large-scale change in the amount of groundwater percolation ***recharge*** because the disturbed areas would be a very small percentage of the overall surface area of a hydrographic area (see Section 4.2.5). Therefore, changes to infiltration rates in the regions where construction would take place would be small, and adverse impacts associated with changes in stormwater infiltration rates would be small.

Most recharge to aquifers in the region is derived from precipitation falling in the higher parts of the inter-basin mountain ranges (see, for example, DIRS 103136-Prudic, Harrill, and Burbey 1993, pp. 2, 58, 84, and 88). The climate in the region through which DOE would construct the Caliente rail alignment is generally arid. These factors combine to produce a deficit of shallow groundwater beneath many parts of the rail alignment, such as several valley floors it would cross. Estimated depths to groundwater beneath most of the hydrographic areas the rail line would cross range from approximately 30 to 100 meters (100 to 330 feet) or more below ground, with the shallowest groundwater at 3 to 15 meters (10 to 50 feet) below ground in the Meadow Valley Wash and Oasis Valley areas (DIRS 182821-Converse Consultants 2005, Plates 4-1 through 4-15; DIRS 182822-Converse Consultants 2006, Appendix B). Available hydrogeologic information suggests that shallow groundwater would occur infrequently, and on a localized basis, beneath the Caliente rail alignment.

Other potential impacts include degradation of groundwater quality due to new sources of contamination that could come into direct contact with, or migrate to, groundwater. Construction-related materials that would be used in this arid environment, that could contaminate groundwater if spilled, include petroleum products (such as fuels and lubricants) and coolants (such as antifreeze) necessary to operate construction equipment. The infrequent occurrence of shallow groundwater beneath the Caliente rail alignment (see Section 3.2.6) indicates that the probability of contaminants reaching underlying groundwater would be low; therefore, DOE would not expect impacts to groundwater quality resulting from spills of hazardous or nonhazardous materials.

As described in Appendix G (Section G.1.1), vertical flow between different aquifers or between different aquifer units within a multiple-unit aquifer was not considered in the impacts analysis calculations. For estimating the radius of influence of a pumping well, this approach is conservative because it maximizes the estimated drawdown at and around a pumping well. However, groundwater quality could be adversely affected by vertical flow if pumping induced vertical movement of poor-quality water between different aquifer units, between different zones within a single aquifer, or to the ground surface. A review of published information (see Appendix G, Section G.1.1) regarding groundwater-quality characteristics in areas that would be crossed by the Caliente rail alignment did not identify any areas beneath the proposed rail alignment where groundwater supply wells could intercept poor-quality/highly mineralized groundwater. Based on an overlay of the proposed rail alignment onto a USGS statewide map showing estimates of total dissolved solids concentration in groundwater from basin-fill aquifers (DIRS 172905-USGS 1995, Figure 70), concentrations of total dissolved solids in groundwater in areas beneath the proposed alignment, for example, are generally less than or equal to 500 to 1,000 milligrams per liter (equivalent to 500 to 1,000 parts per million [ppm]). Poor-quality (highly mineralized) groundwater areas are restricted to areas of discharge, or sink areas, including playas, or locally near some thermals springs (DIRS 172905-USGS 1995, all). The proposed alignment does not traverse directly over discharge, sink, playa, or thermal spring areas (see Section 3.2.1.3); therefore, the possibility of a proposed well intercepting poor-quality groundwater is small. Available information suggests that in one localized area along the Caliente alignment (area along Caliente common segment 1 near proposed well location PanV7 [see Figure 3-76]), the alignment might traverse near an area of marginally poor groundwater quality (on the order of 1,000 to 3,000 ppm total dissolved solids). However, that area lies to the northeast of proposed well location PanV7, and the range of total dissolved solids concentrations in groundwater in the area around the PanV7 location does not appear to be high enough to pose a concern with respect to the potential issue of vertical movement of poor-quality groundwater to the affected environment.

Poor-quality groundwater, if it were to be intercepted in the ***screened*** zone of a well, might be able to reach the ground surface by the mechanism of artesian flow (in a free-flowing well). The top of the screened zone of each proposed new well would not be less than about 3 meters (10 feet) below the ground surface, and could be much deeper; that is, up to several hundred meters (several hundred feet) below the ground surface. The new wells would be constructed in accordance with current standards and practices used for well construction. The annular space in each new well (space between the well casing and the borehole wall) alongside the screened zone of the well casing would be backfilled with clean, permeable, granular material, covered with a low-permeability seal, and the annular space above this seal would be filled with grout to minimize the possibility of vertical mixing of groundwater from different groundwater horizons. The length of the screened zone in each new well would also likely be limited to the minimum length needed to allow the desired groundwater pumping rate, thus minimizing the potential for well screens to cross multiple groundwater horizons/aquifer units. Additionally, available information for existing well logs suggests that, with the possible exception of two isolated locales near but not beneath the proposed Caliente alignment, artesian conditions are not expected to be encountered at the proposed well locations. In those two local areas where artesian conditions might occur (in the area near the proposed PanV4 well location, and northeast of the proposed PanV7 well location), the range of total dissolved solids concentrations in groundwater in the two range from less than 500 ppm to possibly as high as 3,000 ppm (DIRS 172905-USGS 1995, Figure 70). As described previously, the latter groundwater area is not directly traversed by the alignment, and would likely not be intercepted in proposed well PanV7, so the range of total dissolved solids concentrations expected to be encountered in proposed wells along the Caliente alignment is expected to be substantially less than 3,000 ppm. For these reasons, the potential for vertical movement of poor-quality groundwater to the ground surface through wells is expected to be very small.

In summary, the potential for impacts to occur to the affected environment from vertical movement of poor-quality water within an aquifer or between different superadjacent aquifer units as a result of groundwater pumping in the newly proposed wells was evaluated using available information from published reports, well logs, and maps. For the reason stated above, the potential for this type of impact to occur is considered to be small for the proposed Caliente rail alignment.

As discussed in Section 4.2.11, Utilities, Energy, and Materials, ***sanitary wastes*** from the construction camps would be disposed of in accordance with all applicable regulatory requirements. By complying with regulatory requirements, DOE expects that wastewater-related impacts to groundwater resources in these areas would be minimized.

Railroad construction activities might occur near one or more existing wells. However, based on the available data, DOE does not anticipate that construction activities would disturb any existing wells. In the unlikely event that wells are identified prior to rail roadbed construction that could be disturbed by construction activities, DOE would take steps to minimize impacts to those wells, such as advising well owners of planned activities and discussing with the owners measures needed to protect the well head (the portion of the well above the ground surface) during construction.

An estimated total of approximately 7.5 million cubic meters (6,100 ***acre-feet***) of water could be required to construct the rail line and railroad construction and operations support facilities (DIRS 180922-Nevada Rail Partners 2007, Section 4.4.1). This estimate updates the estimate of 880,000 cubic meters (710 acre-feet) given in the Yucca Mountain FEIS (DIRS 155970-DOE 2002, Figure 6-4). DOE would use water for earthwork compaction, control of excavation dust, workforce needs, and ballast production (DIRS 180922-Nevada Rail Partners 2007, Section 4.4.2). As discussed in Chapter 2, Proposed Action and Alternatives, DOE is considering a 4- to 10-year railroad construction schedule.

The typical groundwater pumping scenario for rail roadbed construction wells assumes a 9-month effective pumping period with 3 months of lost production for each construction well because of adverse weather conditions or other factors such as equipment repairs. This provides for a conservative or upper bound estimate of groundwater withdrawal rates that would result in the largest potential impacts (greatest amounts of drawdown) to groundwater resources and existing groundwater users potentially situated within the region of influence of the proposed water wells. If the construction schedule were lengthened (for example, up to 10 years), the same amount or less water would be required to support construction activities in any given year, thereby resulting in the same or reduced groundwater withdrawal rates and the same or reduced impacts to groundwater resources and existing groundwater users. Section 4.2.6.2.2 further describes the approach and methods DOE used to quantitatively evaluate potential site-specific impacts to groundwater resources.

Table 4-60 lists the proposed Caliente rail alignment alternative segments and common segments and summarizes the estimated total construction-related water requirements (demands) within each hydrographic area. The table lists a range of water demand values for hydrographic areas associated with more than one alternative segment or common segment (Coal Valley, Garden Valley, Alkali Spring Valley, Stonewall Flat, and Lida Valley areas). Figure 4-13 depicts the Caliente rail alignment, hydrographic areas the rail line would cross, and the range of estimated total water demands associated with construction within each hydrographic area.

As described in Section 3.2.6, Table 3-35 identifies hydrographic areas considered to be ***designated groundwater basins***, and lists information about total annual committed resources and ***pending annual duty*** amounts in the listed hydrographic areas. Six of the 19 hydrographic areas are designated groundwater hydrographic areas. Comparison of the estimated construction water demands within each hydrographic area the Caliente rail alignment would cross with information presented in Table 3-35 indicates that water demands in some hydrographic areas could, depending on the alternative segment selected (areas 144 and 145), or would (area 229), exceed the estimated ***perennial yield*** value for that hydrographic area. It should be noted that, for all hydrographic areas crossed, approximately 90 percent of the groundwater withdrawals would be temporary withdrawals, occurring within 1 year or less, rather than long-term withdrawals. For evaluating potential impacts from the proposed groundwater withdrawals, it is also noteworthy that although available groundwater resources in some hydrographic areas might be deemed to be currently "overcommitted" as a whole (hydrographic areas 203, 204,170, 173A, 149, 146, 228, and 229), one or more particular aquifers within a hydrographic area might not be overcommitted. Additionally, all water-rights appropriations might not be in service simultaneously.

Tables 3-35 and 4-60 suggest that the selection of one alternative segment over another would make no notable difference in the amount of water needed to support construction when compared to the annual committed resources and pending annual duty amounts for each hydrographic area, with the following exceptions:

- Goldfield alternative segment 3 would not cross and, therefore, would not require any groundwater withdrawals, within hydrographic area 142 (Alkali Spring Valley). Construction of either Goldfield alternative segment 1 or 4 through hydrographic area 142 would result in groundwater demands representing approximately 5 percent or 19 percent, respectively, of the estimated annual perennial yield and approximately 5 percent or 21 percent, respectively, of the total annual committed resources of the hydrographic area.
- Construction of Goldfield alternative segment 3 within hydrographic area 145 (Stonewall Flat) would result in a groundwater demand representing approximately 460 percent of the estimated annual perennial yield and approximately 38 times the total committed resources of the hydrographic area. Construction of either Goldfield alternative segment 1 or 4 through hydrographic area 145 would result in groundwater demands representing approximately 290 percent or 40 percent, respectively, of the estimated annual perennial yield and approximately 24 times or 36 times, respectively, of the total committed resources of the hydrographic area.
- Construction of Goldfield alternative segment 4, Caliente common segment 4, and Bonnie Claire alternative segment 2 within hydrographic area 144 (Lida Valley), would result in the highest groundwater demand, approximately 108 percent of the estimated annual perennial yield and approximately 525 percent of the total annual committed resources of the hydrographic area.

Construction of Goldfield alternative segment 1, Caliente common segment 4, and Bonnie Claire alternative segment 3 would result in the lowest groundwater demand, approximately 44 percent of the estimated annual perennial yield and approximately 216 percent of the total annual committed resources of the hydrographic area. Construction of Caliente common segment 4 and other combinations of alternative segments within hydrographic area 144 would result in total water demands between the high and low demands associated with the two combinations described above.

- Construction of Oasis Valley alternative segment 1 and common segments 5 and 6 within hydrographic area 128 (Oasis Valley) would result in a groundwater demand equaling approximately 41 percent of the estimated annual perennial yield and approximately 31 percent of the total annual committed resources of the hydrographic area. Construction of Oasis Valley alternative segment 3 and common segments 5 and 6 through hydrographic area 128 would result in a groundwater demand equaling approximately 57 percent of the estimated annual perennial yield and approximately 44 percent of the total annual committed resources of this hydrographic area.

DOE evaluated potential impacts to existing groundwater resources assuming that it would apply for permits to appropriate water from 150 to 176 new construction water wells, including new quarry water wells, to furnish all the water required to support rail line construction, construction camps, quarry operations, and operation of railroad operations support facilities, including sidings (DIRS 182822-Converse Consultants 2006, Tables 3-2 and 2-3 and Appendix A; DIRS 180922-Nevada Rail Partners 2007, Section 3.1.4). Each construction camp would require approximately one new water well. The actual number of wells required would depend on the specific combination of alternative segments selected and flow rates achieved in installed wells.

New multiple-use water wells could be installed in each hydrographic area along the Caliente rail alignment, with the exception of area 227A. DOE assumed that each of the wells used to support rail roadbed construction would be pumped for a period not to exceed 1 year (for purposes of quantitative analysis, DOE assumed 9 months) (DIRS 182822-Converse Consultants 2006, Section 2.1). These wells would have the highest required water withdrawal rates. DOE could use quarry water wells, which would have lower production rates of approximately 91 liters (24 gallons) per minute, to support startup of quarries and during a quarry operational period of about 2 years. Wells to supply water for construction camps would be temporary and would have average withdrawal rates less than 76 liters (20 gallons) per minute. Wells supplying water for railroad operations support facilities and sidings would have the lowest average withdrawal rates (approximately 16 liters [4.2 gallons] per minute to less than 4 liters [1 gallon] per minute); these would be permanent wells (DIRS 180919-Nevada Rail Partners 2007, Table 3-B; DIRS 182822-Converse Consultants 2006, Section 2.1).

DOE would construct, and would subsequently decommission, all new water wells in accordance with applicable State of Nevada well-construction standards. After DOE completed construction of the rail line, some wells would remain in operation to supply water to railroad operations support facilities located near sidings, rail yards, or elsewhere along the rail line during the operations phase. DOE currently plans that wells not needed for operation of the rail line or for quarries would be abandoned in compliance with State of Nevada regulations, and the well sites and temporary access roads would be reclaimed (DIRS 180922-Nevada Rail Partners 2007, Section 4.4.4) in accordance with applicable requirements. Prior to abandonment (decommissioning) of groundwater wells, DOE would investigate whether there are other parties (for example, ranchers, the BLM, county governmental agencies) interested in using groundwater wells to obtain water or monitor groundwater conditions, and would work with those parties to help facilitate their possible use of these wells upon completion of the railroad. Those interested parties would be responsible for following Nevada laws to obtain water rights, if necessary, and would also be responsible for obtaining a right-of-way from the BLM (Table 7-2).

Table 4-60. Estimated water requirements for rail line construction by hydrographic area – Caliente rail alignment (page 1 of 4).

Hydrographic area[a] number and name	Perennial yield for hydrographic area (acre-feet)[b,c]	Total annual committed resources/pending annual duties for hydrographic area (acre-feet)[d]	Rail line segment or rail line segment combination[e]	Estimated water demand or range of construction water demand values within hydrographic area (acre-feet)[f]
204 – Clover Valley	1,000	3,787/0	Caliente alternative segment	16
			Eccles alternative segment	80
203 – Panaca Valley*	9,000	31,367/0	Caliente alternative segment and Caliente common segment 1	454
			Eccles alternative segment and Caliente common segment 1	566
181 – Dry Lake Valley	2,500	57/21,824	Caliente alternative segment 1	468
208 – Pahroc Valley	21,000	30/0	Caliente alternative segment 1	919
207 – White River Valley	37,000	31,819/42,512	Caliente alternative segment 1	81
171 – Coal Valley	6,000	38/33,071	Caliente common segment 1 and Garden Valley alternative 1	79
			Caliente common segment 1 and Garden Valley alternative 2	133
			Caliente common segment 1 and Garden Valley alternative 3	80
			Caliente common segment 1 and Garden Valley alternative 8	113
172 – Garden Valley	6,000	559/12,224	Caliente common segment 1 and Garden Valley alternative 2	274
			Caliente common segment 2 and Garden Valley alternative 2	149
			Caliente common segment 2 and Garden Valley alternative 2	203
			Caliente common segment 8 and Garden Valley alternative 2	146
170 – Penoyer Valley*	4,000	14,461/11,888	Caliente common segment 2	145

Table 4-60. Estimated water requirements for rail line construction by hydrographic area – Caliente rail alignment (page 2 of 4).

Hydrographic area[a] number and name	Perennial yield for hydrographic area (acre-feet)[b,c]	Total annual committed resources/pending annual duties for hydrographic area (acre-feet)[d]	Rail line segment or rail line segment combination[e]	Estimated water demand or range of construction water demand values within hydrographic area (acre-feet)[f]
173A – Railroad Valley (southern part)	2,800	3,867/0	Caliente alternative segment 2, South Reveille alternative segment 2, and Caliente common segment 3	197
			Caliente common segment 2, South Reveille alternative segment 3, and Caliente common segment 3	169
156 – Hot Creek Valley	5,500	4,231/0	Caliente common segment 3	416
149 – Stone Cabin Valley*	2,000	11,532/6,400	Caliente common segment 3	197
141 – Ralston Valley*	6,000	4,330/1	Caliente common segment 3 and Goldfield alternative segment 1	519
			Caliente common segment 3 and Goldfield alternative segment 3	573
			Caliente common segment 3 and Goldfield alternative segment 4	129
142 – Alkali Spring Valley	3,000	2,596/0	Goldfield alternative segment 1	141
			Goldfield alternative segment 4	550
145 – Stonewall Flat	100	12/0	Goldfield alternative segment 1	291
			Goldfield alternative segment 3	458
			Goldfield alternative segment 4	43

Table 4-60. Estimated water requirements for rail line construction by hydrographic area – Caliente rail alignment (page 3 of 4).

Hydrographic area[a] number and name	Perennial yield for hydrographic area (acre-feet)[b,c]	Total annual committed resources/pending annual duties for hydrographic area (acre-feet)[d]	Rail line segment or rail line segment combination[e]	Estimated water demand or range of construction water demand values within hydrographic area (acre-feet)[f]
144 – Lida Valley	350	72/0	Goldfield alternative segment 4, Caliente common segment 4, and Bonnie Claire alternative segment 2	378
			Goldfield alternative segment 1, Caliente common segment 4, and Bonnie Claire alternative segment 2	245
			Goldfield alternative segment 1, Caliente common segment 4, and Bonnie Claire alternative segment 3	156
			Goldfield alternative segment 3, Caliente common segment 4, and Bonnie Claire alternative segment 2	257
			Goldfield alternative segment 3, Caliente common segment 4, and Bonnie Claire alternative segment 3	168
			Goldfield alternative segment 4, Caliente common segment 4, and Bonnie Claire alternative segment 3	289
146 – Sarcobatus Flat*	3,000	3,591/0	Bonnie Claire alternative segment 2	336
			Bonnie Claire alternative segment 3	449
228 – Oasis Valley*	1,000	1,299/0	Common segment 5, Oasis Valley alternative segment 1, and common segment 6	401
			Common segment 5, Oasis Valley alternative segment 3, and common segment 6	574
229 – Crater Flat	220	1,147/82	Caliente common segment 6	256
227A – Fortymile Canyon, Jackass Flats	880[g]	58/5	Caliente common segment 6	572

Table 4-60. Estimated water requirements for rail line construction by hydrographic area – Caliente rail alignment (page 4 of 4).

Hydrographic area[a] number and name	Perennial yield for hydrographic area (acre-feet)[b,c]	Total annual committed resources/pending annual duties for hydrographic area (acre-feet)[d]	Rail line segment or rail line segment combination[e]	Estimated water demand or range of construction water demand values within hydrographic area (acre-feet)[f]
Total approximate quarry water demand plus miscellaneous water demand				100[h]
Estimated lowest total water demand value (acre-feet) based on possible combinations of rail line segments				Approximately 5,300
Estimated highest total water demand value (acre-feet) based on possible combinations of rail line segments				Approximately 7,400
Current estimate of total water demand (acre-feet) – current best estimate (see text)				Approximately 6,100

a. Source: DIRS 106094-Harrill, Gates, and Thomas 1988, Summary, Figure 3, with the proposed rail alignment map overlay. An asterisk (*) indicates that the State of Nevada considers the hydrographic area a designated groundwater basin (DIRS 177741-State of Nevada 2005, all).
b. Source: DIRS 103406-Nevada Division of Water Planning 1992, Regions 10, 13, and 14, except hydrographic areas 227A, 228, and 229, for which the source is DIRS 147766-Thiel 1999, pp. 6 to 12. The perennial yield value shown for area 228 is the lowest value in range of estimated values (1,000 to 2,000 acre-feet per year) presented by Thiel Engineering Consultants 1999.
c. To convert acre-feet to cubic meters, multiply by 1,233.5. To convert acre-feet to gallons, multiply by 3.259×10^5.
d. Data for committed groundwater resources and pending annual duties are current as of the dates described in section 3.2.6. Data for pending groundwater resources include underground duties but do not include duties for streams or springs. All values have been rounded to the nearest acre-foot.
e. Figures 3-75 through 3-82 show the locations of the Caliente rail alignment alternative segments and common segments.
f. Water demand estimates are from DIRS 182822-Converse Consultants 2006, Table 2-3, with reference also to DIRS 180922-Nevada Rail Partners 2007, Tables 4-4 and 4-5.
g. Based on a 1979 Designation Order by the State Engineer; there are no committed resources in area 227A. However, water-rights information from the NDWR indicates there are 58 acre-feet in committed resources for this area. The discrepancy appears to be related to the location of the boundary between areas 227A and 230 (Amargosa Desert) (DIRS 182821-Converse Consultants 2005, p. 30 and Table 4-45). The perennial-yield value shown for area 227A is the lowest estimated value presented in *Data Assessment & Water Rights/Resource Analysis of: Hydrographic Region #14 Death Valley Basin* (DIRS 147766-Thiel 1999, p. 8), for the entirety of hydrographic area 227A. The perennial yield estimate for area 277A is broken down into 300 acre-feet for the eastern third of the area and 580 acre-feet for the western two-thirds of the area.
h. Quarry and miscellaneous water demand values apply to all estimated water demand value cases. This total 100 acre-feet of water demand reflects a difference in the water demand calculation methodology used in DIRS 182822-Converse Consultants 2006, Table 2-3 versus DIRS 180922-Nevada Rail Partners 2007, Tables 4-4 and 4-5.

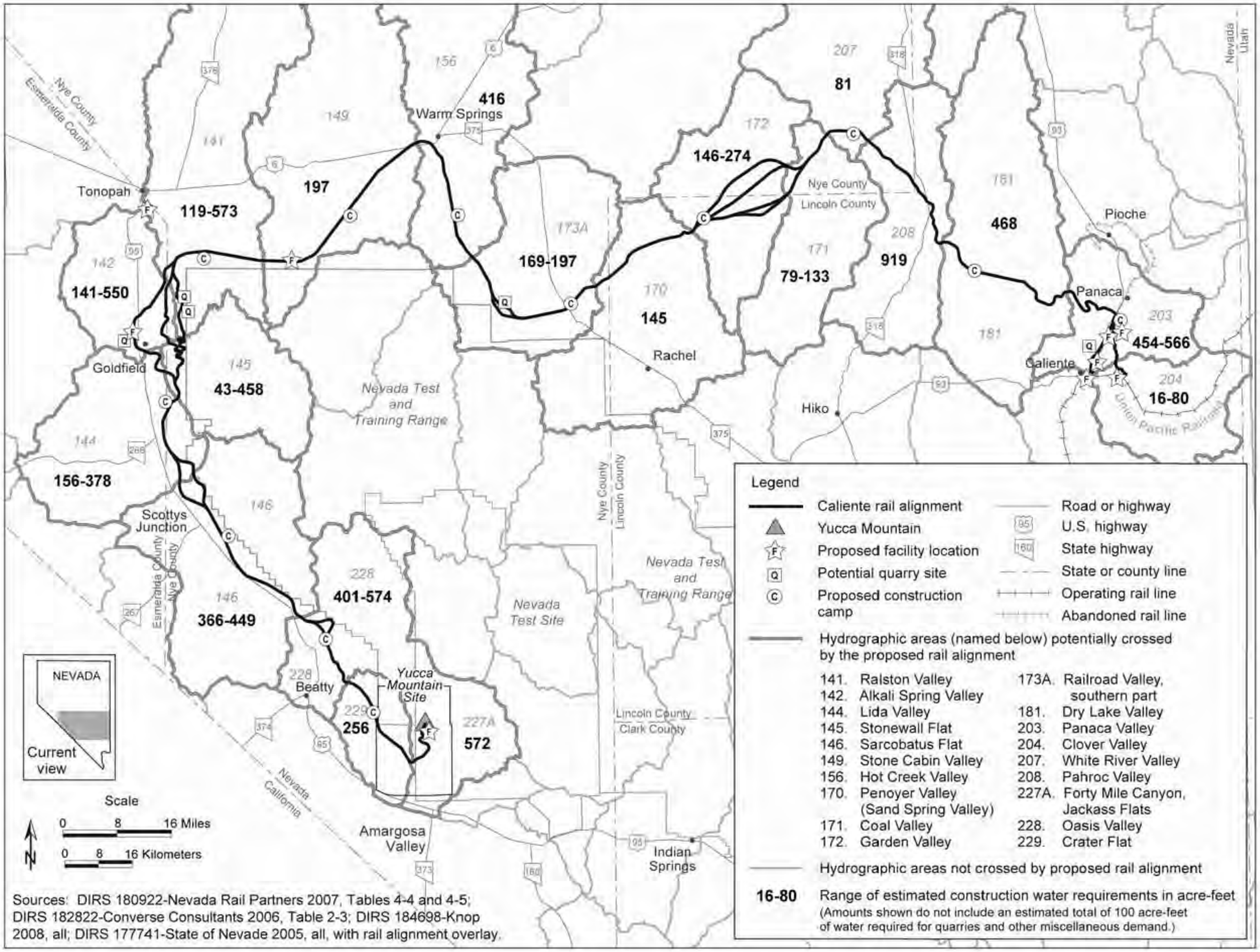


Figure 4-13. Estimated water requirements along the Caliente rail alignment.

DOE assumed that proposed new well sites outside the typical maximum 300-meter (1,000-foot)-wide rail alignment construction right-of-way would consist of an approximately 5,800-square-meter (1.4-acre) drilling pad (DIRS 180922-Nevada Rail Partners 2007, Section 4.4.4). Depending on water needs and well yields, DOE would install one or two wells on each drilling pad. Areas identified as potential locations for such well sites would be adjacent to documented existing land disturbances, including existing improved or unimproved roadways. If necessary, DOE would construct temporary access roads to accommodate 0.1- to 0.2-meter (4- to 6-inch)-diameter temporary aboveground pipelines that would transport water from these wells to the area of the construction right-of-way. Impacts that might result from the construction and temporary use of such water transfer pipelines are evaluated in the sections of this Rail Alignment EIS that address applicable resources or media (such as Biological Resources, Cultural Resources, and Land Use and Ownership). After construction of the rail line was complete, some wells would remain in operation to supply water to railroad operations support facilities near sidings, rail yards, or other locations along the rail alignment during the operations phase.

Well water would be piped through the temporary aboveground pipelines to temporary in-ground storage basins (reservoirs), inflatable bladders ("pillow tanks"), or rigid storage tanks within the construction right-of-way to provide storage capacity to meet daily construction needs. For planning purposes, DOE assumed that temporary water-storage reservoirs, if used, would be approximately 30 by 30 meters (100 feet by 100 feet) wide and approximately 3 meters (10 foot) deep, and would be used to store the daily water production from wells. Storage tanks or inflatable bladders, if used, could vary in their storage capacity up to approximately 190,000 liters (50,000 gallons) or more, depending on water demands and water withdrawal rates required for specific locations along the construction right-of-way. Open-storage basins or reservoirs, if used, would be surrounded by a fence to mitigate the potential to attract wildlife (see Section 4.2.7).

In determining the quantity of water that can be appropriated from a specific hydrographic area, requirements contained in the applicable State of Nevada statutes are considered. This authority includes the ability to grant appropriation requests in hydrographic areas that are designated groundwater basins or in cases where such appropriations would cause an exceedance of an area's estimated perennial yield.

DOE evaluated the potential impacts to groundwater resources using two withdrawal scenarios: (1) withdrawal of groundwater from the proposed new water well where each well is assumed to be pumped at its projected base-case average pumping rate (DIRS 182822-Converse Consultants 2006, Appendix A, fourth column); and (2) groundwater withdrawals from a number of wells considered in the first scenario but at an assumed withdrawal rate of up to 852 liters (225 gallons) per minute, or approximately 0.014 cubic meter (0.5 cubic foot) per second. In the second set of (sensitivity analysis) calculations, DOE varied the assumed groundwater pumping rates at higher values to determine how sensitive the radius of influence would be to groundwater withdrawal rates. The sensitivity analysis scenario also helped assess the degree of flexibility available for possibly utilizing some proposed new wells more than, or in lieu of, other proposed wells, based on potential differences in well productivity that might occur between the new wells.

Any groundwater withdrawal would decrease the availability of water within a portion of the aquifer in the region of influence surrounding a groundwater-withdrawal well. However, as described previously, DOE would obtain approximately 90 percent of all the water required for construction of the proposed rail line along the Caliente rail alignment from new temporary groundwater wells. The withdrawal of groundwater from new wells to support railroad construction would not be likely to result in long-term adverse impacts to the groundwater aquifers that are targeted for meeting project water demands because:

- For the proposed new groundwater withdrawals, analysis results (see Section 4.2.6.2.2 and Appendix G) show that short-term direct impacts on groundwater availability in aquifers resulting from proposed groundwater withdrawals where the new wells would be pumped at the projected base-case average required groundwater withdrawal rates would be limited in area (lateral) extent. Analytical results indicate that the maximum calculated lateral extent of the drawdown feature (the radius of influence of the cone of depression) that would be induced at any location within host aquifers from proposed groundwater withdrawals at the base-case production average rates would be approximately 0.8 kilometer (0.5 mile), and in most cases much less at the proposed well locations. With the exception of one location in the Oasis Valley hydrographic area (see Section 4.2.6.2.2.11) and one location in the Panaca Valley hydrographic area (see Section 4.2.6.2.2.1), withdrawals of groundwater from the proposed new water wells at the base-case average withdrawal rates would not be expected to impact existing groundwater users (owners of active pumping wells) or impact discharge rates or groundwater quality at nearby springs, seeps, or other surface-water-right locations. Sections 4.2.6.2.2.1 and 4.2.6.2.2.11 describe one or more mitigation approaches that could be implemented in order to avoid potential impacts at these otherwise affected locations. In addition, Section 4.2.6.2.2.6 describes a best management practice that could be implemented for the selective use of proposed new wells in the Hot Creek Valley hydrographic area to avoid a potential impact on an existing spring.

- Results of sensitivity analyses (see Sections 4.2.6.2.2 and Appendix G) to evaluate potential impacts to existing wells, springs, seeps, and other surface-water-right locations from a hypothetical increase in the withdrawal rate of groundwater from the proposed new water wells to up to 852 liters (225 gallons) per minute, or approximately 0.014 cubic meter (0.5 cubic foot) per second, indicate that, with the exception of four to possibly five locations in the Panaca Valley hydrographic area (Section 4.2.6.2.2.1), DOE expects no short-term direct impacts to groundwater resources resulting from such higher-rate groundwater withdrawals. Section 4.2.6.2.2.1 describes a possible approach for avoiding potential impacts at these potentially affected locations. In addition, Section 4.2.6.2.2.6 describes a possible approach for the selective use of proposed new wells in the Hot Creek Valley hydrographic area to avoid a potential impact on an existing spring.
- For areas where proposed new water wells would be near the boundary between adjacent hydrographic areas, groundwater withdrawals would not be likely to affect downgradient hydrographic areas because: (1) there are no identified existing wells, springs, seeps, or other surface-water-right locations in downgradient groundwater basins that are within 1.6 kilometers (1 mile) of any of these proposed well water withdrawal locations (see Figures 3-75 through 3-82), or (2) available hydrogeologic information indicates that there is no significant inter-basin groundwater (under)flow in the areas downgradient of the proposed well locations (see Figure 3-73).
- Long-term direct impacts to groundwater resources would not be likely because approximately 90 percent of the total project water demand would be used over a short period to support railroad construction. Most water demands within any given hydrographic area would occur over approximately 9 months under an assumed 4-year railroad construction schedule; therefore, long-term impacts resulting from their use would be small.
- Direct impacts to groundwater would not be likely for the reasons stated above; indirect impacts to groundwater resources in adjacent downgradient hydrographic areas also would not be likely.

New wells proposed to be installed outside the construction right-of-way of some rail alignment segments to support railroad construction or quarries would be on BLM-administered land (see Section 4.2.2). Direct or indirect impacts to these land areas from construction and use of such wells would be expected to be small and capable of being minimized through the use of appropriate planning and mitigation measures, as required (see Section 4.2.2).

Several of the proposed railroad operations support facilities and sidings would overlie hydrographic areas that are designated groundwater basins. Construction-water demand for these facilities would be low compared to the amount of water required for railroad construction. These facilities include the Caliente-Indian Cove, Caliente-Upland, and Eccles-North Staging Yard optional locations for the proposed railroad in hydrographic area 204, the Maintenance-of-Way Trackside Facility along Caliente common segment 3 in hydrographic area 149 and the Maintenance-of-Way Headquarters Facility south of Tonopah in area 141 (Figures 3-80 and 4-13) or the consolidated Maintenance-of-Way Facility at the trackside location near Goldfield in hydrographic area 142 (Figure 3-80), and proposed sidings in several hydrographic areas. Although the locations for the Staging Yard would not overlie a designated groundwater basin, the ***committed groundwater resources*** in area 204 exceed the estimated annual perennial yield. DOE assumed that water demand for constructing these railroad facilities and sidings would be met by installing new wells.

Details on the water requirements activity and groundwater impacts at the railroad operations facilities are provided in the *Facilities–Design Analysis Report Caliente Rail Corridor*, *Task 10: Facilities*, *Rev. 03* (DIRS 180919-Nevada Rail Partners 2007, Section 3.1.5). These facilities would require only limited amounts of water, with water required for operations of most facilities estimated to range from approximately 9,500 to 23,000 liters (2,500 to 6,000 gallons) per day at the facilities, which is equivalent to 6.4 to 16 liters (1.7 to 4.2 gallons) per minute. DOE derived operations water requirements from estimated staffing and shift projections, a 190-liter (50-gallon) per day per capita use ratio, estimated shop process needs, and a multiplier of 1.5 to account for miscellaneous water needs (DIRS 180919-Nevada Rail Partners 2007, Section 3.1.5). Water needed for meeting emergency water storage capacity requirements (for fire safety) are estimated to range from 380,000 to 830,000 liters (100,000 to 220,000 gallons). The water demand for operation of the Cask Maintenance Facility is estimated at approximately 40,000 liters (10,500 gallons) per day, which is equivalent to approximately 7 gallons per minute (DIRS 104508-CRWMS M&O 1999, Table III-1). Water needs for meeting water storage requirements and facility operations needs at each facility could be readily met using a new low-productivity well. For this reason, the magnitude of short-term or long-term impacts on the host aquifer for the individual facility water wells would be small. For this reason, DOE did not perform quantitative impact analyses for water wells that would support facilities operations.

Water consumption rates during the period of use of construction camps during the peak output year have been estimated at approximately 76 liters (20 gallons) per minute, which is equivalent to approximately 110,000 liters (28,800 gallons) per day (DIRS 182822-Converse Consultants 2006, Table 2-1). Water consumption rates during the period of use of quarries have been estimated at approximately 91 liters (24 gallons) per minute, which is equivalent to 131,000 liters (34,560 gallons) per day (DIRS 182822-Converse Consultants 2006, Table 2-1). New wells proposed for supplying water to support construction camp and quarry operations were considered when performing the quantitative impact analyses. Construction of the Cask Maintenance Facility would require approximately 4,400 cubic meters (approximately 3.6 acre-feet, or 1.176 million gallons) of water, with construction estimated to occur over approximately 2 years (DIRS 104508-CRWMS M&O 1999, Table III-2). The amount of water needed to construct the other railroad facilities (Maintenance-of-Way Facilities and the Rail Equipment Maintenance Yard) would range from approximately 14,000 to 200,000 cubic meters, which is equivalent to 11.5 to 161.1 acre-feet, or 3.75 to 52.5 million gallons (DIRS 180919-Nevada Rail Partners 2007, Table 3-B). No additional water would be required for constructing the rail sidings (DIRS 180919-Nevada Rail Partners 2007, Table 3-B). When compared to the total annual committed groundwater resources listed in Table 3-35, the direct short-term impacts to groundwater resources in the respective hydrographic areas due to water withdrawals associated with construction of railroad facilities and sidings would be small, and long-term direct and indirect impacts on groundwater resources also would be small.

DOE also assessed the potential for the proposed groundwater withdrawals to cause ground subsidence in areas of the proposed withdrawals. Groundwater pumping-induced ground subsidence has been observed at some locations in the western United States, including the Las Vegas Valley of Nevada, the Santa Clara

Valley and San Joaquin Valley areas of California, and other selected locations in Texas, New Mexico, and Arizona, and selected other locations overseas. The subsidence that has occurred is primarily related to prolonged groundwater withdrawal at rates that exceed the estimated annual recharge to the affected groundwater system. The estimated annual recharge to the aquifer systems in each of these localities is often less than approximately 50 percent of the total average annual groundwater pumped from these aquifers. In the Las Vegas Valley, groundwater withdrawals between 1955 and 1990 ranged from approximately 49.4 to 108.5 million cubic meters (40,080 to more than 88,000 acre-feet) per year, with the maximum groundwater withdrawal occurring in 1968 (108.9 million cubic meters [88,290 acre-feet]) (DIRS 181390-Bell et al. 2002, p. 156). Estimates of annual recharge rate to the Las Vegas Valley aquifer system range from approximately 30.6 to 72.2 million cubic meters (25,000 to 59,000 acre-feet) per year, indicating that groundwater withdrawal rates in the Las Vegas Valley have typically exceeded, sometimes by a factor of more than two, natural recharge rates over a period of decades (DIRS 181390-Bell et al. 2002, p. 156). Groundwater withdrawals of more than 12.1 billion cubic meters (9.8 million acre-feet) per year in the San Joaquin Valley resulted in withdrawal overdrafts of at least 4.93 billion cubic meters (4 million acre-feet) per year during the 1950s and 1960s (DIRS 181392-Poland, ed. 1984, p. 264). Annual groundwater pumping rates in each of these areas have exceeded their respective annual groundwater recharge rates between the mid-1940s to 1950s and the 1990s.

Interbedded fine- and coarse-grained sediments underlie each of these areas. Where impermeable caliche horizons occur within alluvial fan deposits or poorly ***permeable*** clay horizons occur within fine-grained basin-fill materials, groundwater is under confined or partially confined conditions, frequently exhibiting artesian flow conditions (for example, DIRS 181390-Bell et al. 2002, p. 156). Continued groundwater pumping in excess of the yearly recharge has reduced the artesian pressures in these aquifer systems resulting in an increase in vertical loads, or effective stresses. The increased effective stresses result in the compaction of the underlying sediments and corresponding ground subsidence.

An evaluation of the proposed new groundwater withdrawal wells for the rail alignment indicates that the majority of the wells would be developed in unconsolidated alluvial sediments, with a remaining minority of wells completed in consolidated bedrock aquifers. Subsidence is not expected to be an issue in consolidated bedrock aquifers because these aquifers are not susceptible to compaction during pumping.

Of the wells developed in unconsolidated alluvial sediments, a relatively small percentage would be developed in confined alluvial sediments. In general, subsidence is not expected to be an issue for pumping unconfined alluvial aquifers, because the major reported cases of land subsidence due to groundwater withdrawals involve pumping from confined aquifers.

Groundwater withdrawals from confined alluvial aquifers, at the withdrawal rates expected for this project, and if they exceed recharge rates, could, in theory, result in some small amount of subsidence within the radius of influence associated with each pumping well. However, no known subsidence effects have been documented for other pre-existing pumping wells situated in these hydrographic areas, many of which are being pumped at rates much higher than the range of pumping rates proposed for this project. Additionally, the area of disturbance within the radius of influence surrounding each well represents an extremely small percentage of the total area of the host aquifer within each hydrographic area. Finally, the duration of pumping for approximately 90 percent of the proposed total groundwater withdrawals would be on the order of 1 year or less within each hydrographic area the alignment would cross. The pumping rates required, the total volume of groundwater that would be withdrawn from each hydrographic area, and the pumping timeframes involved are much smaller than the pumping rates, water volumes removed, and the prolonged periods of pumping that were involved at locations where ground subsidence has been observed, such as the Las Vegas Valley, Santa Clara Valley, and San Joaquin Valleys. For these reasons, the potential for ground subsidence to occur as a result of constructing and operating a railroad along the Caliente rail alignment would be expected to be low.

4.2.6.2.2 Construction Impacts for Specific Alternative Segments and Common Segments

DOE evaluated potential site-specific impacts to groundwater resources from constructing and operating a railroad along the Caliente rail alignment. This section summarizes the approach and methodologies DOE used to quantitatively evaluate the extent of potential hydrogeologic impacts from withdrawing groundwater to support construction of the rail line and railroad construction and operations support facilities. Appendix G provides a more detailed description of the approach and methodology. Section 3.2.6 summarizes the existing groundwater resources along each of the alternative segments and common segments.

To evaluate potential impacts of proposed groundwater withdrawals from new water wells on existing wells, springs, seeps, and other surface-water-right locations, DOE reviewed proposed well locations, well construction details, estimated groundwater depths, and proposed groundwater withdrawal rates and timeframes (DIRS 182822-Converse Consultants 2006, all; DIRS 180922-Nevada Rail Partners 2007, Section 4.4). Unless noted otherwise, the sources for all spring, seep, and other surface-water-right location and well data in this section are as follows:

- DIRS 182821-Converse Consultants 2005, all
- The Nevada Division of Water Resources (NDWR) water-rights database and water-well log database, and other datasets (DIRS 183992-Luellen 2007, all; DIRS 184045-Luellen 2007, all)
- Data from the U.S. Geological Survey (USGS) National Water Information System (NWIS) database (DIRS 176325-USGS 2006, all; DIRS 177294-MO0607USGSWNVD.000, all)
- Geographic Information Systems databases on springs and water bodies in Nevada (DIRS 176979-MO0605GISGNISN.000, all; DIRS 177712-MO0607NHDPOINT.000, all; DIRS 177710-MO0607NHDWBDYD.000, all)
- DIRS 177293-MO0607PWMAR06D.000, all

For initial screening purposes, if DOE identified an existing well, spring, seep, or other surface-water-right location or NDWR-recorded permitted (PER) well location within a 1.6-kilometer (1-mile) radius (buffer distance) of a proposed new water well, DOE selected that proposed well location as a candidate for conducting a groundwater hydrogeologic impacts evaluation. When DOE found no existing well or PER well location, spring, seep, or other surface-water-right location within this initial search radius, it identified the nearest spring, seep, or other surface-water-right location or existing well or PER well location within a 2.4-kilometer (1.5-mile) radius (buffer distance) of the proposed new water well, and determined its hydrogeologic and construction characteristics. In addition to the above screening processes, and before completing impacts analyses, for a selected set of new groundwater withdrawal well locations where the well was specifically targeted for installation within a fault zone or an extensive ***fracture*** zone, the locations of existing wells and springs, seeps, or other surface-water-right locations up to 9.7 kilometers (6 miles) away from each such proposed well were identified. These larger search distances were considered to: (1) allow evaluation of potential simultaneous drawdown effects involving existing individual private wells having higher withdrawal rates that might be located in the general vicinity; and (2) assess the potential for a fault zone or extensive fracture zone present at the proposed new well location to act as a conduit for groundwater flow (possibly resulting in a groundwater drawdown effect over a larger distance).

DOE searched the NDWR water-rights database and well-log databases to confirm the identity, use, and water-rights status and appropriated annual ***duty*** and diversion rate, if any, associated with each existing well located within these buffer distances. DOE included domestic wells and considered the appropriated annual duty and diversion rate for each well with a water right in hydrogeologic impacts analyses to estimate potential hydrogeologic impacts from groundwater withdrawals at the proposed well location. In some cases, using the available information, DOE could not positively correlate wells listed in the USGS NWIS database to any well listed in the NDWR water-rights database or the NDWR well-log database. For such wells, DOE did not perform quantitative impacts analyses for these wells. For impacts analysis purposes, DOE considered the locations of known domestic wells with respect to the proposed alignment and relative to proposed new well locations. Figures 3-75 to 3-82 show the approximate locations of existing wells and PER well locations, including domestic wells, and springs, seeps, or other surface-water-right locations within the 1.6-kilometer (1-mile) screening level region of influence.

In addition, wells for which water-rights applications had been submitted to the State Engineer and that had been assigned a status of "permitted (PER)" by the State Engineer at the time the data were acquired were considered when conducting the groundwater resources impact analyses for existing water-rights locations. As described in Section G.1.2.1 of Appendix G, the impact analyses considered PER water-rights locations as far away as 2.4 kilometers (1.75 miles) from proposed new wells.

DOE also assessed the potential for cumulative impacts to groundwater resources to occur as a result of the combined impacts from pumping at the proposed new rail alignment-related well locations and pumping at proposed future well locations (for which water-rights applications had been submitted to the State Engineer and that had been assigned a status of either "Ready for Action [RFA]," or "Ready for Action, Protested [RFP]" at the time the data were acquired). Whether such cumulative impacts might occur would be dependent on whether these proposed future wells are approved by the State Engineer and installed and put into operation at the same time as the proposed new rail alignment-related wells. The analyses conducted for these potential cumulative impacts considered RFA and RFP water-rights locations as far away as 2.4 kilometers (1.75 miles) from proposed new wells. Results of the impacts analyses indicate that such potential cumulative impacts, if they were to occur, would be localized in extent. A discussion of such proposed RFA and RFP water-rights locations (proposed future well locations) and the potential impacts associated with these proposed well locations is presented in Sections 5.2.1.3 and 5.2.2.6.

In conducting the impact analyses (for both present and potential future cumulative impacts), DOE considered a scenario where existing wells as well as PER, RFA, and RFP wells and well locations in proximity to proposed new wells would, in theory, be approved, implemented, and put into operation at the same time as the new groundwater withdrawal wells proposed for this project. This is equivalent to assuming that known committed groundwater resources and reasonably foreseeable proposed future groundwater pumping wells within the region of influence of each proposed new DOE well location would be in place and in operation at the same time as the proposed new groundwater withdrawal well.

DOE reviewed available geologic and hydrogeologic information to confirm the hydrogeologic characteristics of known and potential aquifers in areas near proposed wells. Where applicable, for the closest existing well having a water right, DOE identified water appropriations information (annual appropriated groundwater duty, well use period, and authorized groundwater diversion rate) and documented the information for subsequent use in analysis.

DOE used the information obtained from the geologic and hydrogeologic data reviews to identify an appropriate analytical method or methods to determine the magnitude of drawdown that would be created in the host aquifer as a result of the proposed groundwater withdrawals, and determine the amount of simultaneous drawdown created, where applicable, due to groundwater production from the nearest existing pumping well. For purposes of analysis, fractured consolidated rock aquifers were treated as homogeneous, ***isotropic*** (identical in all directions), equivalent porous media. For a selected set of new groundwater withdrawal well locations where the well was determined to be in the vicinity of faults or extensive fracture systems or specifically targeted for installation within a major fault zone or an extensive fracture zone (DIRS 182822-Converse Consultants, 2006, Appendix B), additional evaluations of hydrogeologic data and/or additional analyses were performed.

In cases where a proposed well was determined to be located lateral to a mapped fault or fracture zone, the fault or fracture zone was treated as a potential no-flow ***barrier*** if it was located sufficiently close to the proposed new well to be within the region of influence from pumping at that well location. In such cases, the calculations included a specific method (image well method) to simulate the potential effects of the fault or fracture zone on groundwater flow behavior.

Hydraulic tests performed in faulted and fractured consolidated rock aquifers at a few wells in the region of the Nevada Test Site indicate that when a pumping well pumps groundwater from a high-***permeability*** zone associated with a fault, that fault zone might act as a conduit for transmitting hydraulic responses from the pumping well over larger-scale (on the order of kilometers) distances. Results from pump tests conducted at these wells often indicate that very complex hydrogeologic conditions, including heterogeneous hydraulic rock properties, the presence of complex structural systems controlling flow, and other non-isotropic conditions, exist at these test sites. For these reasons, where a proposed new well was identified as targeting a specific fault or fracture system that could act as a high-permeability conduit, DOE identified the locations of existing wells and springs up to 9.7 kilometers (6 miles) away from each such proposed well. In these cases, DOE reviewed available data on existing wells and springs and locations of known (mapped) faults and fracture zones within the 9.7-kilometer radius surrounding each new well location and compared these with the locations of the proposed well to estimate the likelihood of a hydraulic connection occurring between the proposed well and existing wells, PER wells (and proposed RFA and RFP well locations – see Chapter 5), springs, seeps, or other surface-water-right locations beyond a distance of 2.4 kilometers (1.5 miles) but within the approximately 9.7-kilometer distance. Additional details regarding the treatment of faults and extensive fracture systems as conduits (or barriers) to flow in the impacts analyses are described in Appendix G.

DOE calculated a region of influence for each well and determined how far from the well the aquifer would be affected by the drawdown. For analysis purposes, DOE assumed that (1) it would obtain all water for railroad construction from new groundwater wells, and (2) groundwater might be pumped at the nearest existing well with a water right, nearest existing domestic well, or nearest PER well (or proposed RFA or RFP well location – see Chapter 5) if approved, implemented, and put into operation simultaneously with groundwater withdrawal activity at the new well or wells. If existing wells or proposed PER wells (or RFA, or RFP well locations – see Chapter 5) were found to be farther away from the proposed new well than the sum of the radii of influence associated with both wells, DOE concluded that there would be no impacts to the nearest existing well. If the nearest spring, seep, or other surface-water-right location was found to be beyond the calculated radius of influence of the proposed new well, DOE concluded that there would be no impacts to the spring, seep, or other surface-water-right location.

For each sensitivity analysis completed, DOE assessed the potential impacts to existing wells from imposing a 852-liters (225-gallons)-per-minute pumping rate at each proposed well, considering the possibility of intersecting cones of depression from the simultaneous pumping of the nearest existing well and the proposed new well. The pumping rate assumed for the nearest well in nearly every case was the average withdrawal rate required to realize the total appropriated annual or seasonal duty value for that well, if that well had a formal appropriated water right, over the authorized period of use. The exceptions included existing wells for which the average pumping rate calculated based on the total appropriated duty value was very low and much smaller than the authorized (short-term) diversion rate for that well. In those cases, to conservatively bound impact analysis results, DOE used the diversion rate to calculate the well's radius of influence.

Sections 4.2.6.2.2.1 to 4.2.6.2.2.12 describe potential impacts to existing springs, seeps, or other surface-water-right locations, existing wells, and well locations that have been assigned a PER status. Table 4-60 lists information about the hydrographic areas the rail line would cross and the estimated volume of water DOE would need to construct each set of Caliente rail alignment alternative and common segments across each hydrographic area.

4.2.6.2.2.1 Interface with the Union Pacific Railroad Mainline. Both the Caliente and Eccles alternative segments would overlie hydrographic areas 203 and 204. The Caliente alternative segment would overlie a greater portion of area 203, approximately 16 kilometers (10 miles), than the Eccles alternative segment (approximately 12 kilometers [7.5 miles]). At present, there are no documented pending annual duties for either hydrographic area 203 or 204 (see Table 4-60).

DOE assumed that appropriations for new water wells represent a viable mechanism for obtaining all water required to support railroad construction in these two hydrographic areas. This approach does not predispose the final outcome of decisions regarding the approval or denial of such appropriation applications; however, the analysis assumes that such applications would, in theory, be accepted, and that that there would be groundwater withdrawals at the proposed new wells as designed. This analysis approach provides a conservative estimate of the potential impacts to groundwater resources resulting from groundwater withdrawals within the two hydrographic areas the Caliente or Eccles alternative segments would cross.

Caliente Alternative Segment Figures 3-75 and 3-76 show the approximate locations of proposed new water wells to meet water demands for constructing the Caliente alternative segment. The first step in assessing potential impacts to groundwater resources in this area involved the evaluation of the hydrogeologic impacts resulting from withdrawing (pumping) groundwater from the new water wells, assuming that each well would be pumped at its projected base-case average required groundwater withdrawal rate. Analysis results for the proposed well locations indicate that, with the exception of one proposed new well location (PanV25/PanV26), there would be no impacts to existing wells or springs, seeps, or other surface-water-right locations in the vicinity of this alternative segment as a result of the proposed groundwater withdrawals. DOE anticipates that wells installed at location PanV26 would have to operate at a short-term (9 months) base-case average withdrawal rate of 76 liters (20 gallons) per minute (DIRS 182822-Converse Consultants 2006, Appendix A). The nearest existing NDWR-listed water well is approximately 650 meters (2,141 feet) west of location PanV26 (see Figure 3-76). The appropriated seasonal (April to September) duty (980,000 cubic meters [797 acre-feet] per season) for this existing well is equivalent to an average withdrawal rate of 3,800 liters (1,002 gallons) per minute during the period of use of this well. The radius of influence calculated for this existing well varies between an estimated upper- and lower-bound value, depending on assumptions made regarding the saturated thickness of the water-bearing zone in the aquifer within that well. The radius of influence determined for the proposed well at location PanV26 when pumped at the proposed base-case average withdrawal rate is estimated to be approximately 76 meters (250 feet). Given the distance separating the proposed PanV26 well location and the existing irrigation well, the sum of the radii of influence for the proposed well and the existing well indicate the cones of depression generated around these wells could either intercept, or likely not, intercept each other for both the upper bound and lower bound scenarios evaluated for the existing well.

As previously stated, the water-rights permit for the existing well allows it to be pumped annually between April and September. Because of the large appropriated duty of the existing well, it appears that use of proposed well location PanV26 would not be a viable option if such use was during the same 6-month period of use as the existing well. If a new well at location PanV26 were pumped between about October and March, pumping operations at PanV26 would likely not impact irrigation operations at the existing well. Additional field evaluation of the precise location and details about the use of this existing well might provide additional information to support viability of this proposed well location.

DOE performed sensitivity analyses to evaluate potential impacts to existing wells and springs, seeps, or other surface-water-right locations from imposition of groundwater pumping rates up to 852 liters (225 gallons) per minute at proposed new well locations along the Caliente alternative segment. The analyses indicated that, with two (or possibly three), exceptions, there would be no impacts to existing wells or springs, seeps, or other surface-water-right locations in the vicinity of this alternative segment from groundwater withdrawals at higher pumping rates. The three (possibly four) exceptions are the proposed well location PanV26 previously described and the following proposed well locations:

- For the PanV6 base case scenario, the nearest known existing well is approximately 1,903 meters (3,590 feet) north of proposed location PanV6. Because of the large appropriated duty of this existing well, and its authorized period of use is for the entire year, it appears that a new well at proposed location PanV6 could not operate at the 852-liter (225-gallon)-per-minute average withdrawal rate, and would need to be restricted to an average withdrawal rate of no greater than approximately 490 liters (130 gallons) per minute to not result in an impact at the existing well, if proposed well PanV6 were to be used contemporaneously with the existing well. Alternatively, DOE could use existing wells to obtain the amount of water needed (that is, by purchasing water), use other proposed water-supply wells in the same general area, or install a new well at an alternative location in the same general area at a sufficient distance from existing wells or springs, seeps, or other surface-water-right locations to preclude impacts. For the first scenario (purchasing water from an existing well owner), a separate application might need to be submitted to the State Engineer to request approval of a change in the manner of use and/or change in the place of use of the water relative to its current manner and place of use.
- PanV4 (possible impact) – Figures 3-75 and 3-76 show an existing NDWR well approximately 1.5 kilometers (5,020 feet) northeast, and a USGS NWIS well approximately 1 kilometer (3,450 feet) northwest, of the proposed well location. However, available information suggests these may be the same well even though the NDWR and USGS locations are plotted differently (see Figure 3-76). The reported appropriated annual duty for the NDWR well equates to an average pumping rate of approximately 1,200 liters (300 gallons) per minute when distributed over a 9-month use season. If the NDWR-plotted location of this well is correct, the cone of depression for proposed well location PanV4, if pumped at 852 liters (225 gallons) per minute, and the cone of depression for the NDWR well, if pumped at 1,100 liters (300 gallons) per minute, would not be expected to intersect if the wells were pumped simultaneously. However, if the USGS-plotted location is correct and the NDWR-plotted location is incorrect, and the existing water right is associated with the well at the USGS-plotted location, the cones of depression generated through simultaneous pumping at location PanV4 and the existing well at these same pumping rates would probably intersect.
- PanV5 – For the base-case scenario, the proposed well at PanV5 would be a permanent facility water well, with a base-case withdrawal rate of only 3.8 liters (1 gallon) per minute. No base-case analysis calculation was completed for this well location because of the very small pumping rate required under the base-case scenario. For the sensitivity analysis, the radius of influence determined for the proposed well at PanV5 pumping at 852 liters (225 gallons) per minute is approximately 500 meters (1,600 feet). The nearest known existing well with a water right is a quasi-municipal well approximately 330 meters (1,085 feet) southwest of location PanV5 (see Figure 3-76). Because the authorized period of use of this well is the entire year, it appears that a new well at proposed location PanV5 could not operate at an average withdrawal rate of greater than 230 liters (60 gallons) per minute without resulting in an impact at the existing well, if the wells were to be pumped simultaneously. Further field evaluation of the precise location and details pertaining to use of the existing well might provide additional information to support viability of this proposed well location.

For the above-described locations, DOE could obtain additional data on actual locations and details regarding the use of existing nearby wells and perform additional analyses to determine maximum allowable groundwater withdrawal rates that could be imposed at the proposed well locations. This would preclude possible intersection of drawdown cones from those well locations and from the nearest existing wells, thereby precluding impacts to the existing nearby wells. Alternatively, DOE could use existing wells to obtain the amount of water needed (that is, by purchasing water), use other proposed water-supply wells in the same general area, or install a new well at an alternative location in the same general area at a sufficient distance from existing wells or springs, seeps, or other surface-water-right locations to preclude impacts. Unless an additional water appropriation is sought from the State Engineer, the quantity of groundwater that might be acquired from an existing municipality and existing water-rights holder would need to be limited such that the total amount of water pumped from that well would not exceed the existing authorized annual or seasonal duty for that well for the calendar year or authorized pumping season and the pumping rate in that well would not exceed the authorized maximum diversion rate for that existing well. Additionally, as described above, when purchasing water from an existing well owner, a separate application might need to be submitted to the State Engineer for approval of a change in the manner of use and/or a change in the place of use of the water relative to its current manner and place of use.

A quarry well, which could also provide water needed to support operation of potential quarry CA-8B, could be installed west of U.S. Highway 93 and approximately 6.9 kilometers (4.3 miles) northeast of Caliente (see location PanV23 on Figure 3-75), and would be approximately 0.32 kilometer (0.2 mile) northwest of an existing USGS NWIS well, and approximately 1.6 kilometer (1 mile) west of an NDWR domestic well.

The average required groundwater withdrawal rate at the new quarry well location would be approximately 91 liters (24 gallons) per minute (DIRS 182822-Converse Consultants 2006, Appendices A and B). Analysis results (see Table 4-61) indicate that the nearest known existing wells and springs, seeps, or other surface-water-right locations in the vicinity of the proposed quarry well would be outside the radius of influence induced by the proposed groundwater withdrawals at each of the wells. Because the quarry well would be situated well outside the typical maximum 300-meter (1,000-foot)-wide rail line construction right-of-way in primarily bedrock-dominated terrain, a groundwater well installed at this location would be unlikely to have the capacity to supply any extra water beyond that required for the quarry operation. Therefore, DOE did not perform sensitivity analyses for this well (or for any other quarry wells) to evaluate whether there would be increased impacts from higher groundwater withdrawal rates.

Available information suggests that in one isolated area along the proposed Caliente alternative segment, groundwater could be less than about 1 to 2.4 meters (less than about 3 to 8 feet) below the ground surface. Shallow groundwater conditions could occur beneath a short stretch of the proposed Caliente alternative segment situated northeast of a proposed facility location (south of Pan V4) and southeast of a proposed quarry (south of proposed well location Pan V23) (see Figure 3-76 and DIRS 182821-Converse Consultants 2005, Plates 4-13a and 4-15).

Excavation work required for constructing these two stretches of the Caliente alternative segment would be limited to about 0.6 meter (2 feet) or less below the ground surface (DIRS 182674-Nevada Rail Partners 2007, Sheets 1, 56, and 57). Although the possibility of excavations intercepting shallower groundwater in this area does exist, the probability of intercepting large areas of groundwater along that stretch of the Caliente alternative segment is considered to be small. If shallow groundwater were to be encountered, standard engineering controls (as described in Section 4.2.5.2.1.1) would be employed to minimize potential impacts to groundwater potentially disturbed by excavation activities.

Table 4-61. Summary of calculated radii of influence for proposed new wells for the Caliente rail alignment – Caliente and Eccles alternative segments.

Well number/aquifer type[a]	Distance to nearest well or nearest spring (miles)[b,c]	Radius of influence at base-case pumping rate (miles)	Radius of influence at 225 gallons[d]-per-minute pumping rate (miles)	Radius of influence for nearest well at assumed pumping rate (miles)
ClV1/AVF	> 1 (well)	0.15	Not applicable[e]	Not applicable
ClV2/AVF	> 1(well)	0.35	0.48	0.16
PanV1/AVF	0.30 (well)[f]	0.26	0.37	0.83[g]
PanV2/AVF	0.60 (well)[h]	0.21	0.33	0.22
PanV3/6/AVF	0.68 (well)	0.26	0.40	0.38
PanV4/AVF	0.65 (well)	0.22	0.46	0.27
PanV5/AVF	0.21 (well)	Not applicable	0.31	0.04
PanV23/AVF and VRA	0.94 (well)[f]	0.17	Not applicable	0.61[g]
PanV24/AVF	0.47 (well)[f]	0.21[h]	0.25	0.22[g]
PanV25/26/AVF	0.37 (well)[f]	0.05	0.17	0.66[g]

a. Aquifer types are abbreviated as follows: AVF = alluvial valley fill; VRA = volcanic rock aquifer; CRA = carbonate rock aquifer; OTH = other: fluvial-lacustrine (stream-lakebed derived) deposits, Cenozoic bedrock unit, or other consolidated rock unit (for example, limestone/dolomite, conglomerate, mudstone, and others).
b. To convert miles to kilometers, multiply by 1.6093.
c. > = greater than.
d. To convert gallons to liters, multiply by 3.78533.
e. For the not applicable cases, no calculation was completed for reasons stated in the text.
f. Nearest well is a domestic well.
g. Radius of influence is associated with a well having a water right.
h. Result is for PanV2. The base-case pumping rate at location PanV24 (1 gpm) is negligibly small.

Eccles Alternative Segment Figures 3-75 and 3-76 show the approximate locations of new wells DOE could install to meet construction-water demands along the Eccles alternative segment. Assuming DOE would pump each well at its projected base-case average groundwater production rate, analysis results indicate there would be no impacts to existing wells and springs, seeps, or other surface-water-right locations near this alternative segment.

Results of sensitivity analyses (see Table 4-61) to evaluate potential impacts from withdrawing groundwater from proposed new wells in the rail line construction right-of-way at up to 852 liters (225 gallons) per minute indicate that, with three exceptions, there would be no impacts to existing wells or springs, seeps, or other surface-water-right locations in the vicinity of this alternative segment. The exceptions are proposed new well location PanV1, and proposed new well locations PanV3/6 and PanV26, as previously described for the Caliente alternative segment. There could be adverse impacts on water levels at the nearest existing domestic well if a well at proposed well location PanV1 were pumped at a rate above approximately 670 liters (176 gallons) per minute. As discussed previously, pumping of a proposed well at location PanV3/6 at above approximately 470 liters (125 gallons) per minute could result in adverse impacts. In both instances, impacts would be expected to occur only if the nearest existing well was also being actively pumped during the same time period. For these locations, DOE could obtain additional data on actual locations and details regarding the use of existing nearby wells to perform additional analyses to determine maximum allowable groundwater withdrawal rates, if any, that could be imposed at the proposed well locations. This would preclude possible intersection of drawdown cones from those well locations and from the nearest existing wells, thereby precluding impacts to the existing nearby wells. Alternatively, DOE could use existing wells to obtain the amount of water needed (that is, by purchasing water), use other proposed water-supply wells in the same general area, or install a new well at an alternative location in the same general area at a sufficient distance from existing wells or springs, seeps, or other surface-water-right locations to preclude impacts. As described above, unless an additional water appropriation is sought from the State Engineer, the quantity of groundwater that might be acquired from an existing municipality and existing water-rights holder would need to be limited such that the total amount of water pumped from that well would not exceed the existing authorized annual or seasonal duty for that well for the calendar year or authorized pumping season and the pumping rate in that well would not exceed the authorized maximum diversion rate for that existing well.

4.2.6.2.2.2 Caliente Common Segment 1 (Dry Lake Valley Area). Caliente common segment 1 would cross hydrographic areas 181, 208, 207, and 171. New wells in these hydrographic areas could be between 60 and 460 meters (200 and 1,500 feet) deep (DIRS 182822-Converse Consultants 2006, Appendix A).

Figures 3-75 through 3-77 show the approximate locations of proposed new wells along common segment 1. These new wells include a series of proposed wells within the Caliente common segment 1 construction right-of-way. These wells might also include wells installed at one or more proposed alternative well locations (DLV5, PahV3, PahV4, and PahV8) north of the common segment 1 construction right-of-way in the Dry Lake Valley hydrographic area or west of the construction right-of-way in the Pahroc Valley hydrographic area (see Section 3.2.6.3.2). These wells could be between 76 and 460 meters (250 and 1,500 feet) deep. The target aquifer for these wells would be alluvial valley-fill aquifers or a regional carbonate rock aquifer underlying the alluvial valley fill in this area (DIRS 182822-Converse Consultants 2006, Appendices A and B). Under a 4-year construction schedule, the total required groundwater withdrawal rate from proposed suites of new wells at the various locations to support construction work in this area could range from approximately 76 to 1,000 liters (20 to 270 gallons) per minute (DIRS 182822-Converse Consultants 2006, Appendix A). Assuming proposed base-case average groundwater withdrawal rates at each proposed new well location, analysis results indicate that with the exception of proposed well location PanV7/PanV8, there would be no impacts to existing wells or springs, seeps, or other surface-water-right locations near common segment 1 from pumping at the proposed well locations. The nearest existing NDWR well to PanV7/PanV8 is approximately 1 kilometer (3,318 feet) east-southeast of PanV7/PanV8 (see Figure 3-76). There is also an existing USGS NWIS-listed well approximately 880 meters (2,900 feet) southeast of PanV7/PanV8; however, this well could not be correlated to an NDWR well. Therefore, DOE did not analyze the radius of influence for this well. The appropriated annual duty (2.22 million cubic meters [1,797 acre-feet] per year) for the nearest existing NDWR well with a water right equates to an average withdrawal rate of approximately 4,200 liters (1,110 gallons) per minute. Because of the large appropriated duty for this existing well, it appears that use of proposed well location PanV7/PanV8 would not be viable as a groundwater withdrawal well location if the nearest existing well with a water right to the northeast of that well is being pumped at the same time as the new well location.

The results of sensitivity analyses (Table 4-62) to evaluate potential impacts from increasing the groundwater withdrawal rate at any new well along this common segment to a maximum value of 852 liters (225 gallons) per minute indicate that there would be no impacts to existing wells or springs, seeps, or other surface-water-right locations in the vicinity from groundwater withdrawals at these higher potential withdrawal rates, with the exception of the previously described proposed new well location PanV7/PanV8.

The potential impact on Bennett Springs due to the proposed pumping at nearby proposed new well locations was analyzed. In the calculations, two different pumping scenarios were analyzed. In the first scenario, a total (combined) pumping rate of 74 gallons per minute, which would be obtained from location Pan V13 (PanV15) and location PanV14 (PanV16), depending on the alternative segment selected, was applied at the PanV13 location. This is the most conservative assumption possible because

Table 4-62. Summary of calculated radii of influence for proposed new wells for the Caliente rail alignment – Caliente common segment 1.

Well number/aquifer type[a]	Distance to nearest well or nearest spring (miles)[b]	Radius of influence at base-case pumping rate (miles)	Radius of influence at 225 gallons[c]-per-minute pumping rate (miles)	Radius of influence for nearest well at assumed pumping rate (miles)
PanV7/8/AVF and OTH	0.67 (well)[d]	0.20	0.31	0.38[e]
PanV13/9/AVF	0.71 (spring)	0.23	0.56	Not applicable[f]
DLV3/AVF and CRA	> 1 (well)[g]	0.31	0.48	2.23[h]
DLV4/AVF and CRA	0.92 (spring)	0.42	0.75	Not applicable
PahV1/2/3/CRA	> 1 (spring)	0.42	0.58	Not applicable
PahV7/8/9/CRA	> 1 (proposed well)[i]	0.38[j]	Not applicable[k]	1.27[i]

a. Aquifer types are abbreviated as follows: AVF = alluvial valley fill; VRA = volcanic rock aquifer; CRA = carbonate rock aquifer; OTH = other: fluvial-lacustrine (stream-lakebed derived) deposits, Cenozoic bedrock unit, or other consolidated rock unit (for example, limestone/dolomite, conglomerate, mudstone, and others).
b. To convert miles to kilometers, multiply by 1.6093.
c. To convert gallons to liters, multiply by 3.78533.
d. The nearest well is a domestic well.
e. The nearest well is associated with a certified well. See text for additional explanation of non-certified wells in the vicinity.
f. For the not applicable cases, no calculation was completed because the nearest resource feature is a spring.
g. This well is considered "Ready for Action (Ready for Action, Protested)."
h. The nearest well location assumed for PahV7/8/9 is a hypothetical well location (proposed well application location).
i. The well is considered "Ready for Action."
j. This result is based on a calculated minimum transmissivity value required for the aquifer in order to yield the specified pumping rate. The published transmissivity value for this aquifer is significantly higher, which would reduce the calculated radius of influence value accordingly.
k. No sensitivity analysis case required because base-case pumping rate assumed is slightly higher than 225 gallons per minute.

it involves the highest possible required groundwater pumping rate for this case and the well location that is closest to Bennett Springs under this scenario. Additionally, a second scenario was analyzed wherein a total (combined) pumping rate of 140 gallons per minute, which would be obtained from location PanV9 (PanV11) and location PanV10 (PanV12), depending on the alternative segment selected, was applied at the PanV9 location, which is the most conservative assumption possible as it involves the highest possible required groundwater pumping rate for this case and the well location that is closest to Bennett Springs under this scenario. This analytical approach considers the greatest potential for impacts to occur at Bennett Springs based on the range of proposed possible well pumping schemes. Analysis results indicate that: (1) Bennett Springs are not expected to be impacted by the proposed pumping at well location PanV13 for these assumed most conservative conditions; and (2) other proposed new well locations along this portion of the proposed Caliente rail alignment (common segment 1) are also located sufficiently far away from Bennett Springs that proposed pumping at those well locations would likewise not be expected to impact Bennett Springs.

For nine proposed new well locations associated with Caliente common segment 1, the targeted water zone in each case was initially identified as a possibly water-bearing fault system (DIRS 182822-Converse Consultants 2006, Appendices A and B and Figures 3-75 through 3-77). The proposed well locations (PanV14/PanV16, DLV2, DLV3, DLV4, DLV6, PahV1, PahV2, PahV5, and PahV8) could be installed in hydrographic areas 203, 181, and 208, either within or outside the typical maximum 300-meter (1,000-foot)-wide construction right-of-way of common segment 1 (Figures 3-75 through 3-77). For these proposed well locations, available information, including GIS baseline data on mapped fault traces in Nevada, indicates that either the proposed well locations do not appear to be associated with any known mapped fault traces or there are no known existing wells, springs, seeps, or other surface-water-right locations within a 9.7-kilometer (6-mile) radius of the proposed well locations that could be associated with the same fault zone that might be intercepted at a proposed well location. One water-right location (a reservoir) approximately 3.8 kilometers (4.1 miles) north of proposed well location DLV3 is situated in proximity to a mapped fault trace that might be associated with the fault zone that could be intercepted at location DLV3. However, the water source for the water stored in this reservoir (Ely Spring) is more than 9.7 kilometers (6 miles) away from location DLV3. Based on these considerations, Ely Spring would not be expected to be impacted by pumping at the DLV3 location.

As described in Section 3.2.6.2, applications have been filed for a proposed irrigation well that would be within approximately 1.7 kilometers (1.1 miles) of proposed well location DLV3 in Dry Lake Valley, for a proposed municipal well that would be within approximately 1.7 kilometers of proposed well location PahV9 in the Pahroc Valley hydrographic area, and for proposed municipal wells that would be approximately 1.5 kilometers (0.9 miles) northeast of the proposed PahV7 well location, and approximately 1 kilometer (0.6 mile) northeast of the proposed PahV8 well location, also in the Pahroc Valley hydrographic area. Potential impacts resulting from these proposed new applications are evaluated in Section 5.2.2.6.

4.2.6.2.2.3 Garden Valley Alternative Segments. Figures 3-77 and 3-78 show the approximate locations of new wells DOE could install to meet construction-water demands and locations of existing wells and springs in the vicinity of Garden Valley alternative segments. There are six existing USGS NWIS wells within 1.6 kilometers (1 mile) of Garden Valley alternative segments 1, 2, 3, and 8. These wells are either dry or have been used as testing or monitoring wells. Other than their possible future use as monitoring wells, these wells have no associated productive (beneficial) use.

Assuming proposed base-case average and sensitivity analysis groundwater withdrawal rates at each new well location, the impacts assessment results (see Table 4-63) indicate that existing wells and springs, seeps, or other surface-water-right locations near the Garden Valley alternative segments would be outside the radius of influence of the proposed new water wells.

As described in Section 3.2.6.3.3, an application has been filed for a proposed municipal well (Figure 3-78) that would be approximately 2.1 kilometers (1.3 miles) southwest of a proposed new well location (GV10). The potential for impacts associated with this proposed well location is evaluated in Section 5.2.2.6.

4.2.6.2.2.4 Caliente Common Segment 2 (Quinn Canyon Range Area). Figures 3-78 and 3-79 show the approximate locations of existing wells and proposed new wells within the rail line construction right-of-way to meet water demands along common segment 2. Documented pending annual duties for hydrographic area total approximately 3.95 million cubic meters (3,200 acre-feet).

DOE could install up to two new water wells at proposed alternative well location PeV1 in Penoyer Valley (see Figure 3-78), which would be adjacent to two USGS NWIS wells south of common segment 2. These wells have no beneficial use and is designed to serve as a groundwater monitoring well only. DOE could install up to three additional new water wells at proposed well pair location PeV2/PeV3 in Penoyer Valley (see Section 3.2.6.3.4 and Figure 3-78) to provide water for construction. There are no known existing wells, springs, seeps, or other surface-water-right locations within 1.6 kilometers (1 mile) or within the potential radius of influence of this proposed alternative well location.

Assuming proposed base-case average and sensitivity analysis groundwater withdrawal rates at each new well location, the impacts assessment results indicate that existing wells, springs, seeps, or other surface-water-right locations near common segment 2 would be outside the radius of influence of the proposed new water wells. For this reason, no quantitative impacts analysis calculations were completed for new well locations proposed for this portion of the Caliente rail alignment.

Table 4-63. Summary of calculated radii of influence for proposed new wells for the Caliente rail alignment – Garden Valley alternative segments.

Well number/aquifer type[a]	Distance to nearest well or nearest spring (miles)[b,c]	Radius of influence at base-case pumping rate (miles)	Radius of influence at 225 gallons[d]-per-minute pumping rate (miles)	Radius of influence for nearest well at assumed pumping rate (miles)
GV2/AVF	> 1 (well)	0.18	0.34	0.16
GV10/AVF	0.78 (well)[e]	0.12	0.29	>1[e]

a. Aquifer types are abbreviated as follows: AVF = alluvial valley fill; VRA = volcanic rock aquifer; CRA = carbonate rock aquifer; OTH = other: fluvial-lacustrine (stream-lakebed derived) deposits, Cenozoic bedrock unit, or other consolidated rock unit (for example, limestone/dolomite, conglomerate, mudstone, and others).
b. To convert miles to kilometers, multiply by 1.6093.
c. > = greater than.
d. To convert gallons to liters, multiply by 3.78533.
e. The well location assumed for GV10 is a hypothetical well location (proposed well application location that is considered "Ready for Action [Protested]").

4.2.6.2.2.5 South Reveille Alternative Segments. The hydrographic area (173A) these alternative segments would cross is not a designated groundwater basin; however, committed groundwater resources exceed the estimated perennial yield. Figure 3-79 shows the approximate location of new water wells DOE would install to meet construction demands for water along these alternative segments. There is one existing NDWR well with a water right approximately 1.77 kilometers (1.1 miles) north-northeast of the northern end of South Reveille alternative segment 2 near where it would merge with Caliente common segment 3 (see Figure 3-79). This well provides water for livestock watering.

A proposed well (RrV8), which could provide water needed to support operation a of potential quarry, could be installed within approximately 1.2 kilometers (0.76 mile) of an existing stockwatering well (see location RrV8 on Figure 3-79). The average required groundwater withdrawal rate at the new quarry well location would be approximately 91 liters (24 gallons) per minute (DIRS 182822-Converse Consultants 2006, Appendices A and B). Analysis results (Table 4-64) indicate that this existing well would not be expected to be impacted by the proposed groundwater withdrawal at the RrV8 location. Because the quarry well would be situated in primarily bedrock-dominated terrain, a groundwater well installed at this location would be unlikely to have the capacity to supply any extra water beyond that required for the quarry operation. Therefore, DOE did not perform sensitivity analyses for this well (or for any other proposed quarry wells) to evaluate whether there would be increased impacts from higher groundwater withdrawal rates.

Assuming proposed base-case average groundwater withdrawal rates at each new well location, analysis results (see Table 4-64) indicate that existing wells, springs, seeps, or other surface-water-right locations

Table 4-64. Summary of calculated radii of influence for proposed new wells for the Caliente rail alignment – South Reveille alternative segments.

Well number/aquifer type[a]	Distance to nearest well or nearest spring (miles)[b,c]	Radius of influence at base-case pumping rate (miles)	Radius of influence at 225 gallons[d]-per-minute pumping rate (miles)	Radius of influence for nearest well at assumed pumping rate (miles)
RrV6/11/AVF	> 1 (well)	0.12	0.31	0.03
RrV8/AVF	0.75 (well)	0.08	Not applicable[e]	0.03

a. Aquifer types are abbreviated as follows: AVF = alluvial valley fill; VRA = volcanic rock aquifer; CRA = carbonate rock aquifer; OTH = other: fluvial-lacustrine (stream-lakebed derived) deposits, Cenozoic bedrock unit, or other consolidated rock unit (for example, limestone/dolomite, conglomerate, mudstone, and others).
b. To convert miles to kilometers, multiply by 1.6093.
c. > = greater than.
d. To convert gallons to liters, multiply by 3.78533.
e. For the not applicable case, no calculation was completed for reasons stated in the text.

near these alternative segments would be outside the radius of influence of proposed new wells. Results of evaluations (Table 4-64) to evaluate the potential for impacts to occur from increasing the groundwater withdrawal rate at any new supply well to a maximum value of 852 liters (225 gallons) per minute indicate that there would be no impacts to existing wells, springs, seeps, or other surface-water-right locations near South Reveille alternative segments from groundwater withdrawals at these higher potential withdrawal rates.

4.2.6.2.2.6 Caliente Common Segment 3 (Stone Cabin Valley Area). Figures 3-79 and 3-80 show the approximate locations of the proposed new water wells in hydrographic areas 141, 149, 156, and 173A needed to support construction. Documented pending annual duties for hydrographic areas 141, 149, 156, and 173A total approximately 4.74 million cubic meters (3,840 acre-feet), all of which are assigned to area 149.

Assuming that the total combined, proposed, base-case average groundwater withdrawal rate of 620 liters (165 gallons) per minute might be applied at either HC5 or HC7 new well location, analysis results (see Table 4-65) indicate that, with the exception of Black Spring, existing wells and springs near Caliente common segment 3 would be outside the radius of influence of the new water wells. If it is conservatively assumed that Black Spring and the host aquifer at proposed new well locations HC5 and HC7 are hydraulically interconnected and groundwater underlying HC5 and HC7 is assumed to be under confined conditions, hydrogeologic impact analysis results indicate that if all of the water required at the specified water-demand station for construction of the proposed alignment was to be obtained from the proposed HC5 well location, this could impact flow rates to Black Spring. However, analysis indicates that if the groundwater withdrawal rate at HC5 did not exceed approximately 490 liters (129 gallons) per minute, it is not expected that discharge rates at Black Spring would be affected by the groundwater withdrawal at location HC5. DOE could instead use a well or wells at the proposed HC7 location for meeting the total water-demand (up to the average required pumping rate of 620 liters [165 gallons] per minute) required at the specified water-demand station. There are no known existing wells or springs within the radius of influence of proposed well location HC7 (see Figure 3-79). Monitoring of the spring would be required in order to confirm whether the proposed well(s) at location HC5 are hydraulically connected to Black Spring. In the event the proposed well location HC5 is utilized and an attempt made to pump a well or wells at location HC5, DOE would institute a program to monitor discharge rates at Black Spring before and during pumping in order to verify whether the well(s) at location HC5 and Black Spring are hydraulically connected. If monitoring data indicate that the water-bearing zone at location HC5 and the spring are hydraulically connected, pumping rates at location HC5 would be adjusted to avoid impacts to the spring.

Table 4-65. Summary of calculated radii of influence for proposed new wells for the Caliente rail alignment – Caliente common segment 3.

Well number/aquifer type[a]	Distance to nearest well or nearest spring (miles)[b,c]	Radius of influence at base-case pumping rate (miles)	Radius of influence at 225 gallons[d]-per-minute pumping rate (miles)	Radius of influence for nearest well at assumed pumping rate (miles)
HC4/AVF	0.81 (well)	0.33	0.55	0.05
HC5/7/AVF and VRA	0.27 (spring)	0.30	0.36	Not applicable[e]
SCV3/AVF	> 1 (well)	0.13	0.35	0.28

a. Aquifer types are abbreviated as follows: AVF = alluvial valley fill; VRA = volcanic rock aquifer; CRA = carbonate rock aquifer; OTH = other: fluvial-lacustrine (stream-lakebed derived) deposits, Cenozoic bedrock unit, or other consolidated rock unit (for example, limestone/dolomite, conglomerate, mudstone, and others).
b. To convert miles to kilometers, multiply by 1.6093.
c. > = greater than.
d. To convert gallons to liters, multiply by 3.78533.
e. No calculation was completed because the nearest resource feature is a spring.

Results of sensitivity analyses (see Table 4-65) to evaluate impacts from increasing the groundwater withdrawal rate at proposed well location HC7 to a maximum value of 852 liters (225 gallons) per minute indicate that there would be no impacts to existing wells, springs, seeps, or other surface-water-right locations near Caliente common segment 3, including Black Spring, from this rate of groundwater withdrawal. Alternatively, as for the case just described involving proposed base-case average withdrawal rates, a maximum pumping rate of 490 liters (129 gallons) per minute could be imposed at HC5.

Caliente common segment 3 would cross an underground pipe conveying water from Black Spring to stock-watering ponds east of the proposed rail line (DIRS 173845-Resource Concepts 2005, Figure 5.31a.1).

Available geologic information, including GIS baseline data on mapped fault traces in Nevada, suggests that the proposed wells at location HC5 might intercept and obtain water directly from a (water-bearing) fault zone. The source of water to Warm Springs (Figure 3-79), which is located approximately 2.7 kilometers (1.7 miles) north of location HC5, may be this same fault zone. If the proposed wells at the HC5 location intercept the same fault zone or a hydraulically connected fault zone, then the proposed groundwater pumping at location HC5 could impact flow behavior at the springs. Monitoring of the springs would be required in order to confirm whether the proposed wells at location HC5 are hydraulically connected to Warm Springs. If monitoring data indicate that the wells and spring are hydraulically connected, pumping rates would be adjusted to avoid impacts to the springs. There is no information to suggest that the proposed wells at location HC7 could intercept a fault zone or fracture system should this well location be used for obtaining water required at corresponding water-demand stations along the rail alignment.

4.2.6.2.2.7 Goldfield Alternative Segments. Figure 3-80 shows the approximate location of proposed new wells along Goldfield alternative segments. Groundwater withdrawals within hydrographic areas 145 for Goldfield alternative segments 1 and 3, and within hydrographic area 144 for a Goldfield alternative segment 4, Caliente common segment 4, and Bonnie Claire alternative segment 2 combination of alternatives, would exceed the estimated annual perennial yields for those hydrographic areas. However, approximately 93 to 95 percent of the proposed withdrawals would be to support rail roadbed construction and would be temporary (DIRS 182822-Converse Consultants 2006, Section 2.1 and Table 2-2). DOE could install up to seven new water wells at proposed alternative well locations AsV1/2/3/4/5/8/9 in the Alkali Spring Valley hydrographic area (area 142) approximately 3.5 kilometers (2.2 miles) west of the centerline of Goldfield alternative segment 3 (see Section 3.2.6.3.7 and Figure 3-80). There are no known existing wells, springs, seeps, or other surface-water-right locations within 1.6 kilometers (1 mile) or within the potential radius of influence of these proposed alternative well locations.

DOE could install up to seven new water wells at proposed alternative well locations StF1/2/3/4/5/8/9 in the Stonewall Flat hydrographic area (area 145) approximately 1.9 to 2.3 kilometers (1.2 to 1.4 miles) east of the centerline of Goldfield alternative segment 3 (see Section 3.2.6.3.7 and Figure 3-80). There are no known existing wells, springs, seeps, or other surface-water-right locations within 1.6 kilometers (1 mile) or within the potential radius of influence of these proposed alternative well locations.

DOE could install up to eight new water wells at proposed alternative well locations LV1/2/3/4/9/10/11/12 in the Lida Valley hydrographic area (area 144) approximately 4.7 to 5 kilometers (2.9 to 3.1 miles) west of the centerline of Goldfield alternative segment 3 (see Section 3.2.6.3.7 and Figure 3-80). There are no known existing wells, springs, seeps, or other surface-water-right locations within 1.6 kilometers (1 mile) or within the potential radius of influence of these proposed alternative well locations.

Assuming proposed base-case average groundwater production rates at each new well, analysis results (see Table 4-66) indicate that existing wells, springs, seeps, or other surface-water-right locations near the Goldfield alternative segments would be outside the radius of influence of these proposed new water wells. A proposed well (AsV6), which could provide water needed to support operation of a potential

Table 4-66. Summary of calculated radii of influence for proposed new wells for the Caliente rail alignment – Goldfield alternative segments.

Well number/aquifer type[a]	Distance to nearest well or nearest spring (miles)[b]	Radius of influence at base-case pumping rate (miles)	Radius of influence at 225 gallons[c]-per-minute pumping rate (miles)	Radius of influence for nearest well at assumed pumping rate (miles)
AsV6/ VRA	0.69 (spring)	0.13	Not applicable[d]	0.08

a. Aquifer types are abbreviated as follows: AVF = alluvial valley fill; VRA = volcanic rock aquifer; CRA = carbonate rock aquifer; OTH = other: fluvial-lacustrine (stream-lakebed derived) deposits, Cenozoic bedrock unit, or other consolidated rock unit (for example, limestone/dolomite, conglomerate, mudstone, and others).
b. To convert miles to kilometers, multiply by 1.6093.
c. To convert gallons to liters, multiply by 3.78533.
d. For the not applicable case, no calculation was completed for reasons stated in the text.

quarry, could be installed approximately 1 kilometer (0.6 mile) northwest of an existing spring (see Figure 3-80). The average required groundwater withdrawal rate at the new quarry well location would be approximately 91 liters (24 gallons) per minute (DIRS 182822-Converse Consultants 2006, Appendices A and B). Analysis results (Table 4-66) indicate that this existing spring would not be expected to be impacted by the proposed groundwater withdrawal at the ASV6 location. Because the quarry well would be situated in primarily bedrock-dominated terrain, the groundwater withdrawal rate at this well would not be expected to exceed its projected required average withdrawal rate. Therefore, DOE did not perform sensitivity analyses for this well (or for any other proposed quarry wells) to evaluate whether there would be increased impacts from higher groundwater withdrawal rates.

For three proposed new well locations associated with the Goldfield alternative segments, the targeted water zone is a possibly water-bearing fractured ***volcanic rock*** system (DIRS 182822-Converse Consultants 2006, Appendices A and B and Figure 3-79).

The proposed well locations (well locations StF10, LV5/LV13, and LV8/LV19) could be installed in hydrographic areas 144 and 145, within the 300-meter (1,000-foot)-wide construction right-of-way of Goldfield alternative segments 1 and 3 and Caliente common segment 4 (Figure 3-80). There are no known existing wells, springs, seeps, or other surface-water-right locations within approximately 9.7 kilometers (6 miles) of any of these proposed well locations that are known to be associated with the same fault or fracture system as the proposed well locations or potentially related major fault or fracture zones, should these wells be used for obtaining water required at corresponding water-demand stations along the rail alignment.

4.2.6.2.2.8 Caliente Common Segment 4 (Stonewall Flat Area). Figures 3-80 and 3-81 show the approximate locations of proposed new water wells along Caliente common segment 4.

Assuming proposed base-case average and sensitivity analysis groundwater withdrawal rates at each new well location, the impacts assessment results indicate that existing wells, springs, seeps, or other surface-water-right locations near common segment 4 would be outside the radius of influence of the proposed new water wells. For this reason, no quantitative impacts analysis calculations were completed for new well locations proposed for this portion of the Caliente rail alignment.

4.2.6.2.2.9 Bonnie Claire Alternative Segments. Figure 3-81 shows the approximate locations of proposed new water wells DOE could use to support construction of these alternative segments. Evaluation of proposed new wells and information regarding existing groundwater wells, springs, seeps, and other surface-water-right locations in the area where Bonnie Claire alternative segments would cross indicate, for cases where groundwater pumping is assumed at the projected base-case average required withdrawal rates and where the hypothetical maximum withdrawal rate of 852 liters (225 gallons) per minute is assumed at each location, that known existing wells, springs, seeps, and other surface-water-right locations along Bonnie Claire alternative segments 2 and 3 would be outside the radius of influence of proposed water wells along this portion of the Caliente rail alignment. There are no existing water wells, springs, seeps, or other surface-water-right locations within the 1.6-kilometer (1-mile) screening area along Bonnie Claire alternative segment 2 or 3 (see Figure 3-81) or within the 2.8-kilometer (1.75-mile) search area around each proposed new well that was considered in the impacts analysis. For this reason, no quantitative impacts analysis calculations were completed for new well locations proposed for this portion of the Caliente rail alignment.

4.2.6.2.2.10 Common Segment 5 (Sarcobatus Flat Area). Figures 3-81 and 3-82 show the approximate locations of proposed new wells that DOE could use to support construction of common segment 5.

Assuming proposed base-case average and sensitivity analysis groundwater withdrawal rates at each new well location, the impacts assessment results (Table 4-67) indicate that existing wells, springs, seeps, or other surface-water-right locations near common segment 5 would be outside the radius of influence of the proposed new water wells. Where the closest existing well, spring, seep, or other surface-water-right location to a proposed new well was found to be more than 2.8 kilometers (1.75 miles) away from that proposed new well location, no quantitative impacts analysis calculations were completed.

Table 4-67. Summary of calculated radii of influence for proposed new wells for the Caliente rail alignment – common segment 5.

Well number/aquifer type[a]	Distance to nearest well or nearest spring (miles)[b,c]	Radius of influence at base-case pumping rate (miles)	Radius of influence at 225 gallons[d]-per-minute pumping rate (miles)	Radius of influence for nearest well at assumed pumping rate (miles)
SaF4/AVF	> 1 (well)	0.28	0.57	0.13
SaF5/9/AVF	> 1 (well)	0.25	0.44	0.88
SaF7/11/AVF	0.94 (well)	0.22	0.39	0.04
OV24/25/26/AVF	> 1 (well)	0.19	0.24	0.04

a. Aquifer types are abbreviated as follows: AVF = alluvial valley fill; VRA = volcanic rock aquifer; CRA = carbonate rock aquifer; OTH = other: fluvial-lacustrine (stream-lakebed derived) deposits, Cenozoic bedrock unit, or other consolidated rock unit (for example, limestone/dolomite, conglomerate, mudstone, and others).
b. To convert miles to kilometers, multiply by 1.6093.
c. > = greater than.
d. To convert gallons to liters, multiply by 3.78533.

4.2.6.2.2.11 Oasis Valley Alternative Segments. A potential concern in this area is that shallow groundwater, if used for meeting potable water needs at a rail siding, construction camp, or quarry, could have elevated fluoride levels. However, deeper groundwater northeast of Beatty could be of higher quality.

Figure 3-82 shows the approximate locations of proposed new water wells within the Oasis Valley alternative segments 1 and 3 construction rights-of-way. Specific siting and use considerations for new wells that would be installed along this portion of the rail alignment are summarized below. Impacts to existing springs in this area (Section 3.2.6.3.11) would be eliminated by the following strategies.

For Oasis Valley alternative segment 1, up to three proposed new wells at locations OV3 and OV4, and up to two new wells at location OV5, sited within valley-fill alluvial materials, could be used to obtain water needed to support rail line construction. Alternatively, or in combination with these wells, a series of alternate wells approximately 7.2 kilometers (4.5 miles) northwest of proposed well location OV4 (at locations OV24, OV25, and OV26 on Figure 3-82), would also be used to supply water, for the same purpose, to a rail alignment water-demand location in the vicinity of proposed well locations OV3, OV4, and OV5. Locations OV24 through OV26 would be within the proposed rail alignment construction right-of-way, and in valley-fill alluvium. A series of springs on the Upper Oasis Valley Ranch (DIRS

169384-Reiner et al. 2002, Figure 7) are within approximately 1 kilometer (0.6 mile) of proposed well locations OV3, OV4, and OV5. Section 3.2.5, Surface-Water Resources, discusses other springs in this area. Wells at locations OV3, OV4, and OV5 would be between approximately 15 and 30 meters (50 and 100 feet) deep, while wells at locations OV24, OV25, and OV26 would be between approximately 30 and 46 meters (100 and 150 feet) deep (DIRS 182822-Converse Consultants 2006, Appendix B). For a 4-year construction schedule, the total combined withdrawal rate for wells at locations OV3 and OV4, taken together with that for alternative wells at locations OV24 and OV25, would be approximately 410 liters (approximately 110 gallons) per minute (DIRS 182822-Converse Consultants 2006, Appendix A). For the same schedule, the total combined withdrawal rate for wells at locations OV5, together with that for alternative wells at location OV26, would be approximately 150 liters (approximately 40 gallons) per minute. The total required water production would be divided between these well locations (Figure 3-82).

For Oasis Valley alternative segment 3, up to two proposed new wells at locations OV13, sited at the same location as OV5 under Oasis Valley alternative segment 1, could be used to obtain water needed to support railroad construction. Alternatively, or in combination with these wells, up to two alternate wells at location OV24, sited at the same location as OV24 under Oasis Valley alternative segment 1 (Figure 3-82), would also be used to supply water to a rail alignment water-demand location in the vicinity of proposed well location OV13. Wells at these locations would have the same depth as the corresponding wells at these locations under Oasis Valley alternative segment 1. For a 4-year construction schedule, the total combined withdrawal rate for wells at location OV13, taken together with that for alternative wells at location OV24, would be approximately 340 liters (approximately 89 gallons) per minute (DIRS 182822-Converse Consultants 2006, Appendix A). The total required water production would be divided between these well locations (Figure 3-82).

Analysis results (see Table 4-68) indicate that pumping groundwater from wells at locations OV3, OV4, and OV5, under the Oasis Valley alternative segment 1, and pumping from wells at location OV13, under Oasis Valley alternative segment 3, would need to be limited to a total withdrawal rate of approximately 76 liters (approximately 20 gallons) per minute or less at each location, under each alternative segment, to preclude possible reductions in discharge rates at the Upper Oasis Valley Ranch Springs. The remaining water needed to support construction activities in this portion of the rail alignment would be obtained from proposed alternate well locations OV24, OV25, and/or OV26. For Oasis Valley alternative segment 1, the total combined net production that would be met through the use of wells at alternate well locations would be approximately 340 liters (89 [109 + 40 – 20 – 20 – 20] gallons) per minute. For Oasis Valley alternative segment 3, the total combined net production from wells at location OV24 would be approximately 260 liters (69 [89 – 20] gallons) per minute.

Evaluation of the effects of proposed groundwater withdrawals from proposed wells at locations OV12, OV17, OV18, OV19, and OV20 for Oasis Valley alternative segment 3 indicate that there would be no expected impact to known existing springs, seeps, or other surface-water-right locations or wells in the Oasis Valley area.

Existing USGS NWIS wells (OVU-Dune Well, OVU-Middle ET Well, OVU-Lower ET Well, and Well ER-OV2) within approximately 0.32 to 0.48 kilometer (0.2 to 0.3 mile) of the proposed new wells at locations OV3, OV4, and OV5 on Oasis Valley alternative segment 1 (see Section 3.2.6.3.11) are shallow groundwater monitoring wells owned and installed by the U.S. Geological Survey. All of these wells have no current or projected beneficial use and are used solely for monitoring purposes. An existing well cluster of USGS NWIS wells (ER-OV-01, ER-OV-06a, and ER-OV-6a2) is approximately 1.9 kilometers (1.2 miles) northeast of the proposed new wells at location OV20/OV21 on Oasis Valley alternative segment 3. These are also shallow groundwater monitoring wells owned and installed by the U.S. Geological Survey. These wells have no current or projected beneficial use and are used solely for monitoring purposes.

Table 4-68. Summary of calculated radii of influence for proposed new wells for the Caliente rail alignment – Oasis Valley alternative segments.

Well number/aquifer type[a]	Distance to nearest well or nearest spring (miles)[b]	Radius of influence at base-case pumping rate (miles)	Radius of influence at 225 gallons[c]-per-minute pumping rate (miles)	Radius of influence for nearest well at assumed pumping rate (miles)
OV3/4/5/AVF	0.40 (spring)	0.17[d]	Not applicable[d,e]	Not applicable[f]
OV9/AVF	0.49 (well)	0.10	0.37	0.11[g]
OV12/18/19/20/ 21/AVF and OTH	0.60 (spring)	0.30	0.35	0.11[g]
OV6/8/14/16/ AVF	0.86 (spring)	0.35	0.49	0.02[h]

a. Aquifer types are abbreviated as follows: AVF = alluvial valley fill; VRA = volcanic rock aquifer; CRA = carbonate rock aquifer; OTH = other: fluvial-lacustrine (stream-lakebed derived) deposits, Cenozoic bedrock unit, or other consolidated rock unit (for example, limestone/dolomite, conglomerate, mudstone, and others).
b. To convert miles to kilometers, multiply by 1.6093.
c. To convert gallons to liters, multiply by 3.78533.
d. Base-case pumping rate was limited to 20 gallons per minute.
e. For this not applicable case, no calculation was completed for reasons stated in the text.
f. For this not applicable case, no calculation was completed because the nearest resource feature is a spring.
g. The radius of influence is associated with a domestic well.
h. The radius of influence is associated with a well having a water right.

Alternatively, for Oasis Valley alternative segment 1, up to four proposed new wells could be installed at proposed alternative well locations OV6 and OV8 west of the Amargosa River in the Oasis Valley area (see Section 3.2.6.3.11 and Figure 3-82). Under Oasis Valley alternative segment 3, these alternate well locations are designated OV14 and OV16, but the wells would have the same characteristics and same required withdrawal rates. These alternate wells would support earthwork construction and would be between 30 and 46 meters (100 and 150 feet) deep. The total combined required withdrawal rate for this set of wells would be approximately 510 liters (136 gallons) per minute (DIRS 182822-Converse Consultants 2006, Appendix A). Analysis results (see Table 4-68) indicate that pumping groundwater from these wells at the full required base-case withdrawal rates would not be expected to impact discharge rates at a group of springs (identified in records as Ute Springs and Manley Springs) approximately 0.64 kilometer (0.4 mile) to 0.97 kilometer (0.6 mile) east of the OV14 and OV16 locations.

Available information suggests that shallow groundwater might be encountered in one isolated area beneath a stretch of the OV1 alternative segment in Oasis Valley where the OV1 segment crosses near the Upper Oasis Valley Ranch Springs area (see Figures 3-82 and 3-196, Volume II of this Rail Alignment EIS) (DIRS 182821-Converse Consultants 2005, Plate 4-3; DIRS 169384-Reiner et al. 2002, Plate 2 and Figure 3). Water-level data from existing wells (such as the OVU-Middle ET Well and OVU-Lower ET Well) located in the Upper Oasis Valley Ranch Springs area (DIRS 169384-Reiner et al. 2002, Plate 2) show groundwater levels less than 2.4 to 3 meters (8 to 10 feet) below the ground surface in this general area.

Excavation work required for constructing this stretch of the OV1 alternative segment would be limited to less than about 1.5 meters (5 feet) below the ground surface or less (DIRS 182674-Nevada Rail Partners 2007, Sheets 56 and 57). Most earthwork done in this area would involve the placement and compaction of fill rather than excavation work. Although the possibility of excavations intercepting shallower groundwater in this area does exist, the probability of intercepting large areas of groundwater in this alternative segment stretch is considered to be small. If shallow groundwater were to be encountered, standard engineering controls (as described in Section 4.2.5.2.1.1) would be employed to minimize potential impacts to groundwater potentially disturbed by excavation activities.

For two proposed new well locations associated with the Oasis Valley alternatives portion of the alignment, the targeted water zone is a possibly water-bearing detachment fault system (DIRS 182822-Converse

Consultants 2006, Appendices A and B and Maps 14a and 14b). A proposed well location (OV7 or OV15, depending on alternative segment) could be installed in the southern portion of hydrographic area 228, within the typical maximum 300-meter (1,000-foot)-wide construction right-of-way of common segment 6 (Figure 3-82). A new well (see Section 3.2.6.3.11 and Figure 3-82) might be installed in the southern part of the Oasis Valley hydrographic area near the area boundary, approximately 0.8 kilometer (0.5 mile) west of common segment 6 (well location OV22 or OV23, depending on alternative segment). The target water source at this location would be a possibly water-bearing detachment fault system (DIRS 182822-Converse Consultants 2006, Appendix B). There are no known existing wells, springs, seeps, or other surface-water-right locations within approximately 9.7 kilometers (6 miles) of either of these proposed well locations that are known to be associated with the same fault system as either of these proposed well locations or potentially related major fault zones, should these wells be used for obtaining water required at corresponding water-demand stations along the rail alignment.

4.2.6.2.2.12 Common Segment 6 (Yucca Mountain Approach). Figure 3-82 shows the approximate locations of proposed new wells along common segment 6. There are approximately 1.4 million cubic meters (1,147 acre-feet) and approximately 72,000 cubic meters (58 acre-feet) of annual committed groundwater resources in hydrographic areas 229 and 227A, respectively. There are approximately 101,000 cubic meters (82 acre-feet) of documented pending annual duties for area 229 and approximately 6,170 cubic meters (5 acre-feet) of pending annual duties for area 227A. Tables 3-35 and 4-60 indicate that water withdrawal required within hydrographic area 229 for construction of common segment 6 would exceed the estimated annual perennial yield for that hydrographic area. However, except for smaller-magnitude water requirements (on the order of 3.8 liters [1 gallon] per minute) associated with a proposed rail siding (DIRS 182822-Converse Consultants 2006, Table 2-1) and a proposed construction camp (approximately 76 liters [20 gallons] per minute), water requirements for common segment 6 would be required for only 9 months (DIRS 182822-Converse Consultants 2006, Appendix A).

There are a total of 17 USGS NWIS wells, four NDWR wells with water rights, no NDWR domestic wells, and no springs, seeps, or other surface-water-right locations within approximately 1.6 kilometers (1 mile) of common segment 6. DOE proposed up to two new water wells at location CF4. These wells would furnish water for earthwork compaction and would be between approximately 370 and 460 meters (1,200 and 1,500 feet) deep. Although there is one USGS NWIS well approximately 1.4 kilometers (0.9 mile) northeast of this location, that well is a groundwater test/monitoring well (NC-EWDP-18P) installed to test subsurface characteristics and monitor groundwater conditions downgradient of the Yucca Mountain Repository site. This well has no current or projected beneficial use, and is only for monitoring purposes (DIRS 182821-Converse Consultants 2005, Plate 4-2 and Appendix A; DIRS 176808-Nye County Nuclear Waste Repository Project Office 2002, all).

As shown in Table 3-35, the perennial yield for the western two-thirds of hydrographic area 227A is approximately 720,000 cubic meters (580 acre-feet) and committed groundwater resources are very low. Appropriations for new wells could be pursued in this area to meet construction-water demand for the proposed operations support facilities inside the Yucca Mountain Site boundary.

Water required for railroad construction and operations through area 227A would be acquired as part of the water inventory of approximately 530,000 cubic meters (430 acre-feet) per year proposed for appropriation in area 227A to support construction and operation of a repository at Yucca Mountain. The total estimated water demand for construction of the portion of common segment 6 within area 227A is approximately 710,000 cubic meters (572 acre-feet). Water requirements associated with the construction and operation of proposed rail facilities in area 227A are described in Section 4.2.6.2.1. If the amount of water required to support railroad construction and operations exceeds the current amount proposed for appropriation, the schedule for railroad construction or for water acquisition could be modified to reduce peak water demands, or an additional temporary water appropriation for railroad construction could be sought (DIRS 182822-Converse Consultants 2006, p. 15).

Assuming proposed base-case average and sensitivity analysis groundwater withdrawal rates at each new well location, the impacts assessment results indicate that existing wells, springs, seeps, and other surface-water-right locations near common segment 6 would be outside the radius of influence of the proposed new water wells. For this reason, no quantitative impacts analysis calculations were completed for new well locations proposed for this portion of the Caliente rail alignment.

Geologic information (for example, DIRS 176904-Workman et al. 2002, all) indicates that a mapped northwest-southeast trending fault trace might be located in close proximity to proposed rail alignment-related well location CF-3 in hydrographic area 229 (Crater Flat). A well installed at location CF-3 therefore might intercept a (water-bearing) fault zone. Similarly, the geologic map prepared by Workman et al. (DIRS 176904-Workman et al. 2002, all) indicates that proposed well location CF-4 in the Crater Flat hydrographic area might be located in close proximity to one of more mapped north-south to northeast-southwest trending fault traces; therefore, a well installed at location CF-4 might also intercept one or more (water-bearing) fault zones.

An existing well having an associated well log located within 9.7 kilometers (6 miles) of proposed well location CF-3 (to the southwest of location CF-3) appears to be located near the same mapped fault trace as (or a mapped fault trace that might be directly associated with) the fault that might be intercepted by a proposed well at location CF-3. Similarly, an existing well having an associated well log located within 9.7 kilometers of proposed well location CF-4 (to the north-northwest of location CF-4) appears to be located near a mapped fault trace that could be the same as (or a mapped fault trace that might be directly associated with) one or more of the faults that could be intercepted by a proposed well at location CF-4. However, both of these existing wells are monitoring wells. Because the existing wells do not have a beneficial use, the possibility of groundwater conduit flow resulting from pumping at proposed well locations CF-3 and/or CF-4 causing impacts on these existing wells is not evaluated further.

4.2.6.3 Operations Impacts

Overall, potential impacts to groundwater resources from operating the rail line from Caliente to Yucca Mountain under the Proposed Action would be small.

Rail line operations facilities would need water for daily operation. However, other than relatively limited water quantities required for maintaining fire protection water-tank reserves at rail sidings and meeting relatively low water needs for operations personnel at selected facility locations along the rail line, there would be no continued need for any large-scale production wells once construction of the railroad is completed. Possible changes to recharge characteristics, if any, in the areas of railroad operations and support facilities would be the same as those at the completion of construction of the rail line.

There would be no impacts to groundwater resources from disposal of wastewater (see Section 4.2.11, Utilities, Energy, and Materials).

4.2.6.4 Impacts under the Shared-Use Option

Impacts to groundwater under the Shared-Use Option would be similar to those identified for the Proposed Action without shared use. Under the Shared-Use Option, additional commercial rail sidings would be constructed as a third track alongside passing sidings (Figure 2-54). The total length of commercial rail sidings would be relatively small compared to the total length of the rail line. Therefore, under the Shared-Use Option, water needs for construction of the rail line would increase only by approximately 150,000 cubic meters (119 acre-feet).

The commercial sidings would likely be in the Caliente, Panaca/Bennett Pass, Warm Springs Summit, Tonopah, Goldfield, and Beatty/Oasis Valley areas. For purposes of analysis, DOE assumed that the commercial sidings would be in the same hydrographic areas as analyzed for the Proposed Action without shared use. Impacts would be similar to those described for the Proposed Action without shared use; additional impacts to groundwater resources in these areas would be small.

The commercial-only facilities that would be constructed under the Shared-Use Option would likely be close to DOE-owned and -operated rail facilities and would likely overlie the same hydrographic areas identified for the Proposed Action without shared use. Overall, the impacts would be similar to those described for the Proposed Action without shared use and would be small.

Impacts to groundwater under Shared-Use Option operations would be similar to those identified for operations under the Proposed Action without shared use (Section 4.2.6.2). Use of the completed rail line from Caliente to Yucca Mountain, including any additional sidings, would have a small impact on groundwater resources. There would be no continued need for water along the additional sidings, and possible changes to recharge, if any, would be the same as those at the completion of construction.

The commercial-only facilities would require water for daily operation. Water demand to operate these facilities has not been determined, but DOE assumes this demand would be small. Therefore, the additional impacts to groundwater resources would likely be small and overall would be similar to those described for the Proposed Action without shared use.

4.2.6.5 Summary

This section summarizes and characterizes potential impacts to groundwater resources from constructing and operating the proposed railroad along the Caliente rail alignment. The potential for impacts to groundwater resources resulting from physical disturbance of the ground surface during the construction phase would be small. Proposed groundwater withdrawals would locally affect groundwater flow patterns and groundwater availability. Impacts on downgradient groundwater basins (hydrographic areas) due to the proposed groundwater withdrawals would be very small. Impacts on groundwater resources due to groundwater withdrawals at proposed quarry locations and rail facility locations would also be very small. DOE would implement best management practices as part of the Proposed Action to avoid, minimize, or otherwise reduce impacts to groundwater resources. Chapter 7 identifies best management practices and potential mitigation measures.

For the case of groundwater withdrawals from proposed wells to support a 4-year rail construction schedule, analysis results (see Tables 4-61 through 4-68), based on anticipated hydrogeologic conditions, indicate that, with the exception of some specific locations (the locations are described below), existing known wells, springs, seeps, and other surface-water-right locations are not expected to fall within the radius of influence of the proposed new wells. The proposed groundwater withdrawal at each new withdrawal well would create a drawdown feature in the portion of the ***saturated zone*** immediately surrounding that well, locally affecting groundwater flow patterns and water availability in the portion of the aquifer immediately surrounding the well. The effects in each case where projected average withdrawal rates are assumed to occur at the proposed well locations would be limited in extent to a maximum horizontal distance of approximately 0.8 kilometers (approximately 0.5 mile) or less in a few instances and generally a much smaller distance. Sensitivity analysis results indicate that the effects in each case where it is assumed that a hypothetical maximum withdrawal rate of 852 liters (225 gallons) per minute might be imposed at each proposed well location would be limited in extent to a maximum horizontal distance of approximately 1.2 kilometers (approximately 0.75 mile) or less.

Analysis results (see Tables 4-61 through 4-68) indicate that certain restrictions or use prohibitions would need to be factored into the final siting and use of some specific proposed new groundwater well locations in some cases (mostly with respect to potential higher well-withdrawal scenarios). Specific locations falling into this category are selected proposed well locations in the Oasis Valley hydrographic area (OV3, OV4, and OV5/OV13), Meadow Valley Wash/Panaca Valley hydrographic area (proposed well locations PanV1, PanV3/6, Pan V26, PanV5, PanV7/8, and possibly location PanV4), and Hot Creek Valley hydrographic area (proposed well location HC5) in order to preclude potential impacts on existing groundwater resources. The resources that have potential to be affected if such restrictions or use prohibitions were not followed include springs (locations OV3, OV4, OV5/13, and HC5) or existing wells (all other locations).

Wells having the largest withdrawal rates would be expected to be those that are designed for use as supply wells for earthwork compaction; groundwater withdrawals from these wells would occur over a period of less than 1 year (typically over a 9-month pumping period). For a longer railroad construction schedule (up to 10 years), groundwater withdrawal rates from new wells would be the same or less than those estimated in this section. For this longer schedule, the magnitude of potential impacts to existing groundwater users from groundwater withdrawals would be equal to or less than that determined for the 4-year railroad construction schedule.

Analysis results indicate that the effects of groundwater withdrawals from the proposed wells at the range of withdrawal rates that could be required for the project would be localized in nature and extent. The impacts caused by the majority of water withdrawals and the wells having the highest production rates (those associated with construction of the rail roadbed) would be short term in duration. Additionally, for those areas where proposed new water wells would be near a boundary between adjacent hydrographic areas, downgradient hydrographic areas would not likely be affected by the proposed groundwater withdrawals because (1) there are no identified existing groundwater users associated with the downgradient groundwater basins within 1.6 kilometers (1 mile) of any of these proposed well-water withdrawal locations, and (2) available hydrogeologic information indicates that significant inter-basin groundwater (under)flow is not occurring in the areas downgradient of the proposed well locations.

DOE compared hydrogeologic conditions and required groundwater withdrawal durations and proposed groundwater withdrawal rates for new wells required for the Proposed Action to hydrogeologic conditions and groundwater withdrawal rates and pumping durations that have occurred at certain locations in the western United States where ground subsidence has been observed as a result of prolonged, large-scale groundwater withdrawals. Comparison results indicate that the potential for ground subsidence to occur as a result of proposed groundwater withdrawals in the hydrographic areas the Caliente rail alignment would cross would be low, both during the construction phase and the operations phase.

Section 5.2.1.3.2 provides information about pending applications for proposed large groundwater development projects in the Caliente rail alignment cumulative impacts region of influence.

Table 4-69 summarizes potential impacts to groundwater resources from constructing and operating the proposed railroad along the Caliente rail alignment.

Table 4-69. Summary of potential impacts to groundwater resources – Caliente rail alignment (page 1 of 2).

Resource	Proposed Action or Shared-Use Option
Groundwater availability and uses	*Construction* - Analysis results indicate that proposed groundwater withdrawals would locally affect groundwater flow patterns and water availability in the portion of the aquifer immediately surrounding each new withdrawal well. The effects in each case where projected average withdrawal rates are assumed to occur at the proposed well locations would be limited in extent to a maximum horizontal distance of approximately 0.8 kilometer (approximately 0.5 mile) or less in a few instances and generally a much smaller distance. Sensitivity

Table 4-69. Summary of potential impacts to groundwater resources – Caliente rail alignment (page 2 of 2).

Resource	Proposed Action or Shared-Use Option
Groundwater availability and uses Cont.	analysis results indicate that the effects in each case, where it is assumed that a hypothetical withdrawal rate of 852 liters (225 gallons) per minute might be imposed at each proposed well location, the radius of influence of the cone of depression created in the aquifer would average approximately 0.64 kilometer (0.4 mile) for the proposed new well locations, and would be limited in extent to a maximum horizontal distance of approximately 1.2 kilometers (approximately 0.75 mile) at one proposed well location. Proposed groundwater withdrawals at selected proposed well locations in the Panaca Valley hydrographic area (PanV1, PanV5, PanV26, PanV3/6, PanV7/8, and possibly PanV4), Hot Creek hydrographic area (HC5), and Oasis Valley hydrographic areas (OV3, OV4, and OV5/13), could, if unmitigated, impact existing groundwater users or existing groundwater resources during the construction phase, if base-case average pumping rates (locations PanV26, OV3, OV4, OV5/13, and OV17) or average pumping rates of approximately 852 liters (225 gallons) per minute (all of the listed locations) were assumed to be applied at the new well locations. Hydrogeologic effects resulting from use of the proposed new wells for supporting rail roadbed construction would be temporary in nature. *Construction and operations* - Physical disruption of existing groundwater resource features such as existing wells, springs, seeps, or other surface-water-right locations resulting from railroad construction and operations would be precluded by designing the rail line to avoid such features. Hydrogeologic impacts to existing groundwater resource features such as existing wells; water-rights locations that have been assigned a permitted (PER) status by the State Engineer; springs; seeps; or other surface-water-right locations (if present within the region of influence of and potentially in hydraulic connection with proposed groundwater withdrawal well water-bearing zones) due to railroad construction- and operations-related groundwater withdrawals would be small. Potential cumulative impacts associated with currently proposed future well locations and assigned a “Ready for Action” or “Ready for Action, Protested” status by the State Engineer are addressed in Chapter 5. *Operations* - Owing to the very small groundwater withdrawal rates needed to support railroad operations, potential impacts to groundwater resources from operating the railroad from Caliente to Yucca Mountain would be small.
Ground subsidence	*Construction* - The temporary duration of the vast majority (approximately 90 percent) of the total groundwater withdrawals required for railroad construction indicates that the potential for the proposed groundwater withdrawals to cause subsidence of the ground surface is small. *Operations* - Owing to the very small groundwater withdrawal rates needed to support railroad operations, the potential for the groundwater withdrawals needed to support railroad operations to cause subsidence of the ground surface is small.
Groundwater quality	*Construction and operations* - The impact to groundwater resources of contaminants that might be released by construction equipment during railroad construction or operations would be small because of generally deep groundwater depths beneath most of the alignment. *Construction and operations* - The impact of proposed groundwater withdrawals on groundwater quality would be small. The proposed withdrawals would not conflict with water-quality standards protecting groundwater resources.

4.2.7 BIOLOGICAL RESOURCES

This section describes potential impacts to biological resources (vegetation, wildlife, special status species, State of Nevada game species, and wild horses and burros) from constructing and operating the proposed railroad along the Caliente rail alignment. Potential impacts are reported and described as either direct or indirect, and either long term or short term.

There could be short-term impacts to biological resources in the rail line construction right-of-way during the construction phase. These impacts would be short term because DOE would restore disturbed lands not required for railroad operations with appropriate vegetation immediately after construction was complete.

There would be long-term impacts to biological resources in areas where there would be unavoidable impacts that would result in a change in the natural setting that could last beyond the 50-year operations phase. These areas would include the rail roadbed, along access roads, and in facility and quarry footprints. For biological resources, such impacts are identified for areas of the maximum edge of cut and toe of slope for fill (see Section 2.2.2.6).

Section 4.2.7.1 describes the methods DOE used to assess potential impacts to biological resources; Section 4.2.7.2 describes impacts under the Proposed Action; Section 4.2.7.3 describes impacts under the Shared-Use Option; and Section 4.2.7.4 summarizes impacts. Section 6.3.7 summarizes laws and regulations governing the protection of biological resources. Appendix H provides more detail on the methods DOE used to assess potential impacts to biological resources.

4.2.7.1 Impact Assessment Methodology

For this analysis, DOE calculated potential direct, long-term impacts to biological resources based on the footprint of the rail roadbed. The footprint would be within the nominal width of the construction right-of-way, and is the area that would involve clearing of vegetation, excavation, and filling to support the rail line. The width of the footprint would fluctuate along the alignment due to topography, cut and fill requirements, and land use, and to avoid or minimize impacts to other resources (such as water and structures). This area would experience direct, long-term impacts.

DOE coordinated with personnel from pertinent federal, state, and local agencies to identify potential impacts to biological resources. Where possible, the Department has quantified potential impacts (such as habitat loss due to construction and operations activities).

Although the Department would minimize the use of the area between the edge of the construction footprint and the outside edge of the construction right-of-way, DOE took a conservative approach and analyzed the short-term impacts to biological resources within this area. This approach overstates impacts as DOE would likely not disturb a large portion of this area.

For facilities that would be outside the nominal width of the construction right-of-way (such as quarries and railroad operations support facilities), the area DOE assessed for potential impacts was the maximum construction footprint of each facility. In order to assess potential impacts, the Department performed a spatial Geographical Information System analysis to compare the footprints of these facilities with biological resources information.

Where possible, this section reports potential impacts to biological resources quantitatively. Potential species-specific impacts are reported qualitatively as either small, moderate, or large, as defined in Section 4.1. DOE estimated impacts based on the amount of change to or loss of the resource from the baseline conditions described in Section 3.2.7, and considered the following criteria for determining the level of change in conditions:

- Direct effects would be-
  - Long-term loss of vegetation (land-cover types)
  - Short-term disturbance to habitat and vegetation
  - Long-term and short-term species displacement or alteration of access to important year-round or seasonal habitat during the construction and operations phases (including watering areas and other key areas)
  - Long-term loss of potential habitat (species-specific land-cover types)
  - Short-term disturbance to habitat and vegetation
  - The risk of trains colliding with wildlife
- Indirect effects would be-
  - Changes in land use that could affect movement patterns and migratory patterns
  - Displacement of species after construction that could add additional stress to other areas and habitat

The assessment of impacts to biological resources considers the potential for continued engineering and site evaluation and planning efforts (see Chapter 2), compliance with applicable requirements (see Chapter 6), and implementation of best management practices (see Chapter 7) to minimize or avoid impacts. This section reports potential direct impacts for the entire rail alignment and specific rail line segments.

DOE expects that there would be small indirect impacts, if any, to biological resources from changes in land use and post-construction displacement, because of the large expanses of land in the area and the types of current uses that tend to be less intrusive than normal development and rural or urban expansion.

DOE concluded from the groundwater impact analysis that project-related groundwater withdrawals would not result in changes to water levels at springs; therefore, there would be no impacts to vegetation, wildlife, special status species, state of Nevada game species, wild horses or burros associated with those springs (see Section 4.2.5, Surface-Water Resources).

4.2.7.1.1 Vegetation

DOE began the assessment of impacts to vegetation resources quantitatively and qualitatively by reviewing available resource data and field surveys. The Department considered the potential direct impacts to land-cover types from railroad construction and operations activities. To assess potential direct impacts from the loss or disturbance of most land-cover types, DOE compared the area of a land-cover type that could be disturbed during the construction and operations phases to the land-cover types present within the affected mapping zones. For ecologically important and relatively uncommon land-cover types within the entire mapping zone, such as ***riparian*** and marsh habitats, DOE compared the area of a land-cover type that would be disturbed (within the construction right-of-way and facilities footprints) to the land-cover type present within the study area, as defined in Section 3.2.7.1.2. The Department used this information to quantitatively estimate the potential loss of habitat and to determine qualitatively whether the loss of habitat would result in a small, moderate, or large impact.

DOE also evaluated potential impacts from noxious or ***invasive plant species*** based on the potential for railroad construction or operations activities to introduce or spread noxious or invasive species.

4.2.7.1.2 Wildlife

DOE assessed potential impacts to wildlife communities qualitatively by reviewing the land-cover types that could be affected during railroad construction and operations and identifying the wildlife species likely to be present within those areas. Habitat loss with these communities would be the primary driver of impacts to wildlife and is the focus of this analysis. The Department also evaluated potential impacts from railroad operations on wildlife.

4.2.7.1.3 Special Status Species

DOE assessed potential impacts to special status species (threatened and ***endangered species***; ***BLM-designated sensitive species***; and State of Nevada-designated sensitive and protected species) qualitatively by reviewing the potential for a species to occur within the study area and the region of influence; species habitat that would be affected; and the potential mechanisms for impact. The primary impact would be from the loss of habitat, which is the focus of this analysis. DOE also evaluated impacts from railroad operations on special status species.

4.2.7.1.4 State of Nevada Game Species

DOE assessed potential impacts to State of Nevada Game Species, as defined in Section 3.2.7.2.4, based on the potential for loss of important foraging habitat, the potential for loss of important water sources, the potential displacement of game, and the potential disruption of movement patterns.

4.2.7.1.5 Wild Horses and Burros

DOE assessed potential adverse impacts to wild horses and burros based on the potential for loss of important foraging habitat, the potential for loss of important watering areas, and the potential for impacts to individual ***herd management areas***.

4.2.7.2 Environmental Impacts

This section describes potential impacts to biological resources from construction and operation of a railroad along the Caliente rail alignment. To minimize redundancy and provide clear and concise reporting of potential impacts, Section 4.2.7.2.1 describes impacts common to all rail line segments and construction and operations support facilities and how each biological resource could be affected. Section 4.2.7.2.2 describes rail line segment- and facility-specific impacts, and does not repeat impacts common to the entire alignment. Tables list the amount of departure from baseline conditions (see Section 3.2.7) based on the indicators described above.

4.2.7.2.1 Environmental Impacts Common to the Entire Caliente Rail Alignment

This section describes potential short-term and long-term impacts to each biological resource that could result from railroad construction along the Caliente rail alignment.

4.2.7.2.1.1 Vegetation. Construction of the rail line and facilities along the Caliente rail alignment would directly impact a diverse mix of vegetation communities and land-cover types. Tables 4-70, 4-71, 4-72, and 4-73 list the land-cover types associated with the Caliente rail alignment common segments, alternative segments, quarries, and operations support facilities that would be affected during the construction phase. The primary construction-related impacts to vegetation communities during the construction phase would be the physical short-term or long-term removal of vegetation and compaction of the soil.

Table 4-70. Short-term and long-term impacts to land-cover types[a] by common segment.

Land-cover type[e]	Area that would be impacted by common segment (acres)[b,c]											
	CS1[d]		CS2		CS3		CS4		CS5		CS6	
	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts
Barren Lands, Non-Specific	0	0	1.36	0.19	0	0	0	0	0	0	0	0
Great Basin Pinyon-Juniper Woodland	0.01	0	3.89	0.21	0	0	0	0	3.04	0	0	0
Great Basin Xeric Mixed Sagebrush Shrubland	999	133	21.8	0.33	54.0	6.03	0	0	0	0	0	0
Inter-Mountain Basins Big Sagebrush Shrubland	3,540	383	698	62.0	1,500	146	4.60	0.95	1.50	0.02	0	0
Inter-Mountain Basins Greasewood Flat	13.2	2.76	2.49	0.39	34.6	2.71	3.06	0.003	0	0	0	0
Inter-Mountain Basins Mixed Salt Desert Scrub	2,604	265	2,650	210.3	5,310	415	764	62.3	0	0	0	0
Inter-Mountain Basins Playa	22.8	1.08	0	0	24.4	2.22	0	0	0	0	0	0
Inter-Mountain Basins Semi-Desert Grassland	19.6	1.01	2.47	0.29	117	8.75	0	0	0	0	0	0
Inter-Mountain Basins Semi-Desert Shrub Steppe	313	53.8	39.01	3.09	370	35.8	30.0	1.56	210.1	12.3	441	58.4
Invasive Annual and Biennial Forbland	0	0	0	0	2.07	0.59	0	0	0	0	0	0
Mojave Mid-Elevation Mixed Desert Scrub	159	26.7	0	0	0	0	0	0	344	23.3	785	94.02
North American Warm Desert Bedrock Cliff and Outcrop	0	0	0	0	0	0	0	0	0	0	13.3	0.99
North American Warm Desert Playa	0	0	0	0	0	0	0	0	0.46	0	4.17	0.49
Sonora-Mojave Creosotebush-White Bursage Desert Scrub	1.15	0.38	0	0	0	0	0	0	722	58.0	2,008.7	246
Sonora-Mojave Mixed Salt Desert Scrub	0.24	0	0	0	0	0	0	0	1,470	107.8	19.3	2.44
Totals[f]	7,672	866.73	3,414.6	276.8	7,413.6	616.24	801.32	64.81	2,746.75	201.38	3,271.47	402.34

a. Source: DIRS 174324-NatureServe 2004, all.
b. To convert acres to square kilometers, multiply by 0.0040469.
c. < = less than.
d. CS = common segment.
e. The land-cover types listed are only those that occur within the construction right-of-way.
f. Totals may differ from the sum of values due to rounding.

Table 4-71. Short-term and long-term impacts to land-cover types[a] by alternative segment (page 1 of 2).

	Area impacted by alternative segment (acres)[b,c,d]															
	Interface with Union Pacific Railroad Mainline alternative segments				Garden Valley								South Reveille			
	Caliente		Eccles		GV1		GV2		GV3		GV8		SR2		SR3	
Land-cover type[e]	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts
Agriculture	1.65	4.10	6.33	6.94	0	0	0	0	0	0	0	0	0	0	0	0
Barren Lands, Non-Specific	0	0	3.52	0.59	0	0	0	0	0	0	0	0	0	0	0	0
Developed, Open Space - Low Intensity	1.14	1.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland	12.41	4.94	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Great Basin Pinyon-Juniper Woodland	36.09	12.5	9.41	3.12	0	0	0	0	0	0	0	0	0	0	0	0
Great Basin Xeric Mixed Sagebrush Shrubland	43.9	7.28	344	39.2	2.11	0	0.35	0.03	1.13	0	8.42	0.40	39.2	1.57	17.8	1.57
Inter-Mountain Basins Big Sagebrush Shrubland	59.1	12.7	337	52.03	681	101.8	447	97.6	1,550	145	408.4	96.9	229	32.5	239	31.3
Inter-Mountain Basins Cliff and Canyon	0	0	0	0	0.43	0	1.54	0	0.43	0	0	0	0	0	0	0
Inter-Mountain Basins Greasewood Flat	19.7	12.9	56.0	9.87	1.04	0	0.58	0	0.71	0	0.58	0	0	0	0	0
Inter-Mountain Basins Mixed Salt Desert Scrub	10.37	8.40	186	31.07	1,690	172	1,900	276	1,054	123	1,840	290.04	876	99.4	1,006.8	102.2
Inter-Mountain Basins Montane Sagebrush Steppe	20.39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Inter-Mountain Basins Semi-Desert Grassland	0	0	1.70	0	0	0	0	0	0	0	0	0	0	0	0	0
Inter-Mountain Basins Semi-Desert Shrub Steppe	0.41	0	5.98	1.32	4.63	0	0	0	3.01	0.73	2.70	0	114	24.0	128	24.8
Inter-Mountain Basins Wash	8.07	0.89	0.15	0	0	0	0	0	0	0	0	0	0	0	0	0
North American Arid West Emergent Marsh	11.9	21.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Totals[f]	225.13	87.11	950.09	144.17	2,381.09	273.8	2,347.42	373.63	2,613.79	268.73	2,259.79	387.34	1,258.2	157.47	1,391.6	159.87

Table 4-71. Short-term and long-term impacts to land-cover types[a] by alternative segment (page 2 of 2).

	Area impacted by alternative segment (acres)[b,c,d]													
	Goldfield						Bonnie Claire				Oasis Valley			
	GF1		GF3		GF4		BC2		BC3		OV1		OV3	
Land-cover type[e]	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts
Barren Lands, Non-Specific	0	0	0	0	0.85	0.27	0	0	0	0	0	0	0	0
Developed, Medium - Large Intensity	0	0	0	0	2.78	0	0	0	0	0	0	0	0	0
Developed, Open Space - Low Intensity	0	0	0	0	7.15	1.07	0	0	0	0	0	0	0	0
Great Basin Xeric Mixed Sagebrush Shrubland	34.6	0.82	225	22.9	51.6	2.49	1.64	0	0	0	0	0	0	0
Inter-Mountain Basins Big Sagebrush Shrubland	322	45.5	522	83	331	50.85	71.3	5.32	11.2	0.79	0	0	0	0
Inter-Mountain Basins Greasewood Flat	46.6	6.49	47.07	6.49	46.6	6.49	0	0	0	0	0	0	0	0
Inter-Mountain Basins Mixed Salt Desert Scrub	2,570	423	2,340	404.6	2,854	372	461	49.8	419	35.6	0	0	0	0
Inter-Mountain Basins Playa	0	0	0	0	0	0	0	0	1.72	0.03	0	0	0	0
Inter-Mountain Basins Semi-Desert Shrub Steppe	102	9.04	249	24.08	64.1	6.71	148	13.9	231	17.1	29.9	5.40	28.2	5.70
Invasive Annual Grassland	3.60	0	0	0	0	0	0	0	0	0	0	0	0	0
Mojave Mid-Elevation Mixed Desert Scrub	2.30	1.03	0	0	0	0	442	36.5	320.06	32	22.6	3.48	4.26	0.64
North American Warm Desert Lower Montane Riparian Woodland and Shrubland	0	0	0	0	0	0	0	0	0	0	0	0	4.67	0
North American Warm Desert Playa	0	0	0	0	0	0	0	0	0	0	33.9	4.72	9.07	2.46
Sonora-Mojave Creosotebush-White Bursage Desert Scrub	0	0	0	0	0	0	198	13.2	373	33	506.8	54.6	710.4	77
Sonora-Mojave Mixed Salt Desert Scrub	0	0	0	0	0	0	74.4	6.13	25.4	2.21	55.03	7.39	219	21.6
Totals[f]	3,078	485.88	3,380	541.07	3,798.19	439.99	1,396.34	124.84	1,381.38	120.73	648.23	75.59	975.6	107.4

a. Source: DIRS 174324-NatureServe 2004, all.
b. To convert acres to square kilometers, multiply by 0.0040469.
c. < = less than.
d. BC = Bonnie Claire; GV = Garden Valley; GF = Goldfield; OV = Oasis Valley; SR = South Reveille.
e. The land-cover types listed are only those that occur within the construction right-of-way.
f. Totals might differ from sum of values due to rounding.

Table 4-72. Short-term and long-term impacts to land-cover types[a] by facility (page 1 of 2).

Land-cover type	Area impacted by facility (acres)[b]																	
	Interchange Yard				Staging Yard						Maintenance-of-Way Trackside Facility		Maintenance-of-Way Headquarters Facility		Maintenance-of-Way Facility		Rail Equipment Maintenance Yard	
	Caliente		Eccles		Caliente-Upland		Caliente-Indian Cove		Eccles-North		GF1 or GF3 option		GF1 or GF3 option		GF4 option			
	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts
Developed, Open Space - Low Intensity	0	0.02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland	0	0.14	2.65	3.14	0	0	18.6	5.39	0	0	0	0	0	0	0	0	0	0
Great Basin Pinyon-Juniper Woodland	0	1.12	1.99	7.87	0.31	0	0.88	5.12	3.07	0	0	0	0	0	0	0	0	0
Great Basin Xeric Mixed Sagebrush Shrubland	0	2.77	0.98	20.76	1.21	0.87	26.6	0	13.04	2.07	0	0	1.46	0	0	0	0	0
Inter-Mountain Basins Big Sagebrush Shrubland	0	0.56	8.96	52.4	1.12	2.42	4.10	0	15.6	1.31	0	0	0	0	0	0	0	0
Inter-Mountain Basins Greasewood Flat	0	0	0	0	58.8	14.5	0	0	59.2	17.6	0	0	0	0	0	0	0	0
Inter-Mountain Basins Mixed Salt Desert Scrub	0	3.57	3.23	8.64	4.84	0.44	0	0	62.9	8.34	207.6	18.3	18.6	0	170.70	11.76	0	0
Inter-Mountain Basins Montane Sagebrush Steppe	0	0	0	1.56	0	0	0.03	0	0	0	0	0	0	0	0	0	0	0
Inter-Mountain Basins Playa	0	0	0	0	1.45	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 4-72. Short-term and long-term impacts to land-cover types[a] by facility (page 2 of 2).

	Area impacted by facility (acres)[b]																	
	Interchange Yard				Staging Yard						Maintenance-of-Way Trackside Facility		Maintenance-of-Way Headquarters Facility		Maintenance-of-Way Facility		Rail Equipment Maintenance Yard	
	Caliente		Eccles		Caliente-Upland		Caliente-Indian Cove		Eccles-North		GF1 or GF3 option		GF1 or GF3 option		GF4 option			
Land-cover type	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts
Inter-Mountain Basins Semi-Desert Grassland	0	0	0	0	0	0	4.02	1.97	0	0	1.20	0	0	0	0	0	0	0
Inter-Mountain Basins Semi-Desert Shrub Steppe	0	0	0	0	0	0	0	0	0	0	13.4	1.95	0	0	1.37	0	24.2	9.62
Inter-Mountain Basins Wash	0	0	0	0	10.96	13.02	7.20	6.80	0	0	0	0	0	0	0	0	0	0
Mojave Mid-Elevation Mixed Desert Scrub	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14.4	3.66
North American Arid West Emergent Marsh	0	1.06	0	0	3.58	0.78	3.51	5.48	0.34	0	0	0	0	0	0	0	0	0
Sonora-Mojave Creosotebush-White Bursage Desert Scrub	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	108.4	60.01
Sonora-Mojave Mixed Salt Desert Scrub	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.72	1.72
Totals[c]	0	9.27	17.8	94.4	82.3	32.03	64.9	24.76	154.15	29.32	222.2	20.25	20.06	0	183.83	11.76	149.72	75.01

a. Source: DIRS 174324-NatureServe 2004, all.
b. To convert acres to square kilometers, multiply by 0.0040469.
c. Totals might differ from sum of values due to rounding.

Table 4-73. Short-term and long-term impacts to land-cover types[a] by quarry.

Land-cover type	Area impacted by quarry (acres)[b]											
	CA-8B		NN-9A		NN-9B		NS-3A		NS-3B		ES-7	
	Short-term impacts	Long-term impact	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts
Barren Lands	0.76	0.90	0	0	0	0	0	0	0	0	0	0
Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland	0.02	1.45	0	0	0	0	0	0	0	0	0	0
Great Basin Pinyon-Juniper Woodland	0.27	2.17	0	0	0	0	0	0	0	0	0	0
Great Basin Xeric Mixed Sagebrush Shrubland	47	204	8.59	31.3	21.3	51.04	46.1	87.2	3.84	5.74	32.5	83.2
Inter-Mountain Basins Big Sagebrush Shrubland	20.7	67	52.2	85.9	25.2	16.7	44.7	76.4	35.2	63	36.5	133
Inter-Mountain Basins Greasewood Flat	0	0.47	0	0	0	0	0	0	0	0	0	0
Inter-Mountain Basins Mixed Salt Desert Scrub	0.12	2.83	67.9	184	77.04	114	99.2	337	46.3	177	9.21	58.02
Inter-Mountain Basins Montane Sagebrush Steppe	0	0.84	0	0	0	0	0	0	0	0	0	0
Inter-Mountain Basins Semi-Desert Shrub Steppe	0	0	19.3	45.01	3.53	11	56.4	182	9.25	27.2	0	4.16
North American Arid West Emergent Marsh	14.9	15.37	0	0	0	0	0	0	0	0	0	0
Totals[c]	83.73	294.94	148	346.07	127.07	193	246.4	682.6	94.6	273.3	78.2	278

a. Source: DIRS 174324-NatureServe 2004, all.
b. To convert acres to square kilometers, multiply by 0.0040469.
c. Totals might differ from sum of values due to rounding.

Areas where there could be short-term impacts to vegetation include the area from the outer edge of the construction right-of-way to the outer edge of the construction footprint. Disturbance to vegetation associated with these areas would result in relatively small impacts compared to the amount of available specific land-cover types within the Great Basin and Mojave Deserts. The impacts would be short term because DOE would implement best management practices. These practices would minimize disturbance and promote effective restoration efforts, including stockpiling and replacing topsoil, reseeding of native species, monitoring for success, and in most cases the eventual return of a native vegetation community.

Areas where there could be long-term impacts include the rail line construction footprint and the footprints of facilities. The amount of vegetation loss would be relatively small compared to the amount of available specific land-cover types within the Great Basin and Mojave Deserts. The removal of vegetation for rail line construction would be primarily linear and for part of its length, would be adjacent to an existing state highway and other roadways. Therefore, impacts related to fragmentation of vegetation communities would be relatively small and would not be expected to disrupt seed dispersal.

Wildfire can have impacts on biological resources and livestock habitat outside of the construction right-of-way depending on the plants, plant communities, and/or wildlife species, including domestic animals. Plant response varies with fire severity, plant growth stage, season, climate, site history, successional status, site characteristics, and many other factors. Wildlife species in turn are differently affected by floristic changes brought on by fire. Some wildfires are a necessity for those fire-dependent plant species and are a part of the ecosystem process. Human-caused fires can also have those types of effects but generally are considered to have adverse effects on species in these arid ecosystems due to timing and/or size. For the purpose of this analysis, wildfire effects would be considered a natural event and have both beneficial and adverse impacts on plant species, and in turn, wildlife species and domestic animals, including horses and burros. The potential for human-caused fires is difficult to describe but is estimated to be small based on mitigation measures described in Chapter 7, Table 7-1, which includes control of brush and weeds along the rail roadbed, monitoring to identify overheated wheel bearings, and development of water sources at sidings to assist in the control and minimization of human-caused fires.

Clearing vegetation and disturbing soil during construction activities could create habitat suitable for ***noxious weeds*** and invasive plant species. Additionally, linear disturbances such as the rail line and access roads across relatively undisturbed regions have the potential to increase the spread of noxious weeds and invasive plant species. If noxious weeds and invasive species were to become established along the rail alignment, they could spread to adjacent areas and affect intact plant communities beyond the initial area of disturbance.

DOE would implement best management practices during and after construction to prevent the establishment of noxious weeds and invasive species. Such practices would include limiting the grading of surfaces and surface disturbance to the immediate area of construction; planting stockpiles of topsoil retained for more than a year; establishing staging areas in previously disturbed areas where practicable; applying approved herbicides; and revegetating disturbed areas not needed for operation of the rail line (see Chapter 7). As a result, potential impacts from the spread of noxious weeds and invasive species would be minimized or avoided, and would be small.

The watering of land surfaces during construction activities for such purposes as soil stabilization, ballast cleaning, vehicle washing, and dust suppression could encourage the growth of noxious weeds and invasive species. However, watering would primarily occur on road surfaces where weeds would not become established. DOE would implement best management practices to limit the watering of land surfaces to the extent practicable (see Chapter 7). Short-term impacts from the introduction and spread of noxious weeds and invasive species would be very small during the construction phase; long-term impacts would be small over the entire length of the rail alignment.

The Department's commitment to monitor and control noxious weeds and invasive species is described in Table 7-1. Table 7-1 describes how weed control would be developed and implemented during construction and operation of the railroad. The Department would develop a weed-management plan that would meet the requirements of the BLM for monitoring and control of weeds, and would consult with other directly affected parties during the development of the plan. DOE would implement a program to monitor and control weeds prior to construction. That program would include an inventory of the alignment prior to construction, monitoring of disturbed sites and control of weeds throughout construction and operations, and reclamation of disturbed sites no longer needed for operation of the railroad. Details about how and when weeds would be monitored and controlled would be included in the weed-management plan. As stated in Table 7-1, application of water to disturbed sites would be limited to that necessary to meet requirements for the control of fugitive dust; weeds that grow as a result of applying water for dust control would be controlled.

4.2.7.2.1.2 Wildlife. Potential impacts to wildlife during construction would consist of the loss of suitable habitat (land-cover types), disturbance of habitat, displacement of or limited access to important year-round or seasonal habitat during the construction phase, disruption of movement patterns, and the potential increase in the risk of wildlife collisions with vehicles along access roads. Reduced vegetation could limit forage for wildlife, such as big game or bird species, and could reduce or limit habitat for ground-dwelling mammals in the area. These impacts are reported as direct short- or long-term losses of land-cover types or habitat. To reduce redundancy, direct impacts from habitat disturbance and displacement and changes in wildlife movement and potential collisions with trains and automobiles are described in segment- and facility-specific sections. Train collisions with wildlife would be minimal over most of the alignment due to the amount of sight distance, low speeds of trains, and area for escape beside the tracks.

Wildlife species that use underground habitats and are present within the construction right-of-way could be crushed or smothered during rail line construction. However, DOE would implement best management practices (such as conducting clearance surveys for the presence of sensitive species and their habitat) before and during the construction phase to minimize adverse impacts to wildlife. The more mobile wildlife species, such as kit fox, bobcats, badgers, mountain lions, and rabbits, would be less likely to incur mortality, as they would be able to avoid the construction area, resulting in a short-term impact to these species due to displacement or avoidance of the area.

Cuts into steep hillsides, depending on design, could encourage wildlife to congregate in the cut areas, resulting in a potential increase of collisions with trains and possible fatalities. Access roads adjacent to the rail line would allow animals to move off the tracks to avoid oncoming trains. Therefore, the potential for mortality of animals congregating in cut areas would be small. Additionally, sight distance and the low speeds of the trains would help minimize potential collisions. Cuts would also have the potential to slightly disrupt movement patterns of some wildlife species. However, this impact would be small because animals would be able to travel around cuts to move up or down the hillsides.

Construction of additional access roads and the improvement of existing access roads could increase traffic during the construction phase and in the short term could increase wildlife fatalities from vehicle collisions and potentially disturb wildlife habitat from the increase in off-road vehicle traffic. However, the degree and magnitude of impacts would be species-specific and would depend on the existing habitat range of the species.

The generation of ***solid waste*** at construction camps could increase the occurrence of coyotes and ravens, indirectly increasing the death rate of the prey of these two species. As part of the worker education program, all personnel would be trained on the proper way to dispose of waste. Therefore, this potential indirect impact would be small.

The Migratory Bird Treaty Act (16 U.S.C. 703 through 712) protects migratory birds, their eggs, and occupied nests, but it does not protect their habitat. As such, all activities that would harm nesting birds or result in nest abandonment would be prohibited during construction and operation of the railroad. However, long-term impacts to migratory bird species as a result of the proposed project could result from loss of suitable nesting and foraging habitat where large amounts of vegetation (for example, junipers and pinyon pines) are removed or where rock outcrops or cliffs are disturbed for construction purposes (see Appendix H, Table H-4 for a list of all bird species that could be present in construction right-of-way). Short-term impacts could include birds avoiding the area during construction activities. To avoid or minimize adverse impacts to migratory birds during the construction phase, DOE would implement best management practices, including minimizing groundbreaking activities in nesting habitat during the critical nesting period, which the BLM defines as May 1 through July 15 (see Chapter 7). If groundbreaking or land-clearing activities had to be conducted during the bird nesting season, DOE would conduct surveys to identify nests of migratory birds before beginning those activities.

4.2.7.2.1.3 Special Status Species. A review of the Nevada Natural Heritage Program database (see Section 3.2.7.3.3), documented 60 special status species that have the potential to be present within the study area, however, this chapter discusses only species that could be affected within the construction right-of-way. Potential impacts to special status wildlife species would include loss of and disturbance to potential foraging and nesting habitat, avoidance behavior that could change movement patterns, and noise disturbance. These impacts are described in more detail in the following discussions of impact types by species, and listed in tables in the segment- and facility-specific sections.

Threatened and Endangered Species The Caliente alternative segment would be constructed on an existing, abandoned rail roadbed adjacent to and east of Meadow Valley Wash. This is the only area where suitable habitat may exist in the Caliente alignment for southwestern willow flycatchers and yellow-billed cuckoos. In this area, Meadow Valley Wash is incised 6.1 to 9.1 meters (20 to 30 feet) below U.S. Highway 93 to the west and the rail roadbed to the east. Along approximately 518.2 meters (approximately 1,700 feet) of this section, from Clover Creek to Antelope Canyon, there is a thin stand of velvet ash, Fremont cottonwood, Goodding's willow, and narrowleaf willow in the incised wash bottom. As described in the Southwestern Willow Flycatcher Recovery Plan 9 (DIRS 185438-FWS 2002, all), the riparian overstory in this area is too narrow and sparse to be breeding habitat for southwestern willow flycatchers. However, this riparian habitat may be used by nonbreeding and migrating southwestern willow flycatchers. There could be direct impacts in the form of noise disturbances to migratory southwestern willow flycatchers during construction activities if the birds used nearby habitat. However, these impacts would be small given that there are no recorded occurrences and migratory or nonbreeding habitat for the southwestern willow flycatcher within the construction right-of-way for all segments of the Caliente rail alignment. DOE has committed to avoiding or minimizing impacts to water-related and riparian habitat along the proposed Caliente alternative segment (see Appendix F). Potential impacts to stream channelization, and changes in erosion and sedimentation rates impacting the aquatic resources in the area would also be minimized.

Habitat for the western yellow-billed cuckoo, a ***candidate species***, is similar to the habitat of the southwestern willow flycatcher. There is no suitable breeding habitat for the western yellow-billed cuckoo within the construction right-of-way (DIRS 182308-Rautenstrauch 2007, all). There is only marginally suitable migratory habitat nearby, and no critical habitat has been identified in the vicinity for this species. Therefore, there would be no direct impacts to the western yellow-billed cuckoo due to the destruction of habitat. There could be direct impacts in the form of noise disturbances to migratory western yellow-billed cuckoos during construction activities if the birds used nearby habitat. However, these impacts would be small given that there are no recorded occurrences of the western yellow-billed cuckoo in this area and there is only marginally suitable migratory habitat for this species nearby.

There is no suitable nesting or winter roosting habitat for the bald eagle, which was delisted as a ***threatened species*** in 2007, within the rail line construction right-of-way. This species is still protected under the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act. Any use of the area along the Caliente rail alignment by bald eagles would be transitory. If a migratory eagle flew over or was present in the vicinity of the Caliente rail alignment during construction, construction activities (noise and human presence) would likely deter the bald eagle from using the area or would cause the bald eagle to flush and leave the area of disturbance. This impact is expected to be small and short term, and would not affect the population of bald eagles in Nevada because this species does not nest or roost in or near the construction right-of-way.

BLM-Designated Sensitive Species There is potential nesting habitat for peregrine falcons on the cliffs along Clover Creek near the City of Caliente, but no species have been observed in this area. This is the only potential nesting habitat within the construction right-of-way for the entire Caliente alignment. Based on the absence of the species and little potential habitat, DOE would not expect impacts to the peregrine falcon anywhere along the Caliente rail alignment. The reduction in vegetation resulting from rail line construction would not be expected to notably impact the availability of prey species for peregrine falcon, given the availability of foraging habitat outside the construction right-of-way, which would not be affected.

Loggerhead shrikes are known to occur along the entire Caliente rail alignment where suitable habitat is present. There could be impacts to this species from increased human activity and noise associated with the construction phase. If shrikes were nesting in the area during construction they would likely be disturbed, which could result in short-term avoidance of the area to abandonment of nesting activities during a given year. The long-term removal of shrubs along the rail alignment would reduce potential nesting habitat for this species. However, loggerhead shrikes occupy a wide range of habitat. Therefore, there would be no long-term impact to the population or viability of this species for any of the rail line segments.

Suitable shrub steppe and desert scrub habitat for the Western burrowing owl occurs within the entire Caliente rail alignment study area and has been documented near common segment 6 in the vicinity of Yucca Mountain. Construction activities have the potential to negatively impact the burrowing owl by covering or collapsing burrows. However, potential impacts to populations of burrowing owls would be small given the expected wide range of this species in the study area and the small amount of suitable nesting habitat in the greater Pioche and Nellis mapping zones that could be lost.

Ferruginous hawks have been reported to occupy and, in some cases, nest in areas adjacent to the proposed Caliente rail alignment (DIRS 174519-Bennett 2005, all). Construction activities within potential hawk habitat, specifically in the Great Basin Pinyon-Juniper Woodland land-cover type, would reduce the amount of potentially suitable nesting habitat for ferruginous hawks. If this species were present in the construction right-of-way during construction activities, noise and the presence of humans could disrupt nesting and foraging activities. This species is a relatively rare breed in the study area and the Great Basin Pinyon-Juniper Woodland land-cover type is relatively abundant within the mapping zone but rare within the construction right-of-way. Therefore, there would be no impacts to ferruginous hawks or their habitat.

Pursuant to BLM protocols DOE would salvage for replanting the minimal amounts of cacti and yucca removed during the construction phase; nevertheless, it is possible that some individual cacti and yucca plants would be lost. However, construction activities would not threaten cacti or yucca populations.

Potential impacts to bat species along the Caliente rail alignment include the disturbance or alteration of mineshafts, caves, talus slopes with cracks, crevices, and cliff faces during cut and fill operations. Potential impacts to bat habitats from construction activities would be small.

Both the dark kangaroo mouse and the pale kangaroo mouse distribution ranges are from Dry Lake Valley to Goldfield (DIRS 174519-Bennett 2005, all). Potential impacts would result from burrows being covered over or collapsing during rail line construction. However, there are no known occurrences of these species within the construction right-or-way. Any potential impact would be small (DIRS 185440-BSC 2008, all).

4.2.7.2.1.4 State of Nevada Game Species. The rail line would cross areas recognized by the BLM and the Nevada Department of Wildlife as habitat for game species (see Figures 3-101 through 3-104). The Ely Proposed Resource Management Plan management objective for wildlife states that crucial summer range, crucial winter range, and occupied bighorn sheep habitat are priority habitats and they have identified management actions that would apply to this project (DIRS 184767-BLM 2007, pp. 2.4.14 and 2.4.15). Direct impacts to game species during rail line construction would include loss of foraging habitat, disturbance from noise, potential fatality or injury from collisions with trains and construction vehicles, and a short-term avoidance of year-round or seasonal habitat, migratory corridors, and water sources during construction activities. However, because of the relatively low density of game animals in the study area, their mobility, and the existing presence of humans and machines, such impacts would be small. Potential impacts to game species would be greatest in the areas under active construction. After sections of the rail line were completed, it is possible that trains moving along the completed portion of track could collide with and injure or kill individual game animals. However, the likelihood of such collisions would be low, because most game animals would likely avoid oncoming trains whenever possible.

During rail line construction there would be a potential for short-term impacts from the temporary disruption of movement patterns of game species within an area or along migratory corridors. This could disturb individuals or groups of animals and cause animals to avoid the construction areas. Game species are large, mobile animals and would be able to avoid contact with humans at construction sites and would likely move temporarily to other areas during construction activities. These changes in movement or habitat-use patterns would affect relatively low numbers of individuals at any one time; therefore, changes in utilization of the water or forage resources in the region would be small.

There could be direct impacts to game populations if animals avoid water sources close to construction activities. Water sources are found only along certain portions of the Caliente rail alignment and there could be a small, short-term impact to individuals if they are unable to reach those water sources. However, there would be no impact on the overall populations of State of Nevada game species.
Other potential impacts to State of Nevada game species would be similar to those described for wildlife, and would be small.

Construction and operation of the proposed railroad would result in the long-term loss of vegetation, and could result in reduced forage for game species. However, the rail line would pass through various land-cover types with varying forage values and the amount of vegetation removed from these differing land-cover types would have a small impact on the availability of forage for game species.

4.2.7.2.1.5 Wild Horses and Burros. This section identifies the magnitude of potential adverse impacts to wild horses and burros based on the potential for wild horses and burros to be displaced and have their habitat degraded or whether wild horse and burro movement patterns would be substantially interrupted.

Construction activities within herd management areas would result in a long-term loss of forage, mortality of individual animals from collisions with trains, the short-term loss of year-round or seasonal habitat, and the potential to disrupt wild horse and burro movement patterns. Appendix H describes specific herd management areas that could be affected during the construction phase.

The removal of vegetation during the construction phase would result in a long-term loss of potential forage for wild horses and burros. However, the amount of vegetation removed would be relatively small compared to the available forage within the affected herd management areas, and would result in an overall small impact to the associated herd management area. Tables in segment- and facility-specific sections list the potential loss of forage due to construction of the proposed railroad.

Generally, wild horses and burros avoid contact with humans and therefore would likely move to other areas during construction activities. These potential changes in movement or habitat-use patterns would affect relatively low numbers of individuals due to the localized nature of construction; therefore, changes in utilization of the water or forage resources in the region would be small. DOE would minimize impacts to herd management areas by fencing off temporary ponds or reservoirs that are used during construction activities to prevent herds from utilizing those water sources, which could otherwise change herd movement patterns. The loss of potential forage and habitat and the temporary short-term loss of access would be the same for each herd management area.

4.2.7.2.2 Segment-Specific Construction Impacts

Sections 4.2.7.2.2.1 through 4.2.7.2.2.18 describe potential short- and long-term direct impacts to biological resources from the construction of specific alternative segments and common segments, quarries, and facilities along the Caliente rail alignment. The discussion in Section 4.2.7.2.1 for the impacts to biological resources common to all segments is not repeated. Rather, tables provide the information necessary to report direct impacts to the specific biological resources associated with each alternative segment, common segment, quarry, and facility. Unless otherwise noted, these sections only identify biological resources for which an impact has been identified.

4.2.7.2.2.1 Alternative Segments at the Interface with the Union Pacific Railroad Mainline. As presented in Table 4-71, construction of the Caliente and Eccles alternative segments would result in long- and short-term impacts to several land-cover types, as described in the following paragraphs.

<u>Vegetation</u> Both the Caliente and Eccles alternative segments would impact the Great Basin Pinyon-Juniper Woodland land-cover type, which is relatively common on the lower mountain slopes in the area and likely provides roosting and nesting habitat for some raptors. Either alternative segment would also pass through several land-cover types that include sagebrush communities, including Inter-Mountain Basins Big Sagebrush Shrubland, Great Basin Xeric Mixed Sagebrush Shrubland, and the Inter-Mountain Basins Montane Sagebrush Steppe. These vegetation communities are relatively common in the area and provide habitat for various species that depend on sagebrush communities, such as the sage thrasher and Brewer's sparrow.

Construction of the Caliente or the Eccles alternative segment would result in some unavoidable impacts to water-related and riparian habitats. Short-term impacts would include removal of plant material. Long-term adverse impacts would include the removal of plant materials or alteration of the largely organic growing medium through the deposition of fill material for construction. Following construction, DOE would revegetate disturbed areas outside the operations right-of-way.

The Caliente alternative segment would be constructed within areas classified as wetlands within the Meadow Valley Wash, including the Indian Cove area and along Clover Creek. Impacts within these areas would be limited to the loss of 0.11 square kilometer (27 acres) of habitat and 0.09 square kilometer

(22 acres) disturbance to habitat; however, impacts in both areas would be limited. DOE would minimize the amount of water-related and riparian habitat affected within Meadow Valley Wash by constructing the rail line on an existing historic railroad bed. Within Clover Creek, impacts to water-related and riparian habitat would be small because construction would only involve constructing a bridge. Construction of the Eccles alternative segment would require constructing a bridge across Meadow Valley Wash approximately 1.6 kilometers (1 mile) south of Caliente common segment 1. Construction of the bridge would cause potential impacts to Meadow Valley speckled dace and Meadow Valley Wash desert sucker habitat, but would not result in any long-term impacts.

The Eccles alternative segment would begin about 8 kilometers (5 miles) east of the City of Caliente and generally run north through Meadow Valley. Construction would result in small impacts to riparian habitat within Clover Creek as a result of activities associated with construction of a 300-meter (1,000-foot) bridge. Short-term impacts such as sedimentation and erosion within water-related and riparian habitat would be minimized and managed by implementing best management practices during construction.

Special Status Species

Threatened and Endangered Species: Table 4-74 lists impacts to threatened and endangered species. Ute ladies'-tresses, a federally listed threatened species, is currently known to occur near Panaca Spring, approximately 8 kilometers (5 miles) north of the Caliente and Eccles alternative segments. There is a small potential for this species to be present in the moist habitats in Meadow Valley Wash between Panaca and Caliente along the Caliente alternative segment.

The known population of Ute ladies'-tresses near Panaca Spring is relatively undisturbed by livestock grazing, compared with the area of the construction right-of-way in Meadow Valley Wash that has been actively grazed by livestock. The known existing population of Ute ladies'-tresses near Panaca Spring would not be affected by construction of either alternative segment, because that population would be outside the construction right-of-way. DOE does not consider potential impacts to this species because of its restricted distribution and because it would be unlikely to occur within the construction right-of-way. The impacts to Ute ladies'-tresses would be the same for all common segments and alternative segments, and no loss of species would be expected.

Impacts to southwestern willow flycatchers and yellow-billed cuckoos are discussed in Section 4.2.7.2.1.2 above and not repeated in this section. This area has been proposed by the BLM as an Area of Critical Environmental Concern for the protection of federally endangered, threatened, and candidate species as well as Nevada State-protected species and BLM sensitive species. There would be approximately 0.4 square kilometer (91 acres) of impact in the Clover Creek Area of Critical Environmental Concern. No riparian habitat within the Area of Critical Environmental Concern would be directly affected. The bridge would be constructed over an intermittent stream and no fish or aquatic habitat would be affected. Appendix F describes potential indirect downstream impacts from alteration of flow regimes and changes in the sediment and flow rates. Based on the existing condition of the habitat that would be lost (no riparian habitat within the footprint) and the DOE commitment to avoid or minimize impacts, the proposed action would be consistent with the management prescriptions of protection of habitat for the conservation of the species. Additionally, the potential Area of Critical Environmental Concern in the Ely Proposed Resource Management Plan calls for avoidance of ground-disturbing activities in these areas. However, rights-of-way may be granted if there is minimal conflict with identified resource values and impacts can be mitigated (DIRS 184767-BLM 2007, all).

BLM- and State of Nevada-Designated Sensitive/Protected Species: The Meadow Valley speckled dace and the Meadow Valley Wash desert sucker are known to occur in Meadow Valley Wash and Clover Creek. Construction of the Caliente alternative segment would require widening the existing

Table 4-74. Summary of the magnitude of potential impacts to biological resources from rail line construction along the Caliente or Eccles alternative segment.

Resource/impact type	Extent of impact, Caliente alternative segment	Extent of impact, Eccles alternative segment
Wildlife		
Loss of vegetation or land-cover type (long term)	87.2 acres[a]	144 acres
Construction-related disturbance to vegetation or land-cover type (short term)	225 acres	950.2 acres
Loss of riparian and water-related habitats (long term)[b]	26.9 acres	0
Construction-related disturbance to riparian habitats (short term)[b]	24.3 acres	0
Wildlife water sources	No impact to water access	No impact to water access
Special status species		
Threatened and endangered species		
Southwestern willow flycatcher (*Empidonax traillii extimus*)	Small loss of marginal non-nesting habitat; no impact	No loss of habitat; no impact
Western yellow-billed cuckoo (*Coccyzus americanus occidentalis*)	Small loss of marginally suitable habitat; no impact	Small loss of marginally suitable habitat; no impact
Ute ladies'-tresses (*Spiranthes divuvialis*)	Small loss of potential habitat; small impact	Marginal habitat outside the construction right-of-way; no impact
BLM- and State of Nevada-designated sensitive/protected species		
Loggerhead shrike (*Lanius ludovicianus*)	Small impact to suitable habitat	Small impact to suitable habitat
Western burrowing owl (*Athenes pallidus*)	Small impact to suitable habitat	Small impact to suitable habitat
Ferruginous hawk (*Buteo regalis*)	Small impact to marginal habitat	Small impact to marginal habitat
Needle Mountains milkvetch (*Astragalus eurylobus*)	No loss of species; small impact to suitable habitat	No loss of species; small impact to suitable habitat
White River catseye (*Cryptantha welshii*)	Potential loss of species; small impact to suitable habitat	No loss of species or suitable habitat; no impact
Pioche blazingstar (*Mentzelia argillicola*)	No loss of suitable habitat; no impact	No loss of species; no loss of suitable habitat; no impact
Meadow Valley speckled dace (*Rhinichthys osculus* ssp. 11)	Small loss of habitat; small impact	Small loss of habitat; small impact
Meadow Valley Wash desert sucker (*Catostomus clarki* ssp., unnamed subspecies)	Small loss of habitat; no loss of species; small impact	Small loss of habitat; no loss of species small impact
Southwestern toad (*Bufo microscaphus*)	Small loss of habitat; small impact	Small loss of habitat; small impact
Bat species (see Table 3-51)	Small construction-related impacts to species through disturbance	Small construction-related impacts to species through disturbance
State of Nevada game species		
Mule deer	Small impact from loss of habitat	Small impact from loss of habitat
Wild horses and burros	Small impact from loss of foraging habitat and displacement	Small impact from loss of foraging habitat and displacement

a. To convert acres to square kilometers, multiply by 0.0040469.
b. Total includes wetlands, seeps, streams, and riparian areas combined.

abandoned rail roadbed and constructing several bridges, which could result in a short-term increase in sediment load within the Meadow Valley Wash. This could increase stress levels of breeding adults or result in individuals unable to reproduce or escape predators. Heightened levels of turbidity and potential filling of adjacent wetlands could result in a short-term increase in fish mortality levels. However, adverse impacts would be minimized by shifting the alignment to minimize filling of wetlands, and engineering all crossings so that there would be no long-term impacts to stream flow or velocity.

DOE would implement best management practices to minimize and manage adverse impacts within Meadow Valley Wash.

The southwestern toad occurs within Meadow Valley Wash and has been observed as far north as the confluence of Meadow Valley Wash and Clover Creek near the southern terminus of the Caliente alternative segment (DIRS 174048-Bennett and Thebeau 2005, all). Suitable habitat for this species consists of cottonwood-willow associations, creeks, pools, irrigation ditches, flooded fields, and reservoirs. However, this habitat is not found within the construction right-of-way of the Caliente alternative segment, but does occur within the greater study area. Impact to habitat for this species would be small due to possible filling of a small area of wetlands along the Caliente alternative segment. However, DOE would mitigate any potential adverse impact to toad habitat by reducing the area of disturbance (to a minimum of 15 meters [50 feet]) in wetland areas. There is potential suitable habitat within the construction right-of-way where the Eccles alternative segment would cross Meadow Valley Wash. There would be no long-term impacts to toad habitat, but there would be small, short-term impacts, such as disturbance to vegetation and soils or increased sedimentation, during bridge construction and where there is habitat at specific sites.

There could be impacts to several bat species, listed in Table 3-53, during the construction phase if water sources were disturbed. These impacts would be short term and small because bats generally return to a water source once the disturbance has ceased, or would find and utilize a different water source nearby. Potential long-term impacts to bat habitat along the Caliente or Eccles alternative segment include rock slopes with cracks, crevices, and cliff faces that would be altered during cut and fill activities. These impacts would be small.

The Needle Mountains milkvetch (a U.S. Fish and Wildlife Service-designated species of concern) has been documented within the vicinity of Meadow Valley Wash. The closest recorded occurrence is 687 meters (2,253 feet) from the Eccles alternative segment, northeast of the proposed Interchange Yard. There are additional occurrences of this species within the study area farther north. However, there would be no impact because they would be outside the construction right-of-way. Suitable habitat for this species could be affected as a result of direct removal of vegetation (habitat); this would result in a small impact.

White River catseye (a U.S. Fish and Wildlife Service-designated species of concern) has been documented in the vicinity of Meadow Valley Wash. The closest recorded occurrence is 80 meters (264 feet) from the Caliente alternative segment. Potential impacts to this species could include loss of suitable habitat, which could result from damage or removal of the upper soil crust within the range of this species. However, construction of the Caliente alternative segment would not likely have an adverse impact on the overall population because riparian and water-related communities are not considered preferred habitat for this species.

The closest documented occurrence of the Pioche blazingstar to the Caliente and Eccles alternative segments is approximately 1.6 kilometers (1 mile) east of Panaca. Potential habitat for this species might be present; however, this species appears to be restricted to barren clay knolls and slopes between Panaca and the Patterson Wash. There could be impacts to potential suitable habitat for this species as a result of the direct removal of vegetation during construction. If individuals of this species were present in the construction right-of-way, they could be trampled, crushed, dug up, or covered during construction activities. There would be limited impacts because there are no known occurrences of and very little suitable habitat for the Pioche blazingstar within the construction right-of-way.

State of Nevada Game Species There are mule deer and BLM-designated habitat within the study area of the Caliente and Eccles alternative segments. Construction of either alternative segment would result in a small loss of habitat.

Wild Horses and Burros There would be potential small, seasonal impacts in the Little Mountain Herd Management Area, which would affect approximately 35 horses during the winter when horses move into the area from the Miller Flat Herd Management Area. Horses and burros in the Clover Creek Herd Management Area would lose localized areas for watering, but the availability of water sources nearby would provide for the displaced animals, resulting in small, short-term impacts.

4.2.7.2.2.2 Facilities Construction at the Interface with the Union Pacific Railroad Mainline. As presented in Table 4-72, construction of the Interface with the Union Pacific Railroad Mainline would result in long- and short-term impacts to several land-cover types. These impacts are discussed in this section.

Vegetation The proposed Interchange Yard along the Caliente alternative segment would be within the City of Caliente, entirely within the Union Pacific Railroad right-of-way, which consists of previously and currently disturbed land and contains no native vegetation. Therefore, there would be no adverse impact to any vegetative land-cover types from construction of the Interchange Yard.

The proposed Interchange Yard along the Eccles alternative segment would be constructed within the Clover Creek floodplain adjacent to the Union Pacific Railroad Mainline. Portions of this area have been disturbed by recent flooding and Union Pacific Railroad activities. Construction of the Interchange Yard would require portions of Clover Creek to be filled to elevate the site out of the floodplain. It is possible that fill would be required along the entire length of the Interchange Yard, which would be approximately 1,500 meters (5,000 feet) long. Construction of the Interchange Yard would have a long-term impact on 0.01 square kilometer (3.14 acres) and temporarily impact less than 0.01 square kilometer (about 2.65 acres) of Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland, and a negligible amount (0.15 square meter [1.61 square feet]) of North American Arid West Emergent Marsh (see Table 4-72) within the construction right-of-way. To reduce any further adverse impacts within the Clover Creek drainage, DOE would implement appropriate erosion-control mechanisms to stabilize and protect riparian habitat.

The Caliente-Indian Cove option for the Staging Yard would be located within an area including water-related and riparian habitat. The area includes emergent wetlands and pasturelands that appear to be frequently inundated (refer to Section 4.2.5.2.3.2 and Appendix F for more details). As summarized in Table 4-72, construction of the Staging Yard at Indian Cove would have a long-term impact on 0.02 square kilometer (5.4 acres) of North American Arid West Emergent Marsh and 0.02 square kilometer of Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland, and a short-term impact on 0.01 square kilometer (3.5 acres) of North American Arid West Emergent Marsh and 0.08 square kilometer (18.6 acres) of Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland.

The Caliente-Upland option of the Staging Yard would be located in an area that includes a small area of water-related and riparian habitat along Meadow Valley Wash. Construction of the Staging Yard at this location would have a long-term impact on less than 0.01 square kilometer (about 0.78 acre) and short-term impact on less than 0.1 square kilometer (3.58 acres) of North American Arid West Emergent Marsh.

The Upland Staging Yard would require ballast that would be loaded at a siding constructed south of that staging yard and east of the quarry. The proposed location for the ballast siding to support the Upland Staging Yard identified in the *Construction Plan Caliente Rail Corridor* (DIRS 180922-Nevada Rail Partners 2007, p. 3-6) is approximately 5 miles south of the yard at track station 1210+00.

The new proposed location of the quarry siding is immediately south of Beaver Dam Road and to the east of the mainline track (see Figure 3-84). The siding would be 1,524 meters (5,000 feet) long and 61 meters (200 feet) wide.

The proposed Eccles-North option of the Staging Yard includes a small portion of water-related and riparian habitat. Construction of the Staging Yard at this location would temporarily impact less than 0.01 square kilometer (about 0.35 acre) of North American Arid West Emergent Marsh. There would be no long-term impacts to riparian/water-related vegetation.

Wildlife There would be potential direct impacts to various wildlife populations because of changes in access to sources of water including springs and streams and migratory routes. These impacts would be small and short term, because there are many places along Clover Creek and Meadow Valley Wash for wildlife to access water sources.

Special Status Species

Threatened and Endangered Species: There is no potential habitat for the yellow-billed cuckoo or southwestern willow flycatcher at any of the facility locations associated with the Union Pacific interchange or the Eccles Interchange Yard.

BLM- and State of Nevada-Designated Sensitive/Protected Species: The loss of Great Basin Pinyon-Juniper Woodland land cover as a result of constructing the Staging Yard at Indian Cove would result in the loss of potential habitat for the ferruginous hawk. This impact would be small given the amount of this land-cover type within the Pioche mapping zone. If DOE selected the Eccles alternative segment, construction of the Interchange Yard would also result in the loss of potential habitat for the ferruginous hawk.

There is potential suitable habitat for the southwestern toad within the Indian Cove area. Construction of the Staging Yard at Indian Cove would likely require the wetland meadow area to be drained and filled above the level of the floodplain. As a result, there would be a small, long-term impact from direct loss of suitable habitat for the southwestern toad.

State of Nevada Game Species There is designated mule deer at all of the proposed locations of the Interchange Yard and Staging Yard and designated elk habitat at the location of the Eccles Interchange Yard. Potential impacts would be small, but long term, due to loss of habitat.

Wild Horses and Burros Construction of the Staging Yard at Indian Cove would result in a small, direct loss of forage area as a result of surface disturbance and a small, indirect impact if wild horses and burros avoided the area during construction activities.

Table 4-75 summarizes the potential impacts on wildlife, special status species, game species, and wild horse and burro populations that have the potential to occur at the proposed facilities associated with the Caliente and Eccles alternative segments.

4.2.7.2.2.3 Quarry CA-8B Construction and Operations. Table 4-76 summarizes potential direct impacts to biological resources from construction of potential quarry CA-8B.

Table 4-75. Summary of the magnitude of potential impacts to biological resources from construction of the facilities associated with the Caliente and Eccles alternative segments.

Resource/impact type	Extent of impact, Interchange Yard-Caliente	Extent of impact, Interchange Yard-Eccles	Extent of impact, Staging Yard-Indian Cove	Extent of impact, Staging Yard-Upland	Extent of impact, Staging Yard-Eccles
Wildlife					
Loss of vegetation or land-cover type (long term)	9.27 acres[a]	94.4 acres	24.8 acres	32.05 acres	29.4 acres
Construction-related disturbance to habitat (short term)	0	17.8 acres	64.9 acres	82.3 acres	154 acres
Loss of riparian and water-related habitats (long term)[b]	1.2 acres	3.14 acres	10.87 acres	0.78 acre	0
Construction-related disturbance to riparian habitats (short term)[b]	0	2.65 acres	22.09 acres	3.58 acres	0.34 acre
Wildlife water resources	No impact	Small impact due to avoidance	Small impact due to avoidance	Small impact due to avoidance	Small impact due to avoidance
Special status species					
Threatened and endangered species	No impact	No impact	No impact	No impact	No impact
BLM- and State of Nevada-designated sensitive/protected species					
Ferruginous hawk (*Buteo regalis*)	No impact to habitat or species	No impact to habitat or species	Small impact on potential habitat	No impact to habitat or species	No impact to habitat or species
Southwestern toad (*Bufo microscaphus*)	No impact to habitat or species	No impact to habitat or species	Small impact on habitat	No impact to habitat or species	No impact to habitat or species
State of Nevada game species					
Mule deer	Small impact to habitat and avoidance	Small impact to habitat and avoidance	Small impact to habitat and avoidance	Small impact to habitat and avoidance	Small impact to habitat and avoidance
Elk	No impact	Small impact to yearlong habitat and avoidance	No impact	No impact	No impact
Wild horses and burros	No impact	No impact	Small impact to forage and avoidance	No impact	No impact

a. To convert acres to square kilometers, multiply by 0.0040469.
b. Total includes wetlands, seeps, streams, and riparian areas combined.

DOE assessed impacts to land-cover types in this potential quarry area utilizing the footprint of the quarry, which includes the quarry site and all access roads and conveyer belts.

Vegetation As discussed in Section 3.2.7, there are several land-cover types that provide habitat for unique or obligate wildlife species that would be impacted by construction of proposed quarry CA-8B along the Caliente alternative segment. The quarry footprint would occupy approximately 1.6 square

Table 4-76. Summary of potential impacts to biological resources from construction and operation of potential quarry CA-8B.

Resource/impact type	Extent of impact
Wildlife	
Loss of vegetation or land-cover type (long term)	310.3 acres[a]
Construction-related disturbance to habitat (short term)	84 acres
Loss of riparian and water-related habitats (long term)[b]	18.3 acres
Construction-related disturbance to riparian habitats (short term)[b]	6.08 acres
Wildlife water resources	Small impacts
Special status species	
Threatened and endangered species	
Southwestern willow flycatcher (*Empidonax traillii extimus*)	No impact to habitat or species
Western yellow-billed cuckoo (*Coccyzus americanus*)	No impact to habitat or species
BLM- and State of Nevada-designated sensitive/protected species	
Loggerhead shrike (*Lanius ludovicianus*)	Small impact to habitat
Western burrowing owl (*Athenes cunicularia*)	Small impact to habitat
Ferruginous hawk (*Buteo regalis*)	No impact to habitat or species
Meadow Valley speckled dace (*Rhinichthys osculus* ssp. 11)	Small, short-term impact to species and habitat
Meadow Valley Wash desert sucker (*Catostomus clarki* ssp., unnamed subspecies)	Small, short-term impact to habitat and species
Southwestern toad (*Bufo microscaphus*)	Small impact to habitat
Bat species (see Table 3-53)	Small impact to habitat and species
State of Nevada game species	
Mule deer	Small impact to habitat
Wild horses and burros	Small, short-term impact from loss of habitat and displacement

a. To convert acres to square kilometers, multiply by 0.0040469.
b. Total includes wetlands, seeps, streams, and riparian areas combined.

kilometers (400 acres) (see Section 2.2.2.4.2). Section 4.2.7.2.1.1 discusses the impacts to these land-cover types. Table 4-73 lists the amount each land-cover type that would be impacted by construction.

The affected vegetation communities are relatively common in the area; therefore, there would be a small impact from the loss of a small portion of these land-cover types.

There are two types of riparian and water-related habitat types that would be affected by activities associated with the operation of the quarry CA-8B. Construction of the railroad siding associated with this quarry would have a long-term impact on 0.05 square kilometer (13.3 acres) of North American Arid West Emergent Marsh and 0.02 kilometer (about 5 acres) of Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland, and a short-term impact of 0.02 kilometer (about 6 acres) of North American Arid West Emergent Marsh and less than 0.01 square kilometer (about 2.5 acres) of Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland. Impacts from construction and operation of the siding would be small from the long-term loss of riparian and water-related vegetation.

Wildlife Potential impacts to wildlife species associated with potential quarry CA-8B would be similar to those described in Section 4.2.7.2.1.2, except for the loss of water resources from construction and operation of the quarry.

Special Status Species Table 4-76 summarizes potential impacts to special status species that have the potential to occur within or near (approximately 1 kilometer [0.62 mile]) potential quarry CA-8B.

State of Nevada Game Species Table 4-76 lists potential impacts to State of Nevada game species and their respective habitats as designations in the Ely Proposed Resource Management Plan.

Wild Horses and Burros The location of the quarry site between the Highland Peak Herd Management Area and the Little Mountain Herd Management Area would result in the potential for small, adverse, localized impacts similar to those described under Section 4.2.7.2.1.5. There would be a small, short-term loss of forage during the construction phase.

4.2.7.2.2.4 Caliente Common Segment 1 (Dry Lake Valley Area), Rail Line Construction. Table 4-77 summarizes potential impacts to biological resources from construction of Caliente common segment 1.

Vegetation Caliente common segment 1 would pass through several land-cover types that provide habitat for unique or obligate wildlife species. Table 4-70 lists the amount of each land-cover type that would be impacted by construction. Section 4.2.7.2.1.1 discusses the impact to these land-cover types.

Construction of Caliente common segment 1 would not disturb any water-related or riparian communities. Approximately 0.44 kilometer (0.27 mile) of common segment 1 would cross the extreme southwest corner of the 19.9-square-kilometer (4,925-acre) proposed Schlesser Pincushion Area of Critical Environmental Concern (Figure 3-84). The BLM has proposed managing this Area of Critical Environmental Concern as an avoidance area when considering land-use authorizations, where rights-of-way may be granted if there is minimal conflict with identified resource values and impacts can be mitigated (DIRS 184767-BLM 2007, Table 2.4-28). The construction right-of-way within this proposed Area of Critical Environmental Concern would be about 0.12 square kilometer (30 acres). The construction footprint generally would be about 61 meters (200 feet) wide or less, and the total area disturbed in the Area of Critical environmental Concern would be less than about 0.03 square kilometer (7 acres). To mitigate impacts to the Schlesser pincushion, DOE will design the rail line in this area to disturb the minimum amount of land possible; avoid this sensitive species where possible; and survey for, collect, and transplant Schlesser pincushions that could not be avoided, as required by the BLM. Because less than 0.01 percent of the Area of Critical Environmental Concern would be disturbed and impacts would be mitigated by avoiding or transplanting cacti, there will be small impacts to the Schlesser pincushion and minimal conflict with the resources values identified by the BLM for the Schlesser Pincushion Area of Critical Environmental Concern.

Wildlife Impacts to wildlife species from construction of Caliente common segment 1 would be similar to those described in Section 4.2.7.2.1.2. The Ely Proposed Resource Management Plan management objective for wildlife states that crucial summer range, crucial winter range, and occupied bighorn sheep habitat are priority habitats and they have identified management actions that would apply to this project (DIRS 184767-BLM 2007, pp. 2.4.14 and 2.4.15). Table 4-77 summarizes the potential impacts on wildlife species that have the potential to occur within or near Caliente common segment 1.

Special Status Species

Threatened and Endangered Species: There would be no impacts to any threatened, endangered, or candidate species from construction of Caliente common segment 1.

Table 4-77. Summary of potential impacts to biological resources from rail line construction along Caliente common segment 1.

Resource/impact type	Extent of impact
Wildlife	
Loss of vegetation or land-cover type (long term)	867 acres[a]
Construction-related disturbance to habitat (short term)	7,670 acres
Loss of riparian and water-related habitats (long term)[b]	0
Construction-related disturbance to riparian habitats (short term)[b]	0
Wildlife water resources	No impact
Special status species	
Threatened and endangered species	No impacts/no species or habitat present
BLM- and State of Nevada-designated sensitive/protected species	
Loggerhead shrike (*Lanius ludovicianus*)	Small impact to habitat
Western burrowing owl (*Athenes cunicularis*)	Small impact to habitat
Ferruginous hawk (*Butea regalis*)	No impacts
Brewer's sparrow (*Spizella breweri*)	Small impact from loss of habitat
Sage thrasher (*Oreoscoptes montanus*)	Small impact from loss of habitat
Greater sage-grouse (*Centrocercus urophasianus*)	Small impact from loss of habitat
Needle Mountains milkvetch (*Astragalus eurylobus*)	No impact to individuals or habitat
Long-calyx eggvetch (*Astragalus oophorus*)	No impact to individuals or habitat
White River catseye (*Cryptantha welshii*)	No impact to individuals or habitat
Schlesser pincushion (*Sclerocactus schlesseri*)	Small impact to habitat
Tiehm blazingstar (*Mentzelia tiehmii*)	Small impact to suitable habitat
Pygmy rabbit (*Brachylagus idahoensis*)	Small impact to habitat
Bat species (see Table 3-53)	Small impact to habitat
Dark kangaroo mouse (*Microdipodops megacephalus*)	Small impacts to habitat
Pale kangaroo mouse (*Microdipodops pallidus*)	Small impacts to habitat
State of Nevada game species	
Desert bighorn sheep (*Ovis canadensis*)	Small impacts to yearlong occupied and yearlong unoccupied habitat
Mule deer	Small impacts to habitat and crucial winter habitat
Pronghorn antelope	Small impacts to yearlong habitat
Wild horses and burros	Small impacts to species and foraging habitat

a. To convert acres to square kilometers, multiply by 0.0040469.
b. Total includes wetlands, seeps, streams, and riparian areas combined.

BLM- and State of Nevada-Designated Sensitive/Protected Species: There is potential habitat for the sage thrasher, Brewer's sparrow, and the greater sage-grouse along Caliente common segment 1.

One sage thrasher was sighted during the 2005 field surveys. No sage-grouse or sage-grouse leks were observed during the 2005 fieldwork; however, a portion of common segment 1 would pass through potential nesting habitat and potential winter habitat of the sage-grouse (see Figure 3-100). Construction along common segment 1 would result in the long-term loss of 0.54 square kilometer (133 acres) of Great

Basin Xeric Mixed Sagebrush Shrubland and 1.55 square kilometers (383 acres) of Inter-Mountain Basins Big Sagebrush Shrubland (see Table 4-70), which is considered suitable sage-grouse, Brewer's sparrow, and sage thrasher habitat. However, the impact would be small because within the affected mapping zones there are 7,600 square kilometers (1.8 million acres) of Great Basin Xeric Mixed Sagebrush Shrubland and 10,000 square kilometers (2.5 million acres) of Inter-Mountain Basins Big Sagebrush Shrubland (Table 3-46).

Construction along Caliente common segment 1 east of Dry Lake Valley could result in the loss of local habitat for the Schlesser pincushion. This potential impact would be small because there is ample potential habitat for this species in the area.

Tiehm blazingstar has been documented in the White River Valley west of the White River near Caliente common segment 1. The closest recorded occurrence of this species is 1.1 kilometers (0.7 mile) away from common segment 1. Field surveys conducted in May 2005 did not detect the presence of this species at the location described in the Nevada Natural Heritage Program (DIRS 185440-BSC 2008, all). Construction along common segment 1 could result in the loss of suitable habitat for the Tiehm blazingstar. Implementation of best management practices during the construction phase and restoration of disturbed areas following construction would minimize adverse impacts to Tiehm blazingstar habitat.

The pygmy rabbit is known to occur in the vicinity of Caliente common segment 1 north of where the segment would cross the White River. With the exception of an isolated population west of Beatty, this is the most southerly extent of pygmy rabbit range (DIRS 174519-Bennett 2005, all). No pygmy rabbits have been documented within the construction right-of-way; however, they are believed to be more widespread throughout the area than the reported data suggests. Potential impacts would be small and long term due to loss of habitat and possible avoidance of the area.

State of Nevada Game Species As described in Section 3.2.7.3.5 and shown on Figures 3-101 to 3-104, the Ely Proposed Resource Management Plan has identified habitat uses and designations for bighorn sheep, antelope, and mule deer along common segment 1. Table 4-77 summarizes the type of habitats that would be lost based on the designation in the Ely Proposed Resource Management Plan. Potential impacts from loss of these habitat designations would be small based on the minor loss in comparison to the overall quantity.

Wild Horses and Burros Caliente common segment 1 would pass through the Dry Lake, Highland Peak, and Seaman Herd Management Areas. There is a potential for an indirect loss of watering locations that would result in impacts to wild horses in the Highland Peak Herd Management Area at Bennett Springs and in the Dry Lake Herd Management Area along the North Pahroc Range. The number of individuals potentially affected at Bennett Pass could range from 35 to 80 animals. The greatest potential for adverse impacts along Bennett Pass would be during the spring. Because the westernmost proposed construction camp along this segment would be within the Seaman Herd Management Area, there would adverse impacts from loss of forage, but these impacts would be small, localized, and short term.

4.2.7.2.2.5 Garden Valley Alternative Segments, Rail Line Construction. Table 4-78 summarizes the potential direct impacts to biological resources from rail line construction along the Garden Valley alternative segments.

Vegetation The Garden Valley alternative segments would pass through several land-cover types that represent sagebrush vegetation communities including Inter-Mountain Basins Big Sagebrush Shrubland and the Great Basin Xeric Mixed Sagebrush Shrubland. These vegetation communities are relatively common in the area and provide habitat for various unique and sagebrush community-obligate species.

Table 4-78. Summary of potential impacts from rail line construction along the Garden Valley alternative segments.

Resource/impact type	Extent of impact, Garden Valley 1	Extent of impact, Garden Valley 2	Extent of impact, Garden Valley 3	Extent of impact, Garden Valley 8
Wildlife				
Loss of vegetation or land-cover type (long term)	274 acres[a]	373 acres	268 acres	387 acres
Construction-related disturbance to habitat (short term)	2,380 acres	2,350 acres	2,610 acres	2,260 acres
Loss of riparian and water-related habitats (long term)[b]	0	0	0	0
Construction-related disturbance to riparian habitats (short term)[b]	0	0	0	0
Wildlife water resources	No impact	No impact	No impact	No impact
Potential impacts to special status species				
Threatened and endangered species	No species or habitat occurrence	No species or habitat occurrence	No species or habitat occurrence	No species or habitat occurrence
BLM- and State of Nevada-designated sensitive/protected species				
White River catseye (*Cryptantha welshii*)	Small impact to habitat	Small impact to habitat	Small impact to habitat	Small impact to habitat
Loggerhead shrike (*Lanius ludovicianus*)	Small impact to nesting habitat	Small impact to nesting habitat	Small impact to nesting habitat	Small impact to nesting habitat
Western burrowing owl (*Athenes cunicularia*)	Small impact	Small impact	Small impact	Small impact
Brewer's sparrow (*Spizella breweri*)	Small impact to potential habitat	Small impact to potential habitat	Small impact to potential habitat	Small impact to potential habitat
Sage thrasher (*Oreoscoptes montanus*)	Small impact to potential habitat	Small impact to potential habitat	Small impact to potential habitat	Small impact to potential habitat
Greater sage-grouse (*Centrocercus urophasianus*)	Small impact to nesting and winter habitat	Small impact to winter habitat	Small impact to nesting and winter habitat	Small impact to winter habitat
Pygmy rabbit (*Brachylagus idahoensis*)	Small impact to habitat	Small impact to habitat	Small impact to habitat	Small impact to habitat
Bat species (see Table 3-53)	No impact	No impact	No impact	No impact
Dark kangaroo mouse (*Microdipodops megacephalus*)	Small, short-term impact to habitat	Small, short-term impact to habitat	Small, short-term impact to habitat	Small, short-term impact to habitat
Pale kangaroo mouse (*Microdipodops pallidus*)	No impact	No impact	No impact	No impact
State of Nevada game species				
Mule deer	Small impact from minor losses of habitat and crucial winter habitat	Small impact from losses of habitat and crucial winter habitat	Small impact from minor losses of habitat and crucial winter habitat	Small impact from minor losses of habitat and crucial winter habitat
Desert bighorn sheep	Small impact from yearlong unoccupied habitat loss	Small impact from yearlong unoccupied habitat loss	Small impact from yearlong unoccupied habitat loss	Small impact from yearlong unoccupied habitat loss
Pronghorn antelope	Small impact from yearlong habitat loss	Small impact from yearlong habitat loss	Small impact from yearlong habitat loss	Small impact from yearlong habitat loss
Wild horses and burros	Small impact from loss of winter range	Small impact from loss of winter range	Small impact from loss of winter range	Small impact from loss of winter range

a. To convert acres to square kilometers, multiply by 0.0040469.
b. Total includes wetlands, seeps, streams, and riparian areas combined.

None of the proposed Garden Valley alternative segments would pass through water-related or riparian land-cover types.

Wildlife There are three ***wildlife guzzlers*** within the study area: Scofield #3 and two guzzlers, both named Garden Valley (see Figure 3-95). Scofield #3 guzzler is 7.6 kilometers (4.7 miles) north of Garden

Valley alternative segment 3. The first Garden Valley guzzler is 1.8 kilometers (1.1 miles) south of Garden Valley alternative segment 8. The second is approximately 2 kilometers (1.2 miles) south of Garden Valley alternative segment 8. Because of the distances between the guzzlers and the rail alignment, DOE would expect no impacts to these wildlife guzzlers from construction of the rail line.

Special Status Species

Threatened and Endangered Species: There are no threatened, endangered, proposed, or candidate species within the study area of the Garden Valley alternative segments.

BLM- and State of Nevada-Designated Sensitive/Protected Species: There is potential habitat for the sage thrasher and Brewer's sparrows along the Garden Valley alternative segments. One sage thrasher was sighted during the 2005 field surveys. Construction of any of the Garden Valley alternative segments would result in the loss of Great Basin Xeric Mixed Sagebrush Shrubland and Inter-Mountain Basins Big Sagebrush Shrubland (see Table 4-71), which is considered suitable Brewer's sparrow and sage thrasher habitat. Comparatively, the overall impact would be small because within the affected mapping zones there are 7,600 square kilometers (1.8 million acres) of Great Basin Xeric Mixed Sagebrush Shrubland and 10,000 square kilometers (2.5 million acres) of Inter-Mountain Basins Big Sagebrush Shrubland (see Table 3-46).

There would be a small impact to the greater sage-grouse as a result of Garden Valley alternative segments 1 and 3 because Garden Valley alternative segment 3 would pass through nesting habitat and Garden Valley 1 would run adjacent to nesting habitat. All Garden Valley alternative segments would pass through potential winter habitat for the sage-grouse (see Figure 3-100). Construction of any of the Garden Valley alternative segments would result in a small loss of suitable greater sage-grouse habitat.

DOE surveyed the area on May 13, 2005, for signs of recent use or individual birds, but there was no evidence that sage grouse still occupy the area even though suitable habitat was present at the time. Therefore, there would be no impacts on sage-grouse breeding and nesting areas during the operations phase in the Garden Valley area, unless sage-grouse were to occupy this area in the future.

The pygmy rabbit is known to occur in the vicinity of the Garden Valley alternative segments 1, 2, 3, and 8. Potential impacts would be small and long term due to loss of habitat and possible avoidance of the area.

State of Nevada Game Species There is BLM Ely Proposed Resource Management Plan-designated habitat and crucial winter habitat for mule deer, yearlong unoccupied habitat for bighorn sheep, and yearlong antelope habitat along the Garden Valley alternative segments (see Section 3.2.7.3.5 and Figures 3-101 to 3-103) that would be affected by the Proposed Action. The potential loss of habitat would result in a small impact based on the amount of loss in context with the quantity of available habitat types.

Wild Horses and Burros The Garden Valley alternative segments would cross a small portion of the Seaman Herd Management Area. The potential loss of forage from construction of any one of the four Garden Valley alternative segments would result in a small impact.

4.2.7.2.2.6 Caliente Common Segment 2 (Quinn Canyon Range Area), Rail Line Construction. Table 4-79 summarizes the potential direct impacts to biological resources from construction of a rail line along Caliente common segment 2.

Table 4-79. Summary of potential impacts on biological resources from rail line construction along Caliente common segment 2.

Resource/impact type	Extent of impact
Wildlife	
Loss of vegetation or land-cover type (long term)	277 acres[a]
Construction-related disturbance to habitat (short term)	3,410 acres
Loss of riparian and water-related habitats (long term)[b]	0
Construction-related disturbance to riparian habitats (short term)[b]	0
Wildlife water resources	No impact
Special status species	
Threatened and endangered species	No species or habitat occurrence
BLM- and State of Nevada-designated sensitive/protected species	
Loggerhead shrike (*Lanius ludovicianus*)	Small impact to habitat
Western burrowing owl (*Athenes cunicularia*)	Small impact to habitat
Ferruginous hawk (*Buteo regalis*)	Small impact to potential habitat
Brewer's sparrow (*Spizella breweri*)	Small impact to habitat
Sage thrasher (*Oreoscoptes montanus*)	Small impact to habitat
Greater sage-grouse (*Centrocercus urophasianus*)	Small impact to habitat
Pygmy rabbit (*Brachylagus idahoensis*)	Small impact to habitat
Bat species (see Table 3-53)	Small impact to habitat
Dark kangaroo mouse (*Microdipodops megacephalus*)	Small impact to habitat
Pale kangaroo mouse (*Microdipodops pallidus*)	Small impact to habitat
State of Nevada game species impacts	
Mule deer and pronghorn antelope	Small impact from loss of a minimal amount of habitat for mule deer and antelope yearlong habitat
Wild horses and burros	Small impact to winter and summer foraging

a. To convert acres to square kilometers, multiply by 0.0040469.
b. Total includes wetlands, seeps, streams, and riparian areas combined.

Vegetation Caliente common segment 2 would pass through Great Basin Juniper Woodland, which is relatively common on the lower mountain slopes in the area, and likely provides roosting and nesting habitat for some raptors such as the ferruginous hawk. Common segment 2 would have a long-term impact on 0.25 square kilometer (62 acres) of Inter-Mountain Basins Big Sagebrush Shrubland and on less than 0.01 square kilometer (about 0.33 acres) of Great Basin Xeric Mixed Sagebrush Shrubland. These land-cover types are relatively common in the area and provide habitat for various unique and sagebrush community-obligate species. In addition, common segment 2 would create a long-term impact on 0.85 square kilometer (210 acres) of Inter-Mountain Basins Mixed Salt Desert Scrub. Caliente common segment 2 would not pass through any water-related or riparian land-cover types.

Special Status Species

Threatened and Endangered Species: There are no threatened, endangered, proposed, or candidate terrestrial or aquatic species within the study area of Caliente common segment 2.

BLM- and State of Nevada-Designated Sensitive/Protected Species: Table 4-79 lists potential direct impacts to designated sensitive and protected species.

<u>State of Nevada Game Species</u> The Ely Proposed Resource Management Plan has designated yearlong habitat for pronghorn antelope and a minimal amount of mule deer habitat along common segment 2 (see Section 3.2.7.3.5). The potential loss of forage would result in a small impact.

<u>Wild Horses and Burros</u> Seasonal wild horse movements in the area suggest that construction of the easternmost portion of Caliente common segment 2 would result in a small loss of spring and summer forage and construction of the western portions of the common segment would result in a small loss of winter forage. Construction activities along this segment could result in a small, short-term impact to seasonal wild horse movement as it is likely that some horses would move from the Quinn Canyon Range (summer) to lower elevations near the proposed rail line in winter.

4.2.7.2.2.7 South Reveille Alternative Segments, Rail Line Construction. Table 4-80 summarizes potential impacts to biological resources from construction of a rail line along the South Reveille alternative segments.

<u>Vegetation</u> The South Reveille alternative segments would pass through several land-cover types that represent sagebrush vegetation communities, including Inter-Mountain Basins Big Sagebrush Shrubland and Great Basin Xeric Mixed Sagebrush Shrubland. These land-cover types are relatively common in the area and may provide habitat for various unique and sagebrush community-obligate species.

The South Reveille alternative segments would not impact any water-related or riparian land-cover types.

<u>Special Status Species</u> There are no threatened, endangered, proposed, or candidate species or habitat for such species along the South Reveille alternative segments. Table 4-80 lists potential impacts to other special status species.

<u>State of Nevada Game Species</u> There is Ely Proposed Resource Management Plan-designated yearlong pronghorn antelope habitat along the South Reveille alternative segments (see Section 3.2.7.3.5). There would be small, long-term impacts due to loss of potential forage and possible antelope avoidance of the area during construction activities.

<u>Wild Horses and Burros</u> South Reveille alternative segments 1 and 2 would skirt a northeastern corner of the Nellis Herd Management Area. There would be short-term impacts from the loss of forage at the southern end of the Reveille Valley. Impacts to wild horses and burros would be similar for each alternative segment.

4.2.7.2.2.8 South Reveille Alternative Segments, Quarry Construction. DOE has identified two potential quarry sites, NN-9A and NN-9B, along the south Reveille alternative segments.

Table 4-81 summarizes potential impacts to biological resources from construction of the South Reveille quarry sites.

<u>Vegetation</u> There are several land-cover types that provide habitat for unique or obligate wildlife species within the potential South Reveille quarry sites. Potential quarry site NN-9B would create a long-term impact to 0.07 square kilometer (16 acres) of Inter-Mountain Basins Big Sagebrush Shrubland and 0.21 square kilometer (51 acres) of Great Basin Xeric Mixed Sagebrush Shrubland, which are relatively common in the area and provide habitat for various sagebrush community-obligate species. In addition, 0.46 square kilometer (114 acres) of Inter-Mountain Basins Mixed Salt Desert Scrub, which provides habitat for various wildlife species, would be affected long term. Construction of potential quarry NN-9A would cause a long-term impact to 0.13 square kilometer (31 acres) of Great Basin Xeric Mixed Sagebrush Shrubland, 0.35 square kilometer (86 acres) of Inter-Mountain Basins Big Sagebrush

Table 4-80. Summary of potential impacts on biological resources from rail line construction along the South Reveille alternative segments.

Resource/impact type	Extent of impact, South Reveille 2	Extent of impact, South Reveille 3
Wildlife		
Loss of vegetation or land-cover type (long term)	157 acres[a]	160 acres
Construction-related disturbance to habitat (short term)	1,260 acres	1,390 acres
Loss of riparian and water-related habitats (long term)[b]	0	0
Construction-related disturbance to riparian habitats (short term)[b]	0	0
Wildlife water resources	No impact	No impact
Special status species		
Threatened and endangered species	No species or habitat occurrence	
BLM- and State of Nevada-designated sensitive/protected species		
Loggerhead shrike (*Lanius ludovicianus*)	Small impact	Small impact
Western burrowing owl (*Athenes cunicularia*)	Small impact	Small impact
Brewer's sparrow (*Spizella breweri*)	No impact	No impact
Sage thrasher (*Oreoscoptes montanus*)	No impact	No impact
Bashful beardtongue (*Penstemon pudicus*)	No impact	No impact
Dark kangaroo mouse (*Microdipodops megacephalus*)	Small impact	Small impact
Pale kangaroo mouse (*Microdipodops pallidus*)	Small impact	Small impact
Bat species (see Table 3-53)	No impact	No impact
State of Nevada game species		
Pronghorn antelope	Small impact to yearlong habitat	Small impact to yearlong habitat
Wild horses and burros	Small impact to winter and summer foraging	Small impact to winter and summer foraging

a. To convert acres to square kilometers, multiply by 0.0040469.
b. Total includes wetlands, seeps, streams, and riparian areas combined.

Shrubland, 0.74 square kilometer (184 acres) of Inter-Mountain Basins Mixed Salt Desert Scrub, and a small percentage of other land-cover types.

There are no water-related or riparian land-cover types in the study area for potential quarry sites NN-9A and NN-9B.

Wildlife Rock outcrops and talus slopes within the footprints of the potential South Reveille quarry sites provide perching and nest sites for raptors and reptiles. During the January 2006 field visit, the biologist observed an unoccupied raptor nest site on a ridge within the quarry NN-9A footprint. The biologist observed signs of raptors on the vertical rock face and collections of small mammal remains (bones) on the ridge. DOE would avoid construction activity during the nesting season to minimize the impact to raptors utilizing this nest site.

Special Status Species There are no threatened, endangered, proposed, or candidate species or habitat for such species in the study area for the potential quarries in Reveille Valley. Table 4-81 lists potential impacts to BLM- and State of Nevada-designated sensitive/protected species.

Table 4-81. Summary of potential impacts on biological resources from construction of the potential South Reveille quarries.

Resource/impact type	Extent of impact, quarry NN-9A	Extent of impact, quarry NN-9B
Wildlife		
Loss of vegetation or land-cover type (long term)	346 acres[a]	193 acres
Construction-related disturbance to habitat (short term)	148 acres	127 acres
Loss of riparian and water-related habitats (long term)[b]	0	0
Construction-related disturbance to riparian habitats (short term)[b]	0	0
Wildlife water resources	No impact	No impact
Raptor nesting site	Small to moderate impact	Small impact
Special status species		
Threatened and endangered species and habit	No species or habitat occurrence	No species or habitat occurrence
BLM- and State of Nevada-designated sensitive/protected species		
Loggerhead shrike (*Lanius ludovicianus*)	Small impact to habitat	Small impact to habitat
Western burrowing owl (*Athenes cunicularia*)	Small impact to habitat	Small impact to habitat
Brewer's sparrow (*Spizella breweri*)	Small impact to habitat	Small impact to habitat
Sage thrasher (*Oreoscoptes montanus*)	Small impact to habitat	Small impact to habitat
Bashful beardtongue (*Penstemon pudicus*)	No impact	No impact
Dark kangaroo mouse (*Microdipodops megacephalus*)	Small impact to habitat	Small impact to habitat
Pale kangaroo mouse (*Microdipodops pallidus*)	Small impact to habitat	Small impact to habitat
Bat species (see Table 3-53)	No impact	No impact
State of Nevada game species		
Pronghorn antelope	Small impact to yearlong habitat	Small impact to yearlong habitat
Wild horses and burros	Small impact from loss of forage	Small impact from loss of forage

a. To convert cares to square kilometers, multiply by 0.0040469.
b. Total includes wetlands, seeps, streams, and riparian areas combined.

State of Nevada Game Species The Ely Proposed Resource Management Plan designated yearlong pronghorn antelope habitat within the footprints of both potential South Reveille quarries. A potential small impact would result from the construction of either quarry due to a small loss of habitat and possible displacement.

Wild Horses and Burros There would be a potential small adverse impact to wild horses and burros in the Nellis Herd Management Area from construction of either quarry due to a small loss of forage.

4.2.7.2.2.9 Caliente Common Segment 3 (Stone Cabin Valley Area), Rail Line Construction. Table 4-82 summarizes potential direct impacts to biological resources (threatened and endangered species, special status species, State of Nevada big game, and wild horses and burros) from rail line construction along the Caliente common segment 3.

Table 4-82. Summary of potential impacts to biological resources from rail line construction along Caliente common segment 3.

Resource/impact type	Extent of impact
Wildlife	
Loss of vegetation or land-cover type (long term)	616 acres[a]
Construction-related disturbance to habitat (short term)	7,410 acres
Loss of riparian and water-related habitats (long term)[b]	0
Construction-related disturbance to riparian habitats (short term)[b]	0
Wildlife water resources	No impact
Potential impacts to special status species	
Threatened and endangered species and habitat	
Railroad Valley springfish (*Crenichthys nevadae*)	No impact
BLM- and State of Nevada-designated sensitive/protected species	
Tonopah fishhook cactus (*Sclerocactus nyensis*)	Small impact to habitat
Eastwood milkweed (*Asclepias eastwoodiana*)	Small impact to habitat
Williams combleaf (*Ployctenium williamsidae*)	No impact
Nevada dune beardtongue (*Penstemon arenarius*)	Small impact to habitat
Bashful beardtongue (*Penstemon pudicus*)	No impact
Loggerhead shrike (*Lanius ludovicianus*)	Small impact to habitat
Western burrowing owl (*Athenes cunicularia*)	Small impact to habitat
Brewer's sparrow (*Spizella breweri*)	Small impact to habitat
Sage thrasher (*Oreoscoptes montanus*)	Small impact to habitat
Greater sage-grouse (*Centrocercus urophasianus*)	Small impact to habitat
Dark kangaroo mouse (*Microdipodops megacephalus*)	No impact
Pale kangaroo mouse (*Microdipodops pallidus*)	No impact
State of Nevada game species	
Mule deer	Small impact to habitat
Pronghorn antelope	Small impact to yearlong habitat
Wild horses and burros	Small impact to foraging habitat and water access

a. To convert acres to square kilometers, multiply by 0.0040469.
b. Total includes wetlands, seeps, streams, and riparian combined.

Vegetation Caliente common segment 3 would pass through several land-cover types that provide habitat for unique or obligate wildlife communities. Some of these land-cover types include sagebrush vegetation communities, such as Inter-Mountain Basins Big Sagebrush Shrubland and Great Basin Xeric Mixed Sagebrush Shrubland, which are relatively common in the area and provide habitat for various sagebrush community-obligate species. However, common segment 3 would primarily impact Inter-Mountain Basins Mixed Salt Desert Scrub, which provides habitat for other wildlife species.

Special Status Species

Threatened and Endangered Species: The Railroad Valley springfish was previously introduced into Warm Springs near Warm Springs Summit. Surveys in 1994 indicate this species no longer occurs in this area. Therefore, there would be no impact to the Railroad Valley springfish from rail line construction along Caliente common segment 3.

BLM- and State of Nevada-Designated Sensitive/Protected Species: The Tonopah fishhook cactus has been documented along Caliente common segment 3, but no individuals were observed during field surveys in May 2005. Rail line construction along common segment 3 would result in a small impact to suitable fishhook cactus habitat.

Eastwood milkweed is known to occur near Caliente common segment 3. The closest known occurrence of this species is 8.4 kilometers (5.2 miles) from common segment 3. Rail line construction along common segment 3 could result in a loss of suitable habitat for this species. However, this would result in a small impact to the Eastwood milkweed population because of the small amount of potential habitat that would be disturbed.

Williams combleaf is known to occur 10 kilometers (6 miles) south of common segment 3, but it is highly unlikely that rail line construction would have an impact on this species. The Nevada dune beardtongue has been identified near common segment 3. The closest known occurrence of this species is 1.1 kilometers (0.7 mile) from common segment 3. Rail line construction could result in loss of habitat and of individual plants. However, this would result in a small impact to Nevada dune beardtongue because of the small amount of potential habitat that would be disturbed.

Bashful beardtongue has been documented near Caliente common segment 3. The closest known occurrence of this species is 8.6 kilometers (5.34 miles) from common segment 3. This species has a narrow distribution and is known from only five sites within the Kawich Range. Because of its limited distribution and range there would be no impact to this species from rail line construction along common segment 3.

State of Nevada Game Species There is BLM-designated mule deer and yearlong pronghorn antelope habitat along common segment 3. Potential impacts from loss of vegetation for forage and habitat needs would be small.

Wild Horses and Burros Caliente common segment 3 would pass through the Reveille, Stone Canyon, and Saulsbury Herd Management Areas (see Section 3.2.7.3.6). The segment would pass through an area of winter range for wild horses and could result in small adverse impacts to seasonal wild horse migrations as animals move from the Kawich Range in the summer to the Reveille Valley in the winter. A proposed construction camp in this area could result in a small adverse impact on water availability because there is a major source of water at the Reveille Mill (more than 6.4 kilometers [4 miles] away) and wild horses would potentially exhibit avoidance behavior if workers visit this area. Potential short-term, small impacts in the Reveille Herd Management Area could affect up to 129 wild horses.

4.2.7.2.2.10 Common Segment 3 (Stone Cabin Valley Area), Facilities Construction. DOE would construct the Maintenance-of-Way Trackside Facility along Caliente common segment 3. Potential direct impacts to biological resources would be similar to the impacts described in Section 4.2.7.2.2.9 and would be small, if any. Table 4-72 lists potential impacts to land-cover types from construction of these facilities along Caliente common segment 3.

Horse populations in this area have recognized unique genetic characteristics. In addition, the Stone Cabin Herd Management Area is of particular historic significance (see Appendix H). Construction of the Maintenance-of-Way Trackside Facility would likely result in a small impact to foraging and herd distribution in the northern portion of Stone Cabin Valley.

4.2.7.2.2.11 Goldfield Alternative Segments, Rail Line Construction. Table 4-83 summarizes potential impacts to biological resources from construction of a rail line along the Goldfield alternative segments.

Table 4-83. Summary of potential impacts to biological resources from rail line construction along the Goldfield alternative segments.

Resource/impact type	Extent of impact, Goldfield 1	Extent of impact, Goldfield 3	Extent of impact, Goldfield 4
Wildlife			
Loss of vegetation or land-cover type (long term)	485 acres[a]	541 acres	460 acres
Construction-related disturbance to habitat (short term)	3,077 acres	3,380 acres	3,530 acres
Loss of riparian and water-related habitats (long term)[b]	0	0	0
Construction-related disturbance to riparian habitats (short term)[b]	0	0	0
Wildlife water resources	Small impact (avoidance)	Small impact (avoidance)	Small impact (avoidance)
Potential impacts to special status species			
Threatened and endangered species and habitat	No species or habitat occurrence	No species or habitat occurrence	No species or habitat occurrence
BLM- and State of Nevada-designated sensitive/ protected species			
Eastwood milkweed (*Asclepias eastwoodiana*)	Small impact to potential habitat	Small impact to potential habitat	Small impact to habitat and species
Loggerhead shrike (*Lanius ludovicianus*)	Small impact to potential habitat	Small impact to potential habitat	Small impact to potential habitat
Western burrowing owl (*Athenes cunicularia*)	Small impact to potential habitat	Small impact to potential habitat	Small impact to potential habitat
Bat species (see Table 3-53)	Small impact to potential habitat	Small impact to potential habitat	Small impact to potential habitat
Dark kangaroo mouse (*Microdipodops megacephalus*)	Small impact to potential habitat	Small impact to potential habitat	Small impact to potential habitat
Pale kangaroo mouse (*Microdipodops pallidus*)	Small impact to potential habitat	Small impact to potential habitat	Small impact to potential habitat
State of Nevada game species			
Mule deer	Small impact to habitat	Small to moderate impact to habitat	No impact to habitat
Pronghorn antelope	Small impact to yearlong habitat	Small impact to yearlong habitat	Small impact to yearlong habitat
Wild horses and burros	Small impact to habitat	Small impact to habitat	Small impact to habitat

a. To convert acres to square kilometers, multiply by 0.0040469.
b. Total includes wetlands, seeps, streams, and riparian areas combined.

Vegetation The Goldfield alternative segments would pass through several land-cover types that provide habitat for unique or obligate wildlife species. Some of these land-cover types include sagebrush vegetation communities, including Inter-Mountain Basins Big Sagebrush Shrubland, Great Basin Xeric Mixed Sagebrush Shrubland, and Inter-Mountain Basins Montane Sagebrush Steppe, which are relatively common in the area and could provide habitat for various sagebrush community-obligate species. Rail line construction along any of the Goldfield alternative segments would not impact riparian or water-related vegetation.

Willow and Cole Springs are close to (less than 1 kilometer to 3 kilometers [less than 1 mile to 1.8 miles] west) Goldfield alternative segment 3. There could be impacts to wildlife species active only during the day because they would likely avoid water sources close to construction activities. Wildlife species active at night when there were no construction activities would likely not avoid the water sources. During the summer, when large animals need daily access to water, inability to access those resources during rail line construction activities could result in small adverse impacts.

There would be no impacts to riparian or water-related habitat from rail line construction along the Goldfield alternative segments.

Special Status Species Eastwood milkweed is known to occur near the Goldfield alternative segments south of where they would join common segment 3. The closest known occurrence of this species is 140 meters (460 feet) west of Goldfield alternative segment 3, near Mud Lake. Construction of any of the Goldfield alternative segments could lead to habitat loss and the loss of individual plants. These impacts would be small.

State of Nevada Game Species There is BLM-designated mule deer habitat along Goldfield alternative segments 1 and 3 and yearlong pronghorn antelope habitat along all three Goldfield alternative segments (see Section 3.2.7.3.5). Potential impacts would be the same as those described in Section 4.2.7.2.1.4.

Wild Horses and Burros The Goldfield alternative segments would pass through the Goldfield Herd Management Area. Small potential adverse impacts to burros would include loss of foraging vegetation and some disruption from construction-related activities.

Rail line construction along the Goldfield alternative segments could affect up to six horses and 20 burros, likely in the area around the beginning of the segments at the end of Caliente common segment 4. Goldfield alternative segment 4 would also pass through the Montezuma Peak Herd Management Area, which would result in a small loss of forage vegetation. Goldfield alternative segment 4 could impact up to 18 horses and 20 burros.

4.2.7.2.2.12 Goldfield Alternative Segments, Quarry Construction. DOE has identified three potential quarry sites in the Goldfield area, NS-3A, NS-3B, and ES-7. Quarries NS-3A and NS-3B would be along Goldfield alternative segment 3. Quarry ES-7 would be along Goldfield alternative segment 4.

Table 4-84 summarizes potential direct impacts to biological resources (threatened and endangered species, special status species, State of Nevada big game, and wild horses and burros) from construction of the potential quarries near Goldfield.

Vegetation Several land-cover types that provide habitat for unique or obligate wildlife species are present within potential quarry sites NS-3A, NS-3B, and ES-7. All three quarry footprints contain land-cover types that include sagebrush vegetation communities, including Inter-Mountain Basins Big Sagebrush Shrubland and Great Basin Xeric Mixed Sagebrush Shrubland, which are relatively common in the area and could provide habitat for various sagebrush community-obligate species. Potential quarry ES-7 would impact a more sagebrush community than NS-3A or NS-3B. Construction of the potential Goldfield quarries would not impact any riparian or water-related vegetation.

Table 4-84. Summary of potential impacts to biological resources from construction of the Goldfield quarry sites.

Resource/impact type	Extent of impact, quarry NS-3A	Extent of impact, quarry NS-3B	Extent of impact, quarry ES-7
Wildlife			
Loss of vegetation or land-cover type (long term)	683 acres[a]	273 acres	278 acres
Construction-related disturbance to habitat (short term)	246 acres	95 acres	78.3 acres
Loss of riparian and water-related habitats (long term)[b]	0	0	0
Construction-related disturbance to riparian habitats (short term)[b]	0	0	0
Wildlife water resources	No impact	No impact	No impact
Special status species			
Threatened and endangered species and habitat	No species or habitat occurrence	No species or habitat occurrence	No species or habitat occurrence
BLM- and State of Nevada-designated sensitive/protected species			
Eastwood milkweed (*Asclepias eastwoodiana*)	Small impact to potential habitat	Small impact to potential habitat	Small impact to potential habitat
Loggerhead shrike (*Lanius ludovicianus*)	Small impact to potential habitat	Small impact to potential habitat	Small impact to potential habitat
Western burrowing owl (*Athenes cunicularia*)	Small impact to potential habitat	Small impact to potential habitat	Small impact to potential habitat
Bat species (see Table 3-53)	Small impact to potential habitat	Small impact to potential habitat	Small impact to potential habitat
Dark kangaroo mouse (*Microdipodops megacephalus*)	Small impact to potential habitat	Small impact to potential habitat	Small impact to potential habitat
Pale kangaroo mouse (*Microdipodops pallidus*)	Small impact to potential habitat	Small impact to potential habitat	Small impact to potential habitat
State of Nevada game species			
Mule deer	No impact to habitat	Small impact to habitat	No impact to habitat
Pronghorn antelope	No impact to yearlong habitat	No impact to yearlong habitat	No impact to yearlong habitat
Wild horses and burros	Small impact from loss of forage	Small impact from loss of forage	Small impact from loss of forage

a. To convert acres to square kilometers, multiply by 0.0040469.
b. Total includes wetlands, seeps, streams, and riparian areas combined.

Special Status Species There could be impacts to bat species from constructing the proposed Goldfield quarries, which would include the disturbance or alteration of mineshafts, caves, talus slopes with cracks, crevices, and cliff faces during cut and fill or quarry operations. Potential impacts to bat habitats from construction activities would be small.

State of Nevada Game Species There is BLM-designated mule deer and yearlong pronghorn antelope habitat within the study area of the potential Goldfield quarry sites. Impacts would be none or small and due to a loss of forage and habitat (Figures 3-102 and 3-103).

Wild Horses and Burros Potential quarries NS-3A and NS-3B would be within the Goldfield Herd Management Area. Quarry ES-7 would be within the Montezuma Peak Herd Management Area. Potential impacts to burros from quarries NS-3A and NS-3B would be a small, short-term loss of vegetation for forage and some minor disturbance from construction activities. There would be no impact to wild horses from quarries NS-3A and NS-3B because the Goldfield Herd Management Area does not support wild horses. Potential impacts to wild horses and burros from construction activities at quarry ES-7 would be a small, short-term loss of vegetation for forage and some minor disturbance from construction activities. Construction of potential quarry ES-7 could affect 18 horses and 20 burros.

4.2.7.2.2.13 Caliente Common Segment 4 (Stonewall Flat Area), Rail Line Construction. Table 4-85 summarizes potential direct impacts to biological resources from rail line construction along Caliente common segment 4.

Vegetation Caliente common segment 4 would pass through a land-cover type that provides habitat for unique or obligate wildlife species. It would pass primarily through Inter-Mountain Basins Mixed Salt Desert Scrub, creating a long-term impact to 0.25 square kilometer (62 acres) of this land-cover type. It would pass through a small portion of Inter-Mountain Basins Big Sagebrush Shrubland, which is relatively common in the area and could provide habitat for various sagebrush community-obligate species.

Rail line construction along Caliente common segment 4 would not impact any riparian or water-related vegetation.

Special Status Species There are no threatened, endangered, proposed, or candidate species or habitat for such species along Caliente common segment 4. Table 4-85 lists potential direct impacts to BLM- and State of Nevada-designated sensitive and protected species.

Table 4-85. Summary of potential impacts on biological resources from rail line construction along Caliente common segment 4.

Resource/impact type	Extent of impact
Wildlife	
Loss of vegetation or land-cover type (long term)	64.8 acres[a]
Construction-related disturbance to habitat (short term)	801 acres
Loss of riparian and water-related habitats (long term)[b]	0
Construction-related disturbance to riparian habitats (short term)[b]	0
Wildlife water resources	No impact
Special status species	
Threatened and endangered species and habitat	No species or habitat occurrence
BLM- and State of Nevada-designated sensitive/protected species	
Loggerhead shrike (*Lanius ludovicianus*)	Small impact to potential habitat
Western burrowing owl (*Athenes cunicularia*)	Small impact to potential habitat
Bat species (see Table 3-53)	Small impact to potential habitat
State of Nevada game species	
Mule deer	No impact to BLM-designated habitat
Pronghorn antelope	Small impact to designated yearlong habitat
Desert bighorn sheep	No impact to BLM-designated habitat
Wild horses and burros	Small impact from loss of forage

a. To convert acres to square kilometers, multiply by 0.0040469.
b. Total includes wetlands, seeps, streams, and riparian areas combined.

State of Nevada Game Species Common segment 4 would pass near designated desert bighorn sheep yearlong occupied habitat, mule deer habitat, and antelope yearlong habitat. It is possible that these game species would pass through the area of the rail line, which along common segment 4 would be adjacent to an existing transportation corridor (U.S. Highway 95). Although it is likely that game species use this area during migration, there are no designated game ***movement corridors*** along or near common segment 4. Thus, impacts to game species would be small and short term, primarily from avoidance of the area during construction activities.

Wild Horses and Burros Caliente common segment 4 would pass through the Stonewall Herd Management Area. The potential impact to burros is a small loss of vegetation for foraging. Burro population estimates indicate that as many as 34 resident burros could be affected.

4.2.7.2.2.14 Bonnie Claire Alternative Segments, Rail Line Construction. Table 4-86 summarizes potential direct impacts to biological resources from rail line construction along the Bonnie Claire alternative segments.

Table 4-86. Summary of potential impacts to biological resources from rail line construction along the Bonnie Claire alternative segments.

Resource/impact type	Extent of impact, Bonnie Claire 2	Extent of impact, Bonnie Claire 3
Wildlife		
Loss of vegetation or land-cover type (long term)	125 acres[a]	120.7 acres
Construction-related disturbance to habitat (short term)	1,400 acres	1,380 acres
Loss of riparian and water-related habitats (long term)[b]	0	0
Construction-related disturbance to riparian habitats (short term)[b]	0	0
Wildlife water resources	No impact	No impact
Special status species		
Threatened and endangered species and habitat	No species or habitat occurrence	No species or habitat occurrence
BLM- and State of Nevada-designated sensitive/protected species		
Loggerhead shrike (*Lanius ludovicianus*)	Small impact to potential habitat	Small impact to potential habitat
Western burrowing owl (*Athenes cunicularia*)	Small impact to potential habitat	Small impact to potential habitat
Bat species (see Table 3-53)	Small impact to potential habitat	Small impact to potential habitat
State of Nevada game species		
Desert bighorn sheep	Small impact to yearlong occupied habitat	Small impact to yearlong occupied habitat
Wild horses and burros	Small impact from loss of forage	Small impact from loss of forage

a. To convert acres to square kilometers, multiply by 0.0040469.
b. Total includes wetlands, seeps, streams, and riparian areas combined.

Vegetation The area of the Bonnie Claire alternative segments represents a transition in vegetative communities. Sagebrush communities occur less frequently as the rail alignment progresses south to southeast into the Mojave mapping zone. The Bonnie Claire alternative segments would pass through only a small portion of Inter-Mountain Basins Big Sagebrush Shrubland and would pass through primarily Inter-Mountain Basins Mixed Salt Desert Scrub, Mojave Mid-Elevation Mixed Desert Scrub, and Sonora-Mojave Creosotebush-White Bursage Desert Scrub (see Section 3.2.7 and Table 4-71). Rail line construction along the Bonnie Claire alternative segments would not impact any riparian or water-related vegetation.

Special Status Species As summarized in Table 4-86, there would be small impacts to BLM- and State of Nevada-designated sensitive and protected species from rail line construction along the Bonnie Claire alternative segments.

State of Nevada Game Species As summarized in Table 4-86, there would be small potential impacts to bighorn sheep yearlong occupied habitat along the Bonnie Claire alternative segments as designated by the BLM (Figure 3-101).

Wild Horses and Burros The Bonnie Claire alternative segments would pass through the Stonewall Herd Management Area. Potential impacts to the herd management area and the wild horses and burros would be a small loss of vegetation for foraging.

4.2.7.2.2.15 Common Segment 5 (Sarcobatus Flat Area), Rail Line Construction.

Table 4-87 summarizes potential direct impacts to biological resources from rail line construction along common segment 5.

Vegetation As discussed in Section 3.2.7 and shown in Table 4-70, common segment 5 would pass through a small area of Great Basin Pinyon-Juniper Woodland, which would be temporarily affected during rail line construction activities. This land-cover type is relatively common on the lower mountain slopes in the area and likely provides roosting and nesting habitat for some raptors.

Construction of common segment 5 would primarily affect Sonora-Mojave Mixed Salt Desert Scrub and Sonora-Mojave Creosotebush-White Bursage Desert Scrub. The potential impacts on these land-cover types would be small because the amount of vegetation loss associated with rail line construction along common segment 5 would be small in relation to the amount of these land-cover types within the mapping zone. Common segment 5 would affect a small portion of Inter-Mountain Basins Big Sagebrush Shrubland, which provides habitat for various sagebrush community-obligate species.

Rail line construction along common segment 5 would not impact any riparian or water-related vegetation.

Special Status Species As summarized in Table 4-87, there would be small impacts to BLM- and State of Nevada-designated sensitive and protected species from rail line construction along common segment 5. Habitat for the burrowing owl and loggerhead shrike are present along common segment 5 and are discussed in Section 4.2.7.2.1, Environmental Impacts Common to the Entire Caliente Rail Alignment. Some isolated sand dunes provide habitat for the Nevada dune beardtongue (*Penstemon arenarius*). Rail line construction would create a small impact to the habitat. Occasional stands of pinyon juniper provide habitat for the ferruginous hawk (*Buteo regalis*). Impacts to this species would be small and short term.

Habitat for the Oasis Valley speckled dace is confined to streams in southern Nye County. Impacts to potential habitat for this species would be small and short term due to the proposed construction of a bridge across Oasis Valley that would temporarily increase turbidity in the stream. After construction, the impact would be minimal.

Table 4-87. Summary of potential impacts to biological resources from rail line construction along common segment 5.

Resource/impact type	Extent of impact
Wildlife	
Loss of vegetation or land-cover type (long term)	201.4 acres[a]
Construction-related disturbance to habitat (short term)	2,750 acres
Loss of riparian and water-related habitats (long term)[b]	0
Construction-related disturbance to riparian habitats (short term)[b]	0
Wildlife water resources	No impact
Special status species	
Threatened and endangered species and habitat	No species or habitat occurrence
BLM- and State of Nevada-designated sensitive/protected species	
Loggerhead shrike (*Lanius ludovicianus*)	Small impact to potential habitat
Western burrowing owl (*Athenes cunicularia*)	Small impact to potential habitat
Ferruginous hawk (*Buteo regalis*)	Small impact to potential habitat
Bat species (see Table 3-53)	Small impact to potential habitat
Nevada dune beardtongue (*Penstemon arenarius*)	Small impact to potential habitat
Oasis Valley speckled dace (*Rhinichthys osculus* ssp. 6)	Small impact to potential habitat
State of Nevada game species	
Pronghorn antelope	Small, short-term impact from avoidance during construction activities
Desert bighorn sheep	Small, short-term impact from avoidance during construction activities and small loss of BLM yearlong occupied habitat
Mule deer	Small, short-term impact from avoidance during construction activities
Wild horses and burros	Small impact to potential habitat

a. To convert acres to square kilometers, multiply by 0.0040469.
b. Total includes wetlands, seeps, streams, and riparian areas combined.

State of Nevada Game Species There is designated pronghorn antelope yearlong habitat to the north of the rail alignment in the Gold Flat area (see Figure 3-103). Potential impacts, if any, to antelope as a result of rail line construction along common segment 5 would be small. Common segment 5 would pass near desert bighorn sheep and mule deer yearlong habitat. It is possible that desert bighorn sheep and mule deer would pass through the area of the rail line, which along common segment 5 would be adjacent to an existing transportation corridor (U.S. Highway 95). Although it is likely that desert bighorn sheep and mule deer use this area during migration, there are no designated game movement corridors along or near common segment 5. Thus, impacts to these species would be small and short term, primarily from avoidance of the area during construction activities.

Wild Horses and Burros Common segment 5 would not pass through any wild horse and burro herd management areas. However, burro activity in the region is likely based on local utilization patterns. Potential impacts to wild horses and burros would be limited to the areas through which the segment passes.

4.2.7.2.2.16 Oasis Valley Alternative Segments, Rail Line Construction. Table 4-88 summarizes potential direct impacts to biological resources from rail line construction along the Oasis Valley alternative segments.

Table 4-88. Summary of potential impacts on biological resources from rail line construction along the Oasis Valley alternative segments.

Resource/impact type	Extent of impact, Oasis Valley 1	Extent of impact, Oasis Valley 3
Wildlife		
Loss of vegetation or land-cover type (long term)	75.6 acres[a]	107.4 acres
Construction-related disturbance to habitat (short term)	648 acres	976 acres
Loss of riparian and water-related habitats (long term)[b]	0	0
Construction-related disturbance to riparian habitats (short term)[b]	0	4.67 acres
Wildlife water resources	No impact	No impact
Special status species		
Threatened and endangered species and habitat	No species or habitat occurrence	No species or habitat occurrence
Southwestern willow flycatcher	No impact	No impact
BLM- and State of Nevada-designated sensitive/protected species		
Black woollypod (*Astragalus funereus*)	Small impact to species and potential habitat	Small impact to species and potential habitat
Loggerhead shrike (*Lanius ludovicianus*)	Small impact to potential habitat	Small impact to potential habitat
Western burrowing owl (*Athenes cunicularia*)	Small impact to potential habitat	Small impact to potential habitat
Oasis Valley speckled dace (*Rhinichthys osculus* spp. [unnamed])	No impact	No impact
Oasis Valley pyrg (*Pyrgulopsis micrococcus*)	No impact	No impact
Amargosa toad (*Bufo nelsoni*)	No impact	No impact
Bat species (see Table 3-53)	Small impact to potential habitat	Small impact to potential habitat
State of Nevada game species		
Mule deer	No impact to designated habitat	Small impact to designated habitat
Desert bighorn sheep	Small impact	Small impact
Wild horses and burros	Small impact from loss of forage	Small impact from loss of forage

a. To convert acres to square kilometers, multiply by 0.0040469.
b. Total includes wetlands, seeps, streams, and riparian areas combined.

Vegetation There is water-related and riparian habitat present within the study area of the Oasis Valley alternative segments. Oasis Valley alternative segments 1 and 3 would cross the Thirsty Canyon/Oasis Valley Wash area. Oasis Valley alternative segment 3 would run within 0.7 kilometer (0.4 mile) of Colson Pond and across the Amargosa River drainage (see Section 3.2.5.3.11).

The Amargosa River receives ephemeral flows during high precipitation events; it does not carry water most of the year. There would be no impacts to Colson Pond and engineering design would include appropriate structures (a culvert and bridge) to reduce impacts to the Amargosa River drainage. Within the Oasis Valley alternative segment 3 construction right-of-way, construction activities would temporarily impact 0.02 square kilometer (4.67 acres) of the North American Warm Desert Lower Montane Riparian Woodland and Shrubland land-cover type.

Potential impacts would be short term from rail line construction along Oasis Valley alternative segment 3, which would only cross this land-cover type. Given the small amount of this land-cover type within the mapping zone and its high value for wildlife, the impacts on riparian and water-related vegetation would be moderate, but short term. However, DOE would use drainage structures and best management practices to minimize erosion, runoff, and the subsequent impacts to riparian vegetation along the Oasis Valley alternative segments.

Special Status Species The black woollypod, a BLM-designated sensitive plant species, is known to occur along the Beatty Wash section of common segment 6. The closest known occurrence of this species is 0.3 kilometer (0.2 mile) from common segment 6. Construction of the Oasis Valley alternative segments could result in small impacts due to loss of suitable habitat and possible individual plants present during construction. However, black woollypod appears to adapt well to disturbed areas; thus, anticipated impacts to this species habitat and population would be small from rail line construction along the Oasis Valley alternative segments.

The Oasis Valley speckled dace occurs in the Amargosa River drainage and Fleur de Lis Spring near the towns of Springdale and Beatty, less than 1.6 kilometers (1 mile) southwest from Oasis Valley alternative segment 1. This subspecies has a very limited range and is only known from this watershed in Oasis Valley. Specific distribution of this fish varies with available water. Because of the distance of this habitat from construction activities, there would be no impacts to the Oasis Valley speckled dace during rail line construction.

The Oasis Valley pyrg is an ***endemic*** snail of the springs found in Oasis Valley. This species has not been documented closer than 4 kilometers (2.5 miles) from the rail alignment and suitable habitat for this species would not occur within the construction right-of-way. Therefore, rail line construction would not impact this species.

The Amargosa toad occurs along the Amargosa River drainage and has been recorded in Oasis Valley, 1.4 kilometers (0.84 mile) from Oasis Valley alternative segment 1 and 1.9 kilometers (1.2 miles) from Oasis Valley alternative segment 3. Typical habitat for this species is near open water, such as springs, seeps and ponds, and the riparian vegetation generally associated with wet areas. In these instances, the presence of moist soil might be sufficient for suitable habitat. There are no open waters that would be within the construction right-of-way, and all seeps and springs within Oasis Valley and Thirsty Canyon would be outside and downgradient of the construction right-of-way. Therefore, it is unlikely that the Amargosa toad would occur within the construction right-of-way, resulting in no impacts to the Amargosa toad.

No water-related or riparian habitat would be impacted along this segment. No impacts to the southwestern willow flycatcher in the Oasis Valley are anticipated.

State of Nevada Game Species The Oasis Valley alternative segments would pass within mule deer habitat (see Figure 3-102) and would be near designated desert bighorn sheep yearlong occupied habitat (see Figure 3-101). Oasis Valley supports riparian vegetation and ephemeral flows that are highly valuable as a potential water source and for forage. Colson Pond, which also provides a potential water source for these species, is 0.7 kilometer (0.4 mile) from Oasis Valley alternative segment 3. However, impacts from rail line construction along the Oasis Valley alternative segments would be small and short term.

Wild Horses and Burros The Oasis Valley alternative segments would pass through northern portions of the Bullfrog Herd Management Area. Potential impacts to the herd management area and the wild horses and burros would be small losses of vegetation for foraging and grazing.

4.2.7.2.2.17 Common Segment 6 (Yucca Mountain Approach), Rail Line Construction. Table 4-89 summarizes potential direct impacts to biological resources (vegetation, threatened and endangered species, special status species, State of Nevada big game, and wild horses and burros) from rail line construction along common segment 6.

Table 4-89. Summary of potential impacts on biological resources from rail line construction along common segment 6.

Resource/impact type	Extent of impact
Wildlife	
Loss of vegetation or land-cover type (long term)	402.4 acres[a]
Construction-related disturbance to habitat (short term)	3,270 acres
Loss of riparian and water-related habitats (long term)[b]	0
Construction-related disturbance to riparian habitats (short term)[b]	0
Wildlife water resources	No impact
Special status species	
Threatened and endangered species and habitat	
Desert tortoise (*Gopherus agassizii*)	Small impact to species and habitat
BLM- and State of Nevada-designated sensitive/protected species	
Black woollypod (*Astragalus funereus*)	Small impact to species and habitat
Rock purpusia (*Ivesia arizonica* var. *saxosa*)	No impact
Loggerhead shrike (*Lanius ludovicianus*)	Small impact to habitat
Western burrowing owl (*Athenes cunicularia*)	Small impact to habitat
Oasis Valley speckled dace (*Rhinichthys osculus* spp. [unnamed])	No impact
Oasis Valley pyrg (*Pyrgulopsis micrococcus*)	No impact
Amargosa toad (*Bufo nelsoni*)	No impact
Chuckwalla (*Sauromalus ater*)	Small impact to habitat
Bat species (see Table 3-53)	Small impact to habitat
State of Nevada game species	
Desert bighorn sheep (*Ovis canadensis*)	Moderate, short-term impact to migration corridor
Mule deer	Small impact to designated habitat
Wild horses and burros	Small impact to forage

a. To convert acres to square kilometers, multiply by 0.0040469.
b. Total includes wetlands, seeps, streams, and riparian areas combined.

Vegetation As discussed in Section 3.2.7 and shown in Table 4-70, common segment 6 would pass through mostly Sonora-Mojave Creosotebush-White Bursage Desert Scrub and Mojave Mid-Elevation Mixed Desert Scrub.

Rail line construction along common segment 6 would not impact water-related vegetation.

Special Status Species

Threatened and Endangered Species: The Mojave desert tortoise is a federally listed threatened species and has low-density habitat (the northernmost extent of its range) in the area crossed by common segment 6. Construction of the proposed rail line, well sites, and construction camps along common segment 6 would result in the potential for species fragmentation, potential species loss, and disturbance of desert tortoise habitat along the southwestern section of common segment 6 from Beatty south to Yucca Mountain (see Figure 3-99). The rail line would not cross any areas of U.S. Fish and Wildlife Service-designated critical habitat. Potential direct impacts to desert tortoises during construction activities could include tortoise injury or mortality from being buried in their burrows or being crushed by construction equipment or other vehicles on access roads. Although these losses would cause a small decrease in the number of individual tortoises in the vicinity of the rail line, there would be no long-term impacts to the survival of this species. Indirect impacts would result from the fragmentation of habitat. A total of 5.61 square kilometers (1,387 acres) of desert tortoise habitat would be disturbed by rail line and facilities construction along common segment 6 (see Table 4-90).

Table 4-90. Amount of desert tortoise habitat that would be disturbed during construction of the rail line and facilities along common segment 6.

Source of disturbance	Amount of habitat disturbed (acres)[a]
Rail roadbed and adjacent access roads	1,100
Access road to Beatty Wash bridge and well site 14	10
Access road to well site 15	2
Construction camp 12	25
Access road to construction camp 12	50
Rail Equipment Maintenance Yard	200
Total	1,387

a. To convert acres to square kilometers, multiply by 0.0040469.

BLM- and State of Nevada-Designated Sensitive/Protection Species: The black woollypod, a BLM-designated sensitive plant species, is known to occur along the Beatty Wash portion of common segment 6. The closest known occurrence of this species is 0.3 kilometer (0.2 mile) from common segment 6. Rail line construction along common segment 6 could result in small impacts from the loss of suitable habitat and individual plants. However, black woollypod appears to adapt well to disturbed areas; thus, anticipated impacts to this species' habitat and population would be small. In addition, DOE would implement best management practices (see Chapter 7) to avoid or minimize plant mortality.

Rock purpusia has been documented approximately 13 kilometers (8 miles) from common segment 6. The loss of a small percentage (less than 0.01 square kilometer [about 1 acre]) of the North American Warm Desert Bedrock Cliff and Outcrop land-cover type would be a long-term impact as a result of rail line construction along common segment 6. There would be possible loss of suitable habitat (rock crevices and cliffs); however, there would be no impact on this species.

There is suitable habitat for the Amargosa toad in Oasis Valley west of common segment 6. This common segment would not cross any suitable habitat; thus, impacts to this species would be highly unlikely. However, any potential impact to this species would be limited to the northern portion of common segment 6 where it would connect to the Oasis Valley alternative segments (see Section 4.2.7.2.2.16).

Habitat for the Oasis Valley speckled dace is found in the neighboring Oasis Valley. It is unlikely that speckled dace exist in the area that would be crossed by common segment 6 due to lack of persistent streams or ponds. Therefore, no impacts to speckled dace would occur. The Oasis Valley pyrg requires habitat similar to the speckled dace and no impact is expected for this segment.

Chuckwalla have been documented in the southeastern foothills of Yucca Mountain adjacent to common segment 6. This area represents the chuckwalla's northernmost range in southern Nevada. Construction activities in this area could result in the loss of habitat for this species and possible loss of individuals. This would be a small overall impact to this species.

State of Nevada Game Species Common segment 6 would intersect a designated desert bighorn sheep migratory corridor near Beatty Wash (see Figure 3-101). There is also yearlong occupied desert bighorn sheep habitat southwest of common segment 6. Impacts would be moderate, but mostly short term, due to possible displacement from the designated migratory corridor during construction activities. There is also mule deer habitat along common segment 6 (see Figure 3-102). Impacts to mule deer habitat would be small.

Wild Horses and Burros Common segment 6 would pass through central portions of the Bullfrog Herd Management Area. Impacts to the herd management area and any wild horses and burros in the area would be similar – a small loss of vegetation for grazing. Burro activity south of Beatty Wash and in the Crater Flat area would likely shift temporarily to other locations farther away from the disturbance of human activity. Burro population estimates for this area suggest that 34 burros could be affected. There are no known populations of wild horses along common segment 6.

4.2.7.2.2.18 Common Segment 6 (Yucca Mountain Approach), Facilities Construction. Table 4-91 summarizes potential direct impacts to biological resources (vegetation, threatened and endangered species, special status species, State of Nevada big game, and wild horses and burros) from construction of facilities along common segment 6.

Vegetation The Rail Equipment Maintenance Yard would occupy an area of 0.41 square kilometer (100 acres). There are several different land-cover types in the area, but most of the land cover is Sonora-Mojave Creosotebush-White Bursage Desert Scrub. Construction of the Rail Equipment Maintenance Yard would impact 0.24 square kilometer (60 acres) in the long term and 0.44 square kilometer (108 acres) in the short term.

Special Status Species

Threatened and Endangered Species: Potential impacts to the desert tortoise would be similar to those described in Section 4.2.7.2.2.17. Construction of the Rail Equipment Maintenance Yard would result in a loss of tortoise habitat (see Table 4-90); however, areas of critical habitat would not be affected. The increase in human activity in the area would increase the risk of vehicle collisions with tortoises on access roads. Although these losses would cause a small decrease in the number of individual tortoises in the vicinity of this facility, there would be no impacts to the long-term survival of this species. Therefore, potential impacts to the desert tortoise as a result of the facility would be small.

Potential impacts to special status species would be similar to the impacts described in Section 4.2.7.2.2.17.

Table 4-91. Summary of potential impacts on biological resources from construction of facilities along common segment 6.

Resource/impact type	Extent of impact
Wildlife	
Loss of vegetation or land-cover type (long term)	74.10 acres[a]
Construction-related disturbance to habitat (short term)	151 acres
Loss of riparian and water-related habitats (long term)[b]	0
Construction-related disturbance to riparian habitats (short term)[b]	0
Wildlife water resources	No impact
Special status species	
Threatened and endangered species and habitat	
Desert tortoise (*Gopherus agassizii*)	Small impact to species and habitat
BLM- and State of Nevada-designated sensitive/protected species	
Black woollypod (*Astragalus funereus*)	Small impact to species and potential habitat
Rock purpusia (*Ivesia arizonica* var. *saxosa*)	No impact
Loggerhead shrike (*Lanius ludovicianus*)	Small impact to habitat
Western burrowing owl (*Athenes cunicularia*)	Small impact to habitat
Oasis Valley speckled dace (*Rhinichthys osculus* spp. [unnamed])	No impact
Oasis Valley pyrg (*Pyrgulopsis micrococcus*)	No impact
Amargosa toad (*Bufo nelsoni*)	No impact
Chuckwalla (*Sauromalus ater*)	Small impact to habitat
Bat species (see Table 3-53)	Small impact to habitat
State of Nevada game species	
Desert bighorn sheep (*Ovis canadensis*)	No impact to designated habitat
Mule deer	Small impact to designated habitat
Wild horses and burros	Small impact from loss of forage

a. To convert acres to square kilometers, multiply by 0.0040469.
b. Total includes wetlands, seeps, streams, and riparian areas combined.

State of Nevada Game Species The Rail Equipment Maintenance Yard would be within mule deer habitat (see Figure 3-102). Potential impacts would be similar as those described in Section 4.2.7.2.1.4. Potential impacts would be small due to the infrequent occurrence of mule deer in the area. However, any existing mule deer would likely avoid the area due to increased human activity and noise.

Wild Horses and Burros Potential impacts to wild horses and burros would be similar to the impacts described in Section 4.2.7.2.2.17.

4.2.7.2.3 Operations Impacts Common to the Entire Caliente Rail Alignment

4.2.7.2.3.1 Vegetation. Activities during the operations phase would remain within the operations right-of-way or areas disturbed during the construction phase. Therefore, there would be no additional impacts to land-cover types.

Noxious Weeds and Invasive Species There would be no additional direct habitat disturbances during the operations phase. However, use of the rail line, facilities, and associated access roads would continue to provide a mechanism for dispersal of seeds and rootable fragments of noxious weeds or invasive plant species.

During the operations phase, DOE would implement best management practices (see Chapter 7) and BLM-prescribed and -approved methods to prevent the establishment of noxious weeds or invasive plant species.

4.2.7.2.3.2 Wildlife. During the operations phase, there would be potential direct impacts to wildlife in the form of wildlife collisions with trains. DOE estimates that approximately 17 one-way trains per week would utilize the track during the operations phase. While some individual animals could be lost from collisions with trains, the impact on wildlife communities would be small based on the speed of the trains (25 to 50 miles [40 to 80 kilometers] per hour), extremely good line of sight, and open space along the rail line. Areas with large cuts and fill could trap animals, but there would be very few such areas along the alignment. Because some wildlife species in the area are often more active at night, nighttime collisions with trains would be possible. DOE would expect small impacts to the nocturnal wildlife communities.

Construction of communication towers, bridges, or any other structures that would provide raptors, crows (*Corvus brachyrhynchos*), and ravens (*Corvus corax*) with additional perches would increase predation pressure on local populations of small animals such as reptiles, rodents, and small birds. This could result in a potential negative indirect impact on the small animals, but a positive indirect impact on the predatory species. Some long-term structures, such as bridges, if designed to include bat roosting and hibernation sites, could provide additional habitat and result in positive indirect impacts to bat species.

Throughout the operations phase, noise from trains would disturb wildlife species close to the rail line. However, this disturbance would diminish with distance from the track and over time because some wildlife species would become acclimated to daily disturbances from passing trains. Noise from the trains and the presence of humans at railroad facilities could cause wildlife species to move away from the tracks during the period of disturbance (short-term avoidance) and possibly cause changes in migratory patterns (long-term displacement).

4.2.7.2.3.3 Special Status Species.

Threatened and Endangered Species General impacts to vegetation and wildlife described in Sections 4.2.7.2.3.1 and 4.2.7.2.3.2 also apply to the threatened and endangered species described below.

Railroad operations would not result in the disturbance or removal of suitable habitat for Ute ladies'-tresses. Therefore, there would be no impacts to this species during the operations phase.

Railroad operations would result in potential short-term impacts to southwestern willow flycatchers and western yellow-billed cuckoos in the form of noise from passing trains and human activities. However, these impacts would be small given that there are no recorded occurrences and only marginal suitable migratory habitat for the flycatcher and cuckoo along the Caliente rail alignment. Furthermore, the area of the marginally suitable habitat is near the existing Union Pacific Railroad rail line and existing roads. Thus, these species would likely already be acclimated to such disturbances.

There would be no impacts to the Railroad Valley springfish during the operations phase because habitat for these species is far from the operations right-of-way and would not be disturbed.

Potential impacts to desert tortoises from habitat fragmentation would be small. Although there is no available documentation of tortoise behavior related to rail lines, it is possible that desert tortoises could use culverts installed within washes under the rail line to cross from one side of the rail line to the other.

Utility lines, buildings, or communication towers installed to support railroad operations might provide additional nesting and perching sites for the common raven, a frequent predator of juvenile tortoises. Therefore, the presence of these structures could increase juvenile tortoise mortality.

BLM- and State of Nevada-Designated Sensitive and Protected Species Potential impacts to vegetation and special status plants associated with railroad operations would be from the possible introduction of invasive plant species by trains or maintenance vehicles. Invasive species could take hold in disturbed areas and essentially out-compete native species for resources.

Any active sage-grouse mating and nesting areas close to the Garden Valley alternative segments would be adversely affected by noise and vibration from the daily operations and maintenance activities during the sage-grouse breeding season. This could result in reduced nesting success, especially during the incubation period when birds would be frightened from their nests, exposing the eggs to predation. However, only one historic sage-grouse lek was identified in the construction right-of-way. No active leks were identified. In general, passing trains would initially disturb BLM special status and state-protected wildlife close to the track. However, this disturbance would diminish with distance from the track and over time as animals became acclimated to daily disturbances. Individual animals could occasionally be killed or injured in collisions with trains. Nevertheless, impacts to animals near the rail line would be small because of the infrequency of trains using the rail line.

Facilities operations would create a potential disturbance to BLM special status and state-protected wildlife species due to the presence of humans and associated noise. This could result in short-term avoidance of an area or lead to long-term displacement, depending on the degree of disturbance.

Migratory Birds Impacts to migratory bird species from railroad operations would be limited to potential disturbances from passing trains (noise and vibration), facility operations, and maintenance activities. Impacts such as altered behavior and nest abandonment could occur initially. However, noise and vibration disturbances would diminish with distance from the track and over time birds could become acclimated to daily disturbances.

4.2.7.2.3.4 State of Nevada Game Species. Direct impacts to game species from railroad operations would consist of long-term habitat loss within the footprint of the rail line, access roads, Facilities at the Interface with the Union Pacific Railroad Mainline, the Maintenance-of-Way Headquarters Facility, and the Rail Equipment Maintenance Yard. There would be a long-term impact on game species habitat in areas where DOE would construct the proposed rail line and associated roads and facilities.

Direct impacts to game species in the form of collisions with trains would also occur during railroad operations when there would be increased traffic on the rail line. Again, mortality rates from collisions would not be expected to increase greatly because game animals are fairly agile and would often be able to move out of the way of oncoming trains. While some individual animals could die from collisions with trains, the impact on game communities would be small.

Noise from trains would disturb game species close to the rail line throughout the operations phase; however, this disturbance would diminish with distance from the track and over time as the game species became acclimated to daily disturbances from passing trains. Noise from the trains could cause game species to move away from the tracks and possibly cause changes in migratory patterns before game species became acclimated to the noise.

The rail roadbed itself would represent an attractive nuisance to antelope, because they prefer a vantage point from which to survey the surrounding areas for predators and would utilize the roadbed for this purpose. As noted above, antelope are agile and would usually be able to avoid oncoming trains.

The finished rail line would bisect game habitat and movement corridors. However, the rail line would not be fenced and once the animals became acclimated to its presence, they would be able to move freely across the rail line. Therefore, impacts to game-species movements would be small.

Operation of support facilities would create a potential disturbance to game species due to the presence of humans and associated noise. This could result in short-term avoidance or long-term displacement of game species from the area.

In the rare event of a possible train derailment resulting in the spill of diesel fuel into surrounding vegetation, foraging habitat and sources of drinking water could become contaminated. The likelihood of and the severity of impacts from such spills would be small because DOE would implement best management practices to help prevent such occurrences (see Chapter 7).

4.2.7.2.3.5 Wild Horses and Burros. Direct impacts to wild horses and burros from operation of the rail line along the Caliente rail alignment would consist of long-term habitat loss where the footprints of the rail line and associated maintenance roads would intersect herd management areas.

There would also be potential direct impacts to wild horses and burros in the form of collisions with trains. DOE estimates that approximately 17 one-way trains per week would utilize the track during the operations phase. Again, death rates from collisions would not be expected to be sizeable because wild horses and burros are fairly agile and would usually be able to move out of the way of oncoming trains. While some individual animals could die from collisions with trains, the impact on wild horse and burro communities would be small.

Noise from trains would disturb wild horses and burros close to the rail line throughout the operations phase; however, this disturbance would diminish with distance from the track and over time the wild horses and burros would become acclimated to daily disturbances from passing trains. Noise from the trains could cause wild horses and burros to move away from the tracks and possibly cause changes in migratory patterns.

The rail line would not be fenced and once the horses and burros became acclimated to its presence, they would be able to move freely across the rail line. Therefore, potential impacts to wild horse and burro movements, as discussed in Section 4.2.7.2.1.5, would be small.

4.2.7.3 Impacts under the Shared-Use Option

The Shared-Use Option would require construction of commercial sidings. All such construction would be immediately adjacent to the DOE rail alignment and would have impacts similar to those under the Proposed Action without shared use. The Shared-Use Option would mean an increase in train traffic. Therefore, DOE would expect special status species, State of Nevada game species, and wild horse and burro interactions with train traffic (collisions, change in movement patterns, altered behavior, and nest abandonment) to be slightly higher than those interactions with rail traffic under the Proposed Action without shared use. This slight increase in train traffic would result in small impacts to the wildlife communities.

4.2.7.4 Summary

Table 4-92 summarizes potential impacts to biological resources from constructing and operating the proposed rail line along the Caliente rail alignment.

Impacts to vegetation communities would be small in relation to the abundance of the vegetation communities in the region, with minimal loss of unique or particularly sensitive communities.

There would be impacts to water-related and riparian habitats from construction of the Caliente alternative segment and either of the potential Staging Yard locations (Indian Cove or Upland), the Eccles alternative segment, and the Interchange Yard.

Potential adverse impacts related to noxious and invasive species would include increased risk of these species becoming established in disturbed areas and encroaching on adjacent undisturbed habitat. DOE would implement best management practices (see Chapter 7) and BLM-prescribed and -approved methods to prevent the establishment of noxious weeds or invasive plant species.

Although there could be impacts to wildlife habitats and individual populations as a result of rail line construction, impacts would be small and would not affect the continued existence of any wildlife species.

There would be the potential for impacts to threatened or endangered species during rail line construction. Potential impacts to desert tortoises would be small. There could be localized and minor loss of roosting and foraging habitat for the southwestern willow flycatcher and western yellow-billed cuckoo. However, because these species do not nest along the rail alignment, impacts would be small and limited to transient individuals.

Habitat for several special status species would be disturbed and individuals of several of the species could be disturbed, injured, or killed during the construction and operations phases. Potential impacts to federally listed species would likely require consultation with the U.S. Fish and Wildlife Service in accordance with Section 7 of the Endangered Species Act.

Overall, there would be a loss of conifer habitat and individual conifer trees. Pursuant to BLM protocols DOE would salvage and replant the minimal amounts of cacti and yucca removed during the construction phase; however, there would also likely be some loss of individual cacti and yucca along the proposed rail line.

Overall, potential impacts to migratory birds would be short-term noise disturbances during the construction phase and long-term habitat loss during the operations phase. These impacts would not have an adverse impact on migratory birds.

Although there would be impacts to game habitats and potential impacts to individuals or populations, impacts would be small and would not significantly affect the continued existence of game species.

Although there would be impacts to herd management areas and potential impacts to individuals or wild horse and burro populations, impacts would be small and would not significantly impact the management strategies utilized within the herd management areas. Direct impacts to wildlife and wild horses and burros during the operations phase would consist of wildlife collisions with trains and short-term disruption of activities (such as foraging, nesting, and resting) due to noise from passing trains and from noise and the presence of humans at railroad facilities. Direct impacts could also include potential contamination of forage, prey species, nesting and spawning habitat, and sources of drinking water in the rare event of train derailment and an associated spill of diesel fuel. Indirect impacts could include possible changes to predator/prey interactions due to the presence of communications towers and other structures that would provide new perch habitat for raptors and other predatory birds.

Table 4-92. Summary of potential impacts to biological resources from constructing and operating the railroad along the Caliente rail alignment (page 1 of 9).

	Land cover (acres)[a]		Introduction/ proliferation of noxious/invasive weeds		Loss of riparian and water-related habitats (acres)		Threatened and endangered species		Special status species		Herd management areas/ Nevada game species	
Segment/ facility	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term
Caliente alternative segment	225	87.2	Small	Small	24.3	26.9	Small impact to potential habitat for Ute ladies' tresses	No impact	Small impact to bats, loggerhead shrike, western burrowing owl, ferruginous hawk, southwestern toad, Needle Mountains milkvetch Meadow Valley speckled dace, Meadow Valley Wash desert sucker, Needle Mountains milkvetch, White River Catseye, and southwestern toad	No to small impact on bats, southwestern willow flycatcher, western yellow-billed cuckoo, peregrine falcon, loggerhead shrike, western burrowing owl, ferruginous hawk, and southwestern toad	Small impact to mule deer, Clover Creek Herd Management Area, and Little Mountain Herd Management Area	Small impact to mule deer, Clover Creek Herd Management Area, and Little Mountain Herd Management Area
Caliente Interchange Yard	0.00	9.27	No impact	Small	0.00	1.2	No impact	No impact	No impact	No impact	Small	Small
Caliente-Upland Staging Yard	82.3	32.05	No impact	Small	3.58	0.78	No impact	No impact	No impact	No impact	Small	Small
Caliente-Indian Cove Staging Yard	65	24.8	No impact	Small	22.09	10.87	No impact	No impact	Small impact on ferruginous hawk and southwestern toad	No impact	Small	Small
Caliente quarry CA-8B	84	310.3	No impact	Small	18	6.08	No impact	No impact	Small impact on bats, Meadow Valley Wash desert sucker, Meadow Valley speckled dace, loggerhead shrike, western burrowing owl, and southwestern toad	Small impact on bats, Meadow Valley Wash sucker, Meadow Valley speckled dace, and southwestern toad	Small impact on mule deer, Highland Peak Herd Management Area, and Little Mountain Herd Management Area	Small impact on mule deer, Highland Peak Herd Management Area, and Little Mountain Herd Management Area

Table 4-92. Summary of potential impacts to biological resources from constructing and operating the railroad along the Caliente rail alignment (page 2 of 9).

	Land cover (acres)[a]		Introduction/ proliferation of noxious/invasive weeds		Loss of riparian and water-related habitats (acres)		Threatened and endangered species		Special status species		Herd management area/ Nevada game species	
Segment/ facility	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term
Eccles alternative segment	950.2	144	Small	Small	0.00	0.00	No impact	No impact	Small impact on bats, loggerhead shrike, western burrowing owl, ferruginous hawk, Meadow Valley speckled dace, Meadow Valley Wash desert sucker, southwestern toad, White River catseye, and Needle Mountains milkvetch	Small impact on loggerhead shrike. western burrowing owl, Meadow Valley speckled dace, and Meadow Valley Wash desert sucker	Small impact on mule deer, Clover Creek Herd Management Area, and Little Mountain Herd Management Area	Small impact on mule deer, Clover Creek Herd Management Area, and Little Mountain Herd Management Area
Eccles Interchange Yard	17.8	94.4	No impact	Small	3.1	2.65	No impact	No Impact	No impact	No impact	Small	Small
Eccles North Staging Yard	154	29.4	No impact	Small	0.34	0.00	No impact	No Impact	No impact	No impact	Small	Small
Caliente common segment 1	7,670	867	Small	Small	0.00	0.00	No impact	No impact	Small impact on bats, loggerhead shrike, western burrowing owl, Brewer's sparrow, sage thrasher, Schlesser pincushion, tiehm blazingstar, pygmy rabbit, dark kangaroo mouse, pale kangaroo mouse, and greater sage-grouse	Small impact on bats, loggerhead shrike, western burrowing owl, Brewer's sparrow, sage thrasher, greater sage-grouse, Needle Mountains milkvetch, and Schlesser pincushion	Small impact on desert bighorn sheep, mule deer, elk, pronghorn antelope, Dry Lake Herd Management Area, Highland Peak Herd Management Area, and Seaman Herd Management Area	Small impact on desert bighorn sheep, mule deer, elk, pronghorn antelope, Dry Lake Herd Management Area, Highland Peak Herd Management Area, and Seaman Herd Management Area

Table 4-92. Summary of potential impacts to biological resources from constructing and operating the railroad along the Caliente rail alignment (page 3 of 9).

	Land cover (acres)[a]		Introduction/ proliferation of noxious/invasive weeds		Loss of riparian and water-related habitats (acres)		Threatened and endangered species		Special status species		Herd management areas/ Nevada game species	
Segment/ facility	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term
Garden Valley 1	2,380	274	Small	Small	0.00	0.00	No impact	No impact	Small impact on loggerhead shrike, western burrowing owl, Brewer's sparrow, sage thrasher, dark kangaroo mouse, White River catseye, pygmy rabbit, and greater sage-grouse	Small impact on loggerhead shrike, western burrowing owl, Brewer's sparrow, sage thrasher, and greater sage-grouse	Small impact on mule deer, elk, pronghorn antelope, and Seaman Herd Management Area	Small impact on mule deer, elk, pronghorn, antelope, and Seaman Herd Management Area
Garden Valley 2	2,350	373	Small	Small	0.00	0.00	No impact	No impact	Small impact on loggerhead shrike, western burrowing owl, Brewer's sparrow, sage thrasher, dark kangaroo mouse, White River catseye, pygmy rabbit, and greater sage-grouse	Small impact on loggerhead shrike, western burrowing owl, Brewer's sparrow, sage thrasher, and greater sage-grouse	Small impact on mule deer, elk, pronghorn antelope, and Seaman Herd Management Area	Small impact on mule deer, elk, pronghorn antelope, and Seaman Herd Management Area
Garden Valley 3	2,610	268	Small	Small	0.00	0.00	No impact	No impact	Small impact on loggerhead shrike, western burrowing owl, Brewer's sparrow, sage thrasher, dark kangaroo mouse, White River catseye, pygmy rabbit, and greater sage-grouse	Small impact on dark kangaroo mouse, loggerhead shrike, western burrowing owl, Brewer's sparrow, sage thrasher, and greater sage-grouse	Small impact on mule deer, elk, pronghorn antelope, and Seaman Herd Management Area	Small impact on mule deer, elk, pronghorn antelope, and Seaman Herd Management Area

Table 4-92. Summary of potential impacts to biological resources from constructing and operating the railroad along the Caliente rail alignment (page 4 of 9).

Segment/ facility	Land cover (acres)[a]		Introduction/ proliferation of noxious/invasive weeds		Loss of riparian and water-related habitats (acres)		Threatened and endangered species		Special status species		Herd management areas/ Nevada game species	
	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term
Garden Valley 8	2,260	387	Small	Small	0.00	0.00	No impact	No impact	Small impact on loggerhead shrike, western burrowing owl, Brewer's sparrow, sage thrasher, dark kangaroo mouse, White River catseye, pygmy rabbit, and greater sage-grouse	Small impact on dark kangaroo mouse, loggerhead shrike, western burrowing owl, Brewer's sparrow, sage thrasher, and greater sage-grouse	Small impact on mule deer, elk, pronghorn antelope, and Seaman Herd Management Area	Small impact on mule deer, elk, pronghorn antelope, and Seaman Herd Management Area
Caliente common segment 2	3,410	277	Small	Small	0.00	0.00	No impact	No impact	Small impact on bats, pygmy rabbit, loggerhead shrike, western burrowing owl, ferruginous hawk, dark kangaroo mouse, pale kangaroo mouse, Brewer's sparrow, sage thrasher, and greater sage-grouse	Small impact on bats, pygmy rabbit, loggerhead shrike, western burrowing owl, Brewer's sparrow, sage thrasher, and greater sage-grouse	Small impact on mule deer, elk, and pronghorn antelope	Small impact on mule deer, elk, and pronghorn antelope
South Reveille 2	1,260	157	Small	Small	0.00	0.00	No impact	No impact	Small impact on loggerhead shrike, western burrowing owl, Brewer's sparrow, dark kangaroo mouse, pale kangaroo mouse, and sage thrasher	Small impact on loggerhead shrike, western burrowing owl, Brewer's sparrow, dark kangaroo mouse, pale kangaroo mouse, and sage thrasher	Small impact on pronghorn antelope and Nellis Herd Management Area	Small impact on pronghorn antelope

Table 4-92. Summary of potential impacts to biological resources from constructing and operating the railroad along the Caliente rail alignment (page 5 of 9).

	Land cover (acres)[a]		Introduction/ proliferation of noxious/invasive weeds		Loss of riparian and water-related habitats (acres)		Threatened and endangered species		Special status species		Herd management areas/ Nevada game species	
Segment/ facility	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term
South Reveille 3	1,390	160	Small	Small	0.00	0.00	No impact	No impact	Small impact on loggerhead shrike, western burrowing owl, Brewer's sparrow, dark kangaroo mouse, pale kangaroo mouse, and sage thrasher	Small impact on loggerhead shrike and western burrowing owl	Small impact on pronghorn antelope and Nellis Herd Management Area	Small impact on pronghorn antelope and Nellis Herd Management Area
South Reveille quarry NN-9A	148	346	No impact	Small	0.00	0.00	No impact	No impact	Small impact on loggerhead shrike, western burrowing owl, Brewer's sparrow, dark kangaroo mouse, pale kangaroo mouse, and sage thrasher	Small impact on loggerhead shrike, western burrowing owl, Brewer's sparrow, and sage thrasher	Small impact on pronghorn antelope	Small impact on pronghorn antelope
South Reveille quarry NN-9B	127	193	No impact	Small	0.00	0.00	No impact	No impact	Small impact on loggerhead shrike, western burrowing owl, Brewer's sparrow, dark kangaroo mouse, pale kangaroo mouse, and sage thrasher	Small impact on loggerhead shrike, western burrowing owl, Brewer's sparrow, and sage thrasher	Small impact on pronghorn antelope and Nellis Herd Management Area	Small impact on pronghorn antelope and Nellis Herd Management Area
Caliente common segment 3	7,410	616	Small	Small	0.00	0.00	No impact	No impact	Small impact on loggerhead shrike, western burrowing owl, Brewer's sparrow, sage thrasher, greater sage-grouse, Tonopah fishhook cactus, eastern milkweed, and Nevada Dune beardtongue	Small impact on loggerhead shrike, western burrowing owl, Brewer's sparrow, sage thrasher, and greater sage-grouse	Small impact on mule deer, pronghorn antelope, Reveille Herd Management Area, Stone Canyon Herd Management Area, and Saulsbury Herd Management Area	Small impact on mule deer, pronghorn antelope, Reveille Herd Management Area, Stone Canyon Herd Management Area, and Saulsbury Herd Management Area

Table 4-92. Summary of potential impacts to biological resources from constructing and operating the railroad along the Caliente rail alignment (page 6 of 9).

Segment/ facility	Land cover (acres)[a]		Introduction/ proliferation of noxious/invasive weeds		Loss of riparian and water-related habitats (acres)		Threatened and endangered species		Special status species		Herd management areas/ Nevada game species	
	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term
Maintenance-of-Way Trackside Facility	222	20.3	No impact	Small	0.00	0.00	Small	Small	Small impact on loggerhead shrike, western burrowing owl, Brewer's sparrow, sage thrasher, greater sage-grouse, Tonopah fishhook cactus, eastern milkweed, and Nevada Dune beardtongue	Small impact on loggerhead shrike, western burrowing owl, Brewer's sparrow, sage thrasher, and greater sage-grouse	Small impact on mule deer, pronghorn antelope, Reveille Herd Management Area, Stone Canyon Herd Management Area, and Saulsbury Herd Management Area	Small impact on mule deer, pronghorn antelope, Reveille Herd Management Area, Stone Canyon Herd Management Area, and Saulsbury Herd Management Area
Maintenance-of-Way Headquarters Facility	20.07	0.00	No impact	Small	0.00	0.00	Small	Small	Small impact on loggerhead shrike, western burrowing owl, Brewer's sparrow, sage thrasher, and greater sage-grouse	Small impact on loggerhead shrike, western burrowing owl, Brewer's sparrow, sage thrasher, and greater sage-grouse	Small impact on mule deer, pronghorn antelope, Reveille Herd Management Area, Stone Canyon Herd Management Area, and Saulsbury Herd Management Area	Small impact on mule deer, pronghorn antelope, Reveille Herd Management Area, Stone Canyon Herd Management Area, and Saulsbury Herd Management Area
Goldfield 1	3,078	485	Small	Small	0.00	0.00	No impact	No impact	Small impact on bats, eastwood milkweed, dark kangaroo mouse, pale kangaroo mouse, loggerhead shrike, and western burrowing owl	Small impact on bats, dark kangaroo mouse, pale kangaroo mouse, loggerhead shrike, and western burrowing owl	Small impact on mule deer, pronghorn antelope, and Goldfield Herd Management Area	Small impact on mule deer, pronghorn antelope, and Goldfield Herd Management Area
Goldfield 3	3,380	541	Small	Small	0.00	0.00	No impact	No impact	Small impact on bats, dark kangaroo mouse, pale kangaroo mouse, loggerhead shrike, western burrowing owl, and Eastwood milkweed	No to small impact on bats, dark kangaroo mouse, pale kangaroo mouse, loggerhead shrike and western burrowing owl	Small impact on mule deer, pronghorn antelope, and Goldfield Herd Management Area	Small impact on mule deer, pronghorn antelope, and Goldfield Herd Management Area

Table 4-92. Summary of potential impacts to biological resources from constructing and operating the railroad along the Caliente rail alignment (page 7 of 9).

	Land cover (acres)[a]		Introduction/ proliferation of noxious/invasive weeds		Loss of riparian and water-related habitats (acres)		Threatened and endangered species		Special status species		Herd management areas/ Nevada game species	
Segment/ facility	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term
Goldfield 4	3,530	460	Small	Small	0.00	0.00	No impact	No impact	Small impact on bats, eastwood milkweed, dark kangaroo mouse, pale kangaroo mouse, loggerhead shrike, and western burrowing owl	No to small impact on bats, dark kangaroo mouse, pale kangaroo mouse, loggerhead shrike, and western burrowing owl	Small impact on mule deer, pronghorn antelope, and Goldfield Herd Management Area	Small impact on mule deer, pronghorn antelope, and Goldfield Herd Management Area
Goldfield quarry NS-3A	246	683	No impact	Small	0.00	0.00	No impact	No impact	Small impact on bats, dark kangaroo mouse, pale kangaroo mouse, loggerhead shrike, western burrowing owl, and Eastwood milkweed	Small impact on bats, dark kangaroo mouse, pale kangaroo mouse, loggerhead shrike, and western burrowing owl	Small impact on mule deer, pronghorn antelope, and Goldfield Herd Management Area	Small impact on mule deer, pronghorn antelope, and Goldfield Herd Management Area
Goldfield quarry NS-3B	94.6	273	No impact	Small	0.00	0.00	No impact	No impact	Small impact on bats, dark kangaroo mouse, pale kangaroo mouse, loggerhead shrike, western burrowing owl, and Eastwood milkweed	No to small impact on bats, dark kangaroo mouse, pale kangaroo mouse, loggerhead shrike, and western burrowing owl	Small impact on mule deer, pronghorn antelope, and Goldfield Herd Management Area	Small impact on mule deer, pronghorn antelope, and Goldfield Herd Management Area
Goldfield quarry ES-7	78.3	278	No impact	Small	0.00	0.00	No impact	No impact	Small impact on bats, dark kangaroo mouse, pale kangaroo mouse, loggerhead shrike, western burrowing owl, and Eastwood milkweed	No to small impact on bats, dark kangaroo mouse, pale kangaroo mouse, loggerhead shrike, and western burrowing owl	Small impact on mule deer, pronghorn antelope, and Montezuma Peak Herd Management Area	Small impact on mule deer, pronghorn antelope, and Montezuma Peak Herd Management Area

Table 4-92. Summary of potential impacts to biological resources from constructing and operating the railroad along the Caliente rail alignment (page 8 of 9).

Segment/ facility	Land cover (acres)[a]		Introduction/ proliferation of noxious/invasive weeds		Loss of riparian and water-related habitats (acres)		Threatened and endangered species		Special status species		Herd management areas/ Nevada game species	
	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term
Caliente common segment 4	801.3	64.8	Small	Small	0.00	0.00	No impact	No impact	Small impact on bats, loggerhead shrike, and western burrowing owl	Small impact on bats, loggerhead shrike, and western burrowing owl	Small impact on mule deer, pronghorn antelope, desert bighorn sheep, and Stonewall Herd Management Area	Small impact on mule deer, pronghorn antelope, desert bighorn sheep, and Stonewall Herd Management Area
Bonnie Claire 2	1,400	125	Small	Small	0.00	0.00	No impact	No impact	No to small impact on bats, loggerhead shrike, and western burrowing owl	Small impact on bats, loggerhead shrike, and western burrowing owl	Small impact on mule deer, pronghorn antelope, desert bighorn sheep, and Stonewall Herd Management Area	Small impact on mule deer, pronghorn antelope, desert bighorn sheep, and Stonewall Herd Management Area
Bonnie Claire 3	1,380	121	Small	Small	0.00	0.00	No impact	No impact	Small impact on bats, loggerhead shrike, and western burrowing owl	Small impact on bats, loggerhead shrike, and western burrowing owl	Small impact on mule deer, pronghorn antelope, desert bighorn sheep, and Stonewall Herd Management Area	Small impact on mule deer, pronghorn antelope, desert bighorn sheep, and Stonewall Herd Management Area
Common segment 5	2,750	201.4	Small	Small	0.00	0.00	No impact	No impact	Small impact on bats, loggerhead shrike, western burrowing owl, Oasis Valley speckled dace, ferruginous hawk, and Nevada Dune beardtongue	Small impact on bats, loggerhead shrike, and western burrowing owl	Small impact on pronghorn antelope, desert bighorn sheep, and mule deer	No impact
Oasis Valley 1	648	75.6	Small	Small	0.00	0.00	No impact	No impact	Small impact on bats, loggerhead shrike, black woollypod, and western burrowing owl	No to small impact on bats, loggerhead shrike, and western burrowing owl	Small impact on mule deer, desert bighorn sheep, and Bullfrog Herd Management Area	Small impact on Bullfrog Herd Management Area

Table 4-92. Summary of potential impacts to biological resources from constructing and operating the railroad along the Caliente rail alignment (page 9 of 9).

Segment/ facility	Land cover (acres)[a]		Introduction/ proliferation of noxious/invasive weeds		Loss of riparian and water-related habitats (acres)		Threatened and endangered species		Special status species		Herd management areas/ Nevada game species	
	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term
Oasis Valley 3	976	107.4	Small	Small	4.67	0.00	No impact	No impact	Small impact on bats, loggerhead shrike, black woollypod, and western burrowing owl	No to small impact on bats, loggerhead shrike, and western burrowing owl	Small impact on mule deer, desert bighorn sheep, and Bullfrog Herd Management Area	Small impact on Bullfrog Herd Management Area
Common segment 6	3,270	402.4	Small	Small	0.00	0.00	Small impact on desert tortoise	Small impact on desert tortoise	Small impact on bats, loggerhead shrike, western burrowing owl, chuckwalla, black woolypod, and desert tortoise	Moderate impact on desert bighorn sheep. Small impact on mule deer, bats, loggerhead shrike, western burrowing owl, chuckwalla, and desert tortoise	Moderate impact on desert bighorn sheep. Small impact on mule deer and Bullfrog Herd Management Area	Small impact on Bullfrog Herd Management Area
Rail Equipment Maintenance Yard	150	75.03	No impact	Small	0.00	0.00	Small impact on desert tortoise	Small impact on desert tortoise	Small impact on bats, loggerhead shrike, western burrowing owl, chuckwalla, and black woollypod	Small impact on bats, loggerhead shrike, western burrowing owl, and chuckwalla	Moderate impact on desert bighorn sheep, mule deer, and Bullfrog Herd Management Area	Moderate impact on desert bighorn sheep and Bullfrog Herd Management Area

a. To convert acres to square kilometers, multiply by 0.0040469.

4.2.8 NOISE AND VIBRATION

This section describes potential noise and vibration impacts from constructing and operating a railroad along the Caliente rail alignment. Section 4.2.8.1 describes the methodology DOE used to assess potential impacts; Section 4.2.8.2 describes potential construction impacts; Section 4.2.8.3 describes potential operations impacts; Section 4.2.8.4 describes potential impacts under the Shared-Use Option; Section 4.2.8.5 describes a responsible opposing viewpoint; and Section 4.2.8.6 summarizes potential impacts of constructing and operating a railroad along the Caliente rail alignment.

Section 3.2.8.1 describes the region of influence for the analysis of noise and vibration impacts along the Caliente rail alignment. Appendix I, Noise and Vibration Impact Assessment Methodology, provides more information on the fundamentals of analyzing noise.

4.2.8.1 Impact Assessment Methodology

The approach for analyzing potential noise impacts is based on measurements of current ambient sound levels (see Section 3.2.8.2), noise modeling for future activities (proposed railroad construction and operations), and identification of changes in sound levels that receptors within the region of influence would experience.

To establish a baseline for determining if there would be an increase in noise, DOE measured ***ambient noise*** in the study area at three representative locations along the rail alignment: Caliente, Garden Valley, and Goldfield (see Section 3.2.8.2). DOE chose these locations because they are representative of the few populated areas or Special Recreational Management Areas near the rail alignment. There is already substantial train activity in Caliente; therefore, DOE used a combination of modeling and measurements to determine the difference between existing and potential future (railroad-related) noise levels in that area.

DOE used several criteria to determine the level of potential impacts from noise and vibration along the rail alignment. For noise impacts from construction activities, DOE used U.S. Department of Transportation, Federal Transit Administration, methods (DIRS 177297-Hanson, Towers, and Meister 2006, all), and construction noise guidelines listed in Table 4-93.

Table 4-93. Federal Transit Administration construction noise guidelines.[a,b]

Land use	8-hour L_{eq} (dBA)		30-day average DNL (dBA)
	Day	Night	
Residential	80	70	75[c]
Commercial	85	85	80[d]
Industrial	90	90	85[d]

a. Source: DIRS 177297-Hanson, Towers, and Meister 2006, p. 12-8.
b. dBA = A-weighted decibels; DNL = day-night average noise level; L_{eq} = equivalent sound level.
c. In urban areas with very high ambient noise levels (DNL greater than 65 dBA), DNL from construction projects should not exceed existing ambient +10 dBA.
d. 24-hour L_{eq}, not DNL.

For operation of trains during the construction and operations phases, DOE analyzed noise impacts under established Surface Transportation Board (STB) criteria. The STB has environmental review regulations for noise analysis (49 CFR 1105.7e(6)), with the following criteria:

- An increase in noise exposure as measured by a ***day-night average noise level*** (DNL) of 3 dBA or more
- An increase to a noise level of 65 DNL or greater

If the estimated noise-level increase at a location would exceed either criterion, the STB then estimates the number of affected noise-***sensitive receptors*** (such as schools, libraries, residences, retirement communities, or nursing homes). The two components (3 dBA increase, 65 DNL) of the STB criteria are implemented separately to determine an upper bound of the area of potential noise impact. However, recent noise evaluations indicate that both criteria must be met to cause an adverse noise impact (DIRS 173225-STB 2003, p. 4-82). That is, noise levels would have to be greater than or equal to 65 DNL and increase by 3 dBA or more for an adverse noise impact to occur.

Day-night average noise level (DNL): The energy average of A-weighted decibel (dBA) sound levels over 24 hours; includes an adjustment factor for noise between 10 p.m. and 7 a.m. to account for the greater sensitivity of most people to noise during the night. The effect of nighttime adjustment is that one nighttime event, such as a train passing by between 10 p.m. and 7 a.m., is equivalent to 10 similar events during the daytime.

A-weighted decibels (dBA): A measure of noise level used to compare noise from various sources. A-weighting approximates the frequency response of the human ear.

The approach for analyzing potential vibration impacts is based on estimates of project-generated vibration and measurements of current ambient vibration conditions (see Section 3.2.8). To evaluate potential vibration impacts from construction and operation activities, DOE used Federal Transit Administration building vibration damage and human annoyance criteria. Under these criteria, if vibration levels exceeded 80 VdB (human annoyance criterion for infrequent events) or if the vibration levels (measured as ***peak particle velocity***) exceeded 0.20 inch per second for fragile buildings or 0.12 inch per second for extremely fragile historic buildings, then there could be a vibration impact (DIRS 177297-Hanson, Towers, and Meister 2006, all). Appendix I provides more information on the vibration metrics used in this study.

To establish a baseline for determining if there would be an increase in vibration, DOE measured ambient vibration in the study area at three representative locations: Caliente, Garden Valley, and Goldfield (see Section 3.2.8).

4.2.8.2 Construction Impacts

Noise and vibration levels created by construction equipment vary greatly depending on such factors as the type of equipment, the specific model, the operation being performed, and the condition of the equipment. In addition, the proximity of the equipment to noise- and vibration-sensitive locations, duration of the activity, and time of day will influence the effects of construction noise and vibration. The results of this assessment reflect the ***uncertainty*** about the exact details of construction activities that would be required. However, the analysis assumes extreme combinations of equipment and operations known at this time that conservatively estimate upper-bound construction noise and vibration levels.

4.2.8.2.1 Construction Noise

The Federal Transit Administration construction noise analysis method suggests using the two noisiest pieces of equipment to estimate noise levels at sensitive locations (DIRS 177297-Hanson, Towers, and Meister 2006, p. 12-7). For this analysis, DOE used heavy trucks and bulldozers as the two noisiest pieces of equipment, based on the types of construction equipment that would be needed (DIRS 182825-

Nevada Rail Partners 2007, Appendix B). DOE estimated the effects of pile driving separately because mobile noise sources, such as trucks, would be likely to cross the entire rail alignment, whereas pile driving would only occur at specific locations such as bridges.

DOE developed 8-hour construction noise-level estimates by assuming that a bulldozer (with a noise emission level of 85 dBA at 15 meters [50 feet]) would be at full operation for 8 hours at a given location along an alternative segment or common segment at the approximate minimum distance to the nearest residential receptor anywhere along the proposed rail alignment. Tables 4-94 and 4-95 list estimated construction noise levels for Caliente, Garden Valley, and Goldfield. In addition, based on the construction schedule, the analysis conservatively assumed that 15 bulldozers would be operating simultaneously in the same general area. DOE also assumed that trucks (with a noise emission level of 88 dBA at 15 meters) would be at full power in the same general area for 8 hours per day. Based on the construction schedule, DOE conservatively assumed that 27 trucks would be operating simultaneously in the same general area. These analyses assume that there would be no construction activities during the night.

Table 4-94. Estimated construction noise levels along the Caliente rail alignment (8-hour L_{eq}).[a]

Alternative segment	Approximate distance to nearest receptor (feet)[b]	8-hour bulldozer L_{eq}	8-hour truck L_{eq}	Total 8-hour L_{eq} (dBA)[a]
Caliente	200	85	90	91
Eccles	390	79	84	85
Garden Valley 1	11,000	50	55	56
Garden Valley 2	5,900	55	61	62
Garden Valley 3	23,000	43	49	50
Garden Valley 8	13,000	48	54	55
Goldfield 1	20,000	44	50	51
Goldfield 3	32,000	41	46	47
Goldfield 4	820	72	78	79

a. dBA = A-weighted decibels; L_{eq} = equivalent sound level.
b. To convert feet to meters, multiply by 0.3048.

Table 4-95. Estimated construction noise levels along the Caliente rail alignment (30-day DNL).[a]

Alternative segment	Approximate distance to nearest receptor (feet)[b]	30-day bulldozer DNL	30-day truck DNL	Total 30-day DNL (dBA)
Caliente	200	70	76	77
Eccles	390	64	69	70
Garden Valley 1	11,000	35	40	42
Garden Valley 2	5,900	40	46	47
Garden Valley 3	23,000	28	34	35
Garden Valley 8	13,000	33	39	40
Goldfield 1	20,000	30	35	36
Goldfield 3	32,000	26	31	32
Goldfield 4	820	58	63	64

a. dBA = A-weighted decibels; DNL = day-night average noise level.
b. To convert feet to meters, multiply by 0.3048.

With the exception of the Caliente and Eccles alternative segments, the distances from construction activities to the nearest receptors would be great; therefore, construction noise levels would be below the Federal Transit Administration noise guidelines listed in Table 4-93. However, construction noise levels in the City of Caliente would exceed the Federal Transit Administration daytime residential noise guidelines by 11 dBA; construction noise levels for receptors near the Eccles alternative segment would exceed guidelines by 5 dBA (see Table 4-94).

DOE also evaluated pile-driving noise from construction of bridges that would cross highways, ravines, or bodies of water. For Goldfield alternative segment 4, the closest residential building to pile-driving activity would be approximately 800 meters (2,600 feet). Assuming continuous pile driving for 8 hours per day and continuous use for 30 days (or longer at some locations), the estimated 8-hour equivalent sound level and 30-day DNL would be 67 dBA, which is below the noise guidelines listed in Table 4-93. Along the Caliente alternative segment, the closest residential building to pile-driving activity would be approximately 80 meters (260 feet). Assuming continuous pile driving for 8 hours per day and continuous use for 30 days, the estimated 8-hour equivalent sound level and 30-day DNL would be 87 dBA, which is 12 dBA above the 30-day DNL noise guidelines listed in Table 4-93.

Of the railroad operations support facilities, only the Interchange Yard and the Staging Yard at the Interface with the Union Pacific Railroad Mainline, if it were located in Caliente, would be near receptors. The Staging Yard could be approximately 1,200 meters (3,900 feet) to the north of receptors in Caliente. Equipment similar to that used to construct the rail line would be used to construct these facilities. Because construction activity related to the rail line would be much closer to receptors, that construction noise would dominate over construction noise associated with the Staging Yard. Temporary construction noise associated with the Interchange Yard would be dominated by existing Union Pacific Railroad locomotive horn noise (see Figure 4-14a and 4-14b). Therefore, there would be no adverse noise impacts from construction of associated rail facilities.

4.2.8.2.2 Construction Vibration

DOE based the construction vibration analysis on Federal Transit Administration methods (DIRS 177297-Hanson, Towers, and Meister 2006, all). Construction vibration should be assessed in cases where there is a significant potential for impact from construction activities. Such activities include blasting, pile driving, drilling, or excavation close to ***sensitive structures***.

Based on the proposed construction equipment and Federal Transit Administration vibration data, DOE estimated potential ground-borne vibration levels due to construction activity. Table 4-96 lists estimated vibration levels associated with potential bulldozer activity.

Table 4-96. Estimated construction vibration levels along the Caliente rail alignment.

Alternative segment	Approximate distance to nearest receptor (feet)[a]	Peak particle velocity (inches per second)
Caliente	200	0.0040
Eccles	390	0.0014
Garden Valley 1	11,000	0.000009
Garden Valley 2	5,900	0.000025
Garden Valley 3	23,000	0.000003
Garden Valley 8	13,000	0.000007
Goldfield 1	20,000	0.000004
Goldfield 3	32,000	0.000002
Goldfield 4	820	0.0005

a. To convert feet to meters, multiply by 0.3048.

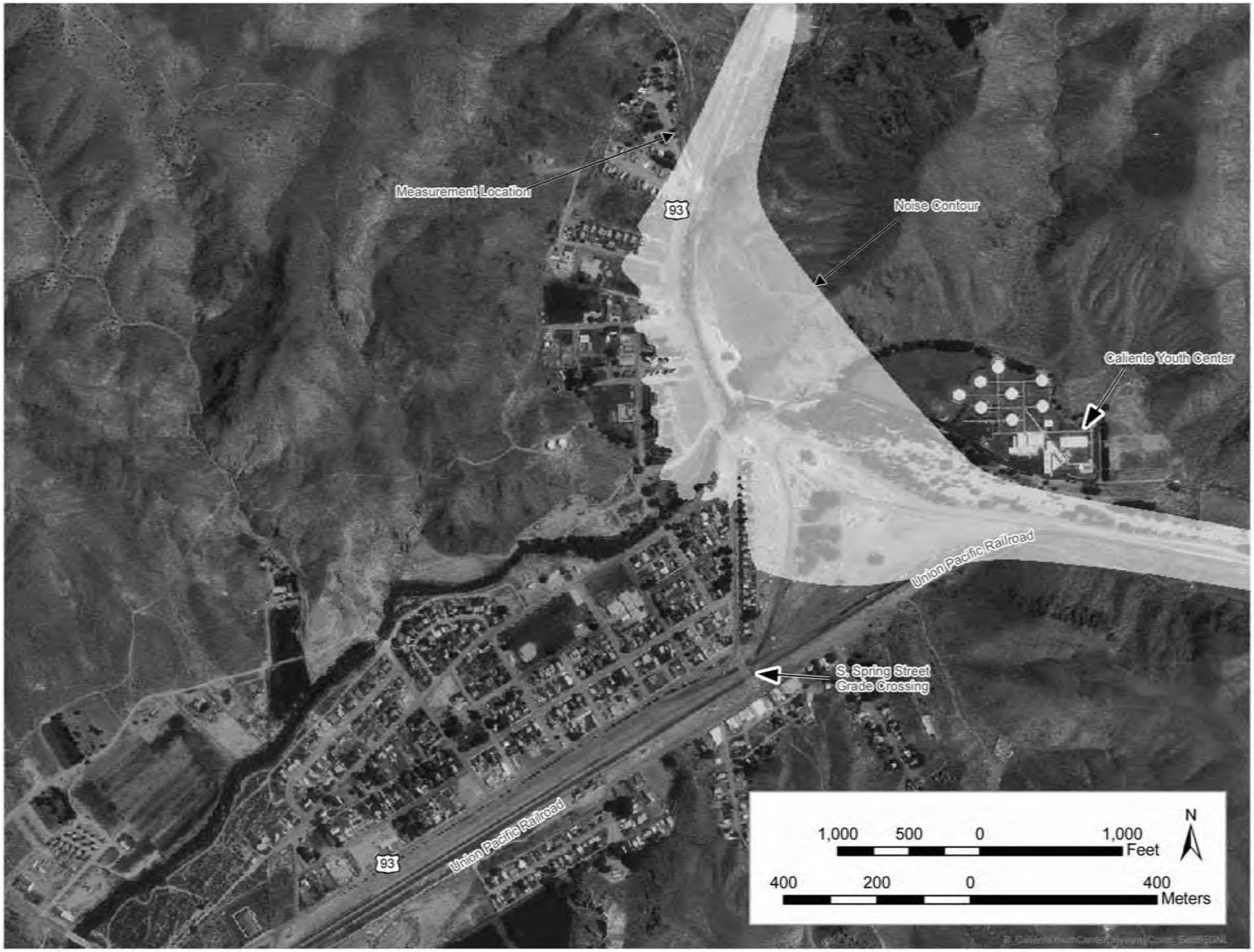


Figure 4-14a. Construction-train 65 DNL contour – easterly traffic flow, Caliente, Nevada.

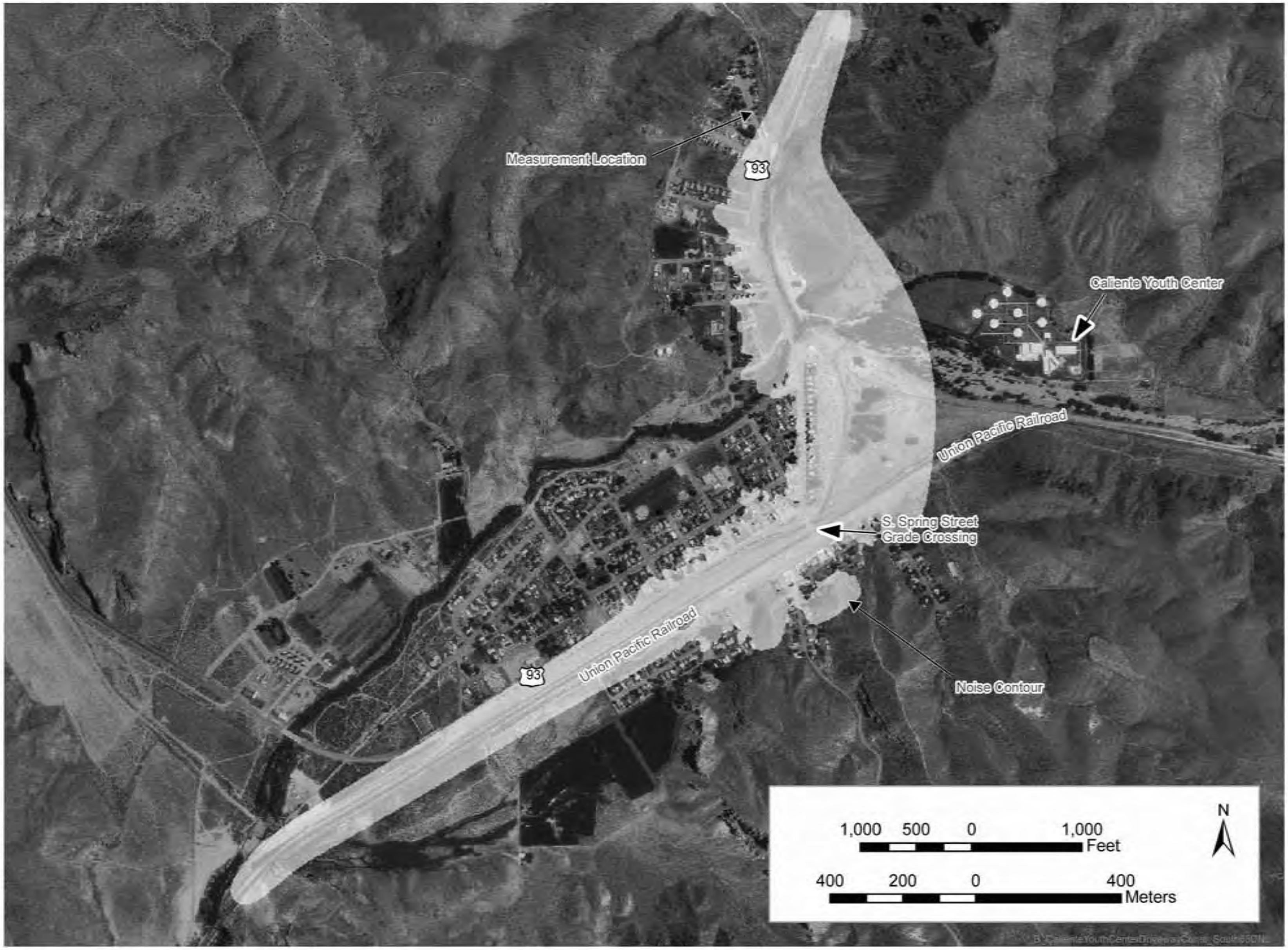


Figure 4-14b. Construction-train 65 DNL contour – southwesterly traffic flow, Caliente, Nevada.

In addition to mobile vibration sources along the rail alignment, DOE evaluated vibration due to pile driving, which would occur at specific locations such as bridges. For the Caliente alternative segment, the closest residential building to pile-driving activity would be approximately 80 meters (260 feet) away, which would result in a peak particle velocity of approximately 0.045 inch per second. For Goldfield alternative segment 4, the nearest residential building to pile-driving activity would be approximately 800 meters (2,600 feet) away, which would result in a peak particle velocity of approximately 0.0014 inch per second. These vibration levels and the vibration levels listed in Table 4-96, are all below Federal Transit Administration building vibration damage criteria (0.20 inch per second for fragile buildings, and 0.12 inch per second for extremely fragile historic buildings). Therefore, DOE would expect no damage to buildings due to vibration during construction. In addition, because of relatively low vibration levels and the temporary nature of construction, human annoyance due to construction vibration would be low.

Blasting operations could be required as part of the excavation process to accommodate the rail roadbed in hilly areas. Uncertainty about the need for and the exact locations of blasting operations is typical at this phase of the proposed project. If blasting were needed and would occur near populated areas, DOE would assess potential blasting noise and vibration and take measures to minimize these temporary impacts, if any.

Of the railroad operations support facilities, only the Interchange Yard and the Staging Yard at the Interface with the Union Pacific Railroad Mainline, if it were located in Caliente, would be near receptors. The Staging Yard could be approximately 1,200 meters (3,900 feet) to the north of receptors in Caliente. Equipment similar to that used to construct the rail line would be used to construct these sites. Because construction activity related to the rail line would be much closer to receptors, that construction vibration would dominate over vibration associated with construction of the Interchange Yard and the Staging Yard; therefore, there would be no adverse vibration impacts from construction of these facilities.

4.2.8.2.3 Construction-Train Noise

As the rail roadbed, track, and bridges were completed, construction trains would be employed to move railroad ties, ballast, and other rail line construction equipment to other construction areas. The amount of construction train activity would vary between Caliente, Garden Valley, and Goldfield. Up to 16 one-way trains per day could pass by certain receptor locations, such as those in Caliente, during a 4-year construction period. If the construction period extended up to 10 years, the same total number of construction trains would operate, but at a lower average number of trains per day. This analysis conservatively uses the higher number of 16 trains per day. As with operations trains, locomotive horn sounding at grade crossings would be the dominant noise source.

Using the equations in Appendix I, Section I.2.1, and analytical methods described in that appendix, DOE generated construction-train noise contours for the three representative areas studied: Caliente, Garden Valley, and Goldfield. Figures 4-14a, 4-14b, 4-15, and 4-16 show 65 DNL noise contours for construction-train activity in these three areas.

There would be 63 receptors within the 65 DNL contour in Caliente. There would be no receptors within the 65 DNL contour in Goldfield or Garden Valley. Approximately 85 receptors would be included within the 3 dBA increase contour in Caliente and approximately 190 receptors would be included within the 3 dBA increase contour in Goldfield. There would be no receptors within the 3 dBA increase contour in Garden Valley.

In Caliente, 34 receptors would experience noise levels of 65 DNL and an increase of 3 dBA. These noise impacts would be adverse but temporary because they would occur during the construction phase.

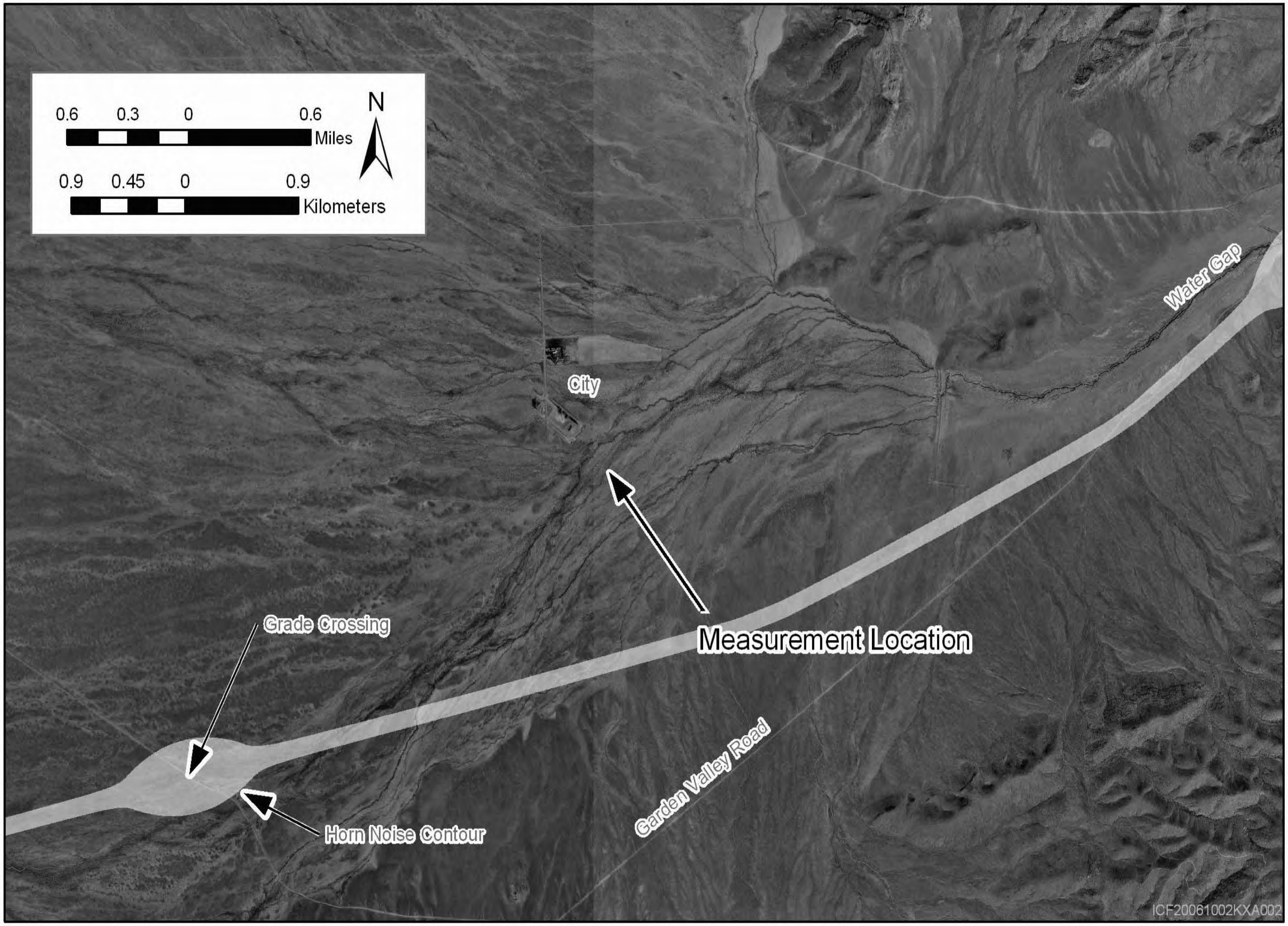


Figure 4-15. Construction-train 65 DNL contour, Garden Valley, Nevada.
(Source: DIRS 174497-Keck Library 2004, filenames 38115A43.sid and 38115A44.sid.)

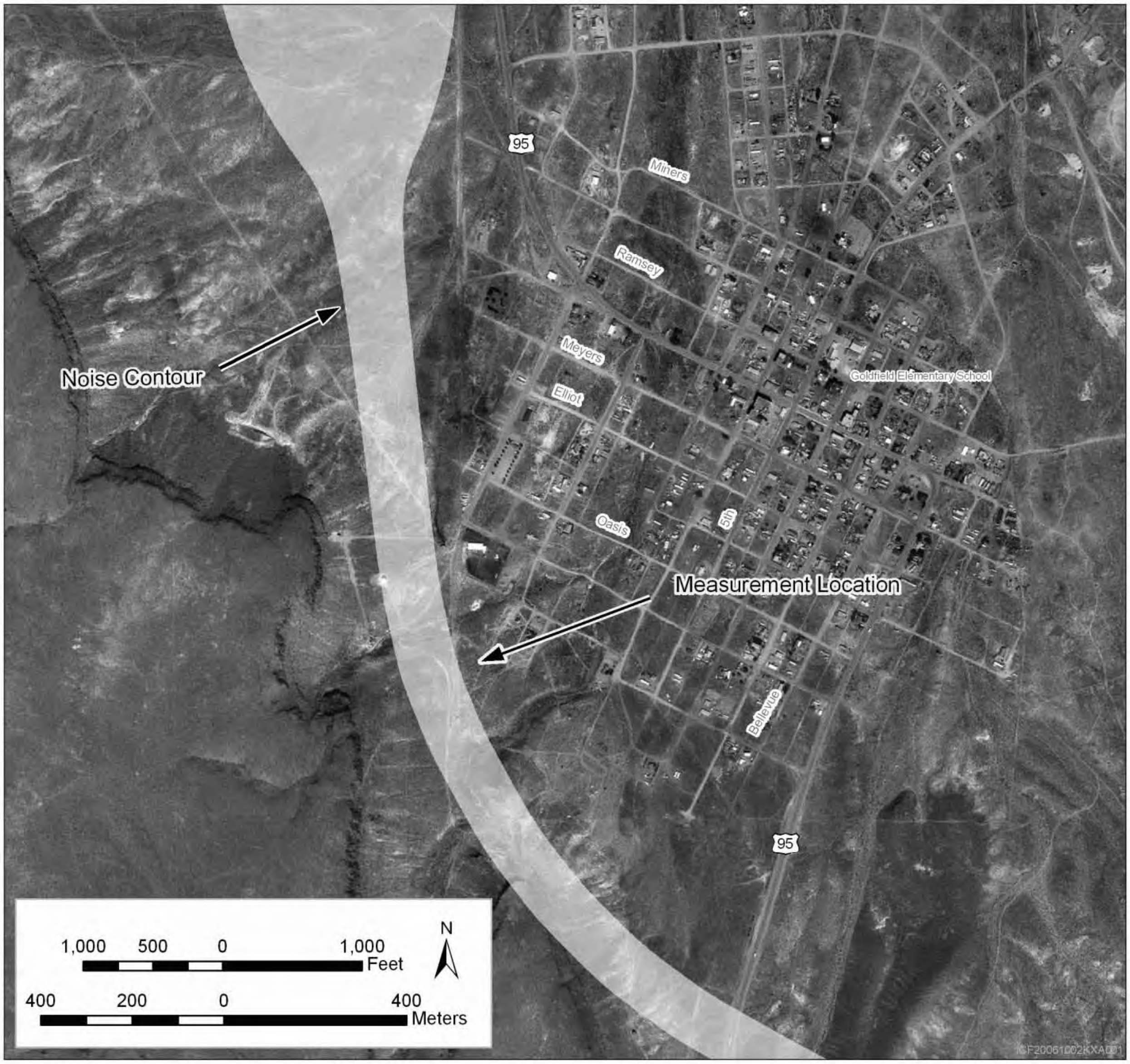


Figure 4-16. Construction-train 65 DNL contour, Goldfield, Nevada.
(Source: DIRS 174497-Keck Library 2004, filename 37114F21.sid.)

4.2.8.2.4 Construction-Train Vibration

Construction trains would travel at lower speeds than operations trains. Because vibration is a function of train speed, construction-train vibration would be lower than operations-train vibration (see Section 4.2.8.3.4). Freight trains operating at 80 kilometers (50 miles) per hour would produce an annoyance-based vibration contour extending approximately 24 meters (80 feet) from the tracks (DIRS 177297-Hanson, Towers, and Meister 2006, p. 10-3). There are no buildings within approximately 24 meters of the Caliente rail alignment, so operations trains would produce no adverse vibration impacts; therefore, there would be no adverse vibration impacts from construction trains.

Construction-train cars carrying ballast could weigh more than operations-train cars; therefore, construction-train cars could produce higher levels of vibration. The locomotive itself would be considered representative of heavier cars. However, typically the locomotive produces the highest vibration level during a train passby, which would determine the maximum passby vibration level. Because operations-train and construction-train locomotives would be similar, the higher-speed operations locomotive would generate the highest level of vibration.

4.2.8.2.5 Quarry-Site Noise

Noise sources associated with potential quarry operations during the construction phase include blasting, rock crushing, heavy-equipment operation, and truck traffic.

Estimated quarry conveyor noise would be approximately 22 dBA at the structure nearest to potential quarry CA-8B northwest of Caliente. While this conveyor noise might be audible at times, it would not constitute an adverse noise impact. There are no receptors in the immediate vicinity of potential quarries NN-9A and NN-9B in South Reveille Valley, or potential quarries NS-3A and NS-3B northeast of Goldfield. Therefore, there would be no noise impacts associated with operation of these quarries during the construction phase.

At potential quarry ES-7 west of Goldfield, there would be blasting and rock-crushing activities at least 1,500 meters (5,000 feet) away from receptors in west Goldfield. While quarry noise would likely be audible in west Goldfield, this distance and the intervening topography, which would act as a barrier to and would attenuate noise, would make it unlikely there would be adverse noise impacts from this quarry.

4.2.8.2.6 Quarry-Site Vibration

Vibration sources associated with operations at potential quarries during the construction phase include blasting, rock crushing, heavy-equipment operation, and truck traffic. Peak overpressures and ground-borne vibration associated with blasting can be an issue in relation to the structural integrity of buildings close to blasting activities.

There are no receptors in the immediate vicinity of potential quarry CA-8B northwest of Caliente, potential quarries NN-9A and NN-9B in South Reveille Valley, or potential quarries NS-3A and NS-3B northeast of Goldfield. Therefore, there would be no vibration impacts associated with operation of these quarries during the construction phase.

At potential quarry ES-7 west of Goldfield, there would be blasting and rock-crushing activities at least 1,500 meters (5,000 feet) away from receptors in Goldfield. Because of this large distance between quarry activities and receptors, it is unlikely that ground-borne vibration would be perceptible at receptor locations; therefore, there would be no adverse vibration impacts.

4.2.8.3 Operations Impacts

The primary sources of noise considered in the analysis for railroad operations were wayside train noise and horn noise. Wayside noise refers collectively to all train-related operations noise adjacent to the operations right-of-way, excluding locomotive warning-horn noise. Wayside noise results from steel train wheels contacting steel rails (wheel-rail noise) and from locomotive exhaust and engine noise.

The amount of noise created by the wheels on the rails would depend on train speed; the amount of engine noise created by the locomotive would depend on the throttle setting. Wheel squeal can sometimes occur on curved sections of track where the radius of curvature of the track is small. There would be horn noise in the vicinity of grade crossings to warn motorists and pedestrians of approaching trains; this noise is assessed separately from wayside noise.

4.2.8.3.1 Wayside Noise

Appendix I describes the methodology DOE used to estimate wayside noise during the operations phase. Wheel-rail noise would vary as a function of speed and could increase by as much as 15 dBA if wheels or rails were in poor condition (DIRS 174623-Kaiser 1998, all). One of the most common causes of additional noise from wheels is the formation of flat surfaces on wheels caused by wheels sliding during hard braking.

The main components of locomotive noise are the exhaust of the diesel engines, cooling fans, general engine noise, and the wheel-rail interaction. Noise associated with the engine exhaust and cooling fans usually dominates; this noise would depend on the throttle setting (most locomotives have eight throttle settings), not on locomotive speed. Tests have shown that locomotive noise levels change by about 2 dBA for each step change in throttle setting, meaning that noise levels increase by about 16 dBA as the locomotive throttle is moved from notch one to notch eight (DIRS 174623-Kaiser 1998, all). Because locomotive engineers constantly adjust throttle settings as necessary, only rough estimates of throttle settings are usually available for noise projections. Numerous field measurements of freight train operations indicate that locomotive noise can be projected with reasonable accuracy by assuming a base condition of throttle position six and adjusting noise levels when better information about typical throttle position is known.

Given the maximum train passby noise level of freight cars and a locomotive under a specific set of reference conditions, the noise models allow estimation of the maximum train passby sound level, the sound exposure level, the DNL, and other noise metrics for varying distances from the track, varying train speeds, and varying schedules.

The spent nuclear fuel and high-level radioactive waste train used to model noise impacts for this analysis would consist of two to three locomotives and four to eight railcars (one to five ***cask cars***, two ***buffer cars***, and one escort car). The average length of the cars would be about 18 to 27 meters (59 to 89 feet), and the length of the locomotives would be 23 meters (75 feet), for a total train length ranging from 118 to 285 meters (390 to 940 feet).

Trains would operate along the rail line at a top speed of 80 kilometers (50 miles) per hour. Because train speed has a direct correlation to noise generated, DOE used the top train speed to conservatively estimate potential noise levels. Table 4-97 lists distances to the wayside 65 DNL noise contour for three locations along the Caliente rail alignment, assuming an average of 2.4 trains per day (based on 17 one-way trips per week). The average of 2.4 trains per day includes ***cask*** trains, maintenance-of-way trains, and repository supply and construction trains.

Table 4-97. Summary of distances to 65 dBA DNL contour at three locations along the Caliente rail alignment.[a]

Area	Speed in miles per hour[b,c]	Distance in feet[d] to 65 dBA DNL contour		Noise-level increase (dBA)
		Wayside	Horn	
Caliente	50	56	250	0 to 6
Garden Valley	50	56	250	0
Goldfield	50	56	250	0 to 10

a dBA = A-weighted decibels; DNL = day-night average noise level.
b. To convert miles per hour to kilometers per hour, multiply by 1.6093.
c Actual speeds would be lower.
d. To convert feet to meters, multiply by 0.3048.

4.2.8.3.2 Horn Noise

The key components in projecting noise exposure from horn noise are the horn sound level, the duration of the horn noise, the distance of the receptor from the tracks, and the number of trains running during daytime and nighttime hours.

For safety reasons, the Federal Railroad Administration requires train engineers to sound horns when approaching most grade crossings unless a Quiet Zone has been established. Horn sounding is generally not required at private crossings. Federal Railroad Administration regulations at 49 CFR 229.129 require all lead locomotives to have an audible warning device that produces a minimum sound level of 96 dBA at a distance of 30 meters (100 feet) in front of the locomotive. In general, locomotive engineers are required to sound the locomotive warning horn at grade crossings in order to warn motorists of a train approaching a crossing. However, communities may apply to the Federal Railroad Administration for a Quiet Zone wherein horns are not sounded as long as certain safety standards are met. Supplementary safety measures, such as four-quadrant gates, and median barriers can be used in accordance with Federal Railroad Administration regulations in order to establish a Quiet Zone.

Most freight train audible warning devices are air horns. The maximum sound level of the air horns can usually be adjusted to some degree by adjusting the air pressure. Maximum sound levels are typically 105 to 110 dBA at 30 meters (100 feet) in front of the trains, well above the 96 dBA value required by the Federal Railroad Administration. Additional noise sources associated with grade crossings would be the grade crossing bells that would start sounding just before the gates were lowered, and idling road traffic that must wait at the crossing. Because train horns create high noise levels, noise exposure would be dominated by horn noise near any grade crossing where sounding horns is required. The analysis assumes that trains would be equally likely to occur at any hour of the day or night. Table 4-97 does not include adjustments for building or terrain shielding. At distances beyond approximately 30 meters, obstructions such as buildings or terrain could act as a partial acoustic shield, causing a noise reduction of approximately 5 to 10 dBA. As one of the final steps in the noise modeling process, DOE included adjustments for building shielding, based on International Organization for Standardization standard number ISO 9613-2 *Acoustics – Attenuation of Sound During Propagation Outdoors – Part 2: General Method of Calculation* (DIRS 176684-ISO 1996, all).

4.2.8.3.3 Railroad Operations Noise Impacts

Table 4-97 lists approximate distances to the wayside for train noise without horns and horn-noise contours from the centerline of the rail alignment in Caliente, Garden Valley, and Goldfield. These distances do not include the effects of building shielding. However, the building shielding effects were accounted for in the noise contours generated through modeling potential noise impacts. Also shown are potential increases in noise in relation to ambient noise conditions, which would vary between and within the three areas where DOE took ambient noise measurements. Ambient noise refers to existing conditions in the region of influence. At present, there is no train activity in Goldfield or Garden Valley, but there is substantial train activity in Caliente.

Figures 4-17a, 4-17b, 4-19, 4-20, and 4-21 show modeled 65 DNL contours in Caliente, Garden Valley, and Goldfield. These figures show that no receptors would be included in the 65 DNL contours in Garden Valley and Goldfield. In Caliente, there would be six receptors within the 65 DNL contour. Figures 4-22 and 4-22a show 3 dBA increase contours for Goldfield and Caliente. For Garden Valley, assuming an ambient noise level of 62 DNL, the 3 dBA increase contour is only slightly larger than the 65 DNL contours shown in Figures 4-19 and 4-20. The 3 dBA increase in the wayside noise contour would extend 26 meters (86 feet) from the tracks and the horn noise contour would extend 120 meters (390 feet) from the tracks.

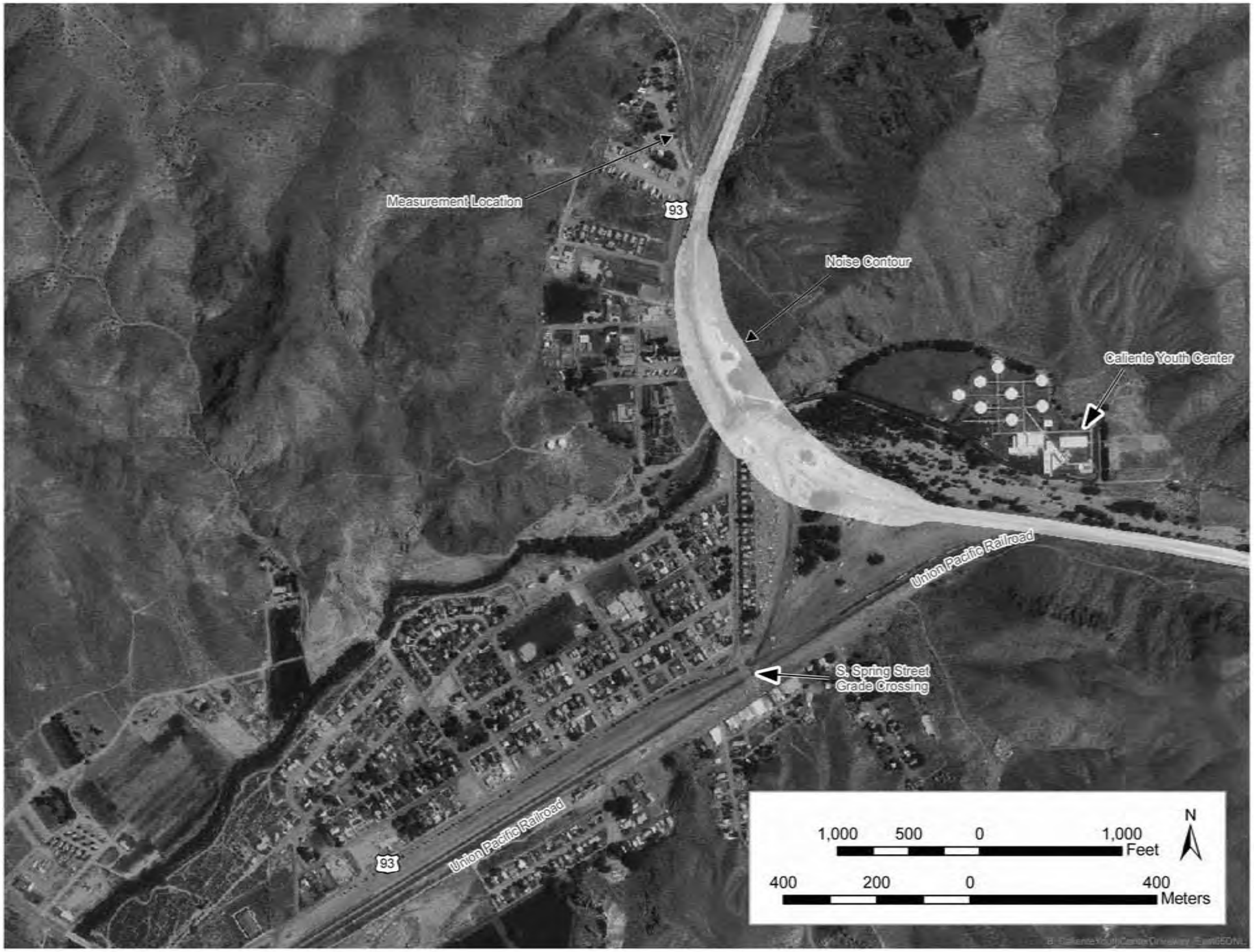


Figure 4-17a. 65 DNL contour – easterly traffic flow, Caliente, Nevada.

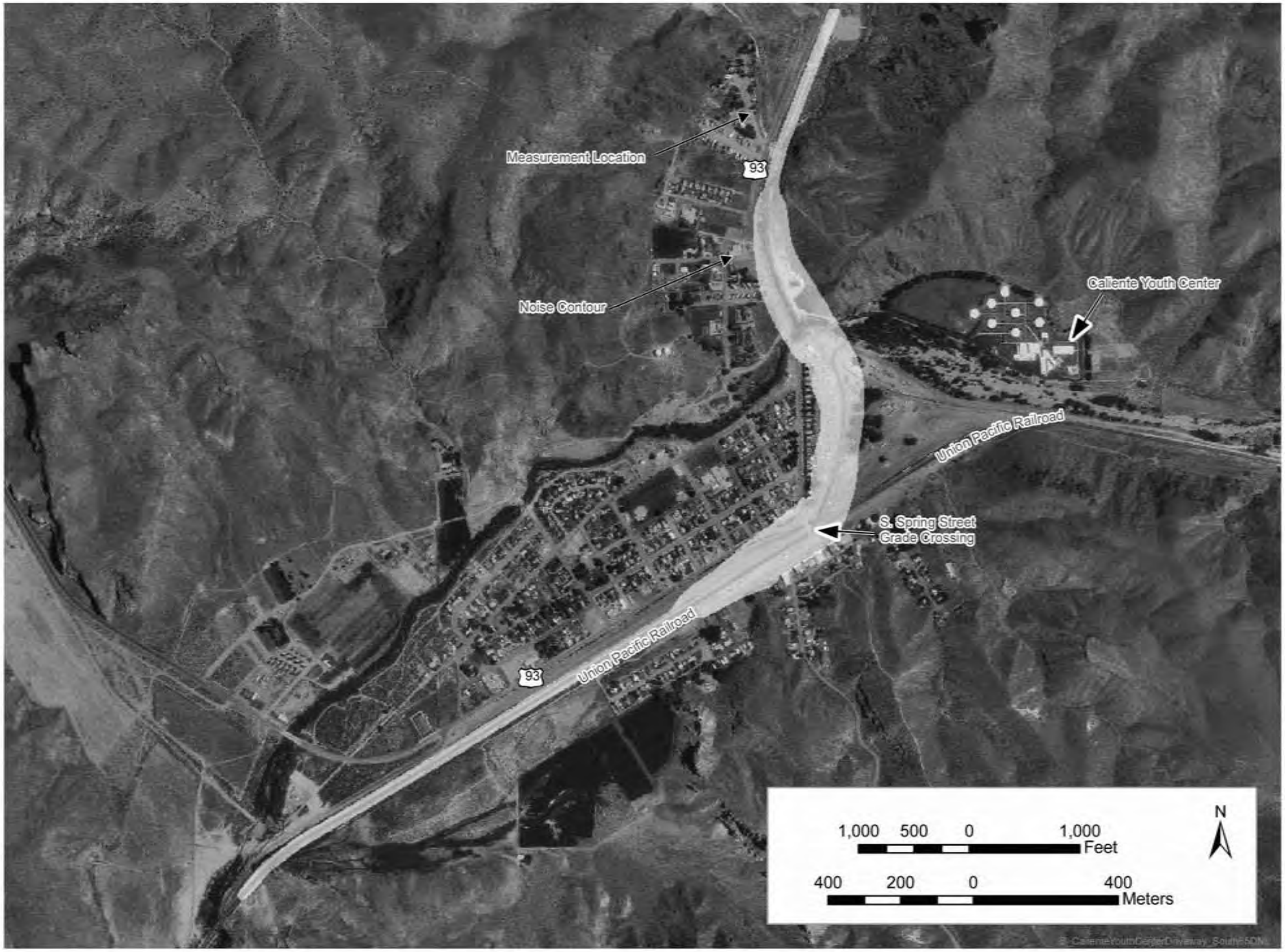


Figure 4-17b. 65 DNL contour – southwesterly traffic flow, Caliente, Nevada.

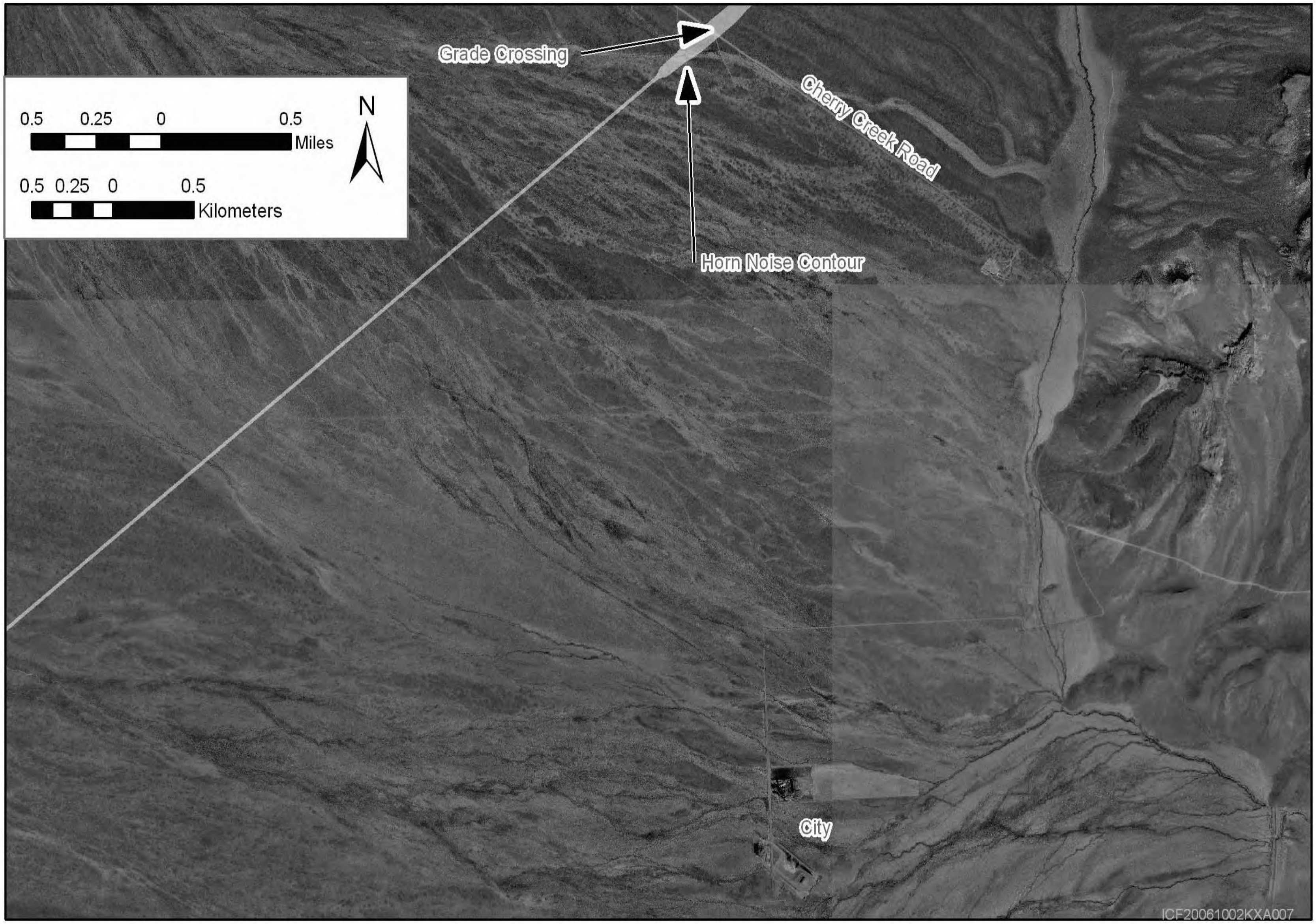


Figure 4-19. 65 DNL contour, Garden Valley alternative segment 1.
(Source: DIRS 174497-Keck Library 2004, filenames 38115A43.sid and 38115A44.sid.)

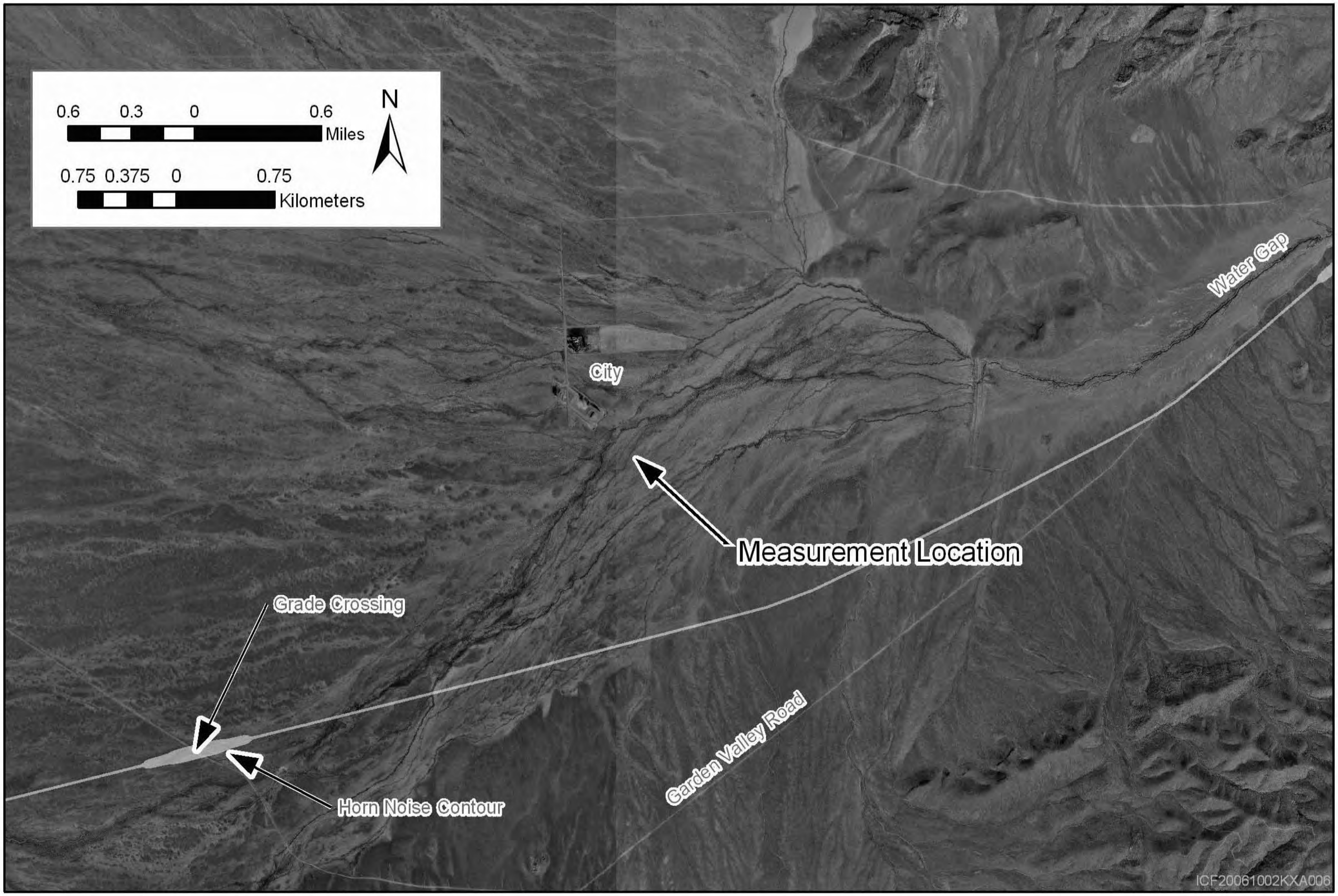


Figure 4-20. 65 DNL contour, Garden Valley alternative segment 2.
(Source: DIRS 174497-Keck Library 2004, filenames 38115A43.sid and 38115A44.sid.)

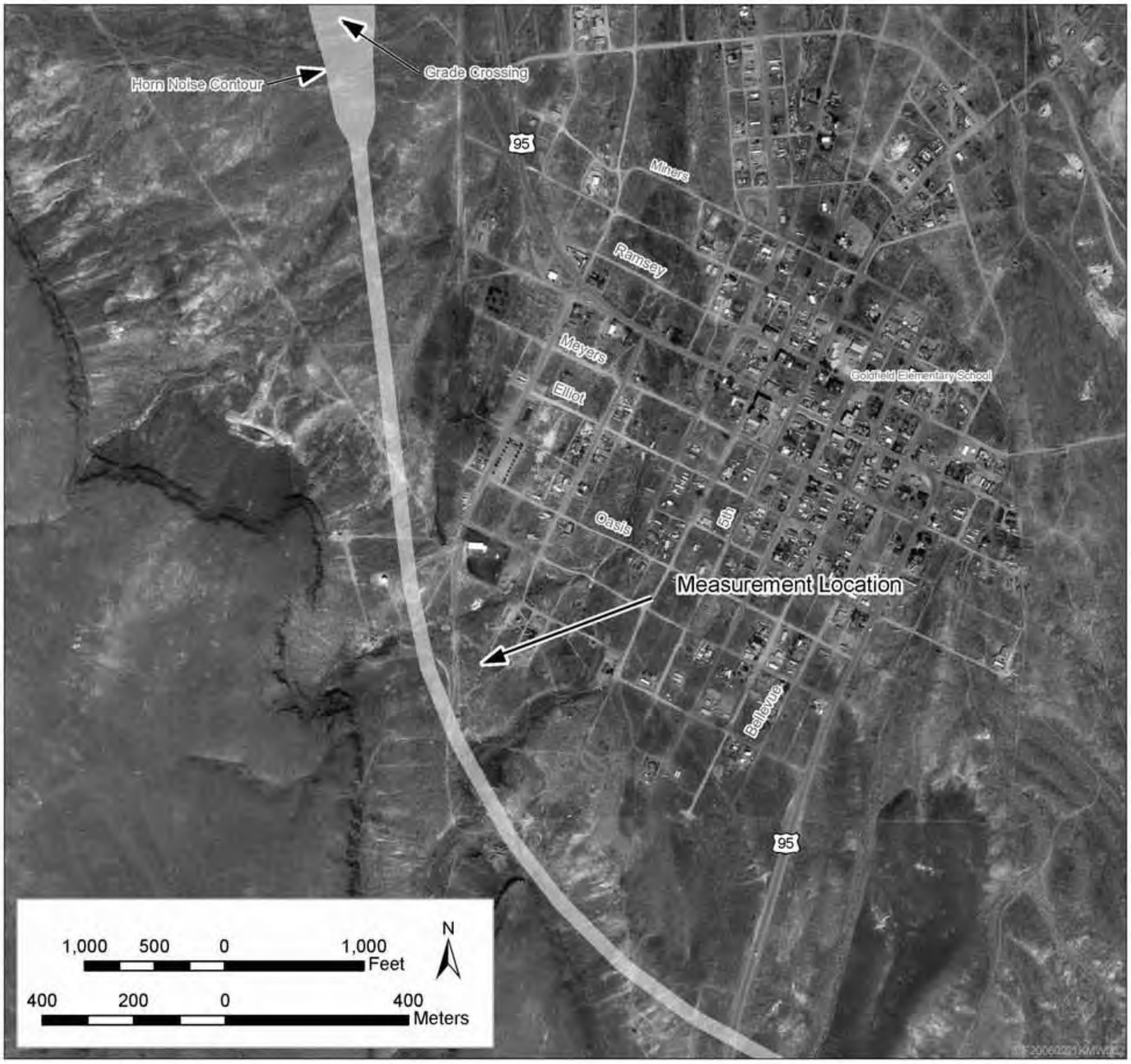


Figure 4-21. 65 DNL contour, Goldfield, Nevada.
(Source: DIRS 174497-Keck Library 2004, filename 37117F21.sid.)

DOE counted receptors that would be included in the 3 dBA increase contours in accordance with STB procedures (DIRS 173225-STB 2003, all). Because of the relatively low ambient sound level in Goldfield (47 DNL), 37 receptors would be within the 3 dBA increase contour. There would be no adverse noise impacts associated with these 37 receptors because they would not experience a 3 dBA increase and also be exposed to 65 DNL or greater. The purpose of the 3 dBA increase component of STB noise guidelines is to identify potential impact areas and areas where train noise would be particularly audible. The audibility of train noise itself does not constitute an adverse noise impact. Because of the higher existing ambient sound level in Garden Valley (62 DNL), the 3 dBA increase contours are narrow; therefore, there would be no receptors within the 3 dBA increase contours at this location. Discounting the two sonic booms measured in Garden Valley (see Section 3.2.8) would result in an ambient noise level of 41 DNL. Conservatively assuming that the ambient level is 41 DNL would result in 3 dBA increase contours that also would include no receptors.

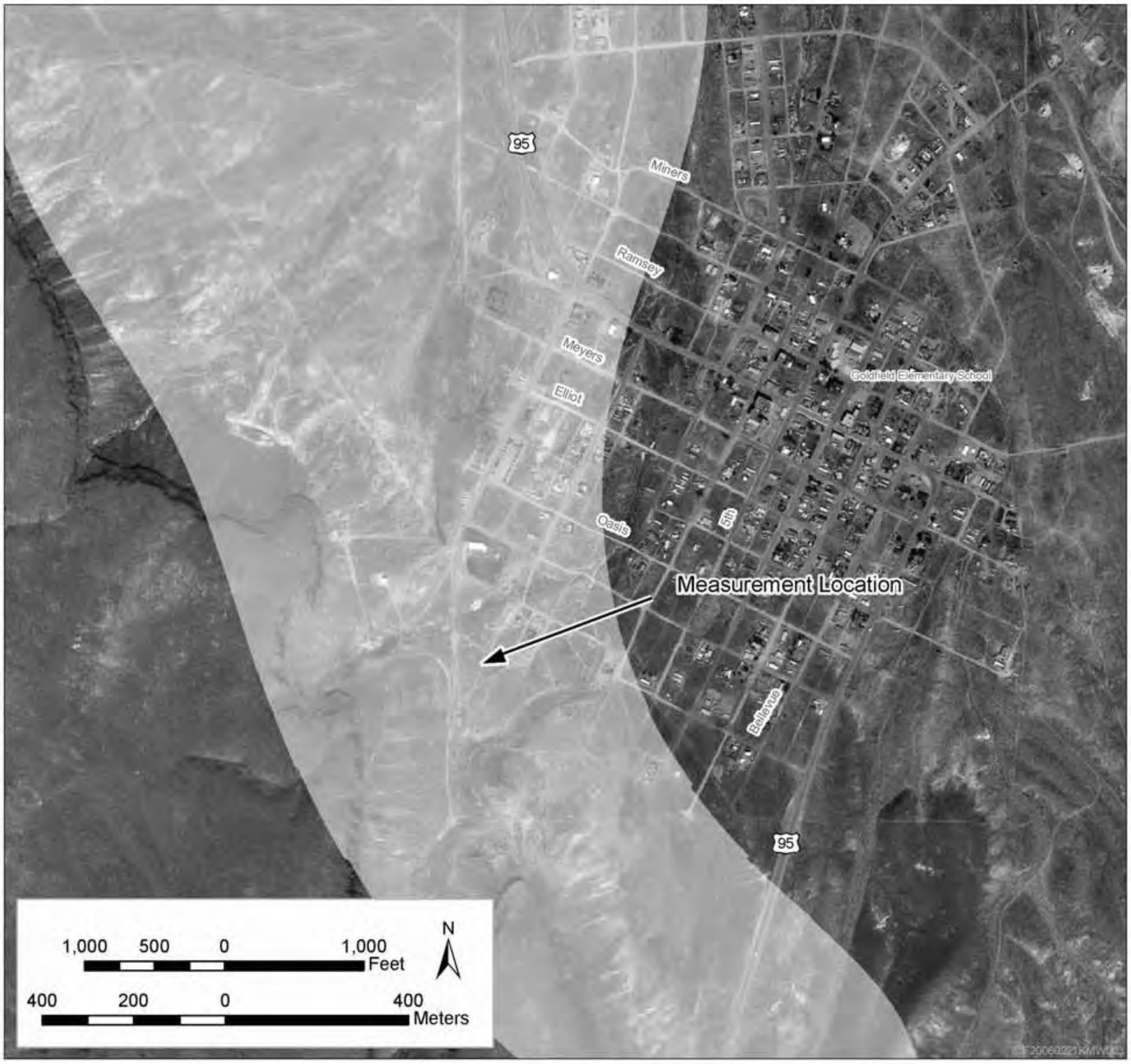


Figure 4-22. 3 dBA increase contour, Goldfield, Nevada.
(Source: DIRS 174497-Keck Library 2004, filename 37114F21.sid.)

Seven receptors fall within the 3 dBA increase contour in Caliente, and of those receptors, three would experience 65 DNL and an increase of 3 dBA. Since these three receptors would experience an adverse noise impact, DOE would consider mitigation such as the development of a Quiet Zone, stationary warning horns, or building sound insulation treatments.

DOE identified two receptors within approximately 120 meters (400 feet) of the Eccles alternative segment. These two receptors would not be within the 65 DNL contour. DOE did not measure ambient sound levels at this location, but based on review of aerial photographs, the population density is low; therefore, ambient sound levels would likely be low. Assuming ambient sound levels as low as measured in Goldfield (47 DNL), and estimated wayside train noise level at this location (52 DNL), these two receptors would be included within the 3 dBA increase contours. However, there would be no adverse noise impact associated with railroad operations at this location because these receptors would not experience a 3 dBA increase and also be exposed to 65 DNL or greater.

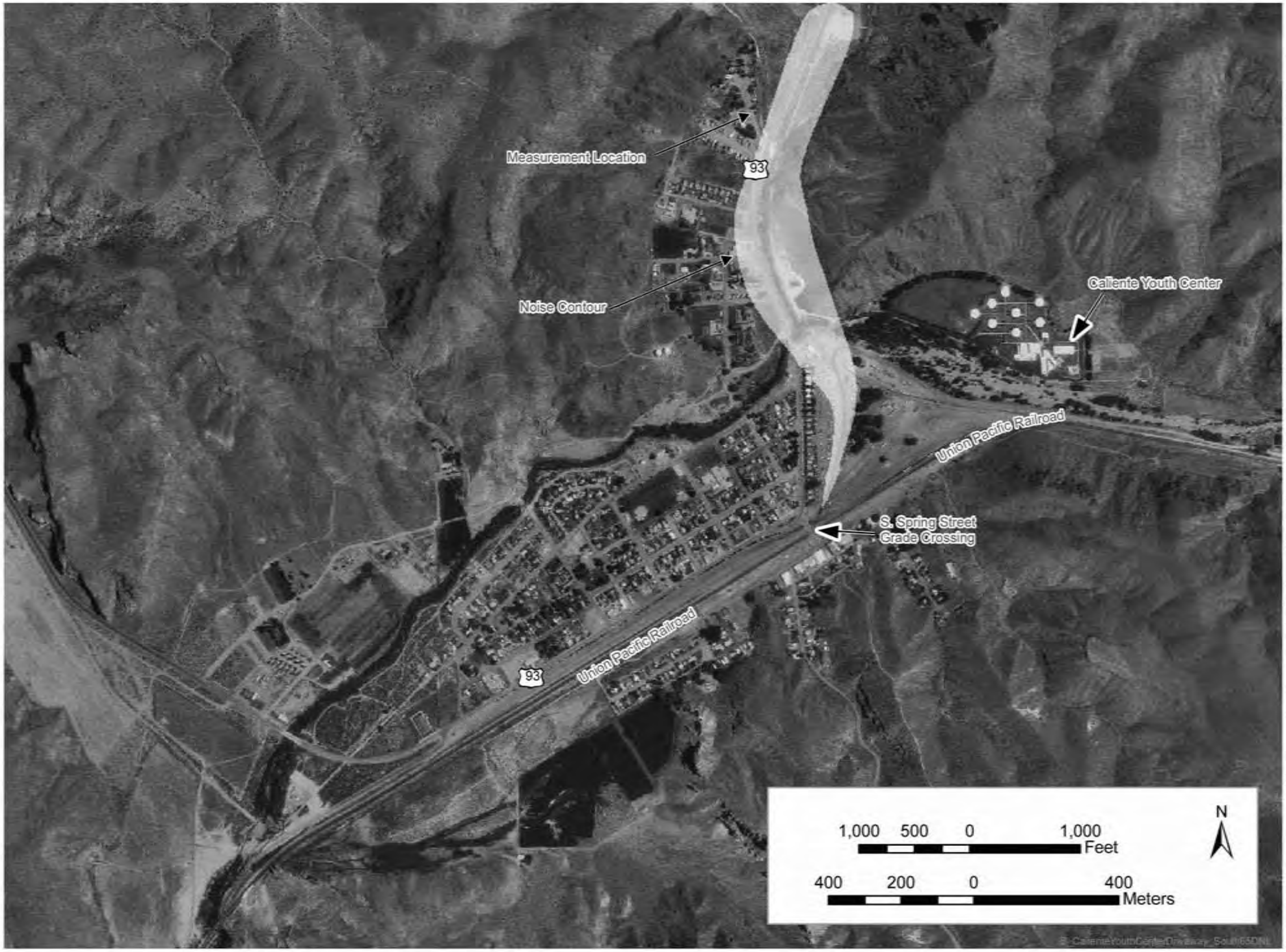


Figure 4-22a. 3 dBA increase contour, Caliente, Nevada.

DOE estimated differences in train noise levels associated with each alternative segment in Garden Valley and Goldfield (see Table 4-98). The analysis accounts for distance attenuation, assumed horn-sounding locations at specific grade crossings, and excess attenuation, and does not include shielding associated with terrain or the effects of ambient noise. DOE calculated the noise levels listed in Table 4-98 at the receptor that would be nearest to each alternative segment.

Goldfield alternative segments 1 and 3 would be much quieter than Goldfield alternative segment 4 because they would be much farther away from receptors than Goldfield 4 (see Table 4-98). In the Garden Valley area, Garden Valley alternative segment 2 would be the noisiest alternative segment, being the closest to receptors. Garden Valley alternative segment 8 would be 6 dBA quieter than Garden Valley 2, and Garden Valley 1 and 3 would produce even less noise because they would be more distant from receptors than the other Garden Valley alternative segments. Garden Valley 3 would be 15 dBA quieter than Garden Valley 2. A 10 dBA reduction is considered a subjective halving of loudness to most people, so Garden Valley 3 would be perceived as less than half as loud as Garden Valley 2.

Table 4-98. Potential railroad operations noise levels for Caliente rail alignment alternative segments in Caliente, Garden Valley, and Goldfield.

Alternative segment	Approximate distance to nearest receptor (feet)[a]	Noise level (DNL, dBA)[b,c]
Caliente	200	67
Eccles	390	52
Garden Valley 1	11,000	30
Garden Valley 2	5,900	37
Garden Valley 3	23,000	22
Garden Valley 8	13,000	31
Goldfield 1	20,000	20
Goldfield 3	32,000	11
Goldfield 4	820	50

a. To convert feet to meters, multiply by 0.3048.
b. dBA = A-weighted decibels; DNL = day-night average noise level.
c. Noise-level differences are based on comparing alternatives with the noisiest alternative segment.

4.2.8.3.4 Railroad Operations Vibration Impacts

At certain times, such as when a locomotive is idling near a residential building, trains can produce low-frequency airborne noise, which in turn can cause structural vibrations. However, trains generally do not produce enough airborne noise or ground-borne vibrational energy to cause building damage.DOE evaluated the potential impacts from vibration during railroad operations by using train-induced vibration levels as a function of distance from a rail line, along with vibration levels likely to result in building damage or annoyance, in combination with information on the location of residences or other buildings in relation to the rail line.

Unlike noise, vibration impacts are evaluated on the basis of maximum level. A freight train traveling at 80 kilometers (50 miles) per hour will generate a vibration velocity level of 95 decibels with respect to 1 micro-inch per second (VdB), measured 3 meters (10 feet) from the tracks (DIRS 177297-Hanson, Towers, and Meister 2006, p. 10-3). This level of vibration is substantially lower than levels that can cause cosmetic building damage (0.51 centimeter per second [0.20 inch per second]), nominally a vibration velocity of 106 VdB, or 100 VdB, assuming a crest factor of 2 (DIRS 176857-Martin 1980, all). This level of vibration is even lower than that which can cause structural damage (126 VdB) (DIRS

175495-Nicholls, Johnson, and Duvall 1971, all). There are no buildings within 3 meters of the proposed rail alignment, so there would be no adverse vibration impacts to buildings.

According to the Federal Transit Administration, a vibration velocity of 80 VdB or above constitutes an impact in terms of human annoyance for infrequent train events (that is, fewer than 70 events per day). For a freight train traveling 80 kilometers (50 miles) per hour, this annoyance impact distance extends approximately 24 meters (80 feet) from the tracks (DIRS 177297-Hanson, Towers, and Meister 2006, p. 10-3). There are no residential buildings within this distance of the Caliente, Eccles, Garden Valley, or Goldfield alternative segments; therefore, DOE expects no adverse vibration impacts related to annoyance.

4.2.8.4 Impacts of the Shared-Use Option

The Shared-Use Option could result in increased train operations because DOE would allow commercial shippers to use the rail line. Such increased operations could result in increased noise impacts because DNL is a function of the number of train events per day. Increased train operations would not affect vibration impacts because vibration is evaluated on a maximum-level basis only.

The typical train under the Shared-Use Option would consist of three to four locomotives and up to 60 railcars. The average length of a car would be 18 meters (60 feet) for a total length (railcars only) of 1,100 meters (3,600 feet). Trains would operate along the rail line at a top speed of 80 kilometers (50 miles) per hour. Table 4-99 shows distances to the wayside 65 DNL noise contour, assuming an average of 3.3 trains per day (the Proposed Action plus Shared-Use Option train volumes).

Table 4-99. Summary of distances to 65 dBA DNL contour under the Caliente rail alignment Shared-Use Option in Caliente, Garden Valley, and Goldfield.[a]

Area	Train speed in miles[b] per hour	Distance in feet[c] to 65 dBA DNL contour		Noise-level increase (dBA)
		Wayside	Horn	
Caliente	50	66	300	0 to 7
Garden Valley	50	66	300	0
Goldfield	50	66	300	0 to 10

a. dBA = A-weighted decibels; DNL = day-night average noise level.
b. To convert miles to kilometers, multiply by 1.6093.
c. To convert feet to meters, multiply by 0.3048.

For Goldfield, the Shared-Use Option would cause increases in the noise level of up to 10 dBA. DOE estimated that 37 receptors would be within the 3 dBA increase contour under the Shared-Use Option. However, no receptors would be within the 65 DNL noise contour; therefore, there would be no adverse noise impact. For Caliente, the Shared-Use Option would cause increases in the noise level of up to 7 dBA; there would be 11 receptors within the 65 DNL contour. There would be 16 receptors within the 3 dBA increase contours, and three receptors within the 65 DNL and 3 dBA increase contours. These three receptors would be adversely impacted. Since these three receptors would experience an adverse noise impact, DOE would consider mitigation such as the development of a Quiet Zone, stationary warning horns, or building sound insulation treatments. For the Eccles alternative segment, there would be two receptors within the 3 dBA increase contour, but there would be no receptors within the 65 DNL contour. For Garden Valley, there would be no receptors within the 3 dBA increase contour or 65 DNL contour.

4.2.8.5 Opposing Viewpoint and DOE Response

Since issuance of the Yucca Mountain FEIS in 2002, the DIA Art Foundation issued a report entitled *Adverse Noise Impacts on "City" Sculpture* (DIRS 174749-Saurenman 2004, all), which asserts that construction and operation of the proposed railroad along the Caliente rail alignment would cause noise impacts on *City* on the basis of audibility of train sound. The Saurenman report presents low ambient noise readings, on the order of 12 dBA, and notes that manmade noise sources, such as aircraft, can be heard from long distances away. The ambient noise measurements were taken over a 2-hour period. The Saurenman report asserts that if train horns were sounded in Garden Valley, the sound would be audible and potentially intrusive throughout the valley. The Saurenman report also presents potential options for reducing noise impacts, including sound walls, eliminating horn sounding by developing a Quiet Zone, and moving the rail line farther away from Garden Valley.

DOE does not agree with the conclusions of the Saurenman report. While locomotive warning horns and wayside noise would likely be audible in the vicinity of *City*, the audibility of noise due to manmade sources would not necessarily constitute an adverse impact. Train noise would not exceed train noise impact criteria under STB noise regulations (49 CFR 1105.7e(6)). Furthermore, special lands that employ impact criteria based on audibility, such as the Grand Canyon National Park, have special noise regulations imposed by the U.S. Congress. This area in Garden Valley does not fall under the jurisdiction of this special type of noise regulation. The Saurenman report presents low ambient noise readings, and DOE measurements also indicate low levels of noise. However, the DOE noise measurements were recorded over a more statistically representative 24-hour period (DNL), and indicate high noise levels due to substantial military aircraft activity. According to the Federal Interagency Committee on Noise, the DNL is the best noise metric with sufficient scientific standing to assess cumulative noise exposure, public health and welfare, and land-use planning (DIRS 174552-Federal Interagency Committee 1992, all). While short-term measurements (such as the 2-hour measurement in the Saurenman report) might indicate low noise levels for certain periods, the more relevant ambient DNL at this location is much higher than the DNL that would be associated with the Proposed Action.

4.2.8.6 Summary

Table 4-100 lists potential noise and vibration impacts related to construction and operation of the proposed railroad along the Caliente rail alignment.

During the construction phase, noise levels at certain receptor locations in Caliente would be higher than impact criteria and there would be a temporary adverse impact from the operation of construction trains. During the operations phase, there would be an adverse impact at three noise-sensitive receptors in Caliente from the operation of trains along the rail alignment.

During the construction and operations phases, vibration levels would not exceed the Federal Transit Administration damage criteria of 0.20 inch per second for fragile buildings, and 0.12 inch per second for extremely fragile historic buildings (see Table 4-96); therefore, DOE would expect no building damage due to vibration. In addition, train-generated vibration levels would be lower than Federal Transit Administration human annoyance criterion.

Table 4-100. Summary of potential impacts from noise and vibration as a result of constructing and operating the proposed railroad along the Caliente rail alignment[a] (page 1 of 2).

Location (county)	Construction impacts	Operations impacts
Alternative segment		
Caliente (Lincoln County)	Noise from construction activities would exceed Federal Transit Administration guidelines. Daytime limits would be exceeded by 11 dBA[b] by construction equipment noise and by 7 dBA from pile driving; 30-day DNL[b] limit would be exceeded by 2 dBA by construction equipment noise and by 12 dBA from pile driving. There would be a temporary adverse impact from the operation of construction trains. Thirty-four receptors would be within the 3 dBA increase contour and 65 DNL contour. There would be no adverse impact from vibration, which would fall below Federal Transit Administration criteria.	There would be adverse impacts from noise from operation of trains along the rail alignment. Three receptors would be within the 3 dBA increase contour and the 65 DNL contour. There would be no adverse impact from vibration, which would fall below Federal Transit Administration criteria.
Eccles (Lincoln County)	Daytime limits would be exceeded by 5 dBA by construction equipment noise. There would be no adverse impact from the operation of construction trains. No receptors would fall within the 65 DNL contours.	There would be no adverse impacts from noise from the operation of trains along the rail alignment. No receptors would be within the 65 DNL contours. There would be no adverse impact from vibration, which would fall below Federal Transportation Administration criteria.
Garden Valley 1, 2, 3, and 8 (analyzed because of Special Recreational Management Area status) (Lincoln and Nye Counties)	No adverse impacts. Noise from construction activities would fall below Federal Transit Administration guidelines. The 30-day average DNL at Garden Valley 1, 2, 3, or 8 would all be below 75 DNL. There would be no adverse impact from vibration, which would fall below Federal Transit Administration criteria. There would be no adverse impact from the operation of construction trains. No receptors would fall within the 65 DNL contours.	There would be no adverse impacts from noise from the operation of trains along the rail alignment. No receptors would fall within the 65 DNL contours. There would be no adverse impact from vibration, which would fall below Federal Transit Administration criteria.
Goldfield 1 and 4 (Nye and Esmeralda Counties) Goldfield 3 (Nye County)	Noise from construction activities would fall below Federal Transit Administration guidelines. The 30-day average DNL at Goldfield 1, 3, or 4 would all be below 75 DNL. There would be no adverse impact from vibration, which would fall below Federal Transit Administration criteria. There would be no adverse impact from the operation of construction trains. No receptors would fall within the 65 DNL contours.	There would be no adverse impacts from the operation of trains along the rail line. No receptors would fall within the 65 DNL contours. There would be no adverse impact from vibration, which would fall below Federal Transit Administration criteria.
Potential quarries	*Potential quarries*	*Potential quarries*
CA-8B (Lincoln County)	There would be no receptors in the vicinity of CA-8B.	Quarry conveyor noise levels would be low at nearby receptors in the vicinity of the CA-8B conveyer.

Table 4-100. Summary of potential impacts from noise and vibration as a result of constructing and operating the proposed railroad along the Caliente rail alignment[a] (page 2 of 2).

Location (county)	Construction impacts	Operations impacts
Potential quarries (continued)		
NN-9A and NN-9B (Nye County)	There would be no receptors in the vicinity of NN-9A or NN-9B.	There would be no receptors in the vicinity of NN-9A or NN-9B.
ES-7 (Nye County)	The nearest receptor would be approximately 4,900 feet[c] away from ES-7; therefore, potential impacts would be small.	The nearest receptor would be approximately 4,900 feet away from ES-7; therefore, potential impacts would be small.
NS-3A and NS-3B (Esmeralda County)	There would be no receptors in the vicinity of NS-3A or NS-3B.	There would be no receptors in the vicinity of NS-3A or NS-3B.
Rail line facilities, construction camps, access roads, water wells	There would be no receptors near these facilities.	There would be no receptors near these facilities.

a. Adverse impacts under the Shared-Use Option would be the same as those under the Proposed Action without shared use.
b. dBA = A-weighted decibels; DNL = day-night average noise level.
c. To convert from feet to meters, multiply by 0.3048.

4.2.9 SOCIOECONOMICS

This section describes potential impacts to socioeconomic conditions (employment and income, population and housing, public services, and transportation) from constructing and operating the proposed railroad along the Caliente rail alignment. This section does not attribute socioeconomic impacts solely to the rail line alternative segments; rather, it describes impacts of the Proposed Action as a whole on the region of influence. Section 4.2.9.1 describes the methodology DOE used to assess potential impacts; Section 4.2.9.2 describes potential construction impacts; Section 4.2.9.3 describes potential operations impacts; Section 4.2.9.4 describes potential impacts under the Shared-Use Option; and Section 4.2.9.5 summarizes potential impacts. The results shown in this section, except as otherwise noted, assume a Maintenance-of-Way Headquarters Facility in Esmeralda County and a Maintenance-of-Way Trackside Facility in Nye County. Sections 4.2.9.2 and 4.2.9.3 also discuss the results of constructing and operating a single consolidated Maintenance-of-Way Facility in Esmeralda County near Goldfield, which could occur if DOE were to select Goldfield alternative segment 4.

Section 3.2.9.1 describes the region of influence for the socioeconomic analysis.

4.2.9.1 Impact Assessment Methodology

DOE analyzed socioeconomic impacts by comparing projected conditions in the region of influence during the construction and operations phases with projected baseline conditions (without the project) described in Section 3.2.9. Sections 4.2.9.1.1 through 4.2.9.1.4 describe the methods DOE used to estimate impacts to socioeconomic conditions.

4.2.9.1.1 Employment and Income

Both the projections of baseline employment and income conditions (without the project) and projections of conditions during the construction and operations phases came from the Regional Economic Models, Inc., *Policy Insight* model (DIRS 182251-REMI 2007, all; DIRS 180485-Bland 2007, all; DIRS 179558-Bland 2007, all) described in Section 3.2.9 and Appendix J, Socioeconomics. Impacts are stated in terms of the number of jobs, ***gross regional product***, ***real disposable income***, and state and local government spending. Direct economic effects are the changes in jobs, gross regional product, and income in sectors that would supply directly needed goods and services, such as heavy-duty equipment, during railroad construction and operations. Indirect or secondary economic effects are the changes in sectors that would supply goods and services to the direct sectors (such as the production of construction material components). Secondary effects also would include the spending of income earned from the project (known as indirect effects). The extent to which a local economy could supply goods and services to the proposed project would be constrained by its level of economic development. DOE has assessed adverse impacts qualitatively in terms of disruption of economic activity, particularly for mining and agricultural operations.

Gross regional product is the value of all final goods and services produced in a specified region.

Real disposable income is the value of total after-tax income received; it is the income available for spending or saving.

DOE used runs of the *Policy Insight* model to estimate construction impacts over 5 years and operations impacts over 52 years (DIRS 182251-REMI 2007, all; DIRS 180485-Bland 2007, all; DIRS 179558-Bland 2007, all). The actual construction phase would range from 4 to 10 years. DOE expects the construction phase to last a minimum of 4 years and 6 months, so the Department modeled a fifth year. Because impacts, described in this analysis as peak changes from the baseline (without the project), would be strongest and most concentrated under a shorter construction schedule, DOE modeled only the 5-year construction phase. Construction-related impacts under a 10-year schedule would be bounded by the analysis described. Noteworthy impacts associated with a longer construction phase are identified, as appropriate. For the operations phase, this analysis assumes that the first 2 years represent a transition period. During these 2 years (2015 and 2016), the railroad support facilities would be operational. Starting in 2017, DOE would begin shipping spent nuclear fuel and high-level radioactive waste to Yucca Mountain; the shipping campaign would span up to 50 years, with up to 50 years of active shipping.

Because the socioeconomic impacts would vary depending on the county in which DOE placed the Nevada Railroad Control Center and National Transportation Operations Center, DOE modeled two different scenarios for both the construction and operation phases. Scenario 1 has the Nevada Railroad Control Center and National Transportation Operations Center in Lincoln County near the beginning of the rail line; Scenario 2 has these facilities in Nye County near the end of the rail line.

4.2.9.1.2 Population and Housing

DOE estimated population impacts by comparing project-related increases or decreases at the county level against the projected population figures without the project. These estimates came from the same *Policy Insight* model runs used to estimate employment and income. Population changes are related to changes in employment; as employment increases in an area, permanent population could also increase, although increases in population typically lag behind increases in employment. DOE assessed impacts on housing by evaluating worker and permanent population increases associated with railroad construction and operations against county and community housing-capacity information. Bureau of Census age distributions are used in the analysis because they are based on the Decennial Census, with data gathered through a well-known methodology. As a result, the age distributions are consistently generated across all jurisdictions.

4.2.9.1.3 Public Services

DOE assessed impacts to public services as changes to the county or community baseline capacity (assuming no railroad), as described in Section 3.2.9. There would be positive impacts when there were project-related enhancements that the community could also access. Adverse impacts would occur when increased demand exceeded the capacities of public services or hastened the deterioration of a particular public service, resulting in a lower level of service to community users.

4.2.9.1.4 Transportation Infrastructure

There could be an adverse impact on roadways within the region of influence if construction or operation of the proposed railroad would degrade the ***level of service*** of a roadway to unacceptable levels (below a level of service of C) as a result of project-related traffic. Section 3.2.9.3.5.1 includes a definition of levels of service. As discussed in Section 3.2.9, existing annual average daily traffic data for the major roadways within the Caliente rail alignment region of influence were provided by the Nevada Department of Transportation. Baseline levels of service of the roadways were then projected using the Highway Capacity Manual guidelines. To assess the impacts the railroad would have on the roadways, DOE added potential project-related vehicles to baseline traffic volumes and then estimated new levels of service. The Department did not calculate road-traffic delays at highway-rail grade crossings because all roads the rail line would cross have very low traffic levels. Section 4.2.10, Occupational and Public Health and Safety, provides the safety analysis (traffic accidents and fatalities) for the proposed railroad along the Caliente rail alignment.

4.2.9.2 Rail Line Construction Impacts

The Caliente Implementing Alternative includes construction and operation of the railroad and its associated construction and operations support facilities. Inputs to the analysis using the *Policy Insight* model (DIRS 182251-REMI 2007, all; DIRS 180485-Bland 2007, all; DIRS 179558-Bland 2007, all) included construction and operations costs, or labor needs, or both when available. The inputs also accounted for the differences between expected project-related wages and average wages, by county and economic sector, contained in the *Policy Insight* model. Project-related wages would generally be higher than the average wages embedded in the model.

The common social and economic activities and changes associated with the construction of the proposed railroad would include:

- A period of brief, intense elevation in project-related employment
- Population increases
- A slightly slower rate of growth in the level of employment as the economy moved from the construction phase to the operations phase
- Some effects on public services (such as health care), particularly where construction activities were concentrated near communities
- Some effects on transportation resources

The equivalent of 1,100 full-time workers would be required during the grading phase of the construction phase, but fewer workers would be required as construction activities moved toward completion (this number reflects full-time work over a typical annual work year of approximately 2,000 hours [accounting for weekends, holidays, and vacation and sick days], and a construction phase of 54 months). More than 1,100 people would be performing this work, because not all employees would work full time. DOE used *Policy Insight* population projections to assess population-related impacts (for example, impacts to housing stock, ***infrastructure***, public services) related to the total number of actual employees resulting from the project. DOE would establish up to 12 temporary construction camps along the rail alignment to house workers.

Construction impacts for employment, income, and population are drawn from model runs of *Policy Insight* (DIRS 182251-REMI 2007, all; DIRS 180485-Bland 2007, all; DIRS 179558-Bland 2007, all), which used a 5-year modeling period. As mentioned above, the actual construction phase would range from 4 to 10 years; impacts associated with the longer construction phase are noted as appropriate. However, levels of impacts would be higher and more concentrated under the modeled 5-year schedule.

4.2.9.2.1 Employment and Income

Direct employment and income impacts would stem from the hiring of construction workers and their spending of wages. Workers would have the option of shopping in towns near the construction camps, or relying on the cafeterias, drug stores, and non-perishables markets at the construction-camp commissaries (DIRS 180922-Nevada Rail Partners 2007, p. 4-5). Indirect impacts could result from employment of workers by businesses that supply goods and services in support of construction work, including the construction and operation of construction camps, where services such as catering, utility supply, and waste disposal would be needed. For purposes of this analysis, and consistent with the methodology established in the Yucca Mountain FEIS, DOE assumes that most construction workers would live in Clark County (DIRS 155970-DOE 2002, Section 4.1.6.2.1) and reside in construction camps. DOE makes this assumption because the construction sectors in Nye, Lincoln, and Esmeralda Counties are not large enough to provide enough workers for the construction activities. This analysis also assumes, like the Yucca Mountain FEIS, that employees at Nye County facilities at or near the repository have residences consistent with historical patterns; that is, that 80 percent of employees at Nye County facilities reside in Clark County and 20 percent of employees at Nye County facilities reside in Nye County. Appendix J, Section J.1.8, presents a sensitivity analysis that assumes a modified residency pattern for employees at Nye County facilities at or near the repository, with 80 percent of employees residing in Nye County and 20 percent of employees residing in Clark County.

Table 4-101 lists potential changes in economic measures during the construction phase for the two modeled scenarios. Appendix J describes the analysis in more detail. Each scenario includes the impact of constructing the proposed railroad. DOE modeled employment of construction workers and some support workers as beginning in 2010 and ending in 2014. All construction-related economic impact values are presented in 2006 dollars. Table 4-101 lists the estimated changes to current trends (without construction of the railroad) in employment and income for each year of the construction phase. The discussion of the data in the table attempts to identify and address the largest deviations ("peak" changes) from the current trends without the railroad as a way to show the upper bounds of potential impacts. Table 4-101a lists additional estimated changes should Goldfield alternative segment 4 be selected.

In all four counties, changes to the baseline (conditions without the proposed railroad) would be similar under the two scenarios. In Lincoln County, the increase in peak employment would represent 5.6 percent of the total projected employment levels in Lincoln County in the absence of the project. The peak construction-related impact to real disposable income would be 4.1 percent above the baseline, and the impact to state and local government spending would be 1.9 percent above the baseline. Gross regional product is the one variable for which there is a slight difference between the two scenarios. If the Nevada Railroad Control Center and National Transportation Operations Center were constructed in Lincoln County, gross regional product would be 28.4 percent above the baseline. If these facilities were constructed in Nye County, gross regional product would be 26.2 percent above the baseline. Residents would likely feel the peak changes to employment and gross regional product.

In Nye County, the project-related increase in employment at peak would correspond to 1.2 percent of the total projected employment levels in Nye County without the project. The peak construction-related impact to real disposable income would be a less than 1-percent increase above the baseline, gross regional product would be 3.5 percent above the baseline, and state and local government spending would correspond to less than 1 percent above the baseline.

In Esmeralda County, the project-related increase in employment at peak would correspond to 2.7 percent of the total projected employment levels without the project. The peak construction-related impact to real disposable income would be a 7.6-percent increase above the baseline, gross regional product would be a 9.5-percent increase above the baseline, and state and local government spending would correspond to a 2.2-percent increase above the baseline.

In Clark County, the peak increase in real disposable income, gross regional product, and ***total employment*** would correspond to an increase of slightly more than one-tenth of 1 percent of the baseline in Clark County. The peak construction-related impacts to state and local government spending would correspond to less than one tenth of 1 percent above the respective baselines, meaning that all impacts, if any, would be small in such a large economy.

If DOE were to select Goldfield alternative segment 4, with a consolidated Maintenance-of-Way Facility in Esmeralda County, economic activity related to the Maintenance-of-Way Facility during the construction phase would be slightly increased in Esmeralda County and slightly decreased in Nye County, relative to the results shown in Table 4-101. Table 4-101a lists the differences from Table 4-101 for Esmeralda and Nye Counties for 2012, the peak year for construction of the Maintenance-of-Way Facility. For example, in Esmeralda County, construction phase peak year changes would lead to an increase in employment of an additional worker, bringing the total change in Esmeralda County employment in 2012 to 13 (Table 4-101a), which is 2.95 percent above the baseline.

Table 4-101. Estimated changes in economic measures during the construction phase – Caliente rail alignment[a] (page 1 of 2).

	Construction year				
County/scenario/measure	2010	2011	2012	2013	2014
Lincoln County					
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Lincoln County					
Employment	103	106	127	78	66
State and local government spending	$511,895	$664,402	$803,395	$809,879	$877,898
Real disposable income	$3,615,195	$2,310,965	$2,766,970	$2,172,683	$2,829,060
Gross regional product	$25,520,040	$16,081,431	$19,192,542	$8,554,134	$3,871,530
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County					
Employment	100	106	127	78	56
State and local government spending	$505,440	$658,710	$798,300	$805,320	$827,792
Real disposable income	$3,575,520	$2,303,730	$2,761,287	$2,168,167	$2,225,479
Gross regional product	$23,563,800	$16,075,800	$19,188,009	$8,550,351	$3,387,124
Nye County					
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Lincoln County					
Employment	239	211	269	176	82
State and local government spending	$573,000	$625,000	$766,000	$725,000	$665,000
Real disposable income	$9,487,000	$6,203,000	$9,494,000	$7,287,000	$3,813,000
Gross regional product	$34,021,000	$28,256,000	$41,980,000	$24,757,000	$8,609,000
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County					
Employment	239	211	273	182	85
State and local government spending	$573,000	$625,000	$771,000	$739,000	$682,000
Real disposable income	$9,479,000	$6,202,000	$9,635,000	$7,540,000	$3,955,000
Gross regional product	$34,012,000	$28,256,000	$42,789,000	$26,157,000	$9,087,000

Table 4-101. Estimated changes in economic measures during the construction phase – Caliente rail alignment[a] (page 2 of 2).

	Construction year				
County/scenario/measure	2010	2011	2012	2013	2014
Esmeralda County					
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Lincoln County					
Employment	13	13	12	9	8
State and local government spending	$80,801	$107,651	$129,294	$120,868	$117,176
Real disposable income	$1,903,902	$1,985,531	$2,044,025	$1,147,679	$963,027
Gross regional product	$2,177,398	$265,243	$271,566	$1,072,654	$403,627
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County					
Employment	13	13	12	9	8
State and local government spending	$80,789	$107,640	$129,335	$120,984	$117,278
Real disposable income	$1,903,590	$1,985,490	$2,045,289	$1,150,005	$963,500
Gross regional product	$2,177,370	$265,239	$271,651	$1,072,830	$403,696
Clark County					
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Lincoln County					
Employment	1,786	1,770	1,826	1,035	542
State and local government spending	$1,519,790	$2,835,480	$4,099,750	$4,532,759	$4,514,596
Real disposable income	$99,635,560	$100,639,540	$107,233,881	$64,900,988	$39,286,436
Gross regional product	$139,697,420	$144,233,260	$154,007,708	$92,116,874	$51,490,741
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County					
Employment	1,771	1,769	1,832	1,046	548
State and local government spending	$1,506,960	$2,823,210	$4,094,729	$4,538,898	$4,527,982
Real disposable income	$98,783,100	$100,608,300	$107,590,977	$65,557,089	$39,741,624
Gross regional product	$138,528,000	$144,144,000	$154,498,617	$93,063,087	$52,053,066

a. Sources: DIRS 179558–Bland 2007, all; DIRS 180485-Bland 2007, all.

Table 4-101a. Construction phase peak year changes for the consolidated Maintenance-of-Way Facility were Goldfield alternative segment 4 to be selected.

County (year of peak)	Change due to Goldfield alternative segment 4 selection (percent change from baseline)[a]	Total change from the baseline, including changes in Table 4-101 (percent change from baseline)
Esmeralda County (2012)		
Employment	1 (0.25)	13 (2.95)
State and local government spending	$700 (0.01)	$130,000 (2.21)
Real disposable personal income	$8,700 (0.03)	$2,054,000 (7.63)
Gross regional product	$2,036,000 (7.25)	$2,307,000 (16.75)
Nye County (2012)		
Employment	-8 (-0.04)	265 (1.16)
State and local government spending	-$8,300 (0.00)	$763,000 (0.4)
Real disposable personal income	-$174,000 (-0.01)	$9,461,000 (0.89)
Gross regional product	-$3,312,000 (-0.24)	$39,477,000 (3.26)

a. Source: DIRS 185436-Bland 2008, all.

The major economic activities that could be adversely affected by construction of the proposed railroad along the Caliente rail alignment are mining and grazing interests. Economic activities could be disrupted during the construction phase, which could range from 4 to 10 years. Impacts on private lands (other than patented mining claims) would be small, because as discussed in Section 3.2.2, the Caliente rail alignment would lie almost entirely within BLM-administered public land. DOE would anticipate impacts to private land mainly in the Goldfield area.

There also could be disruption of economic activity from construction impacts on the transportation infrastructure as the movement of construction equipment and supplies temporarily disrupted traffic flow along local road systems. Under the 4-year construction schedule, DOE traffic modeling predicts that construction of the rail line itself would not affect traffic volume on local roads, but that construction of facilities might. Construction of the Maintenance-of-Way Headquarters Facility, the Interchange Yard, and the Staging Yard would affect traffic on U.S. Highway 95 between Goldfield and Tonopah and U.S. Highway 93 at Caliente; however, the level of service would remain the same in both locations. DOE would limit the impact of these disruptions by measures such as limiting road closures to low-traffic periods. Construction of the facilities inside the Yucca Mountain Site boundary near the repository (the Rail Equipment Maintenance Yard, the Cask Maintenance Facility, and possibly the Nevada Railroad Control Center and National Transportation Operations Center) would affect traffic on U.S. Highway 95 at the entrance to the Yucca Mountain Site, resulting in a drop in level of service from a B to a C at peak times during the construction phase. There would be fewer such impacts under a 10-year construction schedule, because worker trips and materials shipments would be spread over a longer period. As discussed in Section 4.2.11, Utilities, Energy, and Materials, the supplies needed for construction would not create shortages at a local, regional, or national level. Primary materials include steel for rails and concrete for rail ties, bridges, and drainage structures. These materials are available regionally and nationally; purchasing would not be expected to create demand and supply impacts, and there should be no harmful price effects.

There could be some reductions in mining- and agriculture-related employment and income because of construction-related land disturbances. The nominal width of the rail line construction right-of-way would include land upon which there are grazing and mining activities. The construction right-of-way might be narrower in certain locations to minimize impacts to lands with mining claims, or wider in other places (such as cut and fill areas and bridges) that could affect parcels adjoining the construction right-of-way where mining and agricultural activities take place.

The only mining claims that would be within the rail line construction right-of-way are associated with South Reveille alternative segments 2 and 3, Caliente common segment 3, and the three Goldfield alternative segments (see Figure 3-13). Although DOE would reduce the area of disturbance to minimize impacts to these claims, South Reveille alternative segments 2 and 3 would intersect 72 claims, common segment 3 would intersect 166 claims, Goldfield alternative segment 1 would intersect 474 claims, Goldfield alternative segment 3 would intersect 359, and Goldfield 4 would intersect 538.

If parties with existing mining claims have plans to explore, develop, or produce minerals on claims within the construction right-of-way, these plans might require accommodations to allow for both construction and mining activities to proceed. Such accommodations might have economic consequences. DOE recognizes that mineral exploration and development is strongly tied to the price of mineral commodities. However, foreseeable impacts to mining from railroad construction would be very small because the mineral production in affected districts is only a small percentage of overall mineral production in Nevada and the number of mining claims the rail line would cross would be small. Further, construction would only temporarily affect the filing of new claims. However, individuals and localized areas could feel the impacts more severely.

As described in Section 4.2.2.2.3.2, wherever the rail line would cross a grazing allotment, DOE quantified the amount of forage loss in animal unit months in accordance with BLM standards. Factors that influence the determination of permitted animal unit months include quantity and quality of forage; type of forage; season in which the forage will be grazed; kind and mix of grazing animals; presence of water; topography; soil, climate, and disturbance regimes; wildlife cover; proper use factor; and management objectives. In 2001, the State of Nevada Department of Agriculture commissioned a report, *Nevada Grazing Statistics Report and Economic Analysis for Federal Lands in Nevada*, in which one animal unit month was assigned a value of $53.40 in direct and indirect contributions to the economy (DIRS 176949-Resource Concepts 2001, p. 47). DOE used this value to estimate economic losses due to impacts to grazing. Section 4.2.2, Land Use and Ownership, describes for each potentially affected grazing allotment, the potential impacts to grazing activities from a land-use perspective.

Grazing allotments within the Caliente rail alignment construction right-of-way would be affected in Lincoln and Nye Counties for a total potential loss of up to 1,036 animal unit months and $55,000 to the local economy during each year of construction activity. This is a conservative estimate, because it assumes DOE would select only the most disruptive alternative segments. Table 4-102 summarizes animal unit month loss information presented in Section 4.2.2 and the corresponding economic impact. Table 4-102 only lists portions of the Caliente rail alignment that would result in a loss (for example, the Goldfield alternative segments are not included because none would affect animal unit months on nearby allotments). DOE calculated the totals to two significant figures by adding common segments and the most conservative alternative segment losses (shown in bold type).

Of the totals, about 677 of the animal unit months and $35,000 would be lost in Nye County, and 391 animal unit months and $20,000 would be lost in Lincoln County, assuming that losses from portions of the Caliente rail alignment (for example, Caliente common segment 1) that would cross parts of both counties were evenly split between the two counties. As presented in Table 3-60, Nye and Lincoln Counties had gross regional products of $1.16 billion and $93.6 million, respectively, in 2007. In economies of these scales, the overall impacts of grazing losses would be small. However, individuals and localized areas could feel the impacts more severely.

Table 4-102. Segment-specific annual economic impacts to grazing allotments during construction of the proposed rail line – Caliente rail alignment.

Rail line segment	Animal unit months lost[a,b]	Value ($)
Caliente alternative segment	1	50
Eccles alternative segment	19	1,000
Caliente common segment 1	452	24,000
Garden Valley alternative segment 1	121	6,500
Garden Valley alternative segment 2	132	7,000
Garden Valley alternative segment 3	125	6,700
Garden Valley alternative segment 8	126	6,700
Caliente common segment 2	117	6,200
South Reveille alternative segment 2	54	2,900
South Reveille alternative segment 3	58	3,100
Caliente common segment 3	229	12,000
Oasis Valley alternative segment 1	8	400
Oasis Valley alternative segment 3	12	600
Common segment 6	17	900
Totals[c]	1,036	55,000

a. Figures for animal unit months lost for the Facilities at the Interface with the Union Pacific Railroad Mainline and South Reveille alternative segments include impacts from associated quarries and the Staging Yard.
b. The values shown are worst-case values of the animal unit months that would be lost for 1 year (per year during proposed railroad construction and operations). The table lists only those portions of the rail alignment that would result in a loss.
c. Totals might differ from sums of values due to rounding.

The BLM could elect to redraw the boundaries of grazing allotments to address these effects. During the construction phase, there could be an additional impact from construction trains colliding with cattle. DOE would compensate ranchers for any such losses of cattle in accordance with Nevada Revised Statutes 705.150 to 705.200.

The potential annual economic impacts to prime farmland areas are described in relation to employment and lost market value of crops. As discussed in Section 4.2.1.2.1.3, up to 1.3 square kilometer (440 acres) of prime farmland soils would be lost under the Caliente Implementing Alternative. Table 4-103 lists the estimated impacts to prime farmland.

Table 4-103. Potential annual impacts to prime farmland – Caliente rail alignment.[a]

Rail line segment	Number of acres[b] affected	Market value of crops per acre ($)	Workers per acre	Market value lost ($)	Employment lost
Caliente alternative segment					
Lincoln County	40	276	0.005	11,040	0.20
Eccles alternative segment					
Lincoln County	23	276	0.005	6,348	0.12
Caliente common segment 1					
Nye County	280	106	0.008	29,680	2.2
Garden Valley alternative segment 2					
Nye County	97	106	0.008	10,282	0.78

a. Source: DIRS 173571-USDA 2004, Tables 1 and 7.
b. To convert acres to square kilometers, multiply by 0.0040469.

Based on data from Nevada's Census of Agriculture, DOE estimated the market value of crops lost from prime farmland as $11,040 in Lincoln County if the Department selected the Caliente alternative segment and $6,348 if the Department selected the Eccles alternative segment. In Nye County, the analysis shows that crops from prime farmland valued at $29,680 would be lost due to Caliente common segment 1 and crops valued at $10,282 would be lost due to Garden Valley alternative segment 2. DOE also estimates that approximately three jobs could be lost in Lincoln County and Nye County under the Caliente Implementing Alternative.

4.2.9.2.2 Population and Housing

Population changes are related to changes in employment. DOE modeled employment of construction workers and some support workers as beginning in 2010 and ending in 2014, and estimated population impacts for the same period. Table 4-104 lists the estimated changes to population during the construction phase for each of the modeled scenarios. Appendix J describes the analysis in more detail. In Esmeralda County, population changes would be identical under either scenario. The peak population increases would be largely due to indirect employment effects.

Table 4-104. Estimated changes to population during railroad construction – Caliente rail alignment.[a]

Location	2010	2011	2012	2013	2014
Lincoln County					
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Lincoln County	42	58	71	77	87
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County	41	57	71	77	81
Nye County					
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Lincoln County	62	73	105	132	136
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County	62	73	106	136	140
Esmeralda County	5	8	10	11	12
Clark County					
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Lincoln County	398	732	1,047	1,144	1,125
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County	395	730	1,045	1,146	1,128

a. Sources: DIRS 179558-Bland 2007, all; DIRS 180485-Bland 2007, all.

In Lincoln County, the peak estimated population change attributed to railroad construction along the Caliente rail alignment would be an increase of 87 people, which would correspond to a 1.7-percent increase in the Lincoln County projected 2014 population level without the project. Twenty-one of these would be school-aged children, according to the age distribution of Lincoln County published by the Bureau of Census (DIRS 175922-Bureau of Census 2000, all).

In Esmeralda County, the peak population gain of 12 people would translate to two additional school-aged children, according to the age distribution of Esmeralda County published by the Bureau of Census (DIRS 175922-Bureau of Census 2000, all). The *Policy Insight*-estimated population gain attributed to railroad construction along the Caliente rail alignment represents a 1.1-percent increase over the projected 2014 population level for Esmeralda County without the project (DIRS 174313-Nevada State Demographer [n.d.], all). Should DOE select Goldfield alternative segment 4, because of the short construction period and minimal employment changes, there would be no increase in Esmeralda County population beyond that shown in Table 4-104 during the construction phase (DIRS 185436-Bland 2008, all).

In Nye County, the peak population increase would be 140 people, about 25 of whom would be school-aged children, according to the age distribution of Nye County published by the Bureau of Census (DIRS 171298-Bureau of the Census 2004, all). The estimated population gain attributed to construction of the proposed railroad along the Caliente rail alignment would be less than a 1-percent increase over Nye County's projected population level without the project for all construction years. Should DOE select Goldfield alternative segment 4, the change in population in Nye County would be reduced from that shown in Table 1-104 by about 2 people. The estimated population gain over the construction period, including any changes as a result of consolidating the Maintenance-of-Way Facility in Esmeralda County, would be less than a 1-percent increase over the baseline (DIRS 185436-Bland 2008, all).

In Clark County, the peak population increase would be 1,146 people. Of this increase, about 207 would be school-aged children, according to the age distribution of Clark County published by the Bureau of the Census (DIRS 171297-Bureau of the Census 2004, all). The estimated population increase attributed to construction of the proposed railroad along the Caliente rail alignment would represent less than a

1-percent increase over Clark County's projected population level without the project for all construction years.Impacts on housing infrastructure would be small during the construction phase because most construction workers would be housed in construction camps at strategic locations along the rail alignment, rather than in nearby communities. If construction workers elected not to stay in the camps, motels or recreational vehicle parks could substitute as housing options. As discussed in Section 3.2.9.3.3, lodging is available along U.S. Highway 95 in and around Goldfield, Beatty, and Town of Amargosa Valley. Between Goldfield and the Yucca Mountain Site, these towns offer eight motels with a total of 252 rooms, and six recreational vehicle parks with a total of 230 spaces. These lodging options could not accommodate all workers and completely substitute for construction camps.

Some contractors could elect to use commercially available facilities to house construction personnel, such as those in Caliente, Tonopah, Goldfield, Beatty, and Pahrump. As indicated in Section 3.2.9, it appears there would be sufficient vacant housing stock in these areas to meet the needs of construction personnel.

4.2.9.2.3 Public Services

Impacts to public services at the county level would likely be small because the population projections with the project show very limited increases in overall counts. An additional impact on local health-care capacity would be the primary impact on public services. The area that is likely to experience the greatest impacts is southern Nye County, where possibly the Rail Equipment Maintenance Yard, Cask Maintenance Facility, and the Nevada Railroad Control Center and National Transportation Operations Center would be. Because of the small changes in population and employment during the construction phase that could be caused should DOE select Goldfield alternative segment 4, the discussion related to public services will not differ whichever Goldfield alternative segment were chosen.

4.2.9.2.3.1 Health Care. As presented in Section 4.2.10, Occupational and Public Health and Safety, during the construction phase, DOE expects approximately 660 total recordable and ***lost workday cases*** among involved and noninvolved workers; that is, fewer than 150 per year. Construction workers would be served by one of the health services centers at each construction camp to be staffed by four medical personnel who would rotate shifts (DIRS 180922-Nevada Rail Partners 2007, p. 4-5). In addition, Nevada Test Site personnel could provide medical services for construction workers along common segment 6 as they do at present for workers at the Yucca Mountain Site. As is the practice at both the

Nevada Test Site and the Yucca Mountain Site, medical evacuation services from Las Vegas would transport cases to facilities in Clark County or in Utah as needed.

Nevertheless, to conservatively estimate potential impacts to health-care capacity in the region of influence, DOE assumed that all of the accident and injury cases would be treated at existing facilities in Nye or Lincoln County. This addition of fewer than 100 cases per year (related to the less than 1 percent increase in population attributable to the construction effort) could have a small adverse impact on the existing health-care capacity in Nye or Lincoln County. As described in Section 3.2.9, Nye and Lincoln Counties are considered medically underserved. The Nye Regional Medical Center in Tonopah and the Grover C. Dils Hospital in Caliente have ambulance services, but lack surgical facilities. The new hospital in Pahrump increased the county capacity to respond to routine and emergency and surgical needs, but the 25-bed increase in capacity might not be sufficient to meet current needs. Thus, any additional number of cases could affect the capacity of either Nye or Lincoln County to address the health-care needs of local users.

4.2.9.2.3.2 Education. Although there are only 29 schools in Lincoln, Nye, and Esmeralda Counties, it is unlikely that the capacities of these schools would be affected by railroad construction. DOE would not expect workers to be accompanied by their families and children because the availability of work camps and the use of 1- to 2-week work shifts would encourage workers to work from camps and return home on their weeks off to established residences in these counties, Clark County, or other Nevada counties. Any small increase in the number of children could be accommodated by the school systems, which have student-to-teacher ratios that are comparable to the national average.

4.2.9.2.3.3 Fire Protection. As discussed in Section 3.2.9, Lincoln, Nye, and Esmeralda Counties all meet fire-suppression needs with volunteers, with the exception of Pahrump, which has a paid fire department. Although most communities characterized in the region of influence are currently able to provide adequate protection (except for Pahrump, which is currently underserved), any increased demand would move them closer to the limit that existing resources (personnel and equipment) could address. However, each construction camp would have personnel dedicated to fire response, and water wells and a water-tank trailer that would be used to respond to fire emergencies at the camps and construction areas. Because of this and low population increases expected for volunteer-reliant Lincoln and Esmeralda Counties, construction-phase activities would not have an adverse impact on fire-protection capacity in the region of influence.

4.2.9.2.3.4 Law Enforcement. Because workers would be dispersed along the rail alignment, and given the low crime rate in the counties that would be directly affected (Lincoln, Nye, and Esmeralda) (particularly in comparison to the substantially higher Clark County and national crime rates), it is unlikely that the incidence of crime would increase to the extent that existing law enforcement services became inadequate. Additionally, construction camps would be staffed with security personnel (DIRS 180922-Nevada Rail Partners 2007, pp. 4-4 to 4-7). Although civil or domestic issues requiring law enforcement interface would be handled by the appropriate authorities, there have not been detailed discussions on protocols and working relationships. Accommodations could be made to decrease the possibility of adverse impacts to local law enforcement capacity.

4.2.9.2.4 Transportation Infrastructure

4.2.9.2.4.1 Traffic Impacts. The increased traffic required to support proposed railroad construction would have some additional effects on existing roadways. Key roads likely to be affected are portions of U.S. Highways 95, 6, and 93, and State Route 375. At present, these roads are mainly operating at levels of service A or B as defined in Section 3.2.9, except for a stretch of U.S. Highway 95 south of U.S. Highway 6 in Tonopah that is operating at level of service C. There could be impacts along these routes, particularly in communities that are near construction sites for the railroad operations support facilities.

Areas where local road systems could be most affected are Caliente/Eccles in Lincoln County, Tonopah, Beatty, Town of Amargosa Valley, at the entrance to the Yucca Mountain Site in Nye County, and Goldfield in Esmeralda County.

Railroad construction would generate vehicle trips during facilities construction, both from the movement of materials and from workers traveling to and from the work sites. Truck traffic would be highest at the beginning and end of the construction phase while equipment was brought in and taken away, and could therefore adversely impact traffic conditions during specific weeks. However, trucks could be directed to move during off-peak hours to minimize their impacts on local traffic. Additionally, most construction materials for the Interchange Yard, Staging Yard, and Maintenance-of-Way Trackside Facility would be transported by rail; therefore, there would be limited truck trips associated with the movement of materials for these facilities. For both reasons, the analysis does not account for transportation of materials, focusing instead on the transportation of workers to and from the work sites.

Construction of the rail line itself would not be likely to adversely affect traffic volumes on local roads, because much of the construction material would be transported by rail. Workers would be housed in construction camps close to work sites, which would place only limited pressure on the transportation infrastructure, mainly at the end of a work week and possibly over the weekend when travel to local towns might increase. Therefore, the analysis of impacts to levels of service focuses on construction of the railroad operations support facilities.

The level of service analysis evaluates the additional traffic volume in terms of the "peak hour," which is the hour with the highest volume of traffic during a study period, usually a peak period. For example, DOE estimated that the movement of employees for the Rail Equipment Maintenance Yard and the Cask Maintenance Facility would require approximately 600 trips per day and 300 trips during the peak hour at the height of construction activities. The traffic analysis assumes that each employee would generate two vehicle trips per day, one of which would be during the peak hour.

The level of service analysis in this section is conservative because it considers construction activities during a peak period when all workers are working simultaneously. DOE estimated the number of workers assigned to each facility (DIRS 182825-Nevada Rail Partners 2007, Appendix D, Table 2; DIRS 181425-MTS 2007, p. 5). Table 4-105 lists the estimated number of vehicle trips during the construction phase.

Based on the estimated increases in traffic volumes listed in Table 4-105, DOE calculated the effect on the level of service of the affected roadways during peak hour traffic for construction of the three key facilities. All affected roadways were assumed to be configured as two-lane, non-divided, paved highways.

Table 4-105. Estimated highway trips during construction of the railroad operations support facilities – Caliente rail alignment.[a]

Facility	Number of daily vehicle trips	Number of peak hour vehicle trips
Employees for construction of the Interchange Yard and Staging Yard	440	220
Employees for construction of the Maintenance-of-Way Facilities	340	170
Employees for construction of the Rail Equipment Maintenance Yard and Cask Maintenance Facility	600	300

a. Sources: DIRS 180874-Nevada Rail Partners 2007, Appendix D, Table 2; DIRS 181425-MTS 2007, p. 5.

The Interchange Yard would be near the former Union Pacific Railroad Caliente station and adjacent to the existing mainline (Caliente alternative segment) or immediately adjacent to the Union Pacific Railroad Mainline within the confines of Clover Creek Wash (Eccles alternative segment). As a conservative assumption, the analysis considered that the access point to the Interchange Yard would be on U.S. Highway 93 north of Caliente, because it is the busiest road segment for which traffic is measured. Construction of the Interchange Yard would degrade the level of service from A to B during the peak hour. A level of service of B is still considered free flow.

The Maintenance-of-Way Headquarters Facility would be 3 kilometers (5 miles) south of Tonopah, on the east side of U.S. Highway 95. The level of service on this highway would remain the same at C or better during the peak hour (that is, there would be no degradation of level of service). The Maintenance-of-Way Trackside Facility would be 5 kilometers (8 miles) south of U.S. Highway 6 on AR 504, close to the boundary of the Nevada Test and Training Range, and DOE assumed that its access point would be on U.S. Highway 6 east of the Tonopah airport. The level of service on this road would remain at A (that is, there would be no degradation of level of service).

Construction of the Rail Equipment Maintenance Yard, the Cask Maintenance Facility, and possibly the Nevada Railroad Control Center and National Transportation Operations Center would affect traffic on U.S. Highway 95 near the entrances to the Yucca Mountain Site, degrading its level of service from B to C during the peak hour. Level C would still represent stable traffic flow, but would mark the beginning of the range of flow that would become affected by interactions with others in the traffic stream.

4.2.9.2.4.2 Traffic Delay at Grade Crossings. DOE examined the potential for delays at grade crossings along the Caliente rail alignment. Rail-highway crossings can be a source of delay to motorists because trains have movement priority. A typical delay analysis at grade crossings accounts for train length, speed, and frequency, and lag time (the interval between the time when the gate goes down and the time the train passes, and the interval between the time the train leaves and the time the gate goes up). Additionally, a delay analysis also requires vehicular arrival and departure rates. Although grade-separated crossings are not mandatory for this project, rail line crossings of U.S. Highway 93, U.S. Highway 95, State Route 318, and State Route 345 would be grade-separated, as described in Chapter 2. All remaining crossings, which would be at grade, would involve very-low-usage roads, and the impact on vehicle delay at these crossings would be small. A quantitative analysis of delay at grade crossings is not necessary for three reasons: there would be very few construction trains per day, the trains associated with the proposed railroad would be short compared to most freight trains, and vehicular traffic is low.

Because of the small changes in population and employment during the construction phase that could be caused should DOE select Goldfield alternative segment 4, the discussion related to traffic impacts will not differ whichever Goldfield alternative segment were chosen.

4.2.9.3 Railroad Operations Impacts

The common social and economic activities and changes associated with the operations phase would include:

- Increases in project-related employment, particularly associated with railroad operations support facilities
- Slight population increases associated with employment increases
- Some pressure on housing in southern Nye County where the Cask Maintenance Facility, Rail Equipment Maintenance Yard, train crew quarters, and possibly the Nevada Railroad Control Center and National Transportation Operations Center would be

- Continued effects on mining and agriculture
- Possible effects on public services (health and education)
- Possible effects on transportation infrastructure

4.2.9.3.1 Employment and Income

Local impacts during the operations phase would be linked to the location of facilities, size of the workforce, and the extent to which the community would provide goods and services to facilities and workers. Table 4-106 lists the estimated number of full-time-equivalent workers that would be required for each railroad operations support facility. DOE used these employment figures as input to the *Policy Insight* model.

Table 4-106. Estimated average employment by railroad operations support facility – Caliente rail alignment.[a]

Facility	Location	Workforce (full-time equivalent)
Facilities at the Interface with the Union Pacific Railroad Mainline	Eccles or Caliente	50
Cask Maintenance Facility	Collocated with the Rail Equipment Maintenance Yard	30
Nevada Railroad Control Center/National Transportation Operations Center	Staging Yard or at end of line collocated with the Rail Equipment Maintenance Yard	15
Maintenance-of-Way Trackside Facility	Nye County	40
Maintenance-of-Way Trackside Facility	Esmeralda County	10
Rail Equipment Maintenance Yard	Inside Yucca Mountain Site boundary near the repository	25
Train crew	Train with overnight stays	10 (per train)

a. Sources: DIRS 180919-Nevada Rail Partners 2007, Table 3-A; DIRS 182825-Nevada Rail Partners 2007, Table 3.

Should DOE select Goldfield alternative segment 4, there could be a consolidated Maintenance-of-Way Facility in Esmeralda County rather than separate Maintenance-of-Way Facilities in Esmeralda and Nye Counties. The workforce at the consolidated Maintenance-of-Way Facility would be 50.

As it did for railroad construction, DOE modeled two scenarios for railroad operations – one with the Nevada Railroad Control Center and the National Transportation Operations Center in Lincoln County (Scenario 1), and the other with these facilities in Nye County (Scenario 2).

DOE modeled employment of operations workers and some support workers as beginning in 2015 and ending in 2067. Table 4-107 lists the economic impacts of both scenarios during the operations phase. All operations-related economic impact values are given in 2006 dollars.

In Lincoln County, increases in economic measures would be similar under the two scenarios; however, the larger increases would be for Scenario 1, with the Nevada Railroad Control Center and National Transportation Operations Center in Lincoln County. The total increased employment in Lincoln County would average about 100 jobs annually over the operations phase. This would represent a 3.9-percent average annual increase above the projected annual average employment level without the project. See Table 3-57 for baseline employment data. The peak operations-related impact to real disposable income,

Table 4-107. Estimated changes in average annual economic measures during the operations phase – Caliente rail alignment.[a]

Location/scenario	Total employment	Real disposable income	Gross regional product	State and local government expenditures
Lincoln County				
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Lincoln County	100	$6.4 million	$8.9 million	$2.0 million
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County	75	$4.3 million	$6.9 million	$1.4 million
Nye County				
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Lincoln County	75	$6.9 million	$15.9 million	$1.3 million
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County	80	$7.2 million	$16.9 million	$1.4 million
Esmeralda County				
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Lincoln County	13	$1.1 million	$1.5 million	$207,000
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County	13	$1.1 million	$1.5 million	$206,000
Clark County				
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Lincoln County	89	$12.5 million	$12.9 million	$1.5 million
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County	96	$13.3 million	$14.2 million	$1.6 million

a. Sources: DIRS 179558-Bland 2007, all; DIRS 180485-Bland 2007, all.

gross regional product, and state and local government spending corresponds to 4.7-percent, 5.2-percent, and 3.2-percent increases above the projected levels for each measure without the project, respectively.

In Nye County, the greater increases in economic measures would be for Scenario 2, with the Nevada Railroad Control Center and the National Transportation Operations Center in Nye County. However, all increases would represent less than a 1-percent average annual increase over the projected annual average without the project. Should DOE select Goldfield alternative segment 4, economic activity related to the

Maintenance-of-Way Facility would take place in Esmeralda County rather than Esmeralda and Nye Counties, and economic measures in Nye County would be reduced from those shown in Table 4-108. For Scenario 2, growth in employment would be reduced by 46 to 34, growth in real disposable income would be reduced by approximately $2.6 million to $4.6 million, growth in the gross regional product would be reduced by approximately $7 million to $9.9 million, and state and local government spending would be reduced by approximately $500,000 to $900,000. The reductions would be the same for Scenario 1.

Table 4-108. Estimated changes to population during railroad operations – Caliente rail alignment.[a]

Location	Average change in population
Lincoln County	
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Lincoln County	181
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County	124
Nye County	
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Lincoln County	224
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County	237
Esmeralda County	
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Lincoln County	20
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County	20
Clark County	
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Lincoln County	330
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County	350

a. Sources: DIRS 179558-Bland 2007, all; DIRS 180485-Bland 2007, all.

In Esmeralda County, changes in economic measures during the operations phase would be nearly identical under the two scenarios. The annual average change in employment would be an average increase of 13 jobs over the baseline during the operations phase. The average increases in economic indicators would be $1.1 million above the baseline for real disposable income, $1.5 million above the baseline for gross regional product, and $200,000 above the baseline for state and local government spending. Should DOE select Goldfield alternative segment 4, economic activity related to the Maintenance-of-Way Facility would take place in Esmeralda County rather than Esmeralda and Nye Counties, and economic measures in Esmeralda County would be increased from those shown in Table 4-108. For Scenario 1, growth in employment would be increased by 58 from 70, growth in real disposable income would be increased by approximately $4.1 million to $5.2 million, growth in gross regional product would be increased by approximately $8.5 million to $10.0 million, and state and local government spending would be increased by approximately $770,000 to $980,000. The increases would be the same for Scenario 2.

In Clark County, the greater increases in economic measures would be observed under Scenario 2, with the Nevada Railroad Control Center and National Transportation Operations Center in Nye County. However, all increases would represent less than a one-tenth of 1-percent average annual increase over the projected annual average without the project.

Section 4.2.11, Utilities, Energy, and Materials, describes impacts related to the use of construction materials and fossil fuel during the construction and operations phases.

The small economic impacts to mining and agriculture identified for the construction phase would continue during the operations phase. As for the construction phase, there would be a risk of trains colliding with cattle. DOE would compensate ranchers for any loss of cattle during railroad operations in accordance with Nevada Revised Statutes 705.150 to 705.200. Train and track inspection and maintenance activities would be confined to areas disturbed by construction activities, so there would be no additional disturbances to the physical environment. There could be some areas that were disturbed during construction activities that would not be affected during operations (for example, staging areas), and on which agricultural and mining activities could be resumed. Areas disturbed during construction but not needed for operations would be reclaimed in accordance with BLM guidance.

4.2.9.3.2 Population and Housing

Population changes would be related to changes in employment. DOE modeled employment of railroad operations workers and some support workers as beginning in 2015 and ending in 2067. Population impacts are estimated for the same period. Table 4-108 lists estimated population changes for the two modeled scenarios during the operations phase.

In Lincoln County, Scenario 1 would result in an average gain of 181 people annually above the projected levels without the project. Of this increase, about 43 people would be school-aged children, according to the age distribution of Lincoln County published by the Bureau of the Census (DIRS 175921-Bureau of Census 2000, all). The estimated average annual population increase attributed to the operations phase would be 2.9 percent above Lincoln County's projected population annual average without the project.

At the county level, Lincoln County might be able to absorb the increased demand for housing. At present there are 638 vacant housing units in Lincoln County (see Table 3-62), and plans for new housing development in the Coyote Springs Valley.

In Nye County, the greater average increase in population would be under Scenario 2, with an average gain of 237 people annually above the projected levels without the project. Of this increase, about 42 would be school-aged children, according to the age distribution of Nye County published by the Bureau of the Census (DIRS 171298-Bureau of the Census 2004, all). The estimated average annual population increase attributed to the operations phase would be less than 1 percent above Nye County's population projected annual average level without the project.

At the county level, Nye County, with 2,625 vacant housing units, would likely be able to absorb the increased demand for housing. Within the county, workers would likely choose to live in southern Nye County, where the Cask Maintenance Facility, Rail Equipment Maintenance Yard, train crew quarters, and possibly the Nevada Railroad Control Center and National Transportation Operations Center would be. The 1,058 vacant housing units in Pahrump could accommodate increased demand, though it should be noted that Pahrump has been undergoing a substantial population increase recently (more than 25 percent between 2000 and 2004). Future increases in population are expected, which will place additional demand on the current housing stock. Therefore, project-worker demand for housing in the community would have the potential to create small impacts on the supply of available housing. No impact is expected on housing availability in the Tonopah area; the number of operations workers residing in that community would likely be small, and there would be adequate vacant housing available in the community to accommodate this increase, as discussed in Section 3.2.9. Should DOE select Goldfield alternative segment 4, there would be decreases in Nye County population growth of 108 people below the growth shown in Table 4-108 during the operations phase (DIRS 185436-Bland 2008, all). Including the decrease, operation of the Nevada railroad could increase the Nye County population by 129 people above the baseline. Should Goldfield alternative segment 4 be chosen, there will be a potential to create small impacts on the supply of available housing in Pahrump.

In Esmeralda County, the average increase in population would be the same under either scenario, with an average gain of 20 people annually above the projected levels without the project. Of this increase, about three would be school-aged children, according to the age distribution of Esmeralda County published by the Bureau of the Census (DIRS 175922-Bureau of Census 2000, all). The estimated average annual population increase attributed to the operations phase is 2 percent above the baseline. Should DOE select Goldfield alternative segment 4, there would be additional increases in Esmeralda County population growth of approximately 80 people beyond that shown in Table 4-108 during the operations phase (DIRS 185436-Bland 2008, all). Including the increase, operation of the Nevada railroad could increase the Esmeralda County population by approximately 100 people above the baseline. This would increase the number of school-aged children by about 15, an increase of about 17 percent above current school enrollment.

At the county level, Esmeralda County, with 378 vacant housing units, would likely be able to absorb the increased demand for housing. At the local level, no impact is expected on housing availability in Goldfield or Tonopah, which are both close to where the Maintenance-of-Way Headquarters Facility, or the consolidated Maintenance-of-Way Facility, would be. The number of operations workers residing in either community would likely be small, and there would be adequate vacant housing available, as discussed in Section 3.2.9.

In Clark County, the greater average increase in population would be under Scenario 2, with an average gain of 350 people annually above the projected levels without the project. Of this increase, about 63 would be school-aged children, according to the age distribution of Clark County published by the Bureau of the Census (DIRS 171297-Bureau of the Census 2004, all). The estimated average annual population increase attributed to the operations phase would be a less than one-tenth of 1-percent increase above Clark County's projected population annual average level without the project.

4.2.9.3.3 Public Services

Railroad operations along the Caliente rail alignment would result in small impacts to health-care capacity in Lincoln, Nye, and Esmeralda Counties and on education infrastructure in southern Nye County (Pahrump). The exact extent of impacts to other public services would depend on the total number of workers and their residential locations, and operations activities in relation to existing system capacity. However, workers could create small to moderate impacts in the form of additional demand for fire-protection services in Lincoln, Nye, and Esmeralda Counties.

4.2.9.3.3.1 Health Care. The increased demand for health care associated with the railroad operations support facilities could result in small adverse impacts by straining the existing health service capacity. As discussed in Sections 3.2.9, Lincoln, Nye, and Esmeralda Counties are all considered medically underserved.

In particular, population impacts associated with facilities in southern Nye County could place increased demand on the health-care system in the county. The peak average increase in Nye County's permanent population would be 237 people (0.32 percent above the projected population without the project, or less than one-third of 1 percent), and it is assumed that many of these people would reside in or near Pahrump. Pahrump does have preventive care clinics and a new hospital although, as noted in Section 4.2.9.2.3.1, it is not clear whether the hospital is able to serve the routine and emergency health-care needs of the local population. Increased demand related to project increases in workers and permanent population, however small, could adversely affect the capacity of Pahrump's health-care system to meet local needs. If the Nevada Railroad Control Center and National Transportation Operations Center were in Lincoln County instead of Nye County, the impacts to the health-care system in Nye County would be slightly less. Under this scenario, Nye County's permanent population would increase by 225 people, which would represent a 0.31-percent average increase.

4.2.9.3.3.2 Education. As indicated in Section 4.2.9.3.2, the annual impact to schools in Lincoln, Nye, and Esmeralda Counties that would result from the increase in population would average about 43, 42, and three additional pupils, respectively. The operations phase workforce could place limited strains on the education system in Lincoln and Nye Counties, resulting in a small, if any, impact. The exact extent of this impact would depend on the final location of railroad operations support facilities, where workers choose to reside, whether workers relocated families and children, the ages of children, and the capacities of particular schools in 2015 and later. A 2000 study indicated that Lincoln County was operating at approximately 50 percent at the time and had sufficient capacity to absorb new students that would result from the increase in population (DIRS 185245-Intertech Services Corporation 2000, all). A more recent report, the *Lincoln County Master Plan*, indicates the Lincoln County School District is operating at 93 percent of capacity. According to the *Lincoln County Master Plan*, the impact of adding approximately 6 percent of projected new students could place the county at or beyond capacity and require additional teachers and/or facilities (DIRS 185538-Lincoln County 2007, all).

The location of railroad facilities at the end of the line could result in many workers and their families residing in Pahrump (Nye County). As noted in Section 3.2.9, independent of the proposed railroad, Pahrump is experiencing a fairly rapid increase in its population, and all schools are functioning at or above maximum design capacity. Further baseline population increases are predicted, meaning that even without project-related impacts, school capacity would become strained in the future. While any additional increases to the projected baseline population would increase the need for school capacity, the estimated additional 30 students associated with the proposed railroad would be a small incremental increase in relation to the school population increases Pahrump is experiencing at present. Therefore, the projected increase the project would create would result in only a small impact.

Impacts in Esmeralda County would be limited because the number of resident workers at the Maintenance-of-Way Headquarters Facility would be small; the elementary school system in Esmeralda County can accommodate an additional 100 students (DIRS 174970-Arcaya 2005, all); and students can attend high school in Tonopah, where there are elementary, middle, and high school facilities. The influx of operations-phase workers to Tonopah or Goldfield would not adversely affect school capacities. Should DOE select Goldfield alternative segment 4, there would be additional increases in population. This would increase the number of school-aged children by about 15, an increase of about 17 percent above current school enrollment. This could increase enrollments by one to two students for each grade level and place small impacts on the schools.

4.2.9.3.3.3 Fire Protection. As discussed in Section 4.2.9.2.3.3, Lincoln, Nye, and Esmeralda Counties all meet fire-suppression needs with volunteers, with the exception of Pahrump's paid fire department. At present, most communities characterized in the region of influence are able to provide adequate protection (except for Pahrump, which is currently underserved, and Lincoln County, which County representatives consider overextended), but increased demand on these services could move them closer to the limit than existing resources (personnel and equipment) could address. Increases to permanent county populations could result in small to moderate impacts in Lincoln, Nye, and Esmeralda Counties, and particularly in Pahrump, where, as noted in Section 3.2.9, fire-protection capabilities are already overextended. With the Cask Maintenance Facility collocated with the Rail Equipment Maintenance Yard, and most workers and their families residing in Pahrump, these additional demands on the fire-protection capabilities of Pahrump could affect the system's ability to meet the community's needs.

4.2.9.3.3.4 Law Enforcement. Given the low crime rates in Lincoln, Nye, and Esmeralda Counties, it is not likely that population increases would increase the incidence of crime to the extent that the existing level of law enforcement services would become inadequate to meet the demand.

4.2.9.3.4 Transportation Infrastructure

4.2.9.3.4.1 Traffic Impacts. There would be fewer road traffic impacts during the operations phase than during the construction phase because there would be considerably fewer workers during the operations phase. DOE estimates that a total of 170 employees would be needed to operate the railroad operations support facilities. A total of 70 employees would be working at the Nevada Railroad Control Center, and National Transportation Operations Center, Rail Equipment Maintenance Yard, and Cask Maintenance Facility. Additionally, 50 employees would work at the Interchange Yard and the Staging Yard, and 50 would work at the Maintenance-of-Way Facilities (DIRS 182825-Nevada Rail Partners 2007, Appendix D, Table 4). Table 4-109 summarizes the projected number of vehicle trips that would be generated during the operations phase, assuming that each of these employees would generate two trips per day, one of them during the peak hour. The affected road segments would be the same as the ones considered in the analysis for the construction phase (see Section 4.2.9.2.4.1).

Table 4-109. Projected highway trips during operation of the railroad operations support facilities – Caliente rail alignment.[a]

Facility	Number of daily vehicle trips	Number of peak hour vehicle trips
Employees for operation of the Staging Yard and Interchange Yard	100	50
Employees for operation of the Maintenance-of-Way Facilities	100	50
Employees for operation of the facilities inside the Yucca Mountain Site boundary near the repository	140	70

a. Source: DIRS 180874-Nevada Rail Partners 2007, Appendix D, Table 4.

DOE determined that the projected trips listed in Table 4-109 for the three key areas could result in the following impacts to traffic:

- Operations at the Facilities at the Interface with the Union Pacific Railroad Mainline would not degrade the level of service on U.S. Highway 93 at Caliente, which would remain at level A.
- Operations at the Maintenance-of-Way Headquarters Facility would not reduce the level of service on U.S. Highway 95 south of Tonopah, which would remain at level C or better during the peak hour. Operations at the Maintenance-of-Way Trackside Facility would not degrade the level of service on U.S. Highway 6 east of the Tonopah Airport, which would remain at level A.
- Operations at the facilities inside the Yucca Mountain Site boundary near the repository would affect traffic along U.S. Highway 95 near the entrance to the Yucca Mountain Site, which would degrade the level of service from B to C. Level C would still represent stable traffic flow, but would mark the beginning of the range of flow that would become affected by interactions with others in the traffic stream.

Increased traffic from railroad operations along the Caliente rail alignment would be sufficient to change the level of service from B to C on U.S. Highway 95 near the entrances to the Nevada Test Site; however, because this increased traffic volume would still represent stable flow conditions, such impacts would be moderate.

4.2.9.3.4.2 Traffic Delay at Grade Crossings. DOE examined the effects of the Caliente Implementing Alternative on delay at grade crossings along the proposed alignment. Rail-highway crossings can be a source of delay to motorists because trains have movement priority. A typical delay analysis at grade crossings accounts for train length, speed, and frequency, and lag time (the interval between the time when the gate goes down and the time the train passes, and the interval between the time the train leaves and the time the gate goes up). Additionally, a delay analysis also requires vehicular arrival and departure rates. Although grade-separated crossings would not be mandatory for this project (DIRS 180695-DOT 2002, p. 45), U.S. Highway 93, U.S. Highway 95, State Route 318, and State Route 345 would be grade separated, as described in Chapter 2. All remaining crossings, which would be at grade, would involve very-low-usage roads, and impact on vehicle delay at these crossings would be small. A quantitative analysis of delay at grade crossings is not necessary for three reasons: there would be very few trains per day, the trains associated with the proposed railroad would be short compared to most freight trains, and vehicular traffic is low.

4.2.9.4 Impacts under the Shared-Use Option

The Shared-Use Option could result in additional facilities to support commercial use of the DOE railroad. Shared-use facilities could include access sidings in any of the following areas: Caliente, Panaca/Bennett Pass, Warm Springs Summit, Tonopah, Goldfield, and the Beatty Wash/Oasis Valley area. Consideration of the Shared-Use Option addresses only those impacts that are reasonably foreseeable based on existing conditions in the affected communities.

4.2.9.4.1 Construction Impacts under the Shared-Use Option

Because commercial entities or local governments would build commercial sidings at the locations of selected passing sidings (to the extent practicable), the incremental effort to construct the commercial sidings would be reduced. While there would be a need for some additional materials and labor, the increase over that needed under the Proposed Action without shared use would be small. As discussed in the following sections, DOE would expect impacts on population and housing; employment and income; public services; and transportation resources to be small under the Shared-Use Option, and similar to those under the Proposed Action without shared use.

4.2.9.4.1.1 Population and Housing. Given the minimal increase in economic activity that would be associated with railroad construction under the Shared-Use Option, there would be no to low population changes and attendant pressures on the available housing stock.

4.2.9.4.1.2 Employment and Income. There could be very limited increases in employment and income associated with construction under the Shared-Use Option. These increases would be similar to the changes in employment and income associated with construction under the Proposed Action without shared use. There could be limited loss of economic activity associated with land acquisition for the commercial-siding and parking-area rights-of-way, but DOE would expect such impacts, if any, to be small.

4.2.9.4.1.3 Public Services. Railroad construction under the Shared-Use Option would impact existing public services similar to the Proposed Action without shared use. Given the minimal incremental change in labor and population under the Shared-Use Option, impacts to health, education, law enforcement, and fire-protection services would be small.

4.2.9.4.1.4 Transportation Infrastructure. The volume of daily and peak-hour trips that would be generated during railroad construction under the Shared-Use Option would be consistent with the volumes generated under the Proposed Action without shared use. For purposes of this analysis, DOE assumed that commercial access sidings and facilities would be constructed at the same time as the rail line, although it could also occur at a later date. There would be little increased traffic volume beyond that described for the Proposed Action without shared use.

The construction approach under the Shared-Use Option would be the same as that described for the Proposed Action without shared use, with construction being phased and best management practices implemented. Because, to the extent practicable, commercial sidings would be built at the locations of selected passing sidings, the incremental effort to construct commercial-use sidings would be minimized. There would be no need for additional construction camps and no need for new roads because the temporary access roads would also be used for commercial siding construction. Therefore, although there would be a need for some additional materials and labor under the Shared-Use Option, there would be little increase beyond that described for the Proposed Action without shared use. Based on the lengths of track involved under the Shared-Use Option, the incremental impacts to traffic from constructing the additional sidings would be a small fraction of the overall impacts for railroad construction under the Proposed Action without shared use. Thus, impacts to the transportation infrastructure under the Shared-Use Option would be small.

Traffic delay impacts at highway-rail grade crossings from construction trains would be consistent with the delay impacts under the Proposed Action without shared use. These impacts would be small.

4.2.9.4.2 Operations Impacts under the Shared-Use Option

Under a DOE-funded cooperative agreement, Nye County commissioned a study of the potential economic benefits to Lincoln, Nye, and Esmeralda Counties during construction and operation of the proposed railroad along the Caliente rail alignment (DIRS 174090-Wilbur Smith Associates 2005, all). The impact assessment for railroad operations under the Shared-Use Option draws on information from this 2005 report and from a DOE analysis (DIRS 180694-Ang-Olson and Gallivan 2007, all), as described in Section 2.2.6. The Nye County report was updated by a Nye County consultant in 2007 (DIRS 185244-Nuclear Waste Project Office 2007, all). Information from the 2007 report is presented in Sections 4.2.9.4.2.1 and 4.2.9.4.2.2. In the near term, commercial shippers using the DOE raiload would be existing nearby companies that currently transport materials and goods by truck.

4.2.9.4.2.1 Population and Housing. It is not likely that there would be noticeable increases in population associated with railroad operations under the Shared-Use Option. Increases in economic activity and associated indicators, particularly in terms of employment, would likely be limited and therefore would not generate substantial changes in permanent population. Therefore, DOE would expect no impacts on housing under the Shared-Use Option.

Nye County's 2007 report (DIRS 185244-Nuclear Waste Project Office 2007, all) estimated increases in employment and income (see Section 4.2.9.4.2.2) due to shared use. Based on Nye County's estimated increase in wages (DIRS 185244-Nuclear Waste Project Office 2007, all), DOE used the REMI *Policy Insight* model to estimate that shared use would lead to an increase in population of approximately 650 above the DOE estimates after 10 years of operations, an increase of less than 1 percent (DIRS 185435-Bland 2008, all). If the Nye County employment and income estimates were to be realized, then the impacts might be larger than DOE expects, although still small. As discussed in Chapter 7, DOE would establish monitoring programs in counties containing the Nevada railroad to evaluate future impacts and the need for potential mitigation related to the Nevada raiload, including those from shared use and transportation issues arising from the repository.

4.2.9.4.2.2 Employment and Income. Shared use of the DOE railroad could allow business activity to develop and expand in the region of influence, which would result in some employment and income benefits. For some companies, especially those involved in the shipment of heavy or bulk products, the railroad could allow firms to access new markets and to ship greater quantities of products to existing and new markets.

Based on the Nye County report (DIRS 174090-Wilbur Smith Associates 2005, all) and the DOE analysis (DIRS 180694-Ang-Olson and Gallivan 2007, all), and as described in Section 2.2.6, overall potential commercial shipments are estimated at 1,050,000 metric tons (1,154,000 tons) or 11,540 carloads annually, with shipments of stone estimated at 169,000 metric tons (186,000 tons) or 1,860 carloads (consisting primarily of outgoing decorative rock); nonmetallic mineral at 500,000 metric tons (550,000 tons) or 5,500 carloads (consisting primarily of pozzolan); and petroleum products at 273,000 metric tons (300,000 tons) or 3,000 carloads (consisting of incoming crude oil).

Based on these shipments, increases in revenue might generate small direct and indirect employment and income impacts.

Nye County, in its recent 2007 report (DIRS 185244-Nuclear Waste Repository Project Office 2007, all) estimated there would be approximately 240 direct jobs created in Nye County as a result of increased economic activity from shared use. This would be approximately 1 percent of the baseline number of direct jobs (23,000) estimated by DOE for 2025 (Table 3-60). Including indirect jobs, the total increase in jobs estimated by Nye County would be approximately 360 (1.5 percent of the baseline), and total new wages brought into the county would be approximately $11.2 million.

Railroad operations under the Shared-Use Option would also generate small employment and income impacts. It is expected that a crew of three people would be needed to operate the commercial train service. As discussed in Section 2.2.4.1, depending on the total travel time for the commercial train, a crew change point might be needed in the Tonopah area. Train crews would use local commercial facilities for sleeping and provision needs, causing some small, but positive, impacts to employment and income. There might also be small economic benefits associated with maintenance of the commercial rail facilities by a commercial contractor.

4.2.9.4.2.3 Public Services. Because the impacts to population and employment would be so small in Lincoln, Esmeralda, Nye, and Clark Counties, impacts to public services under the Shared-Use Option would be small in any of these counties.

4.2.9.4.2.4 Transportation Infrastructure. Under the Shared-Use Option, commercial rail service would begin after the completion of construction. During railroad operations, trains carrying casks would have priority over trains carrying commercial shipments in terms of time in transit. Up to eight one-way commercial trains per week would run along the rail line (DIRS 180694-Ang-Olson and Gallivan 2007, all). For comparison, an average total of 17 one-way trains would run between the Staging Yard and the Rail Equipment Maintenance Yard per week carrying casks and other materials for ***maintenance-of-way activities*** (DIRS 175036-BSC 2005, Table 4.2). The commercial trains (not including the locomotives) would consist of up to 60 cars and would be approximately 1,100 meters (3,600 feet) long. Depending on the weight of the train, three or four locomotives would be required (DIRS 176756-Ang-Olson and Khan 2005, all).

Commercial trains would haul a range of products to and from businesses, including stone and other nonmetallic minerals, oil and petroleum products, and nonradioactive waste materials. DOE expects the operating characteristics of these trains to be similar to those typical of freight train operations. The Nevada Railroad Control Center would control and coordinate commercial rail service movements and would therefore maintain overall safety of operations along the rail line.

The volume of daily and peak-hour vehicle trips that would be generated during operations under the Shared-Use Option would be consistent with operations under the Proposed Action without shared use. There would be little increase in traffic volumes beyond those described in Section 4.2.9.2.4.1.

During operation of commercial service on the raiload, there would be an increase in truck traffic to and from the commercial sidings as compared to the Proposed Action without shared use. DOE assumed that under the Proposed Action without shared use, private companies near the railroad would continue to ship and receive freight using truck-only transport. Under the Shared-Use Option, some of those shipments would be diverted to rail, with trucks accessing the commercial sidings. The reduced number of truck shipments that would result from rail shipment would offset the adverse impacts due to the additional increase in number of trucks under the Shared-Use Option. Therefore, DOE would anticipate little increase in adverse impacts to the traffic levels of service of nearby roadways. Also, the increase in the number of workers under the Shared-Use Option at the facilities at the Interchange with the Union Pacific Railroad Mainline and the Rail Equipment Maintenance Yard would be small; therefore, adverse impacts would be small.

Road traffic delay impacts at highway-rail grade crossings would be consistent with the delay impacts under the Proposed Action without shared use. These impacts would be small.

4.2.9.5 Summary

Table 4-110 summarizes the potential socioeconomic impacts of constructing and operating the proposed railroad along the Caliente rail alignment. Impacts under the Shared-Use Option would be the same as those under the Proposed Action without shared use; however, DOE recognizes the uncertainty in increased economic development. Table 4-110 also includes changes that would occur should DOE select Goldfield alternative segment 4, consolidating the Maintenance-of-Way Facilities in Esmeralda County.

Potential impacts to socioeconomics from constructing and operating the proposed railroad along the Caliente rail alignment include the following:

- Population increases in all of the counties in the region of influence during the construction phase. The greatest percentage increase in population would be in Lincoln County (1.7 percent) and Esmeralda County (1.1 percent).
- Population increases in all of the counties in the region of influence during the operations phase. The greatest percentage increase in population would be in Lincoln County (2.9 percent) and Esmeralda County (2 percent). Table 4-110 also includes changes that would occur should DOE select Goldfield alternative segment 4, consolidating the Maintenance-of-Way Facilities in Esmeralda County.
- Employment increases in all of the counties in the region of influence during the construction phase. The greatest percentage increase in employment would be in Lincoln County (5.6 percent) and Esmeralda County (2.7 percent).
- Employment increases in all of the counties in the region of influence during the operations phase. The greatest percentage increase in employment would be in Lincoln County (3.9 percent) and Esmeralda County (3 percent). For Goldfield alternative segment 4, Esmeralda County employment would increase by 16 percent.
- Real disposable income increases in all of the counties in the region of influence during the construction phase. The greatest percentage increase in real disposable income would be in Esmeralda County (7.6 percent) and Lincoln County (4.1 percent).

- Real disposable income increases in all of the counties in the region of influence during the operations phase. The greatest percentage increase in real disposable income would be in Lincoln County (4.7 percent) and Esmeralda County (2.9 percent). For Goldfield alternative segment 4, Esmeralda County employment would increase by 16 percent.
- Gross regional product increases in all of the counties in the region of influence during the construction phase. The greatest percentage increase in gross regional product would be in Lincoln County (28 percent) and Esmeralda County (9.5 percent).
- Gross regional product increases in all of the counties in the region of influence during the operations phase. The greatest percentage increase in gross regional product would be in Lincoln County (5.2 percent) and Esmeralda County (3.8 percent). For Goldfield alternative segment 4, Esmeralda County employment would increase by 16 percent.
- State and local government spending increases in all of the counties in the region of influence during the construction phase. The greatest percentage increase in state and local government spending would be in Esmeralda County (2.2 percent) and Lincoln County (1.9 percent).
- State and local government spending increases in all of the counties in the region of influence during the operations phase. The greatest percentage increase in state and local government spending would be in Lincoln County (3.2 percent) and Esmeralda County (3.1 percent). For Goldfield alternative segment 4, Esmeralda County state and local government spending would increase by 14 percent.

Impacts to public services and transportation are discussed in Table 4-110.

Table 4-110. Summary of impacts to socioeconomic conditions – Caliente rail alignment[a,b] (page 1 of 3).

County	Construction	Operations
Lincoln	Population and housing • Population: 1.7 percent increase Employment and income • Employment: 5.6 percent increase • Real disposable income: 4.1 percent increase • Gross regional product: 28 percent increase • State and local government spending: 1.9 percent increase Public services: small impacts Transportation • Traffic impacts to local highways: level of service on U.S. Highway 93 at Caliente would degrade from A to B • Delay impacts on road traffic at grade crossings: small	Population and housing • Population: 2.9 percent increase Employment and income • Employment: 3.9 percent increase • Real disposable income: 4.7 percent increase • Gross regional product: 5.2 percent increase • State and local government spending: 3.2 percent increase Public services • Small impacts to health-care services due to population increases in a medically underserved area • Small impacts to fire-protection services due to population increases • Addition of 43 students to schools nearing capacity Transportation • Traffic impacts to local highways: no change in level of service Delay impacts on road traffic at grade crossings: small

Table 4-110. Summary of impacts to socioeconomic conditions – Caliente rail alignment[a,b] (page 2 of 3).

County	Construction	Operations
Nye	Population and housing • Population: 0.2 percent increase Employment and income • Employment: 1.2 percent increase • Real disposable income: 0.9 percent increase • Gross regional product: 3.5 percent increase (3.3 percent increase for Goldfield alternative segment 4) • State and local government spending: 0.4 percent increase Public services: small impacts • Addition of fewer than 100 cases per year to health-care facilities Transportation • Traffic impacts to local highways: level of service on U.S. Highway 95 near access to the Yucca Mountain Site would degrade from B to C • Delay impacts on road traffic at grade crossings: small	Population and housing • Population: 0.3 percent increase (0.3 percent increase for Goldfield alternative segment 4) • County-wide population increase of 237 could place strain on supply of 1,058 vacant housing units in Pahrump Employment and income • Employment: 0.3 percent increase (0.2 percent increase for Goldfield alternative segment 4) • Real disposable income: 0.3 percent increase (0.2 percent increase for Goldfield alternative segment 4) • Gross regional product: 0.5 percent increase (0.2 percent increase for Goldfield alternative segment 4) • State and local government spending: 0.3 percent increase (0.2 percent increase for Goldfield alternative segment 4) Public services • Moderate impacts to health-care services due to population increases in a medically underserved area • Moderate impacts to fire-protection services in Pahrump due to population increases in an underserved area • Addition of 42 school-aged children to overcrowded schools Transportation • Traffic impacts to local highways: level of service on U.S. Highway 95 near access to the Yucca Mountain Site would degrade from B to C • Delay impacts on road traffic at grade crossings: small
Esmeralda	Population and housing • Population: 1.1 percent increase Employment and income • Employment: 2.7 percent increase •	Population and housing • Population: 2 percent increase (10 percent increase for Goldfield alternative segment 4) • Employment: 3 percent increase (16.2 percent increase for Goldfield alternative segment 4)

Table 4-110. Summary of impacts to socioeconomic conditions – Caliente rail alignment[a,b] (page 3 of 3)

County	Construction	Operations
Esmeralda (continued)	Employment and income • Real disposable income: 7.6 percent increase • Gross regional product: 9.5 percent increase • State and local government spending: 2.2 percent increase Impacts to mining: Goldfield 1 would intersect six patented mining claims; Goldfield 3 would intersect two; and Goldfield 4 would intersect four	Employment and income • Real disposable income: 2.9 percent increase (13.7 percent increase for Goldfield alternative segment 4) • Gross regional product: 3.8 percent increase (28 percent increase for Goldfield alternative segment 4) • State and local government spending: 3.1 percent increase (14.1 percent increase for Goldfield alternative segment 4) Impacts to mining: Goldfield 1 would intersect six patented mining claims; Goldfield 3 would intersect two; and Goldfield 4 would intersect four
	Public services: small impacts Transportation • Traffic impacts to local highways: no change in level of service • Delay impacts on road traffic at grade crossings: small	Public services • Small impacts to health-care services due to population increases in a medically underserved area • Small impacts to fire-protection services due to population increases • Three additional students to schools due to population increases (17 percent increase in students for Goldfield alternative segment 4) Transportation • Traffic impacts to local highways: no change in level of service • Delay impacts on road traffic at grade crossings: small
Clark	Population and housing[b] • Population: < 0.1 percent increase Employment and income • Employment: 0.1 percent increase • Real disposable income: 0.2 percent increase • Gross regional product: 0.2 percent increase • State and local government spending: small increase Public services: small impacts	Population and housing • Population: < 0.1 percent increase Employment and income • Employment: < 0.1 percent increase • Real disposable income: < 0.1 percent increase • Gross regional product: < 0.1 percent increase • State and local government spending: < 0.1 percent increase Public services: small impacts
Throughout region of influence	Employment and income Up to 1,083 animal unit months lost, valued at $57,000	Employment and income Continued lack of access to up to 1,083 animal unit months, valued at $57,000

a. Impacts under the Shared-Use Option would be the same as those under the Proposed Action without shared use.
b. < = less than.

4.2.10 OCCUPATIONAL AND PUBLIC HEALTH AND SAFETY

> **Incident-free transportation:** Routine transportation in which cargo travels from origin to destination without being involved in an accident.
>
> **Accident:** An unplanned sequence of events that leads to undesirable adverse consequences.

This section describes potential nonradiological and radiological health and safety impacts to workers and the public from construction and operation of the proposed railroad along the Caliente rail alignment, including ***incident-free transportation*** and transportation accident scenarios and acts of sabotage or terrorism. Section 4.2.10.1 describes the impact assessment methodology, Section 4.2.10.2 describes potential impacts associated with the Proposed Action, Section 4.2.10.3 describes potential impacts associated with the Shared-Use Option, and Section 4.2.10.4 summarizes potential impacts.

Section 3.2.10.1 describes the region of influence for nonradiological and radiological impacts.

Appendix K, Radiological Health and Safety, describes the methods and data DOE used to assess radiological impacts for this Rail Alignment EIS.

4.2.10.1 Impact Assessment Methodology

4.2.10.1.1 Nonradiological Occupational Impact Assessment Methodology

Nonradiological impacts to occupational health and safety would include impacts to workers resulting from physical hazards and exposure to nonradioactive ***hazardous chemicals*** during construction and operation of the proposed rail line and associated facilities. DOE estimated such impacts using occupational incident rates for total ***recordable cases***, lost workday cases, and fatalities. Total recordable cases are defined as the total number of work-related injuries or illnesses that resulted in fatalities, days away from work, job transfer or restriction, or other cases as identified in *Occupational Safety and Health Administration Form 300, Log of Work-Related Injuries and Illnesses* (DIRS 175488-OSHA [n.d.], all). Recordable cases of work-related injury or illness include fatality; loss of consciousness; injury or illness resulting in one or more days away from work; administration of medical treatment other than first aid; and other workplace injury or illness diagnosed by a physician or other health-care professional. The Occupational Safety and Health Administration defines lost workday cases as injuries or illnesses resulting in loss of 1 or more work days, not including the day the injury or illness occurred.

DOE estimated nonradiological occupational impacts by multiplying the number of labor hours worked by involved and noninvolved construction workers and operations workers by workplace health and safety incident rates in units of number of occurrences per hour worked for involved workers and noninvolved workers. The workplace incident rates DOE used for this analysis are U.S. Department of Labor, Bureau of Labor Statistics, data for 2005 (DIRS 179129-BLS 2007, all; DIRS 179131-BLS 2006, all). The nonradiological occupational health and safety impact analysis is based on health and safety incident statistics defined as follows (DIRS 155970-DOE 2002, p. F-17):

- Fatalities, regardless of the time between the injury and death, or the length of the illness
- Lost workday cases, other than fatalities, that result in lost workdays
- Nonfatal cases without lost workdays that result in transfer to another job, termination of employment, medical treatment (other than first aid), loss of consciousness, or restriction of work or motion

DOE estimated the frequency of occurrence of such incidents based on the specific activity (construction or operations) and the number of activity-specific worker labor hours.

Table 4-111 cites U.S. Department of Labor, Bureau of Labor Statistics, incident rate data DOE used to estimate total recordable cases, lost workday cases, and fatalities for involved and noninvolved workers during construction and operation of the proposed railroad. Involved workers are defined for the purposes of this analysis as personnel who would be directly involved in construction or operations activities. Noninvolved workers are defined for the purposes of this analysis as personnel who would be involved in management and administrative functions. The Bureau of Labor Statistics compiled the health and safety statistics by employment sector, including the Heavy and Civil Engineering Construction Sector; Management of Companies and Enterprises Sector; Transportation and Warehousing: Rail Transportation Sector; Support Activities for Transportation Sector; Non-Metallic Mineral Manufacturing (Batch Plant Construction and Operation); and Mining and Support Activities for Mining (Quarry Construction and Operation involved and noninvolved workers). Fatality incident statistics are compiled by employment sector, including Construction; Professional and Business Services; Transportation and Warehousing; Mining (Quarry Construction and Operation); and Manufacturing (Batch Plant Construction and Operation).

Table 4-111. U.S. Department of Labor, Bureau of Labor Statistics, incident rate data for estimating industrial safety impacts common to the workplace.[a]

	Total recordable cases incidents per 100 FTEs[b]		Lost workday cases per 100 FTEs		Fatalities per 100,000 FTEs	
Activity	Involved	Noninvolved	Involved	Noninvolved	Involved	Noninvolved
Construction						
Rail line	5.6	2.4	3.1	1.3	11	3.5
Facilities	5.6	2.4	3.1	1.3	11	3.5
Quarry/ballast-site construction and operations	4.1	3.9	2.7	2.2	25.6	3.5
Batch plant construction and operations	9.1		3.8		2.4	
Operations						
Rail line	2.5	2.4	1.9	1.3	17.6	3.5
Facilities	5.5	2.4	3.4	1.3	17.6	3.6

a. Sources: DIRS 179129-BLS 2007, all; DIRS 179131-BLS 2006, all.
b. FTEs = full-time-equivalent workers; one FTE is defined as 2,000 labor hours worked.

The Bureau of Labor Statistics incident rate data cited in Table 4-111 and used in the occupational health and safety analysis in this Rail Alignment EIS represent national average data for public and private sector entities conducting specific types of activities (for example, heavy and civil construction) and reporting incidents resulting from those activities. These national average incident rates reflect the wide range of occupational health and safety performance of the reporting public and private sector entities and are therefore not necessarily representative of the occupational health and safety performance DOE would achieve in constructing and operating the rail line and facilities under the Proposed Action. For example, DOE presented information in Table F-5 of the Yucca Mountain FEIS (DIRS 155970-DOE 2002, Yucca Mountain Project Worker Industrial Safety Loss Experience, Table F-5, p. F-21) that shows better worker safety experience than that presented in Table F-4 (DIRS 155970-DOE 2002, Health and Safety Statistics for Estimating Industrial Safety Impacts Common to the Workplace, Table F-4, p. F-20) as the basis for projections of impacts in the Yucca Mountain FEIS. For example, during the 30-month period during which DOE constructed the 5-mile-long Exploratory Studies Facility tunnel at the Yucca Mountain Repository Site, involving 52 million total labor hours worked (equivalent to 26,000 full-time-equivalent workers), there were no fatalities. Total recordable cases during this 30-month construction period were about 45 percent of the value that would have been expected based on DOE industrial safety loss experience (that is, the actual number of total recordable cases per 100 full-time-equivalent workers for the Exploratory Studies Facility construction was xx and the expected number was yy). DOE anticipates that the actual incident rates for construction and operation of the proposed rail line and facilities will similarly be below the values that would be expected from statistical data.

The U.S. Department of Labor, Mine Safety and Health Administration, reports occupational nonfatal incident and fatality incident data for stone, quarry and mill operations (surface mining) (DIRS 178746-MSHA 2006, all; DIRS 178747-MSHA 2006, all; DIRS 178748-MSHA 2006, all). In 2005 a total of nine fatalities were reported in sand and gravel surface mining for 37,258 full-time-equivalent workers and a total of five fatalities were reported in stone surface mining for 34,744 full-time-equivalent workers. This corresponds to a total fatal incident rate of 20.3 fatalities per 100,000 full-time-equivalent workers. This is lower than the fatality incident rate of 25.6 fatalities per 100,000 full-time-equivalent workers reported by the Bureau of Labor Statistics for all mining activities. DOE used the Bureau of Labor Statistics fatality incident rate to estimate the fatalities associated with quarry and ballast-site construction, operations, and reclamation for the purposes of maintaining consistency with the Bureau of Labor Statistics incident rate data for other rail line and facilities construction and operations activities.

The statistics for recordable cases and lost workday cases for rail line and associated facility construction for involved workers are applicable to the Heavy and Civil Engineering Construction Sector, and statistics for noninvolved workers are applicable to the Management of Companies and Enterprises Sector. The statistics for total recordable cases and lost workday cases for rail line operations for involved workers are applicable to the Transportation and Warehousing: Rail Transportation Sector. The statistics for railroad facility operations for involved workers are applicable to the Support Activities for Transportation Sector. The statistics for noninvolved workers are applicable to the Management of Companies and Enterprises Sector. Statistics for fatalities are applicable to the Construction Sector and Transportation and Warehousing Sector for involved workers and to the Professional and Business Services Sector for noninvolved workers. All Bureau of Labor Statistics data used in this Rail Alignment EIS are for 2005. Table 4-111 summarizes these statistics. DOE applied them to estimate the total recordable cases, lost workday cases, and fatalities for proposed railroad construction and operations.

DOE performed the following steps as part of the nonradiological occupational health and safety impact calculations:

1. DOE obtained full-time-equivalent data for each phase of construction and operation of the proposed rail line and associated facilities from the following documents: The numbers of full-time-equivalent ***worker years*** for each rail line construction and operations activity were obtained from Appendix D of the *Air Quality Emissions Factors and Socioeconomic Input-Caliente Rail Corridor*, Rev 03, May 15, 2007 (DIRS 182825-Nevada Rail Partners 2007, all), and the Personnel Breakdown Per Camp shown as Table 4-2 and the schedule shown as Figure 7-A, NRL Construction Schedule, from the *Construction Plan-Caliente Rail Corridor*, Rev 03, May 15, 2007 (DIRS 180922-Nevada Rail Partners 2007, all). The numbers of full-time-equivalent worker years for each railroad facility construction and operations activity were obtained from Appendix D of the *Air Quality Emissions Factors and Socioeconomic Input-Caliente Rail Corridor*, Rev 03, May 15, 2007 (DIRS 182825-Nevada Rail Partners 2007, all). A "full-time-equivalent" is defined as 2,000 labor hours worked per year. It is not necessarily the case that all 2,000 hours of an annual full-time-equivalent would be worked by the same individual. For example, train engineers operate on a crew schedule based on the

number of train trips. Therefore, the 2,000 hours per year worked for one full-time-equivalent for the labor category "train engineer" may comprise several individual train engineers.

2. DOE categorized full-time-equivalent workers for construction and operations workers as either "involved" workers or "noninvolved" workers depending on the specific activity of the worker identified. For purposes of this analysis, involved workers are defined as workers directly involved in construction or operations activities. Noninvolved workers are defined as workers performing management, administration, or security functions.

   The incident statistics used in the calculation are reported by the Bureau of Labor Statistics for calendar year 2005 (DIRS 179129-BLS 2007, all; DIRS 179131-BLS 2006, all).

   Incident rate statistics for total recordable cases, lost workday cases, and fatalities differ for involved and noninvolved workers.

   - All railroad operations workers are categorized as involved workers.
   - Facilities operations workers in job categories including "management," "administration," "clerical," and "security" are categorized as "noninvolved" workers.
   - Facilities operations workers in other job categories are categorized as "involved" workers.

   The Bureau of Labor Statistics compiles health and safety statistics by employment sector, including the Heavy and Civil Engineering Construction Sector; Management of Companies and Enterprises Sector; Transportation and Warehousing: Rail Transportation Sector; and Support Activities for Transportation Sector. The statistics for total recordable cases and lost workday cases for rail line and associated facilities construction for involved workers are applicable to the Heavy and Civil Engineering Construction Sector, and for noninvolved workers are applicable to the Management of Companies and Enterprises Sector. The statistics for total recordable cases and lost workday cases for rail line operations for involved workers are applicable to the Transportation and Warehousing: Rail Transportation Sector, the statistics for railroad facility operations for involved workers are applicable to the Support Activities for Transportation Sector, and for noninvolved workers are applicable to the Management of Companies and Enterprises Sector. Statistics for fatalities are applicable to the Construction Sector and Transportation and Warehousing Sector for involved workers and to the Professional and Business Services Sector for noninvolved workers. All Bureau of Labor Statistics data used in this Rail Alignment EIS are for 2005.

3. Full-time-equivalent workers for construction of the rail line include the following activities.

   - Rail line construction

4. Full-time-equivalent workers for construction of railroad facilities include the following facilities.

   - Concrete batch plant construction
   - Concrete batch plant operation
   - Water-well drilling
   - Construction camp construction
   - Construction camp operation
   - Quarry construction
   - Quarry operation
   - Facilities at the Interface with the Union Pacific Railroad Mainline (including the Interchange Yard and the Staging Yard)

- Maintenance-of-Way Facility (Goldfield 4)
- Maintenance-of-Way Trackside Facility (Goldfield 1 or 3)
- Maintenance-of-Way Headquarters Facility (Goldfield 1 or 3)
- Satellite Maintenance-of-Way Facilities
- Nevada Railroad Control Center and National Transportation Operations Center
- Cask Maintenance Facility
- Rail Equipment Maintenance Yard
- Facility access roads

5. Full-time-equivalent workers for operation of the railroad facilities include the following facilities.

   - Facilities at the Interface with the Union Pacific Railroad Mainline (including the Interchange Yard and the Staging Yard)
   - Maintenance-of-Way Facility (Goldfield 4)
   - Maintenance-of-Way Trackside Facility (Goldfield 1 or 3)
   - Maintenance-of-Way Headquarters Facility (Goldfield 1 or 3)
   - Satellite Maintenance-of-Way Facilities
   - Nevada Railroad Control Center and National Transportation Operations Center
   - Cask Maintenance Facility
   - Rail Equipment Maintenance Yard

6. DOE identified construction full-time-equivalent workers for each year of the construction schedule for the rail line and each rail line facility. The full-time-equivalent workers for each year are summed to calculate the total involved full-time-equivalent workers and total noninvolved full-time-equivalent workers for the rail line and each facility.

7. Full-time equivalent worker data for involved workers and noninvolved workers are multiplied by incident rates published by the U.S. Department of Labor, Bureau of Labor Statistics, for various employment sector categories applied to involved and noninvolved construction workers and operations workers to estimate the number of incidents for construction and operation of the rail line and associated facilities for the Proposed Action and Shared-Use Option. Employment sector categories for the Bureau of Labor Statistics incident rate data applied to involved and noninvolved workers are described above in Step 2.

Sections 4.2.10.2 and 4.2.10.3 discuss nonradiological impacts to the public from construction and operation of the proposed rail line and associated facilities under the Proposed Action and the Shared-Use Option. These nonradiological impacts include air quality impacts, noise impacts, and transportation (traffic accident and fatality) impacts. The methodologies for estimating these impacts from specific resource areas are described in the respective sections of this Rail Alignment EIS. Potential impacts from occupational exposure to workplace dust and noise during construction and operation of the Proposed Action and the Shared-Use Option are also discussed in Sections 4.2.10.2 and 4.2.10.3.

4.2.10.1.2 Radiological Impact Assessment Methodology

Radiation is the emission and propagation of energy through space or through a material in the form of waves or bundles of energy called photons, or in the form of high-energy subatomic particles. Radiation generally results from atomic or subatomic processes that occur naturally. The most common kind of radiation is electromagnetic radiation, which is transmitted as photons. Electromagnetic radiation is emitted over a range of wavelengths and energies. Humans are most commonly aware of visible light, which is part of the spectrum of electromagnetic radiation. Radiation of longer wavelengths and lower energy includes infrared radiation, which heats material when the material and the radiation interact, and radio waves. Electromagnetic radiation of shorter wavelengths and higher energy (which are more penetrating) includes ***ultraviolet radiation***, which causes sunburn, and X-rays and gamma radiation.

Ionizing radiation is radiation that has sufficient energy to displace ***electrons*** from atoms or molecules to create ions. It can be electromagnetic (for example, X-rays or gamma radiation) or subatomic particles (for example, alpha, beta, or ***neutron*** radiation). The ions have the ability to interact with other atoms or molecules; in biological systems, this interaction can cause damage in the tissue or organism.

Radioactivity is the property or characteristic of an unstable atom to undergo spontaneous transformation (to disintegrate or decay) with the emission of energy as radiation. Usually the emitted radiation is ionizing radiation. The result of the process, called radioactive ***decay***, is the transformation of an unstable atom (a ***radionuclide***) into a different atom, accompanied by the release of energy (as radiation) as the atom reaches a more stable, lower energy configuration.

Radioactive decay produces three main types of ionizing radiation—***alpha particles***, ***beta particles***, and ***gamma*** or ***X-rays***. Neutrons emitted during nuclear fission are another type of ionizing radiation. These types of ionizing radiation can have different characteristics and levels of energy and, thus, varying abilities to penetrate and interact with atoms in the human body. Because each type has different characteristics, each requires different amounts of material to stop (shield) the radiation. Alpha particles are the least penetrating and can be stopped by a thin layer of material such as a single sheet of paper. However, if radioactive atoms (called radionuclides) emit alpha particles in the body when they decay, there is a concentrated deposition of energy near the point where the radioactive decay occurs. Shielding beta particles requires thicker layers of material such as several reams of paper or several inches of wood or water. Shielding from gamma rays, which are highly penetrating, requires very thick material such as several inches to several feet of heavy material (for example, concrete or lead). Deposition of the energy by gamma rays is dispersed across the body in contrast to the local energy deposition by an alpha particle. Some gamma radiation will pass through the body without interacting with it. Shielding from neutrons, which are also highly penetrating, requires materials that contain light elements such as hydrogen.

In a ***nuclear reactor***, heavy atoms such as uranium and plutonium can undergo another process, called ***fission***, after the absorption of a subatomic particle (usually a neutron). In fission, a heavy atom splits into two lighter atoms and releases energy in the form of radiation and the kinetic energy of the two new lighter atoms. The new lighter atoms are called ***fission products***. The fission products are usually unstable and undergo radioactive decay to reach a more stable state.

Some of the heavy atoms might not fission after absorbing a subatomic particle. Rather, a new ***nucleus*** is formed that tends to be unstable (like fission products) and undergo radioactive decay.

The radioactive decay of fission products and unstable heavy atoms is the source of the radiation from spent nuclear fuel and high-level radioactive waste that makes these materials hazardous in terms of potential human-health impacts.

Radiation that originates outside of an individual's body is called external or direct radiation. Such radiation can come from an X-ray machine or from radioactive materials that directly emit radiation, such as radioactive waste or radionuclides in soil. ***Exposure*** to direct radiation can be mitigated by placing shielding, such as lead, between the source of the radiation and the exposed individual. Internal radiation originates inside a person's body following intake of radioactive material or radionuclides through ingestion or inhalation. Once in the body, the fate of a radioactive material is determined by its chemical behavior and how it is metabolized. If the material is soluble, it might be dissolved in bodily fluids and transported to and deposited in various body organs; if it is insoluble, it might move rapidly through the gastrointestinal tract or be deposited in the lungs.

Exposure to ionizing radiation is expressed in terms of absorbed dose, which is the amount of energy imparted to matter per unit mass. Often simply called ***dose***, it is a fundamental concept in measuring and quantifying the effects of exposure to radiation. The unit of absorbed dose is the ***rad***. The different types of radiation mentioned above have different effects in damaging the cells of biological systems. ***Dose equivalent*** is a concept that considers the absorbed dose and the relative effectiveness of the type of ionizing radiation in damaging biological systems, using a radiation-specific quality factor. The unit of dose equivalent is the ***rem***. In quantifying the effects of radiation on humans, other types of concepts are also used. The concept of ***effective dose equivalent*** is used to quantify effects of radionuclides in the body. It involves estimating the susceptibility of the different tissue in the body to radiation to produce a tissue-specific weighting factor. The weighting factor is based on the susceptibility of that tissue to ***cancer***. The sum of the products of each affected tissue's estimated dose equivalent multiplied by its specific weighting factor is the effective dose equivalent. The potential effects from a one-time ingestion or inhalation of radioactive material are calculated over a period of 50 years to account for radionuclides that have long ***half-lives*** and long residence time in the body. The result is called the committed effective dose equivalent. The unit of effective dose equivalent is the rem. Total effective dose equivalent is the sum of the committed effective dose equivalent from radionuclides in the body plus the dose equivalent from radiation sources external to the body (also in rem). All estimates of radiation dose in this Rail Alignment EIS, unless specifically noted otherwise, are total effective dose equivalents, which are quantified in terms of rem or millirem (mrem).

More detailed information on the concepts of radiation dose and dose equivalent are in publications of the National Council on Radiation Protection and Measurements (DIRS 101857-NCRP 1993, all) and the International Commission on Radiological Protection (DIRS 101836-ICRP 1991, all).

The factors used to convert estimates of radionuclide intake (by inhalation or ingestion) or external exposure to radionuclides (by ***groundshine*** or ***cloudshine*** [immersion]) to radiation dose are called dose conversion factors or dose coefficients. The International Commission on Radiological Protection and federal agencies such as the U.S. Environmental Protection Agency (EPA) publish these factors (DIRS 172935 ICRP 2001, all; DIRS 175544-EPA 2002, all). They are based on original recommendations of the International Commission on Radiological Protection (DIRS 101836-ICRP 1991, all).

The radiation dose to an individual or to a group of people can be expressed as the total dose received or as a ***dose rate***, which is dose per unit time (usually an hour or a year). ***Collective dose*** is the total dose to an exposed population. ***Person-rem*** is the unit of collective dose. Collective dose is calculated by summing the individual dose to each member of a population. For example, if 100 workers each received 0.1 rem, the collective dose would be 10 person-rem (100 persons × 0.1 rem).

Exposures to radiation or radionuclides are often characterized as being acute or chronic. Acute exposures occur over a short period, typically 24 hours or less. Chronic exposures occur over longer periods (months to years); they are usually assumed to be continuous over a period, even though the dose rate might vary. For a given dose of radiation, chronic radiation exposure is usually less harmful than acute exposure because the dose rate (dose per unit time, such as rem per hour) is lower, providing more opportunity for the body to repair damaged cells.

The radiation dose estimates discussed in this Rail Alignment EIS are associated with exposure to radiation at low dose rates. Such exposures can be chronic (continuous or nearly continuous), such as those to workers who are security escorts. In some instances, exposures to low levels of radiation would be intermittent (for example, infrequent exposures to an individual from radiation emitted from ***shipping casks*** as they are transported). Cancer induction is the principal potential risk to human health from exposure to low levels of radiation. However, this cancer induction is a statistical process because exposure to radiation conveys only a chance of developing cancer, not a certainty. Furthermore, other causes, such as exposure to chemical agents, can induce cancer in individuals.

Cancer is the principal potential risk to human health from exposure to low or chronic levels of radiation. Radiological health impacts are expressed as the incremental changes in the number of expected fatal cancers (referred to as ***latent cancer fatalities***) for populations and as the incremental increases in lifetime probabilities of contracting a fatal cancer for an individual. The estimates are based on the dose received and on dose-to-health-effect conversion factors recommended by the Interagency Steering Committee on Radiation Standards (DIRS 174559-Lawrence 2002, all). The Interagency Steering Committee on Radiation Standards is comprised of eight federal agencies (the Environmental Protection Agency, the Nuclear Regulatory Commission, DOE, the Department of Defense, the Department of Homeland Security, the Department of Transportation, the Occupational Safety and Health Administration, and the Department of Health and Human Services), three federal observer agencies (the Office of Science and Technology Policy, the Office of Management and Budget, and the Defense Nuclear Facilities Safety Board), and two state observer agencies (Illinois and Pennsylvania). The Committee estimated that, for the general population and workers, a collective dose of 1 person-rem would yield 6×10^{-4} excess latent cancer fatalities.

Sometimes, calculations of the number of latent cancer fatalities associated with radiation dose do not yield whole numbers, and, especially in environmental applications, can yield numbers less than 1.0. For example, if each individual in a population of 100,000 received a total radiation dose of 0.001 rem, the collective radiation dose would be 100 person-rem and the corresponding estimated number of latent cancer fatalities would be 0.06 (100,000 persons × 0.001 rem × 0.0006 latent cancer fatalities per person rem). How should one interpret a nonintegral number of latent cancer fatalities, such as 0.06? The answer is to interpret the result as a statistical estimate. That is, 0.06 is the average number of latent cancer fatalities that would result if the same exposure situation were applied to many different groups of 100,000 people. For most groups, no one would incur a latent cancer fatality from the 0.001 rem radiation dose each member would have received. In a small fraction of the groups (about 6 percent), one latent cancer fatality would result; in exceptionally few groups, two or more latent cancer fatalities would occur. The average number of latent cancer fatalities over all of the groups would be 0.06. The most likely outcome for any single group is 0 latent cancer fatalities.

DOE estimated radiological impacts for incident-free transportation, transportation accident risks and the consequences of severe transportation accidents, and transportation sabotage events. Radiation doses were estimated for two groups, workers and members of the public. For each group, radiation doses were estimated for the collective population and ***maximally exposed individuals***. For members of the public, the collective population was the population within 800 meters (0.5 mile) of the rail line or Staging Yard and was determined using U.S. Census data. The distances of the maximally exposed individuals from the rail line or Staging Yard were determined using geographic information system (GIS) data and imagery. The 800-meter distance is based on the distance used to estimate radiation doses in *Environmental Survey of Transportation of Radioactive Materials to and from Nuclear Power Plants* (DIRS 185281-NRC 1972, p. 110).

For transportation accidents, radiation doses were estimated out to 80 kilometers (50 miles) from the accident. This distance is based on the distance used to estimate radiation doses from accidents in *Environmental Survey of Transportation of Radioactive Materials to and from Nuclear Power Plants* (DIRS 185281-NRC 1972, p. 94). The analysis of potential radiological occupational and public health and safety impacts in this Rail Alignment EIS includes all of those potentially exposed individuals discussed in Section 3.2.10 of this Rail Alignment EIS. No spent nuclear fuel or high-level waste would be transported during the construction period. Therefore, there would be no construction-related radiation dose to workers or the public related to radioactive materials transportation during repository construction activities.

The DOE Department of Environment Safety and Health guidance in *Recommendations for the Preparation of Environmental Assessments and Environmental Impact Statements*, Second Edition, December 2004 (DIRS 178579-DOE 2004, all), requires that radiological impacts be estimated, no matter how small the population. Therefore, the radiological impact analyses in this Rail Alignment EIS are applied to various populations of potentially exposed individuals.

4.2.10.1.3 Nonradiological Transportation Impact Assessment Methodology

DOE based the transportation impact analyses on guidelines from the American Institute of Chemical Engineers with respect to chemical transportation risk analyses (DIRS 182284-CCPS 1995, all). The methodology presented in this section uses both qualitative and quantitative components. The number of fatalities and accidents resulting from vehicular and train travel were based on fatality and accident rates provided by Federal Railroad Administration and Nevada Department of Transportation statistics. The rates were used in combination with the specifics of an operation (for example, total distance traveled, route length, and number of trips) to estimate the likelihood of accidents and fatalities. The estimated number of potential vehicular traffic fatalities was based on assuming a total distance traveled from workers commuting during both the construction and operational phases. The estimates for potential rail traffic fatalities and accidents were also based on assuming total distances traveled from material/equipment transport during construction and shipment during operations. Traffic accidents under the Shared-Use Option were qualitatively analyzed based on a proportional comparison to the Proposed Action. Rail line fatalities associated with the Shared-Use Option were evaluated by revising the analyses for the additional rail traffic levels.

4.2.10.2 Proposed Action

4.2.10.2.1 Nonradiological Occupational Impacts

Nonradiological health and safety addresses potential occupational incidents to construction and operations workers resulting from physical hazards and exposure to nonradioactive chemicals generated from construction and operations. This section also summarizes impacts associated with nonradiological occupational health and safety hazards from specific resource areas, including biological hazards, dust and soils hazards, air quality hazards, and noise hazards.

4.2.10.2.1.1 Workers. Tables 4-112 and 4-113 summarize nonradiological impacts to workers from industrial hazards associated with construction and operation of the proposed rail line and associated facilities under the Proposed Action. Table 4-112 summarizes impacts for construction and operation of the rail line. Table 4-113 summarizes impacts for construction and operation of facilities. In general, rail line construction would create hazards that are common to heavy construction and earthmoving operations. Accidents that commonly occur at construction workplaces are:

- Trip and fall
- Object falls on worker
- Electrocution
- Asphyxiation (confined space or other)
- Penetrating wounds
- Dermal exposure skin injury
- Jobsite vehicle accident injury
- Hearing injury
- Object in eye
- Welding or laser eye injury
- Injury from trench or slope collapse
- Injury from explosion

Similar types of workplace accidents can occur during operation and maintenance of the proposed rail line and facilities. Workplace incidents also include incidents such as heat stress and workplace exposure to hazardous chemicals. These types of workplace accidents and incidents are included in the Bureau of Labor Statistics incident rate statistics for total recordable cases, lost workday cases, and fatalities summarized in Table 4-111.

DOE would adopt a rigorous safety program that would enable workers to avoid most common accidents as required by DOE Order O 440.1A, *Worker Protection Management for DOE Federal and Contractor Employees*, as codified in 10 CFR Part 851. Chapter 7 of this Rail Alignment EIS describes mitigation measures and safety management practices to address workplace hazards. In accordance with 10 CFR Part 851 DOE would also be required to comply with applicable regulations under 29 CFR Part 1910, *Occupational Health and Safety Standards*, 29 CFR Part 1926, *Safety and Health Regulations for Construction*, and 29 CFR Part 1960, *Basic Program Elements for Federal Employee Occupational Safety and Health Programs and Related Matters* (Section 11.4, Table 11-4, pp. 1 to 3). Code of Federal Regulations 29 Part 1926 applies to DOE contractors; 29 CFR Part 1960 (Basic Elements for Federal Employees OSHA) applies to DOE employees; 10 CFR 851.23 also requires DOE to apply American Council of Government Industrial Hygienist Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices when the Threshold Limit Values are lower (more protective) than permissible exposure limits in 29 CFR Part 1910.

Table 4-112 includes nonradiological impacts from proposed rail line construction and operations, but does not include facilities construction and operations. Rail line construction impacts are estimated for activities occurring during the minimum 4.5-year construction phase, including construction of the rail line (rail roadbed, track).

Table 4-112. Estimated impacts to workers from nonradiological industrial hazards during proposed railroad construction and railroad operations under the Proposed Action.[a,b]

	Construction			Operations		
Group and industrial hazard category	FTEs[c]	Labor hours worked	Incidents	FTEs[c]	Labor hours worked	Incidents
Involved workers	5,444	10.9 million		1,471	2.9 million	
Total recordable cases[d]			304			37
Lost workday cases			168			28
Fatalities			0.62			0.26
Noninvolved workers	1,350	2.7 million		0	0	
Total recordable cases			32			0
Lost workday cases			18			0
Fatalities			0.05			0
Totals[e]	6,794	13.6 million		1,471	2.9 million	
Total recordable cases			336			37
Lost workday cases			186			28
Fatalities			0.67			0.26

a. Calculations are based on U.S. Department of Labor, Bureau of Labor Statistics, incident rates in Table 4-111 and full-time-equivalent worker year data from Appendix D of the *Air Quality Emissions Factors and Socioeconomic Input-Caliente Rail Corridor*, Rev 03, May 15, 2007 (DIRS 182825-Nevada Rail Partners 2007) and Table 4-2 and Figure 7-A, NRL Construction Schedule, from the *Construction Plan-Caliente Rail Corridor*, Rev 03, May 15, 2007 (DIRS 180922-Nevada Rail Partners 2007). All rail line construction workers are considered to be involved workers with the exception of construction camp operating workers.
b. Totals include rail line construction, quarry construction and operations, concrete batch plant construction and operations, construction camp construction and operations, construction train operations, and water-well construction and operations. Totals do not include construction or operation of rail line facilities.
c. FTE = full-time-equivalent worker; one FTE is defined as 2,000 labor hours worked. FTE and labor hours worked values are calculated over the minimum 4.5-year construction phase and 50-year operations phase of the Proposed Action.
d. Total recordable cases include injury and illness.
e. Totals might differ from sums of values due to rounding.

Rail line operations impacts include impacts to train crews and escort and security personnel. The numbers of full-time-equivalent worker years for each rail line construction and operations activity, summarized in

Table 4-112, were obtained from Appendix D of the *Air Quality Emissions Factors and Socioeconomic Input-Caliente Rail Corridor*, Rev 03, May 15, 2007 (DIRS 182825-Nevada Rail Partners 2007, Appendix D) and the Personnel Breakdown Per Camp shown as Table 4-2 and the schedule shown as Figure 7-A, NRL Construction Schedule, from the *Construction Plan-Caliente Rail Corridor*, Rev 03, May 15, 2007 (DIRS 180922-Nevada Rail Partners 2007, Figure 7-A).

Impacts from rail line construction support facilities include:

- Construction of the construction camps
- Operation of construction camps
- Construction of ballast quarries
- Operation of ballast quarries
- Construction of water wells
- Operation of water wells
- Construction of concrete batch plants
- Operation of concrete batch plants

Railroad facility construction and operations impacts include impacts to facility construction workers and facility operations workers during the minimum 4.5-year construction phase and 50-year operations phase for the facilities. Table 4-113 summarizes the nonradiological impacts of constructing and operating rail line construction and operations support facilities under the Proposed Action, including the Rail Equipment Maintenance Yard, the Facilities at the Interface with the Union Pacific Railroad Mainline (including the Interchange Yard and Staging Yard), Nevada Railroad Control Center and National

Table 4-113. Estimated impacts to workers from nonradiological industrial hazards during facility construction and facility operations under the Proposed Action.[a,b]

	Construction			Operations		
Group and industrial hazard category	FTEs[c]	Labor hours worked	Incidents	FTEs	Labor hours worked	Incidents
Involved workers	1,569	3.1 million		6,850	13.7 million	
Total recordable cases[d]			88			377
Lost workday cases			49			233
Fatalities			0.02			1.21
Noninvolved workers	0	0		1,700	3.4 million	
Total recordable cases[d]			0			41
Lost workday cases			0			22
Fatalities			0			0.06
Totals[e]	1,569	3.1 million		8,500	17.0 million	
Total recordable cases			88			418
Lost workday cases			49			255
Fatalities			0.02			1.27

a. Source: Calculations are based on U.S. Department of Labor, Bureau of Labor Statistics, incident rates in Table 4-111 and full-time-equivalent worker year data from Appendix D of the *Air Quality Emissions Factors and Socioeconomic Input-Caliente Rail Corridor*, Rev 03, May 15, 2007 (DIRS 182825-Nevada Rail Partners 2007, Appendix D).
b. Totals include construction and operation of the Facilities at the Interface with the Union Pacific Railroad Mainline, Maintenance-of-Way Facilities, Cask Maintenance Facility, Nevada Railroad Control Center and National Transportation Operations Center, and Rail Equipment Maintenance Yard. Totals do not include construction or operation of rail line facilities.
c. FTE = full-time-equivalent worker; one FTE is defined as 2,000 labor hours worked. FTE and labor hours worked values are calculated over the minimum 4.5-year construction phase and 50-year operations phase of the Proposed Action.
d. Total recordable cases include injury and illness.
e. Totals might differ from sums of values due to rounding.

Transportation Operations Center, Maintenance-of-Way Facility, Maintenance-of-Way Trackside Facility, Maintenance-of-Way Headquarters Facility, Satellite Maintenance-of-Way Facilities, and Cask Maintenance Facility. The numbers of full-time-equivalent workers for each facility construction and operations activity were obtained from Appendix D of the *Air Quality Emissions Factors and Socioeconomic Input-Caliente Rail Corridor*, Rev 03, May 15, 2007 (DIRS 182825-Nevada Rail Partners 2007, Appendix D). Construction and operations workers under the Proposed Action could be exposed to nonradiological hazardous chemicals related to operation and maintenance of construction equipment and facility equipment, including maintenance-of-way and management of fleet. Such activities are anticipated to include welding, metal degreasing, painting, and related activities. Occupational health and safety impacts could also result from worker exposure to fuels, lubricants, and other materials used in construction, operation, and maintenance of the proposed rail line and facilities.

Railroad Construction Construction of the proposed railroad would involve 13.6 million labor hours corresponding to a total of 6,794 full-time-equivalent construction workers over the entire construction phase.

For the purposes of this Rail Alignment EIS, nonradiological impacts associated with construction of the proposed rail line are reported separately from the nonradiological impacts associated with construction of the railroad facilities. Table 4-112 summarizes nonradiological occupational health and safety impacts associated with construction of the proposed rail line, not including the Rail Equipment Maintenance Yard and Facilities at the Interface with the Union Pacific Railroad or other facilities.

Facilities Construction Construction of railroad construction support facilities and railroad operations support facilities, including the Facilities at the Interface with the Union Pacific Railroad Mainline (the Interchange Yard and the Staging Yard), Nevada Railroad Control Center and National Transportation Operations Center, Maintenance-of-Way Facility, Maintenance-of-Way Trackside Facility, Satellite Maintenance-of-Way Facilities, Maintenance-of-Way Headquarters Facility, Cask Maintenance Facility, and Rail Equipment Maintenance Yard, would involve 3.1 million labor hours corresponding to approximately 1,569 full-time-equivalent construction workers over the entire construction phase. Table 4-113 summarizes the nonradiological impacts of constructing rail line operations support facilities.

Railroad Operations The proposed railroad would operate for up to 50 years and would involve approximately 1,471 operations full-time-equivalent workers over the life of the project, corresponding to approximately 2.9 million labor hours.

For the purposes of this Rail Alignment EIS, nonradiological impacts associated with operation of the operations along the rail line are reported separately from the nonradiological impacts associated with operation of the support facilities. Table 4-112 lists nonradiological occupational health and safety impacts associated with operations along the rail line, not including the Rail Equipment Maintenance Yard or Facilities at the Interface with the Union Pacific Railroad or other operations support facilities.

Overall railroad operations, including cask trains, maintenance-of-way trains, and repository construction and supplies trains correspond to approximately 16 million train-kilometers (10 million train-miles) over the 50-year operations phase for the 541-kilometer (336-mile)-long Caliente rail line, based on transporting 9,495 casks (eight cask trains per week) and an additional two maintenance-of-way trains and seven repository construction and supplies trains per week. The 37 total recordable cases and 28 lost workday cases over the 50-year operations phase (see Table 4-112) correspond to 4.5 total recordable cases and 3.4 lost workday cases per million train-kilometers traveled.

Railroad Facilities Operations Operation of the operations support facilities under the Proposed Action, including the Facilities at the Interface with the Union Pacific Railroad, Nevada Railroad Control Center and National Transportation Operations Center, Maintenance-of-Way Trackside Facility, Satellite

Maintenance-of-Way Facilities, Maintenance-of-Way Headquarters Facility, Maintenance-of-Way Facility, Cask Maintenance Facility, and the Rail Equipment Maintenance Yard would take place over 50 years and would involve approximately 170 full-time-equivalent operations workers per year of operation (DIRS 182825-Nevada Rail Partners 2007; DIRS 180922-Nevada Rail Partners 2007), corresponding to approximately 17 million labor hours over the 50-year operations phase. Table 4-113 summarizes the nonradiological impacts of operating railroad operations support facilities under the Proposed Action. The 418 total recordable cases and 255 lost workday cases over the 50-year operating phase (see Table 4-113) correspond to 51 total recordable cases and 31 lost workday cases per million train-kilometers traveled.

Impacts from Specific Resource Areas Workers constructing the proposed railroad could be exposed to a variety of hazards associated with specific resource areas. These include biological hazards, dust and soils hazards, air quality hazards, transportation accidents, and noise hazards. Transportation hazards include wild horses and burros and free-range livestock. Biological hazards include potential human-health effects from rodent-borne diseases, soil-borne diseases, insect-borne diseases, and venomous animals. Dust and soils hazards include potential human-health effects from exposure to inhalable soils and dusts containing hazardous constituents and potential occupational encounters with unexploded ordnance. Construction workers could also be exposed to air quality hazards, including potential human-health effects of exposure to fugitive dust, diesel engine exhaust, and other air emissions associated with construction activities. Workers could also be exposed to noise hazards from operation of equipment. Operations workers, in particular maintenance-of-way workers, could also be exposed to similar hazards. Impacts associated with specific resource areas are discussed in the paragraphs that follow.

Biological Hazards: Biological hazards are any virus, bacteria, fungus, parasite, or other living organism that can cause a disease or otherwise harm human beings. Biological hazards that may be encountered by workers constructing and operating the proposed rail line and associated facilities include disease-causing organisms and venomous animals. Diseases potentially encountered when performing construction activities include West Nile Virus, Valley Fever, Hantavirus, and rabies. Venomous animals potentially encountered include spiders, snakes, scorpions, bees, wasps, and other insects. These biological hazards are described in the following sections. The recorded incidence rates of these biological hazards in the region of influence in Nevada are small, according to statistics published by state and federal agencies including the U.S. Centers for Disease Control and the Nevada State Health Division, as cited below. Therefore, DOE would expect small impacts to construction or operations workers from these biological hazards.

- **Venomous Animals –** Nevada is home to five venomous snake species: Sidewinder, Mohave, Speckled, Western Diamondback and Great Basin rattlesnakes (*Crotalus* spp.). These types of rattlesnakes may inhabit the open grasslands and desert habitat in the construction and operations areas. The Gila Monster, a venomous lizard, also occurs in southern Nevada. There are several types of scorpions (such as *paruroctonus* spp.) native to Nevada that may occur in construction and operations areas. Scorpions are venomous and are most active at night. A scorpion sting would require medical treatment, but for the specific species of scorpions found in Nevada, would not be fatal. Black widow spiders (*Latrodectus mactans*) and brown recluse spiders (*Loxosceles recluse*) may also occur in construction areas. Bites from these spiders would require medical treatment and are potentially fatal if untreated. Other types of spider bites are generally harmless to most people. Spider bites usually occur when someone is reaching into dark, out-of-the way places. Bees, including Africanized Swarming Bees, and wasps also occur in southern Nevada.

- **West Nile Virus –** West Nile virus is a mosquito-borne virus that can cause illness in humans, including meningitis or arboviral encephalitis, a brain inflammation. Mosquitoes acquire the virus from birds and pass it on to other birds, and occasionally to humans. Mosquitoes spread this virus after they feed on infected birds and then bite other birds, people, or certain domestic animals. The virus is not spread by person-to-person contact. West Nile virus occurs primarily in the late summer or early autumn, although the mosquito season is generally April through October. About 80 percent of people who are infected with West Nile virus exhibit no symptoms, or at most, experience symptoms similar to the flu. People with mild infections, referred to as West Nile fever, may experience fever, headache, body ache, skin rash, and swollen lymph glands. More severe infection can result in more serious symptoms including high fever, headache, disorientation, coma, tremors, occasional convulsions, and paralysis. This form is referred to as West Nile meningitis or encephalitis. In 2004, a total of 44 cases of West Nile virus were reported in Nevada, including 23 cases in Clark County. Of the 44 West Nile virus cases, 19 involved West Nile fever. In 2005, 31 cases of West Nile virus were reported in Nevada, including eight cases in Clark County and three cases in Nye County (DIRS 177618-USGS 2006, all). No human cases of West Nile virus were reported in Nye, Esmeralda, or Lincoln Counties in 2004 (DIRS 175028-USGS 2005, all; DIRS 175026-NSHD 2005, all). In 2006, there were a total of 123 reported cases of West Nile virus, including two cases in Nye County and three cases in Clark County (DIRS 178696-USGS 2007, all). Incident rates of West Nile Virus are affected by the population density and availability of water.

- **Valley Fever –** The technical name for Valley Fever is *Coccidioidomycosis*. It is caused by *Coddidioides immitis*, a fungus that lives in soil. Fungus spores become wind-borne and may be inhaled into the lungs, where infection can occur. Valley Fever is not contagious from person to person. It appears that after one exposure, the body develops immunity. The Valley Fever fungus is established in the Southern Nevada region of influence. Infection rates, as reflected by positive skin tests, are 2 to 3 percent per year in highly endemic regions, and activities associated with heavy dust exposure (such as excavation, agricultural labor) increase infection rates (DIRS 175021-Barnato, Sanders, and Owens 2001, p. 1). About 60 percent of people who breathe the spores do not develop any symptoms. About one out of every 200 persons infected with Valley Fever develops the disseminated form, in which the disease spreads beyond the lungs through the bloodstream causing meningitis. Meningitis is a potentially fatal inflammation of the membrane around the brain and the spinal cord.

- **Hantavirus –** A 1993 outbreak of fatal respiratory illness on an Indian Reservation in the Four Corners area (where the states of Arizona, New Mexico, Colorado, and Utah meet) led to the identification of Hantavirus as the causative agent. Hantavirus is a rodent-borne disease. The route of exposure is believed to be inhalation of aerosolized virus, and/or ingestion of rodent excreta through contaminated food or water. Rodent bites and direct contact with broken skin or mucous membranes are also potential sources of infection. Symptoms include pneumonia, fever, and other flu-like symptoms. In 24 to 48 hours after symptoms appear, potentially fatal respiratory failure may occur. As of March 2007, there have been 465 recorded cases of Hantavirus in the United States, with 18 of the cases recorded in Nevada (DIRS 181391-CDC 2007, all). DOE has implemented procedures for decontamination of any rodent excreta encountered by construction workers during construction activities at the Yucca Mountain Site to prevent Hantavirus infection of workers.

- **Rabies –** Rabies may be a hazard to construction and operation workers through accidental contact with mammalian species in construction and operations areas. The route of exposure is a bite or scratch from an infected animal, or non-bite exposure through inhalation of aerosolized rabies virus. Rabies has been reported in Nevada in bats but not in terrestrial animals (DIRS 177449-Krebs et al. 2005, p. 1917). The incubation period of rabies is variable, ranging from less than 10 days to greater than 6 years, and post exposure treatment is necessary following true exposure unless the subject has been vaccinated. Absent post exposure treatment, the first symptoms may be noted within 30 to 90 days of exposure. Once symptoms occur, death may occur in less than 1 week following the development of initial symptoms, usually as a result of respiratory failure. No human cases of rabies were reported in Nevada between

January 2000 and September 2005, the latest period for which data are available (DIRS 177449-Krebs et al. 2005, p. 1920).

Dust and Soils Hazards: Dust and soils hazards include potential occupational exposure to hazardous inhalable soils and dust, including the minerals crystalline silica, cristobalite, and ***erionite*** and potential occupational encounters with unexploded ordnance. These hazards are discussed below.

- **Inhalable Dust –** Construction activities such as blasting, scarifying, and excavating create dust that can be inhaled by workers.

Some types of rock and associated soils may contain hazardous minerals such as crystalline silica, cristobalite, and erionite. It is unlikely that any fugitive particulates generated in the construction areas would contain a concentration of crystalline silica, eronite, or cristobalite that would result in exceedance of occupational exposure limits for these materials. Inhaling dust originating from these types of rock and containing these minerals can lead to disease such as silicosis if adequate precautions are not taken when working in dusty areas. However, DOE recognizes the potential for exposure to crystalline silica, cristobalite, or erionite during the development of quarries for production of hard rock ballast, in ballast placement, rock cuts, and other types of excavation. Of the three mineral dust hazards mentioned above, crystalline silica is the most common in hard rock ballast because it is a material of relative abundance in granite and quartz. DOE would be required to comply with Occupational Safety and Health Administration workplace guidance for mineral dusts (29 CFR 1910-1000, Table Z-3, Mineral Dusts).

DOE would therefore conduct routine monitoring of occupational dust exposure during quarry construction and operations and during rail alignment construction activities, such as ballast placement, with the potential for such exposure. DOE would apply best management practices and engineering controls such as application of water for dust suppression and washing the ballast before placement in order to minimize the potential for occupational exposure to dust, and an industrial hygienist would take mineral dust measurements to identify if any potential exposure hazards are present. In the event that these monitoring activities identify potential occupational exposure at levels exceeding Occupational Safety and Health Administration occupational exposure standards for silica, DOE would implement additional processing and engineering controls to mitigate, prevent, or reduce exposures to silica to below occupational exposure standards. Therefore, impacts associated with occupational exposure to these materials are anticipated to be small.

- **Unexploded Ordnance –** Portions of the construction area may have unexploded ordnance in surface or in subsurface locations. The potential areas of concern for unexploded ordnance are sections west of the Nevada Test and Training Range and within the Nevada Test Site. These include areas south of Goldfield and north of Beatty Wash. Unexploded ordnance may include shell casings, projectiles, or fragments, and may include live small arms ammunition, bombs, and rockets. These types of unexploded ordnance may have been generated from historical Air Force and other military training activities in the region. Sections of rail alignment and associated facility locations north and east of Goldfield are considered clear of unexploded ordnance at this time. DOE would coordinate with the U.S. Air Force concerning proposed construction activities and would follow standard and established procedures for unexploded ordnance. An unexploded ordnance specialist would develop a plan, including evaluation of types of unexploded ordnance possible, depths, etc. Unexploded ordnance technicians would be present and screen ahead of the construction crew in areas where there is potential for unexploded ordnance.

Air Quality Hazards: Construction workers could be exposed to air quality hazards, including potential human-health effects of occupational exposure to stationary and area source emissions associated with construction activities. Operations workers, in particular maintenance-of-way workers, could also be exposed to similar air quality hazards.

Stationary and area source emissions associated with the construction phase would include exhaust emissions from on-site vehicles and heavy construction equipment, and fugitive dust from excavation and construction activities. Stationary and area source exhaust emissions associated with the operations phase would include emissions from locomotive fueling stations and locomotive and rail line maintenance operations. Section 4.2.4, Air Quality and Climate, describes stationary source and area source emissions associated with the construction and operations phases.

Exposure of construction and operations workers to vehicle exhaust emissions and other air emissions would be subject to exposure standards, including standards established under 10 CFR 851. Threshold Limit Values established by the Occupational Safety and Health Administration and American Council of Government Industrial Hygienists would apply to occupational exposure to vehicle exhaust emissions and other air emissions. DOE would apply administrative controls and conduct workplace monitoring to control exposure to below applicable standards.

Noise Hazards: Workers conducting construction and operations activities under the Proposed Action could be exposed to noise from operation of heavy construction equipment, operation of locomotives, or from conducting blasting operations. Potential sources of occupational noise exposure, applicable noise exposure standards, and requirements for controlling noise exposure are described in this section and further described in Section 4.2.8.

- **Roadbed/Track Structure Construction Noise Exposure –** DOE would require employers of construction workers exposed to heavy equipment noise to comply with Occupational Safety and Health Administration regulation 29 CFR 1910.95 to avoid effects of excessive noise exposure. Hearing damage is related to absolute noise level and duration of exposure. Table 4-114 shows Occupational Safety and Health Administration noise level limits that would require hearing protection. Code of Federal Regulations 10 Part 851 requires DOE to use American Conference of Governmental Industrial Hygienists Threshold Limit Values as occupational exposure standards. Table 4-114 also shows the Threshold Limit Values.

DOE would be required to administer a continuing, effective hearing conservation program whenever employee noise exposures equal or exceed an 8-hour time-weighted average sound level of 85 A-weighted decibels.

- **Railroad Worker Noise Exposure –** Railroad operators are required to comply with Federal Railroad Administration Regulation 49 CFR 229.121 for worker exposure to locomotive cab noise. Applicable noise levels, the exceedance of which would require hearing protection, are shown in Table 4-114.

4.2.10.2.2 Radiological Impacts

This section discusses the radiological impacts for workers and members of the public during construction and operation of the railroad and facilities such as the Staging Yard, the Rail Equipment Maintenance Yard, the Maintenance-of-Way Trackside Facility, and the Cask Maintenance Facility. Both incident-free impacts and radiological accident risks are discussed. Also discussed are the impacts from severe transportation accidents and from acts of sabotage.

Risk Terms

A risk value of 1×10^{-4} is equivalent to 1 in 10,000.
A risk value of 1×10^{-6} is equivalent to 1 in 1,000,000.
A risk value of 1×10^{-8} is equivalent to 1 in 100,000,000.

Table 4-114. Occupational noise exposure limits.[a]

Duration per day, hours	Sound level (decibels slow response)	ACGIH[b] Threshold Limit Value
8	90	85
6	92	86
4	95	88
3	97	89
2	100	91
1.5	102	92
1	105	94
0.5	100	97
0.25 or less	115	100

a. Source: 29 CFR 1910.95; 30 CFR 62.130; 10 CFR 851.
b. ACGIH = American Conference of Governmental Industrial Hygienists.

4.2.10.2.2.1 Workers.

Rail line and Facilities Construction No spent nuclear fuel or high-level radioactive waste or other radioactive materials would be transported along the rail line during the construction phase. Therefore, there would be no radiological worker health and safety impacts related to radioactive materials transportation associated with construction of the proposed rail line or associated facilities under the Proposed Action.

Railroad Operations Potential occupational radiological impacts to workers associated with incident-free operation of the rail line and rail line facilities are described below. Occupational radiological impacts are quantified in terms of latent cancer fatalities. Occupational radiation doses (effective dose equivalent) are also reported.

Radiation Levels Emitted From Transportation Casks

The radiological impact analysis for spent nuclear fuel and high-level radioactive waste transportation assumes that the external radiation levels emitted from each transportation cask will be at the regulatory limit of 10 millirem per hour at a distance of 2 meters (6.6 feet). This assumption would tend to overestimate the radiation dose to workers and the public because not all casks will be loaded with spent nuclear fuel or high-level radioactive waste that has the characteristics that would result in the cask external dose rate being at the regulatory limit. In its report, *Assessment of Incident Free Transport Risk for Transport of Spent Nuclear Fuel to Yucca Mountain Using RADTRAN 5.5*, the Electric Power Research Institute noted that more than 40 percent of the spent nuclear fuel shipped is likely to have been stored for times greater than 20 years (DIRS 185330-EPRI 2005, p. 5-2). The longer spent nuclear fuel is stored, the lower the radiation dose would be when the spent nuclear fuel is shipped, and cask external dose rates would be lower than the regulatory limit. Section J.1.3.2.4 of the Yucca Mountain FEIS discussed this issue. The Yucca Mountain FEIS analysis estimated that the cask dose rate would be 50 to 70 percent of the regulatory limit. Based on this analysis, DOE expects that the radiological risks to workers and the public from incident-free transportation would be 50 to 70 percent of the values estimated in this Rail Alignment EIS.

Incident-Free Transportation: During the shipment of spent nuclear fuel and high-level radioactive waste from the Caliente-Upland, Caliente-Indian Cove, or Eccles-North Staging Yard to the repository, workers would potentially be exposed to direct radiation from 9,495 shipping casks. These workers would include rail transportation crew members, security escorts, workers potentially exposed when trains with loaded shipping casks passed the Maintenance-of-Way Trackside Facility, and workers potentially exposed when trains with loaded shipping casks passed trains with unloaded casks or other materials at sidings. A buffer railcar would separate the escorts from the last shipping cask in the train. Escorts would be located in an escort railcar at a distance of 39 meters (128 feet) from this shipping cask. A buffer railcar would also separate the crew members from the first shipping cask in the train. These workers would be shielded by the engine of the locomotive and unexposed. Workers at the Maintenance-of-Way Trackside Facility or Maintenance-of-Way Facility would be located 60 meters (200 feet) from the rail line and workers at sidings would be located 7.6 meters (25 feet) from the rail line. The methods and data used to estimate the radiation doses for these workers are described in Appendix K.

As discussed in Chapter 2, there are a number of possible combinations of common segments and alternative segments that could make up the rail alignment from the Interchange Yard to the repository. For the radiological impacts analyses, four specific alignments were evaluated: (1) the alignment with the highest population within the region of influence, (2) the shortest alignment, (3) the longest alignment, and (4) the alignment with the lowest population within the region of influence. These alignments are described in Table 3-67.

Table 4-115 lists the radiation doses and impacts for the workers along these four alignments. The collective radiation dose for these workers is estimated to be 310 to 320 person-rem. In the potentially exposed population of workers, the probability of a latent cancer fatality is estimated to be 0.19.

Table 4-115. Estimated radiological impacts for workers along the proposed rail alignment.

Group	Radiation dose	Latent cancer fatality
Maximally exposed worker[a] (annual)	0.50 rem per year	0.00030
Maximally exposed worker (50-year operation)	25 rem[b]	0.015[b,c]
Worker population	310 to 320 person-rem	0.19[d]

a. The maximally exposed worker is a security escort.
b. Total for 50 years of operation.
c. The estimated probability of a latent cancer fatality for an exposed individual worker.
d. The estimated number of latent cancer fatalities in an exposed worker population.

The maximally exposed worker would be a security escort. This worker is estimated to receive a radiation dose of 25 rem over the entire operations phase, based on a 0.5 rem per year administrative dose limit for repository facilities (DIRS 174942-BSC 2005, Section 4.9.3.3) and assuming that a person could work for up to 50 years escorting shipments. The probability of a latent cancer fatality for this worker is estimated to be 0.015. Security escort workers and other rail line workers would be subject to a radiation protection program. Workers, including security escort workers, would not be exposed to radiation in excess of the administrative dose limit for repository facilities of 0.5 rem per year. This requirement may in some cases limit the number of hours per year that workers are permitted to work as security escorts to less than 2,000 hours per year.

- **Staging Yard at Caliente-Indian Cove, Caliente-Upland, or Eccles-North, Rail Workers, Inspectors, and Escorts –** When shipping casks arrived at the Staging Yard, the railcars containing the shipping casks would be removed from the train, an inspection would be conducted, and the railcars would be transferred to the train for transport to the Rail Equipment Maintenance Yard. The escorts that had accompanied the shipping cask from its origin would also be present during this inspection. Involved workers such as rail workers, inspectors, and escorts would potentially be exposed to direct radiation from 9,495 shipping casks over the entire shipping campaign. Inspectors would be located 1 meter (3.3 feet) from the shipping cask. Escorts would be located further away, at a distance of 30 meters (100 feet) from the shipping cask. Noninvolved workers at the Staging Yard would be located at a distance of 100 meters

(330 feet) from the shipping casks. The methods and data used to estimate the radiation doses for these workers are described in Appendix K.

Table 4-116 lists the radiation doses and impacts for the workers involved with these activities. The analysis assumed that noninvolved workers would also potentially be exposed to direct radiation during these activities.

Table 4-116. Estimated radiological impacts for rail workers, inspectors, and escorts at the Staging Yard.

Group	Radiation dose	Latent cancer fatality
Maximally exposed worker[a] (annual)	0.50 rem per year	0.00030
Maximally exposed worker (50-year operation)	25 rem[b]	0.015[b,c]
Worker population (involved workers)	240 person-rem	0.14[d]
Worker population (noninvolved workers)	12 person-rem	0.0074
Worker population (total)	250 person-rem	0.15

a. The maximally exposed worker is an escort or inspector.
b. Total for 50 years of operation.
c. The estimated probability of a latent cancer fatality for an exposed individual worker.
d. The estimated number of latent cancer fatalities in an exposed worker population.

The collective radiation dose for involved and noninvolved workers is estimated to be 250 person-rem. In the potentially exposed population of workers, the probability of a latent cancer fatality is estimated to be 0.15.

The maximally exposed worker would be an escort or inspector. This worker is estimated to receive a radiation dose of 25 rem over the 50 years of operation, based on a 0.5 rem per year administrative dose limit for repository facilities (DIRS 174942-BSC 2005, Section 4.9.3.3) and assuming that a person could work for up to 50 years at the Staging Yard. The probability of a latent cancer fatality for this worker is estimated to be 0.015. Staging Yard workers and other facilities workers would be subject to a radiation protection program. Workers, including Staging Yard workers, would not be exposed to radiation in

Lifetime Dose to the Maximally Exposed Worker

The lifetime radiation exposure for the maximally exposed individual worker is estimated to be 25 rem based on the assumption that he or she would receive an annual administrative limit of 500 millirem per year for a 50-year working life escorting shipments. The use of the maximum annual results based on the administrative dose limit of 500 millirem would tend to overestimate the actual exposure of the maximally exposed individual worker, even assuming that the worker remained in the same job for 50 years, which is unlikely.

Industry experience indicates that the worker radiation doses will be much lower. For example, Progress Energy has conducted a total of 210 shipments, which includes 375 casks and 5,205 spent fuel assemblies. All shipments were conducted by rail using IF-300 casks (DIRS 185461-Edwards 2008, all). Forty-four of those shipments were from the Robinson plant to the Brunswick plant. Thirty-seven shipments were from the Robinson plant to the Harris plant. One hundred twenty-nine shipments were from the Brunswick plant to the Harris plant. During these shipments, all shipment escorts, train crews, and passengers were monitored for radiation exposure using thermoluminescent dosimeters. Dose rates at 2 meters (6.6 feet) from the cask were measured at less than 2 millirem per hour and during these shipments there has been zero recordable radiation dose to escorts, crews, and passengers. The collective radiation dose for crews loading, unloading, and decontaminating the casks at the shipping and receiving plants is generally less than 0.250 person-rem for a shipment, which includes the combined dose for all workers supporting the shipping and receiving plants.

excess of the administrative dose limit for repository facilities of 0.5 rem per year. This requirement may in some cases limit the number of hours per year that workers are permitted to work at the Staging Yard to less than 2,000 hours per year.

- **Rail Equipment Maintenance Yard –** Under the Proposed Action, a Rail Equipment Maintenance Yard would be constructed and operated to transfer cask cars to the repository. The workers at this facility would potentially be exposed to direct radiation from handling 9,495 shipping casks over 50 years of shipping. The radiation doses for these workers would be similar to the radiation doses for handling dedicated rail shipments at other railyards and are described in Neuhauser et al. The methods for estimating these radiation doses are described in Neuhauser et al. (DIRS 155430-Neuhuaser, Kanipe, and Weiner 2000, Section 3.5.2).

Table 4-117 summarizes the radiation doses and impacts for workers involved in these activities. The collective radiation dose for these workers is estimated to be 16 person-rem. In the potentially exposed population of workers, the probability of a latent cancer fatality is estimated to be 0.0096.

The individual radiation dose for workers at this facility was estimated to be 0.013 rem per year. The probability of a latent cancer fatality for this worker is estimated to be 7.6×10^{-6}. If this individual worked at the facility for 50 years, their radiation dose would be 0.64 rem. The probability of a latent cancer fatality for this worker is estimated to be 0.00038.

Table 4-117. Estimated radiological impacts for workers at the Rail Equipment Maintenance Yard.

Group	Radiation dose	Latent cancer fatality
Maximally exposed worker (annual)	0.013 rem per year	7.6×10^{-6}[a]
Maximally exposed worker (50-year operation)	0.64 rem[b]	0.00038[a]
Worker population	16 person-rem[b]	0.0096[c]

a. The estimated probability of a latent cancer fatality for an exposed individual worker.
b. Total for 50 years of operation.
c. The estimated number of latent cancer fatalities in an exposed worker population.

- **Cask Maintenance Facility –** Under the Proposed Action, Cask Maintenance Facility operations would include testing, inspection, certification, incidental repair, and minor decontamination and modification of the transportation casks. Impacts to workers from activities at the Cask Maintenance Facility were based on the impacts for a similar facility, the Alaron Regional Service Facility, located inWampum, Pennsylvania. This facility provides treatment, decontamination, compaction, and repackaging services for generators of radioactively contaminated materials. One of the services provided by Alaron is the decontamination of spent nuclear fuel casks, which is similar to the activities that would occur at the Cask Maintenance Facility. The activities at Alaron are described in *Environmental Assessment for Alaron Corporation* (DIRS 181886-NRC 1989, all) and *Environmental Assessment Renewal of Materials Licenses for ALARON Corp* (DIRS 151227-Blasing et al. 1998, all).

Radiation dose from cask handling and maintenance activities at the Cask Maintenance Facility could result in radiation dose to workers, primarily as a result of exposure to “crud.” Crud is the term used to describe contamination on the outside of spent nuclear fuel and would consist of the radionuclides Co-60, Mn-54, Fe-55, and Zn-65. Crud may be present in reactor spent nuclear fuel pools and may contaminate the inside of the cask during loading, even if the spent nuclear fuel has been placed in canisters. For the radionuclides contained in crud, average radionuclide inventories at the Alaron Regional Service Facility would consist of about 4.7 Ci of Co-60, 0.32 Ci of Mn-54, 7.6 Ci of Fe-55, and 0.061 Ci of Zn-65. Not all of this radionuclide inventory would be from the decontamination of spent nuclear fuel casks; some of the radionuclide inventory would be as a result of other services provided at the Alaron Regional Service Facility.

Workers at Alaron were estimated to receive an individual radiation dose of 0.04 rem per month. Over the course of a year, a worker would receive a radiation dose of 0.480 rem. This radiation dose was used to estimate the radiation dose to a worker at the Cask Maintenance Facility. The probability of a latent cancer fatality for this worker is estimated to be 0.00029.

Based on the total number of workers at the Cask Maintenance Facility, the collective radiation dose at the Cask Maintenance Facility would be 14 person-rem per year. In the potentially exposed population of workers, the probability of a latent cancer fatality is estimated to be 0.0086. Table 4-118 summarizes these impacts and also presents impacts for the entire duration of operations (50 years).

Table 4-118. Estimated radiological impacts for workers at the Cask Maintenance Facility.

Group	Radiation dose	Latent cancer fatality
Maximally exposed worker (annual)	0.48 rem per year	0.00029[a]
Maximally exposed worker (50-year operation)	24 rem[b]	0.014[a,b]
Worker population (annual)	14 person-rem per year	0.0086[c]
Worker population (50-year operation)	720 person-rem[b]	0.43[b,c]

a. The estimated probability of a latent cancer fatality for an exposed individual worker.
b. Total of 50 years of operation.
c. The estimated number of latent cancer fatalities in an exposed worker population.

- **Other Railroad Facility Operations –** Under the Proposed Action, other railroad facilities would be constructed and operated, including the Maintenance-of-Way Trackside Facility, Maintenance-of-Way Headquarters Facility, Satellite Maintenance-of-Way Facilities, Maintenance-of-Way Facility, and Nevada Railroad Control Center and National Transportation Operations Center. Radiological health impacts to workers operating these facilities are anticipated to be minimal, as casks would not be loaded or unloaded at these facilities. Note that the dose impacts for rail facility operations workers in Table 4-115 include radiological exposure to workers at the Maintenance-of-Way Trackside Facility and at workers at sidings who would potentially be exposed when the cask train passes by.

4.2.10.2.2.2 Public.

Construction No spent nuclear fuel or high-level radioactive waste or other radioactive materials would be transported along the rail line during the construction period. Therefore, there would be no radiological public health and safety impacts related to radioactive materials transportation associated with construction of the proposed rail line or associated facilities under the Proposed Action.

Operations

Incident-Free Rail Transportation:

- **Public along the Proposed Rail Line –** During the shipment of spent nuclear fuel and high-level radioactive waste from the Caliente-Upland, the Caliente-Indian Cove, or the Eccles-North Staging Yard to the Rail Equipment Maintenance Yard, residents and other people located along the proposed rail line would potentially be exposed to direct radiation from the 9,495 shipping casks that would pass by while being transported from the Staging Yard to the repository. ***Dedicated trains*** would be used for all shipments of spent nuclear fuel, high-level radioactive waste, and all other materials transported to or from the repository. Under incident-free circumstances, the dedicated trains would not stop anywhere along the rail line when transporting spent nuclear fuel or high-level radioactive waste from the Staging Yard to the repository. Also, under the Proposed Action, no passenger trains and no other freight trains would use the rail line; only trains transporting spent nuclear fuel, high-level radioactive waste, or other materials between the Staging Yard and the repository would use the rail line. Therefore, under incident-free conditions, no members of the public would share the rail line during radioactive materials transportation, and thus there would be no exposures of any members of the public sharing the transportation route or exposures of any members of the public located at stops along the route during transportation of radioactive materials. The collective population was the population within 800 meters (0.5 mile) of the rail line and was determined using U.S. Census data. The distance of the maximally exposed individual from the rail line was determined using geographic information system (GIS) data and imagery. The methods and data used to estimate the impacts from direct radiation for the public along the rail line are described in Appendix K.

As discussed in Chapter 2, there are a number of possible combinations of common segments and alternative segments that could make up the rail alignment from Caliente-Indian Cove, Caliente-Upland, or Eccles-North to the Rail Equipment Maintenance Yard. For the radiological impacts analyses, four specific alignments were evaluated. These alignments are described in Table 3-67.

Table 4-119 lists the potential radiological impacts for members of the public from incident-free transportation along the proposed rail line. Under the assumed conditions, the collective radiation dose for members of the public is estimated to be 0.087 to 0.21 person-rem. The probability of a latent cancer fatality based on the estimated dose would be 5.2×10^{-5} to 1.3×10^{-4}. The maximally exposed individual is a resident who lives 18 meters (60 feet) from the rail line. This individual is assumed to be exposed to each of the 9,495 shipping casks that pass by on the rail line. The radiation dose for this individual is estimated to be 0.0078 rem. The probability of a latent cancer fatality for this individual based on the estimated dose and the assumptions would be 4.7×10^{-6}.

Table 4-119. Estimated radiological impacts for the public along the proposed rail line.

Group	Radiation dose	Latent cancer fatality
Maximally exposed individual[a]	0.0078 rem[b]	4.7×10^{-6}[c]
Population	0.087 to 0.21 person-rem	5.2×10^{-5} to 1.3×10^{-4}[d]

a. The maximally exposed individual is a resident located 18 meters (60 feet) from the rail line.
b. Total for 50 years of operation.
c. The estimated probability of a latent cancer fatality for an individual within the region of influence.
d. The estimated number of latent cancer fatalities in the population within the region of influence.

- **Public near the Staging Yard at Caliente-Indian Cove –** The public around the Staging Yard location at Caliente-Indian Cove would potentially be exposed to direct radiation from 9,495 shipping casks over the entire shipping campaign. The collective population was the population within 800 meters (0.5 mile) of the edge of the Staging Yard and was determined using U.S. Census data. For the maximally exposed individual, the distance was from the center of the Staging Yard and was determined using geographic information system (GIS) data and imagery. The methods and data used to estimate the radiation doses for members of the public are described in Appendix K.

Table 4-120 lists the radiation doses and impacts for the public around the Staging Yard at Caliente-Indian Cove. The collective radiation dose is estimated to be 0.026 person-rem. Under the assumed conditions, the probability of a latent cancer fatality based on the estimated dose would be 1.6×10^{-5}. The ***maximally exposed individual*** is a resident who lives 1,600 meters (5,250 feet) from the Staging Yard. This individual was assumed to be exposed to each of the 9,495 shipping casks for a period of 2 hours per cask. The radiation dose for this individual is estimated to be 3.0×10^{-6} rem for the 9,495 casks over the entire shipping campaign. The probability of a latent cancer fatality for this individual based on the estimated dose and the assumptions would be 1.8×10^{-9}.

Table 4-120. Estimated radiological impacts for the public at the Staging Yard at Caliente-Indian Cove.

Group	Radiation dose	Latent cancer fatality
Maximally exposed individual[a]	3.0×10^{-6} rem[b]	1.8×10^{-9}[c]
Population	0.026 person-rem	1.6×10^{-5}[d]

a. The maximally exposed individual is a resident located 1,600 meters (5,250 feet) from the Staging Yard.
b. Total for 50 years of operation.
c. The estimated probability of a latent cancer fatality for an individual within the region of influence.
d. The estimated number of latent cancer fatalities in the population within the region of influence.

- **Public near the Staging Yard at Caliente-Upland –** The public around the Staging Yard location at Caliente-Upland would potentially be exposed to direct radiation from 9,495 shipping casks over the entire shipping campaign. The collective population was the population within 800 meters (0.5 mile) of the edge of the Staging Yard and was determined using U.S. Census data. For the maximally exposed individual, the distance was from the center of the Staging Yard and was determined using geographic information system (GIS) data and imagery. The methods and data used to estimate the radiation doses for members of the public are described in Appendix K.

Table 4-121 lists the radiation doses and impacts for the public near the Staging Yard at Caliente-Upland under the assumed conditions. The collective radiation dose is estimated to be 0.0064 person-rem. The probability of a latent cancer fatality based on the estimated dose would be 3.9×10^{-6}. The maximally exposed individual is a resident who lives 400 meters (1,310 feet) from the Staging Yard. This individual was assumed to be exposed to each of the 9,495 shipping casks for a period of 2 hours per cask. The radiation dose for this individual is estimated to be 0.0027 rem over the entire shipping campaign. The probability of a latent cancer fatality for this individual based on the estimated dose and the assumptions would be 1.6×10^{-6}.

Table 4-121. Estimated radiological impacts for the public at the Staging Yard at Caliente-Upland.

Group	Radiation dose	Latent cancer fatality
Maximally exposed individual[a]	0.0027 rem[b]	1.6×10^{-6}[c]
Population	0.0064 person-rem	3.9×10^{-6}[d]

a. The maximally exposed individual is a resident located 400 meters (1,310 feet) from the Staging Yard.
b. Total for 50 years of operation.
c. The estimated probability of a latent cancer fatality for an individual within the region of influence.
d. The estimated number of latent cancer fatalities in the population within the region of influence.

- **Public near the Staging Yard at Eccles-North –** The public around the Staging Yard location at Eccles-North would potentially be exposed to direct radiation from 9,495 shipping casks over the entire shipping campaign. The collective population was the population within 800 meters (0.5 mile) of the edge of the Staging Yard and was determined using U.S. Census data. For the maximally exposed individual, the distance was from the center of the Staging Yard and was determined using geographic information system (GIS) data and imagery. The methods and data used to estimate the radiation doses for members of the public are described in Appendix K.

Table 4-122 lists the radiation doses and impacts for the public near the Staging Yard at Eccles-North. Under the assumed conditions, the collective radiation dose is estimated to be 0.0039 person-rem. In the potentially exposed population, the probability of a latent cancer fatality is estimated to be 2.4×10^{-6}. The maximally exposed individual is a resident who lives 1,500 meters (4,920 feet) from the Staging Yard. This individual was assumed to be exposed to each of the 9,495 shipping casks for a period of 2 hours per cask. The radiation dose for this individual is estimated to be 3.4×10^{-6} rem over the entire shipping campaign. The probability of a latent cancer fatality for this individual based on the estimated dose and the assumptions would be 2.1×10^{-9}.

Table 4-122. Estimated radiological impacts for the public at the Staging Yard at Eccles-North.

Group	Radiation dose	Latent cancer fatality
Maximally exposed individual[a]	3.4×10^{-6} rem[b]	2.1×10^{-9}[c]
Population	0.0039 person-rem	2.4×10^{-6}[d]

a. The maximally exposed individual is a resident located 1,500 meters (4,920 feet) from the Staging Yard.
b. Total for 50 years of operation.
c. The estimated probability of a latent cancer fatality for an individual within the region of influence.
d. The estimated number of latent cancer fatalities in the population within the region of influence.

- **Cask Maintenance Facility –** Under the Proposed Action, Cask Maintenance Facility operations would include testing, inspection, certification, incidental repair, and minor decontamination and modification of the transportation casks. Impacts to members of the public from activities at the Cask Maintenance Facility were based on the impacts for a similar facility, the Alaron Regional Service Facility, located in Wampum, Pennsylvania. This facility provides treatment, decontamination, compaction, and repackaging services for generators of radioactively contaminated materials. One of the services provided by Alaron is the decontamination of spent nuclear fuel casks, which is similar to the activities that would occur at the Cask Maintenance Facility. The activities at Alaron are discussed in Environmental Assessment for Alaron Corporation and Environmental Assessment Renewal of Materials Licenses for ALARON Corp (DIRS 181886-NRC 1989, all; DIRS 151227-Blasing et al. 1998, all).

At the Alaron Regional Service Facility, the maximally exposed member of the public was located 300 meters (984 feet) from the facility. The radiation dose for this individual from emissions through all environmental pathways was estimated to be 2.0×10^{-9} rem per year. The probability of a latent cancer fatality for this individual is estimated to be 1.2×10^{-12}. The radiation dose and latent cancer fatality risk for members of the public from emissions from the Cask Maintenance Facility would be much smaller, because the public is located much further from the facility. For example, the nearest site boundary is 11 kilometers (7 miles) from the repository, while at Alaron, the maximally exposed member of the public was located 300 meters from the facility.

The ***total population*** within 84 kilometers (52 miles) of the Cask Maintenance Facility is estimated to be about 118,000 people in the year 2067. If all of these people were exposed at the same level as the maximally exposed member of the public, the resulting collective radiation dose would be 0.00023 person-rem per year. In this potentially exposed population, the probability of a latent cancer fatality is estimated to be 1.4×10^{-7}. Table 4-123 summarizes these impacts and also presents impacts for the entire duration of operations.

> The exposed population surrounding the proposed Cask Maintenance Facility is within an area 84 kilometers (52 miles) from the facility and the population in this area is assumed to be exposed at the same level as the maximally exposed individual. This assumption would overestimate the total population dose to the public from the Cask Maintenance Facility.

Accidents: To quantify the potential radiological impacts of transportation accidents, DOE performed two types of analyses. The first analysis provided an estimate of the radiological accident risks associated with transporting spent nuclear fuel and high-level radioactive waste along the Caliente rail alignment. The analysis of radiological accident risks takes into account a spectrum of accidents ranging from higher-probability accidents of low severity to hypothetical high-severity accidents that have a correspondingly low probability of occurrence. Accident risks included:

- Accidents in which there was no breach of containment and no deformation of shielding
- Accidents in which no release of radioactive material occurred, but where there was a deformation of shielding because of lead shield displacement
- Accidents in which radioactive material was released from the shipping cask.

Table 4-123. Estimated radiological impacts for the public from the Cask Maintenance Facility.

Group	Radiation dose	Latent cancer fatality
Individual member of the public (annual)	2.0×10^{-9} rem per year	1.2×10^{-12}[a]
Individual member of the public (50 years)	1.0×10^{-7} rem[b]	6.0×10^{-11}[a,b]
Collective members of the public (annual)	0.00023 person-rem per year	1.4×10^{-7}[c]
Collective members of the public (50 years)	0.012 person-rem[a]	7.0×10^{-6}[b,c]

a. The estimated probability of a latent cancer fatality for an individual within the region of influence.
b. Total for 50 years of operation.
c. The estimated number of latent cancer fatalities in the population within the region of influence.

Radiological accident risks were defined as the probability of occurrence of an accident multiplied by the consequences of the accident, summed over a complete spectrum of accidents. This quantity is known as "***dose risk***."

The second analysis provided an estimate of the consequences of severe transportation accidents, known as maximum reasonably foreseeable transportation accidents. Historically, the maximum reasonably foreseeable transportation accident is defined as a transportation accident with a frequency of about 1×10^{-7} per year.

Nonradiological accidents are discussed in Section 4.2.10.2.3 below.

- **Accident Risks –** The methods and data used to estimate radiological accident risks are discussed in Appendix K. The impacts from these accidents are listed in Table 4-124. The risks from radiological accidents are estimated to be 6.7×10^{-7} to 1.3×10^{-6} latent cancer fatalities.

Table 4-124. Estimated radiological accidents risks from potential transportation accidents along the proposed rail line.

Risk	Accident dose risk[a]	Latent cancer fatality
Radiological accident risk	1.1×10^{-3} to 2.2×10^{-3}	6.7×10^{-7} to 1.3×10^{-6}

a. Radiological accident dose risk is the sum of the products of the probabilities and consequences in person-rem of all potential transportation accidents. This sum is converted to latent cancer fatalities using the conversion factor of 0.0006 latent cancer fatality per person-rem.

- **Maximum Reasonably Foreseeable Accident –** Severe accidents having a frequency of about 1×10^{-7} per year are known as ***maximum reasonably foreseeable accidents***. Accidents with frequencies below 1×10^{-7} per year are generally not reasonably foreseeable. In this Rail Alignment EIS, the maximum reasonably foreseeable transportation accident has a frequency of about 6×10^{-7} per year. This accident involves a long duration, high-temperature fire that would engulf a cask. The methods and data used to estimate the impacts of this accident are discussed in Appendix K.

For the four evaluated rail alignments described in Table 3-67, there were no urban areas as defined in U.S. Census Bureau population data. However, there were suburban areas and rural areas. Suburban areas are defined as areas with a population density between 139 and 3,326 people per square mile. Rural areas were defined as areas with a population density less than 139 people per square mile. Using alignment-specific 2000 Census population data escalated to the year 2067, the average population density in suburban areas along the alignments was 223 to 226 people per square kilometer (577 to 586 people per square mile), near Caliente and Goldfield. The average population density along rural areas, escalated to the year 2067, ranged from 0.346 to 0.585 people per square kilometer (0.896 to 1.51 people per square mile).

Table 4-125 lists estimates of the impacts of this severe accident. If the maximum reasonably foreseeable accident were to occur in a suburban area, the population radiation dose would be 770 person-rem. Under the assumed conditions, the probability of a latent cancer fatality based on the estimated dose would be 0.46. If the maximum reasonably foreseeable accident were to occur in a rural area, the collective radiation dose would be 2.0 person-rem. Under the assumed conditions, the probability of a latent cancer fatality based on the estimated dose would be 1.2×10^{-3}. Because these risks would be for the entire exposed population, the risk for any single individual would be small.

Table 4-125. Estimated radiological impacts from the maximum reasonably foreseeable transportation accident scenario for suburban and rural areas.[a,b]

Impact	Suburban area[c]	Rural area[c]
Impacts to population		
Population dose (person-rem)	770	2
Latent cancer fatalities	0.46	1.2×10^{-3}
Impacts to maximally exposed individuals		
Maximally exposed individual dose (rem)	34	34
Probability of a latent cancer fatality	0.020	0.020
Impacts to a first responder		
Maximally exposed responder dose (rem)	0.14 to 2.0	0.14 to 2.0
Probability of a latent cancer fatality	8.2×10^{-5} to 0.0012	8.2×10^{-5} to 0.0012

a. There are no urban areas for the four specific alignments.
b. Accident frequency is estimated to be 6×10^{-7} per year.
c. Radiological impacts were based on low wind speeds and stable atmospheric conditions. These were defined as Class F stability and a wind speed of 2.9 feet per second.

In either a suburban area or rural area, the radiation dose from the maximum reasonably foreseeable transportation accident for the maximally exposed individual located 330 meters (1,100 feet) from the accident would be 34 rem. The probability of a latent cancer fatality for that individual based on the estimated dose and the assumptions would be 0.020.

The radiation dose to a first responder would range from 0.14 to 2.0 rem. The probability of a latent cancer fatality for this first responder based on the estimated dose and the assumptions would range from 8.2×10^{-5} to 0.0012.

- **Accidents at the Cask Maintenance Facility –** Under the Proposed Action, Cask Maintenance Facility operations would include testing, inspection, certification, incidental repair, and minor decontamination and modification of the transportation casks. Impacts to members of the public from activities at the Cask Maintenance Facility were based on the impacts for a similar facility, the AlaronRegional Service Facility, located in Wampum, Pennsylvania. This facility provides treatment, decontamination, compaction, and repackaging services for generators of radioactively contaminated materials. One of the services provided by Alaron is the decontamination of spent nuclear fuel casks, which is similar to the activities that would occur at the Cask Maintenance Facility. The activities at Alaron are discussed in *Environmental Assessment for Alaron Corporation* and *Environmental Assessment Renewal of Materials Licenses for ALARON Corp* (DIRS 181886-NRC 1989, all; DIRS 151227-Blasing et al. 1998, all).

For the accident analysis for the proposed Cask Maintenance Facility, DOE has assumed that the entire population would be exposed at the same level as a member of the public located 300 meters (984 feet) from the facility, even though the nearest public would be located about 11 kilometers (7 miles) from the Cask Maintenance Facility. This assumption would overestimate the collective population dose that would result from a fire at the facility.

A fire at the Alaron Regional Service Facility was estimated to result in a radiation dose of 0.00045 rem to a member of the public at a distance of 50 meters (164 feet) from the facility and a radiation dose of 0.000011 rem to a member of the public at a distance of 300 meters (984 feet) from the facility. The probability of a latent cancer fatality for these individuals is estimated to be 2.8×10^{-7} and 6.5×10^{-9}, respectively. For a similar fire at the Cask Maintenance Facility, the impacts would be much lower, because the public is located much further from the facility, about 11 kilometers (7 miles), as opposed to 50 to 300 meters at Alaron.

The total population within 84 kilometers (52 miles) of the Cask Maintenance Facility is estimated to be about 118,000 people in the year 2067. If all of these people were exposed at the same level as the member of the public located 300 meters (984 feet) from the facility, the resulting collective radiation dose would be 1.3 person-rem. The probability of a latent cancer fatality based on the estimated dose and the assumptions would be 7.6×10^{-4}.

SEVERE TRANSPORTATION ACCIDENTS: AN OPPOSING VIEWPOINT

The State of Nevada has provided analyses that indicate that the consequences of severe transportation accidents would be much higher than those in this Rail Alignment EIS. For example, the state has estimated that the long-term consequences of a rail accident in a rural area could result in seven to 614 latent cancer fatalities in the exposed population (DIRS 181756-Lamb, Resnikoff, and Moore 2001, Table 41), while DOE estimates that about one latent cancer fatality would occur in the exposed population.

The State estimated these consequences using computer programs that DOE developed and uses. However, the state's analysis used values for parameters that would be at or near their maximum values. DOE guidance for the evaluation of accidents in environmental impact statements (DIRS 172283-DOE 2002, p. 6) specifically cautions against the evaluation of scenarios for which conservative (or bounding) values are selected for multiple parameters because the approach yields unrealistically high results.

DOE's approach to accident analysis estimates the consequences of severe accidents having frequencies as low as 1×10^{-7} per year (1 in 10 million) (DIRS 172283-DOE 2002, p. 9) using realistic yet cautious methods and data. DOE believes that the State of Nevada estimates are unrealistic and that they do not represent the reasonably foreseeable consequences of severe transportation accidents.

Evaluation of Transportation Sabotage

Transportation Sabotage Considerations – In response to the terrorist attacks of September 11, 2001, and to intelligence information that has been obtained since then, the U.S. Government has initiated nationwide measures to reduce the threat of sabotage. These measures include security enhancements intended to prevent terrorists from gaining control of commercial aircraft, such as (1) more stringent screening of airline passengers and baggage by the Transportation Security Administration, (2) increased presence of federal air marshals on many flights, (3) improved training of flight crews, and (4) hardening of aircraft cockpits. Additional measures have been imposed on foreign passenger carriers and domestic and foreign cargo carriers, as well as charter aircraft.

Beyond these measures to reduce the potential for terrorists to gain control of an aircraft, DOE has adopted an approach that focuses on ensuring that safety and security requirements are adequate and effective in countering and mitigating the effects of sabotage events that involve transportation casks. The Federal Government has greatly improved the sharing of intelligence information and the coordination of response actions among federal, state, and local agencies. DOE has been an active participant in these efforts; it now has regular and frequent communications with other federal, state, and local government agencies and industry representatives to discuss and evaluate the current threat environment, to assess the adequacy of security measures at DOE facilities and, when necessary, to recommend additional actions. In addition to its domestic efforts, DOE is a member of the International Working Group on Sabotage for Transport and Storage Casks, which is investigating the consequences of sabotage events and exploring opportunities to enhance the physical protection of casks.

In addition, the Nuclear Regulatory Commission has promulgated rules (10 CFR 73.37) and interim compensatory measures (67 *FR* 63167, October 10, 2002) specifically to protect the public from harm that could result from sabotage of spent nuclear fuel casks. The purposes of these security measures are to minimize the possibility of sabotage and to facilitate recovery of spent nuclear fuel shipments that could come under the control of unauthorized persons. These measures include the use of armed escorts to accompany all shipments, safeguarding of the detailed shipping schedule information, monitoring of shipments through satellite tracking and a communication center with 24-hour staffing, and coordination of logistics with state and local law enforcement agencies, all of which would contribute to shipment security. The Department has committed to following these rules and measures (see 69 *FR* 18557, April 8, 2004).

The Department, as required by the Nuclear Waste Policy Act, as amended (NWPA) (42 U.S.C. 10101 *et seq.*), would use Nuclear Regulatory Commission-certified shipping casks. Each cask design must meet stringent requirements for structural, thermal, shielding, and criticality performance and confinement integrity for routine (incident-free) and accident events. Spent nuclear fuel is protected by the robust metal structure of the shipping cask, and by cladding that surrounds the fuel pellets in each fuel rod of an assembly. Further, the fuel is in a solid form, which would tend to reduce dispersion of radioactive particulates beyond the immediate vicinity of the cask, even if a sabotage event were to result in a breach of the multiple layers of protection.

Based on this knowledge, the Department has analyzed plausible threat scenarios, required enhanced security measures to protect against these threats, and developed emergency planning requirements that would mitigate potential consequences for certain scenarios. DOE would continue to modify its approach to ensuring safe and secure shipments of spent nuclear fuel and high-level radioactive waste, as appropriate, between now and the time of shipments.

For the reasons stated above, DOE believes that under general credible threat conditions the probability of a sabotage event that would result in a major radiological release would be low. Nevertheless, because of the uncertainty inherent in the assessment of the likelihood of a sabotage event, DOE has evaluated events in which a military jet or commercial airliner would crash into a spent nuclear fuel cask or a modern weapon (high-energy density device) would penetrate a spent nuclear fuel cask (see Consequences of Potential Sabotage Events below).

Consequences of Potential Sabotage Events – Whether acts of sabotage or terrorism would occur, and the exact nature and location of the events or the magnitude of the consequences of such acts if they were to occur, is inherently uncertain—the possibilities are infinite. Nevertheless, the Yucca Mountain FEIS and, consistent with Departmental guidance (DIRS 172283-DOE 2002, all), this Rail Alignment EIS took a hard look at the consequences of potential acts of sabotage or terrorism during the transport of spent nuclear fuel and high-level radioactive waste by evaluating two fundamentally different scenarios: one involving aircraft and one involving a weapon or device that struck a transportation cask loaded with commercial spent nuclear fuel. DOE estimated the consequences of these scenarios without regard to their probability of occurrence; that is, DOE assumed the scenarios would occur and under conditions that would reasonably maximize the consequences.

To estimate the consequences of aircraft crashes, DOE identified the aircraft parts most likely to penetrate a transportation cask, identified the military and commercial aircraft most likely to be involved in a crash in an urban area (for example, Las Vegas, Nevada), and estimated the speed of the aircraft at impact (DIRS 155970-DOE 2002, Section J.3.3.1). DOE first considered the ability of aircraft parts to penetrate a transportation cask and concluded that the parts with the highest chance of penetration would be the engines and engine shafts. Based on flight information from Nellis Air Force Base, DOE selected the F-15 and F-16 high-performance jet fighters, which represent more than 70 percent of military flight operations. For the commercial aircraft analysis, DOE selected the B-767, a relatively large and widely used jet. Lastly, DOE selected aircraft impact speeds of 550 kilometers per hour (340 miles per hour). Based on this analysis, DOE determined that neither the engine nor engine shafts of any of the three aircraft would penetrate the wall of a transportation cask to a sufficient depth to cause a release of radioactive materials. Further analysis determined that if the impact and resultant fire caused a cask seal to fail, little radiation would escape and there would be less than 0.65 latent cancer fatality in the affected urban population. In the rural and suburban areas along the Caliente rail alignment, the impacts would be even lower.

In selecting the high-energy density devices, DOE first performed a survey of weapons and devices that might be capable of penetrating a full-size spent nuclear fuel cask. From the many different types of weapons and devices the survey considered, the Department selected four general types for further evaluation: conical-shaped charges, contact-breaching charges, platter charges, and pyrotechnic torches. Analyses that subjected both simulated and actual spent nuclear fuel truck casks to the four types of high-energy density devices provided data for selection of a high-energy density device that would show the greatest potential to penetrate a full-size spent nuclear fuel cask and disperse its contents. As DOE reported in the Yucca Mountain FEIS (DIRS 155970-DOE 2002, Section 6.2.4.2.3), two specific high-energy density devices were chosen for more detailed analysis. The first high-energy density device was designed to produce the maximum cavity volume from its explosive impact, was near the weight limit that a single individual could carry, and had been used in the full-scale cask penetration test of a spent nuclear fuel truck cask. The second high-energy density device was an anti-tank weapon that was designed to achieve maximum penetration depth in an armored vehicle and could be delivered remotely using a launch and guidance system. DOE then modeled the incidents and benchmarked the results against the physical tests.

To assess the consequences of a weapon or device (also referred to as a high-energy density device) that penetrated a transportation cask, DOE selected a rail cask and two possible high-energy density devices, one of which had been shown through various physical tests to penetrate a cask. The rail cask for the analysis was based on a conceptual design similar in construction to casks the Nuclear Regulatory Commission has certified, such as the NAC-STC, NUHOMS MP187, NUHOMS MP197, HI-STAR 100, and others.

To estimate the potential consequences of a sabotage event in which a high-energy density device penetrated a rail cask, DOE, in the Yucca Mountain FEIS, referred to *Projected Source Terms for Potential Sabotage Events Related to Spent Fuel Shipments* to obtain estimates of the fraction of spent nuclear fuel materials that would be released (release fractions) (DIRS 104918-Luna et al. 1999, all). In this Rail Alignment EIS, the Department used the more recent release fraction estimates from "Release Fractions from Multi-Element Spent Fuel Casks Resulting from HEDD [high-energy density device] Attack" (DIRS 181279-Luna 2006, all) to estimate the consequences of such events involving spent nuclear fuel in rail casks. These more recent estimates of release fractions (DIRS 181279-Luna 2006, all) are based on the release fractions estimated in 1999 from *Projected Source Terms for Potential Sabotage Events Related to Spent Fuel Shipments* (DIRS 104918-Luna et al. 1999, all), but they also incorporate data from additional tests sponsored by *Gesellschaft für Anlagen - und Reaktorsicherheit* in Germany and conducted in France in 1994 that were not available for the 1999 report. These additional test data suggest that the consequences of the sabotage event DOE analyzed in the Yucca Mountain FEIS could be overstated by a factor of between 2.5 and 12.

The potential impacts of sabotage were assessed for rail shipments from the Caliente-Upland, Caliente-Indian Cove, or Eccles-North Staging Yard to the repository. As with the maximum reasonably foreseeable accidents discussed in the Accidents section, four specific rail alignments were evaluated. The methods and data used to estimate the impacts of sabotage events are described in Appendix K.

For the four specific alignments there were no urban areas, as defined in U.S. Census Bureau population data. However, there were suburban areas and rural areas. Using alignment-specific 2000 Census population data escalated to the year 2067, the average population density in suburban areas along the alignments was 223 to 226 people per square kilometer (577 to 586 people per square mile), near Caliente and Goldfield. The average population density along rural areas, escalated to the year 2067, ranged from 0.346 to 0.585 people per square kilometer (0.896 to 1.51 people per square mile).

The impacts of a sabotage event are listed in Table 4-126. If a sabotage event occurred in a suburban area, the collective radiation dose is estimated to be 1,800 person-rem. The total latent cancer fatalities for people exposed during a sabotage event is estimated to be 1.1. If the sabotage event occurred in a rural area, the collective radiation dose is estimated to be 4.7 person-rem. The total latent cancer fatalities for people exposed during this sabotage event is estimated to be 0.0028. Because these risks would be for the entire population, the risk for any single individual would be small.

Table 4-126. Estimated radiological impacts for a sabotage event involving a rail shipping cask for suburban and rural areas.[a,b]

Impact	Suburban area[c]	Rural area[c]
Impacts to populations		
Population dose (person-rem)	1,800	4.7
Latent cancer fatalities	1.1	0.0028
Impacts to maximally exposed individuals		
Maximally exposed individual dose (rem)	27	27
Probability of a latent cancer fatality	0.016	0.016

a. There are no urban areas for the four specific alignments
b. Impacts are based on a sabotage event with High Energy Density Device 1 (DIRS 181279-Luna 2006, all).
c. Based on neutral atmospheric conditions and moderate wind speeds; defined as Class D stability and a wind speed of 15 feet per second.

In either a suburban area or rural area, the maximally exposed individual would be located 100 meters (330 feet) from the sabotage event. The radiation dose for the maximally exposed individual is estimated to be 27 rem. The probability of a latent cancer fatality for the maximally exposed individual is estimated to be 0.016.

The State of Nevada, in its scoping comments and comments on DOE's EISs related to Yucca Mountain, recommended that the DOE sabotage analysis address postulated attacks that involved, for example, multiple weapons, combinations of weapons that were designed to maximize release and dispersal of radioactive materials, environmental and population conditions unique to specific locations and locations with high symbolic value, large groups of well-trained adversaries, suicide attacks, and infiltration of trucking and railroad companies. The State of Nevada also suggested that DOE consider the potential for human error to exacerbate the consequences of such attacks on a transportation cask.

In support of the State of Nevada's contention that DOE has underestimated the potential consequences of a sabotage or terrorist attack, the state commissioned a study to reevaluate the DOE sabotage analysis and concluded that a scenario that used a high-energy density device, such as an antitank missile, would result in consequences about 10 times greater than those DOE estimated (DIRS 181892-Lamb et al. 2002, p. 19). The state has asserted that the antitank missile would penetrate both sides of a truck or rail cask and cause a much greater release than that DOE estimated (DIRS 181892-Lamb et al. 2002, p. 18), but has provided no credible scientific evidence for this assertion.

Nevada's assertion of higher consequences is contrary to the results of the DOE computer modeling, which the Department benchmarked to physical test results and which demonstrated that a weapon such as that in the state's study would not perforate both sides of the cask (DIRS 104918-Luna et al. 1999, all). In addition, the higher consequences the state predicted were a result of the selection of parameter values that are either incorrect, are based on views not generally accepted by the scientific community, or when taken together inappropriately result in compounding the adverse consequences of the scenarios analyzed. To illustrate:

- Cesium is a key contributor to dose in a release from a cask. In a spent nuclear fuel rod, cesium may reside in three locations: in the gap between the cladding and the fuel pellet, at fuel grain boundaries, and in the fuel matrix. The amount of cesium in the gap between the cladding and the fuel pellet ranges from 0.21 to 10.50 percent of the total cesium inventory, with an average of about 2.95 percent (DIRS 169987-BSC 2004, Table 6-3). The amount of cesium at the fuel grain boundaries ranges from 0.19 to 1.23 percent of the total cesium inventory, with an average of about 0.19 percent of the total cesium inventory (DIRS 169987-BSC 2004, Table 6-3). Collectively, the cesium inventory for the gap between the cladding and the fuel pellet and at the fuel grain boundaries is often referred to as the "gap inventory" and ranges from 0.40 to 11.73 percent of the total cesium inventory, with an average of about 3.7 percent (DIRS 169987-BSC 2004, Table 6-3). In accidents involving spent nuclear fuel, this cesium may be rapidly released if the cladding is ruptured.

  In Luna et al. (DIRS 104918-Luna et al. 1999, all), the release of cesium during a sabotage event had two components: the release of the cesium gap inventory in the disrupted spent nuclear fuel rods, and the release of cesium from the fuel matrix in the disrupted spent nuclear fuel rods. All the cesium in the matrix of the disrupted rods was assumed to be released to the cask cavity during a sabotage event. Because much more cesium is present in the fuel matrix than in the gap, the release of cesium was dominated by the release of cesium from the matrix, not the release of cesium from the gap. This is in contrast to most accidents involving spent nuclear fuel, where often only the gap inventory is released when the cladding is ruptured, and there is no release from the fuel matrix.

  To estimate its cesium release fraction, the state considered a DOE-funded study that estimated the cesium inventory in the gap to be as high as 9.9 percent, 33 times higher than the gap inventory the state said was used in the Luna study. The state apparently assumed that the entire cesium release fraction was proportional to the gap inventory, and accordingly multiplied the total release fraction used by Luna by 33. The state's approach is incorrect because it does not recognize that all of the cesium inventory, that is, the cesium in the gap and that in the matrix, was released to the cask cavity in the Luna study. By increasing the total release fraction by a factor of 33, the state's analysis effectively released 33 times the entire amount of cesium in the disrupted spent nuclear fuel rods, which is clearly incorrect.

- In this Rail Alignment EIS, DOE used the dose-to-health-effect conversion factor of 0.0006 latent cancer fatality per person-rem that both the Interagency Steering Committee on Radiation Standards (DIRS 174559-Lawrence 2002, all) and current DOE guidance (DIRS 178579-DOE 2004, pp. 22 to 24) recommend. This value is consistent with the lethality-adjusted cancer risk coefficients from the *2007 Recommendations of the International Commission on Radiological Protection*, 0.00041 per person-rem for workers and 0.00055 per person-rem for individuals among the general population

(DIRS 182836-ICRP 2008, p. 53); the dose-to-health-effect conversion factors published by the National Research Council in the *Health Risks from Exposure to Low Levels of Ionizing Radiation, BEIR VII Phase 2* (DIRS 181250-National Research Council 2006, p. 15), which ranged from 0.00041 to 0.00061 latent cancer fatality per person-rem for solid cancers and 0.000050 to 0.000070 latent cancer fatality per person-rem for leukemia; and the age-specific dose-to-health-effect conversion factor published by the Environmental Protection Agency, 0.000575 latent cancer fatality per person-rem (DIRS 153733-EPA 2000, Table 7.3, p. 179).

The Dose and Dose Rate Effectiveness Factor (DDREF) is used to account for the lower cancer risks of radiation exposures at low doses and low dose rates as compared with radiation exposures at high doses and high dose rates. The State of Nevada used a dose-to-health-effect conversion factor of 0.001 latent cancer fatality per person-rem, which the state estimated by not including a DDREF (that is, by using a DDREF of 1) (DIRS 181892-Lamb et al. 2002, p. 7). The state cites as support for this argument an article by Pierce and Preston. In response, DOE notes that the use of a DDREF of 1.5 to 2 is supported by both the National Research Council (DIRS 181250-National Research Council 2006, p. 15) and the International Commission on Radiological Protection (DIRS 182836-ICRP 2008, p. 53).

The state also points out that the dose-to-health-effect conversion factor depends on age and gender. However, the dose-to-health-effect conversion factors developed by the International Commission on Radiological Protection, the National Research Council, and the Environmental Protection Agency already consider age and gender and so no further adjustment to the dose-to-health-effect conversion factor is necessary.

- The degree of dispersal of radioactive particles is proportional to the height at which the radioactive particles are released; the lower the height at which the particles are released, the less the dispersion and the higher the consequences. In its study, the state used a release height for all particles of 1.508 meters (4.95 feet) for a truck cask and 2.08 meters (6.82 feet) for a train cask (DIRS 181892-Lamb et al. 2002, p. 6). These release heights are not realistic because they do not account for plume rise as a result of the explosive action of a high-energy density device. In contrast, DOE accounted for plume rise by using multiple release heights and estimated that 4 percent of the release would occur at a height of 1 meter (3.3 feet), 16 percent at 16 meters (52 feet), 25 percent at 32 meters (100 feet), 35 percent at 48 meters (160 feet), and 20 percent at 64 meters (210 feet) (DIRS 157144-Jason Technologies 2001, p. 189). Indeed, the state acknowledged that an increase in the release height would result "in a decrease in the dose to the MEI [maximally exposed individual]" (DIRS 181892-Lamb et al. 2002, p. 6).

- The meteorological conditions at the time of release from a cask have a bearing on the consequences. The state chose to use stable atmospheric conditions (Class F stability), which represent plume concentrations that would not be exceeded 95 percent of the time in its analysis (DIRS 181892-Lamb et al. 2002, p. 6). In contrast, because it is not possible to forecast the environmental conditions that might exist during an act of sabotage, DOE used neutral atmospheric conditions (Class D stability), which represent plume concentrations that would not be exceeded 50 percent of the time.

DOE recognizes that it could analyze scenarios with, for example, higher aircraft impact velocities or weapons with greater destructive capabilities, or it could postulate scenarios with combinations of factors, such as human error and suicide attacks, as the State suggested, that could produce a much broader range of consequences that are more detrimental than those this Rail Alignment EIS estimates. As an initial matter, for an act of sabotage or terrorism to be carried out, the persons responsible for such acts would have to overcome the security measures in place. The intent of safeguards and security measures (see Transportation Sabotage Considerations) is to thwart such attacks and, in any event, the measures would tend to minimize the consequences of such an attack. The scenarios DOE analyzed are conservative because the Department did not consider the effectiveness of such measures, and that such measures would make the likelihood of a sabotage event even lower.

Further, and setting aside the security measures that would be in place, the effectiveness of a sabotage event would depend on a number of critical factors such as the ability to deliver the weapon perpendicular to the circular surface of a relatively small object (a rail cask is about 2.26 meters [7.4 feet] in diameter and 5.18 meters [17 feet] long), which might be in transit and thus a moving target, the extent to which the individual had the knowledge to select and the training to use the appropriate weapon, and whether the weapon was at the optimal distance from the cask.

As with any aspect of environmental impact analysis, it is always possible to postulate scenarios that could produce higher consequences than previous estimates. In eliminating the requirement that agencies conduct a worst-case analysis, the Council on Environmental Quality has pointed out that "one can always conjure up a worse 'worst case'" by adding more variables to a hypothetical event (50 *FR* 32234, August 8, 1985), and that "'worst case analysis' is an unproductive and ineffective method … one which can breed endless hypothesis and speculation" (51 *FR* 15620, April 25, 1986). As indicated in the Council on Environmental Quality regulations that implement NEPA, an agency has a responsibility to address reasonably foreseeable significant adverse effects. The evaluation of impacts is subject to a "rule of reason," ensuring analysis is based on credible scientific evidence useful to the decisionmaking process. In applying the rule of reason, an agency does not need to address remote and highly speculative consequences in its EIS. The crafting and analysis of the scenarios the state suggested would be based on conjecture and would not have the support of credible scientific evidence.

DOE has required enhanced security measures to protect against plausible threat scenarios and developed emergency planning requirements that would mitigate potential consequences for certain scenarios. For all the reasons discussed above, DOE believes that under general threat conditions, the probability of a sabotage event against a transportation cask that carried spent nuclear fuel or high-level radioactive waste that could result in a major radiological release would be low. Nevertheless, DOE has taken a hard look by examining potential, but fundamentally different, sabotage scenarios.

4.2.10.2.3 Nonradiological Transportation Impacts

4.2.10.2.3.1 Construction Impacts.

Nonradiological Roadway Accidents During construction, personnel and equipment would be moved initially by truck and other vehicles, and could be moved by rail once portions of the rail line were completed. Such movements of equipment and personnel could lead to roadway accidents.

DOE estimates that the construction phase would involve approximately 2,160 full-time-equivalent workers during the first three years, 1,080 full-time-equivalent workers in the fourth year, and 540 full-time-equivalent workers in the last year, for a total of 8,100 full-time-equivalent workers, not including the Cask Maintenance Facility (DIRS 174083-WPI 2003, all; DIRS 182825-Nevada Rail Partners 2007, Appendix D, Tables 1 and 2). The construction phase would take a minimum of 4 years and 6 months. The Cask Maintenance Facility construction would involve an additional 150 workers for 88 weeks.

In total, there would be 8,100 full-time-equivalent workers involved in the construction of the rail line and associated facilities and an additional 263 full-time-equivalent workers for construction of the Cask Maintenance Facility. The exact distribution over time is not significant for the traffic safety calculations, which are aggregated over the total construction time. In other words, if the construction phase were assumed to take place over a 10-year period, this would only mean that fewer workers would be making more trips; this would result in a similar total number of trips as the minimum 4.5-year construction phase.

For each year, it is assumed that each worker would make two trips per day over five days a week for 50 weeks a year (that is, 2,000 hours per year full-time-equivalent workers). To provide a conservative upper bound estimate of roadway accidents, DOE assumed that all workers would individually make daily vehicle trips on roadways, even though it is likely that many rail line construction workers would reside in construction camps linked to work sites by access roads. Each trip is assumed to be 80 kilometers (50 miles) in length, which translates to approximately 40,000 kilometers (25,000 miles) per year per worker. While the distances involved for portions of this construction project are obviously much greater, a worker might travel hundreds of miles each way every one to two weeks and stay in the construction camps between these longer trips. This travel pattern would result in approximately the same distance traveled per worker. Collectively, the total distance driven by all workers would be approximately 335 million kilometers (200 million miles).

Based on a fatal accident rate of 1.65 fatalities per 100 million vehicle-kilometers (2.66 per 100 million vehicle-miles) (DIRS 180484-FHWA 2006, p. 1, Section V, Tables FI-20 and VM-2) traveled for light trucks or passenger cars in rural areas in Nevada, approximately six fatalities could occur due to the movement of workers during construction of the rail line and facilities.

These estimates would not vary among the proposed specific alignments, because the number of potential fatalities is based on the total distance traveled and is not dependent on the minor difference in the length or location of the alternative segments. Therefore, the predicted accident rates are the same for each specific alignment.

Nonradiological Rail Line Accidents During the construction phase, there are expected to be up to 992 loaded trains servicing the Caliente area, 1,116 for Garden Valley, and 1,984 near Goldfield (DIRS 182826-Nevada Rail Partners 2007, Appendix A, p. A-9) as the portions of the rail line that had already been completed were used to bring critical materials to the various staging areas (the length of line constructed from a particular staging area would influence the number of trains used on each segment of the partially completed rail line). A shorter construction phase would result in more trains per day, and a more extended construction phase would likely experience the lower end of the range of expected train volume.

Given the variability in the number of trains per day or year, this analysis focuses on the total number of inbound loaded and outbound unloaded construction trains, which is predicted to be 8,184 ([992 + 1,116 + 1,984] × 2). These trains would travel at speeds between 24 and 64 kilometers (15 and 40 miles) per hour depending on both the load carried and the area in which they operate. DOE assumes that each train would travel one-half of the total route length, or approximately 270 kilometers (170 miles) on average. Therefore, the total number of train-kilometers would be approximately 2.2 million train-kilometers (1.4 million train-miles). The total expected number of loaded railcars (including locomotives) during the construction phase are 22,240 for the Caliente area, 25,020 for Garden Valley, and 44,480 for Goldfield. The total number of inbound loaded and outbound unloaded construction railcars is predicted to be 183,480 ([22,240 + 25,020 + 44,480] × 2), resulting in approximately 50 million railcar-kilometers (31 million railcar-miles).

The transportation safety impacts of concern during construction focus on rail-related accidents and worker and public fatalities. Based on the same rail accident rates described in the operations phase (Section 4.2.10.2.3.2), accidents associated with train-kilometers and railcar-kilometers are calculated. A total of three rail accidents would be expected to occur for the entire set of estimated train and railcar movements during construction.

Based on Federal Railroad Administration statistics, the fatality rate for workers is 3.46×10^{-10} fatality per railcar-kilometer traveled, and the rate for occupants of other vehicles and pedestrians is 1.11×10^{-8} fatality per railcar-kilometer traveled (DIRS 178016-DOT 2005, Chapter 1, all). Rates were derived by considering fatalities associated with freight train operations only (fatalities associated with passenger train operations were omitted for more applicable rates). As a result, the worker category considers worker-on-duty, worker-not-on-duty, contractor-on-duty, and contractor-other. Public fatalities include both trespassers and non-trespassers. Because passenger operations are not relevant to the Proposed Action, there is no consideration of the passengers-on-train category.

Based on these fatality rates, a total of 0.6 fatality (that is, not more than one) would be expected to occur for the entire set of estimated railcar movements during construction. No detectable difference is expected for the specific alignments, as the total variation in route lengths is minimal (greatest difference would be between Goldfield alternative segment 1 and Goldfield alternative segment 4, which is a 5-kilometer [3-mile] difference).

Many movements of rail-mounted construction equipment are also anticipated. This equipment would travel fairly short distances each day to conduct activities such as setting out railroad ties or preparing the ballast. These movements have not been included in the count of train-kilometers as they would occur in controlled work areas and in very small increments, rather than at any measurable speed in a publicly accessible area.

4.2.10.2.3.2 Operations Impacts.

Nonradiological Roadway Accidents The assessment of impacts to transportation safety begins with accidents, such as may be experienced by any vehicle, independent of cargo. These accidents typically result in injuries or fatalities to drivers or operators, other motorists, or pedestrians, and could result from the movement of cargo.

Approximately 230 workers would be involved in the operation of the rail line and the facilities. Each year it is assumed that each worker would make two trips per day, over 5 days a week, for 50 weeks a year. It is assumed that each trip would be 80 kilometers (50 miles). This would result in 40,000 kilometers (25,000 miles) per year per worker. Collectively, over the 50-year operations phase, the total number of kilometers driven by workers would be approximately 460 million kilometers (288 million miles).

Based on a fatal accident rate of 1.65 fatalities per 100 million vehicle-kilometers (2.66 per 100 million vehicle-miles) traveled for light trucks or passenger cars in rural areas in Nevada (DIRS 180484-FHWA 2006, p. 1, Section V, Tables FI-20 and VM-2), approximately eight fatalities would be expected due to the movement of workers during operation of the rail line and facilities over 50 years of operation. These estimates are not specific to the specific alignments, because the small variations in length and location of the alternative segments would not significantly affect the total distance traveled.

Nonradiological Rail Line Accidents The rail transportation safety analysis for the operations phase of the Proposed Action assesses the impacts of transportation, rail facilities, and grade crossings.

Rail Alignment: The proposed rail line would range from 528 to 541 kilometers (approximately 328 to 336 miles) in length, depending on which alternative segments are chosen. Given the similarities in the lengths of the alternative segments, the longest specific alignment has been selected to conservatively estimate the overall accident risks for the rail line.

This analysis includes both dedicated railcar cask trains and other trains not involving casks from the Interchange and Staging Yard to the Rail Equipment Maintenance Yard. A typical spent nuclear fuel or high-level radioactive waste train would have two to three locomotives, followed by a buffer car, one to five cask cars, another buffer car, and an escort car. The actual number of casks per train could vary from one to five, while the number of locomotives could vary from two to three. The total number of casks that would be moved by rail is 9,495. Based on Total System Model runs, there would be 2,833 trains carrying loaded casks and an equal number carrying empty casks. Therefore, to determine the impacts of moving cask cars, the analysis considers 5,666 trains (2,833 × 2) involving cask cars. The Model runs also give the total number of railcars involved in cask trains, with an average of 8.54 cars per train (3.35 cask cars, 2.19 locomotives, two buffer cars, and one escort car). Over the 50-year operations phase, there would be approximately 48,408 railcars associated with cask trains.

In addition to trains involving cask cars, there are also other types of trains that would be operating along the rail line, including maintenance-of-way trains (two one-way trains per week), and repository supply and construction trains (seven one-way trains per week). The total number of trains not involving casks would be 23,400 over 50 years of operation. The total number of railcars not carrying casks would be 58,338, accounting for both loaded and unloaded cars (DIRS 182826-Nevada Rail Partners 2007, Section 4.0, Table 1).

The total number of railcars (all kinds) moved under the Proposed Action would be approximately 106,746 (48,408 + 58,338), considering both directions of travel. Based on the same fatality rates used in the construction analysis, namely 3.46×10^{-10} fatality per worker per railcar-kilometer, and 1.11×10^{-8} fatality per pedestrian per railcar-kilometer, 0.7 fatality (that is, not more than one) would be expected to occur for the entire set of estimated railcar movements during operation.

The Interchange Yard would operate like a typical large siding or other similar types of rail yards, so the hazards associated with its operation would be the potential for transport accidents. However, because the buffer cars, cask cars, and escort car would be separated as a unit from the trains used to transport the casks from their origins, there would be limited chances for derailments involving the cask cars in the Interchange Yard. Accidents in yards typically occur as individual cars are handled, not with complete sets of cars. Accidents during the handling of railcars also occur at very low speeds, further limiting the chance of an accident. Because the trains are expected to enter the Interchange Yard from the Union Pacific Railroad Mainline at normal track speed, the accident rate for the Interchange Yard would be based on mainline accident rates rather than yard accident rates.

Accident rates for rail transportation are generally presented as either accidents per train-kilometers or a combination of accident rates based on both accidents per train-kilometer traveled and accidents per railcar-kilometer traveled, considering these two classes of accident causes separately. Review of Federal Railroad Administration statistics and industry data on the distribution of track classes produced the accident rates given in Table 4-127 for Track Class 3 (DIRS 180220-Bendixen and Facanha 2007, all).

Table 4-127. Estimated rail accident rates.[a]

Accident location	Accident rate per train-mile	Accident rate per car-mile	Combined accident rate per mile for 8-car train
Mainline track	1.2×10^{-6}	2.7×10^{-8}	1.4×10^{-6}

a. Source: DIRS 180220-Bendixen and Facanha 2007, all.

These rates include derailments and collisions from a variety of causes, including track failures resulting from geological hazards. These accident rates reflect railroad operations involving general freight service. Dedicated train service, which would be used to move cask railcars to the Yucca Mountain Repository, would follow stringent safety regulations. Additionally, dedicated train service has increased control and command capabilities, since shorter trains allow better visual monitoring from the locomotive and the escort car. Therefore, the accident rates here included provide a conservative estimate of the number of accidents involved in the operations of the rail line.

While not all accidents would lead to derailments of any railcars, any accident is likely to require the train to be inspected and other precautions to be taken. Hence, this analysis conservatively considers all accidents. In addition, a number of design and operating changes for dedicated trains have been predicted to reduce accident rates for dedicated trains, but to maintain conservatism, these potential benefits are not considered here.

Based on the lengths of each alternative segment and common segment, and the combined accident rate for an 8.54-car train (that is, 8.95×10^{-7} accident per train-kilometer), the predicted accident counts are given in Table 4-128 for the full set of cask shipments expected during the entire operations phase (that is, the analysis considers the 5,666 trains involving cask cars, which includes trains traveling in both directions). For accidents not involving cask trains, the total number of accidents was calculated by adding the accidents associated with the number of trains and the accidents associated with the number of railcars. For purposes of this analysis, DOE used the longest specific alignment. Because the upper bound of the accident rate is so small for the specific alignments, there would be no discernable difference.

As shown in Table 4-128, a total of approximately three accidents involving cask trains would occur over the 50-year operations phase. While potential consequences could involve environmental damage, evacuation costs, and human-health impacts, the focus of the frequency analysis is on scenarios that could lead to human-health impacts as discussed in greater detail elsewhere in this section. The total number of accidents involving trains that do not carry casks would be 10 for 50 years of operation. Therefore, the total number of predicted rail accidents would be approximately 13.

Rail Facilities: The analysis of potential incidents at rail facilities was based on the types of activities and operations that are expected to be carried out at such facilities. The scenarios of concern relate primarily to transportation accidents at the Interchange and Staging Yards. The likelihoods of accidents are based on both available failure and accident rates, and on the number of switchovers that would need to be made. The results for accident potential at the Interchange and Staging Yards are included within the calculations for Table 4-128 (alternative segments at the Interface with the Union Pacific Railroad Mainline).

The Rail Equipment Maintenance Yard and the geologic repository operations area interface are essentially rail yards in terms of the operations that would occur there: train make-up and car switching. Casks would be removed from the railcars at the geologic repository operations area and empty casks would be placed back onto railcars at the Rail Equipment Maintenance Yard. The results for accident potential at the Rail Equipment Maintenance Yard and the geologic repository operations area interface are also included within the calculations for Table 4-128 (common segment 6).

Grade Crossings: DOE also examined the consequences of the Proposed Action on delay and safety conditions for at-grade crossings along the proposed rail alignment. Delay considerations are discussed in Section 4.2.9. The examination of grade-crossing safety typically considers the expected numbers and locations of grade crossings, the volume of both vehicle and rail traffic at the crossings, the nature of road traffic (for example, trucks versus passenger vehicles), the design and safety features of the crossings, and train and vehicle speeds in the vicinity of any crossings. Grade-crossing collisions reported as train accidents are included in the number of rail accidents estimated in Table 4-128.

Grade-crossing safety is influenced by the type of protection installed at each crossing. Most of the crossings for this project would involve very low-usage unpaved roads that would mainly involve passive warning systems (such as cross-bucks and stop signs). Public at-grade crossings (paved roads) may have active warning systems that would include flashing lights and gates. Generally, DOE would employ active warning devices for crossings at paved county roads and passive systems at unpaved roads. Although grade-separated crossings are not mandatory for this project, DOE would be providing up to five grade-separated crossings on state and federal highways as identified in Chapter 2. The numbers of crossings with primary roads with each type of protection are listed in Table 4-129 for each rail line-specific alignment and alternative and common segment. Table 2-22 provides a detailed list of grade crossings.

Table 4-128. Estimated number of predicted rail accidents.[a]

Rail alignment segment	Segment length (longest alternative segment, in miles)[b]	Predicted number of accidents	
		Involving cask trains	Not involving cask trains
Interface with Union Pacific Railroad Mainline alternative segments (including the Interchange and Staging Yards)	12[c]	0.10	0.35
Caliente common segment 1	71	0.56	2.04
Garden Valley alternative segments	23[d]	0.19	0.69
Caliente common segment 2	31	0.25	0.93
South Reveille alternative segments	12	0.10	0.35
Caliente common segment 3	70	0.56	2.04
Goldfield alternative segments	33	0.27	0.98
Caliente common segment 4	7	0.06	0.20
Bonnie Claire alternative segments	13	0.11	0.39
Common segment 5	25	0.20	0.74
Oasis Valley alternative segments	9	0.07	0.26
Common segment 6 (including the Rail Equipment Maintenance Yard)	32	0.26	0.95
Totals	336	2.71	9.92

a. During 50-year operations phase.
b. To convert miles to kilometers, multiply by 1.6093.
c. Eccles alternative segment.
d. Garden Valley alternative segment 3 or 8.

Table 4-129. Number of grade crossings with primary roads.[a]

Rail line segment	Passive protection	Active protection	Grade separation
Alternative segments at the Interface with the Union Pacific Railroad Mainline (Caliente/Eccles)	None	1	1
Caliente common segment 1	6	None	1
Garden Valley alternative segments	3 to 4[b]	None	None
Caliente common segment 2	2	None	1
South Reveille alternative segments	2 to 5[b]	None	None
Caliente common segment 3	2	1	None
Goldfield alternative segments	None	None	None to 2[b]
Caliente common segment 4	None	None	None
Bonnie Claire alternative segments	None	None	None
Common segment 5	None	1	None
Oasis Valley alternative segments	1	None	None
Common segment 6	None	None	None
Totals	16 to 20[c]	3	3 to 5

a. This list does not include all grade crossings.
b. This depends on the specific alternative segment.
c. First number represents scenario under which South Reveille alternative segment 2 and Garden Valley alternative segment 1, 2, or 3 are the selected alternative segments. Second number represents scenario under which South Reveille alternative segment 3 and Garden Valley alternative segment 8 are the selected alternative segments.

4.2.10.3 Shared-Use Option

4.2.10.3.1 Nonradiological Impacts

4.2.10.3.1.1 Impacts to Workers. Railroad construction and operations nonradiological occupational health and safety impacts for the Shared-Use Option would be approximately the same as for the Proposed Action, based on the construction and operation of the proposed rail line. It is assumed that construction of the proposed rail line for the Shared-Use Option would require approximately the same number of workers and labor hours, and approximately the same amount of construction materials and equipment as would construction of the proposed rail line for the Proposed Action.

Rail line facility construction and operations nonradiological occupational health and safety impacts for the Shared-Use Option would be approximately the same as for the Proposed Action, based on the construction and operation of the proposed rail line and associated facilities. It is assumed that the construction of the railroad facilities under the Shared-Use Option would require approximately the same number of workers and labor hours, and approximately the same amount of construction materials and equipment as would construction of the railroad facilities under the Proposed Action, and that the configuration and operation of the facilities, including emergency response systems, would be the same for both the Proposed Action and Shared-Use Option.

4.2.10.3.1.2 Impacts from Specific Resource Areas. Rail line construction and operations nonradiological occupational health and safety impacts related to the specific resource areas discussed in Section 4.2.10.2.1 would be approximately the same for the Shared-Use Option as for the Proposed Action, based on the construction and operation of the proposed rail line.

4.2.10.3.2 Radiological Impacts

4.2.10.3.2.1 Impacts to Workers. It is anticipated that worker health and safety impacts under the Shared-Use Option would be similar to those under the Proposed Action, with the exception of radiological occupational exposure impacts. One difference would be the number of times a loaded cask train would pass workers at sidings. For the Proposed Action, there could be up to about 50 passes involving loaded cask trains and other trains (DIRS 182826-Nevada Rail Partners 2007, all). Over the life of the rail shipping campaign, a cask train could pass more than one shared-use train between the Staging Yard and Yucca Mountain Site boundary. This would result in a collective radiation dose of 0.0024 person-rem for these workers. This is equivalent to a probability of a latent cancer fatality of 1.4×10^{-6}. Under the Shared-Use Option, there could be up to about 100 passes involving loaded cask trains and other trains. This would result in a collective radiation dose of 0.0051 person rem for these workers. This is equivalent to a probability of a latent cancer fatality of 3.0×10^{-6}.

4.2.10.3.2.2 Impacts to the Public. It is anticipated that radiological health and safety impacts for the Shared-Use Option would be similar to those for the Proposed Action with the exception of radiological occupational exposure impacts. The additional trains that would be operated for the Shared-Use Option would not involve transportation of radioactive materials and therefore there would be no additional exposure of the public.

4.2.10.3.3 Nonradiological Transportation Impacts

4.2.10.3.3.1 Construction Impacts.

Nonradiological Roadway Accidents Under the Shared-Use Option, any increase beyond what is described under the Proposed Action for roadway accidents and fatalities would be minimal. The collective impact would be expected to be less than 1 percent of the overall risk calculated for construction of the Proposed Action rail line. Therefore, impacts are considered to be the same as those identified for the Proposed Action.

Nonradiological Rail Line Accidents No commercial rail transportation would be conducted during construction of the Shared-Use Option. Under the Shared-Use Option, any increase beyond what is described under the Proposed Action for rail line accidents and fatalities would be minimal. The collective impact would be expected to be less than 1 percent of the overall risk calculated for construction of the Proposed Action rail line. Therefore, impacts are considered to be the same as those identified for the Proposed Action.

4.2.10.3.3.2 Operations Impacts.

Nonradiological Roadway Accidents Under Shared-Use Option operations, any increase beyond what is described under the Proposed Action for roadway accidents and fatalities would be minimal. Impacts are considered to be the same as those identified for the Proposed Action.

Nonradiological Rail Line Accidents The rail transportation safety analysis for the operations phase of the Shared-Use Option assesses the impacts of transportation, rail facilities, and grade crossings.

Rail Alignment: The Shared-Use Option differs from the Proposed Action only in the amount and type of traffic that would use different portions of the proposed rail line and the composition of some of the trains in terms of both length and materials categories. Up to eight one-way commercial train trips (four round trips) a week would be expected, with each train consisting of up to four locomotives and up to 60 railcars (DIRS 180694-Ang-Olson and Gallivan 2007, all). For comparison, an average total of 17 trains would run one way between the Proposed Action Staging Yard and the geologic repository per week carrying casks, repository construction materials and supplies, and other materials for maintenance-of-way activities. It is anticipated that the trains would travel at 64 kilometers per hour (40 miles per hour). The addition of the commercial trains would have a small impact on the potential for an accident involving a cask car, as operational procedures and controls regarding both scheduling and the use of sidings would restrict the interactions of the two types of trains. Trains carrying cask cars would take precedent. The overall density of trains on the proposed rail line would still be considered low, even with the commercial trains added in, so additional risk of an accident involving cask cars due to increased traffic densities would be minimal.

During the peak level of transportation operations along the rail line, there could be 17 one-way trains servicing the repository each week (eight cask trains, seven repository construction and supplies trains, and two maintenance-of-way trains), and eight one-way commercial trains (four round trips). During these peak years, the transportation safety impacts associated with nonradiological risks might increase by approximately 50 percent. Over the full 50-year operating lifetime of the rail line, the Shared-Use Option could result in an additional 20,800 trains, considering each direction separately (eight one-way trains per week). All trains are assumed to travel the full length of the rail line, generating roughly 11.3 million train-kilometers over 50 years. Based on a list of potential shippers, demand estimates were developed (DIRS 180694-Ang-Olson and Gallivan 2007, all). A total of 225 weekly carloads would be expected to be shipped along different portions of the rail line. According to the location and demand of each potential shipper, it was estimated that each loaded car would travel an average of 200 kilometers (124 miles). Considering both directions of travel, this would result in approximately 234 million car-kilometers over 50 years (225 cars × 52 weeks × 50 years × 200 kilometers × 2). Assuming the same rail fatality and accident rates included in Sections 4.2.10.2.3.1 and 4.2.10.2.3.2, respectively, a total of three additional fatalities and 13 additional accidents would be expected to occur for the entire set of estimated railcar movements during Shared-Use Option operations. Rail accidents are not allocated to specific rail line segments due to the uncertainty of where those accidents will occur.

In general, the operating characteristics of these commercial trains are unknown at this time; therefore, the travel times and operational movements of these trains cannot be described. However, the Nevada Railroad Control Center described under the Proposed Action would control and coordinate commercial rail service movements and would therefore maintain overall safety of operations along the rail line to minimize potential rail accidents.

Rail Facilities: The Rail Equipment Maintenance Yard and the geologic repository operations area interface would not be affected by any shared use of the proposed rail line because commercial shippers would not use the DOE Rail Equipment Maintenance Yard. Many of the commercial railcars would be dropped off along the way at intermittent commercial facilities. As a result, the commercial service end-of-line facility would have significantly less car handling than the Rail Equipment Maintenance Yard, and operations at the commercial facility would have no impact on the number of accidents involving the cask cars.

Grade Crossings: The increased number of trains under the Shared-Use Option would slightly increase the potential for accidents because of the increased number of trains crossing each at-grade crossing (at three round trips per week). However, because this volume of commercial traffic would be low, adverse impacts would be small. Delay considerations were included in Section 4.2.9.

4.2.10.4 Summary

This section summarizes nonradiological occupational health and safety impacts, public and occupational radiological impacts, and nonradiological transportation impacts under the Proposed Action and the Shared-Use Option for the Caliente rail alignment.

Alignment segments and facility locations are not relevant to the nonradiological transportation impacts analysis or to the nonradiological occupational health and safety impacts analysis. Nonradiological occupational health and safety impacts depend on the number of construction and operations full-time-equivalent works. Nonradiological transportation impacts depend on the number of construction and operations full-time-equivalent workers and the number of casks transported. Therefore, there are no important differences among alignments or facility locations in relation to nonradiological transportation impacts or nonradiological occupational health and safety impacts.

Radiological impacts for the Caliente rail alignment are estimated based on the longest-distance alignment, the shortest-distance alignment, the alignment with the highest population density, and the alignment with the lowest population density. Radiation dose to the public is estimated for Staging Yard locations (options) for the Caliente rail alignment. There are no important differences among alignments or among Staging Yard locations in relation to radiological impacts for the Caliente rail alignment.

All nonradiological transportation impacts for construction and operations, including vehicle-related fatalities, rail-related accidents, and rail-related fatalities, are considered to be long-term impacts. Nonradiological occupational health and safety incidents for construction and operation could be either short term (such as lost workday cases involving short-term disability) or long term (such as workday cases involving long-term disability); however, because there is no way to know the duration of a specific lost workday case, for example, all nonradiological occupational health and safety impacts are deemed to be long-term impacts. All radiological impacts from railroad and facility operations are considered long-term impacts because such impacts would be experienced over the 50-year operating life of the railroad. Nonradiological transportation impacts, nonradiological occupational health and safety impacts, and radiological impacts are direct impacts.

4.2.10.4.1 Nonradiological Impacts

A summary of nonradiological impacts to workers from industrial hazards associated with construction and operation of the proposed rail line and associated facilities under the Proposed Action is included in Table 4-130 and Table 4-131. Impacts to involved workers and noninvolved workers and total impacts are shown in Table 4-112 for rail line construction and operations and in Table 4-113 for associated facility construction and operations. No construction or operations activities would occur under the No-Action Alternative. Therefore, there would be no occupational or public health and safety impacts associated with the No-Action Alternative.

Table 4-130 includes nonradiological impacts of construction and operation of the railroad under the Proposed Action including construction of the rail line, construction and operation of the construction work camps, construction and operation of quarries to produce ballast for construction activities, construction and operation of wells to produce water for construction activities, operation of construction trains, and construction and operation of batch plants to produce concrete for construction activities. Operations impacts include impacts to train crews and escort and security personnel. Table 4-131 summarizes the nonradiological impacts of construction and operation of railroad facilities under the Proposed Action, including the Rail Equipment Maintenance Yard, Facilities at the Interface with the Union Pacific Railroad Mainline, Nevada Railroad Control Center and National Transportation Operations Center, Maintenance-of-Way Facilities, and Cask Maintenance Facility. Table 4-132 summarizes the total impacts from railroad construction and operations under the Proposed Action.

Table 4-130. Estimated impacts to workers from nonradiological industrial hazards during railroad construction and operations under the Proposed Action.

Group and industrial hazard category	Construction		Operations	
	Labor hours worked	Incidents	Labor hours worked	Incidents
	13.6 million		2.9 million	
Total recordable cases		336		37
Lost workday cases		186		28
Fatalities		0.67		0.26

Table 4-131. Estimated impacts to workers from nonradiological industrial hazards during railroad facility construction and operations under the Proposed Action.

Group and industrial hazard category	Construction		Operations	
	Labor hours worked	Incidents	Labor hours worked	Incidents
	3.1 million		17.0 million	
Total recordable cases		88		418
Lost workday cases		49		255
Fatalities		0.02		1.27

Table 4-132. Total estimated impacts to workers from nonradiological industrial hazards during railroad and facility construction and operations under the Proposed Action.

Group and industrial hazard category	Construction		Operations	
	Labor hours worked	Incidents	Labor hours worked	Incidents
	16.7 million		19.9 million	
Total recordable cases		424		455
Lost workday cases		235		283
Fatalities		0.69		1.53

4.2.10.4.1.1 Workers. Nonradiological occupational health and safety impacts from railroad construction and operations under the Proposed Action involve approximately 880 recordable incidents, approximately 520 lost workday accidents, and approximately three fatalities.

Rail line construction and operations nonradiological occupational health and safety impacts for the Shared-Use Option would be approximately the same as for the Proposed Action, based on the construction and operation of the proposed rail line. It is assumed that construction of the proposed rail line for the Shared-Use Option would require approximately the same number of workers and labor hours, and approximately the same amount of construction materials and equipment as would construction of the proposed rail line for the Proposed Action.

Construction and operations workers under the Proposed Action and Shared-Use Option could potentially be exposed to nonradiological hazardous chemicals related to operation and maintenance of construction equipment and facility equipment, including maintenance-of-way and maintenance of casks. Such activities are anticipated to include welding, metal degreasing, painting, and related activities.

Occupational health and safety impacts could also result from worker exposure to fuels, lubricants, and other materials used in construction, operation, and maintenance of the proposed rail line and associated facilities. The recorded incident rates of these exposure hazards during construction work at the Yucca Mountain Site has also been small and is anticipated to be small for construction and operation of the rail alignment and facilities under the Proposed Action.

Dust and soils hazards include potential occupational exposure to hazardous inhalable dust, including the minerals crystalline silica, cristobalite, and erionite, and potential occupational encounters with unexploded ordnance. It is unlikely that any fugitive particulate generated in the construction areas would contain a concentration of crystalline silica, erionite, or cristobalite that would result in exceedance of occupational exposure limits for these materials. Therefore, impacts associated with occupational exposure to these materials are not anticipated from construction and operation of the railroad and facilities under the Proposed Action.

Impacts to construction or operations workers from unexploded ordnance would be small due to implementation of inspection procedures and mitigation measures if necessary.

Workers could also be exposed to biological hazards including infectious diseases (such as Hantavirus, West Nile virus) and other biological hazards (such as venomous animals). The recorded incidence rates of these biological hazards in the region of influence in Nevada are small, according to statistics published by state and federal agencies including the U.S. Centers for Disease Control and the Nevada State Health Division, and the recorded incident rates of these biological hazards during construction work at the Yucca Mountain Site have also been small. Therefore, DOE would expect small impacts to construction or operations workers from these biological hazards.

4.2.10.4.1.2 Public. Nonradiological impacts to the public from the construction and operation of the rail line and facilities (other than impacts from transportation accidents) are presented in the air quality section and noise section of this Rail Alignment EIS and are therefore not further discussed in Section 4.2.10. Impacts to the public from transportation accidents (those transportation accidents not involving release of radiation) are discussed in Section 4.2.10.4.3.

4.2.10.4.2 Radiological Impacts

For radiological impacts analyses, the four specific alignments described in Table 3-67 were evaluated. Table 4-133 summarizes the radiation doses and impacts along these four classes of alignments.

Table 4-133. Summary of occupational and public estimated radiological impacts for the Proposed Action (expressed as latent cancer fatality units).[a,b,c]

Case	Staging Yard	Workers	Public	Accident risk	Total
Highest population	Caliente-Indian Cove	0.34	1.4×10^{-4}	1.3×10^{-6}	0.34
Highest population	Caliente-Upland	0.34	1.3×10^{-4}	1.3×10^{-6}	0.34
Shortest distance	Caliente-Indian Cove	0.34	1.2×10^{-4}	1.1×10^{-6}	0.34
Shortest distance	Caliente-Upland	0.34	1.1×10^{-4}	1.1×10^{-6}	0.34
Longest distance	Eccles-North	0.34	6.6×10^{-5}	7.6×10^{-7}	0.34
Lowest population	Eccles-North	0.34	5.5×10^{-5}	6.7×10^{-7}	0.34

a. Radiation doses modeled from the point where the proposed railroad would meet the existing Union Pacific Railroad Mainline.
b. The highest population route and the shortest distance route would originate at Caliente-Indian Cove.
c. The lowest population route and the longest distance route would originate at Eccles-North.

Radiological occupational and public health and safety impacts to workers and the public for the Shared Use Option would be approximately the same as those for the Proposed Action, as the additional trains that would be operated for the Shared-Use Option would not involve transportation of radioactive materials that would result in additional occupational or public exposure to radiation.

4.2.10.4.2.1 Workers. For workers, the radiological impacts of the Proposed Action and Shared-Use Option are estimated to result in less than one latent cancer fatality.

4.2.10.4.2.2 Public. For members of the public, radiation doses and radiological impacts of the Proposed Action and Shared-Use Option are estimated to result in less than one latent cancer fatality.

4.2.10.4.2.3 Accidents. For members of the public, radiological impacts of the Proposed Action are estimated to result in less than one latent cancer fatality.

4.2.10.4.3 Nonradiological Transportation Impacts

Table 4-134 summarizes impacts from nonradiological transportation accidents, including vehicular-related accidents and rail-related accidents, from railroad construction and operations under the Proposed Action and Shared-Use Option. Impacts under the Shared-Use Option are considered to be the same as those identified for the Proposed Action for the construction phase.

Table 4-134. Summary of estimated transportation accident impacts.

	Construction	Operations	
	Proposed Action and Shared-Use Option	Proposed Action	Shared-Use Option
Vehicular-related fatalities	6	8	8
Rail-related fatalities	0.6	0.7	4
Rail-related accidents	3	13	26
Rail-related accidents involving cask trains	Not applicable	3	3

4.2.11 UTILITIES, ENERGY, AND MATERIALS

This section describes potential impacts to utilities, energy, and materials from constructing and operating the proposed railroad along the Caliente rail alignment. Section 4.2.11.1 describes the methodology DOE used to assess potential impacts to utilities, energy, and materials; Section 4.2.11.2 describes potential impacts; Section 4.2.11.3 describes potential impacts under the Shared-Use Option; and Section 4.2.11.4 summarizes potential impacts.

Section 3.2.11.1 describes the regions of influence for utilities, energy, and materials. To aid reader understanding, the regions of influence are repeated throughout Section 4.2.11 where appropriate.

4.2.11.1 Impact Assessment Methodology

The utilities, energy, and materials impacts analysis considered whether construction and operation of the proposed railroad along the Caliente rail alignment would:

- Cause utility service outages as a result of construction activities
- Affect the capacity of public water systems, directly or indirectly
- Require extension of water mains involving off-site construction for connection to a public water source
- Impact water-supply capacity needed for fire suppression
- Affect the capacities of public wastewater-treatment facilities, directly or indirectly
- Require extension of sewer mains involving off-site construction for connection with a public wastewater-treatment system
- Require expansion of telecommunications systems involving off-site construction for connections with the network (including construction of communications towers)
- Affect the capacity and distribution capabilities of local and regional suppliers of fossil fuel
- Cause new sources of construction materials and operations supplies to be built, such as new mining areas, processing plants, or fabrication plants
- Affect the capacity of existing materials suppliers and industries in the region

4.2.11.2 Construction and Operations Impacts

This section describes potential impacts to utilities, energy, and materials resources from constructing and operating the proposed railroad along the Caliente rail alignment. The analysis of impacts to existing utilities considers:

- Potential impacts of constructing the rail line in or near existing utility lines or rights-of-way
- Potential impacts on the capacities of public utilities
- Potential impacts on the availability of fossil fuels (the focus of the energy analysis)
- Potential impacts on the availability of construction materials

4.2.11.2.1 Construction Impacts

4.2.11.2.1.1 Potential Interfaces with Public Utility Corridors and Rights-of-Way. Potential utility conflicts would arise if construction activities could interfere with a public utility’s ability to continue service or could prevent future expansion of that utility or its use of a right-of-way. Conflicts could arise in areas where the rail line and its construction and operations support facilities would either cross or overlap an existing utility corridor or right-of-way.

Utility crossings are common to linear projects such as roads, railroads, and pipelines, and they can be accomplished with minimal impact using standard engineering procedures and appropriate design specifications (see Chapter 2).

Utilities that would require the construction of crossings either above or beneath the rail line (new grade crossings) might be subject to temporary interruption as the switch is made from the existing infrastructure to the new routing. Service interruptions for electrical and telephone service, if necessary, could be limited to the time required to throw a transfer switch or to disconnect and reconnect. Service interruptions to pipelines might be longer, but to the greatest extent practicable, would be limited to a few hours.

4.2.11.2.1.2 Public Utility Systems. Potential impacts to public utility systems during the construction phase would be related to the demands on these systems to support construction activity and sustain construction workers. DOE would establish 12 temporary construction camps along the rail alignment within the construction right-of-way to house construction workers, and would fully operate a maximum of six construction camps at any one time (DIRS 182825-Nevada Rail Partners 2007, Table D-1). DOE estimates that 2,160 construction personnel would be employed full-time. Each construction camp would have the capacity to house 360 people (254 construction workers and 106 support staff) for such functions as construction administration, utilities, emergency services, and other support. The personnel at each camp would comprise 40 professional staff, 20 clerical staff, and 300 craftsmen (DIRS 180922-Nevada Rail Partners 2007, p. 4-4). The utilities sector of each construction camp would include areas dedicated to power, wastewater treatment, water treatment, and trash disposal. DOE expects that most construction workers would live in and spend most of their time in these camps, thereby reducing the impacts that these individuals would have on public water and wastewater systems and the use of fuel for travel.

As described in Section 4.2.9, Socioeconomics, population changes are related to changes in employment. DOE expects that most of the full-time construction workers would live in the construction camps, but the Department estimates 40 construction workers might live in Lincoln County, five in Esmeralda County, and 15 in Nye County (DIRS 182825-Nevada Rail Partners 2007, Table D-1). There would be some population increases in nearby towns attributable to construction workers and indirect support workers. Because increases in population affect future demand on public utilities in a community, the utilities impacts analysis uses the basic assumptions and expectations regarding population change during the construction phase, as described below.

For purposes of this analysis, and consistent with the methodology described in Section 4.2.9 of this Rail Alignment EIS, DOE assumes that most construction workers would come from outside the region of influence rather than the more sparsely populated Lincoln, Nye, and Esmeralda Counties. Any changes in the populations of Lincoln, Nye, Esmeralda, and Clark Counties and towns within those counties would be small (see Section 4.2.9). Therefore, associated infrastructure impacts at the county and local levels during the construction phase would be small.

Public Water Systems The region of influence for public water systems is Lincoln, Nye, and Esmeralda Counties and communities within those counties. However, water requirements for the project during the construction phase would be met by new wells.

Because DOE does not plan to rely on public water systems as primary sources of water during the construction phase, direct impacts to public water systems would be those related to permanent population increases within the region of influence attributable to the construction phase.

Because, as previously discussed in Section 4.2.9, permanent population increases would be expected to be minor for most areas during the construction phase, DOE expects that existing public water systems in the region of influence could accommodate the increased demand within existing system capacities without adverse impacts.

Wastewater-Treatment Systems The region of influence for wastewater transported offsite for treatment and disposal is the existing permitted treatment facilities in Lincoln, Nye, and Esmeralda Counties and communities within those counties.

DOE estimated that up to 626,000 liters (165,000 gallons) per day of sanitary wastewater could be generated during the construction phase, as summarized in Table 4-135. However, because construction activities would be phased, actual daily maximums would be less. The Department estimates that the amount of sanitary wastewater that would be generated at each construction camp would peak at 95,000 liters (25,000 gallons) per day. Most of this wastewater would be generated from flush toilets and showers. Sanitary sewage generated at the construction camps would be treated on-site using portable wastewater-treatment facilities, and treated wastewater would be recycled and used for construction purposes (such as soil compaction and dust suppression). DOE would recycle about 90 percent of all construction-generated wastewater. Therefore, there would be no impacts to existing wastewater-treatment capacity in the region of influence.

Table 4-135. Wastewater generation during the construction phase – Caliente rail alignment.

Facility	Number of personnel (maximum)	Wastewater generation (gallons per day per person)[a,b]	Total wastewater (gallons per day)[c]
Construction camps[d]	2,160[e]	70	151,000
Interchange Yard and Staging Yard	220[e]	20	4,400
Maintenance-of-Way Headquarters and Trackside Facilities	170[e]	20	3,400
Rail Equipment Maintenance Yard	150[e]	20	3,000
Cask Maintenance Facility	150[f]	20	3,000
Concrete batch plants	20[e]	20	400
Total			165,000

a. Sources: Daily wastewater-generation rates from DIRS 180922-Nevada Rail Partners 2007, Section 4.1 (for construction camps); Nevada Administrative Code 444.8312 as an estimated per person wastewater flow from an office (for other facilities).
b. To convert gallons to liters multiply by 3.78533.
c. Numbers in column are rounded to three significant figures.
d. Six construction camps of a total of 12 would be in operation at one time.
e. Source: DIRS 182825-Nevada Rail Partners 2007, Appendix D.
f. Source: DIRS 181425-MTS 2007, p. 4.

Commercial vendors would provide portable restroom facilities where needed and would transport wastewater offsite for treatment, which could include the use of permitted wastewater treatment facilities in the region of influence. As shown in Table 3-72, permitted wastewater-treatment facilities in the region of influence have adequate capacity. Therefore, any impacts to those wastewater-treatment facilities during the construction phase would be small.

DOE expects permanent population increases would be small for most areas during the construction phase (see Section 4.2.9); therefore, existing publicly owned wastewater-treatment works in the region of influence could accommodate the increased wastewater within existing system capacities without adverse impacts.

Telecommunications Systems The region of influence for telephone and fiber-optic telecommunications systems is the southern Nevada region serviced by Nevada Bell Telephone Company (AT&T Nevada), Citizens Telecommunications Company of Nevada, and Lincoln County Telephone System, Inc. For wireless communications, the region of influence is that area of southern Nevada served by Verizon One, following U.S. Highway 93 north from Caliente and following U.S. Highway 95 north from the Las Vegas area.

During preliminary grading, construction communications would be provided via short-wave radio and satellite telephone (DIRS 180922-Nevada Rail Partners 2007, p. 2-3). Communications systems during construction would be designed to not interfere with other licensed services operating in the same geographic areas and would remain in place until the communications systems for railroad operations were in place and commissioned. Little or no landline or wireless telecommunications service would be required during the construction phase. The installation and use of telecommunications systems would have a small impact on local telecommunications utilities.

Electricity The region of influence for electric power includes areas serviced by the southern Nevada electrical grid operated by Nevada Power Company, Sierra Pacific Power Company, Valley Electric Association, Inc., Caliente Public Utilities, and Lincoln County Power District No. 1. Electric energy demand for initial construction activities would be satisfied with portable generators until electrical connections were established. This section discusses energy needs that would be satisfied through the use of existing electrical utilities.

During the construction phase, DOE proposes to lay an underground 25-kilovolt distribution line under the rail roadbed (DIRS 180922-Nevada Rail Partners 2007, p. 4-6). The primary purpose of the distribution line would be to provide electric power to facilities and equipment needed for routine railroad operations (such as signals, switches, and radio communication towers), and to be able to provide the capacity to meet expected power needs for support facilities; a secondary purpose would be to provide an alternative to diesel-powered generators or local power sources.

Although power might be required during construction or operations only in specific areas along the rail alignment (such as at sidings, radio communication towers, construction camps, and quarries), for purposes of analysis DOE assumed that the 25-kilovolt distribution line would be laid end-to-end in a trench along the entire length of the rail alignment. At the same time the Department was laying the power distribution line, it would also lay the fiber-optic cable to be used as part of a telecommunications system (encased in a polyvinyl-chloride [commonly referred to as PVC] duct), and place it in the same trench as the 25-kilovolt distribution line. Once the cables were placed, the trench would be backfilled to grade.

Based on initial planning studies, power to the distribution system would be fed from locations where the rail line would intersect existing high-voltage transmission lines (DIRS 180922-Nevada Rail Partners 2007, p. 4-6). At this stage in the design process, DOE has not identified specific locations. DOE would construct substations within the nominal width of the construction right-of-way to feed the 25-kilovolt distribution line from the higher-voltage transmission lines at such intersections. At locations along the rail line where lower-voltage power was required for railroad systems, DOE would place step-down transformers from the 25-kilovolt distribution line on the trackside.

Construction camps would be powered one of three ways: (1) from existing transmission or distribution lines where they run alongside the camp sites, (2) from the 25-kilovolt distribution line, or (3) from diesel-powered generators. Option (1) would require access to pre-existing nearby transmission or distribution lines at construction-camp sites and their contracted use. Option (2) would depend on the availability of an energized 25-kilovolt distribution line during the period in which a construction camp would be operated. For options (1) and (2), DOE would place a substation at the construction camp. If neither option (1) nor (2) was available, DOE would select option (3). In addition, for options (1) and (2), the Department would use backup diesel-powered generators at each camp during unexpected power outages. Energy use at each camp during the peak output year would approach 54,000 kilowatt-hours per day, or 20 million kilovolt-hours per year.

Quarry sites would require electric power for conveyor belts, machinery, lighting, and support services. That need would be met by either of three options: (1) from nearby transmission or distribution lines if available, (2) from diesel-powered generators, or (3) from the 25-kilovolt distribution line. DOE would build a substation at each quarry site. Temporary power lines would distribute power at the quarry facility. If DOE selected option (1) or (3), diesel-powered backup generators would always be available at each quarry site for emergencies. Each quarry would be expected to use 27,600 kilowatt-hours of power per day and energy use at each quarry site during the peak output years would approach 10 million kilowatt-hours per year (DIRS 180922-Nevada Rail Partners 2007, p. 3-2).

DOE plans to have 24-meter (80-foot)-long rails delivered by rail from manufacturing plants to Caliente. DOE would set up a portable welding plant at Caliente and would later relocate the plant along the rail alignment at 80- to 160-kilometer (50- to 100-mile) increments to weld 24-meter-long rail into 438-meter (1,440-foot)-long strings to be distributed along the rail alignment by dedicated welding trains (DIRS 180922-Nevada Rail Partners 2007, p. 3-10). Typically, such welding units are powered by diesel generators generating 375 kilowatts of electrical power. DOE might build a substation connected to existing transmission lines to supply this need at Caliente, but this is conceptual at this stage of design. Yard and siding areas would be likely candidate relocation sites, and at these sites DOE would use portable diesel-powered generators, or conceptually, the 25-kilovolt distribution line if available and energized. (Alternatively, off-line welding of the rail would be possible, but would require dedicated welding trains to support track construction activities.)

The major electrical providers in the project region, including Nevada Power Company, Sierra Pacific Power Company, Valley Electric Association, Inc., and Lincoln County Power District No. 1, would have adequate generating capacity or power-purchase capabilities (see Section 3.2.11) to supply the project during peak demand without disrupting service to the providers' respective coverage areas. As discussed in Section 3.2.11, demand is expected to remain relatively stable in the serviced areas, increasing at about 2 percent annually, and is not expected to impact the capacity of service providers. In cooperation with the affected utilities, DOE would perform electrical-capacity analyses to ensure adequate capacity exists, including evaluation of the conditions of existing electric facilities and determination of appropriate interface equipment to meet the needs of both parties, prior to any connection to a transmission or distribution line; therefore, any impact to electric services would be small.

For purposes of analysis, DOE assumed that electricity requirements for construction of the railroad operations support facilities (Interchange Yard, Staging Yard, the Nevada Railroad Control Center and National Transportation Operations Center, Maintenance-of-Way Facilities, the Rail Equipment Maintenance Yard, and the Cask Maintenance Facility) would be met with portable generating equipment, but could later be met through substations connected to the 25-kilovolt distribution line when it was completed.

4.2.11.2.1.3 Fossil Fuels. At this point in project planning, DOE has not identified specific providers of fossil fuels. However, for purposes of analysis, DOE expects that regional supply systems and suppliers could economically supply the project.

Fossil-fuel consumption during the construction phase would primarily consist of diesel fuel for construction equipment and vehicles. Heavy construction equipment would be diesel-powered, as would electric generators. Fuel and oil would be transported by truck and stored at the hazardous materials storage areas at the construction camps. These materials would be stored in accordance with applicable state and federal regulations (DIRS 180922-Nevada Rail Partners 2007, Section 6.2). DOE estimated that annual consumption of diesel fuel would be 117 million liters (31 million gallons) (DIRS 182825-Nevada Rail Partners 2007, Appendix D, Table 5b). The annual consumption of diesel fuel for the region of influence, as represented by the State of Nevada, is approximately 1.8 billion liters (480 million gallons) (DIRS 176397-EIA 2005, Table 4, 2004 data). Construction fuel consumption would represent 6.5 percent of diesel fuel used annually in Nevada.

Construction of the proposed railroad would have a small impact on the capacity of regional suppliers or the availability of fuel resources. The fuel supply system is such that it can flexibly respond to changes in demand. Fuel consumption for construction of the railroad operations support facilities would be lower; therefore, fuel consumption during construction of those facilities would have a small impact on the capacity of regional suppliers or the availability of fuel resources.

4.2.11.2.1.4 Materials. As described in Section 3.2.11, the region of influence for necessary raw materials is limited to the distribution networks and suppliers that can economically service the general project area. For cast-in-place concrete and subballast, the region of influence is limited to the State of Nevada. DOE would need a ***free-use permit*** from the BLM to use common varieties of sand, stone, and gravel from BLM-administered public lands during the construction phase, pursuant to the regulations implementing the Materials Act of 1947 (30 U.S.C. 601 through 603) as codified in 43 CFR Part 3600. As described in Chapter 2, the Department could obtain ballast materials from up to four of the six potential quarry sites within Nevada that would be close to the Caliente rail alignment construction right-of-way. Therefore, the region of influence for obtaining ballast would be limited to the immediate area in Nevada. Other materials, including steel, steel rail, concrete ties, and other precast concrete could be procured and shipped from anywhere in the continental United States. Therefore, the region of influence for these materials is considered to be national.

Material needs for construction of the rail line along the Caliente rail alignment would vary among the alternative segments roughly in proportion to their lengths. The primary materials that would be consumed in rail line construction include steel; concrete, principally for rail ties, bridges, and drainage structures; and rock for ballast and subballast. Table 4-136 lists the rail line construction material requirements and current production rates within the respective regions of influence.

Table 4-136. Rail line construction material requirements – Caliente rail alignment.

Material	Total requirements	Annual requirements over a 4- to 10- year construction period	Region of influence	Region of influence annual production	Percent of region of influence production
Steel rail	90,000 tons[a]	22,500 to 9,000 tons	U.S. (all steel)	95,000,000 tons	0.024 to 0.01
			U.S. (steel rail)	571,000 tons	4.0 to 1.6
Concrete, cast-in-place	127,000 tons	31,800 to 12,700 tons	Nevada	18,000,000 tons[b]	0.19 to 0.07
Concrete, precast (including concrete ties)	500,000 tons	125,000 to 50,000 tons	U.S.	17,000,000 tons[b]	0.75 to 0.03
Concrete ties	1,020,000 ties	250,000 to 100,000 ties	U.S.	1,000,000 ties	25 to 10
Ballast	3.5 million tons	875,000 to 350,000 tons	Nevada	11,500,000 tons[b]	7.6 to 3.0
Subballast	3 million tons	750,000 to 300,000 tons	Nevada	10,200,000 tons[b]	7.3 to 2.9

a. To convert tons to metric tons, multiply by 0.90718.
b. Crushed stone for all users, 2000 data (DIRS 173393-Tepordei 2003, Table 6).

Steel DOE has calculated that construction of the proposed rail line along the Caliente rail alignment of approximately 550 kilometers (340 miles), including sidings and yard tracks, would require 2,834 strings of ***136 RE*** welded rail, each string being 439 meters (1,440 feet) long (DIRS 180922-Nevada Rail Partners 2007, p. 3-10). This would correspond to a requirement for 82,000 metric tons (90,000 tons) of steel over an estimated construction period of 4 to 10 years. DOE would acquire the sections of rail from national commercial sources.

Because DOE would purchase steel rail from national suppliers in staggered preordered phases over a 2- to 3-year period, the impact on availability of steel rail would be small.

DOE would need additional steel for rail hardware, bridges, and facility structures. Existing commercial fabricators would supply the steel required for the bridges. The designs of bridges and rail facilities are not sufficiently advanced to tabulate materials needs; however, the quantities required would be substantially less than required for rail line construction.

Concrete DOE has estimated that 50,000 cubic meters (65,000 cubic yards) of cast-in-place concrete would be required for Caliente rail alignment structures (DIRS 182825-Nevada Rail Partners 2007, p. B-19). Concrete weighs approximately 2.4 metric tons per cubic meter (145 pounds per square foot) and 50,000 cubic meters would translate to an approximate requirement of 115,000 metric tons (127,000 tons) over the 4- to 10-year construction phase. As described in Chapter 2, DOE would obtain concrete for site placement activities at proposed bridges and other structures from two portable batch plants set up near the construction sites. DOE would truck all aggregate and cement from the portable batch plants to the construction sites. Annual production of cast-in-place concrete in Nevada equals approximately 16 million metric tons (18 million tons) per year (DIRS 173400-NRMCA 2004, p. 2).

Based on Yucca Mountain FEIS estimates (DIRS 155970-DOE 2002, Table 6-34), the total precast concrete demand for a rail line along the Caliente rail alignment (that is, the longest alignment at approximately 550 kilometers [340 miles]) would be approximately 450,000 metric tons (500,000 tons). The estimated requirement for precast concrete roadbed ties is approximately 1,020,000 ties for standard track construction (DIRS 180922-Nevada Rail Partners 2007, Section 3.2). Using 318-kilogram (700-pound) ties at 0.61-meter (2-foot) intervals would require 324,000 metric tons (357,000 tons) of concrete to produce the ties. Precast concrete ties would either be supplied through national manufacturers or potentially through a dedicated tie production facility established locally by a commercial manufacturer (DIRS 180922-Nevada Rail Partners 2007, Section 3.2). Additional precast concrete requirements would include manufactured elements such as culverts, bridge beams, and overpass components. These precast concrete elements would be obtained from commercial sources nationally.

Annual national production of concrete railway ties has been increasing from about 620,000 ties in 2000 (DIRS 173572-RTA 2000, p. 22) to about 720,000 ties in 2004, and is projected to grow to about 1.2 million ties in 2007 (DIRS 173573-Gauntt 2004, p. 17). The 324,000 metric tons (357,000 tons) of concrete ties that would be required to construct the rail line along the Caliente rail alignment represent 10 percent to 25 percent of the annual national production of concrete ties. Although this might seem like a significant requirement, the national production volume for concrete ties does not reflect manufacturing capacity. Concrete tie production is a very scaleable industry, and recent data suggests that, if needed, the industry has the capacity to increase concrete tie production rapidly (DIRS 173573-Gauntt 2004, p. 17). For example, the current national production of concrete ties represents only approximately 0.3 percent of all manufactured (precast) concrete production, which is 15 million metric tons (17 million tons) per year (DIRS 173392-van Oss 2003, Table 15). Because DOE would purchase precast concrete components from national suppliers in staggered preordered phases, and because construction would involve a small amount of cast-in-place concrete via the use of on-site batch plants, the impact on availability of concrete would be small.

> **Ballast:** Gravel or broken stone laid in a rail roadbed to distribute train weight uniformly across the bed.
>
> **Subballast:** Gravel or broken stone that does not have to meet the ballast specifications, layered beneath the ballast as a transition between the ballast and the compacted subgrade.
>
> Source: DIRS 180922-Nevada Rail Partners 2007, p. 3.1.

Ballast and Subballast Ballast and subballast are essentially crushed rock such as that required for the development of the rail roadbed. DOE has estimated that a total of approximately 3.2 million metric tons (3.5 million tons) of rail roadbed ballast would be required for track construction along the Caliente rail alignment (DIRS 180922-Nevada Rail Partners 2007, p. 4-2). DOE would obtain ballast from new quarries. As discussed in Chapter 2 and Section 3.2.11, the Department has identified six potential quarry sites along the Caliente rail alignment with the potential to provide more than 90 million metric tons (100 million tons) of ballast. Of the six potential quarry sites, DOE would develop up to four. Each of the potential quarries could produce approximately 3,100 metric tons (3,400 tons) of useable ballast per day. Therefore, the impact to availability of ballast from constructing the rail line along the Caliente rail alignment would be small.

DOE has estimated that a total of approximately 2.7 million metric tons (3.0 million tons) of subballast would be required for track construction along the Caliente rail alignment (DIRS 182777-Nevada Rail Partners 2007, p. 4-2). Material specifications for subballast are less restrictive than for ballast. DOE would obtain subballast from materials excavated during rail roadbed construction or from crushing rock in quarries. To minimize transportation costs, the Department would use multiple source areas. Available quantities of subballast materials in the Caliente rail alignment region of influence should be more than sufficient to supply the project. Thus, impacts on the availability of subballast materials would be small.

DOE would construct 7.3-meter (24-foot)-wide gravel access roads parallel to the rail line and within the construction right-of-way. The rail line and the alignment access roads would be accessed via existing public roads where the rail line would cross an existing roadway. DOE would construct additional access roads to reach features like wells and quarries that are not immediately accessible to the rail alignment. The quarry sites identified would be within 3 kilometers (2 miles) of the alignment, thereby minimizing access-road construction requirements.

Materials for access-road construction or improvement would be obtained primarily from locally available materials such as stone, and gravel resulting from cuts and fills along the alignment and overburden at quarries. Access roads would likely have gravel surfaces. The native material would be supplemented by crushed rock screenings as necessary to provide a serviceable roadway surface.

Sand and Gravel There is a high likelihood DOE would find sand and gravel on the alluvial fans along cuts for the line that would be suitable for construction purposes and road making. Sand and gravel also would be generated from overburden at quarry and borrow sites. DOE would use some natural sand and gravel excavated from cuts and crushed rock from the quarries to make concrete aggregate (DIRS 183643-Shannon & Wilson 2007, pp. 24 to 26). The Department would determine the prime sand and gravel deposits needed before beginning construction. Using locally available sand and gravel would result in the consumption of a nonrenewable resource that could be used as a supply of construction materials for other construction projects in the area. However, alluvial deposits of sand and gravel are commonplace in the Caliente rail alignment region of influence, and their use to construct the rail line would not substantially reduce the area's resources; thus, impacts would be small.

Other Materials Requirements In addition to the materials needed for the rail line, DOE would also need construction materials for railroad operations support facilities. An estimated total of approximately 11,000 square meters (119,000 square feet) of building space would be required for operations support facilities (DIRS 180919-Nevada Rail Partners 2007, Tables 5-B, 6-B, 6-C, 6-D, 7-A, and 7-B; DIRS

181425-MTS 2007, p. 1). By comparison, the Las Vegas market alone had over 186,000 square meters (2 million square feet) of industrial space under construction in 2004 (DIRS 173390-Colliers International Partnership 2004, p. 1) and 160,000 square meters (1.7 million square feet) of office space completed in the 12-month period ending in March 2004 (DIRS 173391-Colliers International Partnership 2004, p. 1). Materials for the construction of rail yards at the operations support facilities are included in the rail line material estimates described in this section. Materials requirements for buildings would not be substantial in comparison to regional demand and would have a small impact on the regional supply system.

4.2.11.2.2 Operations Impacts

4.2.11.2.2.1 Utility Systems. None of the potential utility interfaces identified in Section 4.2.11.2.1.1 would prevent the future expansion of a utility service area. Impacts on infrastructure at the county level associated with railroad operations would be small because regional population projections anticipate modest growth (see Section 4.2.9.3.2). However, there could be some impacts on infrastructure in towns near the proposed railroad operations support facilities. Areas that would be likely to experience the greatest impacts include:

- Caliente/Eccles (Lincoln County), where the Interchange Yard, Staging Yard, and train crew quarters would be located, and which is also a possible location for the Nevada Railroad Control Center and National Transportation Operations Center
- Tonopah (Nye County) and Goldfield (Esmeralda County), the towns that would be closest to the Maintenance-of-Way Headquarters and Trackside Facilities, or the consolidated Maintenance-of-Way Facilities if Goldfield alternative segment 4 is selected
- Southern Nye County, the location of the Rail Equipment Maintenance Yard, Cask Maintenance Facility, train crew quarters, and possibly the Nevada Railroad Control Center and National Transportation Operations Center

Public Water Systems Water would be needed for railroad operations, particularly at operations support facilities. Because they would be reclaimed after the end of the construction phase, there would be no water demands associated with the quarries.

DOE estimates water consumption at the Rail Equipment Maintenance Yard would be about 23,000 liters (6,000 gallons) per day for personnel and an additional 11,000 liters (3,000 gallons) per day for building and railyard uses, including irrigation and vehicle washing. At the Rail Equipment Maintenance Yard, water needs would be met by using the repository's well system, which would eliminate the need for service by any local public water system. The Staging Yard, Nevada Railroad Control Center and National Transportation Operations Center, and Maintenance-of-Way facilities would all obtain their water from local wells tapping into nearby groundwater systems (see Section 4.2.6, Groundwater Resources). Where water connections into local public systems would be needed, usage would be primarily from employees at the facilities.

Public water systems in Lincoln, Esmeralda, and Nye Counties could be affected by incremental changes in population attributable to railroad operations. Because the population increase attributable to employees at the Interchange Yard and Staging Yard would be relatively small (see Section 4.2.9.3.2), any impacts to public water systems in Lincoln County that could be attributed to population increase would be small.

As discussed in Section 3.2.11, Lincoln County is able to meet current and future demands for water. Goldfield, in Esmeralda County, has the groundwater resources and infrastructure available to triple the number of users served by its public water system and thus has the potential to meet increased demand for water by additional residential users and by commercial users such as the Staging Yard.

In Nye County, given the level of demand and the limited capacity of groundwater resources (particularly in the Pahrump Valley hydrographic area), water needs could strain supply. Although the Cask Maintenance Facility would be collocated with the Rail Equipment Maintenance Yard and the geologic repository operations area interface in Nye County, the estimates for population increase attributable to the employees at the Yucca Mountain Site (see Section 4.2.9.3.2) would represent a small incremental increase. Therefore, impacts to the public water systems in Nye County from the demands associated with these potential new residents would be small.

Wastewater-Treatment Facilities DOE would dispose of sanitary wastewater in accordance with State of Nevada regulations. Under the Statutory Authority of Nevada Revised Statutes (NRS) 445A.300 through 445A.730, and pursuant to the Nevada Administrative Codes (NAC) 445A.810 through 445A.925, and NAC 444.750 through 444.828, the Nevada Division of Environmental Protection, Bureau of Water Pollution Control, issues wastewater-discharge permits, administers loans to publicly owned treatment works, and oversees the certification program for sewer-treatment plant employees. In most cases, DOE would construct on-site sanitary wastewater-treatment systems within the railroad operations right-of-way and they would be permitted by the State of Nevada. These would likely be ***package plants***, as described in Section 3.2.11.2.3. If access to nearby existing permitted wastewater-treatment facility capacity was available to any on-site facilities, DOE would discharge sanitary waste to those existing facilities. Impacts to existing wastewater-treatment capacities of jurisdictions in the region of influence during the operations phase would be small.

Table 4-137 lists the rates of wastewater generation that would be associated with railroad facilities during the operations phase.

Table 4-137. Wastewater generation during the operations phase – Caliente rail alignment.

Facility	Number of personnel (maximum)	Total wastewater generation (gallons per day)[a]
Facilities at the Interface with the Union Pacific Railroad Mainline (Interchange Yard and Staging Yard)	50[b]	1,000
Maintenance-of-Way Facilities (including staff for the Satellite Maintenance-of-Way Facilities)	50[b]	1,000
Rail Equipment Maintenance Yard, including the Nevada Railroad Control Center and National Transportation Operations Center	40[b,c]	800
Cask Maintenance Facility	30	600
Totals	170	3,400

a. Twenty gallons per person per day wastewater generation rate, Nevada Administrative Code 444.8312 for offices; to convert gallons to liters, multiply by 3.78533.
b. Source: DIRS 180825-Nevada Rail Partners 2007, p. D-7.
c. Source: DIRS 181425-MTS 2007, p. 5.

Wastewater from the Interchange Yard and the Staging Yard would be disposed of at the permitted wastewater-treatment facility in Caliente. Wastewater from the train crew quarters in Caliente, Goldfield, or near the Rail Equipment Maintenance Yard would be disposed of through septic systems or wastewater-treatment facilities (DIRS 180919-Nevada Rail Partners 2007, p. 3-5). One potential location for the Maintenance-of-Way Headquarters Facility would be 8 kilometers (5 miles) south of Tonopah on U.S. Highway 95, and it would include maintenance work areas, office space, and a material storage area. Another potential location would be along Goldfield alternative segment 4, west of U.S. Highway 95, just north of Goldfield.

Employees at this facility and employees in crew cars that would be outfitted with washing and showering facilities would generate wastewater, which would be disposed of through local septic systems and leach fields (DIRS 180919-Nevada Rail Partners 2007, p. 3-5). The Nevada Railroad Control Center and National Transportation Operations Center would be either at the Rail Equipment Maintenance Yard or at the Staging Yard. These facilities would consist primarily of office space, and would generate small amounts of sanitary wastewater.

The Rail Equipment Maintenance Yard would provide a staging area for delivery of loaded cask cars to the repository, construction materials, and fuel. The facility would include office space, and train crew and escort personnel quarters, all of which would generate sanitary wastewater. Sanitary wastewater disposal at this facility would consist of septic systems or wastewater-treatment facilities at the Yucca Mountain Site (DIRS 180919-Nevada Rail Partners 2007, p. 3-5).

The numbers of employees projected to reside in the communities near railroad operations support facilities would represent small fractions of the existing populations (see Section 4.2.9.3). Also, as shown in Table 3-72, most of the existing wastewater-treatment facilities are operating well below their capacities, and these facilities would be capable of accommodating the anticipated increases in wastewater attributable to railroad facility employees. In addition, as described in 3.2.11.2.3, a 2003 grant from the U.S. Department of Agriculture Rural Development Nevada allowed Caliente, in Lincoln County, to complete the rehabilitation of its wastewater-collection system, and Goldfield has recently been awarded a Water Resource Development Act grant of approximately $3 million for renovations and upgrades. Therefore, the impact on public wastewater systems from operating railroad support facilities would be small.

Telecommunications Systems The communication system required to support railroad operations would utilize four distinct communication technologies: synchronous optical network fiber-optic backbone, very high frequency (VHF) land mobile radio, geosynchronous satellite dispatch radio, and possibly satellite telephone service (DIRS 182826-Nevada Rail Partners 2007, Section 6.1.3). The fiber-optic cable laid along the length of the rail alignment would allow the installation of a VHF land mobile radio system comprising a series of base stations located at points approximately 16 to 32 kilometers (10 to 20 miles) apart along the rail alignment to provide full radio coverage communications with locomotive and maintenance crews. Base stations would consist of an equipment room that would house the radio and fiber-optic electronics and a monopole radio tower to mount an elevated VHF antenna. The Nevada Railroad Control Center would also have a private branch exchange telephone system. In the event of a failure of all or part of the primary VHF radio system, operations would continue via a geosynchronous satellite dispatch radio system. As a backup, DOE could utilize satellite telephone hand sets.

At the Nevada Railroad Control Center, the system would be configured to allow the dispatcher easy access to all of the various communication modes available, including the ability to patch communication modes together if required. However, for external communications, the Staging Yard, the Nevada Railroad Control Center and National Transportation Operations Center, the Maintenance-of-Way Facilities, the Cask Maintenance Facility, and the Rail Equipment Maintenance Yard would each require digital subscriber line and telephone service. The Rail Equipment Maintenance Yard would require the greatest telecommunications capacity, with approximately 75 conventional telephone lines, 50 broadband internet connections, five secure telephone lines, a fiber-optic line for closed-circuit television and data communication, and radio communications for railroad operations in conjunction with the centralized traffic control rail signal system (DIRS 180919-Nevada Rail Partners 2007, Section 6.6). The radio communication systems would be designed not to interfere with other licensed systems operating in the same area. The levels of commercially provided service would be small, and would not adversely affect the capacities of commercial telecommunication providers.

Electricity Impacts associated with the underground 25-kilovolt distribution line would be related to utility interfaces, as discussed in Section 4.2.11.2.1.1, and in Section 4.2.2, Land Use and Ownership.

Operation of the proposed railroad would require electricity for buildings, signaling, communications, and control. Twelve-kilovolt electrical service would be required for each facility. Depending on the distance from available power sources, larger distribution lines and intermediate substations might be needed. In addition to commercial sources, electric power could be supplied from the installed power distribution system. Each facility site would require a 12-kilovolt/480-volt transformer with a 480-volt distribution system to power industrial equipment and feed each building where a 480-volt/120-volt transformer would supply the building power (DIRS 180919-Nevada Rail Partners 2007, p. 3-5). Additional transformers could be required for other site requirements such as site lighting, power to yard switches and signals, or power for communications equipment. Each site would require a diesel-powered emergency generator to supply electrical power in case of an outage.

DOE estimates that the Staging Yard facilities (yard office, crew change facility, a Satellite Maintenance-of-Way Facility, and the Nevada Railroad Control Center and National Transportation Operations Center if in Caliente rather than at the Rail Equipment Maintenance Yard) would have a normal power demand of 386 kilowatts (or 290 kilowatts without the Nevada Railroad Control Center and National Transportation Operations Center) (DIRS 180919-Nevada Rail Partners 2007, p. 5-11). DOE would build a substation connected to existing transmission lines to service this power need at the selected alternative for the Staging Yard (Caliente-Indian Cove or Caliente-Upland, or Eccles-North). Diesel-powered generators would provide backup power.

DOE estimates that the Maintenance-of-Way Trackside Facility would have a normal power demand of 78 kilowatts, and the Maintenance-of-Way Headquarters Facility would have a normal power demand of 406 kilowatts (DIRS 180919-Nevada Rail Partners 2007, p. 7-10). Commercial electrical power from nearby Nevada Power Company distribution lines to Tonopah would be available to both the Maintenance-of-Way Headquarters Facility and the Maintenance-of-Way Trackside Facility, or to a combined facility if DOE should choose Goldfield alternative segment 4. In addition, electric power from the proposed railroad distribution line could be available for use at the Maintenance-of-Way Trackside Facility, as would diesel-powered standby generators.

DOE has made separate estimates of power demand at the Rail Equipment Maintenance Yard that range between 722 and 815 kilowatts (DIRS 180919-Nevada Rail Partners 2007, p. 6-20). The Department has established an 8 megawatt power requirement (which includes a 30-percent reserve) for the Rail Equipment Maintenance Yard and Cask Maintenance Facility (DIRS 181033-Hamilton-Ray 2007, all). DOE could obtain power from a newly constructed substation connected to the existing supply system providing power to the Yucca Mountain Site, or from a new 138-kilovolt transmission line DOE plans to build to the geologic repository operations area.

The 2007 peak load for the Nevada Power Company was expected to be 6,300 megawatts (DIRS 185100-Nevada State Office of Energy 2007, pp. 33 to 34), whereas DOE has estimated there would be approximately an 8-megawatt demand to operate the proposed railroad. The Department would perform an electrical capacity analysis before connecting into local transmission or distribution lines, and consistent with the demonstration of available capacity. Therefore, impacts to other regional needs for electric power during the railroad operations phase would be small.

4.2.11.2.2.2 Fossil Fuels. DOE has estimated that 119 million liters (31.5 million gallons) of diesel fuel would be consumed over an anticipated 50-year operations phase, and that the annual consumption rate would peak at 4.3 million liters (1.1 million gallons) (DIRS 182825-Nevada Rail Partners 2007, Appendix D, Table D-5a), a rate that would be less than 0.25 percent of the current annual vehicular diesel fuel usage in Nevada. Therefore, potential impacts to capacities of national and regional fuel producers and distributors during the operations phase would be small.

4.2.11.2.2.3 Materials. Materials use during the operations phase would be limited to materials for repair and maintenance of the railroad, including the locomotives, railcars, casks, and operations support facilities. The annual rate of material use over the 50-year operations phase would be substantially less than during the construction phase, and materials requirements would be expected to remain well below available capacity.

DOE would reclaim the quarries developed during the construction phase and would not use them during the operations phase. Therefore, the relatively minor amounts of ballast required for repairs and replacements during the operations phase would be met through existing commercial sources that at this stage of the design process have been identified as quarries in Milford, Utah, and Oroville, California, as described in Section 3.2.11.4. The impacts to available supplies of ballast at these existing quarries would be small.

4.2.11.3 Impacts under the Shared-Use Option

Railroad construction under the Shared-Use Option would include all of the features described in Section 4.2.11.2, but would include the construction of commercial sidings and support facilities. All such construction would occur on lands immediately adjacent to the rail alignment within the rail line construction right-of-way and would have impacts related to interfaces with utility corridors and rights-of-way similar to those under the Proposed Action without shared use.

The incremental demands on public water systems, wastewater systems, telecommunications systems, electric power systems, fossil fuels, and materials for construction of commercial sidings and support facilities would be sufficiently small that the anticipated impacts on these resources would be effectively the same as for the Proposed Action without shared use. Therefore, potential impacts to local, regional, or national suppliers of such resources under the Shared-Use Option would be small.

Railroad operations under the Shared-Use Option would be the same as described in Section 4.2.11.2 for the Proposed Action without shared use, but commercial shippers would add to traffic on the rail line.

The incremental demands on public water systems, wastewater systems, telecommunications systems, electric power systems, and materials for the operation and maintenance of commercial sidings and support facilities would be sufficiently small that the anticipated impacts on these resources would be effectively the same as those for the Proposed Action without shared use. Therefore, potential impacts to local, regional, or national suppliers of such resources under the Shared-Use Option would be small.

Fossil-fuel requirements for transporting general freight under the Shared-Use Option would depend on the volume and distance of shared-use traffic. It has been estimated that the incremental annual diesel consumption for commercial shared-use traffic would be 5.5 million liters (1.5 million gallons) (DIRS 182825-Nevada Rail Partners 2007, Appendix D, Table D-5a), a rate that is less than 0.3 percent of current annual diesel fuel usage in Nevada. Most, if not all, of this fuel consumption would be offset by diesel fuel that would otherwise be used if the goods or materials were shipped by truck. Therefore, the impact to the capacities of national and regional fuel producers and distributors under the Shared-Use Option would be small.

4.2.11.4 Summary

Table 4-138 summarizes potential impacts to utilities, energy, and materials from constructing and operating the proposed railroad along the Caliente rail alignment. DOE determined that those impacts would be small.

Table 4-138. Summary of potential impacts to utilities, energy, and material resources – Caliente rail alignment.[a]

Resource	Construction impacts	Operations impacts
Utility interfaces	Potential for short-term interruption of service. No permanent or long-term loss of service or prevention of future service-area expansions.	None.
Public water systems	Most water would be supplied by new wells; small effect on public water systems from population increase attributable to construction employees.	Most water for operations would be supplied by new wells; small effect on public water systems from population increase attributable to operations employees.
Wastewater-treatment systems	Dedicated treatment systems would be provided at construction camps; small impact on public systems from population increase attributable to construction employees.	Dedicated treatment systems would be provided at operations facilities; small impact on public systems from population increase attributable to operations employees.
Telecommunications systems	Dedicated systems; minimal reliance on communications providers.	Dedicated system along rail line; minimal reliance on communications providers.
Electricity	Peak demand would be within capacity of regional providers.	Peak demand would be within capacity of regional providers.
Fossil fuels	Demand would be approximately 6.5 percent of statewide use and could be met by existing regional supply systems and suppliers. Under the Shared-Use Option, demand would be less than 0.3 percent of statewide use during operations. Demand would be met by existing regional supply.	Demand would be less than 0.25 percent of statewide use.
Materials	Requirements generally would be very small in relation to supply capacity.	Requirements would be very small in relation to supply capacity.

a. Impacts under the Shared-Use Option would be similar to those under the Proposed Action without shared use, except as noted for fossil fuels.

4.2.12 HAZARDOUS MATERIALS AND WASTES

This section describes potential impacts of the use of hazardous materials and the management of nonhazardous wastes, ***hazardous wastes***, and ***low-level radioactive wastes*** that would be generated during construction and operation of the proposed railroad along the Caliente rail alignment. The section identifies the types of hazardous materials DOE would use and the hazardous, nonhazardous, and low-level radioactive wastes that would be generated during the construction and operations phases. The applicable guidelines, regulations, and available methods for treatment or ***disposal*** are identified for each waste. DOE evaluated the potential impacts of hazardous materials, hazardous wastes, nonhazardous wastes, and low-level radioactive wastes based on this information.

Section 4.2.12.1 describes the methodology DOE used to assess potential impacts; Section 4.2.12.2 describes potential construction impacts; Section 4.2.12.3 describes potential operations impacts; Section 4.2.12.4 describes potential impacts under the Shared-Use Option; and Section 4.2.12.5 summarizes potential impacts related to the use of hazardous materials and the generation of wastes.

DOE could purchase hazardous materials necessary for railroad construction and operations, such as engine coolant and solvents, through the federal supply chain or through local vendors. The Department anticipates local distributors in Nevada would supply propane and natural gas. The required hazardous materials would consist primarily of products consumers could purchase at most hardware, building-supply, or home-improvement stores. Therefore, DOE does not expect the supply of such products to be limited. As a consequence of using hazardous materials, associated hazardous wastes would be generated.

Section 3.2.12.1 describes the region of influence for hazardous materials and wastes.

4.2.12.1 Impact Assessment Methodology

DOE developed a list of anticipated types of hazardous materials and wastes to evaluate potential impacts from the use of hazardous materials or generation of wastes (see Table 4-139). To avoid or limit adverse impacts, DOE emphasizes adhering to applicable laws, regulations, policies, standards, and directives. The storage and disposal of hazardous and nonhazardous wastes is largely governed by the Resource Conservation and Recovery Act of 1976 (42 U.S.C. 6901 *et seq.*) and State of Nevada waste regulations (see Chapter 6, Statutory, Regulatory, and Other Applicable Requirements).

Table 4-139. General considerations for assessing potential impacts from the use of hazardous materials and the generation of hazardous and nonhazardous wastes.

Material	Basis for assessing adverse impacts
Hazardous materials	Determine if the use of hazardous materials would create reasonably foreseeable conditions that would significantly increase the risk of a release of hazardous materials resulting from not adhering to storage and use standards set in applicable guidelines and regulations
Hazardous waste	Determine if the quantity of hazardous wastes generated would adversely affect the capacity of hazardous-waste collection and disposal services
Nonhazardous waste	Determine if the volume of solid and industrial and special wastes generated would adversely affect the capacity of solid-waste collection service and landfills
Low-level radioactive waste	Determine if the quantity of low-level radioactive wastes generated would adversely affect the capacity of available disposal facilities

4.2.12.2 Construction Impacts

This section summarizes the types of hazardous materials DOE would use and the wastes that would be generated during construction of the proposed railroad. DOE would handle all wastes in accordance with applicable federal, state, and local environmental, occupational safety, and public health and safety requirements to minimize the possibility of adverse impacts to plants, animals, soils, and water resources inside or outside the region of influence. Because DOE would manage the use of hazardous materials and the disposal of wastes in accordance with applicable regulations and would implement best management practices (see Chapter 7), adverse impacts to environmental resources would be small.

4.2.12.2.1 Nonhazardous Waste

A total of approximately 2,300 metric tons (2,500 tons) per year of nonhazardous ***solid waste*** (such as general trash from kitchens and dormitories) would be generated during the construction phase, for a daily rate of approximately 6.3 metric tons (6.9 tons). Most of the solid waste would be generated at construction camps. DOE would dispose of all solid waste in permitted landfills. Table 4-140 summarizes the solid-waste generation rate during the construction phase.

Table 4-140. Solid waste generation during the construction phase – Caliente rail alignment.

	Number of personnel (maximum)	Solid-waste generation (pounds per day per person)[a,b]	Total solid waste (tons per day)[c,d]	Total solid waste (tons per year)[d]
Workforce	2,160[e]	6.4	6.90	2,500

a. Source: Per person solid waste generation rate is from DIRS 174041-State of Nevada 2004, p. 13.
b. To convert pounds to kilograms, multiply by 0.45359.
c. To convert tons to metric tons, multiply by 0.90718.
d. Numbers are not exact due to rounding.
e. Source: DIRS 182825-Nevada Rail Partners 2007, Appendix D.

Construction activities would generate approximately 4,020 metric tons (4,380 tons) of ***industrial and special wastes*** (such as construction debris, used tires, and other materials with specific management requirements) per year, for an approximate daily rate of 11 metric tons (12 tons) (DIRS 180922-Nevada Rail Partners 2007, p. 6-6). DOE would minimize the amount of these wastes as much as possible by ordering construction materials in correct sizes and amounts, reusing leftover materials, and recycling appropriate types of materials (DIRS 152540-Hoganson 2000, all).

Almost 1.8 million metric tons (2 million tons) of industrial and special wastes were disposed of in Nevada in 2002, which was 90 percent of the total solid waste (all categories) generated statewide (DIRS 174663-State of Nevada 2005, slide 8). Nevada has 20 operating municipal landfills that combined accept more than 17,000 metric tons (19,000 tons) of waste per day (DIRS 184969-Nevada Division of Environmental Protection 2007, Appendix 3). However, most of this capacity is available through the Apex Landfill, which serves the Las Vegas Valley, and receives an average of 10,000 metric tons (11,000 tons) per day (DIRS 184969-Nevada Division of Environmental Protection 2007, pp. 6 and 7). Some of the landfills in Esmeralda, Lincoln, and Nye Counties are quite small by comparison, and receive about 2.7 metric tons (3 tons) of waste per day (DIRS 184969-Nevada Division of Environmental Protection 2007, pp. 6 and 7).

It is likely that while some of the larger landfills would not see an appreciable change in the amount of waste received if they were utilized, some of the smaller landfills might see a substantial, although manageable, change in daily receipt of solid and industrial and special wastes if utilized during the construction phase.

As shown in Table 3-74, landfills in Lincoln, Nye, Esmeralda, and Clark Counties accept more than 11,700 metric tons (13,000 tons) of waste per day combined. The addition of about 6.3 metric tons (6.90 tons) per day of solid waste anticipated during the construction phase (see Table 4-140) would raise the total amount disposed of in the four-county area by approximately 0.054 percent. DOE anticipates that about 11 metric tons (12 tons) per day of industrial and special wastes would need to be disposed of due to construction activities, which would result in an increase of approximately 0.094 percent in waste receipt to local landfills (DIRS 180922-Nevada Rail Partners 2007, p. 6-6). Therefore, impacts to local landfills from the disposal of solid and industrial and special wastes would be small (for the relatively large Apex Landfill) to moderate (for the smaller landfills).

The geotechnical exploration program would include drilling approximately 3,200 boreholes at depths of 15 to 60 meters (50 to 200 feet). These borings would generate more than 1,500 cubic meters (2,000 cubic yards) of drill cuttings (DIRS 181867-Holder 2007, all). DOE would not dispose of these drill cuttings in landfills, but would dispose of them through land application, which would involve spreading the drill cuttings on the land surface. All drilling fluids would meet the requirements for standard land disposal. Therefore, there would be no impacts to waste treatment or disposal facilities as a result of the generation of drill cuttings.

Construction activities would include some clearing of land. Wastes generate d from this activity, including soil and plant material, would be used to construct fill slopes and contours within the rail line construction right-of-way; therefore, no waste would need to be disposed of and there would be no impacts to local waste disposal facilities from clearing of land (DIRS 180922-Nevada Rail Partners 2007, p. 6-3).

Earthwork cuts and fills for rail line construction would be expected to equal each other or nearly equal each other (DIRS 180916-Nevada Rail Partners 2007, Appendix E). In the event that more cut material was generated than would be needed as fill, DOE would use the excess to strengthen access roads and rail embankments. Therefore, no excess cut material would need to be disposed of and there would be no impacts to disposal facilities from the generation of excess cut material.

4.2.12.2.2 Hazardous-Materials Use and Hazardous-Waste Generation

DOE would store and use hazardous materials such as oil, gasoline, diesel fuel, and solvents during the construction phase primarily for the operation and maintenance of equipment and cleaning of equipment and facilities. The Department would implement an Environmental Management System and a Pollution Prevention/Waste Minimization Program during the construction and operations phases, which would include an evaluation of alternatives to eliminate, reduce, or minimize the amounts of hazardous materials used and hazardous wastes generated. As part of the Environmental Management System, DOE would regularly perform assessments to identify opportunities to reduce the generation of waste (DIRS 182385-Burns 2007, all). The Department would formulate and implement Spill Prevention Control and Countermeasures plans, including the use of secondary containment, to prevent releases of hazardous materials, such as diesel fuel, to the environment.

Table 4-141 lists the anticipated hazardous materials and the waste types that could be generated. The Department expects some materials (such as diesel fuel, lubricants, and hydrocarbons) would be used at each of the construction support facilities. However, most materials used and wastes generated would be specific to certain activities and facilities. It is estimated that each year during the course of construction, approximately 18 metric tons (approximately 20 tons) of hazardous waste would be generated (a total of 74 metric tons [82 tons] over the entire construction phase), much of which can be recycled through existing Nevada municipal waste programs. The nonrecyclable hazardous wastes generated during both the construction and operations phases of the railroad will be stored and disposed of in accordance with applicable federal and state regulations.

Table 4-141. Summary of anticipated types of hazardous materials that would be used and wastes that would be generated during railroad construction and operations – Caliente rail alignment.[a,b]

	Railroad construction	Construction camps	Concrete batch plants	Asphalt plants	Railroad operations[c]
Materials					
Fuel	X	X	X	X	X
Lubricants	X	X	X	X	X
Hydrocarbons (oils, greases)	X	X	X	X	X
Solvents	X	X	-	X	X
Compressed gas (flammable and nonflammable)	X	X	X	-	X
Batteries (such as lead, acid, nickel-cadmium)	X	X	X	-	X
Battery acid	X	X	-	-	X
Reactive (magnesium welding/fusing)	X	X	-	-	X
Explosives	X	X	-	-	-
Flammables (such as paints, coatings)	X	X	X	X	X
Herbicides/pesticides	X	X	-	-	X
Cleaning supplies (such as bleach, ammonia)	X	X	X	-	X
Lithium lubricants	X	-	-	-	X
Wastes					
Refuse	X	X	X	X	X
Industrial/construction waste	X	X	X	-	X
Hazardous waste	X	X	-	X	X
Recyclable/biodegradable	X	X	-	X	X
Universal waste (such as fluorescent lighting)	X	X	X	X	X
Tires	X	X	X	X	X
Asphalt	X	-	-	X	-
Antifreeze	X	X	X	X	X
Hydrocarbon-contaminated soils	X	X	X	X	X
Sewage	X	X	X	X	X
Gray water	-	X	-	-	X
Low-level radioactive waste	-	-	-	-	X

a. Source: DIRS 176750-Bishop 2006, all.
b. An X indicates that the listed material would be used or the listed waste would be generated during that specific activity or at that specific facility; a dash indicates that the listed material would not be used or the listed waste would not be generated during that specific activity or at that specific facility.
c. Includes only the proposed railroad activities; does not include DOE facilities at the Yucca Mountain Repository.

Hazardous wastes, such as used lubricants and solvents, would be accumulated and disposed of in accordance with Resource Conservation and Recovery Act regulations. Hazardous wastes would be shipped in accordance with 49 CFR Parts 171 and 172 and U.S. Department of Transportation Hazardous Materials 215D regulations. The disposal capacity for hazardous wastes in western states has been estimated at 50 times the demand for landfills and 7 times the demand for incineration until at least 2013 (DIRS 103245-EPA 1996, pp. 32, 33, 36, 46, 47, and 50); thus, there would be ample capacity available to dispose of any hazardous wastes. Through compliance with applicable state and federal regulations, adverse impacts from the use of hazardous materials, generation of hazardous waste, and the disposal of hazardous waste would be small.

DOE could use explosives during quarry, access-road, and rail line construction, and would develop a safety program specifically for the storage, transportation, and handling of these materials. The Department would adhere to the requirements of DOE Order 440.1A, *Worker Protection Management for DOE Federal and Contractor Employees* (as described in Chapter 6), which specifies that explosives operations must comply with the DOE Explosives Safety Manual (DOE M 440.1-1A). The manual provides guidance on the storage and transportation of explosives and refers to Occupational Safety and Health Administration safety requirements for routine construction and tunnel-blasting operations.

There could be impacts if hazardous materials, such as fuels, lubricants, and antifreeze, were released and spread. DOE would store such materials at construction camps, and supply trucks would routinely bring new materials and remove used lubricants and coolants from the construction sites. These activities could result in local spills and releases of contaminants. DOE would immediately remediate any areas affected by such spills in accordance with applicable regulations (see Chapter 6).

4.2.12.2.3 Low-Level Radioactive Waste

No low-level radioactive waste would be generated during the construction phase.

4.2.12.3 Operations Impacts

DOE would purchase hazardous and nonhazardous products and materials during the operations phase. The use of hazardous materials and products would lead to the generation of hazardous wastes. Table 4-141 lists the anticipated hazardous materials and the waste types that could be generated during the operations phase.

4.2.12.3.1 Nonhazardous Waste

Railroad operations would generate solid wastes, which DOE would dispose of at facilities along the rail line. Amounts of such wastes would be very small and would not impact disposal capacity in Clark, Esmeralda, Nye, and Lincoln Counties.

Amounts of industrial and special wastes generated during maintenance of fixed equipment such as signals and rail crossings would be very small and would be disposed of in accordance with applicable federal and state regulations. Where possible such wastes would be recycled (DIRS 180919-Nevada Rail Partners 2007, p. 3-6). DOE anticipates that crossties, ballast, rails, and bridges would not require replacement in approximately 25 years of operations. However, if and when these materials did require maintenance or replacement, they would be recycled if their reuse was not an option. Therefore, no impacts to local landfills would be anticipated from the disposal of industrial and special wastes during the operations phase.

The anticipated quantity of solid waste generated at all railroad operations support facilities is 180 metric tons (198 tons) per year or 0.5 metric ton (0.55 ton) per day (Table 4-142). DOE would transport solid waste to permitted solid-waste landfills. As shown in Table 3-74, landfills in Lincoln, Nye, Esmeralda, and Clark Counties accept more than 11,700 metric tons (13,000 tons) of waste per day combined.

The addition of about 0.5 metric ton (0.55 ton) of solid waste anticipated during the operations phase (see Table 4-142) would raise the total amount disposed of in the four-county area by less than 0.01 percent. Nevada has enough landfill capacity to accommodate this additional solid waste; therefore, impacts to landfill capacities would be small.

Table 4-142. Solid waste generation at proposed railroad operations support facilities – Caliente rail alignment.

Facility	Number of personnel (maximum)	Solid-waste generation (pounds per day per person)[a,b]	Total solid waste (tons per day)[c]	Total solid waste (tons per year)
Cask Maintenance Facility	30[d]	6.4	0.096	35
Facilities at the Interface with the Union Pacific Railroad Mainline (Interchange Yard and Staging Yard)	50[d,e]	6.4	0.16	58
Rail Equipment Maintenance Yard (including the Nevada Railroad Control Center and National Transportation Operations Center)[f]	40[d,e]	6.4	0.13	47
Headquarters, Satellite, and Trackside Maintenance-of-Way Facilities	50[e]	6.4	0.16	58
Totals[g]	170		0.55	198

a. To convert pounds to kilograms, multiply by 0.45359.
b. Source: Per person solid waste generation rate is from DIRS 174041-State of Nevada 2004, p. 13.
c. To convert tons to metric tons, multiply by 0.90718.
d. Includes four rail-crew members.
e. DIRS 182825-Nevada Rail Partners 2007, Appendix D.
f. The Nevada Railroad Control Center could be at either the Rail Equipment Maintenance Yard or the Staging Yard and the National Transportation Operations Center could be anywhere in the continental United States; for purposes of analysis, DOE assumed these Centers would be at the Rail Equipment Maintenance Yard.
g. Totals might not equal sums of values due to rounding.

4.2.12.3.2 Hazardous-Materials Use and Hazardous-Waste Generation

Maintenance of rolling and stationary railroad equipment and track would generate some hazardous wastes, including lubricants from equipment and machinery, solvents, paint, and other hazardous materials typical of railroad operations.

The Facilities at the Interface with the Union Pacific Railroad Mainline would use limited quantities of hazardous materials, such as oils, solvents, and lubricants, and associated wastes would be generated. An off-site contractor would perform diesel fueling at the Staging Yard using a tank truck to service the yard switcher locomotive. DOE would also store propane and natural gas at the Staging Yard (DIRS 180919-Nevada Rail Partners 2007, pp. 5-1 and 5-11).

The Maintenance-of-Way Headquarters Facility would include maintenance work areas, office space, and a material-storage area. DOE would store limited quantities of hazardous materials such as lubricants, solvents, and possibly pesticides (for example, herbicides and rodenticides), at this facility, and associated wastes would be generated. The Department would also store propane or natural gas onsite in tanks (DIRS 180919-Nevada Rail Partners 2007, pp. 7-1 and 7-2).

DOE would store and use hazardous materials, including diesel fuel, gasoline, propane, oils, paints, and solvents, at the Cask Maintenance Facility and associated hazardous wastes (such as oily rags and solvent wastes) would be generated (DIRS 174083-WPI 2003, pp. 30, 39, and 52). Compressed flammable gas and oxygen would also be stored at the Cask Maintenance Facility.

The Nevada Railroad Control Center could be at either the Rail Equipment Maintenance Yard or the Staging Yard and the National Transportation Operations Center could be anywhere in the continental United States, although for purposes of analysis, DOE assumed these Centers would be at the Rail

Equipment Maintenance Yard. The Centers would consist primarily of office space (DIRS 180919-Nevada Rail Partners 2007, p. 6-3). DOE would store general cleaning supplies at these facilities.

There would be a diesel fuel storage tank with a 190,000-liter (50,000-gallon) capacity and a diesel fueling depot at the Rail Equipment Maintenance Yard (DIRS 181033-Hamilton-Ray 2007, all). There would also be a staging area where fuel oil and construction materials could be delivered to the repository. DOE would store and use hazardous materials, including lubricating oil, diesel fuel, natural gas or propane, and solvents, at the Rail Equipment Maintenance Yard and associated hazardous wastes would be generated (DIRS 180919-Nevada Rail Partners 2007, Section 6). Locomotive maintenance activities would generate approximately 420 liters (110 gallons) of used oil for each locomotive maintained. During peak operations, a maximum of 442 locomotives would travel on the rail line each year (DIRS 175036-BSC 2005, Table 4-2), which would generate approximately 190,000 liters (50,000 gallons) per year of used oil from locomotive maintenance. The used oil would be reclaimed rather than disposed of (DIRS 155970-DOE 2002, p. 6-89). During the operations phase of the railroad, approximately 8,709 metric tons (approximately 9,600 tons) of hazardous waste could be produced during the shipping campaign. It is anticipated that much of this material will also be recyclable through existing waste programs.

There could be small spills of hazardous materials such as oils and fuel along the rail line during the operations phase. DOE would immediately remediate any areas affected by such spills in accordance with applicable regulations (see Chapter 6).

DOE would manage the use of hazardous materials and would follow all federal, state, and local regulations, and would transport hazardous wastes to appropriately permitted disposal facilities that have ample capacities to receive such wastes, as discussed in Section 4.2.12.2.2. Therefore, impacts from the use of hazardous materials and the disposal of hazardous wastes during the operations phase would be small.

4.2.12.3.3 Low-Level Radioactive Waste

Activities at the Cask Maintenance Facility would generate from 3,200 to 7,900 cubic meters (113,000 to 280,000 cubic feet) of Class A low-level radioactive waste throughout the operations phase (DIRS 181425-MTS 2007, p. 6). Site-generated, low-level radioactive waste would be controlled and disposed of in a DOE low-level radioactive waste disposal site, in an ***Agreement State*** site, or in a U.S. Nuclear Regulatory Commission-licensed site subject to the completion of the appropriate review pursuant to the National Environmental Policy Act. Disposal in an Agreement State site or in a U.S. Nuclear Regulatory Commission-licensed site would be in accordance with applicable portions of 10 CFR Part 20.

Impacts to licensed disposal facilities from low-level radioactive waste would be small because the amount of such waste would be small. For comparison, the total amount of waste estimated to be generated throughout the operations phase accounts for only about 6 percent of the low-level waste disposed of in 2005 at commercial low-level waste facilities nationwide (DIRS 182320-NRC 2007, all).

4.2.12.4 Impacts under the Shared-Use Option

Impacts under the Shared-Use Option would be similar to those described for the Proposed Action without shared use. The only difference would be the construction and operation of additional sidings and a slight increase in overall rail traffic. Waste characteristics, generation rates, and disposal requirements would vary only slightly. Therefore, any additional adverse impacts associated with the Shared-Use Option would be small.

4.2.12.5 Summary

Table 4-143 summarizes potential impacts related to the use of hazardous materials and the generation of waste from constructing and operating the proposed railroad along the Caliente rail alignment. Chapter 7 describes mitigation measures DOE could employ to reduce impacts.

Impacts from nonhazardous waste (solid and industrial and special waste) disposal listed in Table 4-143 represent the degree to which potentially affected landfills could be affected by increased waste receipt rates as a result of railroad construction and operations along the Caliente rail alignment. Construction of the proposed railroad along the Caliente rail alignment would raise the disposal rate of nonhazardous waste to landfills in the region of influence by about 0.15 percent. Overall, impacts during the construction phase would be small, for the relatively large Apex Landfill, to moderate for smaller landfills. During the operations phase, impacts to landfills would be small.

Impacts from the use of hazardous materials listed in Table 4-143 represent the likelihood that railroad construction and operations along the Caliente rail alignment would create reasonably foreseeable conditions that would significantly increase the risk of a release of hazardous material. Overall, impacts during the construction and operations phases would be small, considering that DOE would implement proper planning measures in relation to the storage and handling of hazardous materials and would adhere to all applicable regulations.

Impacts from hazardous-waste disposal listed in Table 4-143 represent the degree to which potentially affected hazardous-waste disposal facilities could be affected by increased waste receipt rates as a result of railroad construction and operation along the Caliente rail alignment. Overall, impacts during the construction and operation phases would be small because adequate disposal capacity would be available.

Impacts from low-level radioactive waste disposal listed in Table 4-143 represent the degree to which potentially affected low-level radioactive waste disposal facilities could be affected by increased waste receipt rates as a result of railroad construction and operations along the Caliente rail alignment. No low-level radioactive waste would be generated during the construction phase. During the operations phase, low-level radioactive wastes would be generated during cask maintenance activities at the Cask Maintenance Facility. Impacts to low-level radioactive waste disposal facilities during the operations phase would be small because the amount of waste generated would be small.

Table 4-143. Summary of potential impacts related to the use of hazardous materials and the generation of waste from constructing and operating the proposed railroad – Caliente rail alignment [a] (page 1 of 2).

Rail line segment/facilities (county)	Construction impacts	Operations impacts
Common to all common segments and alternative segments (Lincoln, Nye, and Esmeralda Counties)	Small (Apex Landfill) to moderate (smaller landfills) impacts from nonhazardous-waste (solid and industrial and special waste) disposal. Small impacts from use of hazardous materials. Small impacts from hazardous-waste disposal.	Small impacts from nonhazardous-waste (solid and industrial and special waste) disposal. Small impacts from use of hazardous materials. Small impacts from hazardous-waste disposal.

Table 4-143. Summary of potential impacts related to the use of hazardous materials and the generation of waste from constructing and operating the proposed railroad – Caliente rail alignment[a] (page 2 of 2).

Rail line segment/facilities (county)	Construction impacts	Operations impacts
Facilities at the Interface with the Union Pacific Railroad Mainline (includes the Interchange Yard and Staging Yard) (Lincoln County)	Small (Apex Landfill) to moderate (smaller landfills) impacts from nonhazardous-waste (solid and industrial and special waste) disposal. Small impacts from use of hazardous materials. Small impacts from hazardous-waste disposal.	Small impacts from nonhazardous-waste (solid and industrial and special waste) disposal. Small impacts from use of hazardous materials. Small impacts from hazardous-waste disposal.
Maintenance-of-Way Facilities (includes Maintenance-of-Way Headquarters Facility; Maintenance-of-Way Trackside Facility; Satellite Maintenance-of-Way Facilities); Rail Equipment Maintenance Yard; Cask Maintenance Facility; and Nevada Railroad Control Center and National Transportation Operations Center at the Rail Equipment Maintenance Yard (Lincoln, Nye, and Esmeralda Counties)	Small (Apex Landfill) to moderate (smaller landfills) impacts from nonhazardous-waste (solid and industrial and special waste) disposal. Small impacts from use of hazardous materials. Small impacts from hazardous-waste disposal.	Small impacts from nonhazardous-waste (solid and industrial and special waste) disposal. Small impacts from use of hazardous materials. Small impacts from hazardous-waste disposal. Small impacts from low-level radioactive waste disposal for wastes that would be generated at the Cask Maintenance Facility.
Construction camps (Lincoln, Nye, and Esmeralda Counties)	Small (Apex Landfill) to moderate (smaller landfills) impacts from nonhazardous-waste (solid and industrial and special waste) disposal. Small impacts from use of hazardous materials. Small impacts from hazardous-waste disposal.	No impact. There would be no construction camps during railroad operations.
Access roads (including alignment service road) (Lincoln, Nye, and Esmeralda Counties)	Small (Apex Landfill) to moderate (smaller landfills) impacts from nonhazardous-waste (solid and industrial and special waste) disposal. Small impacts from use of hazardous materials. Small impacts from hazardous-waste disposal.	No impact. Use of access roads during railroad operations would not involve the use of hazardous materials or the generation of wastes.
Quarries (common to all potential quarry locations)	Small (Apex Landfill) to moderate (smaller landfills) impacts from nonhazardous-waste (solid and industrial and special waste) disposal. Small impacts from use of hazardous materials. Small impacts from hazardous-waste disposal.	No impact. DOE would not operate quarries after the end of the construction phase.

a. Impacts under the Shared-Use Option would be similar to those under the Proposed Action without shared use.

4.2.13 CULTURAL RESOURCES

This section describes potential impacts to cultural resources from constructing and operating the proposed railroad along the Caliente rail alignment. Section 4.2.13.1 describes the methods DOE used to assess potential impacts; Section 4.2.13.2 describes potential construction and operations impacts; Section 4.2.13.3 describes potential impacts under the Shared-Use Option; and Section 4.2.13.4 summarizes potential impacts to cultural resources. This section also incorporates American Indian perspectives to assess the potential direct and indirect impacts to important American Indian prehistoric and historic resources.

Section 3.2.13.1 describes the region of influence for cultural resources. Unless specified otherwise, this section describes impacts within the 3.2-kilometer (2-mile)-wide area centered on the rail alignment (the Level II region of influence).

4.2.13.1 Impact Assessment Methodology

Because of the length of the proposed rail line along the Caliente rail alignment, DOE is using a phased cultural resource identification and evaluation approach, as described in 36 CFR 800.4(b) 2, to identify specific cultural resources along the alignment. Under this approach, DOE would defer final field surveys (an intensive BLM ***Class III inventory***) of the actual construction right-of-way, as provided in the programmatic agreement between DOE, the BLM, the STB, and the Nevada State Historic Preservation Office (DIRS 176912-Wenker et al. 2006, p. 15) (see Appendix M).

> A **Class II inventory** is a sample-oriented field inventory designed to locate and record, from surface and exposed profile indications, all cultural resource sites within a portion of a defined area to make possible an objective estimate of the nature and distribution of cultural resources in the entire defined area.
>
> A **Class III inventory** is an intensive field survey designed to locate and record all cultural resource sites within a specified area. Upon completion of such an inventory, no further cultural resource inventory work is normally needed in the area.

The programmatic agreement states that an appropriate level of field investigation – including on-the-ground intensive surveys; evaluations of all recorded resources listed on the *National Register of Historic Places*; assessments of adverse effects; and applicable mitigation of identified impacts – be completed before any ground-disturbing construction activities could begin. This programmatic agreement also stipulates that there be tribal consultation activities, and treatment (mitigation) guidelines and measures designed to cover unanticipated discoveries and impacts during the construction and operations phases. Tribal consultation is addressed in detail in the programmatic agreement and specifies the use of written communication, telephone communication, personal meetings, procedures for resolving identified issues, participation of tribal monitors during field studies, and notification of tribes within 2 days in the event that any unanticipated archaeological (including American Indian human remains and sensitive cultural items as covered by the Native American Graves Protection and Repatriation Act) are encountered. Under the Native American Graves Protection and Repatriation Act, tribes must be notified if American Indian human remains or sensitive cultural items are discovered during excavation, and activity in that area must immediately stop. These requirements are included in Section II.D. of the programmatic agreement. Mitigation of impacts would be guided by an appropriate treatment or data recovery plan and would be designed to lessen or mitigate project-related effects to historic properties through avoidance, data recovery, or measures other than data recovery (including Historic American Buildings Survey/Historic American Engineering recordation, oral history, historic markers or exhibits, or interpretive publications). The BLM administers most of the potentially affected land along the Caliente rail alignment. Relevant provisions of another programmatic agreement between the BLM, the State of Nevada, and the Nevada State Historic Preservation Office (DIRS 174690-Abbey & Baldrica 2005, all) would apply, along with cultural resources procedures outlined in the BLM *Cultural Resource Inventory Guidelines* (DIRS 174691-BLM 1990, all).

The region of influence for the Class III inventory would include all potential direct and indirect effects to cultural resources and all properties of traditional religious and cultural importance from any construction activities associated with the proposed railroad. Before beginning any ground-disturbing activities, DOE would conduct a Class III inventory and an ethnographic study for the following specific region of influence for project activities (DIRS 176912-Wenker et al. 2006, p. 2):

> The APE [Area of Potential Effect, referred to in this Rail Alignment EIS as the region of influence] for the rail line will be 200 feet [61 meters] from the centerline of the alignment or the actual ROW [right-of-way] application submitted to BLM, whichever is greater. The APE for access roads outside of the alignment will be a minimum of 100 feet [30.5 meters] wide with at least 50 feet [15 meters] on either side of centerline. The minimum APE for any construction areas or other temporary use areas, outside of the alignment, will be the footprint of the area plus 100 feet outward in all directions from the perimeter of each area. The APE for assessing indirect effects on historic properties outside of the rail line alignment will extend at least one mile in all directions from the perimeter of the direct effects APE.

Cultural resource requirements for the portion of common segment 6 (see Figure 2-11) and the Rail Equipment Maintenance Yard within the Yucca Mountain Site boundary would be covered by a separate programmatic agreement addressing development of a geologic repository at Yucca Mountain, Nevada, underway between the DOE Office of Civilian Radioactive Waste Management, the Advisory Council on Historic Preservation, and the Nevada State Historic Preservation Office.

The present evaluation of impacts depends on a comprehensive review of existing literature and site-file databases, sample archaeological inventory, and discussions with responsible federal agencies, State of Nevada agencies, and American Indian groups, which have identified many known and potential archaeological, historical, and American Indian sites and features along the Caliente rail alignment. Section 3.2.13.3 provides pertinent baseline information. American Indian viewpoints for potential impacts to sites and resources important to regional tribes and organizations are expressed in *American Indian Perspectives on the Proposed Rail Alignment Environmental Impact Statement for the U.S. Department of Energy's Yucca Mountain Project* (the American Indian Resource Document; DIRS 174205-Kane et al. 2005, all).

DOE would commission an ethnographic study of the rail alignment to gain understanding of American Indian use of the area and the meaning of features and natural resources to Indian people. Plans for ethnographic studies are also described in Chapter 7.

4.2.13.2 Railroad Construction and Operations Impacts

Nearly all potential direct impacts to cultural resources, including those that would physically damage, alter, or disturb a historic property, would occur during the construction phase, specifically within the designated rail line construction right-of-way. There could be additional construction-related ground disturbances at quarry sites, road crossings, temporary access roads, borrow sites, ***spoils areas*** or piles, and 12 temporary construction camps. Each camp would have a construction footprint of about 0.1 square kilometer (25 acres). There would be other ground disturbances at the locations of the railroad operations support facilities, including the Facilities at the Interchange with the Union Pacific Railroad Mainline in the vicinity of either Caliente (0.06 square kilometer [15 acres]) or Eccles (0.12 square kilometer [30 acres]); the Maintenance-of-Way Trackside Facility (0.06 square kilometer [15 acres]), which would be near Goldfield; the Maintenance-of-Way Headquarters Facility (0.01 square kilometer

[3 acres]), which would be near Tonopah; the Rail Equipment Maintenance Yard (about 0.41 square kilometer [101 acres]), which would be within the Yucca Mountain Site boundary; and the Cask Maintenance Facility, which would be collocated with the Rail Equipment Maintenance Yard.

There could be various forms of indirect impacts during both the construction and operations phases, such as visual intrusions or increased access and visitation. During construction, large numbers of workers in the vicinity of the construction camps could increase the potential for both intentional and unintentional impacts to nearby cultural resources. Excavation and other construction-related ground-disturbing activities could unearth additional cultural materials that, based on previous archaeological surveys, were either thought to occur only at the surface or were previously undetected because they were completely buried. Improved access to remote areas could also increase the likelihood of looting or other damage to archaeological properties during the construction and operations phases.

Another indirect impact that would be unavoidable from construction in remote areas would be visual intrusion effects to a variety of resources designated as potential cultural resource landscapes. These resources include potential ***ethnographic landscapes***, rural historic landscapes, and historic mining landscapes, and incorporate geographic areas, including both cultural and natural resources associated with historic events or activities. In some instances, the literature reviews, known-site file searches, and the Class II inventory conducted for this Rail Alignment EIS have identified potential areas of specific impacts for some of the alternative segments and common segments. In addition, the American Indian Resource Document (DIRS 174205-Kane et al. 2005, all) provides other relevant information.

4.2.13.2.1 Construction Impacts along Caliente Rail Alignment Alternative Segments and Common Segments

The following sections outline both the direct and indirect construction-related impacts within each of the Caliente rail alignment alternative segments and common segments. Each section begins with a discussion of the direct impacts to cultural resources, which is followed by a discussion of the indirect impacts. These sites include those listed on the *National Register of Historic Places*, those eligible for listing on the National Register, and those known to have cultural significance but are not listed on the National Register.

4.2.13.2.1.1 Alternative Segments at the Interface with the Union Pacific Railroad Mainline.

Caliente Alternative Segment The Class I site-file search identified 11 previously recorded cultural resources along the Caliente alternative segment, including two within the Level I region of influence and nine within the Level II region of influence. These resources include three prehistoric sites (two rockshelters and a campsite), three isolated artifacts, and five historic sites (two railroad features, two trash scatters, and a cemetery). The search revealed that one site, the Caliente Union Pacific Railroad Depot, is listed on the *National Register of Historic Places* and two sites, the Caliente-Panaca Railroad berm and a prehistoric rockshelter site, are evaluated as eligible for listing on the *National Register of Historic Places*. DOE did not perform a Class II sample inventory due to private property issues. Most of the lands along the Caliente alternative segment are privately owned. If DOE selected this alternative segment, the Department would complete an inventory before beginning construction.

There could be direct impacts to one *National Register of Historic Places*-eligible site. Construction of the rail roadbed could directly impact the abandoned Caliente-Panaca Railroad berm. The rails have been removed from the berm, but several undocumented wooden and metal bridges remain along the stretch that would be covered by the proposed rail line.

There could be indirect impacts to two National Register-eligible sites, including the Caliente Union Pacific Railroad Depot and a prehistoric rockshelter. The Caliente Union Pacific Railroad Depot is in downtown Caliente, south of the proposed interchange with the Union Pacific Railroad Mainline. Historic maps and photographs indicate that several early buildings, including a depot and a roundhouse, existed in that area and it is probable that subsurface historical archaeological remains exist even though the structures have been removed. The area known as Indian Cove, just north of the City of Caliente, through which the rail line would pass and the possible location of the Staging Yard, has evidence of prehistoric use in the form of a previously recorded rockshelter, an unevaluated rock-art panel, and ***lithic scatters*** and isolates. The rail line would extend through Meadow Valley, and would constitute a possible visual intrusion on the potential early Mormon settlement cultural landscape.

A rail line along the Caliente alternative segment could also directly and indirectly impact unrecorded sites. For example, the unrecorded Caliente Hot Springs Motel and Baths is where the proposed rail line would depart from the Union Pacific Railroad Mainline.

Potential quarry CA-8B would be along the Caliente alternative segment, on the eastern exposure of a rocky ridge overlooking Meadow Valley Wash. Preliminary archaeological reconnaissance of this location indicates that development of a quarry there would not result in direct impacts to known sites.

Eccles Alternative Segment The Class I site-file search identified three cultural resources along the Eccles alternative segment, including one within the Level I region of influence and two within the Level II region of influence. These resources include two prehistoric sites and one isolated artifact. The search revealed no sites have been evaluated as eligible for listing on the *National Register of Historic Places*; however, there could be direct impacts to two previously recorded but unevaluated prehistoric rockshelters in the vicinity of the Eccles-North Staging Yard location. The American Indian Resource Document (DIRS 174205-Kane et al. 2005, Section 2.3) also indicates that Clover Valley is a culturally important place with associated songs, plants and animals, and water resources.

DOE inventoried three Class II survey sample units along this alternative segment, a total of 2.4 kilometers (1.5 miles) or 13 percent of the segment. No sites were recorded, but five isolated artifacts were found. In the area of Meadow Wash at the northern end of the alternative segment, there is a potential early Mormon settlement cultural landscape.

The sample inventory indicates that approximately eight sites could be present within the Level I region of influence.

4.2.13.2.1.2 Caliente Common Segment 1 (Dry Lake Valley Area). The Class I site-file search identified 39 previously recorded cultural resources along Caliente common segment 1, including nine within the Level I region of influence and 30 within the Level II region of influence. These resources include 11 prehistoric sites (a toolstone quarry locale and 10 lithic scatters), 20 isolated artifacts, and eight historic sites (three ranching campsites, three trash scatters, and Old State Route 38 along the White River).

The Class II field survey inspected a total of 23 sample units along this segment, a total of 19 kilometers (12 miles) or 16 percent of the segment. The survey recorded two sites, a prehistoric lithic scatter and a historic campsite; neither site was recommended as eligible for listing on the *National Register of Historic Places*. Seventeen isolated artifact occurrences were also recorded during the field survey along this segment.

The search revealed no previously recorded National Register-eligible sites within the area that would be directly affected by rail line construction. However, there could be indirect impacts to a National Register-eligible prehistoric/historic campsite in the vicinity of Black Rock Spring. The campsite includes abundant lithics, ceramics, and early historic-period artifacts.

Construction activities along the eastern part of Caliente common segment 1 could result in direct and indirect impacts to the Meadow Valley Wash early Mormon settlement cultural landscape, and a historically important Pioche-Hiko silver mining community route and campsites of the 1849 Bennett-Arcane Party. The 1849 party camped at Bennett Springs, about 1.6 kilometers (1 mile) from the Caliente rail alignment. The party also camped in the vicinity of Black Rock Spring before crossing the North Pahroc Range. The route the party followed, commonly referred to as the Lost '49er Trail, has not been physically identified but is known to have crossed Bennett Pass and Pahroc Summit. To date, no archaeological sites associated with the Bennett-Arcane Party have been identified in the present region of influence.

The American Indian Resource Document (DIRS 174205-Kane et al. 2005, all) does not identify any potentially significant American Indian resources in the region of influence along Caliente common segment 1, though the American Indian Writers Subgroup notes that systematic ethnographic studies have not been conducted. The Subgroup does note the significance of cultural resources in the White River Valley, such as the well-known White River Narrows rock-art sites, charcoal ovens, and the area of Pahranagat Valley. These resources would be several kilometers from the Caliente rail alignment region of influence and would not be affected by rail line construction.

Sample inventory indicates that approximately 56 resources may be present within the Level I region of influence.

4.2.13.2.1.3 Garden Valley Alternative Segments.

Garden Valley Alternative Segment 1 The Class I site-file search identified 10 previously recorded cultural resources along Garden Valley alternative segment 1, including one within the Level I region of influence and nine within the Level II region of influence. These resources include five prehistoric sites (two rockshelters and three lithic scatters), four isolated artifacts, and one historic trash scatter. No sites have been evaluated as eligible for listing on the *National Register of Historic Places*. The Class II survey examined five sample units along this alternative segment, a total of 4 kilometers (2.5 miles) or 11 percent of the segment. Only six isolated artifact occurrences were recorded.

The American Indian Resource Document (DIRS 174205-Kane et al. 2005, p. 22) notes that Garden Valley contained extensive American Indian trail systems used for trade, commerce, pilgrimage, and for access to mountain ranges. Because systematic ethnographic studies have not been conducted for this alternative segment, the Resource Document gives no specific locations for trails. Therefore, Garden Valley alternative segment 1 could result in direct and indirect impacts to American Indian trail systems that pass through this part of Garden Valley.

Sample inventory indicates that approximately nine resources could be present within the Level I region of influence.

Garden Valley Alternative Segment 2 The Class I site-file search identified 12 cultural resources along Garden Valley alternative segment 2 (see Figure 3-119), including four prehistoric sites within the Level I region of influence and eight isolates within the Level II region of influence. The Class II survey inspected four sample units along this segment, a total of 3.2 kilometers (2 miles) or 9 percent of the segment; two isolates were recorded. Three cultural resources are evaluated as eligible for listing on the *National Register of Historic Places*, including the two campsites and a lithic scatter associated with a cluster of rock features.

Construction activities could directly impact two archaeological sites evaluated as eligible for listing on the *National Register of Historic Places*, a campsite and a lithic scatter, which would be in the Level I region of influence.

The American Indian Resource Document (DIRS 174205-Kane et al. 2005, p. 22) notes that Garden Valley had extensive American Indian trail systems used for trade, commerce, pilgrimage, and for access to mountain ranges. There could be direct and indirect impacts to early American Indian trails, and construction of Garden Valley alternative segment 2 could result in potential visual intrusions to the Freiberg Mining District cultural landscape in the northern part of the Worthington Mountains.

Sample inventory indicates that approximately 44 resources could be present within the Level I region of influence.

Garden Valley Alternative Segment 3 The Class I site-file search identified 17 previously recorded cultural resources along Garden Valley alternative segment 3, including one within the Level I region of influence and 16 within the Level II region of influence. These resources include two prehistoric sites (a rock feature and lithic scatter), 13 isolated artifacts, and two historic trash scatters. The Class II sample survey examined four sample units along this segment, a total of 3.2 kilometers (2 miles) or 9 percent of the segment. Only two isolates were recorded. No sites are evaluated as National Register-eligible.

Similar to the other Garden Valley alternative segments, the American Indian Resource Document (DIRS 174205-Kane et al. 2005, p. 22) notes that this area had extensive American Indian trail systems used for trade, commerce, pilgrimage, and access to mountain ranges. Construction of Garden Valley alternative segment 3 could result in direct and indirect impacts to these trail systems. The BLM Ely office has suggested that a potential sheep ranching cultural landscape might exist in the northern part of Garden Valley due to the proximity of the Uhalde and Paris Ranches and grazing areas, which included not only northern Garden Valley and the nearby Quinn Canyon Range, but the northern part of Coal Valley and the Seaman Range to the east. Rail line construction could result in indirect visual impacts to these landscapes.

Sample inventory indicates that approximately 12 resources could be present within the Level I region of influence.

Garden Valley Alternative Segment 8 The Class I site-file search identified five previously recorded cultural resources along Garden Valley alternative segment 8, all within the Level II region of influence. These resources include three prehistoric lithic scatters and two isolated artifacts. The Class II sample survey inspected three units along this alternative segment, a total of 2.4 kilometers (1.5 miles) or 7 percent of the segment; eight isolated artifacts were recorded. No cultural resources along Garden Valley alternative segment 8 are evaluated as National Register-eligible.

The American Indian Resource Document (DIRS 174205-Kane et al. 2005, p. 22) notes that Garden Valley had extensive American Indian trail systems used for trade, commerce, pilgrimage, and for access to mountain ranges. Construction of Garden Valley alternative segment 8 could result in direct and indirect visual impacts to these trail systems, and could result in potential visual intrusions to the Freiberg Mining District cultural landscape in the northern part of the Worthington Mountains.

4.2.13.2.1.4 Caliente Common Segment 2 (Quinn Canyon Range Area). The Class I site-file search identified eight cultural resources along Caliente common segment 2, including three within the Level I region of influence and six within the Level II region of influence. These resources include seven prehistoric sites (two campsites, a rockshelter, and four lithic scatters) and one isolated artifact. The Class II sample survey inspected seven sample units, a total of 5.6 kilometers (3.5 miles) or 11 percent of the segment; three sites and 16 isolated artifacts were recorded. Three cultural resources along Caliente common segment 2 are evaluated as eligible for listing on the *National Register of Historic Places,* including two lithic scatters and one locale with rockshelters and an associated scatter of artifacts.

The American Indian Resource Document (DIRS 174205-Kane et al. 2005, Section 2.3) notes the rockshelter site as a culturally significant place, and refers to it as the "Black Top Archaeological Locality" (see Figures 3-119 and 3-120), and the Class II sample survey resulted in the identification of three sites and 16 isolated artifacts.

Indirect impacts along this common segment could include visual impacts to the significant Black Top archaeological locality, which would be within the rail alignment construction right-of-way. This site includes a stratified rockshelter, artifact scatter, and rock alignments, and is noted in the American Indian Resource Document (DIRS 174205-Kane et al. 2005, p. 22) as a culturally significant place. The American Indian Writers Subgroup noted the proximity of Caliente common segment 2 to the Quinn Canyon Range and, specifically, to Quinn Canyon itself, where there were historical events important to American Indians. At the west end of Caliente common segment 2, construction and operation of the proposed railroad could constitute a visual intrusion for the unrecorded historic Cedar Pipeline Ranch, which is part of the larger Reveille Valley historic ranching cultural landscape. It is also in this area that the rail alignment would intersect the 1854 John C. Fremont exploration trail. However, no physical manifestations of this trail or associated features have been identified on the ground surface.

Direct and indirect impacts to American Indian trail systems and a potential historic sheep ranching cultural landscape would be possible. The BLM Ely office has suggested that because of the proximity of ranches and grazing areas in Garden Valley, there could be a potential sheep ranching cultural landscape in the northern part of the valley.

Sample inventory indicates that approximately 27 resources could be present within the Level I region of influence.

4.2.13.2.1.5 South Reveille Alternative Segments. Because the Level II region of influence for the South Reveille alternative segments (Figure 3-120) overlap, they are discussed jointly for the Class I site-file search and the Class II survey. The Class I site-file search revealed the presence of three cultural resources along these segments. These resources include two recorded prehistoric lithic scatter sites and one historic mine prospect. Also in this vicinity are the Reveille Valley rock-art panels. This location was identified in the American Indian Resource Document (DIRS 174205-Kane et al. 2005, Section 2.3) as a culturally important site for American Indian people.

DOE examined two sample units for each of these alternative segments during the Class II field survey, a total of 1.6 kilometers (1 mile) or 8.5 percent of the segments. Only a single isolate was encountered along South Reveille 2. The Class II survey also recorded the rock-art site noted above.

Both South Reveille alternative segments 2 and 3 would pass within 0.8 kilometer (0.5 mile) of a National Register of Historic Places-eligible rock-art site. Based on limited observations, the American Indian Resource Document (DIRS 174205-Kane et al. 2005, p. 20) also associated a high level of American Indian cultural significance with this property. Construction and operation of the proposed railroad could represent a long-term indirect impact on this important place.

There are two potential quarry locations (NN-9A and NN-9B) along South Reveille alternative segments 2 and 3. The northernmost location (NN-9A) would be within 366 meters (1,200 feet) of a significant rock-art site. Development of the quarry could result in indirect aesthetic, visual, and noise impacts to that site. Potential quarry NN-9B would occupy a long, narrow sandy ridge with frequent rocky outcrops. Preliminary archaeological reconnaissance of this location indicates that development of this quarry would not result in direct impacts to known sites.

Sample archaeological inventory did not indicate the presence of any archaeological sites within the Level I region of influence for these segments.

4.2.13.2.1.6 Caliente Common Segment 3 (Stone Cabin Valley Area). The Class I site-file search identified 35 cultural resources along Caliente common segment 3 (see Figure 3-120), including seven within the Level I region of influence. These resources include 29 prehistoric sites and six historic sites. The Class II survey examined 22 sample units, a total of 18 kilometers (11 miles) or 16 percent of the segment. Three prehistoric sites are evaluated as eligible for listing on the National Register of Historic Places, including two lithic scatters within the Level I region of influence and a rock-art site within the Level II region of influence. Several potentially important cultural resources are found along Caliente common segment 3, although most are just outside the Level II region of influence.

Caliente common segment 3 would cross nearly all of Reveille Valley, Stone Cabin Valley, and the southern part of Ralston Valley, and it would pass close to many archaeological and historical places, and several potential cultural landscapes that could be eligible for listing on the *National Register of Historic Places* (see Section 3.2.13.3.4 for a list of individual sites and cultural landscapes). There could be direct and indirect impacts at one National Register-eligible archaeological site recorded during the Class II inventory. Based on the prevalence of known but largely unrecorded cultural resources in these valleys, it can be anticipated that a Class III inventory of the construction right-of-way would encounter additional cultural resources that could be subject to direct impacts from construction activities.

Based on available information, the greatest potential for impacts would be of the indirect visual-intrusion type, with the rail line intersecting possible ethnographic and historic ranching and mining cultural landscapes, and passing in full view of other possible historic properties.

Sample inventory indicates that approximately 45 resources could be present within the Level I region of influence.

4.2.13.2.1.7 Goldfield Alternative Segments.

<u>Goldfield Alternative Segment 1</u> The Class I site-file search identified four cultural resources along Goldfield alternative segment 1, all within the Level II region of influence. These resources include two prehistoric lithic scatters and two historic sites (a trash scatter and a campsite). The Class II survey examined six sample units along this segment, a total of 4.8 kilometers (3 miles) or 10 percent of the segment; 52 isolated artifacts were recorded. No sites within the Goldfield alternative segment 1 are considered as eligible for listing on the *National Register of Historic Places*.

Construction of Goldfield alternative segment 1 could result in direct impacts to several important cultural resources close to the construction right-of-way, including a rockshelter and rock art in the vicinity of Mud Lake and early Western Shoshone camps east of Goldfield. None of these sites would be within the construction right-of-way, but they could be subject to indirect impacts during construction, and in the longer term, by a potential visual intrusion to the cultural landscape.

Construction of Goldfield alternative segment 1 could result in additional direct and indirect impacts to the five prehistoric sites within the region of influence, including three campsites, a lithic scatter, and an historic habitation, none of which is eligible for listing on the *National Register of Historic Places*. The American Indian Resource Document (DIRS 174205-Kane et al. 2005, Section 2.3) identifies the campsites, which occur at springs east of Goldfield, as possible Western Shoshone camps, with one of them (Willow Springs), having been identified as such in the literature. The American Indian Resource Document (DIRS 174205-Kane et al. 2005, Section 2.3) also notes the Lowe rockshelter site as having a high level of cultural significance. There are also rock-art panels at this location. The Lowe site would be east of Goldfield alternative segment 1.

Sample archaeological inventory did not indicate the presence of any archaeological sites within the Level I region of influence for this segment.

Goldfield Alternative Segment 3 The Class I site-file search identified three previously recorded cultural resources along Goldfield alternative segment 3, including one within the Level I region of influence and two within the Level II region of influence. These resources include two rockshelters and a prehistoric campsite. The Class II survey covered 2.4 kilometers (1.5 miles) or 5 percent of the segment, and 13 isolated artifacts were recorded. The campsite is the same possible group of Western Shoshone winter camps discussed in the preceding section. The American Indian Resource Document discussion from Goldfield alternative segment 1 also applies to this segment.

A potential quarry site NS-3A would be along the northern portion of this alternative segment. Limited archaeological reconnaissance of this location indicates that development of this quarry would not result in direct impacts to known sites; DOE has not evaluated potential indirect effects.

Sample inventory indicates that approximately 21 resources could be present within the Level I region of influence.

Goldfield Alternative Segment 4 The Class I site-file search revealed 154 previously recorded cultural resources along Goldfield alternative segment 4 (see Figure 3-121), including 35 within the Level I region of influence and 119 within the Level II region of influence. The Class II field effort examined eight sample units along this segment, totaling 6.4 kilometers (4 miles) or 12 percent of the segment, resulting in the identification of 69 isolates.

Sites that are evaluated as being *National Register of Historic Places*-eligible include the downtown section of Goldfield itself, which is National Register listed. Goldfield 4 would pass through the National Register-eligible historic Goldfield town dump area and two mining sites. Rail line construction could result in direct or indirect impacts to these resources.

Other eligible sites outside the Level I region of influence include two town-related features, three mining sites, and three lithic scatters. In addition, several unrecorded prehistoric and historic sites are known to exist in the region of influence (see Section 3.2.13.1), based on literature reviews and field reconnaissance, along with an unmarked historic cemetery.

The American Indian Resource Document (DIRS 174205-Kane et al. 2005, Section 2.3) commented on the known presence of numerous American Indian resources in the vicinity of Goldfield alternative segment 4. American Indian Writers Subgroup field reconnaissance noted the presence of several rockshelters, a boulder with rock art, and several unrecorded lithic scatters. Additionally, a grave marker in the paupers section of the historic Goldfield Cemetery indicates that an American Indian woman was buried there in 1908.

A potential quarry ES-7 would be near Goldfield alternative segment 4, west of Goldfield. No cultural materials or other evidence of prehistoric or historic activities were noted during preliminary archaeological reconnaissance of the quarry area. Access to this quarry from Goldfield would pass through recent and historic mining areas, but neither the quarry location nor the access road would directly overlay the historic mining areas.

Sample inventory indicates that approximately 289 resources may be present within the Level I region of influence.

4.2.13.2.1.8 Caliente Common Segment 4 (Stonewall Flat Area). In Stonewall Flat, Caliente common segment 4 would generally follow an abandoned historic rail line for much of its length to a place in Lida Valley. The Class I site-file search identified one previously recorded but unevaluated rockshelter site along this segment. The Class II survey examined four sample units, a total of 3.2 kilometers (2 miles) or 29 percent of the segment. Eight isolates were recorded.

The American Indian Resource Document does not note any specific areas of importance to American Indians. In the Stonewall Flat area, the rail line construction right-of-way would create a direct impact for the unrecorded and unevaluated trail stop of Ralston, where there could be buried historical archaeological features and remains.

Sample inventory indicates that approximately 4 resources could be present within Level I region of influence.

4.2.13.2.1.9 Bonnie Claire Alternative Segments.

Bonnie Claire Alternative Segment 2 The Class I site-file search identified one cultural resource in the Level I region of influence. The site includes both prehistoric and historic components (a lithic scatter and mining prospects and debris). The prehistoric component was evaluated as being eligible for listing on the *National Register of Historic Places*.

The Class II sample survey examined five sample units, a total of 4 kilometers (2.5 miles) or 19 percent of the segment. Two sites and five isolates were recorded. The sites include a prehistoric campsite with a lithic and ground stone scatter, evaluated as being eligible for listing on the *National Register of Historic Places*, and a lithic scatter for which eligibility is under review.

Potential direct and indirect impacts along this alternative segment include the National Register-eligible prehistoric lithic and ground stone scatter identified during the Class II survey. This area also reveals the potential for the existence of prehistoric lithic scatters, obsidian nodule source areas, and rockshelters that, if present, would be directly affected by the construction of this alternative segment. The American Indian Resource Document (DIRS 174205-Kane et al. 2005, all) does not identify any known areas of importance to American Indians along this alternative segment.

The sample inventory indicates that approximately 10 resources could be present within the Level I region of influence.

Bonnie Claire Alternative Segment 3 The Class I site-file search identified four cultural resources within the Level I region of influence. These resources include four previously recorded but unevaluated prehistoric sites. One of these is a rockshelter, and the other three are extractive sites located in areas of obsidian cobble occurrences.

The Class II survey inspected four sample units along this segment, a total of 3.2 kilometers (2 miles) or 17 percent of the segment. One site and 24 isolates were recorded. The site is an historic rail line construction camp along the abandoned combined Bullfrog and Goldfield/Las Vegas and Tonopah rail bed, recommended as eligible for listing on the *National Register of Historic Places*. The American Indian Resource Document (DIRS 174205-Kane et al. 2005, all) does not identify specific resources for this alternative segment.

Construction along this alternative segment could result in direct and indirect impacts to the historic railroad camp along the abandoned Bullfrog and Goldfield/Las Vegas and Tonopah Railroad.

Sample inventory indicates that approximately 12 resources could be present within the Level I region of influence.

4.2.13.2.1.10 Common Segment 5 (Sarcobatus Flat Area). The Class I site-file search identified 33 cultural resources along common segment 5, including seven within the Level I region of influence and 26 within the Level II region of influence. These resources include 20 prehistoric sites (14 lithic scatters and six quarry extractive sites), four historic sites (a Tolicha mining district campsite, two debris scatters, and a railroad segment), seven isolates, and two unknown sites. Of these sites, one lithic scatter has been recommended as eligible for listing on the *National Register of Historic Places*, 11 are not eligible, and 14 remain unevaluated.

DOE surveyed 10 sample units along this segment for the Class II effort, a total of 8 kilometers (5 miles) or 20 percent of the segment. Four prehistoric sites (three lithic scatters and one campsite) and 33 isolates were recorded. Of these sites, the campsite was recommended as eligible for listing on the *National Register of Historic Places*, and the tree lithic scatters are not eligible. Common segment 5 would pass about 2.4 kilometers (1.5 miles) east of the Timbisha Shoshone Trust Lands at Scottys Junction. However, no specific cultural resource properties are identified on those lands that would be indirectly affected by construction of the proposed railroad. There is a high probability for direct and indirect impacts along common segment 5. Previous cultural resources inventories in the Sarcobatus Flat area indicate a relatively high potential for lithic scatters and extractive quarries (obsidian nodules).

The sample inventory indicates that approximately 15 resources could be present within the Level I region of influence.

4.2.13.2.1.11 Oasis Valley Alternative Segments. The Class I site-file search identified three cultural resources along Oasis Valley alternative segments 1 and 3, within the Level II region of influence. These resources include one prehistoric campsite (recommended as eligible for nomination to the *National Register of Historic Places*) and two sites with both prehistoric and historic components (unevaluated ethnographic village sites).

Oasis Valley Alternative Segment 1 The Class II survey looked at three sample units along Oasis Valley 1, a total of 2.4 kilometers (1.5 miles) or 25 percent of the segment. Two prehistoric sites (lithic scatters) and one historic mine site were recorded, all recommended not eligible for nomination to the *National Register of Historic Places*.

This alternative segment would cross the culturally sensitive Oasis Valley, where potential ethnographic and historic ranching cultural landscapes are present. There could be direct and indirect impacts to sites in the Oasis Valley, particularly the unrecorded historic Beatty Cattle Company Ranch and an unevaluated Western Shoshone winter camp.

The American Indian Resource Document notes the presence of the early Western Shoshone camp and also states that, because of its abundant water supply and large variety of culturally important plants and animals, American Indian people extensively used the entire valley (DIRS 174205-Kane et al. 2005, Section 2.3). Recent ethnographic studies on the nearby Nevada Test and Training Range revealed cultural links to Oasis Valley. The Oasis Valley area is both a potential ethnographic and historic ranching cultural landscape. In later historic times, these landscapes overlapped, as American Indian people collocated and supplied labor for the ranches.

Rail line construction could directly and indirectly affect sites in the Oasis Valley, particularly the historic Beatty Cattle Company Ranch and a known Western Shoshone winter camp.

The sample inventory indicates that approximately 20 resources could be present within the Level I region of influence.

Oasis Valley Alternative Segment 3 The Class II sample survey inspected four sample units, a total of 3.2 kilometers (2 miles) or 22 percent of the segment; five sites and 28 isolated artifacts were recorded. These resources include five prehistoric sites (four lithic scatters and one campsite with a lithic scatter and cleared rock rings). The campsite has been determined eligible for listing on the *National Register of Historic Places.*

Oasis Valley 3 also would cross the culturally sensitive Oasis Valley. It would pass just east of another historic ranch, the Colson or Indian Camp Ranch, which also has an early Western Shoshone winter camp adjacent to the ranch buildings. While both the ranch and Western Shoshone camp are unevaluated, rock lines (geoglyphs) were observed at the Indian camp area during field reconnaissance. These resources would be additional components of the potential Oasis Valley ethnographic and historic ranching cultural landscapes. Construction of the alternative segment could result in a visual intrusion to these cultural landscapes.

The sample inventory indicates that approximately 23 resources could be present within the Level I region of influence.

4.2.13.2.1.12 Common Segment 6 (Yucca Mountain Approach). The Yucca Mountain area has been heavily analyzed in conjunction with repository ***site characterization*** studies. Intensive cultural resource studies related to the development of the repository site have been completed. Consequently, a large number of archaeological sites have been found along common segment 6. This is due more to the intensive nature of past studies than actual site density characteristics.

A Class I site-file search identified 204 cultural resources along common segment 6. These resources include 152 prehistoric sites, 3 historic sites, one site with both prehistoric and historic components, and 49 isolates. Prehistoric sites include eight rockshelters (four eligible), two eligible rock-art sites, 13 campsites (five eligible), six quarry sites (two eligible), four rock features and two rock rings, and 117 lithic scatters (one eligible). Historic sites include two debris scatters and one rail segment.

The Class II survey for common segment 6 did not extend inside the Yucca Mountain Site boundary. DOE inspected 13 sample units, a total of 11 kilometers (7 miles) or 22 percent of the segment. Seven sites (two prehistoric lithic scatters, four eligible sites with both prehistoric and historic components, and one historic debris scatter) and 52 isolates were recorded.

To provide additional information on cultural resources along common segment 6 within the Yucca Mountain Site boundary, Desert Research Institute conducted a Class III supplementary field survey along the section of proposed rail alignment inside the Yucca Mountain Site boundary. This survey investigated a 150-meter (500-foot)-wide corridor centered on the rail alignment for an approximate length of 5.9 kilometers (3.7 miles). This land comprised acreage that was previously surveyed during repository site characterization activities. Desert Research Institute identified eight cultural resources (two prehistoric sites, five isolates, and one historic site) during the Class III survey. All were evaluated as ineligible for National Register listing.

Given the large number of resources in the area, construction of common segment 6 could result in direct and indirect impacts to prehistoric and historic sites. Three National Register-eligible prehistoric quarry sites are in this area within the Level I region of influence. The Beatty Wash Petroglyphs Site, listed on the National Register, is in the vicinity of a proposed bridge over Beatty Wash. Direct and indirect impacts from construction activities would include vibration of the rock matrix exhibiting the rock-art panels, and a potential for inadvertent or deliberate adverse impacts due to increased access and worker presence. The site holds important cultural value for American Indians. Over the long term, American Indians would likely view the bridge and operating trains as a visual and noise impact to the rock-art cultural landscape site.

After common segment 6 crossed onto the Yucca Mountain Site, it would cross an area that has undergone earlier intensive archaeological inventory and has been the subject of previous American Indian studies during repository characterization. As discussed in Section 4.2.13.1, DOE would consider identification, evaluation, and mitigation of potential impacts to these resources under a separate programmatic agreement with those along the proposed rail alignment.

Based primarily on previous ethnographic studies, the American Indian Resource Document (DIRS 174205-Kane et al. 2005, Section 2.3) identifies several areas of cultural significance for American Indians along this common segment. Several of these fall inside the Yucca Mountain Site boundary, including the Busted Butte rock-art site, Fortymile Wash, and Alice Hill. The American Indian Writers Subgroup also notes the cultural importance of the Beatty area rock-art site and Crater Flat, specifically the Black Cone geological feature in Crater Flat, which would be within 0.8 kilometer (0.5 mile) of common segment 6.

The sample inventory of the segment outside the Yucca Mountain Site boundary indicates that approximately 32 sites could be present within Level I region of influence.

4.2.13.2.2 Railroad Operations Impacts

After the construction phase, there would be no additional direct or indirect impacts at cultural resource sites, other than the potential visual intrusion of operating trains on the character of potential cultural landscapes. American Indians would continue to view operation of the rail line as an intrusion on their holy lands.

4.2.13.3 Impacts under the Shared-Use Option

Impacts under the Shared-Use Option would be the same as those under the Proposed Action without shared use. Although under the Shared-Use Option there would be a slight increase in train traffic from the addition of commercial users, construction and operation of the proposed railroad would not differ and the slight increase in train traffic under the Shared-Use Option would not result in additional impacts. Construction of any additional commercial-use sidings would have the potential to impact cultural resources.

4.2.13.4 Summary

DOE would complete intensive cultural resource inventories of the Caliente rail alignment alternative segments and common segments. Because of the length of the rail alignment and the complexity associated with engineering a feasible alignment, the Department is using a phased cultural resource identification and evaluation approach, described in 36 CFR 800.4(b)2, to identify specific cultural resources. Under this approach, the Department would complete an inventory of the construction right-of-way, evaluate all recorded resources in accordance with criteria established for listing on the *National Register of Historic Places*, assess adverse impacts, and apply mitigation measures for identified impacts before it started any ground-disturbing construction activities. Identification, evaluation, mitigation, and tribal consultation efforts would be guided by the programmatic agreement developed between DOE, the BLM, the STB, and the Nevada State Historic Preservation Office (DIRS 176912-Wenker et al. 2006, all).

Table 4-144 summarizes the potential for impacts to cultural resources within the region of influence for each Caliente rail alignment alternative segment and common segment. At present, DOE cannot fully characterize potential effects on cultural resources and the magnitude of those impacts. The potential for impacts is based primarily on the relationship between the frequency of cultural resource sites associated with each alternative segment and common segment (that is, the greater the likely frequency of sites along a particular alternative segment or common segment, the higher the potential of affecting one or more of these sites). Sample inventory indicates that approximately 545 archaeological sites could be present within the Caliente rail alignment Level I region of influence. Based on this sample, DOE expects that most of these sites would be characterized as prehistoric sites (65 percent), primarily lithic scatters, followed by historic sites (20 percent) and sites with both prehistoric and historic components (15 percent). Data currently available indicate that many of these sites (78 percent or more) would not meet eligibility criteria for listing in the *National Register of Historic Places*.

Based on preliminary information and sample surveys conducted to date, the magnitude of these impacts would likely range from small to moderate because there would be an extensive effort to avoid or mitigate impacts in accordance with the regulatory framework and with the terms of the cultural resources programmatic agreement (see Appendix M). To the extent feasible, cultural resources identified within the construction areas would be avoided. Where appropriate, temporary barriers would be used to isolate resources during construction. Monitoring and data recovery through excavation would also be used where necessary to mitigate impacts to archaeological sites. If the additional future inventory work described above indicated the presence of National Register-eligible sites, the magnitude of impacts could be greater. Additionally, if the future inventory work described above indicated the discovery of traditional cultural properties or other resources important to American Indians that cannot be avoided, the magnitude of impacts might be greater.

Table 4-144. Summary of potential impacts to cultural resources – Caliente rail alignment (page 1 of 3).

Location	Construction impacts[a]	Operations impacts[b]
Rail line segment		
Caliente alternative segment (Lincoln County)	Potential direct and indirect impacts at two known National Register-eligible sites, and at other sites that might be identified during the complete survey.	No additional direct or indirect impacts.
Eccles alternative segment (Lincoln County)	Potential direct and indirect impacts at two known prehistoric rockshelters, and at other sites that might be identified during the complete survey.	No additional direct or indirect impacts.
Caliente common segment 1 (Lincoln County and Nye County)	Construction activities could result in impacts to the early Mormon colonization cultural landscape, the Pioche-Hiko silver mining community route, 1849 emigrant campsites, National Register-eligible prehistoric sites in the vicinity of Black Rock Springs, and to other sites that might be identified during the complete survey.	No additional direct or indirect impacts.
Garden Valley alternative segments 1, 2, 3, and 8 (Lincoln County and Nye County)	Construction of Garden Valley alternative segments could result in direct and indirect impacts to American Indian trail systems and to other sites that might be identified during the complete survey.	No additional direct or indirect impacts.
Caliente common segment 2 (Lincoln County and Nye County)	Potential indirect impacts include visual impacts to the Black Top archaeological locality; potential direct and indirect impacts to American Indian trail systems and a potential historic ranching cultural landscape, and to other sites that might be identified during the complete survey.	No additional direct or indirect impacts.

Table 4-144. Summary of potential impacts to cultural resources – Caliente rail alignment (page 2 of 3).

Location	Construction impacts[a]	Operations impacts[b]
Rail line segment (continued)		
South Reveille alternative segments 2 and 3 (Nye County)	Rail line construction could represent a long-term indirect impact on a National Register-eligible rock-art site, and potential direct and indirect impacts at other sites that might be identified during the complete survey.	No additional direct or indirect impacts.
Caliente common segment 3 (Nye County)	Potential direct and indirect impacts at one known National Register-eligible archaeological site, and at other sites that might be identified during the complete survey.	No additional direct or indirect impacts.
Goldfield alternative segments 1 and 4(Nye County and Esmeralda County) Goldfield alternative segment 3 (Nye County)	Potential direct and indirect impacts at archaeological sites identified along segments subjected to sample inventory, and at other sites that might be identified during the complete survey.	No additional direct or indirect impacts.
Caliente common segment 4 (Nye County and Esmeralda County)	Potential direct and indirect impacts at archaeological sites identified along segments subjected to sample inventory, and at other sites that might be identified during the complete survey.	No additional direct or indirect impacts.
Bonnie Claire alternative segments 2 and 3 (Nye County)	Potential direct and indirect impacts at two National Register-eligible archaeological sites, and at other sites that might be identified during the complete survey.	No additional direct or indirect impacts.
Common segment 5 (Nye County)	Potential direct and indirect impacts at two National Register-eligible archaeological sites, 20 additional resources that have been recorded within the region of influence, and at other sites that might be identified during the complete survey.	No additional direct or indirect impacts.
Oasis Valley alternative segments 1 and 3 (Nye County)	Potential direct and indirect impacts at archaeological sites identified along segments subjected to sample inventory, and at other sites that might be identified during the complete survey.	No additional direct or indirect impacts.
Common segment 6 (Nye County)	Potential direct and indirect impacts at archaeological sites recorded in region of influence, including three National Register-eligible resources, and at other sites that might be identified during the complete survey.	No additional direct or indirect impacts.

Table 4-144. Summary of potential impacts to cultural resources – Caliente rail alignment (page 3 of 3).

Location	Construction impacts[a]	Operations impacts[b]
Proposed facilities		
Access roads (including alignment access roads) (Lincoln, Nye, and Esmeralda Counties)	Potential direct and indirect impacts at sites that might be identified during the complete survey. Significant resources likely avoidable.	No additional direct or indirect impacts.
Facilities at the Interface with the Union Pacific Railroad Mainline (including the Interchange Yard and the Staging Yard) (Lincoln County)	Potential direct and indirect impacts at sites that might be identified during the complete survey. Significant resources likely avoidable.	No additional direct or indirect impacts.
Combined Maintenance-of-Way Facility (includes Maintenance-of-Way Headquarters Facility, Maintenance-of-Way Trackside Facility, Satellite Maintenance-of-Way Facility); Rail Equipment Maintenance Yard; Cask Maintenance Facility; and Nevada Railroad Control Center and National Transportation Operations Center (Lincoln, Nye, and Esmeralda Counties)	Potential direct and indirect impacts at sites that might be identified during the complete survey. Significant resources likely avoidable.	No additional direct or indirect impacts.
Construction camps (Lincoln, Nye, and Esmeralda Counties)	Potential direct and indirect impacts at sites that might be identified during the complete survey. Significant resources likely avoidable.	No additional direct or indirect impacts.
Wells (Lincoln, Nye, and Esmeralda Counties)	Potential direct and indirect impacts at sites that might be identified during the complete survey. Significant resources likely avoidable.	No additional direct or indirect impacts.
Potential quarries		
Quarry CA-8B (Lincoln County)	Potential direct and indirect impacts at sites that might be identified during the complete survey. Significant resources likely avoidable.	No additional direct or indirect impacts.
Quarries NA-9A and NA-9B (Nye County)	No direct impacts; indirect impacts to a National Register-eligible rock-art site would be likely.	Utilization of quarries in this area could represent a long-term indirect impact on a National Register-eligible rock-art site.
Quarry ES-7 (Nye County)	No impacts.	No additional direct or indirect impacts.
Quarry NS-3A (Esmeralda County)	No impacts.	No additional direct or indirect impacts.

a. Impact assessment based on sample inventory only; actual impacts would not be identified until completion of field studies.
b. After the construction phase, no additional direct or indirect impacts would be anticipated at archaeological, historical, and cultural sites, other than the potential visual intrusion of operating trains on the character of potential cultural landscapes.

4.2.14 PALEONTOLOGICAL RESOURCES

This section describes potential impacts to paleontological resources (***fossils***) from constructing and operating the proposed railroad along the Caliente rail alignment. Section 4.2.14.1 describes the methodology DOE used to assess impacts to such resources; Section 4.2.14.2 describes potential impacts during the construction phase; Section 4.2.14.3 describes potential impacts during the operations phase; Section 4.2.14.4 describes impacts under the Shared-Use Option; and Section 4.2.14.5 summarizes potential impacts.

Section 3.2.14.1 describes the region of influence for paleontological resources along the Caliente rail alignment.

4.2.14.1 Impact Assessment Methodology

Any project activity involving land disturbance could have an adverse impact on the physical environment that could contain paleontological resources. Paleontological resources could be disturbed or destroyed by ground excavation, cuts and fills, surface-disturbing activities such as road building and blasting, or vandalism or theft of the resources.

DOE used the BLM system (DIRS 176084-BLM 1998, all; DIRS 176085-BLM 1998, all) to identify and classify paleontological resource areas along the Caliente rail alignment according to their potential for containing vertebrate (animals with backbones) fossils or noteworthy occurrences of invertebrate or plant fossils. The BLM uses these paleontological resource classifications (***Condition 1***, ***Condition 2***, and ***Condition 3***; see the text box in Section 3.2.14) to identify areas that might warrant special management or special designation for paleontological resources.

The BLM steps to evaluate the potential for impacts to fossil resources are outlined in *General Procedural Guidance for Paleontological Resource Management* (DIRS 176084-BLM 1998, Chapter III), and include identification by a qualified paleontologist and protection of any paleontological area uncovered during field surveys. Educating the public about the value of paleontological resources is also an important part of BLM resource management.

To assess potential impacts to paleontological resources along the Caliente rail alignment, DOE considered whether unique or scientifically important vertebrate, invertebrate, or plant fossils could be damaged, destroyed, or removed during construction and operation of the proposed railroad, quarries, water wells, and access roads.

4.2.14.2 Construction Impacts

There is a Condition 1 paleontological resource site in an area known as Ruin Wash approximately 4.8 to 8 kilometers (3 to 5 miles) south of where Caliente common segment 1 would cross Bennett Pass (DIRS 174204-Palmer 1998, all; DIRS 183644-Shannon & Wilson 2007, pp. 108 and 109; DIRS 174509-Russ 2005, all). Because of its distance from the rail alignment, DOE would expect no impacts to the site as a result of rail line construction.

While other areas within the Caliente rail alignment region of influence could contain paleontological resources, none of the remaining areas of alternative segments or common segments are known to contain or have a strong potential to contain important paleontological resources. Therefore, DOE would expect no impacts to paleontological resources in any of those areas.

None of the proposed railroad construction and operations support facilities would be at or near known or likely fossil beds. Therefore, DOE would expect no impacts to paleontological resources from these facilities.

In addition to known locations of paleontological resources near Caliente common segment 1, DOE could encounter unknown paleontological resources during the construction phase. The BLM would continue to manage all identified paleontological resources in accordance with its management plans, and if DOE discovered new paleontological resources during the construction phase, the BLM would take appropriate action.

4.2.14.3 Operations Impacts

The most likely source of potential impacts to paleontological resources would be from land disturbance during the construction phase, as discussed in Section 4.2.14.2. DOE expects there would be no impacts to paleontological resources resulting from railroad operations.

4.2.14.4 Construction and Operations Impacts under the Shared-Use Option

As for the Proposed Action without shared use (see Sections 4.2.14.2 and 4.2.14.3), DOE expects there would be no impacts to paleontological resources along the Caliente rail alignment under the Shared-Use Option.

4.2.14.5 Summary

DOE expects there would be no impacts to known paleontological resources along Caliente rail alignment common segment 1. There are no known paleontological resources along any of the other Caliente rail alignment alternative segments and common segments or at the proposed locations of railroad construction and operations support facilities. While there could be a potential to uncover previously unknown fossils during the construction phase, DOE would consult with the BLM to develop appropriate measures to minimize damage to any paleontological resources discovered during the construction phase.

Chapter 7, Best Management Practices and Mitigation, describes the best management practices DOE would implement as part of the Proposed Action and the mitigation measures the Department would consider to reduce or eliminate the potential for impacts to paleontological resources.

4.2.15 ENVIRONMENTAL JUSTICE

This section describes the DOE analysis of ***environmental justice*** (whether impacts are ***disproportionately high and adverse*** to ***minority*** or ***low-income populations***) under the Proposed Action along the Caliente rail alignment. Section 4.2.15.1 describes the DOE methodology for analyzing environmental justice; Section 4.2.15.2 describes the assessment of impacts to environmental resources; Section 4.2.15.3 describes the potential for disproportionately high and adverse impacts; and Section 4.2.15.4 summarizes any environmental justice impacts.

Section 3.2.15.1 describes the region of influence for environmental justice.

4.2.15.1 Impact Assessment Methodology

For this analysis, DOE uses the terms minority and low income in the context of environmental justice (DIRS 155970-DOE 2002, Section 3.1.13.1; DIRS 174625-Bureau of Census 2005, all).

DOE performed the analysis of environmental justice impacts in accordance with Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, and Council on Environmental Quality guidance (DIRS 177702-CEQ 1997, all). Using information from Sections 4.2.1 through 4.2.14, this section assesses whether any high and adverse impacts could fall disproportionately on minority or low-income populations.

As a starting point, as described in Section 3.2.15.2, DOE determined whether there would be minority or low-income populations in the Caliente rail alignment region of influence for environmental justice. Next, DOE determined whether there would be any potential for high and adverse impacts to environmental resources as evaluated in Sections 4.2.1 through 4.2.14. Finally, DOE determined whether any high and adverse impacts would fall disproportionately on minority or low-income populations.

For the Yucca Mountain FEIS, DOE followed the Council on Environmental Quality guidance (DIRS 177702-CEQ 1997, all) and the then-existing methodology of the U.S. Nuclear Regulatory Commission to identify low-income and minority communities (also called low-income and minority populations). However, since that time, the U.S. Nuclear Regulatory Commission methodology used in the Yucca Mountain FEIS has been revised, and for this Rail Alignment EIS, DOE used the revised methodology to identify low-income and minority communities (69 *FR* 52048). The revised methodology is, in part:

> Under current NRC [Nuclear Regulatory Commission] staff guidance, a minority or low-income community is identified by comparing the percentage of the minority or low-income population in the impacted area to the percentage of the minority or low-income population in the County (or Parish) and the State. If the percentage in the impacted area significantly exceeds that of the State or the County percentage for either the minority or low-income population then EJ [environmental justice] will be considered in greater detail. 'Significantly' is defined by staff guidance to be 20 percentage points. Alternatively, if either the minority or low-income population percentage in the impacted area exceeds 50 percent, EJ matters are considered in greater detail.

The details for consideration of environmental justice impacts for these identified communities are discussed in Section 4.2.15.3.

DOE also considered whether minority or low-income populations would be affected by an alternative in different ways than the general population, such as through unique ***exposure pathways*** or rates of exposure, special sensitivities, or different uses of natural resources.

If there would be no high and adverse impacts to environmental resource areas, or if any identified high and adverse impacts would not fall disproportionately on minority or low-income populations, then there would be no environmental justice impacts.

4.2.15.2 Assessment of Impacts to Environmental Resources

Results of the impacts analyses described in Sections 4.2.1 through 4.2.14 indicate that there would be moderate to large impacts in the following environmental resource areas:

- Land use. Construction and operation of the proposed railroad along the Caliente rail alignment would result in general impacts to land use and ownership along the entire alignment. Specifically there would be changes in land uses on private land within the rail line construction and operations rights-of-way and impacts to unpatented mining claims.
- Aesthetic resources. There would be small to large impacts as a result of construction along all portions of the Caliente rail alignment. There would be small to large, but temporary, impacts as a result of construction along Garden Valley alternative segments 1, 2, 3, and 8. There would be moderate, but temporary, impacts from construction of the Staging Yard at Caliente-Indian Cove and moderate impacts from construction at potential quarry CA-8B. There would be small to moderate impacts from railroad operations along all segments of the Caliente rail alignment. There would be small to large impacts from railroad operations along Garden Valley alternative segments 1, 2, 3, and 8. There would be moderate impacts from Staging Yard operations at Caliente-Indian Cove.
- Air quality. Air pollutant concentrations would not exceed the National Ambient Air Quality Standards for construction or operation of the railroad or any associated facilities, with the exception of the 24-hour standards for PM_{10} that could be exceeded during quarry operations at South Reveille Valley during the construction phase.
- Surface water. The Staging Yard at Caliente-Indian Cove would be in a meadow that is a floodplain of Meadow Valley Wash on the east side of U.S. Highway 93, roughly midway between the City of Caliente and Indian Cove. Construction of the Staging Yard in this area would require the wetlands to be filled above the level of the floodplain. It might also require an active drainage system and a channel around the site to keep the area dry and in a stable condition. Construction of the Staging Yard in Indian Cove would require filling up to 0.19 square kilometer (47 acres) of wetlands, all of which have been categorized as assessment unit 2 wetlands (see Section 4.2.7 for a discussion of impacts to biological resources).
- Biological resources. There would be impacts to wetlands and riparian habitats from construction of the Caliente alternative segment and either of the potential Staging Yard locations (Indian Cove or Uplands), the Eccles alternative segment, and the Interchange Yard. There could be impacts to wetlands in the vicinity of Caliente common segment 1 and Oasis Valley alternative segment 1 from rail line construction. Potential adverse impacts related to noxious and invasive species would include increased risk of these species becoming established in disturbed areas and encroaching on adjacent undisturbed habitat. There would be the potential for impacts to threatened or endangered species during the construction phase. Habitat for several special status species would be disturbed and individuals of several of the species could be disturbed, injured, or killed from construction and operation of the proposed railroad. Direct impacts to wildlife and wild horses and burros from railroad operations would consist of potential collisions of wildlife with trains and temporary disruption of activities (such as foraging, nesting, and resting) due to the disturbance from noise caused by passing trains and from noise and the presence of humans at railroad facilities and potential contamination of forage, prey species, nesting, and spawning habitat, and sources of drinking water in the rare event of train derailment and associated spill of diesel fuel. Indirect impacts could include

possible changes to predator/prey interactions due to the construction of towers and other structures that would provide new perch habitat for raptors and other predatory birds.

Although there are many historic and archaeological sites along the Caliente rail alignment (see Section 3.2.13), and construction and operation of the proposed railroad could directly and indirectly affect those resources (see Section 4.2.13), that analysis did not determine that impacts to cultural resources would be high and adverse.

4.2.15.3 Potential for Disproportionately High and Adverse Impacts

To determine whether environmental impacts identified in Sections 4.2.1 through 4.2.14 could be disproportionately high and adverse to minority or low-income populations, DOE considered the following factors:

- Whether there would be an impact on the natural or physical environment that would adversely affect a minority population, low-income population, or American Indian tribe (such effects could include ecological, cultural, human health, economic, or social impacts on minority communities, low-income communities, or American Indian tribes when those impacts are interrelated with impacts on the natural or physical environment)
- Whether environmental effects could have an adverse impact on minority populations, low-income populations, or American Indian tribes that would be meaningfully greater than or be likely to be meaningfully greater than the impact on the general population or other appropriate comparison group
- Whether minority or low-income populations would be affected by an alternative in different ways than the general population, such as through unique exposure pathways or rates of exposure, special sensitivities, or different uses of natural resources
- Whether the environmental effects could occur in a minority population, low-income population, or American Indian tribe affected by cumulative or multiple adverse exposures from environmental hazards

Based on these factors, DOE identified for further analysis the following impacts to land use, aesthetic resources, air quality, surface-water resources, biological resources, and unique or special pathways:

- Land use. DOE would need to gain access to some private land, the amount of which would be very small (about 1 percent) compared to the total amount of land that would be required for the project. Additionally, there would be unpatented mining claims along some rail line segments where they would fall within the construction right-of-way, some of which could be extinguished. There is also the possibility that the rail line could be affected by or affect underground mining tunnels or shafts. During the final design phase, DOE would need to perform a survey for these underground features to avoid adverse impacts.

  These impacts would be in census blocks that do not meet the 50-percent threshold for impacts to minority populations, and, because of the low population density, the census units are generally too large in land area to efficiently illustrate distributions of minority populations. Therefore, impacts to land use would not fall disproportionately on minority populations. These impacts would also be in census block groups that do not exceed the 31-percent threshold (20 percent above the state average of 11 percent) used for analysis of impacts to low-income populations in this Rail Alignment EIS. Thus, land-use impacts would not fall disproportionately on low-income populations located mostly in Caliente.

- Aesthetic resources. There would be small to large impacts from construction as a result of weak to strong contrast in the short term from visible construction equipment either operating or in storage, and from scars on soil and vegetated landscape from cuts, fills, and well pads; and weak to strong contrast in the long term from scars on rock from cuts, and from access roads along the entire Caliente rail alignment. There would be small to large, but temporary, impacts from construction as a result of weak to strong contrast in the short term, along Garden Valley alternative segments 1, 2, and 8, which would not meet BLM management objectives for Class II visual resources. There would be moderate, but temporary, impacts from construction as a result of moderate contrast during construction of the Staging Yard Caliente-Indian Cove consistent with surrounding non-BLM lands treated as Class III, but inconsistent with BLM management objectives for Class II visual resources on the BLM lands at the north end of the yard. There would be moderate impacts from construction as a result of moderate contrast in the short term from installation and use of the conveyor from the quarry across U.S. Highway 93, consistent with surrounding non-BLM lands treated as Class III.

There would be small to moderate impacts from railroad operations as a result of no to moderate contrast in the long term from the installation of linear track, signals, communications towers, power poles connecting to the grid, and access roads along the entire Caliente rail alignment. There would be small to large impacts from railroad operations as a result of track on some parts of Garden Valley alternative segments 1, 2, 3, and 8 that would create a new linear feature that would not meet BLM Class II management objectives. There would be moderate impacts from railroad operations as a result of moderate contrast in the Class III non-BLM lands, and weak contrast from the track on BLM Class II lands at the north end.

These impacts would be in census blocks that do not meet the 50-percent threshold for impacts to minority populations, and because of the low population density, the census units are generally too large in land area to efficiently illustrate distributions of minority populations. Therefore, impacts to aesthetic resources would not fall disproportionately on minority populations. These impacts would also be in census block groups that do not exceed the 31-percent threshold (20 percent above the state average of 11 percent) used for analysis of impacts to low-income populations in this Rail Alignment EIS. Thus, the moderate and large impacts to aesthetic resources would not fall disproportionately on low-income populations located mostly in Caliente.

- Air quality. Emissions for all air pollutants projected to be released during the construction phase would be greater than during the operations phase. Projected ambient concentrations of all air pollutants would be below the National Ambient Air Quality Standards, except for quarry operations in South Reveille Valley. Therefore, the projected impacts throughout the region of influence, during both construction and operations, would be small, except in the vicinity of the South Reveille quarries. Under the Shared-Use Option, there would be an increase in emissions over those of the Proposed Action without shared use, but impacts to air quality would still be small.

  These impacts would be in census blocks that do not meet the 50-percent threshold for impacts to minority populations, and, because of the low population density, the census units are generally too large in land area to efficiently illustrate distributions of minority populations. Therefore, impacts to air quality would not fall disproportionately on minority populations. These impacts would also be in census block groups that do not exceed the 31-percent threshold (20 percent above the state average of 11 percent) used for analysis of impacts to low-income populations in this Rail Alignment EIS. Thus, the moderate and large impacts to air quality resources would not fall disproportionately on low-income populations located mostly in Caliente.

- Surface-water resources. There are two options for siting the Staging Yard along the Caliente alternative segment: one approximately 1.6 kilometers (1 mile) northeast of Caliente (the Indian Cove option); the other 6.4 kilometers (4 miles) northeast of Caliente (the Upland option). The Indian Cove option would be in a meadow that is a floodplain of Meadow Valley Wash on the east side of U.S. Highway 93, roughly midway between the City of Caliente and Indian Cove.

Construction of the Staging Yard at Indian Cove would require the wetlands to be filled above the level of the floodplain. This would be an area of up to 0.19 square kilometer (47 acres) of wetlands, all of which have been categorized as assessment unit 2 wetlands (see Section 4.2.7 for a discussion of impacts to biological resources). It might also require an active drainage system and a channel around the site to keep the area dry and in a stable condition. Construction of the Staging Yard in this area would result in the loss of approximately 0.12 square kilometer (30 acres) of wetlands. DOE prepared this estimate by intersecting the wetland areas identified during the field survey in support of this Rail Alignment EIS with the perimeter of the Staging Yard fenceline. This facility would also impact the ability of the valley to handle floodwaters. Although the Federal Emergency Management Agency has not mapped floodplains this far north, development in Meadow Valley would make it reasonable to follow Agency criteria for construction in floodplains. The flow path for floodwaters would be constricted through this area, potentially causing the elevation of the floodwaters to increase upstream of the Staging Yard. DOE would incorporate hydraulic modeling into the engineering design process to ensure that adverse impacts to floodplains from elevated floodwaters were kept to an acceptable level (as determined through modeling).

These impacts would be in census blocks that do not meet the 50-percent threshold for impacts to minority populations, and because of the low population density, the census units are generally too large in land area to efficiently illustrate distributions of minority populations. Therefore, impacts to aesthetic resources would not fall disproportionately on minority populations. These impacts would also be in census block groups that do not exceed the 31-percent threshold (20 percent above the state average of 11 percent) used for analysis of impacts to low-income populations in the Rail Alignment EIS. Thus, impacts to surface-water resources would not fall disproportionately on low-income populations located mostly in Caliente.

Lincoln, Esmeralda, and Nye Counties and the county subdivisions within them have been identified as having a higher percentage of low-income residents than the State of Nevada overall. However, these census block groups do not exceed the 31-percent threshold (20-percent above the state average of 11 percent) used for analysis of impacts to low-income populations in this Rail Alignment EIS. There are no minority populations along the Caliente rail alignment that meet the 50-percent threshold. Thus, the potentially large impacts to surface-water resources would not fall disproportionately on low-income or minority populations located mostly in Caliente.

- Biological resources. There would be impacts to wetlands and riparian habitats from construction of the Caliente alternative segment and either of the potential Staging Yard locations (Indian Cove or Upland), the Eccles alternative segment, and the Interchange Yard. There could be impacts to wetlands in the vicinity of common segment 1 and Oasis Valley alternative segment 1 from rail line construction. However, during final design, DOE would make slight adjustments to minimize such impacts. Potential adverse impacts related to noxious and invasive species would include increased risk of these species becoming established in disturbed areas and encroaching on adjacent undisturbed habitat. DOE would implement best management practices (see Chapter 7) and BLM-prescribed and -approved methods to prevent the establishment of noxious weeds or invasive plant species. There would be the potential for impacts to threatened or endangered species during rail line construction. Habitat for several special status species would be disturbed and individuals of several of the species could be disturbed, injured, or killed from construction and operation of the proposed railroad and associated facilities. Potential impacts to federally listed species would likely require consultation with the U.S. Fish and Wildlife Service in accordance with Section 7 of the Endangered Species Act. Direct impacts to wildlife and wild horses and burros during the operations phase would consist of potential collisions of wildlife with trains; temporary disruption of activities (such as foraging, nesting, and resting) due to the disturbance from noise caused by passing trains and from noise and presence of humans at railroad facilities; and potential contamination of forage, prey species, nesting, and spawning habitat, and sources of drinking water in the rare event of train derailment and associated spill of diesel fuel. Indirect impacts could include possible changes to predator/prey interactions due to the construction of towers and other structures that would provide new perch habitat for raptors and other predatory birds.

These impacts would be in census blocks that do not meet the 50-percent threshold for impacts to minority populations, and because of the low population density, the census units are generally too large in land area to efficiently illustrate distributions of minority populations. Therefore, impacts to biological resources would not fall disproportionately on minority populations. These impacts would also be in census block groups that do not exceed the 31-percent threshold (20 percent above the state average of 11 percent) used for analysis of impacts to low-income populations in this Rail Alignment EIS. Thus, the impacts to biological resources would not fall disproportionately on low-income populations located mostly in Caliente.

- Unique or special pathways: DOE concluded in the Yucca Mountain FEIS that there would not be any high and adverse impacts from transportation of spent nuclear fuel and high-level radioactive waste in Nevada on any populations, and that disproportionately high and adverse effects would be unlikely for any specific segment of the population, including minorities and low-income communities. DOE further concluded that there were no special pathways (unique practices and activities creating opportunities for increased impacts) "revealed a potential for disproportionately high and adverse impacts" (DIRS 155970-DOE 2002, p. 6-67). Therefore, the Yucca Mountain FEIS concluded that there were no environmental justice impacts associated with any proposed rail corridor.

  Since DOE completed the Yucca Mountain FEIS, DOE has not identified any new high and adverse impacts to any population. DOE has also not identified any new minority or low-income populations in the Caliente rail alignment region of influence. DOE found no additional information that would indicate high and adverse impacts to American Indians through special pathways. Therefore, there would be no environmental justice impacts associated with the Caliente rail alignment through special or unique pathways.

Seventeen tribes and organizations have formed the Consolidated Group of Tribes and Organizations, which is a forum consisting of tribally approved representatives who are responsible for presenting their respective tribal concerns and perspectives to DOE. The Consolidated Group of Tribes and Organizations has provided DOE with valuable insights into American Indian cultural and religious values and beliefs.

Section 3.4 summarizes the interests and concerns expressed by various American Indian tribes and organizations within or near the Caliente and Mina rail alignments regions of influence. Sections 3.2.13 and 3.3.13, Cultural Resources, provide additional information on American Indian cultural resources. Perceptions about the types and magnitudes of potential impacts to American Indian interests along the Caliente and Mina rail alignments vary among the various stakeholders with interests in the proposed railroad because of different beliefs, goals, responsibilities, and values. American Indians are concerned that the proposed railroad could cause substantial and high adverse effects to a number of American Indian interests within and adjacent to the Caliente rail alignment region of influence. American Indian views on environmental justice are presented in Section 3.4.2.4. DOE acknowledges the concerns of the American Indians and has consulted with the tribes. The Department would continue to consult with the Consolidated Group of Tribes and Organizations throughout the life of the project. If DOE implemented Proposed Action, the Department would work closely with American Indians to ensure that a mitigation action plan was developed and to ensure compliance with Section 106 of the National Historic Preservation Act.

The environmental justice analysis for the Shared-Use Option is the same as that described for the Proposed Action without shared use.

4.2.15.4 Conclusion

Based on current information, DOE has concluded that constructing and operating the proposed railroad along the Caliente rail alignment would not result in any high and adverse impacts to minority or low-income populations. No special pathways were identified; therefore, DOE concluded that there would be no disproportionately high and adverse impacts to minority or low-income populations. If, during the development of the inventory described in Section 4.2.13.4, additional cultural resources related primarily to American Indian interests were discovered that could not be avoided, then the magnitude of environmental justice impacts might also be larger and disproportionately high and adverse.

Similarly, if during development of ethnographic studies described in Section 3.4.5, special pathways were identified, then the magnitude of environmental justice impacts might be larger. Should larger environmental justice impacts be identified, such as for cultural resources or special pathways, DOE would institute mitigation through the process described in Chapter 7.

4.3 Mina Rail Alignment

4.3.1 PHYSICAL SETTING

This section describes potential impacts to physical setting from constructing and operating the proposed railroad along the Mina rail alignment. Section 4.3.1.1 describes the method DOE used to assess potential impacts to physical setting; Section 4.3.1.2 describes potential impacts of constructing the railroad; Section 4.3.1.3 describes potential impacts of operating the proposed railroad; Section 4.3.1.4 describes potential impacts under the Shared-Use Option; and Section 4.3.1.5 summarizes potential impacts to physical setting.

As described in Section 3.3.1, physical setting includes physiography, geology, and soils. Section 3.3.1.1 describes the ***region of influence*** for physical setting along the Mina rail alignment.

4.3.1.1 Impact Assessment Methodology

To assess potential impacts to physical setting along the Mina rail alignment, DOE considered whether railroad construction and operations would:

- Result in soil erosion or loss of topsoil
- Result in the direct conversion of ***prime farmland*** to nonagricultural uses
- Result in the loss of availability of a known mineral resource that would be of value to the region or residents of Nevada
- Generate unstable slope conditions that could result in an on-site or off-site landslide or collapse
- Expose construction workers, DOE personnel, and structures to amplified or unique adverse effects from ***seismic*** activity

If possible, DOE quantified impacts using data from Nevada soils surveys, geological maps, ***earthquake fault*** maps and records, and the total area of disturbance that would result from construction and operation of the proposed railroad.

The total area of disturbance would be the sum of disturbed areas within the nominal width of the rail line construction right-of-way and areas outside the nominal width of the construction right-of-way (railroad operations support facilities, quarry sites, some water-well sites, and access roads). The nominal width of the construction right-of-way would encompass the rail line, alignment access roads, some wells, ***construction camps***, and ***cuts*** and ***fills*** required to attain an appropriate ***grade***. While the nominal width of the construction right-of-way would be 300 meters (1,000 feet) across BLM lands, the width could vary in certain locations along the rail alignment. For example, it could be wider to accommodate additional earthwork, or narrower to avoid a sensitive environmental resource. Section 4.3.1.2.3 describes potential impacts from constructing the railroad operations support facilities; the number and size of those facilities would not vary among alternative segments.

Some potential impacts to physical setting along the Mina rail alignment are more specifically addressed under other ***environmental resource areas***. Section 4.3.2, Land Use and Ownership, describes potential impacts to ***mining districts*** and mineral and energy resources; Section 4.3.4, Air Quality and Climate, describes soil loss from ***fugitive dust*** emissions; Section 4.3.5, Surface-Water Resources, describes potential erosion due to surface-water flow; and Section 4.3.10, Occupational and Public Health and Safety, describes impacts to worker safety from geologic hazards.

4.3.1.2 Construction Impacts

Direct impacts to physical setting along the Mina rail alignment would occur primarily during the construction phase. Section 4.3.1.2.1 describes potential construction impacts common to the entire rail alignment. Section 4.3.1.2.2 describes impacts specific to alternative segments and common segments. Tables in Section 4.3.1.2.2 list the key information DOE used to analyze potential impacts to physical setting for the common and alternative segments.

4.3.1.2.1 Construction Impacts Common to the Entire Mina Rail Alignment

4.3.1.2.1.1 Physiography. To the extent practicable, the Mina rail alignment would avoid uneven topography and rugged terrain by following valleys and skirting mountain ranges, as described in Section 3.3.1.2.1 and illustrated in Figure 3-124. Where it is necessary to cross mountain ranges, the rail line would be located in gaps and passes. The rugged natural terrain surrounding the mountain ranges would, however, contribute to the potential for impacts to topography and soils. The ruggedness of an area is represented by the "rise and fall" calculation, which is the absolute elevation change measured at a fixed distance along the alignment. The rise and fall calculation provides a context for determining the amount of disturbance that would be required to establish appropriate grades.

Depending on the combination of alternative segments and common segments along the Mina rail alignment, the total area that would be disturbed during the construction phase would range from 40 to 48 square kilometers (9,900 to 12,000 acres) (DIRS 180874-Nevada Rail Partners 2007, p. B-3). Construction impacts to physical setting would be centered along the rail alignment and would decrease with distance from the alignment.

Cuts and fills would be required to level steep slopes and provide a suitable grade for the rail ***roadbed***. The estimated volume of cuts along the Mina rail alignment is 10.9 million to 18.8 million cubic meters (14.3 million to 24.6 million cubic yards), and the estimated volume of fill is 15.9 million to 25.7 million cubic meters (20.8 million to 33.6 million cubic yards) (DIRS 180872-Nevada Rail Partners 2007, Appendix D). Cut and fill activities would occur within the construction right-of-way. DOE would use the material excavated from the cuts to supply a portion of the required fill. The Montezuma alternative segments, especially Montezuma alternative segment 1, would require the most earthwork (see Section 4.3.1.2.2.7). There also would be major cut, fill, and other earthwork processes around the Calico Hills and Terrill Mountains, the Goldfield Hills, Beatty, and Yucca Mountain.

DOE would build up to 10 construction camps along the rail alignment. Each camp would include housing, support facilities, office space, utilities, contractor work areas, roadways, and parking, and would disturb approximately 0.10 square kilometer (25 acres) inside the nominal width of the construction right-of-way (DIRS 180922-Nevada Rail Partners 2007, p. 4-1).

There are five potential quarry sites along the Mina rail alignment, of which DOE would develop up to two. Each site would be expected to disturb an area from 0.97 to 2.7 square kilometers (240 to 660 acres) outside the nominal width of the construction right-of-way (DIRS 180922-Nevada Rail Partners 2007, pp. 3-1 and 3-2).

Construction of the ***Staging Yard*** at Hawthorne could disturb a total of 0.20 square kilometer (50 acres). Construction of the Maintenance-of-Way Facility would disturb 0.061 square kilometer (15 acres), and the ***Rail Equipment Maintenance Yard*** would disturb the largest area (0.41 square kilometer [100 acres]) (DIRS 180874-Nevada Rail Partners 2007, p. A-5).

Construction activities that would disturb topsoil include, but are not limited to, cut excavation; quarry-pit excavation and borrow-pit stockpiles; placement of compacted fill, ***ballast***, and ***subballast***; road development and grading; and building facility foundations. During the construction phase, the soil column would be disturbed and topsoil would be removed. The areas with disturbed soils would have an increased potential for erosion by wind and water. DOE would implement best management practices (see Chapter 7) to control erosion, minimize soil loss, and conserve topsoil for grading after construction was completed. After construction was completed, disturbed areas away from the rail line would be leveled to a grade that would blend with the terrain, covered with reserved topsoil, and to the extent practicable, revegetated.

4.3.1.2.1.2 Geology.

Faulting and Seismic Activity Seismic-related hazards in the project area include ground shaking, rock falls and landslides, soil liquefaction, and fault displacement. The northern portion of the Mina rail alignment would cross through an area with more earthquakes; however, seismic activity in this area is consistent with the rest of southern Nevada, as shown on Figure 3-127. Construction activities would not induce earthquakes or reactivate any faults. The Mina rail alignment would generally cross Quaternary fault traces at a perpendicular angle, which would minimize the contact between the rail alignment and the linear range-bounding faults. At a minimum, DOE would design and operate the proposed railroad to be consistent with American Railway Engineering and Maintenance-of-Way Association seismic guidelines (DIRS 162040-AREMA 2001, Chapter 9) and could decide to implement additional, more stringent standards.

During the construction and operations phases, DOE would monitor earthquake activity using U.S. Department of the Interior, Geological Survey, and Yucca Mountain seismic networks. The response level of the maintenance-of-way authority would depend on the earthquake magnitude and distance to the rail line (see Table 4-145). DOE would develop an inspection protocol that would outline the procedures that would be used to inspect the track, rail roadbed, bridges, and other structures along the rail line. If required after a seismic event, construction would halt, trains would run at reduced speeds, and qualified inspectors would verify the safety of the track.

The rail line and transportation casks would be constructed to be consistent with the American Railway Engineering and Maintenance-of-Way Association seismic guidelines. The inspection protocol and acceptance of the seismic guidelines would ensure that the risks associated with operating in a seismically active area would be minimized. Section 4.3.10, Occupational and Public Health and Safety, describes potential impacts to transportation safety and worker and public health and safety from seismic hazards.

Rock-Slope Hazards Several sections of the Mina rail alignment would pass through steep and rugged terrain where unstable rock slopes would be a hazard (DIRS 183635-Shannon & Wilson 2007, pp. 40 and 41, and Table 6). Rock-slope failures typically occur where rock discontinuities (such as joints, bedding, foliation, and faults) are adversely oriented in relation to natural or constructed slope faces. Slope stability could be further reduced by natural weathering processes, which contribute to the mechanical breakdown of the rock mass within the rock ***matrix*** and along the discontinuities (DIRS 183635-Shannon & Wilson 2007, p. 41).

Rail line construction activities such as blasting and other cut procedures would have the potential to induce rock falls and landslides. Blasting could be required to excavate bedrock and would occur in strict compliance with existing regulations. Impacts resulting from construction and construction-related blasting are expected to be small, due to safety measures DOE would employ during blasting activities.

Debris Flows Debris flows are rapidly moving mixtures of water, soil, rock, and organic material. A debris flow can begin during or after heavy precipitation, and is especially dangerous if the debris dams a stream channel. If the dam fails, the saturated debris can travel downslope for several miles in a confined

Table 4-145. American Railway Engineering and Maintenance-of-Way Association seismic guidelines.[a]

Earthquake magnitude (Richter scale)	Response radii (miles)[b]	Response level[c]	Response protocol
0.0 to 4.9	d	I	Resume maximum operating speed. The need for the continuation of inspections will be determined by the proper maintenance-of-way authority.
5.0 to 5.9	100	II	All trains and engines will run at restricted speed within a specified radius of the epicenter until inspections have been made and appropriate speeds established by proper authority.
6.0 to 6.9	200	III	All trains and engines within the specified radius of the epicenter must stop and may not proceed until inspections have been performed and appropriate speed restrictions established by proper authority.
	300	II	All trains and engines will run at restricted speed within a specified radius of the epicenter until inspections have been made and appropriate speeds established by proper authority.
7.0 or greater	As directed, but not less than for 6.0 to 6.9	III	All trains and engines within the specified radius of the epicenter must stop and may not proceed until inspections have been performed and appropriate speed restrictions established by proper authority. The radius shall not be less than that specified for earthquakes between magnitudes 6.0 and 6.9.
		II	All trains and engines will run at restricted speed within a specified radius of the epicenter until inspections have been made and appropriate speeds established by proper authority. The radius shall not be less than that specified for earthquakes between magnitudes 6.0 and 6.9.

a. Source: DIRS 162040-AREMA 2001, Table 9-1.1 and p. 9-1.5.
b. To convert miles to kilometers, multiply by 1.6093.
c. Response level as defined by the American Railway Engineering and Maintenance-of-Way Association.
d. Radii not applicable.

channel. Debris flows lose their energy and begin to deposit material when the stream gradient flattens or when the channel widens (DIRS 183635-Shannon & Wilson 2007, pp. 45 and 46).

There would be a potential for debris flows along portions of the rail alignment during the construction and operations phases. Such flows would be most common where there is evidence of prior activity, specifically in steep areas and channels of ***alluvial fans*** (DIRS 183635-Shannon & Wilson 2007, pp. 45 and 46). Debris flows could bury the rail line in sediment, destroy portions of the line, or weaken bridge pylons as a result of excessive erosion. It would not be possible to completely avoid debris flows in the area around the rail alignment.

Mineral and Energy Resources The rail line could cross surface or subsurface mineral or energy resources not part of identified mining districts or mineral leases. During construction, previously unknown resources could be identified in areas with large cuts. The area surrounding the Mina rail alignment has an extensive history of ***mining claims*** and commercial operations. For this analysis, DOE used the existence of historical commercial mining as an indicator of mineral potential.

During the construction phase, some minerals could be rendered inaccessible because they would be within the construction right-of-way. However, the ***operations right-of-way*** would be smaller than the construction right-of-way, so these restricted areas would become available during the operations phase.

The Mina rail alignment would not cross any known mineral deposits unique to the region. Any impacts related to restricted access of mineral resources would be temporary and limited to the construction phase. Sections 4.3.1.2.2.1 through 4.3.1.2.2.12 provide more information on potential impacts to individual mineral and energy resources along Mina rail alignment alternative segments and common segments. Section 4.3.2, Land Use and Ownership, describes potential impacts to local mining districts.

Local Sources of Construction Materials Construction of the rail line along the Mina rail alignment would require from 2.49 to 2.73 million metric tons (2.74 to 3.01 million tons) of crushed-rock ballast and from 2.18 to 2.39 million metric tons (2.40 to 2.64 million tons) of subballast for rail roadbed construction (DIRS 180874-Nevada Rail Partners 2007, p. A-5). Soil and rock excavated from construction cuts would not be suitable for ballast; DOE would use this material for subballast and embankment fill (DIRS 183643-Shannon & Wilson 2007, pp. 15, 19, and 20). The amount of cut material excavated during construction would not be sufficient to supply the necessary fill. Additional ***borrow sites*** would be opened to supplement the cut material. These sites would be excavated from alluvial gravel and sand approximately every 16 kilometers (10 miles) within the construction right-of-way. Where possible, these sites would be within or adjacent to existing Nevada Department of Transportation gravel pits. Additional subballast requirements would also be supplemented with bedrock extracted from the ballast quarries.

DOE has identified five potential ballast quarry sites along the Mina rail alignment in the Garfield Hills, Gabbs Valley Range, and Goldfield areas (DIRS 180875-Nevada Rail Partners 2007, Figure 3-C). Of these potential locations, DOE would develop two to supply rock for ballast and subballast during the construction phase. Each quarry would be approximately 24 meters (80 feet) deep, with an anticipated ***footprint*** of approximately 0.04 square kilometer (10 acres). However, depending on the number of open quarries, and the quality of the mineral materials, a quarry-pit footprint could be as large as 1 square kilometer (260 acres). A waste-rock pile at each quarry site would disturb approximately 0.06 square kilometer (14 acres). ***Overburden*** material and rock not suitable for ballast or subballast gravel would be stored at this location until the end of quarry operations. A railroad ***siding*** to accommodate the ballast cars would be included in the total quarry disturbance area (DIRS 180922-Nevada Rail Partners 2007, pp. 3-1 and 3-2). When adding all of the maximum areas of the quarry site that could be disturbed during construction (quarry pit, production plant, ballast storage, and waste pile), and including a temporary construction buffer area, a quarry site could disturb between 0.97 and 2.7 square kilometers (240 to 660 acres). These quarry-site values are considered to be maximum calculations, in the event of irregular topography and poor-quality excavated mineral materials. Section 4.3.1.2.4 describes potential impacts from the quarry facilities in more detail. The quarries would remain open through the construction phase. Afterward, DOE would reclaim disturbed areas in accordance with the post-construction and maintenance best management practices described in Chapter 7. Such practices would include grading the disturbed area, reshaping quarry-pit walls to stabilized slopes, replacing reserved topsoil, and revegetating.

DOE could use other local materials for rail line construction. Subballast would be generated from borrow sites on certain alluvial fans and crushed quarry rock. Blasted bedrock from slope cuts and excess ballast rock would be suitable for use to protect rail roadbed embankments from erosion. Some natural sand and gravel excavated from cuts and crushed rock from the quarries could be used to make concrete aggregate (DIRS 183643-Shannon & Wilson 2007, pp. 24 to 26). DOE would determine the prime sand and gravel deposits to be used before beginning construction.

Using local materials for ballast, subballast, and concrete aggregate would result in the consumption of construction resources (such as rock, sand, and gravel) often used for other construction projects in the area. However, alluvial deposits are plentiful in the region, and their use to construct the rail line would not substantially reduce the area supply of these resources. Because the potential impact to sand and gravel resources would be small along the entire alignment, this resource is not discussed further in

Sections 4.3.1.2.2.1 through 4.3.1.2.2.12. Section 4.3.11, Utilities, Energy, and Materials, describes impacts to regional supply chains for other construction materials.

4.3.1.2.1.3 Soils. This section describes potential impacts to soils, including the removal of prime farmland from productive use. Rock excavation and land clearing would cause soil loss, surface erosion, and disruption of soil structure on previously undisturbed land.

During the construction phase, most soils would be excavated using conventional earthmoving equipment such as bulldozers, scrapers, rubber-tired backhoes, and track-mounted excavators. Solid rock encountered along the rail alignment would require drilling and blasting (DIRS 183635-Shannon & Wilson 2007, pp. 48 and 49).

Soil Loss and Erosion There would be soil loss and erosion at all places where construction activities disturbed the ground surface. The severity of soil loss would depend on the extent of the disturbance, the erodibility of the soil, and the steepness of the terrain.

Land disturbed along the rail alignment would be most susceptible to soil loss and erosion during heavy rains and high winds. Areas where fine-textured soil and sand (such as on alluvial fans, lake-bed terraces, valleys, and flats) and where soils exhibit the ***erodes easily*** or ***blowing soil*** characteristic would be most susceptible to erosion. The Mina rail alignment would be in an area with an ***arid*** climate that has variable rainfall events across the region. The northern portion of the Mina rail alignment occasionally experiences low-intensity, long period events (DIRS 180885-Parsons Brinckerhoff 2007, pp. 13 and 14). Once the ground is saturated, a brief increase in rainfall intensity can initiate surface flooding. South of the Goldfield Hills, rainfall is typically brief, but can be very intense and form washouts in low-lying areas. Elevated water velocities during rain events would increase erosion and scouring in areas where there is no vegetation, in areas dominated by sandy soils on steep slopes, along channel banks, and at bridge crossings (DIRS 183639-Shannon & Wilson 2007, p. 50). Construction of the proposed railroad would result in the loss of some topsoil and soil erosion. During and after construction, DOE would implement best management practices (see Chapter 7) to reduce the potential for additional soil loss due to erosion. In areas of temporary surface disturbance, the topsoil would be reserved and replaced, where practicable.

Disturbed soils would also be susceptible to wind erosion, because wind speeds greater than 19 kilometers (12 miles) per hour are sufficient to move sand grains (DIRS 183639-Shannon & Wilson 2007, p. 52). Disturbed soils with the blowing soil characteristic tend to generate sand dunes, increase fugitive dust in the air, and contribute to the loss of topsoil. Wind and water erosion could also impact ***air quality***, surface-water quality, and biological resources, as discussed in Sections 4.3.4, 4.3.5, and 4.3.7, respectively.

Prime Farmland The Farmland Protection Policy Act (7 U.S.C. 4201 *et seq*.) seeks to minimize the extent to which federal programs contribute to the unnecessary and irreversible conversion of farmlands to nonagricultural uses. As discussed in Section 3.3.1.2.3, less than 0.1 percent of soils along the Mina rail alignment are classified as prime farmlands. The Schurz alternative segments would cross prime farmland soils around the Walker River on the Walker River Paiute Reservation (see Figure 3-129). DOE calculated the amount of potentially disturbed prime farmland soils by multiplying the total area of disturbance by the calculated percentage of prime farmland that would be within the rail line construction right-of-way. On the Reservation, there is 0.011 square kilometer (2.7 acres) of prime farmland along Schurz alternative segment 1, 0.012 square kilometer (3 acres) along Schurz alternative segment 4, and 0.014 square kilometer (3.5 acres) along each of Schurz alternative segments 5 and 6.

Along these alternative segments, DOE would limit the disturbance within the construction right-of-way to minimize potential impacts to private lands and thus minimize impacts to farmland. All of the Schurz alternative segments would cross the prime farmland soils around the Walker River on the eastern side of Sunshine Flat. At present, these soils are not farmed. The Walker River Paiute Reservation contains approximately 5.5 square kilometers (1,400 acres) of prime farmland soils; thus, the proposed railroad would temporarily disturb 2.6 percent of the prime farmland soils on the Reservation.

In addition to using the Nevada soil survey database classification, DOE also requested assistance from the Nevada Natural Resources Conservation Service office to identify prime, unique statewide, or locally important farmland along the Mina rail alignment (DIRS 181388-Arcaya 2007, all). The Conservation Service analysis determined that the Mina rail alignment would not cross prime, unique statewide, or locally important farmland.

Soil Stability Excavation and grading activities would disturb the natural structure of the soil by breaking plant roots and natural mineral cements that bind soils. Soils disturbed along cut slopes would have a higher risk of becoming unstable and creating mudflows or landslides in steep topography because water-bearing properties would have changed, and the soil structure would have been altered. However, DOE would revegetate or otherwise stabilize these areas and would reclaim them to the extent practicable, which would reduce the potential for increased erosion (see Chapter 7).

DOE would erect up to 10 construction camps along the rail alignment to house workers. Although the camps would be temporary and used only during the construction phase, soil could become compacted at these sites. After construction was complete, DOE would grade the terrain and revegetate these areas with ***native plant*** species (see Chapter 7), which would minimize the effects of soil compaction.

Studies have shown that, if left to natural ***soil recovery***, the return of soil to pre-disturbed conditions and natural succession of vegetation in the Yucca Mountain area could take decades or more, creating an increased potential for erosion, landslides, and mudslides (DIRS 104837-DOE 1989, p. 17). Impacts due to soil disruption would be large within the construction right-of-way and immediate region of influence until new vegetation was established and the natural succession was reestablished. DOE would reduce the impacts related to the increased potential for erosion, landslides, and mudslides through the implementation of best management practices, such as revegetating disturbed sites, establishing proper roadbed grades, and using stormwater erosion control measures (see Chapter 7).

4.3.1.2.2 Construction Impacts along Alternative Segments and Common Segments

4.3.1.2.2.1 Department of Defense Branchline North (Wabuska to the boundary of the Walker River Paiute Reservation). DOE would construct a rail siding along the existing rail line within the existing operations right-of-way. This siding would be constructed on previously disturbed land. Otherwise, DOE would not perform any ground-disturbing activities along this portion of the Mina rail alignment. Therefore, there would be no impacts to physical setting along this existing branchline.

4.3.1.2.2.2 Department of Defense Branchline through Schurz. This branchline would not be part of the Mina rail alignment. Rather, as part of the Proposed Action, DOE would remove the track and ballast from this branchline, leaving only the rail roadbed, subballast, and structures such as bridges and culverts. The use of rail removal equipment (such as hydraulic spike pullers, fork-lifts, and front-end loaders) to help dismantle the rail line would cause temporary soil disruption and increased soil erosion. However, this would be confined to the previously disturbed area and would not affect undisturbed resources.

4.3.1.2.2.3 Department of Defense Branchline South. DOE would construct a rail siding along the existing rail line within the existing operations right-of-way. This siding would be constructed on previously disturbed land. Otherwise, DOE would not perform any ground-disturbing activities along this portion of the Mina rail alignment. Therefore, there would be no impacts to physical setting along this existing branchline.

4.3.1.2.2.4 Schurz Alternative Segments. The Schurz alternative segments would travel around or through several mountain ranges and valleys in the Walker River Basin. To maintain a rail grade of less than 2 percent, DOE would excavate and level high points along the alignment and, to the extent practicable, use this material to raise the low points. Table 4-146 lists the anticipated cut and fill requirements and other important information used in the impact analysis for the Schurz alternative segments. The cut and fill requirements would be greatest where an alternative segment would cross mountain passes, specifically between the Calico Hills and Terrill Mountains (Schurz alternative segments 4 and 5), and through an unnamed pass in the Terrill Mountains (Schurz alternative segment 6). Schurz alternative segments 5 and 6 would require the greatest ground disturbance (6.9 and 6.5 square kilometers [1,700 and 1,600 acres], respectively). Schurz alternative segment 1 would primarily travel along alluvial fans along Sunshine Flat and in Campbell Valley, and would therefore involve the least amount of ground disturbance (4.6 square kilometers [1,100 acres]). Construction activities required to achieve the appropriate grade could contribute to the loss of topsoil and local erosion; however, DOE would reduce impacts by regrading and revegetating the disturbed areas (see Chapter 7).

The Schurz alternative segments would cross faults associated with the Wassuk Range fault sequence. Schurz alternative segment 6 would also cross a fault near the Terrill Mountains. Since the U.S. Geological Survey began keeping seismic records, there have been a few earthquakes larger than 4.0 around the town of Schurz. The largest was a magnitude 6.3 earthquake in 1959 (DIRS 183635-Shannon & Wilson 2007, p. 17). The seismic activity in this area is suggested to be part of the extension of the Walker Lane structural belt. DOE would monitor the seismic activity along the Mina rail alignment, and follow procedures outlined in Table 4-145 in the event of an earthquake.

There is a low to moderate ***probability*** for metallic minerals in the mountains the Schurz alternative segments would bypass. Gold, silver, and copper historically have been mined in the Calico Hills and Terrill Mountains (DIRS 183637-Shannon & Wilson 2007, pp. 19, 20, 28, and 29). Nonmetallic minerals, such as soda and halite, are identified in the lowland area of Double Springs Marsh (DIRS 183637-Shannon & Wilson 2007, pp. 33 and 34). Each of the Schurz alternative segments is expected to have little or no impact on metallic and nonmetallic minerals in the area because they would be in the lowlands and would not disturb known commercial-grade deposits.

Less than 1 percent of the Schurz alternative segments would traverse prime farmland soils. Depending on alternative segment, 0.011 to 0.015 square kilometer (2.6 to 3.6 acres) of prime farmland soils would be disturbed (see Table 4-146). Prime farmland soils along the Schurz alternative segments only occur in the immediate vicinity of the Walker River.

All of the Schurz alternative segments would contain a high percentage of soils with blowing soil characteristics. Schurz alternative segment 1 would cross a higher percentage of blowing soils than the other Schurz alternative segments. In addition, southwest of Red Ridge, the southern portion of all the Schurz alternative segments would cross an area with a high percentage of blowing soils (see Figure 3-128). Soils with the blowing soils characteristic easily form sand dunes. Schurz alternative segments 1 and 4 would cross a higher percentage of erodes easily soils, but the alternative segments would disturb only about 0.19 to 0.29 square kilometer (46 to 72 acres) of this soil type. As a ***mitigation*** measure (see Chapter 7), DOE might need to install fencing around the rail alignment in this area to stabilize existing sand dunes that would be disturbed during rail line construction. DOE would implement best management practices (see Chapter 7) to reduce the potential for additional soil loss due to erosion.

4.3.1.2.2.5 Department of Defense Branchline South (end of Schurz Alternative Segments to beginning of Mina Common Segment 1). DOE would develop construction camp number 17 on the southern portion of Department of Defense Branchline South near its junction with

Table 4-146. Summary of key information for assessing impacts from constructing Schurz alternative segment 1, 4, 5, or 6.

Attribute	Schurz 1	Schurz 4	Schurz 5	Schurz 6
Length (miles)[a,b]	32	40	44	45
Rise and fall (feet)[a,c]	700	1,400	2,000	2,600
Earthwork cut quantities (cubic yards)[a,d]	1.63 million	4.57 million	8.35 million	6.31 million
Earthwork fill quantities (cubic yards)[a]	2.01 million	5.66 million	6.35 million	8.96 million
Construction[e]	Cuts up to 45 feet and fills up to 35 feet	Cuts up to 60 feet and fills up to 75 feet	Cuts up to 105 feet and fills up to 80 feet	Cuts up to 110 feet and fills up to 80 feet
Number of construction camps[f]	1 (no. 18A)	1 (no. 18B)	1 (no. 18C)	1 (no. 18D)
Number of well sites outside nominal width of construction right-of-way[f]	0	1 (no. 22)	1 (no. 22)	2 (nos. 23 and 24)
Disturbed area (acres)[g]				
• Rail alignment[h]	1,100	1,500	1,700	1,600
• Quarries[f]	Not applicable	Not applicable	Not applicable	Not applicable
• Well sites outside nominal width of construction right-of-way[f]	Not applicable	1.4	1.4	2.8
• Access roads to construction camps/well sites/quarries[f]	Not applicable	Not applicable	Not applicable	2.9 (to construction camp 18D)
	Not applicable	2.5 (to well site 22)	2.5 (to well site 22)	4.7 (to well sites 23 and 24)
Total disturbed area (acres)[f,i]	1,100	1,500	1,700	1,600
Percent soil characteristics[j]	4.7 erodes easily 83 blowing soils 0.24 prime farmland	4.8 erodes easily 69 blowing soils 0.19 prime farmland	2.9 erodes easily 63 blowing soils 0.21 prime farmland	2.9 erodes easily 51 blowing soils 0.21 prime farmland
Soil characteristic area (acres)[k]	52 erodes easily 910 blowing soils 2.6 prime farmland	72 erodes easily 1,000 blowing soils 2.9 prime farmland	49 erodes easily 1,000 blowing soils 3.6 prime farmland	46 erodes easily 820 blowing soils 3.4 prime farmland

a. Source: DIRS 180872-Nevada Rail Partners 2007, Appendix D.
b. To convert miles to kilometers, multiply by 1.6093.
c. To convert feet to meters, multiply by 0.3048.
d. To convert cubic yards to cubic meters, multiply by 0.76456.
e. Source: DIRS 180880-Shannon & Wilson 2007, Table 6.
f. Source: DIRS 180875-Nevada Rail Partners 2007, Table 4-6, and Appendix H.
g. To convert acres to square kilometers, multiply by 0.0040469.
h. Source: DIRS 180874-Nevada Rail Partners 2007, p. B-3.
i. Totals might not equal sums of values due to rounding.
j. Source: DIRS 184079-Natural Resources Conservation Service 2007, all.
k. Soil area calculated by multiplying total disturbed area by the percent soil characteristic.

Mina common segment 1 (see Figure 2-14). The construction camp would disturb approximately 0.10 square kilometer (25 acres), which would result in topsoil loss and increased erosion. In addition, approximately 39 percent of the area that would be disturbed contains soils with the blowing soil characteristic. DOE would implement best management practices (see Chapter 7) to reduce the potential for additional soil loss due to erosion. Other than construction of this camp, the Department does not anticipate any other surface-disturbing activities in this area; therefore, there would be no other impacts associated with this portion of the Mina rail alignment. DOE would build the Staging Yard directly north of the junction between Department of Defense Branchline South and Mina common segment 1. Section 4.3.1.2.3.1 describes potential impacts associated with the Staging Yard.

4.3.1.2.2.6 Mina Common Segment 1. Mina common segment 1 would generally travel within valleys flanked by expansive mountain ranges. Most of the required earthwork would be used to fill topographic variations on alluvial fans. Table 4-147 summarizes the key information DOE considered to assess impacts to physical setting from construction of Mina common segment 1. The rail line would disturb a total of 12 square kilometers (3,100 acres). Surface disturbance from construction activities would remove topsoil and increase the potential for erosion around the rail alignment. DOE would implement best management practices (see Chapter 7) to reduce the potential for additional soil loss due to erosion.

Mina common segment 1 would cross some Quaternary faults. The Soda Spring Valley has experienced several earthquakes in the last 150 years (see Figure 3-126). However, most of these earthquakes had magnitudes below human detection. DOE would adopt the American Railway Engineering and Maintenance-of-Way Association guidelines to reduce the hazards to people and structures from earthquakes greater than magnitude 4.0 (see Chapter 7).

Mina common segment 1 would cross multiple mining districts, which are centered around the bounding mountains. Metallic minerals such as copper, gold, and silver have been identified and occasionally mined within these districts. Impacts to commercial minerals along Mina common segment 1 would be small because, although Mina common segment 1 would approach mining districts with claims, the segment would be restricted to valley locations and would not disturb subsurface mineral deposits.

4.3.1.2.2.7 Montezuma Alternative Segments. The Montezuma alternative segments would travel in valleys and passes as much as possible; however, all of these alternative segments would need to cross some mountain ranges, including the Montezuma Range and Goldfield Hills. Montezuma alternative segment 1 would require the greatest amount of fill material, while Montezuma alternative segment 3 would require the greatest amount of cuts. Table 4-148 summarizes the key information DOE considered to assess impacts to physical setting from construction of any of the Montezuma alternative segments.

Surface disturbance related to construction of the rail line, quarries, water wells, and access roads would range from 11 square kilometers (2,800 acres) along Montezuma alternative segment 2 to 17 square kilometers (4,100 acres) along Montezuma alternative segment 3. Cuts and fills associated with construction of any of the Montezuma alternative segments would result in the loss of topsoil and an increased potential for erosion.

Construction of the Montezuma alternative segments would disturb between 1.5 square kilometers (360 acres) and 2.3 square kilometers (570 acres) of erodes easily soils. More soils along Montezuma alternative segments 2 and 3, in the Big Smoky Valley and Montezuma Valley, have the blowing soils characteristic. These soils would have additional potential to be easily displaced by wind. Section 4.3.4, Air Quality and Climate, includes more discussion of impacts related to blowing soils and fugitive dust emissions. DOE would implement best management practices (see Chapter 7) to reduce the potential for additional soil loss due to erosion.

Montezuma alternative segments 1, 2, and 3 would cross some Quaternary faults, specifically as they approach mountain foothills. There has been one magnitude 5.3 earthquake recorded to the west of Lone

Table 4-147. Summary of key information for assessing potential impacts from constructing the proposed railroad along existing branchlines and Mina rail alignment common segments (page 1 of 2).

Key information	Union Pacific Railroad Hazen Branchline	Department of Defense Branchline North	Department of Defense Branchline through Schurz	Department of Defense Branchline South	Mina common segment 1	Mina common segment 2	Common segment 5	Common segment 6
Length (miles)[a,b]	43	5	NA	22	72	2.1	25	32
Rise and fall (feet)[a,c]	NA[d]	NA	NA	NA	2,100	33	560	1,400
Earthwork cut quantities (cubic yards)[a,e]	NA	0	NA	0	0.92 million	0	0.59 million	7.69 million
Earthwork fill quantities (cubic yards)[a]	NA	0.056 million	NA	0.056 million	6.74 million	0.13 million	1.32 million	3.85 million
Construction[f]	NA	New siding along existing rail alignment	NA	New siding along existing rail alignment	Cuts up to 65 feet high; fills up to 45 feet deep	Cuts and fills up to 20 feet high	Cuts up to 50 feet and fills up to 10 feet	Cuts up to 140 feet and fills up to 110 feet
Number of construction camps[g]	NA	NA	NA	1 (no. 17)	3 (nos. 14, 15, and 16)	0	1 (no. 10)	1 (no. 12)
Number of well sites outside nominal width of construction right-of-way[g]	NA	NA	NA	NA	1 (no. 21)		0	2 (nos. 14 and 15)
Disturbed area (acres)[g,h]								
• Rail alignment[i]	NA	40	NA	40	2,500	70	770	1,300
• Quarries[g,j]	NA	NA	NA	NA	590 (Garfield Hills and Gabbs Range)	NA	NA	NA
• Well sites outside nominal width of construction right-of-way[g]	NA	NA	NA	NA	1.4	NA	NA	2.8
• Access roads to construction camps/well sites/quarries[g]	NA	NA	NA	NA	3.3 (to construction camp 15) 6.0 (to well site 21)	NA	5 (to construction camp 10)	46 (to construction camp 12) 11 (to well sites 14 and 15)

Table 4-147. Summary of key information for assessing potential impacts from constructing the proposed railroad along existing branchlines and Mina rail alignment common segments (page 2 of 2).

Key information	Union Pacific Railroad Hazen Branchline	Department of Defense Branchline North	Department of Defense Branchline through Schurz	Department of Defense Branchline South	Mina common segment 1	Mina common segment 2	Common segment 5	Common segment 6
Total disturbed area (acres)[g,k]	NA	40	NA	40	3,100	70	780	1,400
Percent soil characteristics[l]	NA	NA	NA	0 erodes easily 39 blowing soils 0 prime farmland	7.9 erodes easily 39 blowing soils 0 prime farmland	100 erodes easily 0 blowing soils 0 prime farmland	0 erodes easily 2.6 blowing soils 0 prime farmland	0 erodes easily 0 blowing soils 0 prime farmland
Soil characteristic area (acres)[h,m]	NA	NA	NA	0 erodes easily 16 blowing soils 0 prime farmland	240 erodes easily 1,200 blowing soils 0 prime farmland	70 erodes easily 0 blowing soils 0 prime farmland	0 erodes easily 20 blowing soils 0 prime farmland	0 erodes easily 0 blowing soils 0 prime farmland

a. Sources: DIRS 180916-Nevada Rail Partners 2007, Appendix E; DIRS 180872-Nevada Rail Partners 2007, Appendix D.
b. To convert miles to kilometers, multiply by 1.6093.
c. To convert feet to meters, multiply by 0.3048.
d. NA = not applicable.
e. To convert cubic yards to cubic meters, multiply by 0.76456.
f. Source: DIRS 180880-Shannon & Wilson 2007, Table 6.
g. Sources: DIRS 180922-Nevada Rail Partners 2007, pp. 3-2 to 3-4 and 4-11, Table 4-7, and Appendices G and H; DIRS 180875-Nevada Rail Partners 2007, Table 4-6, and Appendix H.
h. To convert acres to square kilometers, multiply by 0.0040469.
i. Sources: DIRS 182825-Nevada Rail Partners 2007, p. B-3; DIRS 180874-Nevada Rail Partners 2007, p. B-3.
j. Assuming that two quarries would be developed along Mina common segment 1.
k. Totals might not equal sums of values due to rounding.
l. Source: DIRS 184079-Natural Resources Conservation Service 2007, all.
m. Soil area calculated by multiplying total disturbed area by the percent soil characteristic.

Table 4-148. Summary of key information for assessing impacts from constructing Montezuma alternative segment 1, 2, or 3.

Key information	Montezuma alternative segment 1	Montezuma alternative segment 2	Montezuma alternative segment 3
Length (miles)[a,b]	73	74	88
Rise and fall (feet)[a,c]	5,000	3,300	4,500
Earthwork cut quantities (cubic yards)[a,d]	6.28 million	3.01 million	4.77 million
Earthwork fill quantities (cubic yards)[a]	9.95 million	5.90 million	5.03 million
Construction[e]	Cuts up to 95 feet high; fills up to 100 feet deep	Cuts up to 10 feet high; fills up to 50 feet deep	Cuts up to 20 feet and fills up to 45 feet
Number of construction camps[f]	2 (nos. 9A and 13A)	1 (nos. 9 and 13B)	2 (nos. 9A and 13B)
Number of well sites outside nominal width of construction right-of-way[f]	4 (nos. 16, 18, 19, and 20)	2 (nos. 10 and 13)	3 (nos. 10, 16, and 18)
Disturbed area (acres)[g]			
• Rail alignment[h]	2,700	2,400	3,000
• Quarries[f,i]	1,100 (North Clayton and Malpais Mesa)	360 (ES-7)	1,100 (North Clayton and Malpais Mesa)
• Well sites outside nominal width of construction right-of-way[f]	5.6	2.8	4.2
• Access roads to construction camps/well sites/quarries[f]	2.9 (to construction camp 13A)	36 (to construction camps 9 and 13B)	15 (to construction camps 9A and 13B)
	18 (to well sites 16, 18, 19, and 20)	13 (to well sites 10 and 13)	10 (to well sites 10, 16, and 18)
	12 (special access road from U.S. Highway 95)		12 (special access road from U.S. Highway 95)
Total disturbed area (acres)[f,j]	3,800	2,800	4,100
Percent soil characteristics[k]	15 erodes easily 5.2 blowing soils 0 prime farmland	13 erodes easily 33 blowing soils 0 prime farmland	10 erodes easily 26 blowing soils 0 prime farmland
Soil characteristic area (acres)[l]	570 erodes easily 200 blowing soils 0 prime farmland	360 erodes easily 920 blowing soils 0 prime farmland	410 erodes easily 1,100 blowing soils 0 prime farmland

a. Source: DIRS 180872-Nevada Rail Partners 2007, Appendix D.
b. To convert miles to kilometers, multiply by 1.6093.
c. To convert feet to meters, multiply by 0.3048.
d. To convert cubic yards to cubic meters, multiply by 0.76456.
e. Source: DIRS 180880-Shannon & Wilson 2007, Table 6.
f. Source: DIRS 180875-Nevada Rail Partners 2007, Table 4-6, and Appendix H.
g. To convert acres to square kilometers, multiply by 0.0040469.
h. Source: DIRS 180874-Nevada Rail Partners 2007, p. B-3.
i. Assuming that two quarries would be developed along Montezuma alternative segment 1 or 3.
j. Totals might not equal sums of values due to rounding.
k. Source: DIRS 184079-Natural Resources Conservation Service 2007, all.
l. Soil area calculated by multiplying total disturbed area by the percent soil characteristic.

Mountain. However, there have been very few earthquakes above magnitude 3.0 in the area (see Figure 3-126). The potential exposure of people or structures to seismic hazards would be small.

There are multiple mining districts in the area surrounding the Montezuma alternative segments. There is an operating lithium evaporate mine immediately east of Silver Peak, and the Goldfield Hills contain multiple mining claims for metallic minerals (DIRS 183637-Shannon & Wilson 2007, pp. 103 to 107). There are also multiple metallic and nonmetallic minerals found within the Monte Cristo and Montezuma Ranges, and at Lone Mountain. However, there would be a small potential for impacts to mineral resources in this area, because ground disturbances would be limited to the rail line construction right-of-way. Construction would not require drilling into the deep saline aquifers Chemetall Foote Corporation uses for its lithium operations.

There is also a high potential for the mineral zeolite around the southern end of Montezuma alternative segment 2. Zeolite can be used as an antimicrobial agent and forms when saline ***groundwater*** reacts with certain volcanic deposits (DIRS 183644-Shannon & Wilson 2007, pp. 30 and 31). The potential impacts to local mineral resources would be small because rail line construction activities would be limited to the nominal width of the construction right-of-way. Section 4.3.2, Land Use and Ownership, also addresses impacts to the mining district from constructing and operating the proposed railroad along the Mina rail segment.

4.3.1.2.2.8 Mina Common Segment 2 (Stonewall Flat Area). Crossing the Stonewall Flat area, Mina common segment 2 would have relatively low rise and fall amounts and low cut and fill requirements (see Table 4-147).

Mina common segment 2 would cross the southern portion of the Stonewall Flat faults. However, within the past 150 years, there have been few earthquakes in the area (see Figure 3-126). There is a high potential for metallic minerals within the central portion of Mina common segment 2. Gold and silver deposits historically have been mined from the Stonewall and Cuprite Mining Districts (DIRS 183644-Shannon & Wilson 2007, pp. 55 to 58). However, impacts to these areas resulting from construction of the proposed rail line would be expected to be small and temporary because the minerals have not been found within the nominal width of the construction right-of-way. There are also geothermal wells near Mina common segment 2. DOE would avoid these wells during rail line construction, thereby reducing potential impacts. Section 4.3.2, Land Use and Ownership, describes land-use impacts regarding access to and use of mineral and energy resources.

Mina common segment 2 would disturb approximately 0.28 square kilometer (70 acres), which would include construction of the rail line, water wells, and access roads. The surface-area disruption would result in a loss of topsoil and the potential for increased erosion. Approximately 0.28 square kilometer (70 acres) of soils along Mina common segment 2 have the erodes easily characteristic and would be especially susceptible to wind erosion during construction.

There are also soils characterized as ***soft soils*** in ***playa*** deposits present along Mina common segment 2. The saline conditions of these soils limit the chemical and physical potentials of the soil and could have negative effects on the vegetation-bearing capacity of the soil. Reclamation of these soils following construction would be more difficult than on non-saline soils, and would require more maintenance and care than on more productive soils. These soils would have a higher potential for erosion until revegetation was complete. DOE would implement best management practices (see Chapter 7) to reduce the potential for additional soil loss due to erosion.

4.3.1.2.2.9 Bonnie Claire Alternative Segments. The two Bonnie Claire alternative segments would pass through Lida Valley and Sarcobatus Flat. The alternative segments would require similar amounts of fill, but Bonnie Claire alternative segment 2 would require excavation of twice as much cut material as Bonnie Claire alternative segment 3. Table 4-149 summarizes the key information DOE considered to assess impacts to physical setting from construction of either of the Bonnie Claire alternative segments.

Bonnie Claire alternative segment 2 would result in a total land disturbance of 1.9 square kilometers (470 acres) and Bonnie Claire alternative segment 3 would result in a total land disturbance of 1.9 square kilometers (460 acres) (see Table 4-149). Areas disturbed during construction would result in a loss of topsoil and increase the potential for erosion. However, these impacts would be temporary and would be reduced through the implementation of best management practices (see Chapter 7).

Although the alternative segments would pass through areas that have experienced recent low-level ***seismicity*** (magnitude 3.0 to 3.9) events, neither Bonnie Claire 2 nor Bonnie Claire 3 would cross known Quaternary fault traces. The primary seismic activity within the past 150 years occurred in 1999, when a magnitude 5.3 earthquake triggered many aftershocks over a series of days. Since then, earthquakes in the immediate vicinity of the Bonnie Claire alternative segments have been below magnitude 3.0 (DIRS 183639-Shannon & Wilson 2007, Plate 4). Seismic hazards in this area are considered consistent with the rest of southern Nevada.

There is a potential for metallic mineral deposits along both Bonnie Claire alternative segments. Each segment would travel around the Wagner Mining District, which has produced low-tonnage mixed oxide and sulfide copper ore (DIRS 183644-Shannon & Wilson 2007, p. 54). DOE would position the rail alignment to avoid the mining district and to reduce the potential for impacts to mineral deposits. Section 4.3.2, Land Use and Ownership, addresses potential impacts to the Wagner Mining District. The rail alignment would travel along the low sections of Stonewall Flat; therefore, impacts to metallic mineral deposits would be small.

About 0.48 to 0.51 square kilometer (120 to 130 acres) of the soils along Bonnie Claire 3 and Bonnie Claire 2, respectively, have the erodes easily characteristic (see Table 4-149). Thus, there would be a high potential for erosion along these alternative segments. DOE would implement best management practices (see Chapter 7) to reduce the potential for additional soil loss due to erosion. Overall, the potential impacts from constructing a rail line along either Bonnie Claire alternative segment 2 or Bonnie Claire alternative segment 3 would be similar.

4.3.1.2.2.10 Common Segment 5 (Sarcobatus Flat Area). Passing through Sarcobatus Flat, common segment 5 would have a low rise and fall. Table 4-147 summarizes the key information DOE considered to assess impacts to physical setting from construction of common segment 5.

The potential to expose people or structures to seismic hazards would be small because common segment 5 would not cross any known Quaternary fault traces, and would travel over relatively level terrain.

There is a high potential for metallic mineral resources where common segment 5 would pass near the Clarkdale Mining District. Small gold and silver deposits have been mined in Clarkdale, and are hypothesized to extend below portions of common segment 5 (DIRS 183644-Shannon & Wilson 2007, Table 1). However, construction activities would not uncover the bedrock and disturb the mineral resources. The area of common segment 5 also has a generally high potential for geothermal resources; there are several thermal springs near U.S. Highway 95 that would be parallel to the rail line (DIRS 183644-Shannon & Wilson 2007, p. 23). However, because DOE would avoid these resources during rail line construction, the potential for impacts would be small.

Construction of this common segment would disturb a total of 3.1 square kilometers (780 acres) of land. Surface disturbance related to construction activities would remove topsoil and increase the potential for

Table 4-149. Summary of key information for assessing impacts from constructing Bonnie Claire alternative segment 2 or 3.

Key information	Bonnie Claire 2	Bonnie Claire 3
Length (miles)[a,b]	13	12
Rise and fall (feet)[a,c]	540	570
Earthwork cut quantities (cubic yards)[a,d]	0.60 million	0.31 million
Earthwork fill quantities (cubic yards)[a]	1.24 million	0.92 million
Construction[e]	Cuts up to 100 feet high in ***tuff***; cuts and fills up to 45 feet deep in ***alluvium***	Cuts to 50 feet and fills to 20 feet; low strength rock; broken rock expected because of faults visible in outcrop
Number of construction camps[f]	0	0
Number of well sites outside nominal width of construction right-of-way[f]	0	0
Disturbed area (acres)[g]		
• Rail alignment[h]	470	460
• Quarries[f]	Not applicable	Not applicable
• Well sites outside nominal width of construction right-of-way[f]	Not applicable	Not applicable
• Access roads to construction camps/well sites/quarries[f]	Not applicable	Not applicable
Total disturbed area (acres)[f,i]	470	460
Percent soil characteristics[j]	27 erodes easily 0 blowing soils 0 prime farmland	25 erodes easily 0 blowing soils 0 prime farmland
Soil characteristic area (acres)[k]	130 erodes easily 0 blowing soils 0 prime farmland	120 erodes easily 0 blowing soils 0 prime farmland

a. Source: DIRS 180916-Nevada Rail Partners 2007, Appendix E.
b. To convert miles to kilometers, multiply by 1.6093.
c. To convert feet to meters, multiply by 0.3048.
d. To convert cubic yards to cubic meters, multiply by 0.76456.
e. Source: DIRS 182854-Shannon & Wilson 2006, Table 5.
f. Source: DIRS 180922-Nevada Rail Partners 2007, pp. 3-2 to 3-4 and 4-11, Table 4-7, and Appendices G and H.
g. To convert acres to square kilometers, multiply by 0.0040469.
h. Source: DIRS 182825-Nevada Rail Partners 2007, p. B-3.
i. Totals might not equal sums of values due to rounding.
j. Source: DIRS 184079-Natural Resources Conservation Service 2007, all.
k. Soil area calculated by multiplying total disturbed area by the percent soil characteristic.

erosion along the rail alignment. These impacts would be temporary and would be reduced through the use of best management practices (see Chapter 7).

Approximately 0.081 square kilometer (20 acres) of common segment 5 has the blowing soils characteristic, which would increase the potential for soil loss from wind. DOE would implement best management practices to minimize any additional soil loss from erosion. Section 4.3.4, Air Quality and Climate, addresses impacts related to construction-generated fugitive dust emissions.

4.3.1.2.2.11 Oasis Valley Alternative Segments. Oasis Valley alternative segments 1 and 3 would have a similar profile throughout the valley. Table 4-150 summarizes the key information DOE considered to assess impacts to physical setting from construction of either Oasis Valley alternative segment.

The Oasis Valley alternative segments would not cross known fault traces. Within the past 150 years of seismic records, there has been generally low earthquake activity in the area, so the potential seismic-related impacts to humans and structures would be small.

There is a low potential for commercial metallic, nonmetallic, and oil resources in the area of the Oasis Valley alternative segments (DIRS 182762-Shannon & Wilson 2005, Appendix E). The minerals present in the area around the alternative segments are found in small veins in the surrounding hills. There would be small impacts to such resources because the rail alignment would remain in the valley, away from mineral-bearing ***outcrops***. There is a high potential for geothermal deposits in the area; however, neither Oasis Valley alternative segment would approach any known hot springs or wells.

Oasis Valley alternative segment 3 would require more earthwork than Oasis Valley alternative segment 1 to obtain the appropriate grade (see Table 4-150) and would disturb 0.3 square kilometer (80 acres) more land area than Oasis Valley alternative segment 1. Construction activities would remove topsoil in the area and increase the potential for erosion along the rail alignment. Oasis Valley 1 also contains about twice as much blowing soils as Oasis Valley 3. DOE would implement best management practices (see Chapter 7) to reduce the potential for additional soil loss due to erosion.

Overall, potential impacts along either Oasis Valley alternative segment would be small. Oasis Valley 3 would be longer and would require more land disturbance than Oasis Valley 1, and Oasis Valley 1 would contain more soils with a high potential for erosion.

4.3.1.2.2.12 Common Segment 6 (Yucca Mountain Approach). Approaching Yucca Mountain, common segment 6 would pass through rugged terrain and along fault blocks. To achieve an appropriate grade, cuts up to 42 meters (140 feet) and fills up to 34 meters (110 feet) would be required (see Table 4-147). Some of the fill would be required to build the bridge over Beatty Wash.

There is a low potential for ground rupture associated with the eastern and western Yucca Fault systems (DIRS 182854-Shannon & Wilson 2006, Table 6). In areas with high topographic relief, construction of this common segment would also result in an increased potential for rock-slope failure and landslides (DIRS 182854-Shannon & Wilson 2007, Table 6). DOE would incorporate appropriate engineering features (see Chapter 2) during construction to stabilize these areas and prevent rock-slope failure and landslides. Construction activities would not be expected to result in off-site rock falls and landslides.

There is a high potential for the occurrence of some metallic and nonmetallic minerals along common segment 6. The rail alignment would cross the northeastern portion of the Bare Mountain Mining District, which has produced a variety of commodities over its period of operation, including fluorspar, silica, limestone, and trace amounts of gold and mercury (DIRS 183644-Shannon & Wilson 2007, pp. 38 to 39). Construction impacts to mineral resources in this area would be small because the width of the construction right-of-way would allow for the extraction of the mining district's resources. Section 4.2.2, Land Use and Ownership, further describes impacts to the Bare Mountain Mining District.

Table 4-150. Summary of key information for assessing impacts from constructing Oasis Valley alternative segment 1 or 3.

Key information	Oasis Valley 1	Oasis Valley 3
Length (miles)[a,b]	6	9
Rise and fall (feet)[a,c]	230	220
Earthwork cut quantities (cubic yards)[a,d]	0.066 million	0.16 million
Earthwork fill quantities (cubic yards)[a]	0.72 million	1.34 million
Construction[e]	Cuts up to 20 feet and fills up to 30 feet	Cuts up to 50 feet and fills up to 40 feet
Number of construction camps[f]	1 (no. 11)	1 (no. 11)
Number of well sites outside nominal width of construction right-of-way[f]	0	0
Disturbed area (acres)[g]		
• Rail alignment[h]	240	320
• Quarries[f]	Not applicable	Not applicable
• Well sites outside nominal width of construction right-of-way[f]	Not applicable	Not applicable
• Access roads to construction camps/well sites/quarries[f]	10 (to construction camp 11)	9.8 (to construction camp 11)
Total disturbed area (acres)[f,i]	250	330
Percent soil characteristics[j]	0 erodes easily 13 blowing soils 0 prime farmland	0 erodes easily 4.8 blowing soils 0 prime farmland
Soil characteristic area (acres)[k]	0 erodes easily 33 blowing soils 0 prime farmland	0 erodes easily 16 blowing soils 0 prime farmland

a. Source: DIRS 180916-Nevada Rail Partners 2007, Appendix E.
b. To convert miles to kilometers, multiply by 1.6093.
c. To convert feet to meters, multiply by 0.3048.
d. To convert cubic yards to cubic meters, multiply by 0.76456.
e. Source: DIRS 182854-Shannon & Wilson 2006, Table 5.
f. Source: DIRS 180922-Nevada Rail Partners 2007, pp. 3-2 to 3-4 and 4-11, Table 4-7, and Appendices G and H.
g. To convert acres to square kilometers, multiply by 0.0040469.
h. Source: DIRS 182825-Nevada Rail Partners 2007, p. B-3.
i. Totals might not equal sums of values due to rounding.
j. Source: DIRS 184079-Natural Resources Conservation Service 2007, all.
k. Soil area calculated by multiplying total disturbed area by the percent soil characteristic.

There is a potential for geothermal resources in the northern portions of common segment 6. There are several warm and hot springs around Beatty, some of which are used as warm bathing pools. The rail alignment would bypass the springs; therefore, there would be no impact to local geothermal resources (DIRS 182762-Shannon & Wilson 2007, p. 31).

Construction activities along common segment 6 would disturb an estimated 5.5 square kilometers (1,400 acres). These activities could cause topsoil loss and increase erosion potential. DOE would implement best management practices (see Chapter 7) to minimize these impacts. There are no special soil characteristics along this common segment.

4.3.1.2.3 Facilities

4.3.1.2.3.1 Staging Yard. DOE would build the Staging Yard northeast of Hawthorne near the end of Department of Defense Branchline South. The Staging Yard would disturb approximately 0.20 square kilometer (50 acres) and consist of a 610-square-meter (6,600-square-foot) office, a 560-square-meter (6,600-square-foot) Satellite Maintenance-of-Way Facility, and a paved access road (DIRS 180919-Nevada Rail Partners 2007, p. 3-1; DIRS 180919-Nevada Rail Partners 2007, p. 5-2). Construction of this facility would result in removal of topsoil and an increased potential for erosion within the disturbed areas. There would be a permanent loss of topsoil in the areas under buildings and paved roads.

4.3.1.2.3.2 Maintenance-of-Way Facility. There are two potential locations for the Maintenance-of-Way Facility along the Mina rail alignment, depending on the alternative segment. The Montezuma alternative segment 1 site would be approximately 1.6 kilometers (1 mile) south of Silver Peak. The site along Montezuma alternative segment 2 or 3 would be 2.9 kilometers (1.8 miles) west of U.S. Highway 95 between Tonopah and Goldfield (DIRS 180919-Nevada Rail Partners 2007, p. 4-4). Construction of this facility would disturb 0.061 square kilometer (15 acres) (DIRS 182825-Nevada Rail Partners 2007, Appendix B). The disturbed area would have the potential for topsoil loss and increased erosion.

4.3.1.2.3.3 Rail Equipment Maintenance Yard. Construction of the Rail Equipment Maintenance Yard would disturb approximately 0.41 square kilometer (100 acres) (DIRS 182825-Nevada Rail Partners 2007, p. A-5). This area would include the ***Cask Maintenance Facility***, and ***escort-car*** and locomotive-light-repair garages. It could also house the ***Nevada Railroad Control Center*** and National Transportation Operations Center. Construction of these facilities would result in topsoil loss and increased erosion potential. DOE would implement best management practices (see Chapter 7) to minimize potential erosion impacts. During construction, the topsoil would be sequestered and stabilized to prevent its permanent loss.

4.3.1.2.3.4 Cask Maintenance Facility. The Cask Maintenance Facility would be used to house the transportation casks, and would process them during routine inspections, cleaning, and repair. The facility would disturb 0.081 square kilometer (20 acres), which would include buildings, a rail yard, and track siding (DIRS 180919-Nevada Rail Partners 2007, p. 1-3). The facility could be in one of three locations: collocated with the Rail Equipment Maintenance Yard inside the ***Yucca Mountain Site*** boundary, along one of the rail alignment segments outside the ***Yucca Mountain Site boundary***, or at a currently undetermined location outside Nevada.

4.3.1.2.4 Quarries

DOE would develop two of five potential quarry sites along the Mina rail alignment. Each quarry site would contain an operations plant, quarry and production area, access roads, and a railroad siding with loading facility, and could contain a conveyor belt (see Figure 2-33). The operations plant would include administrative offices, a parking area, sanitary facilities, and an equipment fueling and service area. The quarry and production area would include the pit, which would vary in size depending on quarry location, a waste-rock pile with a rectangular footprint of 0.057 square kilometer (14 acres), a ballast stockpile, settling ponds, a water well, and emergency generators.

The maximum disturbance area for each quarry was calculated from the areas that would be disturbed from excavating the quarry pit and building the associated plant facilities, roads, railroad siding, and conveyor belts. The area for a temporary construction buffer was also included, which would be reclaimed once construction was completed. The quarry pit would create the largest disturbance area, so depending on the quality of the bedrock and the quantity of required ballast and subballast, the total disturbance area for the quarry site would most likely be much smaller. Depending on the topography, the relative positions of the facilities, and the quality and amount of the extracted rock, the total area of disturbance from a quarry site would be 0.97 to 2.7 square kilometers (240 to 660 acres).

Construction and operation of quarries would modify the physical setting in multiple ways. Construction of the buildings, access roads, and conveyer belts would disturb topsoil. During quarry operation, rock extraction would require the removal of the thin soil overburden. The result would be some topsoil loss during quarry construction and operation. Construction and operation of the quarries would also increase the potential for erosion. These impacts would be temporary, limited to the area around the quarry facilities, and DOE would implement best management practices (see Chapter 7) to reduce the impacts. Where practicable, the topsoil would be reserved for reclamation and revegetation. Excavation of bedrock from the pit would result in permanent loss of the mineral resources and change the local topography. However, the quarries would be in areas with abundant mineral resources, so impacts to overall availability of minerals suitable for quarrying would be small.

After construction, DOE would implement reclamation activities to reduce permanent impacts (see Chapter 7). The Department would demolish quarry access roads by removing the roadway materials and regrading the area. Terrain restoration around the quarry facility and pit would include restoring quarry-pit walls to more stable slopes, grading and replacing topsoil, and revegetating the area (DIRS 180922-Nevada Rail Partners 2007, p. 3-4). Reclamation activities would reduce the direct and indirect topsoil loss and increased erosion impacts caused by quarry construction and operation.

Sections 4.3.1.2.4.1 through 4.3.1.2.4.5 describe potential impacts related to each potential quarry site along the Mina rail alignment.

4.3.1.2.4.1 Garfield Hills Quarry. The potential Garfield Hills quarry would be in low hills south of Mina common segment 1. The quarry pit (see Figure 2-28) would be mined from the southwest side of a mesa, extracting basalt from two 30-meter (100-foot) hills. At most, this quarry pit could occupy an area of 0.30 square kilometer (74 acres) with an average depth of 22 meters (71 feet), which would produce 38.1 million metric tons (42 million tons) of ballast (DIRS 180875-Nevada Rail Partners 2007, p. A-4). Actual quarry dimensions would likely be much smaller – approximately 0.04 square kilometer (10 acres) (DIRS 180922-Nevada Rail Partners 2007, p. 3-2). The ballast produced from this quarry could supply a portion of the 2.49 to 2.73 million metric tons (2.74 to 3.01 million tons) required for railroad construction and maintenance (DIRS 180875-Nevada Rail Partners 2007, p. 3-1).

Access to the Garfield Hills quarry site would be by existing and new roads (DIRS 180875-Nevada Rail Partners 2007, Appendix H). To connect the quarry pit to the facilities, the Mina common segment 1 siding, and U.S. Highway 95, DOE would construct 3.1 kilometers (1.9 miles) of new roadway and would improve 3.2 kilometers (2 miles) of existing roadway (DIRS 180875-Nevada Rail Partners 2007, Table 4-6). The Department would update existing roads with grading and a gravel roadbed. Excavated ballast would be trucked to the quarry plant site, which would be on an alluvial fan to the north of the quarry site. Once the ballast was separated, it would be transported to the rail alignment via conveyer belt. This conveyer belt would need to cross U.S. Highway 95 to reach the siding. The conveyer belt and service road would travel approximately 1.6 kilometers (1 mile) and disturb a 15-meter (50-foot)-wide path from the processing plant to the rail loading facility. The entire quarry footprint, including pit, facilities, and associated transportation routes would disturb a maximum of 1.4 square kilometers (350 acres).

4.3.1.2.4.2 Gabbs Range Quarry. The potential Gabbs Range quarry and its facilities would be northeast of Mina common segment 1, shown on Figure 2-29. When operational, this quarry could supply a portion of the 2.49 to 2.73 million metric tons (2.74 to 3.01 million tons) of ballast required for railroad construction and maintenance (DIRS 180875-Nevada Rail Partners 2007, p. 3-1). The southern edge of a 120-meter (400-foot)-high ridge would be mined for granite. The quarry pit would be able to produce a maximum of 13 million metric tons (14.3 million tons) of ballast excavated out of a 0.21-square-kilometer (52-acre) pit on average 23 meters (77 feet) deep. The potential plant facility would be to the southwest of the quarry pit and adjacent to the rail alignment. Ballast would be trucked along a modified off-road vehicle trail to the loading facility along Mina common segment 1. For the Gabbs Range quarry, DOE would upgrade 8.9 kilometers (5.5 miles) of existing roads, and create 0.81 kilometer (0.50 mile) of new roads (DIRS 180875-Nevada Rail Partners 2007, Table 4-6). The Gabbs Range quarry footprint would disturb about 0.97 kilometer (240 acres).

4.3.1.2.4.3 North Clayton Quarry. The potential North Clayton quarry would be north of Montezuma alternative segment 3 and east of Montezuma alternative segment 1 north of the Montezuma Mountains. The quarry pit would be on granite hills north of the Montezuma Range and Clayton Ridge. The plant site and waste-rock pile would be on alluvial fans to the west and east of the rail alignment, respectively (see Figure 2-30). The quarry would be able to produce a maximum of 12.3 million metric tons (13.6 million tons) of granite rock from a pit totaling 0.35 square kilometer (86 acres) with a bench height of 15 meters (50 feet). Construction requirements for ballast for the rail alignment would be 2.49 to 2.73 million metric tons (2.74 to 3.01 million tons) (DIRS 180875-Nevada Rail Partners 2007, p. 3-1). The ballast would be trucked from the quarry pit to the quarry plant facility, and then trucked to the rail alignment along new and existing roads. DOE would construct 3.1 kilometers (1.9 miles) of new road and use 5.8 kilometers (3.6 miles) of existing roads to connect the quarry pit to the plant facilities and the rail alignment. The entire quarry footprint would disturb a maximum of 1.8 square kilometers (440 acres).

4.3.1.2.4.4 Malpais Mesa Quarry. The potential Malpais Mesa quarry would be in the area between Montezuma alternative segments 1, 2, and 3, shown on Figure 2-32. ***Basalt*** rock would be excavated from the side of a 61-meter (200-foot)-high bowl-shaped cliff. The waste-rock pile and plant facilities would be to the southwest at the base of the cliff. A maximum of 11.9 million metric tons (13.1 million tons) of ballast could be extracted from the 1-square-kilometer (260-acre) pit with a depth of 21 meters (70 feet). Depending on the percentage of the required 2.49 to 2.73 million metric tons (2.74 to 3.01 million tons) of ballast the quarry would supply, the final quarry footprint would likely be smaller (DIRS 180875-Nevada Rail Partners 2007, p. 3-1).

Access to the quarry pit and production plant would be via 5.3 kilometers (3.3 miles) of updated off-road vehicle trails off U.S. Highway 95, with 6.8 kilometers (4.2 miles) of new roadway construction to connect the quarry site to the rail alignment, waste-rock pile, and plant facility (DIRS 180875-Nevada Rail Partners 2007, Table 4-6). A conveyer belt would carry the ballast from the production facility to the rail siding. The width of the conveyer belt and correlating service road would be 15 meters (50 feet). The Malpais Mesa quarry footprint would disturb about 2.7 square kilometers (660 acres).

4.3.1.2.4.5 Quarry ES-7. Potential quarry ES-7 would be west of Montezuma alternative segment 2 or 3, shown on Figure 2-31. The quarry pit and plant facilities would be on a 49-meter (160-foot)-high mesa with access to two basalt deposits. DOE could extract a maximum of 8.49 million metric tons (9.36 million tons) of basalt ballast from the 0.11-square-kilometer (27-acre) pit with a depth of 30 meters (100 feet). Depending on the amount of ballast required, the footprint of this quarry would likely be smaller. There could also be a secondary quarry of variable-quality rock in the area. It would be able to produce a maximum of 2.9 million metric tons (3.2 million tons) of ballast from a 37,000-square-meter (9.2-acre) pit 30 meters deep. However, the final dimensions of this secondary quarry would likely be smaller. This quarry could supply a portion of the required 2.49 to 2.73 million metric tons (2.74 to 3.01 million tons) of ballast (DIRS 180875-Nevada Rail Partners 2007, p. 3-1).

Access to the quarry pit and production plant would be via an existing road off U.S. Highway 95, with new roadway construction to extend into the quarry site (DIRS 180922-Nevada Rail Partners 2007, Appendix I). DOE would construct approximately 6.6 kilometers (4.1 miles) of new roadway and would improve 8.4 kilometers (5.2 miles) of existing roadway to access the quarry pit and facilities (DIRS 180922-Nevada Rail Partners 2007, Table 4-7). A conveyer belt would carry the ballast from the production facility to the rail siding. The conveyer belt and correlating service road would be 15 meters (50 feet) wide. The total disturbance area of the quarry footprint would be 1.5 square kilometers (370 acres).

4.3.1.3 Operations Impacts

The proposed railroad would operate for up to 50 years (DIRS 182826-Nevada Rail Partners 2007, p. 4-1). The operations right-of-way would be nominally 61 meters (200 feet) on either side of the centerline of the rail line. By definition, the operations right-of-way would be within the construction right-of-way; therefore, use of the completed rail line to Yucca Mountain would have no additional impact to physical setting beyond the permanent alterations resulting from construction.

Rail line maintenance would require periodic inspections to verify the condition of the track, drainage structures, and rock-wall surfaces. When necessary, rock faces on cuts would be repaired to minimize the potential for rockfall or landslide. Areas along the rail line would also be monitored for evidence of erosion, particularly where there is a high percentage of soils classified as erodes easily (Schurz alternative segment 1 [31 percent], Schurz alternative segment 5 [36 percent], Schurz alternative segment 6 [49 percent], and Mina common segment 2 [100 percent]).

Eroded areas encroaching on the track bed would be repaired, which could include replacement of ballast and subballast to reduce erosion of exposed soils. Although there would be a potential for erosion and landslides along the rail line, the potential would be substantially similar to baseline conditions, and would be attributed to natural occurrences after construction was completed, not due to train operations. In addition, DOE would use appropriate slope-stabilizing engineering practices (see Chapter 2) during the construction phase that would reduce hazards from rockfalls and landslides during the operations phase. Section 4.2.8, Noise and Vibration, discusses potential impacts from vibration in more detail.

During the operations phase, DOE would continue to monitor seismic activity in the region. DOE would also continue to follow the procedures based on the American Railways Engineering and Maintenance-of-Way Association seismic guidelines adopted during the construction phase (see Section 4.3.1.2.1.2 and Table 4-145). These measures, also outlined in Chapter 7, would reduce the potential for structural damage and human exposure to seismic hazards.

4.3.1.4 Impacts under the Shared-Use Option

The Shared-Use Option would include the construction and operations activities described in Sections 4.3.1.2 and 4.3.1.3, and private companies would use the rail line for shipment of general freight. Under the Shared-Use Option, potential construction and operations impacts would be very similar to those identified in Sections 4.3.1.2 and 4.3.1.3 for the Proposed Action without shared use.

The Shared-Use Option would require the construction of more rail sidings within the rail line construction right-of-way in areas of relatively flat terrain. A commercial-use interchange facility at the beginning of the line and a facility at the commercial-use termination point to support the Shared-Use Option would also be constructed within the construction right-of-way. Implementation of the Shared-Use Option would increase the area of surface disturbance by less than 0.1 percent (see Chapter 2). There would be a potential for topsoil loss and increased erosion in this area.

Under the Shared-Use Option, the rail line would likely be in use for more than 50 years, compared to the railroad operations life under the Proposed Action without shared use. Shared use of the proposed rail line would add no impacts to physical setting beyond the permanent alterations already described.

4.3.1.5 Summary

Table 4-151 summarizes potential impacts to physical setting from constructing and operating the proposed railroad along the Mina rail alignment. With the exception of topsoil loss, overall impacts would be small because of the best management practices or mitigation procedures DOE would implement (see Chapter 7). There would be a potential for increased erosion because relatively undisturbed land would be extensively graded. Impacts related to soil erosion or loss of topsoil would be small because implementation of best management practices would effectively reduce the potential for increased erosion and sedimentation that could occur during construction activities. In addition, soil disturbance would be distributed through several counties, reducing the concentration of increased soil erosion.

The Mina rail alignment would cross faults in Nevada, a seismically active area. However, DOE would adopt the American Railway Engineering and Maintenance-of-Way Association seismic guidelines. Additional seismic monitoring procedures would also be implemented during the construction and operations phases. Construction of the rail line would avoid known commercial mineral deposits, and would not remove them from permanent use. The quarries and borrow sites that would be developed and used for supplying the ballast and subballast would remove mineral resources from the area. However, construction would consume only a small percentage of the total available supply over several counties. There would be no additional impacts to the physical setting from railroad operations under the Proposed Action or the Shared-Use Option.

Table 4-151. Summary of impacts to physical setting from constructing and operating the proposed railroad along the Mina rail alignment[a] (page 1 of 4).

Rail line segment/ facilities (county)	Construction impacts	Operations impacts
Rail line segment		
Department of Defense Branchline North (Lyon County)	Total surface disturbance: 40 acres, would result in topsoil loss and increased potential for erosion.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.
Schurz alternative segments 1, 4, 5, and 6 (Lyon, Churchill, and Mineral Counties including Walker River Paiute Reservation)	Total surface disturbance would result in topsoil loss and increased potential for erosion: Schurz 1 = 1,100 acres Schurz 4 = 1,500 acres Schurz 5 = 1,700 acres Schurz 6 = 1,600 acres Loss of prime farmland soils: Schurz 1 = 2.6 acres Schurz 4 = 2.9 acres Schurz 5 = 3.6 acres Schurz 6 = 3.4 acres Each segment would cross 2.6 percent of the prime farmland soils of the Walker River Paiute Reservation. Small impact to local mineral resources due to metallic minerals historically mined in local mountains.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.

Table 4-151. Summary of impacts to physical setting from constructing and operating the proposed railroad along the Mina rail alignment[a] (page 2 of 4).

Rail line segment/ facilities (county)	Construction impacts	Operations impacts
Rail line segment (continued)		
Department of Defense Branchline South (Mineral County)	Total surface disturbance: 40 acres, would result in topsoil loss and increased potential for erosion.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.
Mina common segment 1 (Mineral and Esmeralda Counties)	Total surface disturbance: 3,100 acres, would result in topsoil loss and increased potential for erosion.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.
Montezuma alternative segments 1, 2, and 3 (Esmeralda and Nye Counties)	Total surface disturbance would result in topsoil loss and increased potential for erosion: Montezuma 1 = 3,800 acres Montezuma 2 = 2,800 acres Montezuma 3 = 4,100 acres Potential impacts to metallic and nonmetallic resources would be small.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.
Mina common segment 2 (Esmeralda and Nye Counties)	Total surface disturbance: 70 acres, would result in topsoil loss and increased potential for erosion. Small impacts to metallic and geothermal resources.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.
Bonnie Claire alternative segments 2 and 3 (Nye County)	Total surface disturbance, would result in topsoil loss and increased potential for erosion: Bonnie Claire 2 = 470 acres Bonnie Claire 3 = 460 acres Small impacts to metallic mineral resources.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.
Bonnie Claire alternative segments 2 and 3 (Nye County)	Total surface disturbance, would result in topsoil loss and increased potential for erosion: Bonnie Claire 2 = 470 acres Bonnie Claire 3 = 460 acres Small impacts to metallic mineral resources.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.
Common segment 5 (Nye County)	Total surface disturbance: 780 acres, would result in topsoil loss and increased potential for erosion. Small impact to metallic mineral and geothermal resources.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.
Oasis Valley alternative segments 1 and 3 (Nye County)	Total surface disturbance would result in topsoil loss and increased potential for erosion: Oasis Valley 1 = 250 acres Oasis Valley 3 = 330 acres Small impacts to mineral resources.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.

Table 4-151. Summary of impacts to physical setting from constructing and operating the proposed railroad along the Mina rail alignment[a] (page 3 of 4).

Rail line segment/ facilities (county)	Construction impacts	Operations impacts
Rail line segment (continued)		
Common segment 6 (Nye County)	Total surface disturbance: 1,400 acres, would result in topsoil loss and increased potential for erosion. Small impacts to mineral and geothermal resources.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.
Facilities		
Access roads (included in total surface disturbance in individual segments) (Mineral, Esmeralda, and Nye Counties)	Total surface disturbance: 370 acres, would result in topsoil loss and increased potential for erosion.	Potential for soil erosion in localized areas around the facility; implementation of erosion prevention methods would reduce impacts.
Staging Yard at Hawthorne (includes the Satellite Maintenance-of-Way Facility) (Mineral County)	Total surface disturbance: 50 acres, would result in topsoil loss and increased potential for erosion.	Potential for soil erosion in localized areas around the facility; implementation of erosion prevention methods would reduce impacts.
Maintenance-of-Way Facility (includes Maintenance-of-Way Headquarters Facility and Maintenance-of-Way Trackside Facility) (Esmeralda County)	Total surface disturbance: 15 acres, would result in topsoil loss and increased potential for erosion.	Potential for soil erosion in localized areas around the facility; implementation of erosion prevention methods would reduce impacts.
Rail Equipment Maintenance Yard (includes Cask Maintenance Facility) (Nye County)	Total surface disturbance: 100 acres, would result in topsoil loss and increased potential for erosion.	Potential for soil erosion in localized areas around the facility; implementation of erosion prevention methods would reduce impacts.
Construction camps (Esmeralda, Nye, and Mineral Counties including the Walker River Paiute Reservation)	Total surface disturbance: 250 acres would result in topsoil loss and increased potential for erosion. Construction camps would be within the nominal width of the construction right-of-way.	Potential for soil erosion in localized areas around the construction camps; implementation of erosion prevention methods would reduce impacts.
Water wells (Lyon, Mineral, Churchill including Walker River Paiute Reservation, Nye, and Esmeralda Counties)	Total surface disturbance: 41 acres, would result in topsoil loss and increased potential for erosion. (105 potential well sites with 130 potential wells; 76 well sites would be within the nominal width of the construction right-of-way; 29 well sites would be outside the nominal width of the construction right-of-way, at 1.4 acres surface disturbance at each well site)	Potential for soil erosion in localized areas around the well sites; implementation of erosion prevention methods would reduce impacts.

Table 4-151. Summary of impacts to physical setting from constructing and operating the proposed railroad along the Mina rail alignment[a] (page 4 of 4).

Rail line segment/ facilities (county)	Construction impacts	Operations impacts
Quarries		
Potential Garfield Hills quarry (Mineral County)	Total surface disturbance: 350 acres, would result in topsoil loss and increased potential for erosion. Extraction of all 42 million tons of rock would reduce the availability of local construction mineral materials.	Potential for soil erosion in localized areas around the quarry; implementation of erosion prevention methods would reduce impacts.
Potential Gabbs Range quarry (Mineral County)	Total surface disturbance: 590 acres, would result in topsoil loss and increased potential for erosion. Extraction of all 14.6 million metric tons of rock would reduce the availability of local construction mineral materials.	Potential for soil erosion in localized areas around the quarry; implementation of erosion prevention methods would reduce impacts.
Potential North Clayton quarry (Esmeralda County)	Surface disturbance: 440 acres, would result in topsoil loss and increased potential for erosion. Extraction of all 13.6 million tons would reduce the availability of local construction mineral materials.	Potential for soil erosion in localized areas around the quarry; implementation of erosion prevention methods would reduce impacts.
Potential Malpais Mesa quarry (Esmeralda County)	Surface disturbance: 660 acres, would result in topsoil loss and increased potential for erosion. Extraction of all 13.1 million tons would reduce the availability of local construction mineral materials.	Potential for soil erosion in localized areas around the quarry; implementation of erosion prevention methods would reduce impacts.
Potential quarry ES-7 (Nye County)	Total surface disturbance: 360 acres, would result in topsoil loss and increased potential for erosion. Extraction of all 12.6 million tons from two pits would reduce the availability of local construction mineral materials.	Potential for soil erosion in localized areas around the quarry; implementation of erosion prevention methods would reduce impacts.

a. To convert acres to square kilometers, multiply by 0.0040469; to convert tons to metric tons, multiply by 0.90718.

4.3.2 LAND USE AND OWNERSHIP

This section describes potential impacts to land use and ownership from constructing and operating the proposed railroad along the Mina rail alignment. Section 4.3.2.1 describes the methods DOE used to assess potential impacts; Section 4.3.2.2 describes potential impacts to land use during the construction phase; Section 4.3.2.3 describes potential railroad operations impacts; Section 4.3.2.4 describes potential impacts under the Shared-Use Option; and Section 4.3.2.5 summarizes potential impacts to land use and ownership.

Section 3.3.2.1 describes the region of influence for land use and ownership.

4.3.2.1 Impact Assessment Methodology

Table 4-152 lists factors DOE considered to determine potential impacts to land use and ownership from project-related construction and operations activities.

Table 4-152. Impact assessment considerations for land use and ownership.

Land use	Potential for impact
General	Nonconformance with applicable general and regional plans and approved or adopted policies, goals, or operations of communities or governmental agencies
Private land	Change in current land use Displacement of existing, developing, or approved urban/industrial buildings or activities (residential, commercial, industrial, non-federal governmental, or institutional) Loss of ownership or title to private land
American Indian land	Conflict with existing land-use plans or cause incompatible land uses
Department of Defense land	Conflict with existing land-use plans or cause incompatible land uses
Livestock grazing lands	Loss of grazing land and associated animal unit months Alteration of livestock operations or disruption of livestock movement Change to the amount or distribution of existing stockwater sources Potential human disturbance to livestock (such as loss of livestock due to collisions with trains)
Mineral and energy resources	Potential to preclude mining operations or the extraction of oil, gas, and geothermal resources within the rail line construction right-of-way Disturbance to existing or proposed mining operations with an approved mining plan Potential to cause the collapse of active underground mines, tunnels, or shafts
Recreational areas and access to public or private lands	Potential disturbance to any land designated as recreational sites Potential alteration of routes for large, recurring organized off-highway vehicle events and races Restricted or altered access to any recreational sites or public land Restricted or altered access to private land
Utility and transportation corridors and rights-of-way	Interference with an existing or planned utility or transportation right-of-way Need for a new right-of-way within a BLM-designated right-of-way avoidance area, such as an Area of Critical Environmental Concern

DOE assessed potential impacts to land use and ownership along the rail line based on the width of the rail line construction right-of-way. The Union Pacific Railroad Hazen Branchline and Department of Defense Branchlines North and South are existing rail lines where there would be no new construction outside of the existing railroad right-of-way under the DOE Proposed Action. Therefore, there would be no changes to land use, ownership, or access associated with those segments.

For railroad construction and operations support facilities, this section describes potential impacts to land use and ownership in conjunction with each facility's nearest segment, based on the current land use at the site. Table 4-153 describes the required support facilities and the current land uses at their proposed locations. Chapter 2 describes the facilities and their locations in more detail.

Table 4-153. Land use associated with proposed construction and operations support facilities.

Facilities	Number of facilities under the Proposed Action[a,b]	Within the nominal width of the rail line construction right-of-way	Land ownership
Construction camps	Up to 10	Yes	BLM-administered public land and the Hawthorne Army Depot
Construction wells	Maximum: 74 well sites needed Area of disturbance for each well outside the construction right-of-way would be 1.4 acres	All but 9	Construction wells outside the nominal width of the construction right-of-way would be on BLM-administered public land and Walker River Paiute Reservation land
Quarries	Up to two needed out of five potential sites	No	All would be on BLM-administered public land except for the potential Garfield Hills quarry, which would be partially on the Hawthorne Army Depot
Staging Yard	One required Area of disturbance would be approximately 63 acres	No	BLM-administered public land and the Hawthorne Army Depot
Maintenance-of-Way Facility	One required	Yes	BLM-administered public land
Rail Equipment Maintenance Yard	Includes the Satellite Maintenance-of-Way Facility, possibly the Nevada Railroad Control Center and National Transportation Operations Center	No	DOE-managed land (Yucca Mountain Site)[c]
Cask Maintenance Facility	One This facility has three location options: (1) collocated with the Rail Equipment Maintenance Yard, (2) anywhere along the rail line outside the Yucca Mountain Site boundary, or (3) anywhere outside Nevada	No	For purposes of analysis, collocated with the Rail Equipment Maintenance Yard

a. To convert square feet to square meters, multiply by 0.092903.
b. To convert acres to square kilometers, multiply by 0.0040469.
c. DOE would implement the Proposed Action only after the proposed public land withdrawal for the Yucca Mountain Site was completed, when land ownership would be transferred to DOE.

Construction camps, some construction wells, and some facilities would lie within the nominal 300-meter (1,000-foot)-wide area that supports the construction of the rail line and service road. Where this occurs, these facilities are included in the analysis of their respective rail segment and are not addressed separately. However, just as rail segments are analyzed individually, facilities that are located outside the nominal construction footprint of the rail line, as shown in Table 4-153, are also individually addressed.

Although not all the well locations identified would be used for the project, for purposes of analysis and to conservatively estimate impacts to land use and ownership, DOE assumes that it would develop all the well locations outside the rail line construction right-of-way and footprints of the quarry sites.

4.3.2.2 Construction Impacts to Land Use and Ownership

Sections 4.3.2.2.1 through 4.3.2.2.8 discuss potential land-use impacts during the construction phase. Because potential impacts to land use would occur primarily from the presence of the rail line, the construction timeframe (which could range from 4 to 10 years) would have little effect on the resulting land-use impacts, other than to provide greater lead time to implement mitigation measures, establish land-use agreements, and revise ***grazing allotment*** permits where applicable. Therefore, DOE did not assess potential land-use impacts for different construction timeframes.

Table 4-154 provides an overview of the land ownership within the proposed construction right-of-way and locations of support facilities.

Table 4-154. Land ownership by common and alternative segments within the proposed construction right-of-way and facilities outside the construction right-of-way[a] (page 1 of 2).

Rail line segment or facility	Land ownership	Area (square kilometers)[b]	Area (acres)[b]
Staging Yard at Hawthorne	Public (BLM-administered)	0.25	63
	Hawthorne Army Depot	1.1	270
Construction camp 17	Hawthorne Army Depot	0.08	20
Schurz alternative segment 1	Walker River Paiute Reservation	3.5	850
	Public (BLM-administered)	0.53	130
Schurz alternative segment 4	Walker River Paiute Reservation	4.7	1,170
	Public (BLM-administered)	0.53	130
Schurz alternative segment 5	Walker River Paiute Reservation	5.0	1,240
	Public (BLM-administered)	2.0	490
Schurz alternative segment 6	Walker River Paiute Reservation	5.3	1,320
	Public (BLM-administered)	2.0	490
Mina common segment 1	Private	0.21	53
	Hawthorne Army Depot	3.45	860
	Public (BLM-administered)	30	7,403
Montezuma alternative segment 1	Public (BLM-administered)	36	8,760
Montezuma alternative segment 2	Private	0.59	145
	Public (BLM-administered)	34	8,420

Table 4-154. Land ownership by common or alternative segment within the proposed construction right-of-way and facilities outside the construction right-of-way[a] (page 2 of 2).

Rail line segment or facility	Land ownership	Area (square kilometers)[b]	Area (acres)[b]
Montezuma alternative segment 3	Private	0.1	24
	Public (BLM-administered)	42	10,460
Mina common segment 2	Public (BLM-administered)	1.1	260
Bonnie Claire alternative segment 2	Public (BLM-administered)	6.1	1,520
Bonnie Claire alternative segment 2	Public (BLM-administered)	6.1	1,500
Common segment 5	Public (BLM-administered)	12	2,950
Oasis Valley alternative segment 1	Private	0.004	0.9
	Public (BLM-administered)	2.9	720
Oasis Valley alternative segment 3	Public (BLM-administered)	4.4	1,070
Common segment 6	Public (BLM-administered)	12	2,880
	Public (DOE)	4.1	1,020

a. Source: DIRS 185440-BSC 2008, all.
b. Land area values are rounded to two significant figures, except for values over 1,000, which are rounded to the nearest 10.

4.3.2.2.1 Private Land

4.3.2.2.1.1 County and Local Land-Use Plans. In general, DOE developed the Mina rail alignment to avoid private land. There would be no land-use conflicts in terms of county land use, projects, or planning.

- *Nye County Comprehensive Plan* (DIRS 147994-McRae 1994, all)

  This plan addresses the proposed Yucca Mountain Repository and states that the repository could affect the county's future economy and the quality of life of its residents. The plan does not address the proposed railroad. However, DOE has determined that a rail line along the Mina rail alignment would not substantially alter current land uses or impact future land-use plans in Nye County.

- *Esmeralda County Master Plan* (DIRS 176770-Duval et. al. 1976, all)

  This plan predates plans for a repository at Yucca Mountain; therefore, it does not address the project. The plan states that the county must be consulted on all proposed federal projects. DOE continues to consult with Esmeralda County on the Proposed Action. DOE has determined that a rail line along the Mina rail alignment would not substantially alter current land uses or impact future land-use plans in Esmeralda County. The only private land that would be impacted within an established town in Esmeralda County would be along Montezuma alternative segment 2 near Goldfield.

Although there is no zoning designation in the community of Goldfield, the designation of its historic district is a consideration for determining potential adverse impacts to land use. The historic district would be approximately 0.6 kilometer (0.4 mile) from the Montezuma alternative segment 2 construction right-of-way. Goldfield has been historically linked with both mining and railroad activity. Therefore, a new rail line adjacent to the town would not be a wholly incompatible feature with its historic characteristics. The BLM, DOE, and the Surface Transportation Board (STB) signed a programmatic agreement regarding the Yucca Mountain rail alignment project with the Nevada State Historic Preservation Office on April 17, 2006, to formalize the consultation process (DIRS 176912-Wenker et. al. 2006, all). As for any other potential cultural resources along the rail alignment, DOE would consult with the State Historic Preservation Office to determine potential impacts and possible mitigation measures (see discussion in Section 4.3.13, Cultural Resources).

4.3.2.2.1.2 Private Parcels. DOE would need to gain access to private land that falls within the Mina rail alignment construction right-of-way and the locations of support facilities. Segments that would cross private lands include Mina common segment 1, Montezuma alternative segments 2 and 3, and Oasis Valley alternative segment 1. None of the other segments would cross private land. Table 4-155 lists private lands the Mina rail alignment could affect. No residences or other privately owned structures would lie within the Mina rail alignment construction right-of-way.

Table 4-155. Uses of private land along the Mina rail alignment.

Segment and land use	Number of parcels within the construction right-of-way	Area of parcels within the construction right-of-way (acres)[a]
Mina common segment 1		
Vacant	1	53
Montezuma alternative segment 2		
Vacant	28	44
Residential	1	0.12
Commercial	1	0.02
Utilities	4	2.4
Patented mining claims[b]	At least 2	99
Montezuma alternative segment 3		
Vacant	1	24
Oasis Valley alternative segment 1		
Commercial	2	0.9

a. To convert acres to square meters, multiply by 4046.9.
b. Geographic information system files for patented mining claims indicate the overall areal extent of these claims, although individual claim boundaries are not drawn. Therefore, this table reflects the geographically distinct areas of patented mining claims instead of the actual number of individual claims intersected by the construction right-of-way.

Mina common segment 1 would cross approximately 0.21 square kilometer (53 acres) of private land (Figure 3-138) just east of the Hawthorne Army Depot. DOE would need to gain access to this land.

Montezuma alternative segments 2 and 3 would cross 0.1 square kilometer (24 acres) of private vacant land at Millers (Figure 3-140). DOE would need to gain access to this land, which would cause a change of land use.

Montezuma alternative segment 2 would pass to the immediate west and south of the community of Goldfield, which is clustered along U.S. Highway 95. The Montezuma alternative segment 2 construction right-of-way would intersect 34 privately owned parcels with at least 20 individual landowners plus at least two areas containing patented ***mining claims*** (0.24 square kilometer [145 acres]) (see Table 4-154 and Figure 3-140). Esmeralda County owns 12 of the 36 parcels, and the Nevada Department of Highways owns one parcel (while state and county entities own 13 parcels, they are non-federal lands and still considered private land in this Rail Alignment EIS). If DOE selected Montezuma alternative segment 2, DOE would gain access to portions of privately owned land, resulting in changes of land use.

The Oasis Valley alternative segment 1 construction right-of-way would cross two parcels owned by a cattle company (see Figure 3-143), impacting 0.004 square kilometer (0.9 acre) of land. DOE would need to gain access to this land, causing a change to land use.

4.3.2.2.2 American Indian Land

4.3.2.2.2.1 Walker River Paiute Reservation. There are no land-use plans for the Walker River Paiute Reservation. However, DOE developed the Schurz alternative segments in consultation with the Tribe to avoid Schurz and other populated areas on the Reservation.

While the nominal width of the construction right-of-way for most of the Mina rail alignment is 300 meters (1,000 feet), DOE has reduced the proposed width along the Schurz alternative segments to 61 meters (200 feet) to minimize disturbance to the Reservation. The construction right-of-way of the Schurz alternative segments would occupy between 3.5 and 5.3 square kilometers (850 and 1,300 acres) of land on the Reservation. This represents a very small area in relation to the entire Reservation, ranging from 0.3 and 0.5 percent of the land area. Because most of the Reservation is rangeland, the rail line could cause a small reduction of land available for grazing and farming. There would also be construction well sites located outside the construction right-of-way on Reservation land: one along Schurz alternative segments 4 and 5, or two along Schurz alternative segment 6. Each well would disturb an additional 5,800 square meters (1.4 acres) of land.

DOE developed the Schurz alternative segments to comply with the Walker River Paiute Tribe's wish to ultimately remove the Department of Defense Branchline through Schurz, which runs directly through Schurz, where most of the Tribe resides. The Tribe based this request on safety concerns related to the current rail shipments of Army munitions through their town. Therefore, as part of the Mina rail alignment, DOE would remove the Department of Defense Branchline through Schurz once the selected Schurz alternative segment was constructed. Removal of the existing rail line would provide a perceived benefit to the town's existing residential land uses and the remaining rail roadbed could become a recreational trail for the Walker River Paiute Tribe.

In April 2007, the Walker River Paiute Tribal Council passed a resolution removing the Tribe from the DOE EIS process and will not allow ***nuclear waste*** to be transported by rail through the Reservation.

If the Mina rail alignment was selected, DOE would seek to obtain a right-of-way across the Reservation in accordance with 25 CFR 169 (Bureau of Indian Affairs, Department of Interior, Part 169, Right of Way Over Indian Lands), the provisions of which restrict the width of new rights-of-way to 30 meters (9100 feet). Under this regulation (169.3(a)), "No right-of-way shall be granted over and across any tribal land, nor shall any permission to survey be issued with respect to any such lands, without the prior written consent of the tribe."

4.3.2.2.2.2 Timbisha Shoshone Trust Lands. During the scoping period for this Rail Alignment EIS in 2004, DOE received comments from the Western Shoshone Nation indicating that a rail line crossing Timbisha Shoshone Trust Lands would be incompatible with current and planned land uses. The opposition was based, in part, on treaty issues involving land in the vicinity of the Caliente rail alignment (see Section 3.4). The Department subsequently eliminated Bonnie Claire alternative segment 1, which would have crossed onto Timbisha Shoshone Trust Lands, from analysis in this Rail Alignment EIS.

4.3.2.2.3 BLM-Administered Public Land

4.3.2.2.3.1 Consistency with BLM Resource Management Plans. Some portions of the Mina rail alignment would cross federal land the BLM has identified for potential disposal (sale). The ***withdrawal*** of these lands along the rail alignment for other federal use would take precedence over potential land disposals. While this federal use would not pose a conflict with BLM ***resource management plans***, the community or public would lose the ability to use affected land for future economic or private development.

- *Carson City Field Office, Consolidated Resource Management Plan* (Carson City Consolidated Resource Management Plan; DIRS 179560-BLM 2001, all)

  The northernmost segments of the Mina rail alignment (the Union Pacific Railroad Hazen Branchline, Department of Defense Branchline North, the Schurz alternative segments, Department of Defense Branchline South, and most of Mina common segment 1) would pass through ***public lands*** covered by the Carson City Consolidated Resource Management Plan. Under that plan, future right-of-way corridors will be evaluated on a case-by-case basis, but should be as consistent as possible with the Western Regional Corridor Study and existing roads and trails should be used whenever possible during construction. The Mina rail alignment would be collocated with existing powerline rights-of-way near U.S. Highway 95 and would also generally follow the former Tonopah and Tidewater railroad route. The Mina rail alignment would not cross any right-of-way avoidance areas. The rail line right-of-way would conform to (be less wide than) the plan's 3-kilometer (2-mile) corridor width criteria. Therefore, the Mina rail alignment would not conflict with Carson City Consolidated Resource Management Plan right-of-way provisions. Mina common segment 1 would intersect the western edge of land disposal areas near Mina and Sodaville. Because DOE has withdrawn the land for study and there are no active disposal actions underway, this rail segment would not conflict with the land disposal provisions of the Carson City Consolidated Resource Management Plan. New segments would cross several grazing allotments in the Carson District. Therefore, if DOE selects the Mina rail alignment, the BLM would need to adjust applicable livestock permits to reflect decreases in public land forage available in accordance with the resource management plan.

- *Tonopah Resource Management Plan and* ***Record of Decision*** (Tonopah Resource Management Plan; DIRS 173224-BLM 1997, all)

  The Tonopah Resource Management Plan designates 1,075 kilometers (668 miles) for transportation and utility corridors (DIRS 173224-BLM 1997, p. 2). It also allows rights-of-way on more than 600 square kilometers (149,000 acres) if the land use is compatible with existing land values. The Tonopah Resource Management Plan identifies areas for potential disposal at Coaldale Junction, Blair Junction, Silver Peak, Millers, Goldfield, Scottys Junction, and Beatty. The plan does not specifically address the portions of land released from withdrawal in 1999 adjacent to (on the western border of) the Nevada Test and Training Range. Because withdrawal for other federal use has precedence over potential land disposals, there would be no conflict with the Tonopah Resource Management Plan. The rail corridor would be much narrower than and be in conformance with the 5-kilometer (3-mile) width criteria for corridors outlined in the Tonopah Resource Management Plan.

- *Record of Decision for the Approved Las Vegas Resource Management Plan and Final Environmental Impact Statement* (Las Vegas Resource Management Plan; DIRS 176043-BLM 1998, all)

  The Las Vegas Resource Management Plan designates corridors within its planning area to avoid ***Areas of Critical Environmental Concern***. The proposed rail alignment would not pass through or near any right-of-way avoidance areas, such as Areas of Critical Environmental Concern. The portion of the rail alignment (common segment 6) that would pass through this district would be on land for which DOE already has a temporary right-of-way and is slated for future land withdrawal for the Yucca Mountain Project. Therefore, there would be no conflict with the Las Vegas Resource Management Plan.

BLM-administered lands encompassing the Mina rail alignment have been withdrawn from surface and mineral entry to avoid land-use conflicts in the near term (70 *FR* 76854, December 28, 2005). Furthermore, this withdrawal takes precedence over potential land disposals that might be planned in and around the rail alignment. Under the terms of the BLM land-disposal policy, identification of the lands for another federal purpose, such as the proposed railroad, would disqualify the land for disposal for other uses. Therefore, there would be no conflict with BLM land-use plans or policies.

4.3.2.2.3.2 Construction Impacts to BLM Grazing Allotments. Construction of the rail line and support facilities would result in surface disturbances across up to 12 active grazing allotments. To characterize this impact, DOE quantified the potential loss in ***animal unit months*** associated with this disturbance for each active grazing allotment crossed by each rail segment.

In order to calculate potential loss of animal unit months, DOE evaluated the proportion of land within each grazing allotment that would fall within the footprints of the rail line construction right-of-way and support facilities. For this analysis, DOE assumed that the entire land area within the rail line construction right-of-way would be unavailable for forage and would no longer support grazing. The Department did not consider site-specific allotment characteristics. In fact, this calculation method assumes that there is uniform forage distribution across the entire allotment, which would be unlikely. Because the proposed rail line would generally follow flatter terrain, such as valley floors (due to grade limitations of the railroad), the rail alignment would likely transect those areas that typically sustain a greater proportion of high-quality forage. Furthermore, where the rail line would bisect allotments or isolate portions of allotments or pastures, additional land and possibly water features such as springs may be inaccessible for grazing and there could be substantially greater losses of animal unit months unless mitigation measures are employed. The BLM would work with affected permittees to develop Interim Grazing Management Plans and revise their allotment management plans to address impacts of the rail alignment. The BLM would determine actual loss of animal unit months for each affected allotment, based on these interim and revised plans, in association with the issuance of a ***right-of-way grant***.

Chapter 7, Best Management Practices and Mitigation, describes measures DOE, in consultion with the BLM, would use to minimize or compensate for the loss of animal unit months. The goal of the measures described in Chapter 7 would be to reduce impacts to both grazing operations and existing range improvements. Mitigation measures could include:

- Relocating existing infrastructure and water sources
- Providing temporary feed, water, and assistance in cattle movement during rail line construction
- The construction of culverts, bridges, and cattle guards to facilitate or prevent the movement of livestock

The presence of a rail line could require livestock on some allotments to adjust to new routes to access water and forage. Generally, livestock could adapt to these new routes and should be able to cross the rail line in most areas. The revised allotment management plans developed by the BLM and the affected permittees would be designed to address forage and water accessibility problems introduced by the presence of the railline. The railroad could result in impacts to ranching operations in that livestock may be struck by passing trains. DOE would provide mitigation to reduce the likelihood of livestock collisions through measures such as relocating stockwater sources further from the rail line and preventing the ponding of water near the rail line. These measures would be site-specific, determined through coordination with permittees and the BLM. DOE or the commercial operator (under the Shared-Use Option) would reimburse ranchers for such livestock losses due to train strikes, as per Nevada law. The rail line would also intersect existing fences on active grazing allotments. DOE would coordinate with permittees and the BLM when determining a fencing plan to promote livestock safety and management while considering the need to prevent the segmenting of wildlife habitat. For allotments that are divided into pastures that would be bisected by the rail line, permittees may choose to alter pasture boundaries to coincide with the rail line under revised allotment management plans. If this approach was taken, it would necessitate the removal of old pasture fences and the installation of miles of new fence along the rail line. DOE would provide mitigation in the form of compensation or range improvements as described in Chapter 7, Best Management Practices and Mitigation.

The Mina rail alignment would cross one stockwater pipeline on an active grazing allotment (Mina common segment 1 crossing of the Pilot-Table Mountain Allotment) and one or more on the inactive

Montezuma Allotment. During the construction phase, the Department would sleeve these pipelines within a casing pipe under the rail roadbed to protect them and keep them operational. The casing pipe would be capable of withstanding the load of the roadbed, track, and rail traffic. DOE would also ensure that permittees retained access to pipelines and other range improvements within the rail line right-of-way for maintenance activities.

It is important to note that DOE collected information on range improvements (pipelines and fences) based on BLM records in November 2004 (DIRS 185440-BSC 2008, all). Therefore, there could be range improvements authorized on allotments since that time that are not reflected in this Rail Alignment EIS. Similarly, DOE did not include the locations of troughs, tanks, corrals, and other range infrastructure in the geographic information system baseline dataset. Therefore, DOE would coordinate with the BLM and allotment permittees to verify the location of potentially affected range improvements prior to construction. The mitigation measures and best management practices outlined in Chapter 7 would apply to all affected improvements, including those that were not specifically addressed in this Rail Alignment EIS.

There would also be a number of new construction wells on grazing allotments outside the construction right-of-way. The well footprints would be small (approximately 0.0057 square kilometer [1.4 acres] each) and would not affect grazing patterns except for the presence of human activity during the construction phase.

Union Pacific Railroad Hazen Branchline and Department of Defense Branchline North
DOE would use the existing rail line along the Union Pacific Railroad Hazen Branchline and the Department of Defense Branchline North. Because there would be no new construction outside of the existing right-of-way, there would be no impacts to the use of the land for grazing along these segments, although increased train traffic along these lines could increase the possibility of livestock being struck by trains.

Schurz Alternative Segments The Schurz alternative segments would begin within the Parker Butte Allotment (see Figure 3-145). However, most of the length of these segments would be on the Walker River Paiute Reservation. Although information on current grazing operations on the Reservation is not available, years of drought have put farming and ranching on hold (DIRS 180701-NAIHC 2004, p. 30). Therefore, impacts to grazing land from the Schurz alternative segments would be small.

Department of Defense Branchline South DOE would use existing rail line along Department of Defense Branchline South. Because there would be no new construction outside of the existing right-of-way, there would be no impacts to the use of the land for grazing along these segments, although increased train traffic along these lines could increase the possibility of livestock being struck by trains.

Mina Common Segment 1 Mina common segment 1 would pass through three active grazing allotments (Pilot-Table Mountain, Bellville, and Monte Cristo) and one closed grazing allotment (Columbus Salt Marsh) (see Figures 3-147 and 3-148). DOE estimates that this segment could reduce animal unit months across all the active allotments by 102. Table 4-156 lists reductions in animal unit months per grazing allotment. There could be one construction well outside the Mina common segment 1 construction right-of-way that would disturb an additional 0.0057 square kilometer (1.4 acres) of land on the Columbus Salt Marsh Allotment. The land disturbance for this well would not impact grazing operations because the Columbus Salt Marsh Allotment is inactive.

There are two potential quarry sites along Mina common segment 1. The potential Garfield Hills quarry would impact both the Garfield Flat and Pilot-Table Mountain Allotments, reducing their animal unit months by 4 and 1, respectively. The potential Gabbs Range quarry would impact the Pilot-Table Mountain Allotment, reducing its animal unit months by 4 (see Table 4-156).

Table 4-156. Potential loss of animal unit months associated with Mina common segment 1.

Allotment	Construction right-of-way area or impact area (acres)[a]	Current animal unit months (maximum) and allotment area[b,c]	Potential loss of animal unit months (as a direct correlation with land area removed)	Percent loss of animal unit months
Pilot-Table Mountain	4,540	7,900 on 512,400 acres	70	0.9
Bellville	220	303 on 154,500 acres	1	0.3
Monte Cristo	1,570	9,352 on 469,000 acres	31	0.3
Totals	6,330	17,555 animal unit months	102	0.6
Garfield Flat (potential Garfield Hills quarry)	320	3,516 on 218,800 acres	5	0.1
Pilot-Table Mountain (potential Gabbs Range quarry)	240	7,900 on 512,400 acres	4	0.1

a. Source: Refer to Table 3-85 for source information.
b. To convert acres to square kilometers, multiply by 0.0040469.
c. Land area values are rounded to two significant figures except for allotment areas over 1,000 acres, which are rounded to the nearest 10.

Montezuma Alternative Segment 1 Montezuma alternative segment 1 would pass through the Columbus Salt Marsh, Silver Peak, Sheep Mountain, Yellow Hills, Montezuma, and Magruder Mountain Allotments (see Figures 3-148 and 3-149). All but Columbus Salt Marsh and Montezuma are active allotments. This segment would pass through the West Pasture of the Montezuma Allotment (near the Yellow Hills Allotment). At present, there is one temporary grazing permit (1 year for 600 animal unit months) for the West Pasture, but that permit will expire in March 2008. DOE estimates that this alternative segment could reduce animal unit months across all the active allotments by 43. See Table 4-157 for reductions in animal unit months per grazing allotment.

Table 4-157. Potential loss of animal unit months associated with Montezuma alternative segment 1.

Allotment	Construction right-of-way area or impact area (acres)[a]	Current animal unit months (maximum) and allotment area[b,c]	Potential loss of animal unit months (as a direct correlation with land area removed)	Percent loss of animal unit months
Silver Peak	2,000	436 on 352,600 acres	3	0.7
Sheep Mountain	460	1,740 on 88,400 acres	9	0.5
Yellow Hills	1,190	1,212 on 62,200 acres	23	1.9
Magruder Mountain	860	6,300 on 660,200 acres	8	0.1
Totals	4,510	9,688 animal unit months	43	0.4

a. Source: Refer to Table 3-85 for source information.
b. To convert acres to square kilometers, multiply by 0.0040469.
c. Land area values are rounded to two significant figures except for allotment areas over 1,000 acres, which are rounded to the nearest 10.

There are two potential quarry sites along Montezuma alternative segment 1: North Clayton and Malpais Mesa. Both would be on the inactive Montezuma Allotment and neither would have an impact on grazing operations.

Montezuma Alternative Segment 2 Montezuma alternative segment 2 would pass through the Columbus Salt Marsh, Monte Cristo, and Montezuma Allotments (see Figures 3-148 and 3-149). Only the Monte Cristo Allotment is active. DOE estimates that Montezuma alternative segment 2 could reduce animal unit months within the Monte Cristo Allotment by 51 (see Table 4-158).

Table 4-158. Potential loss of animal unit months associated with Montezuma alternative segment 2.

Allotment	Construction right-of-way area or impact area (acres)[a]	Current animal unit months (maximum) and allotment area[b,c]	Potential loss of animal unit months (as a direct correlation with land area removed)	Percent loss of animal unit months
Monte Cristo	2,570	9,352 on 469,000 acres	51	0.5
Montezuma (potential ES-7 quarry)	360	None		

a. Source: Refer to Table 3-85 for source information.
b. To convert acres to square kilometers, multiply by 0.0040469.
c. Land area values are rounded to two significant figures except for allotment areas over 1,000 acres, which are rounded to the nearest 10.

There is one potential 1.5 square kilometer (360 acre) quarry site along the alternative segment, ES-7, which would be on the inactive Montezuma Allotment and would not have an affect on grazing operations.

Montezuma Alternative Segment 3 Montezuma alternative segment 3 would pass through the Columbus Salt Marsh, Monte Cristo, Montezuma, and Magruder Mountain Allotments (see Figures 3-148 and 3-149). Only the Monte Cristo and Magruder Mountain Allotment are active. This segment would pass through the West Pasture of the Montezuma Allotment (near the Yellow Hills Allotment). At present, there is one temporary grazing permit (1 year for 600 animal unit months) for the West Pasture, but that permit will expire in March 2008. DOE estimates that this alternative segment could reduce animal unit months in the affected grazing allotments by 59 (see Table 4-159).

Table 4-159. Potential loss of animal unit months associated with Montezuma alternative segment 3.

Allotment	Construction right-of-way area or impact area (acres)[a]	Current animal unit months (maximum) and allotment area[b,c]	Potential loss of animal unit months (as a direct correlation with land area removed)	Percent loss of animal unit months
Monte Cristo	2,570	9,352 on 469,000 acres	51	0.5
Magruder Mountain	860	6,300 on 660,200 acres	8	0.1
Totals	3,430	15,652 animal unit months	59	0.4
Montezuma (potential North Clayton quarry)	440	None		
Montezuma (potential Malpais Mesa quarry)	650	None		

a. Source: Refer to Table 3-85 for source information.
b. To convert acres to square kilometers, multiply by 0.0040469.
c. Land area values are rounded to two significant figures except for allotment areas over 1,000 acres, which are rounded to the nearest 10.

There are two potential quarry sites along the Montezuma alternative segment 3: North Clayton and Malpais Mesa. Both would be on the inactive Montezuma Allotment and neither would have an impact on grazing operations.

Mina Common Segment 2 Mina common segment 2 would cross a narrow stretch of the inactive Montezuma Allotment west of the Nevada Test and Training Range and east of the Magruder Mountain Allotment (see Figure 3-150). Because the Montezuma Allotment is inactive, there would be no impacts to grazing activities or stockwater resources during rail line construction along this segment.

Bonnie Claire Alternative Segments The Bonnie Claire alternative segments would cross a narrow stretch of the inactive Montezuma Allotment west of the Nevada Test and Training Range and east of the Magruder Mountain Allotment (see Figure 3-150). Because the Montezuma Allotment is inactive, there would be no impacts to grazing activities or stockwater resources during rail line construction along either of the Bonnie Claire alternative segments.

Common Segment 5 (Sarcobatus Flat Area) Common segment 5 would pass through the southern portion of the inactive Montezuma Allotment near the southwestern boundary of the Nevada Test and Training Range (see Figures 3-150 and 3-151). Because the Montezuma Allotment is inactive, rail line construction along common segment 5 would not impact grazing activities or stockwater resources.

Oasis Valley Alternative Segments The Oasis Valley alternative segments would cross the inactive Montezuma Allotment and the active Razorback Allotment (see Figure 3-151). The Razorback Allotment has one permittee. Oasis Valley alternative segment 1 would pass near the northeastern corner of the small Springdale 2 Allotment, but the construction right-of-way would not fall within the allotment. There are no stockwater features within the construction right-of-way of either of the Oasis Valley alternative segments.

Oasis Valley alternative segments 1 and 3 could result in the loss of 8 or 13 animal unit months, respectively, within the Razorback Allotment (see Table 4-160).

Table 4-160. Potential loss of animal unit months associated with the Oasis Valley alternative segments.

Alternative segment/allotment	Construction right-of-way area or impact area (acres)[a]	Current animal unit months (maximum) and allotment area[b,c]	Potential loss of animal unit months (as a direct correlation with land area removed)	Percent loss of animal unit months
Oasis Valley 1 – Razorback	590	959 animal unit months on 72,880 acres	8	0.8
Oasis Valley 3 – Razorback	940	959 animal unit months on 72,880 acres	12	1.3

a. Source: DIRS 173224-BLM 1997, p. A-14.
b. To convert acres to square kilometers, multiply by 0.0040469.
c. Land area values are rounded to two significant figures, except for allotment areas over 1,000 acres, which are rounded to the nearest 10.

Common Segment 6 (Yucca Mountain Approach) Common segment 6 would cross a corner of the inactive Montezuma Allotment near the beginning of the common segment. At present, there are no permittees on this allotment (DIRS 176942-Metscher 2006, all). Common segment 6 would also pass through the Razorback Allotment (see Figure 3-151) and encompass approximately 5.3 square kilometers (1,320 acres) of the allotment. This would correspond to a potential loss of 17 animal unit months (1.8 percent loss of the grazing allotment) (see Table 4-161).

Table 4-161. Potential loss of animal unit months associated with common segment 6.

Allotment	Construction right-of-way area or impact area (acres)[a,b]	Current animal unit months (maximum) and allotment area	Potential loss of animal unit months (as a direct correlation with land area removed)	Percent loss of animal unit months
Razorback	1,320 acres	959 animal unit months on 72,880 acres	17	1.8

a. Source: DIRS 173224-BLM 1997, p. A-14.
b. To convert acres to square kilometers, multiply by 0.0040469.

4.3.2.2.4 Department of Defense-Managed Land

The Mina rail alignment would use portions of the existing Department of Defense Branchlines and DOE would construct a new rail line across the Hawthorne Army Depot (Mina common segment 1). The Staging Yard would also be on the Depot. All new construction would occur within the active military area, near existing rail lines. The Army has concurred with the proposed location of the Mina rail line and facilities. One land-use compatibility concern would be meeting the Explosive Quantity Safety Distance between the ammunition storage areas and Army rail line to the planned Staging Yard, which would be occupied by personnel. Section 4.3.10, Occupational and Public Health and Safety, addresses these safety aspects.

The Department of Defense provided comments during the first scoping period for this Rail Alignment EIS in 2004, which resulted in DOE modifying Bonnie Claire alternative segment 2 and proposing Bonnie Claire alternative segment 3 as a new alternative segment to avoid crossing the Nevada Test and Training Range. These rail segment changes were carried through for the Mina rail alignment when it was added as an alternative. Specifically, the Air Force commented that the earlier proposed rail segments were "within the weapons safety footprint for test and training munitions" and that the rail line would "impinge on Range testing and training activities."

The closest segment to the Range would be Bonnie Claire alternative segment 2, the centerline of which would be approximately 100 meters (330 feet) from the Range boundary. The construction right-of-way for this segment has been reduced to specifically avoid entering Range land. Other segments closest to the Range and the distances of the edge of the construction right-of-way from the boundary include Montezuma alternative segment 2 (200 meters [660 feet]), common segment 5 (560 meters [1,800 feet]), and Oasis Valley alternative segment 3 (280 meters [920 feet]). While the Mina rail alignment would not directly affect land use on the Nevada Test and Training Range, portions of the Bonnie Claire alternative segment 2 and common segment 5 would cross land formerly within the western border of the Range. The land released by the Range now falls under the BLM Tonopah planning area. Portions of the rail line (common segment 5 and common segment 6) would be beneath restricted air space associated with the Range. However, testing and training activities within the restricted air spaces would generally not exceed the western boundary of the range and the Department of Defense would institute controls so that activities within related air spaces would not pose harm to the rail line. The proposed railroad would not interfere with Range activities and would not conflict with the Range's Resource and Management Plan.

4.3.2.2.5 DOE-Managed Land

The Rail Equipment Maintenance Yard, Cask Maintenance Facility, and a portion of common segment 6 would be within the Yucca Mountain Site boundary. These proposed maintenance facilities would be on land that is currently part of the Nevada Test Site, and used for Yucca Mountain Project characterization. Because the proposed railroad project would proceed only after control of the proposed Yucca Mountain Site was transferred to DOE, the Rail Equipment Maintenance Yard and Cask Maintenance Facility and portions of common segment 6 proposed within the Yucca Mountain Site boundary would not conflict with future land uses on the Nevada Test Site.

4.3.2.2.6 Construction Impacts to Mineral and Energy Resources (Public and Private Land)

Because of the relatively high mineral and energy potential of lands along the Mina rail alignment, DOE evaluated the potential impacts to these resources. Rail line construction would require that DOE gain access to lands that contain patented or ***unpatented mining claims*** or have active energy leases (oil, gas, or geothermal). Rail line construction would also require substantial quantities of ballast and subballast that would be obtained from existing or new quarry and borrow sites (see Sections 2.2.2.4.2 and

2.2.2.4.3). Section 4.2.11, Utilities, Energy, and Materials, describes the impact of the removal of material from the proposed quarries and ballast sites based on regional material availability.

For the Mina rail alignment, DOE would obtain subballast from one (or more) of four sources: by utilizing waste rock generated by ballast quarry sites; from materials excavated during rail roadbed construction; from existing borrow sites along the rail alignment; or from the development of new subballast borrow sites along the rail alignement. New subballast borrow sites would be located approximately every 16 to 32 kilometers (10 to 20 miles) along the rail alignment, which would result in the development of approximately 15 to 30 new sites. Possible borrow site locations include areas adjacent to existing Nevada Department of Transportation material sites. There are 55 of these material source areas along the Mina rail alignment. Figure 2-33a illustrates potential existing and new subballast borrow sites along the Mina rail alignment. To develop sand and gravel borrow sites, DOE would need a ***free-use permit*** from the BLM to use common varieties of sand, stone, and gravel from BLM-administered public lands during the construction phase, pursuant to the regulations implementing the Materials Act of 1947 (30 U.S.C. 601 through 603) as codified in 43 CFR Part 3600. The location of new borrow sites would be coordinated with the BLM to minimize impacts to existing and future public land uses and conform to applicable resource management plans. DOE would follow BLM permit stipulations for these material sites and follow best management practices to control fugitive dust, limit the spread of noxious weeds, and protect wildlife and cultural resources. Reclamation activities at these sites would include grading, as well as permanent dust abatement and control.

The land encompassing the Mina rail corridor was withdrawn through a ***public land order*** (see Chapter 1) from surface and mineral entry through December 2015 so DOE could evaluate the land for the possible location of a rail line. If the BLM granted DOE a right-of-way for the rail line before the public land orders expire, then surface and mineral entry prohibitions would be removed from lands not part of the right-of-way. Therefore, the BLM could issue new unpatented mining claims and energy leases on lands near the rail line during the construction and operations phases of the project. While the presence of the line would not necessarily preclude non-surface resource extraction activities, the applicant would be required to work closely with the BLM and DOE to ensure they would not interfere with the safe operation of the railroad. Engineering solutions for the safe extraction of mineral and energy resources near or beneath the rail line could include directional (lateral) drilling of wells or ensuring all mining shafts or tunnels were sufficiently deep and reinforced to prevent subsidence.

4.3.2.2.6.1 Union Pacific Railroad Hazen Branchline and Department of Defense Branchline North. DOE would use the existing rail line along the Union Pacific Railroad Hazen Branchline and the Department of Defense Branchline North. Because there would be no new construction outside of the existing right-of-way, there would be no land-use impacts to mineral or energy resources along these segments.

4.3.2.2.6.2 Schurz Alternative Segments. The Schurz alternative segments would cross one or more mining districts. However, none of the districts (Calico Hills, Double Springs Marsh, Buckley, Benway, or Holy Cross) have active mining operations (see Figure 3-153). There are no patented or unpatented mining claims within the construction right-of-way of these segments. There are also no active geothermal, oil, or gas leases near the Schurz alternative segments. Therefore, there would be no land-use impacts to mineral or energy resources along these segments.

4.3.2.2.6.3 Department of Defense Branchline South. DOE would use the existing rail line along the Department of Defense Branchline South. Because there would be no new construction outside of the existing right-of-way, there would be no land-use impacts to mineral or energy resources along this segment.

4.3.2.2.6.4 Mina Common Segment 1. Mina common segment 1 would cross six mining districts, although only two of these have active mining or claims that would be impacted by the rail line (see Figures 3-154 through 3-156). The segment would bisect active mining claims in the New York Canyon area east of Luning and cross the Redlich claim block in the northern part of the Rock Hill District. Overall, the Mina common segment 1 construction right-of-way would intersect 20 sections that contain up to 355 unpatented mining claims. Because data on unpatented mining claims are provided by Township and Range Section, the actual number of mining claims within the construction right-of-way would likely be much less. DOE would negotiate surface rights across affected unpatented mining claims with the claim holders.

There are no active oil and gas leases within Mina common segment 1 construction right-of-way. However, it would cross the northeasternmost section of a geothermal lease block (Figure 3-155).

4.3.2.2.6.5 Montezuma Alternative Segments.

Montezuma Alternative Segment 1 Montezuma alternative segment 1 would cross the southwestern portion of Silver Peak Marsh Mining District where production of lithium is ongoing. This alternative segment would cross the Montezuma Mining District but would not intersect historically mined areas near Montezuma, Nevada. It would also cross the northeastern portion of the Cuprite Mining District where there is evidence of recent mining claims and trenching and drilling. Although there are no patented mining claims within the construction right-of-way, there are 17 sections containing up to 94 unpatented mining claims that intersect the construction right-of-way. These include one section southwest of the Alum Mining District; four sections on the western edge of the Silver Peak Marsh Mining District; seven sections south of the Montezuma Mining District; and five sections along U.S. Highway 95 near the Cuprite Mining District. Montezuma alternative segment 1 would cross several geothermal leases near the Alum Mining District and Silver Peak Marsh Mining District (see Figures 3-156 and 3-157).

Montezuma Alternative Segment 2 Montezuma alternative segment 2 would cross the Goldfield and Stonewall Mining Districts. Most of the mining in the Goldfield district occurs to the east of Montezuma alternative segment 2, although the segment's construction right-of-way would intersect four patented mining claims within the district. At present, there is exploration in the Stonewall Mining District 5 kilometers (3 miles) east of the alternative segment. The construction right-of-way would intersect 24 sections containing up to 362 unpatented mining claims. Two of the sections are approximately 10 kilometers (6 miles) east-northeast of Blair Junction. Four sections are approximately 6 to 8 kilometers (4 to 5 miles) north of Goldfield, and one section is to the west of the Stonewall Mining District. The proposed mining activities by Metallic Ventures Gold, Inc., for the Gemfield deposit, if they occur, could pose a direct conflict with the Montezuma alternative segment 2 route. Under Phase 2 of this project, Metallic Ventures Gold would relocate U.S. Highway 95 to the west, which would similarly necessitate DOE to relocate its rail line further west on public land. While there could be a direct land-use conflict, DOE would be prepared to revise its right-of-way application and move its rail line infrastructure to the degree necessary to accommodate this mineral exploration. The land section to the immediate west is public land, within the inactive Montezuma Grazing Allotment, that does contain some unpatented mining claims. Subsequently, DOE would need to review nearby mining claims to develop a revised route to minimize impacts to active mining. DOE would also employ mitigation and avoidance strategies as discussed in Chapter 7, Best Management Practices and Mitigation. There is apparently adequate area to move the alignment to the vacant public land west of the current alignment. The vacant public land to the west has favorable topography (DIRS 185098-Gehner 2008, p. 2). There are no geothermal or energy leases along this alternative segment, although there are geothermal occurrences near the segment in the vicinity of Ralston (see Figure 3-157).

Montezuma Alternative Segment 3 Montezuma alternative segment 3 would cross the Montezuma and Cuprite Mining Districts. The segment would be well north of historically mined areas near

Montezuma, Nevada. It would also cross the northeastern portion of the Cuprite Mining District where there is evidence of recent mining claims and trenching and drilling. There are 19 sections containing up to 164 unpatented mining claims that would intersect the construction right-of-way. These include two sections south of the Gilbert Mining District along U.S. Highway 6; four sections approximately 8 kilometers north of Goldfield; one section within the northern portion of the Montezuma Mining District; seven sections south of the Montezuma Mining District; and five sections along U.S. Highway 95 near the Cuprite Mining District. There are no geothermal or energy leases along this alternative segment, although there are geothermal occurrences near the segment in the vicinity of Ralston (see Figure 3-157).

DOE would negotiate surface rights across affected unpatented mining claims with the claim holders and surface rights across geothermal lease areas with lease holders.

There are three underground mines or tunnels/shafts within the Montezuma alternative segments construction rights-of-way (see Figures 3-156 and 3-157). There is one underground mine near Millers along Montezuma alternative segments 2 and 3. There is one tunnel/shaft near Goldfield along Montezuma alternative segment 2 and one tunnel/shaft on the southern end of the Montezuma Mining District along Montezuma alternative segments 1 and 3. As discussed in Chapter 2, DOE would conduct further investigations, including drilling ***boreholes***, the use of ground penetrating radar or seismic analysis, to determine the extent of nearby underground features. The Department would then develop appropriate engineered solutions to address underground features. This process for addressing underground mine shafts and tunnels is also described in Chapter 7, Best Management Practices and Mitigation.

4.3.2.2.6.6 Bonnie Claire Alternative Segments. The Wagner Mining District would lie between the two Bonnie Claire alternative segments, just to the west of Bonnie Claire alternative segment 3 (see Figure 3-158). There are patented mining claims in this district, but they would all be outside the construction right-of-way of each segment. There are no geothermal or oil and gas leases within the construction right-of-way of either segment. Therefore, there would be no direct impacts to mining or energy resource extraction along either alternative segment. Section 4.3.2.2.7.5 describes potential impacts associated with road access to the patented mining claims in the Wagner Mining District.

4.3.2.2.6.7 Common Segment 5 (Sarcobatus Flat Area). The southwestern portion of the Clarkdale Mining District would be approximately 0.8 kilometer (0.5 mile) northeast of common segment 5, outside the construction right-of-way (see Figure 3-158). Almost two-thirds of the Clarkdale Mining District is on the Nevada Test and Training Range, and the historically mined areas of the district are far enough away from common segment 5 that there would be no impacts to mining activities as a result of rail line construction (DIRS 183644-Shannon & Wilson 2007, p. 49).

There are geothermal resources along U.S. Highway 95 in Sarcobatus Valley, but none would be within the rail line construction right-of-way. There is one warm spring that would be approximately 0.8 kilometer (0.5 mile) northeast of common segment 5, and a hot well that would be approximately 0.4 kilometer (0.25 mile) northeast (DIRS 183644-Shannon & Wilson 2007, p. 48). There are no identified uses of these geothermal resources, and they would be far enough away from common segment 5 that they would not be affected by the rail line. The common segment 5 construction right-of-way would not cross any oil or gas lease areas.

4.3.2.2.6.8 Oasis Valley Alternative Segments. The Oasis Valley alternative segments would intersect two sections containing seven unpatented mining claims; DOE would negotiate surface rights across affected unpatented mining claims with the claim holders for either alternative segment. There are oil and gas leases north of Beatty along the southwest flank of Pahute Mesa in southern Nye County (see Figure 3-159). Oasis Valley alternative segments 1 and 3 would cross portions of this oil and gas lease block (DIRS 173837-Sweeney 2005, pp. 49 and 50). At present, the lease is not in production, and records show that there has been no exploration in these areas since the 1970s (DIRS 183644-Shannon & Wilson 2007, p. 48). Therefore, the Oasis Valley alternative segments would not affect ongoing operations associated with this oil and gas lease.

4.3.2.2.6.9 Common Segment 6 (Yucca Mountain Approach). Common segment 6 would cross the northern section of the Bare Mountain Mining District (see Figure 3-159). Most past mining activity in the district occurred more than 3 kilometers (2 miles) south of the common segment (see Figure 3-152). There are recently active gold mining operations within the district, approximately 6 to 8 kilometers (4 to 5 miles) from common segment 6. The Silicon Mine and Thompson Quicksilver Mine would be north of common segment 6. The Silicon Mine would be approximately 800 meters (2,500 feet) and the Thompson Quicksilver Mine would be approximately 1,400 meters (4,500 feet) outside the construction right-of-way. Recent mining activity in these areas would be outside the rail line construction right-of-way, and would not be directly affected by common segment 6. The common segment 6 construction right-of-way would intersect four sections containing 19 unpatented mining claims. DOE would negotiate the surface rights across unpatented mining claims with the claim holders. There are no energy leases (oil, gas, or geothermal) within the common segment 6 construction right-of-way.

4.3.2.2.7 Construction Impacts to Recreation and Access (Public and Private Lands)

DOE developed the Mina rail alignment alternative segments and common segments to avoid crossing sensitive areas, such as Wilderness Areas, ***Wilderness Study Areas***, state and national forests and parks, and other prominent recreational and scenic areas. DOE would maintain access for all existing roads the rail line would cross at or near their current location by constructing ***at-grade crossings*** (the road and the rail line would cross paths at the same elevation) or ***grade-separated crossings*** (the road and the rail line would cross paths via an overpass or an underpass), as appropriate, resulting in no long-term adverse impacts to traffic patterns and land access. However, there could be temporary small impacts to access to these areas during rail line construction due to temporary road closures and detours.

At locations where there would be several road crossings close to one another (generally over a distance of 0.8 kilometer [0.5 mile] or less), there could be some minor rerouting and consolidation of crossings, but those would not prevent crossing the rail line. The regulatory authority to make decisions regarding roads, road closures, and rail line crossings rests with the BLM and county and local governments. DOE would work in close consultation with these groups to ensure access would be maintained.

Although many undeveloped recreation opportunities exist over much of the public lands surrounding the rail alignment (such as off-highway vehicle use and dispersed hunting), descriptions of potential impacts in Sections 4.2.2.2.7.1 through 4.2.2.2.7.3 are limited to defined recreation areas. While impacts to non-designated recreation areas are not specifically addressed, individuals might have to alter their access routes to particular recreation areas near the rail line. Construction of the rail line might also cause some dispersed recreationists (such as hunters) who use non-designated areas nearby to temporarily relocate. Future Special Recreation Permits issued by applicable BLM offices would take the presence of the rail line into consideration to minimize impacts to both the applicant and the construction and operation of the railroad. Most organized off-highway vehicle events with previously approved race routes are on existing roads and trails, and access across the rail line for these events would not be compromised. However, some previously permitted routes that the rail line would cross might need to alter their crossing locations in areas where crossings are consolidated.

4.3.2.2.7.1 Churchill County. DOE would use existing rail line along the rail segments in Churchill County. Therefore, there would be no impacts to recreation or access along segments in this county.

4.3.2.2.7.2 Lyon County. DOE would use existing rail line along the rail segments in Lyon County. Therefore, there would be no impacts to recreation or access along segments in this county.

4.3.2.2.7.3 Walker River Paiute Reservation. Common and alternative segments crossing through the Walker River Paiute Reservation would intersect a number of roads that provide access to nearby tribal and private lands.

DOE would remove the Department of Defense Branchline through Schurz, and DOE would transfer ownership of the rail roadbed and remaining structures to the Walker River Paiute Tribe. The Tribe would then have the option to convert the railbed to a recreational trail, potentially resulting in a positive impact to recreation on the Reservation. DOE would remove the ties, track, and ballast under the Mina Implementing Alternative.

The Weber Reservoir on the Walker River, which the Walker River Paiute Tribe manages, lies west of the Schurz alternative segments. Access to the reservoir is primarily via a light duty road that runs west-east between Alternate U.S. Highway 95 and U.S. Highway 95. Schurz alternative segments 1 and 4 would intersect this road east of the reservoir. If DOE selected either of these alternative segments, the Department would maintain access to the reservoir from U.S. Highway 95 with an at-grade-crossing of the rail line; access to the reservoir via this unpaved Reservation road from Alternate U.S. Highway 95 would not be affected.

In addition to U.S. Highway 95, which would intersect all of the alternative segments, the Schurz alternative segments would intersect a number of smaller roads and trails (see Figure 3-161 and Table 3-89).

There are a number of private properties west of the alternative segments along the Walker River. Because these parcels would lie between the Schurz alternative segments and U.S. Highway 95, access to these areas would not be affected. There are no patented or unpatented mining claims and no active energy leases near any of the Schurz alternative segments.

4.3.2.2.7.4 Mineral County. Common and alternative segments crossing through Mineral County would intersect a number of roads that provide access to nearby public and private lands.

Recreational use along the rail alignment region of influence in Mineral County is generally dispersed, and DOE would maintain access across the rail line to recreation areas. However, access to the dispersed recreation areas east of Walker Lake and east of Mina, Nevada, could be temporarily affected due to construction of Mina common segment 1 at intersections with primary access roads and rail line construction through the extreme western portion of the recreation area near Mina. No impacts to the Gabbs Valley Range Wilderness Study Area or other recreation areas in Mineral County would occur.

The portion of Mina common segment 1 located in Mineral County would intersect a number of roads and trails (see Figures 3-162 through 3-164, and Table 3-89). Because this portion of Mina common segment 1 would essentially follow the route of U.S. Highway 95, there could be small impacts to private-land access east of the rail line during the construction phase. At the intersection of common segment 1 and State Route 361, which provides access to the unimproved roads to the Gabbs Valley Range Wilderness Study Area and several private parcels north of the common segment, a grade-separated crossing would be used to maintain access. Private parcels accessed via roads from U.S. Highway 95 that would be bisected by Mina common segment 1 include an area east of Hawthorne, Nevada, and another east of Mina. Additional private property along the common segment would be located west of U.S. Highway 95; therefore, access would not be affected.

Of the two actively mined claims Mina common segment 1 would bisect, the common segment would only intersect the primary access to the New York Canyon mine.

4.3.2.2.7.5 Nye County. Rail line common and alternative segments crossing through Nye County would intersect a number of roads that provide access to nearby public and private lands. There are no designated recreation areas in the immediate vicinity of rail segments in Nye County.

Bonnie Claire 2 and 3 and Mina common segment 2 would cross a limited number of roads and trails (see Figure 3-166 and Table 3-89). There is no active grazing of the land surrounding these segments. However, there are patented mining claims east of Bonnie Claire alternative segment 3 and west of Bonnie Claire alternative segment 2 (within the Wagner Mining District) (see Figure 3-166). If DOE selected Bonnie Claire alternative segment 3, the rail line would cross one access road to these mining claims.

There are more than a dozen privately owned properties that would be west of common segment 5 clustered at Scottys Junction. These properties lie on either side of U.S. Highway 95. Because the rail line would be to the east of these properties and not interfere with access from U.S. Highway 95, it would not impact access to land near Scottys Junction. Common segment 5 would cross one road that provides primary access from U.S. Highway 95 to oil and gas leases that would be north of the rail line and provides access to the Nevada Test and Training Range. DOE proposes an active at-grade crossing for this location (DIRS 180916-Nevada Rail Partners 2007, pp. D-1 and D-2).

Each of the Oasis Valley alternative segments would cross three roads (see Figure 3-167). Roads in this area provide access to private property owned by a cattle company; the northern portion of the Razorback Allotment; oil and gas leases; and the Nevada Test and Training Range. Oasis Valley alternative segment 3 would pose minimal restriction to road access from U.S. Highway 95 to the oil and gas leases and privately owned land, and access within the Razorback Allotment because it would be farthest away from these established areas.

Common segment 6 would cross roads that provide access to the Nevada Test and Training Range and the northern portion of the Razorback Allotment (see Figure 3-167). The only privately owned properties in the vicinity of common segment 6 are west of the rail alignment at its northernmost point. These properties are adjacent to U.S. Highway 95 and the rail line would not impact access thereto.

4.3.2.2.7.6 Esmeralda County. Rail line common and alternative segments crossing through Esmeralda County would intersect a number of roads that provide access to nearby public and private lands.

Recreation along the proposed rail alignment in Esmeralda County is generally dispersed, and there are no developed BLM recreation areas within the region of influence. Mina common segment 1 would cross a small portion of the proposed site for the Monte Cristo State Park directly adjacent to U.S. Highways 95 and 96. The common segment would not approach the geologic features cited by park proponents as the basis for designation, because it would not enter the Monte Cristo Range, and thus would not affect the area or its unique attributes. Additionally, the common segment would not cross the existing access road to the area. There would be no impacts to the Silver Peak Wilderness Study Area, Clayton Valley Special Recreation Management Area, or other designated recreation features in Esmeralda County.

Private property along Mina common segment 1 would be primarily located west of U.S. Highway 95; and therefore, access to these areas would not be affected.

In addition to U.S. Highway 95 (grade-separated crossing), the Montezuma alternative segments would cross a number of roads and trails (see Figures 3-164 and 3-165, and Table 3-89).

Access to private land near Montezuma, Nevada, from Silver Peak Road is via Montezuma Wells Road, which Montezuma alternative segment 1 would cross twice; access to private land north of Silver Peak from State Route 265 is via Paymaster Canyon Road, which the alternative segment would cross once. Montezuma alternative segment 1 would intersect Silver Peak Road, the primary access to the active lithium mining area near Silver Peak, but DOE would maintain access with a passive road crossing. The alternative segment would also bisect East Railroad Springs Road and several unnamed off-road vehicle trails, which provide access from U.S. Highway 95 to areas of the Montezuma Range and Goldfield Hills that contain numerous unpatented mining claims (see Figure 3-165).

Montezuma alternative segment 2 would cross through or near numerous unpatented and patented mining claims, resulting in small temporary impacts to access during rail line construction. Access to claims near Goldfield is from U.S. Highway 95 and Silver Peak Road via a series of unpaved roads and off-road vehicle trails. The alternative segment would intersect Silver Peak Road (at-grade passive crossing) and a number of minor roads and off-road vehicle trails in this area (see Figure 3-165). Montezuma alternative segment 2 would also intersect additional roads and trails that provide access from U.S. Highway 95 to the active ***mining areas*** near Stonewall Flats (see Figure 3-165).

Access to private parcels near Montezuma alternative segment 2 in Goldfield and Millers, Nevada, could experience temporary impacts during rail line construction. Access to the private parcels near Millers from U.S. Highway 95 is via two unnamed roads, both of which would intersect the alternative segment; access to private parcels just west of U.S. Highway 95 in Goldfield is via several roads and off-road vehicle trails that would intersect the segment.

Montezuma alternative segment 3 would bisect East Railroad Springs Road and several unnamed jeep trails that provide access from U.S. Highway 95 to areas of the Montezuma Range and Goldfield Hills containing unpatented mining claims. Access to private parcels near Montezuma alternative segment 3 in the historic towns of Millers and Montezuma could suffer temporary small impacts due to rail line construction where the alternative segment and primary access roads intersect. Access to private parcels near Millers is from U.S. Highway 95 via two unnamed roads; access to private land near the town of Montezuma from Silver Peak Road is via Montezuma Wells Road.

4.3.2.2.8 Land-Use Conflicts with Utility Corridors and Rights-of-Way

Where the rail line would cross an existing utility right-of-way, DOE would take precautions to minimize disturbance and disruption of the utilities. Section 4.3.11, Utilities, Energy, and Materials, describes measures the Department would implement to protect existing utilities.

Of the 367 kilometers (228 miles) of new rail line proposed under the longest possible alignment, 161 kilometers (100 miles), or 44 percent, would fall within corridors designated by applicable resource management plans (this does not include use of existing rail line or rail line through the Walker River Paiute Reservation). However, the resource management plans allow for transportation rights-of-way outside these designated corridors if no other option is feasible and the right-of-way would not substantially conflict with other land-use goals and designations. No parts of the rail line common segments or alternative segments would cross right-of-way avoidance areas. DOE would perform field verifications of utility right-of-way locations and would incorporate the information into the final rail line design.

Because final engineering design for utility connections is still underway, the exact tie-in locations for electricity along the rail alignment are unknown. While it is expected that transmission lines could be tapped where they currently cross the rail line, there is a possibility that the project could require additional utility rights-of-way for small feeder lines.

4.3.2.3 Operations Impacts

Land-use and ownership impacts would occur before or during the railroad construction phase. The operations right-of-way would be generally narrower than the construction right-of-way along most of the rail alignment, and some of the land could therefore be returned to its previous uses.

Topics related to the quality-of-life aspects of land use include visual quality, air quality, and noise and vibration, as described in other sections of this Rail Alignment EIS (see Section 4.3.3, Aesthetic Resources; Section 4.3.4, Air Quality and Climate; and Section 4.3.8, Noise and Vibration).

Railroad operations could affect the use of grazing land. For example, the presence of a rail line could require livestock on some allotments to adjust to new routes to access water and forage. Generally, livestock could learn these new routes after construction of the rail line was complete. The revised allotment management plans developed by the BLM and the affected permittees would be designed to address forage and water accessibility problems introduced by the presence of the rail line.

Nevada is an open-range state, where it is the responsibility of private landowners to fence their properties to prevent livestock from damaging their property and where ranchers could be compensated for the loss of their livestock killed by vehicles and trains. If DOE trains struck and killed livestock, DOE or the commercial carrier (under the Shared-Use Option) would reimburse ranchers for such losses, as appropriate. DOE would implement measures to prevent the congregation of livestock near the rail line, such as fencing, relocating stockwater sources further from the rail line, and preventing the ponding of water near the rail line. These measures would be site-specific, determined through coordination with permittees and the BLM.

As discussed in 4.3.2.2.6, the BLM could issue new unpatented mining claims and energy leases on lands near the rail line during the construction and operations phases. While the presence of the rail line would not necessarily preclude non-surface resource extraction activities, the applicant would be required to work closely with the BLM and DOE to ensure they would not interfere with the safe operation of the railroad. Engineering solutions for the safe extraction of mineral and energy resources near or beneath the rail line could include directional (lateral) drilling of wells or ensuring all mining shafts or tunnels were sufficiently deep and reinforced to prevent subsidence.

The parallel rail alignment access roads (unpaved) could improve land access along most of the rail alignment. While most of the rail alignment would follow or be within a few kilometers of existing unpaved roads and trails that are currently open for public use, the new access roads could be of better quality in some areas than nearby existing roads, increasing the likelihood of use. Off-road vehicle use, hunting intensity, and other recreational activities could increase along the rail alignment access roads. Improved human and vehicle access to surrounding areas could result in indirect impacts to vegetation and wildlife, as described in Section 4.3.7, Biological Resources. Recreational use of public land along the access roads (as with other similar roads on public land) would be monitored by the BLM to ensure compliance with its land management goals, as stated in applicable BLM resource management plans. It is important to note that DOE would not maintain the access roads as public roads, except in locations where they would be used for rerouting to consolidate rail line crossings, and the Department would post signs indicating potential users would proceed on the roads at their own risk.

Lastly, future Special Recreation Permits issued by applicable BLM offices would take the presence of the rail line into consideration to minimize impacts to both the applicant and operation of the rail line. This may require new routes to minimize or avoid crossing the rail line and greater manpower to implement and monitor these new routes during recreation events.

4.3.2.4 Impacts under the Shared-Use Option

Impacts to land use and ownership under the Shared-Use Option would be similar to those described for the Proposed Action without shared use, with a small addition of impacts from the construction and operation of commercial sidings. Under the Shared-Use Option, commercial trains would haul a range of products to and from businesses, including stone and other nonmetallic minerals, oil and petroleum products, and nonradioactive waste materials (see Section 2.2.6.3). DOE cannot predict the exact locations of these possible commercial-use sidings, but locations could include Luning, Mina, the Goldfield area, Silver Peak, and the Beatty/Oasis Valley area. The sidings would likely be constructed within the operations right-of-way; if so, there would be no additional impacts to land use and ownership (see Figure 2-54). Because only approximately 0.5 percent (approximately 0.5 square kilometer [112 acres]) of land within the rail line construction right-of-way is privately owned, any commercial sidings or commercial facilities that would be outside the construction right-of-way would likely be on BLM-administered land, and implemented under a separate BLM-issued right-of-way.

Implementation of the Shared-Use Option could facilitate the expansion or introduction of industrial (mining) or commercial operations in the region. This could have future, long-term impacts on land use, such as new or revised land-use zoning plans to accommodate industrial and commercial land uses in Churchill, Lyon, Mineral, Esmeralda, and Nye Counties in the vicinity of the rail line. The expansion of industrial or commercial activity from shared use of the rail line could also indirectly result in land-use changes in relation to additional residential development. Increased rail traffic could also increase the likelihood of livestock mortality along the rail line within active grazing allotments.

4.3.2.5 Summary

The Mina rail alignment construction right-of-way would occupy between 111 and 124 square kilometers (27,500 to 30,700 acres) of land. Most of this would be public land, although DOE would need to gain access to up to 0.8 square kilometer (200 acres) of private land along the rail alignment. This amount of private land would be very small (less than 1 percent) compared to the total amount of land that would be required for the project. The Mina rail alignment would not displace existing or planned land uses over a substantial area, nor would it substantially conflict with applicable land-use plans or goals. The area with the highest density of private land the rail alignment would cross is Goldfield (Montezuma alternative segment 2). These lands include private yet vacant land, including patented mining claims and state and county land. DOE would work with affected landowners to develop specific measures to avoid, reduce, or mitigate impacts to private land as described in Chapter 7, Best Management Practice and Mitigation.

The Schurz alternative segments would cross the Walker River Paiute Reservation, utilizing between 0.3 and 0.5 percent of the Reservation's land (up to 5.3 square kilometers [1,300 acres]), depending on segment. At present, the Walker River Paiute Tribe does not support routes over their Reservation and their concurrence would be necessary to secure a right-of-way for the rail line. Under the Mina Implementing Alternative, DOE would remove existing Department of Defense rail line through Schurz, providing a perceived benefit to the town's existing residential land uses; the Tribe could also use the existing roadbed as a recreational trail. DOE developed the Bonnie Claire alternative segments to avoid American Indian lands. The closest segment, common segment 5, would be approximately 3 kilometers (2 miles) east of the Timbisha Shoshone Trust Lands.

The Mina rail alignment would use up to 113.3 square kilometers (28,000 acres) of BLM-administered land. Some of the rail line segments would pass through lands the BLM has identified for potential disposal (sale). However, the land withdrawals already in place for the rail alignment and the potential use by another federal agency would take precedence over disposal actions that could affect the project.

The Mina rail alignment would cross 4.6 square kilometers (1,145 acres) of land within the Hawthorne Army Depot near its northern border where it would not pose a conflict with the base's mission or land uses.

Where the rail segments and facilities would cross active grazing allotments on BLM-administered land, some grazing land would be lost or may be isolated by the rail line. Assuming all the vegetation in the construction right-of-way or support facilities was unavailable for forage, the Mina rail alignment would directly result in less than a 2-percent loss of animal unit months across all affected allotments. While DOE would coordinate with permittees and the BLM to institute mitigation measures and allotment management plans to minimize impacts associated with the rail line, additional animal unit months could be lost due to the inaccessibility of forage where the rail line acts as a barrier.

The presence of a rail line and the implementation of revised allotment management plans could require livestock on some allotments to adjust to new routes to access water and forage. Generally, livestock could learn these new routes and acclimate to and cross the rail line in most areas. DOE would provide temporary feed, water, and assistance in livestock movement during rail line construction to assist with the adjustment of cattle to the presence of the rail line. The rail line could affect ranching operations because livestock could be struck by passing trains. DOE would coordinate with permittees and the BLM to provide mitigation measures to prevent congregation of livestock near the rail line. DOE or the railroad's commercial operator (under the Shared-Use Option) would reimburse ranchers for such losses, as appropriate. DOE would consult with permittees and the BLM to determine where fences should be restored or constructed on specific allotments to facilitate grazing operations, while minimizing impacts to wildlife movement.

Construction wells located on grazing allotments outside the construction right-of-way would have small and temporary impacts in terms of loss of grazing area. Once each well was drilled, DOE would reclaim the site in accordance with DOE and BLM requirements. The Department would construct a 10- to 15-centimeter (4- to 6-inch)-diameter temporary pipeline on top of the ground along access roads to transport water to the construction right-of-way. Wells not needed for railroad operations would be properly abandoned in compliance with State of Nevada regulations, and sites and access roads would be reclaimed (DIRS 180922-Nevada Rail Partners 2007, p. 4-12).

Most of the local mining activity would be outside the rail line construction right-of-way. DOE would need to negotiate the surface rights to cross the few affected unpatented mining claims the rail line would cross. The Mina rail alignment would cross potentially up to half the number of unpatented mining claims than the Caliente rail alignment. Mina common segment 1 would cross sections with 355 unpatented mining claims and the Montezuma alternative segments would cross sections with between 94 and 362 unpatented mining claims. The proposed mining activities by Metallic Ventures Gold, Inc., for the Gemfield deposit, if they occur, could pose a direct conflict with the Montezuma alternative segment 2 route. Under Phase 2 of this project, Metallic Ventures Gold would relocate U.S. Highway 95 to the west, and could similarly necessitate DOE to relocate its rail line further west on public land. While there could be a direct land-use conflict, DOE would employ mitigation and avoidance strategies as discussed in Chapter 7.

The rail line could be affected by or affect underground mining tunnels or shafts. During the final engineering design phase of the project, DOE would perform a survey to verify the locations of tunnels and shafts to avoid adverse impacts, as described in Chapter 7, Best Management Practices and Mitigation.

DOE developed the Mina rail alignment to avoid Wilderness Areas and other scenic and recreational areas. Road crossings would be constructed to prevent the rail line from obstructing access to private and public land. While there could be temporary road closures or detours during the rail line construction phase, there would be no impact to land access during the operations phase. In addition, organized off-highway vehicle events permitted in the past by BLM might need to alter their routes to avoid the rail line.

Depending on the alternative segments selected, the rail line would cross between 22 and 29 known utility lines. DOE would negotiate crossing agreements with the right-of-way holders and the BLM to determine the duration of use, access needs, mitigation, and compensation, as applicable. DOE would protect existing utilities from damage so that disruption to utility service or damage to lines would be at most small and temporary. The project would require a new BLM right-of-way outside the existing planning corridors, which would be outside of right-of-way avoidance areas. Under the longest potential route, approximately 40 percent of the Mina rail alignment would fall within existing BLM planning corridors (not including existing Department of Defense Branchlines and alternative segments within the Walker River Paiute Reservation).

In addition, to avoid the proliferation of new rights-of-way, the BLM may elect to grant future rights-of-way for new utilities adjacent to the proposed rail line.

Construction and operation of a railroad along the Mina rail alignment could result in the following general impacts to land use and ownership along the entire alignment:

- Changes in land uses on private and public lands within the construction and operations rights-of-way
- Possible increase in livestock mortality (collisions with trains)
- Reduced animal unit months on affected grazing allotments as determined by the BLM
- Reduction in land available for BLM disposal
- Alteration of past routes for BLM-permitted off-highway vehicle events
- Possible expansion of mining, manufacturing, industrial, or commercial land uses under the Shared-Use Option

Tables 4-162 through 4-167 summarize potential impacts to land use and ownership for each rail line segment and construction and operations support facility. As discussed in Section 4.3.2.2.3.2, the loss of animal unit months reflected in these tables are potential direct losses within the construction right-of-way due to possible vegetation loss. Potential changes to permitted animal unit months for each grazing allotment due to the presence of the rail line would be heavily influenced by the possible isolation of forage where the rail line acts as a barrier, the degree to which mitigation measures can offset adverse impacts, and the degree to which revised allotment management plans can be implemented to sustain or improve grazing operations.

Table 4-162. Summary of potential impacts to land use and ownership – Schurz alternative segments (Walker River Paiute Reservation).

Construction impacts	Schurz 1	Schurz 4	Schurz 5	Schurz 6
Private parcels the alignment would cross (construction right-of-way)	0	0	0	0
Affected property owners	0	0	0	0
Active grazing allotments the alignment would cross	0	0	0	0
Stockwater pipelines the alignment would cross	0	0	0	0
Unpatented mining claims the alignment would cross	0	0	0	0
Underground mines, shafts, and tunnels the alignment would cross	0	0	0	0
Roads and trails the alignment would intersect	12	13	12	15
Utility lines/rights-of-way the alignment would cross or overlap	3	3	3	3

Table 4-163. Summary of potential impacts to land use and ownership – Mina common segments 1 through 6 (Mineral, Esmeralda, and Nye Counties).

Construction impacts	Mina common segment 1	Mina common segment 2	Common segment 5	Common segment 6
Private parcels the alignment would cross (construction right-of-way)	1	0	0	0
Affected property owners	1	0	0	0
Land area of private land affected (including patented mining claims)	53 acres[a]	Not applicable	Not applicable	Not applicable
Active grazing allotments the alignment would cross	3	0	0	1
Stockwater pipelines the alignment would cross	1	0	0	0
Animal unit months lost (estimated) or percent of allotment(s)	102 or 0.6 percent	Not applicable (grazing allotment inactive)	Not applicable (grazing allotment inactive)	17 or 1.8 percent
Active grazing allotment land that would be within the construction right-of-way	6,330 acres	Not applicable (grazing allotment inactive)	Not applicable (grazing allotment inactive)	1,320 acres
Unpatented mining claims the alignment would cross	20 sections with 355 claims	0	0	Four sections with 19 claims
Underground mines, shafts, and tunnels the alignment would cross	0	0	0	0
Linear distance outside BLM utility corridors	30 miles[b]	2.1 miles	12 miles	25 miles
Roads and trails the alignment would intersect	31	1	14	7
Utility lines/rights-of-way the alignment would cross or overlap	15	0	1	0

a. To convert acres to square kilometers, multiply by 0.0040469.
b. To convert miles to kilometers, multiply by 1.6093.

Table 4-164. Summary of potential impacts to land use and ownership – Montezuma alternative segments (Esmeralda and Nye Counties) (page 1 of 2).

Construction impacts	Montezuma 1	Montezuma 2	Montezuma 3
Private parcels the alignment would cross (construction right-of-way)	0	36	1
Affected property owners	0	21	1
Land area of private land affected (including patented mining claims)	0	145 acres	24 acres
Active grazing allotments the alignment would cross	4	1	2
Stockwater pipelines the alignment would cross	1	7	2
Animal unit months lost (estimated) or percent of allotment(s)	43 or 0.4 percent	51 or 0.5 percent	59 or 0.4 percent
Active grazing allotment land that would be within the construction right-of-way	4,510 acres[a]	2,570 acres	3,430 acres
Unpatented mining claims the alignment would cross	17 sections containing 94 claims	24 sections containing 362 claims	19 sections containing 164 claims

Table 4-164. Summary of potential impacts to land use and ownership – Montezuma alternative segments (Esmeralda and Nye Counties) (page 2 of 2).

Construction impacts	Montezuma 1	Montezuma 2	Montezuma 3
Unpatented mining claims the alignment would cross	17 sections containing 94 claims	24 sections containing 362 claims	19 sections containing 164 claims
Underground mines, shafts, and tunnels the alignment would cross	1	2	2
Linear distance outside BLM utility corridors	41 miles[b]	52 miles	57 miles
Roads and trails the alignment would intersect	19	34	30
Utility lines/rights-of-way the alignment would cross or overlap	3	10	10

a. To convert acres to square kilometers, multiply by 0.0040469.
b. To convert miles to kilometers, multiply by 1.6093.

Table 4-165. Summary of potential impacts to land use and ownership – Bonnie Claire alternative segments (Nye County).

Construction impacts	Bonnie Claire 2	Bonnie Claire 3
Private parcels the alignment would cross (construction right-of-way)	0	0
Affected property owners	0	0
Grazing allotments the alignment would cross	1, inactive	1, inactive
Stockwater pipelines the alignment would cross	0	0
Animal unit months lost (estimated) or percent of allotment(s)	Not applicable	Not applicable
Active grazing allotment land that would be within the construction right-of-way	Not applicable	Not applicable
Unpatented mining claims the alignment would cross	0	0
Underground mines, shafts, and tunnels the alignment would cross	0	0
Linear distance outside BLM utility corridors	13 miles[a]	11 miles
Roads and trails the alignment would intersect	1	4
Utility lines/rights-of-way the alignment would cross or overlap	0	0

a. To convert miles to kilometers, multiply by 1.6093.

Table 4-166. Summary of potential impacts to land use and ownership – Oasis Valley alternative segments (Nye County) (page 1 of 2).

Construction impacts	Oasis Valley 1	Oasis Valley 3
Private parcels the alignment would cross (construction right-of-way)	1	0
Affected property owners	1	0
Land area of private land affected (including patented mining claims)	0.9 acres[a]	Not applicable
Active grazing allotments the alignment would cross	1	1
Stockwater pipelines the alignment would cross	0	0
Animal unit months lost (estimated) or percent of allotment(s)	8 or 0.8 percent	12 or 1.3 percent
Active grazing allotment land that would be within the construction right-of-way	590 acres	940 acres

Table 4-166. Summary of potential impacts to land use and ownership – Oasis Valley alternative segments (Nye County) (page 2 of 2).

Construction impacts	Oasis Valley 1	Oasis Valley 3
Unpatented mining claims the alignment would cross	2 sections containing 7 claims	2 sections containing 7 claims
Underground mines, shafts, and tunnels the alignment would cross	0	0
Linear distance outside BLM utility corridors	0.1 mile	2 miles
Roads and trails the alignment would intersect	3	3
Utility lines/rights-of-way the alignment would cross or overlap	0	0

a. To convert acres to square kilometers, multiply by 0.0040469.
b. To convert miles to kilometers, multiply by 1.6093.

Table 4-167. Summary of potential impacts to land use and ownership – railroad construction and operations support facilities (Mineral, Esmeralda, and Nye Counties).

Facility	Construction impacts
Staging Yard	Yard would be on 270 acres on the Hawthorne Army Depot and 63 acres on BLM-administered grazing land.
Maintenance-of-Way Facility	The facility would be on approximately 15 acres within the rail alignment construction right-of-way. If located at Silver Peak (Montezuma alternative segment 1), it would be on the active Silver Peak Allotment. If located at Klondike (Montezuma alternative segments 2 and 3), it would be on the inactive Montezuma Allotment.
Rail Equipment Maintenance Yard, Cask Maintenance Facility, Nevada Railroad Control Center and National Transportation Operations Center	These facilities would be entirely on the Nevada Test Site. There would be no charge in land use or ownership.
Potential quarries	
Garfield Hills	This quarry would result in the loss of 320 acres[a] of grazing land on the Garfield Flat Allotment, reducing overall animal unit months by 5. The quarry would also impact 22 acres of land on the Hawthorne Army Depot.
Gabbs Range	This quarry would result in the loss of 240 acres of grazing land on the Pilot-Table Mountain Allotment, and the loss of 4 animal unit months.
North Clayton	This quarry would be on 440 acres of public land within an inactive grazing allotment.
ES-7	This quarry would be located on 360 acres of public land within an inactive grazing allotment.
Malpais Mesa	This quarry would be on 650 acres of public land within an inactive grazing allotment.

a. To convert acres to square kilometers, multiply by 1.6093

4.3.3 AESTHETIC RESOURCES

This section describes potential impacts to aesthetic (visual) resources from constructing and operating the proposed railroad along the Mina rail alignment. Section 4.3.3.1 describes the methods DOE used to assess potential impacts; Section 4.3.3.2 describes potential impacts during the construction phase; Section 4.3.3.3 describes potential impacts during the operations phase; Section 4.3.3.4 describes potential impacts under the Shared-Use Option; and Section 4.3.3.5 summarizes potential impacts to aesthetic resources.

Section 3.3.3.1 describes the region of influence for aesthetic resources along the Mina rail alignment.

4.3.3.1 Impact Assessment Methodology

4.3.3.1.1 Approach

Most of the lands along the Mina rail alignment are BLM-administered public lands. For this reason, DOE used BLM methods to evaluate potential impacts to visual resources.

The BLM uses a process to rate visual resource contrast and evaluate the magnitude of a project's impact on existing visual resources (DIRS 173053-BLM 1986, all). The BLM evaluates the contrast between existing conditions and conditions expected during a project, drawing on information from the BLM visual resource management inventory, which the BLM uses to classify the aesthetic value of BLM-administered lands (DIRS 101505-BLM 1986, all). BLM management objectives allow different levels of project-related contrast for each visual resource management class (DIRS 101505-BLM 1986, Section VB). Figure 4-23 shows the visual resource management classes for lands surrounding the Mina rail alignment. DOE used the BLM methodology to assign visual resource management classes to non-BLM public and private land.

To identify potential impacts to aesthetic resources, DOE applied the process for rating visual resource contrast specified in BLM Manual Handbook 8431-1 (DIRS 173053-BLM 1986, all). This process involved comparing the existing aesthetic conditions to conditions that would exist during proposed railroad construction and operations in relation to:

- Landform attributes, vegetative features, and structural features (such as existing and proposed rail roadbeds, power distribution lines, buildings, and communications towers)
- Form, line, color, and texture
- Other factors including distance, angle of observation, how long the project feature would be visible, relative size or scale, season of use, light conditions, recovery time for vegetation after construction, spatial relationships, and atmospheric conditions

DOE developed contrast ratings using the methodology in BLM Manual Handbook 8410-1 (DIRS 101505-BLM 1986, all) from the key observation points identified in Section 3.3.3 (see Figure 3-176). DOE prepared simulations to illustrate the expected project-related contrast at some key observation points. Appendix D, Aesthetics, Section D.2, provides baseline photographs and simulations for the Mina rail alignment.

4.3.3.1.2 Criteria for Determining Impacts

DOE used the criteria listed in Table 4-168 to rank the contrast between existing conditions and conditions expected during the railroad construction and operations phases at each key observation point.

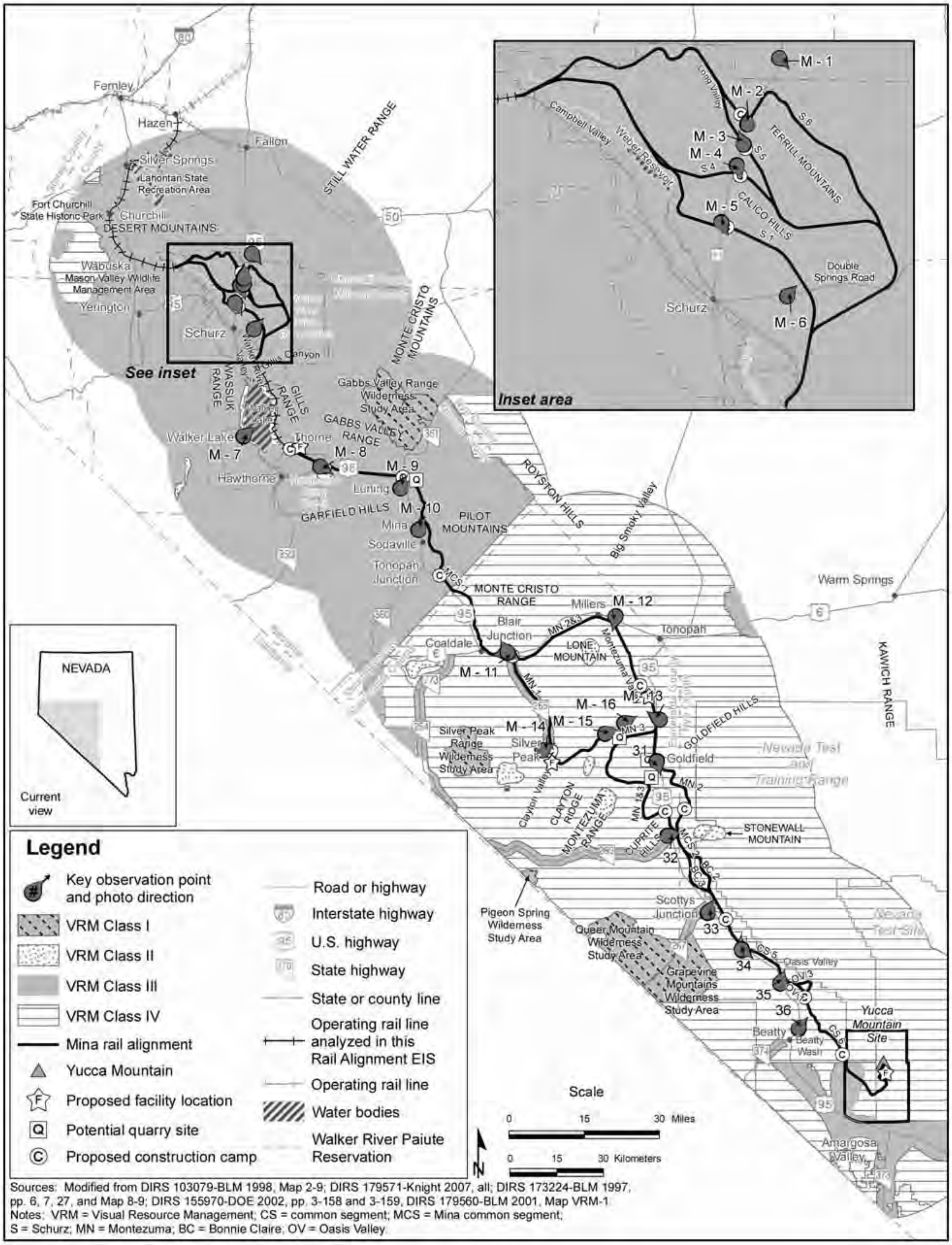


Figure 4-23. Visual resource management classifications and key observation points along the Mina rail alignment.

Table 4-168. Criteria for determining degree of visual contrast.[a]

Degree of contrast	Criteria
None	The element contrast is not visible or perceived.
Weak	The element contrast can be seen but does not attract attention.
Moderate	The element contrast begins to attract attention and begins to dominate the characteristic landscape.
Strong	The element contrast demands attention, will not be overlooked, and is dominant in the landscape.

a. Source: DIRS 173053-BLM 1986, Section III.D.2.a.

DOE then considered contrast ratings against the BLM visual resource management objectives listed in Table 4-169, where applicable. In general, the BLM manages areas of high visual value (Classes I and II) to minimize contrast, while allowing more contrast in areas of lower visual value (Classes III and IV).

Table 4-169. BLM visual resource management classes and objectives.[a]

Visual resource class	Objective	Acceptable changes to land
Class I	Preserve the existing character of the landscape.	Provides for natural ecological changes but does not preclude limited management activity. Changes to the land must be small and must not attract attention.
Class II	Retain the existing character of the landscape.	Management activities may be seen but should not attract the attention of the casual observer. Changes must repeat the basic elements of form, line, color, and texture of the predominant natural features of the characteristic landscape.
Class III	Partially retain the existing character of the landscape.	Management activities may attract attention but may not dominate the view of the casual observer. Changes should repeat the basic elements in the predominant natural features of the characteristic landscape.
Class IV	Provides for management activities that require major modifications of the existing character of the landscape.	Management activities may dominate the view and be the major focus of viewer attention. An attempt should be made to minimize the impact of activities through location, minimal disturbance, and repeating the basic elements.

a. Source: DIRS 101505-BLM 1986, Section V.B.

In this analysis, the primary basis for identifying potential adverse impacts to aesthetic resources is inconsistency with BLM management objectives for a ***viewshed***. This includes consideration of effects on the visual values of parks, recreation areas, and other scenic resources (recognized at the national, state, or local level) and visual intrusions or contrasts affecting the quality of landscapes. Along much of the Mina rail alignment, where the landscape is sparsely populated and undeveloped, the visual impact of equipment, facilities, and activities could create a weak or moderate contrast, according to the criteria listed in Table 4-168. That is, from key observation points that are within a few miles, equipment, facilities, and activities could be seen (weak contrast) or would begin to attract attention and begin to dominate the viewshed (moderate contrast). However, as noted in BLM guidance, distance and duration of project activities affect perceptions of contrast (DIRS 173053-BLM 1986, Section III.D.2.b).

Distance of an observer from project activities and facilities would greatly affect the observer’s perception of project-related contrasts with the landscape. The likelihood that activities or facilities would divert an observer’s attention away from the landscape would decrease as distance increased. Thus, views from observation points where the project would appear in the foreground or middleground would usually be affected more than views from observation points where the project was in the background.

Duration of activities also affects conclusions about a project’s consistency with BLM visual resource management objectives in a particular location. For example, visible construction activities over 18 months could cause a moderate degree of contrast and be inconsistent with Class II objectives. Such activities would be recognized as a moderate adverse impact of construction in Class II areas, although BLM methodology recognizes that “few projects meet the VRM [visual resource management] management objectives during construction” (DIRS 173053-BLM 1986, Section III.D.2.b.7). In contrast, passage of a train on a track more than approximately 1.6 kilometers (1 mile) from observers for a few minutes three times a day for up to 50 years might comply with Class II objectives if the rail line itself did not attract attention or dominate the view of a casual viewer, thus creating only a weak degree of contrast. In such a case, presence of the proposed rail line would be recognized as a small adverse impact of operation.

4.3.3.2 Construction Impacts

Table 4-170 lists contrast ratings for views from each key observation point along the Mina rail alignment and consideration of project consistency with BLM management objectives. In cases where construction and operations activities would cause different levels of contrast, the table identifies the phase for each rating; otherwise, a single rating applies to both construction and operations. Figure 4-23 is the same as Figure 3-176 in Section 3.3.3, showing visual resource management classifications of lands around each key observation point. It is a useful reference when reading impact discussions in this section. Appendix D, Section D.2, provides photographs of views from each key observation point and simulations of views including the rail line, trains, or other features.

4.3.3.2.1 Construction Impacts Common to the Entire Mina Rail Alignment

Construction-related equipment, facilities, and activities would be potential sources of short-term (temporary) impacts to visual resources during the construction phase. Most of the equipment, facilities, and activities would be within the nominal width of the construction right-of-way. From some viewpoints, the presence of workers, vehicles, equipment, supply trains, borrow pits, quarries, laydown yards, well pads, construction camps, and electric distribution lines, and the generation of dust and vehicle exhaust, might be seen or might attract the attention of a casual observer during construction. These would result in small impacts to visual setting except in areas discussed in Section 4.3.3.2.2.

Newly constructed cut and fill slopes could temporarily result in a weak to strong contrast with adjacent soils and vegetation. The short-term (construction phase) level of impact to the visual setting from this contrast would be small to large, and would decrease with the reestablishment of vegetation post-construction, which could take many years, or decades in some cases. In some places, differences in density and type of vegetation would be visible as a weak to strong contrast for many years or decades, resulting in long-term, small to large impacts to the visual setting. Cuts in virgin rock would initially show a weak to strong contrast between freshly exposed rock and previously weathered rock. Without mitigation, this contrast would result in long-term small to large impacts to the visual setting.

Construction supply trains consisting of eight to 20 cars would pass eight times per day, at most (loaded on the trip out, empty on the return), along rail line segments under active construction. Construction

Table 4-170. Contrast ratings along the Mina rail alignment and consistency with BLM objectives (page 1 of 5).

Key observation point	Location	Visual resource management classes in viewshed[a]	Contrast rating[b]	Consistent with visual resource management class rail line would cross?[c]	Impact level[d]	Notes
M-1	U.S. Highway 95, view over Rawhide Flats toward Schurz alternative segment 6 against hills	Surrounding lands (III)	Weak	Yes	Small	None
M-2[e]	U.S. Highway 95 view of Schurz alternative segment 6 rail-over-road crossing	Surrounding lands (III)	Construction: strong Operations: moderate	No Yes	Construction: moderate to large Operations: moderate	Extensive earthworks would be required for approach to the rail-over-road crossing.
M-3[e]	U.S. Highway 95 in Long Valley, views of Schurz alternative segment 5 and road-over-rail crossing	Surrounding lands (III)	Construction: moderate Operations: weak	Yes	Construction: moderate Operations: small	
M-4[e]	U.S. Highway 95 at intersection with Weber Dam Road, view of Schurz alternative segment 4 and road-over-rail crossing	Surrounding lands (III)	Construction: moderate Operations: weak	Yes	Construction: moderate Operations: small	
M-5[e]	U.S. Highway 95, view of Schurz alternative segment 1 and road-over-rail crossing	Surrounding lands (III)	Construction: moderate Operations: weak	Yes	Construction: moderate Operations: small	
M-6[e]	Double Springs Road, view of Schurz alternative segment 1 and at-grade crossing	Surrounding lands (III)	Weak	Yes	Small	At-grade crossing of dirt road, typical of crossing of this type.

Table 4-170. Contrast ratings along the Mina rail alignment and consistency with BLM objectives (page 2 of 5).

Key observation point	Location	Visual resource management classes in viewshed[a]	Contrast rating[b]	Consistent with visual resource management class rail line would cross?[c]	Impact level[d]	Notes
M-7	Town of Walker Lake, view across lake to Department of Defense Branchline South	Surrounding lands (II and III), western and eastern perimeters of Walker Lake (II)	None	Yes	Small	Existing rail line.
M-8	U.S. Highway 95 just west of Hawthorne, view of potential Garfield Hills quarry facilities	Surrounding lands (III)	Construction: moderate Operations: weak to none	Yes	Construction: moderate Operations: small	Conveyor and support facilities associated with quarry would be visible. DOE would dismantle the quarry conveyor system and facilities after construction was complete.
M-9	Town of Luning, view of potential Gabbs Range quarry site	Surrounding lands (III)	Construction: weak to moderate Operations: none	Yes	Construction: Small to moderate Operations: small	DOE would dismantle the facilities after construction was complete.
M-10	Town of Mina, view of Mina common segment 1	Surrounding lands (III)	Weak	Yes	Small	Buildings and vegetation might shield segment from most homes.

Table 4-170. Contrast ratings along the Mina rail alignment and consistency with BLM objectives (page 3 of 5).

Key observation point	Location	Visual resource management classes in viewshed[a]	Contrast rating[b]	Consistent with visual resource management class rail line would cross?[c]	Impact level[d]	Notes
M-11	Near intersection of State Route 265 and U.S. Highway 95 (Blair Junction), views of Mina common segment 1 toward Monte Cristo Range; south-southeast over State Route 265 to Montezuma alternative segment 1; west over Mina common segment 1	Surrounding lands (III and IV), State Route 265 (III), Monte Cristo Range (IV)	Construction of Mina common segment 1: moderate	Yes	Moderate	None
			Construction of Montezuma alternative segment 1: moderate	Yes	Moderate	None
			Operation of Mina common segment 1: weak to moderate	Yes	Small	View west might not show rail line due to topography.
			Operation of Montezuma alternative segment 1: weak	Yes	Small	None
M-12	U.S. Highway 95 in Montezuma Valley, view south across Montezuma alternative segment 2 toward Lone Mountain	Surrounding lands (IV)	Weak	Yes	Small	Follows existing rail bed.

Table 4-170. Contrast ratings along the Mina rail alignment and consistency with BLM objectives (page 4 of 5).

Key observation point	Location	Visual resource management classes in viewshed[a]	Contrast rating[b]	Consistent with visual resource management class rail line would cross?[c]	Impact level[d]	Notes
M-13	U.S. Highway 95, view toward Montezuma alternative segment 2 and proposed Maintenance-of-Way Facility	Surrounding lands (IV)	Weak to none	Yes	Small	None
M-14	Main Street in Silver Peak (just past the Chemetall Foote Corporation processing plant), view east over Montezuma alternative segment 1	Surrounding lands (IV), State Route 265 (III)	Weak to moderate	Yes	Small to moderate	Buildings and vegetation would shield segment from most viewers.
M-15	Silver Peak Road, view toward Montezuma alternative segment 1 and potential North Clayton quarry	Surrounding lands (IV)	Weak	Yes	Small	None
M-16	Silver Peak Road intersection with road to Klondike, views over Montezuma alternative segment 2	Surrounding lands (IV)	Weak to none	Yes	Small	Rail line would barely be visible in background.
31	Rail line crossing U.S. Highway 95 south of Goldfield, view south-southeast toward Montezuma alternative segment 2	Surrounding lands (IV)	Weak	Yes	Small	
32	U.S. Highway 95 at State Route 266, view east to Montezuma alternative segments	Surrounding lands (IV), State Route 266 (III), Stonewall Mountain (II)	Weak	Yes	Small	Montezuma alternative segment 2 would be distant from Class II feature, which would be in background; Class III lands would not be visible in views from highway over the rail line.

Table 4-170. Contrast ratings along the Mina rail alignment and consistency with BLM objectives (page 5 of 5).

Key observation point	Location	Visual resource management classes in viewshed[a]	Contrast rating[b]	Consistent with visual resource management class rail line would cross?[c]	Impact level[d]	Notes
33	U.S. Highway 95 at State Route 267, view north-northeast over common segment 5	Surrounding lands (IV), State Route 267 (III)	Weak	Yes	Small	None
34	U.S. Highway 95 (typical cut), view toward common segment 5 hill cuts	Surrounding lands (IV)	Strong to moderate	Yes	Large to moderate	None
35	U.S. Highway 95 north of Oasis Valley (typical landscape)	Surrounding lands (IV)	Weak	Yes	Small	Rail line would be visible but would not attract attention away from topography in background.
36	U.S. Highway 95 and Beatty Wash access road, view northeast to construction access road	Surrounding lands (IV)	None to weak	Yes	Small	Rail line would not be visible from key observation point; increased traffic along access road would be visible but would not attract attention.

a. Sources: DIRS 155970-DOE 2002, pp. 3-158 amd 3-159; DIRS 173224-BLM 1997, pp. 6, 7, and 27, and Map 8; DIRS 103079-BLM 1998, Map 2-9; DIRS 101811-DOE 1996, pp. 4-152 to 4-154; DIRS 179560-BLM 2001, Map VRM-1; DIRS 179571-Knight 2007, all.
b. Contrast rating definitions from DIRS 173053-BLM 1986, Section III.D.2.a; see Table 4.4-1.
c. BLM methodology recognizes that "few projects meet the VRM [visual resource management] management objectives during construction" (DIRS 173053-BLM 1986, Section III.D.2.b.7).
d. Impact level definitions from Section 4.1.
e. Key observation point is located on the Walker River Paiute Reservation.

trains would likely be visible for 5 to 20 minutes from a single vantage point, depending on train speed and terrain. In addition, small pieces of equipment such as track tampers, ballast regulators, tie handlers, rail clip applicators, and ballast consolidators would pass two to eight times per day (DIRS 180874-Nevada Rail Partners 2007, Appendix A). The level of impact to visual resources would be small.

Activities associated with five of the potential quarry sites (see Figure 2-22) would be visible from towns, highways, or county roads. At the potential Garfield Hills quarry just south of the Hawthorne Army Depot, the plant, a conveyor and a siding would be visible from U.S. Highway 95. This site would be entirely within Class III land and would present a moderate degree of contrast from the highway (see Appendix D, Figure D-104). The potential Gabbs Range quarry, 4 kilometers (2.5 miles) east of Luning, would be in a Class III area visible from U.S. Highway 95 and Luning. Viewers in Luning and on the highway would see a weak to moderate contrast from the quarry and associated facilities (see Appendix D, Figure D-106). Moderate levels of contrast are compatible with BLM Class III management objectives. The potential North Clayton quarry would be in Class IV land and the plant site, siding, and waste dump areas would be visible from Silver Peak Road, though the quarry itself would not be visible from any frequently traveled roads. A weak to moderate degree of contrast would result from the quarry facilities. The potential Malpais Mesa quarry would not be visible from U.S. Highway 95, but would be visible from Railroad Springs Road. Viewers passing on Railroad Springs Road would encounter a moderate to strong contrast from the quarry and associated facilities. A moderate or strong contrast is compatible with BLM Class IV management objectives. The quarry siding and conveyor belt for potential quarry site ES-7 west of Goldfield would be visible from both U.S. Highway 95, where they would represent a weak contrast that would not attract attention, and from primitive roads north of Goldfield Cemetery, where they would cause a moderate to strong contrast that would attract the viewer’s attention. The level of contrast created by the ES-7 siding and conveyor would be compatible with objectives for the surrounding Class IV areas.

In situations where water wells could not be constructed within the nominal width of the construction right-of-way (see Figure 2-3), they would lie within a 23-square-meter (250-square-foot) drilling area connected to the construction right-of-way by small pipelines feeding temporary 9.3-square-meter (100-square-foot) reservoirs. These would cause localized short-term weak-to-moderate contrast, compatible with BLM management objectives in surrounding lands.

There would be up to 10 temporary construction camps along the rail alignment at intervals of approximately 50 kilometers (30 miles) (see Figure 2-22). The camps, which would each average 0.1 square kilometer (25 acres) in size, would have a long and narrow layout of approximately 730 meters by 120 meters (2,400 feet by 400 feet) and would be within the nominal width of the rail line construction right-of-way as close as possible to intersections of existing public roads and the rail alignment access roads. Each camp would consist of single-story housing, offices, support facilities (commissary, kitchen, cafeteria, recreation facilities, service station, fueling area, and medical facilities), utilities (power lines, water- and ***wastewater-treatment*** facilities, and trash storage), a contractor work area (sections for maintenance and parts and materials storage), and parking (DIRS 180875-Nevada Rail Partners 2007, Chapter 4). The most visible structures at each construction camp would be the housing facilities. The camps would contrast weakly against the landscape as observed by passing motorists, resulting in short-term small impacts to the visual setting. See Figure 4-24 for a simulation showing a construction camp along the Caliente rail alignment, with camp layout and design identical to that planned for camps along the Mina rail alignment.

Electricity distribution lines would be buried within the operations right-of-way over the length of the rail line (see Section 4.3.11, Utilities, Energy, and Materials). Where the lines connected to the commercial power grid, an electrical substation and a line of power poles extending from the substation to the rail line would be visible. Temporary electrical distribution poles would be visible carrying power to facilities within construction camps, contributing to short-term small impacts to the visual setting around the camps.

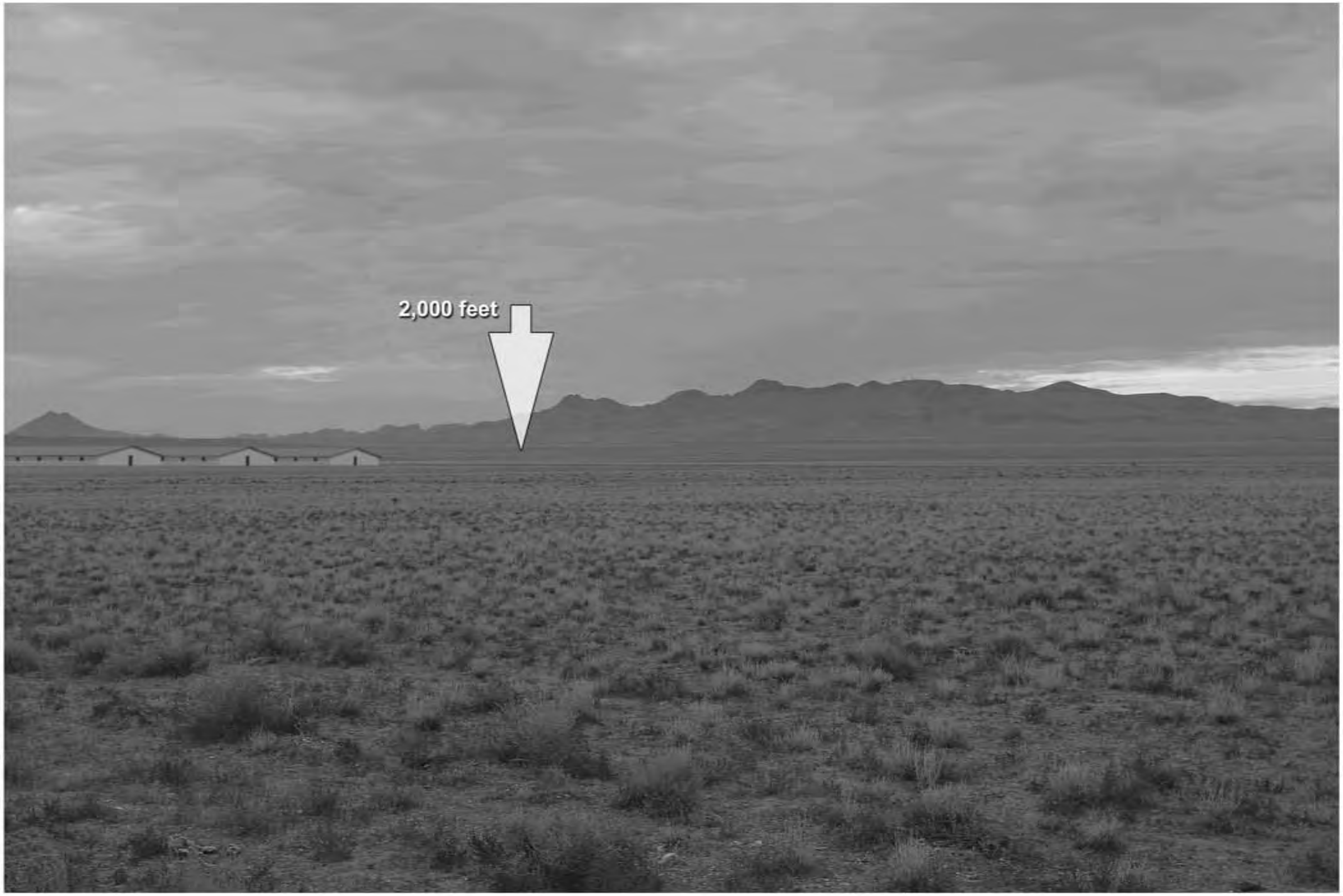


Figure 4-24. Simulation of a typical construction camp.

Construction duration at most individual locations along the rail line would be a period of weeks or a few months under a 4-year construction schedule. Under a 10-year schedule, there would be multiple phases of work (of weeks or a few months) separated by years of inactivity. Active construction would be longer at locations of major structures, such as bridges and railroad operations support facilities, but nowhere would construction of earthworks and rail line be expected to exceed 18 continuous months except at the bridge over Beatty Wash, which DOE expects would take 2 years to construct. DOE would withdraw construction camps from service and keep them in reserve during periods of construction inactivity, and would close camps and reclaim the land as sections of the rail line were completed. Thus, a longer construction schedule would not increase the level of visual impact because inactivity would minimize the visual contrast at individual locations where construction was halted, although the impact of disturbed soil and vegetation would be prolonged. Under either construction schedule, DOE would consider requests by local governments to leave individual construction camp sites (the cleared and hardened site the camp occupied) in place after permanent closure of the facility for possible use by these governments or their designees. The visual impacts from these sites would likely be small because the Department would remove equipment and structures prior to transfer, and rail line-related construction activities would cease.

Considering the effects of distance and duration, construction activities or facilities would either not be visible or would be noticeable during the construction phase but would not dominate the attention of a viewer. That is, they would create no contrast or a weak degree of contrast at key observation points, with the exception of those discussed in Section 4.3.3.2.2. A weak degree of contrast, even where Class I and II lands are present in the viewshed, is compatible with BLM management objectives for all classes of land. Thus, there would be small, temporary project-related impacts to the visual setting during construction of any of the Mina rail alignment alternative segments and common segments, except as described in Section 4.3.3.2.2. As noted in Section 4.3.3.1.2, BLM methodology recognizes that "few projects meet the VRM [visual resource management] management objectives during construction" (DIRS 173053-BLM 1986, Section III.D.2.b.7).

The section of Department of Defense rail line currently in operation on the Walker River Paiute Reservation (Department of Defense Branchline Schurz) would be decommissioned, and the ballast and rail would be removed, with the selection of any of the Schurz alternative segments. Removal of the rail and ballast material would result in a small decrease in the contrast with the surrounding landscape, though the linear feature of the railbed would remain. A weaker contrast would likely result in a small positive impact to the visual setting near the site of this existing rail line. Department of Defense Branchline Schurz as it currently appears from Alternate U.S. Highway 95 north of the town of Schurz is shown in Figure 4-25.

4.3.3.2.2 Construction Impacts along Alternative Segments and Common Segments

The aesthetic resources impact analysis identified moderate or strong contrast ratings associated with construction along three portions of the Mina rail alignment, as described in Sections 4.3.3.2.2.1 through 4.3.3.2.2.3.

4.3.3.2.2.1 Schurz Alternative Segments (Walker River Paiute Reservation). The Schurz alternative segments would cross through non-BLM-administered lands treated in this analysis as Class III. The construction of several of the crossings of U.S. Highway 95 could present a moderate to strong contrast to passing motorists due to topography, cuts and fills, and installation of crossing structures. Construction activities for the crossing of Schurz alternative segment 6 over U.S. Highway 95 near the crest of the hills between Long Valley and Rawhide Flats would begin to dominate the viewscape of drivers approaching key observation point M-2 from the south due to the large amount of earthworks required for the long approach and the type and span of the crossing structure. The construction of this

Figure 4-25. View south from key observation point M-4 toward typical road-over-rail crossing structure.

crossing would not be compatible with BLM Class III management objectives, as it would represent a strong degree of contrast. Construction of the Schurz alternative segments 1, 4, and 5 road-over-rail crossing structures of U.S. Highway 95, seen from key observation points M-3, M-4, and M-5 (see Appendix D, Figures D-93 through D-98), would result in a moderate degree of contrast due to hill cuts and the construction of the crossing structures and rail line. A moderate contrast rating would meet BLM management objectives for the Class III lands in the area of these crossings.

4.3.3.2.2.2 Mina Common Segment 1 (Hawthorne Army Depot to Blair Junction). Mina common segment 1 would cross exclusively through Class III land in the Carson City BLM District and Class IV land in the Battle Mountain BLM District. From key observation point M-8 on U.S. Highway 95 overlooking the potential Garfield Hills quarry site (see Appendix D, Figure D-104), ballast production facilities and a conveyor crossing the highway would cause a moderate degree of contrast. Similarly, development and use of the potential Gabbs Range quarry site (see Appendix D, Figure D-106) would cause a weak to moderate contrast when viewed from key observation point M-9 at U.S. Highway 95 and Luning. Either quarry would be in Class III areas, where a moderate contrast would be consistent with BLM management objectives. Construction of the common segment would also cause a moderate contrast when viewed from key observation point M-11 at the intersection of State Route 265 and U.S. Highway 95; a moderate degree of contrast would be consistent with the Class III and IV surrounding areas.

4.3.3.2.2.3 Montezuma Alternative Segments. The Montezuma alternative segments would cross Class III and Class IV lands as they head south. Because of the close proximity of Montezuma alternative segment 1 to the Class III area surrounding State Route 265, and the unobstructed view of the segment viewers would have from this highway, the contrast due to construction would be moderate as seen from key observation point M-11. For viewers at key observation point M-14 in Silver Peak, construction of the rail line through the Class IV Clayton Valley would cause a moderate contrast due to the color disparity between the ballast and playa bottom, although topography and structures and vegetation in Silver Peak would screen the construction from most viewers in Silver Peak. A moderate degree of contrast is compatible with BLM Class III and IV management objectives.

The potential North Clayton quarry would be in Class IV land and the plant site, siding, and waste dump areas would be visible from Silver Peak Road, though the quarry itself would not be visible from any frequently traveled roads. The quarry facilities would cause a weak to moderate degree of contrast, which would be compatible with management objectives for the surrounding area. The potential Malpais Mesa quarry would not be visible from U.S. Highway 95, and the potential ES-7 quarry siding and conveyor would represent only a weak contrast when viewed from this highway. Both quarries, or their associated facilities, would be highly visible from lightly traveled primitive roads, where they would cause a moderate to strong contrast that would attract the viewer's attention. A moderate to strong degree of contrast would be compatible with management objectives for the Class IV areas surrounding both quarries.

4.3.3.3 Operations Impacts

4.3.3.3.1 Operations Impacts Common to the Entire Mina Rail Alignment

Sources of potential impacts to the visual setting during the operations phase would be the presence of the rail line and operations support facilities in the landscape, and the passage of trains to and from the repository. For sections of new rail line, there would be less impact to the visual setting during the operations phase than during the construction phase, because there would be less activity (fewer, shorter trains and equipment, and fewer people), the operations right-of-way (nominally 61 meters [200 feet] on either side of the centerline of the rail line) would be narrower in some areas, and disturbed areas outside the operations right-of-way would be reclaimed (see Chapter 7 for a discussion of best management practices). For existing sections of rail line, operations impacts to the visual setting would be less noticeable than during construction because there would be comparatively fewer and shorter trains. The decommissioning and removal of Department of Defense Branchline Schurz would result in a small positive impact to viewers near the current rail line, which runs directly through the town of Schurz, as all traffic would cease.

The primary visual impact of railroad operations would be the existence of the linear track for up to 571 kilometers (355 miles) (of which 112 kilometers [70 miles] would be existing rail line), with ***wayside signals*** and communications towers visible from short distances. No new linear feature would be created along some sections of rail line, as portions of some common and alternative segments would follow existing, abandoned rail beds (Mina common segment 1, Montezuma alternative segments 2 and 3, and a small portion of Schurz alternative segments 4, 5, and 6). Additionally, the electrical distribution line currently located along U.S. Highway 95 creates a linear feature between this commonly traveled route and the potential location of Mina common segment 1.

In addition to the impact of the track itself, the passage of a train would attract the attention of a casual observer, both because of the sound associated with the train and its appearance on the track, but this would be an infrequent, short-duration visual distraction. Travel along the rail line is expected to peak at 17 one-way train trips per week (DIRS 180874-Nevada Rail Partners 2007, Appendix C). This would average fewer than three one-way trips per day. Trains would be up to 19 cars long, and would likely be visible for between 5 and 20 minutes from a single vantage point, depending on train speed and terrain. Passage of these trains would create a small impact to the visual setting.

Along the rail alignment, DOE would install 4.6-meter (15-foot)-tall wayside signals to control train movements at intervals sufficient to connect each by line-of-sight. DOE would place 23-to-30-meter (75-to-100 foot)-tall radio communications towers at the beginning and the end of the line and at intervals along the rail line as needed to ensure signal transmission (DIRS 182826-Nevada Rail Partners 2007, Chapter 6). See Figure D-29 and D-35 in Appendix D for simulations showing signals and communications towers along the Caliente rail alignment, which would utilize designs identical to those along the Mina alignment. The substations and distribution lines that connect the buried power lines to the grid would remain during the operations phase. The wayside signals, radio communication towers, substations, and distribution lines all would create small impacts to the visual setting unless placed in visually sensitive areas close to observers, where impacts could be moderate or large.

DOE established contrast ratings at key observation points considering the view of the rail line or operations support facilities and the nature and extent of operations activities that would be visible. The Department compared ratings with BLM visual resource management objectives for the lands in the viewshed. Contrast ratings at key observation points confirmed that the presence of the rail line and associated crossing structures, while noticeable in some cases, would not dominate a viewer’s attention and would result in a weak level of contrast (see Figure 4-26), except in some cases where the rail line would be close to the viewer and at some grade-separated crossings. In some instances where the rail line would run close to the viewer, the linear track would cause a moderate contrast (see Section 4.3.3.3.2). Ratings from key observation points with views of road crossings (all of which would be in Class III and IV lands) found contrasts would range from moderate to none. A weak level of contrast is compatible with BLM management objectives for all classes of land, a moderate level of contrast is compatible with BLM management objectives for Class III and IV lands but not for Class II lands, and a strong level of contrast is sometimes compatible with BLM Class IV objectives but not with Class III objectives.

Contrast ratings confirmed that the level of contrast between a passing train and the landscape would be strong (demanding a viewer’s attention) or moderate (beginning to attract attention) where the rail line would fall in the foreground or middleground of the viewshed. Contrast between the landscape and a passing train would be less where the rail line would be in the background. In such cases, the level of contrast would be moderate or weak, where the passing of a train could be noticeable but would not demand attention (see Figure 4-27). The extremely short duration of the passage would diminish the effect, so that management objectives would be met for Class II, III, and IV lands, even if the rail line were to fall in the foreground or middleground of the viewshed, as long as it would not create a linear feature across the landscape that would attract attention or would begin to dominate the landscape.

4.3.3.3.2 Operations Impacts along Alternative Segments and Common Segments

The analysis of impacts to aesthetic resources identified moderate contrast ratings associated with railroad operations along two portions of the Mina rail alignment, as discussed in Sections 4.3.3.3.2.1 and 4.3.3.3.2.2.

4.3.3.3.2.1 Schurz Alternative Segments (Walker River Paiute Reservation). The Schurz alternative segments would cross through non-BLM-administered lands treated in this analysis as Class III. Because it would cross directly over U.S. Highway 95 near where the road crests the hills between Long Valley and Rawhide Flats, the Schurz alternative segment 6 rail-over-road grade-separated crossing seen in Appendix D, Figures D-91 and D-92, would likely draw the attention of viewers. This structure would cause a moderate degree of contrast compatible with BLM management objectives for the Class III lands in the area.

4.3.3.3.2.2 Montezuma Alternative Segments. The Montezuma alternative segments would cross Class III and Class IV lands as they head south. From key observation point M-14 (Appendix D, Figure D-118) in Silver Peak, Montezuma alternative segment 1 running through the Class IV Clayton Valley would be clearly evident due to the color discrepancy between the ballast and playa bottom, causing a moderate contrast where visible (though topography and structures and vegetation would screen the rail line from most viewers in Silver Peak). A moderate level of contrast is compatible with BLM management objectives for Class III and IV lands.

4.3.3.4 Impacts under the Shared-Use Option

Impacts to aesthetic resources during the construction phase under the Shared-Use Option would be the same as those under the Proposed Action without shared use (see Section 4.3.3.2.1). Construction of additional sidings or short spurs would create small impacts to the visual setting because of the short duration of construction.

Impacts to the visual setting during the operations phase under the Shared-Use Option would be the same as those under the Proposed Action without shared use (see Section 4.3.3.3.1). Under the Shared-Use Option, there would be an additional five round-trip trains per week on rail line sections south of Hawthorne and nine round trips on the sections north of Hawthorne (DIRS 180694-Ang-Olson and Gallivan 2007, p. 3). These additional trains would not substantially increase the assumed three one-way trips per day DOE used to establish visual contrast ratings under the Proposed Action without shared use.

Figure 4-26. View east from key observation point M-10 in the town of Mina showing passage of a train in background.

Figure 4-27. View of Department of Defense Branchline Schurz from Alternate U.S. Highway 95 on the Walker River Paiute Reservation north of the town of Schurz.

4.3.3.5 Summary

Table 4-171 summarizes potential impacts to aesthetic resources from constructing and operating the proposed railroad along the Mina rail alignment.

Table 4-171. Summary of potential impacts to aesthetic resources – Mina rail alignment[a] (page 1 of 2).

Location (county)	Construction impacts[b]	Operations impacts
Rail alignment		
Impacts common to all portions of the Mina rail alignment	Small impact. Weak to moderate contrast in the short term from dust and exhaust; lighting, temporary power poles, construction camps, and material laydowns; operation of supply trains. Small to large impact. Weak to strong contrast in the short term from visible construction equipment either operating or in storage. Weak to strong contrast from scars on soil and vegetated landscape from cuts, fills, and well pads; contrast may be visible in the long term where revegetation is slow or contrasts with the surrounding vegetation types. Small to large impact. Weak to strong contrast in the long term from scars on rock from cuts, and from access roads.	Small to moderate impact. No to moderate contrast in the long term from the installation of linear track, signals, communications towers, power poles connecting to the grid, and access roads. Small impact. No to strong contrast in the short term from passing trains.
Schurz alternative Segments 1, 4, 5, and 6 (Churchill County and Mineral County)	Small to large, but temporary, impact. Moderate to strong contrast in the short term for rail-over-road crossing of U.S. Highway 95 by Schurz 6, which would not meet BLM Class III management objectives. Weak to moderate contrast in the short term for other rail line sections and structures, which would meet Class III objectives.	Small to moderate impact. Weak to moderate contrast as rail line and crossing structures would, in places, attract the attention of viewers, but would meet BLM Class III management objectives.
Mina common segment 1	Moderate impact. Moderate contrast at the intersection of State Route 265 and U.S. Highway 93 due to proximity of rail to road; would meet BLM Class III and IV management objectives.	Small impact. Weak to no contrast from track adjacent to U.S. Highway 95 that would be obscured at points by topography; would meet BLM Class III and IV management objectives.
Montezuma alternative segment 1 (Esmeralda County)	Moderate impact. Moderate contrast due to proximity to viewers on State Route 265 and in some parts of town of Silver Peak; would meet BLM Class III and IV management objectives.	Small to moderate impact. Weak contrast from new linear feature adjacent to State Route 265 and weak to moderate contrast in Clayton Valley; would meet BLM Class III and IV management objectives.

Table 4-171. Summary of potential impacts to aesthetic resources – Mina rail alignment[a] (page 2 of 2).

Location (county)	Construction impacts[b]	Operations impacts
Quarries		
Potential Garfield Hills quarry (Mineral County)	Moderate impact. Moderate contrast in the short term from quarrying, ballast production facilities, and conveyor close to viewers on U.S. Highway 95 that would be compatible with BLM Class III management objectives.	Small to no impact. Production facilities and conveyor would be removed and quarried areas restored after closure of quarry at end of construction phase.
Potential Gabbs Range quarry (Mineral County)	Small to moderate impact. Weak to moderate contrast in the short term from ballast production facilities close to viewers on U.S. Highway 95 and in Luning that would be compatible with BLM Class III management objectives.	Small to no impact. Production facilities would be removed after closure of quarry at end of construction phase.
Potential North Clayton quarry (Esmeralda County)	Small to moderate impact. Moderate contrast in the short term from production facilities close to viewers on Silver Peak Road that would be compatible with BLM Class IV management objectives.	Small to no impact. Production facilities would be removed and waste dumps restored after closure of quarry at end of construction phase.
Potential Malpais Mesa quarry (Esmeralda County)	Moderate impact. Moderate to strong contrast to viewers on a secondary road in the short term from quarrying, ballast production facilities, and conveyor close to viewers that would be compatible with BLM Class IV management objectives.	Small to no impact. Production facilities would be removed and waste dumps restored after closure of quarry at end of construction phase.
Potential ES-7 quarry (Esmeralda County)	Moderate to small impact. Moderate to strong contrast to viewers on a secondary road in the short term from conveyor and siding; weak contrast for these facilities from U.S. Highway 95. Contrast levels would be compatible with BLM Class IV management objectives.	Small to no impact. Conveyor would be removed at end of construction phase.

a. Impacts under the Shared-Use Option would be similar to those under the Proposed Action without shared use.
b. BLM methodology recognizes that “few projects meet the VRM [visual resource management] management objectives during construction” (DIRS 173053-BLM 1986, Section III.D.2.b.7).

4.3.4 AIR QUALITY AND CLIMATE

This section describes potential impacts to air quality from constructing and operating a railroad along the Mina rail alignment. Section 4.3.4.1 describes the methodology DOE used to assess potential impacts; Section 4.3.4.2 discusses conformity with the appropriate State Implementation Plan(s); Section 4.3.4.3 describes potential construction and operations impacts; Section 4.3.4.4 describes potential impacts under the Shared-Use Option; Section 4.3.4.5 discusses green house gas emissions; and Section 4.3.4.6 summarizes potential impacts to air quality.

Section 3.3.4.1 describes the region of influence for the air quality impacts analysis.

4.3.4.1 Impact Assessment Methodology

DOE calculated project-related emissions and examined county emissions inventories to determine county-level increases in air pollutant emissions, and performed air quality simulations to determine potential changes in air pollutant concentrations at specific receptors (population centers). Appendix E, Air Quality Assessment Methodology, provides a detailed description of the approach DOE used to perform the air quality assessment.

For areas along the Mina rail alignment for which no local air quality data are available, DOE compared projected emissions under the Proposed Action with the U.S. Environmental Protection Agency county-level emissions data in the National Emission Inventory database (DIRS 177709-MO0607NEI2002D.000). DOE compared emissions from proposed railroad construction and operations in Churchill, Lyon, Mineral, Esmeralda, and Nye Counties to existing emissions in three categories: highway emissions, off-highway emissions, and all county sources. Section 4.3.4.3.1 describes projected emissions associated with construction of the proposed railroad and Section 4.3.4.3.2 describes emissions from railroad operations.

To assess potential impacts to air quality in the region of influence, DOE modeled air quality where there are population centers that would be relatively close to the proposed railroad: Schurz, Hawthorne, and Mina in Mineral County; and Silver Peak and Goldfield in Esmeralda County. In each case, DOE compared the modeling results to the Nevada and National ***Ambient Air Quality Standards*** (NAAQS). These two standards are nearly identical (Section 3.2.4 explains differences), but DOE primarily references the NAAQS in this section with noted exceptions. DOE also modeled air quality and assessed impacts for construction and operations of associated railroad facilities: the Staging Yard at Hawthorne and for construction-related activities at the northern potential quarry site of Garfield Hills and the southerly potential quarry site of Malpais Mesa. Appendix E provides a detailed description of the air quality modeling methodology and assumptions.

There would be an adverse impact to air quality if the Proposed Action:

- Would conflict with or obstruct implementation of a state or regional air quality management plan
- Would violate a NAAQS primary standard or contribute to existing or projected violations

4.3.4.2 The Conformity Rule

Section 176(c) of the Clean Air Act (42 U.S.C. 7401 *et seq.*) requires that federal actions conform to the appropriate State Implementation Plan. The final rule for "Determining Conformity of General Federal Actions to State or Federal Implementation Plans" (called the Conformity Rule) is codified in 40 CFR Parts 6, 51, and 93. This Conformity Rule established the conformity criteria and procedures necessary to ensure that federal actions conform to the State Implementation Plans and meet the provisions of the

Clean Air Act. In general, this rule ensures that all emissions of ***criteria pollutants*** and ***volatile organic compounds*** are specifically identified and accounted for in the State Implementation Plan's attainment or maintenance demonstration, and conform to the State Implementation Plan's purpose of eliminating or reducing the severity and number of violations of the NAAQS and achieving expeditious attainment of such standards.

The provisions of the Conformity Rule apply only where the action is undertaken in a federally classified ***nonattainment*** or maintenance ***area***. Apart from Clark and Washoe Counties, the rest of the State of Nevada is classified as ***in attainment*** for all criteria pollutants. There are no nonattainment or maintenance areas in the proposed rail alignment's host counties of Churchill, Lyon, Mineral, Esmeralda and Nye. Hence, the provisions of the Conformity Rule do not apply to the Proposed Action.

4.3.4.3 Impacts to Air Quality

4.3.4.3.1 Construction Impacts

Potential impacts to air quality from construction of a rail line and railroad construction and operations support facilities along the Mina rail alignment would include (1) exhaust emissions from construction equipment and (2) fugitive dust ***particulate matter*** emissions resulting from construction activities. These impacts would be small, except in the vicinity of the potential Garfield Hills quarry, the Staging Yard at Hawthorne, and near the rail line construction right-of-way in the vicinity of Mina and Schurz.

Appendix E describes the modeling approach and methodology DOE used to estimate emissions and air quality impacts that would result from these activities.

DOE evaluated emissions and air quality impacts by county because the most complete and comprehensive annual emissions data available from the U.S. Environmental Protection Agency National Emission Inventory are at the county level (DIRS 177709-MO0607NEI2002D.000). DOE assessed emissions impacts by comparing construction emissions with 2002 annual county-wide emissions for ***nitrogen oxides*** (NO_x), particulate matter with aerodynamic diameters equal to or less than 10 micrometers (***PM_{10}***) and 2.5 micrometers (***$PM_{2.5}$***), ***sulfur dioxide*** (SO_2), ***carbon monoxide*** (CO), and volatile organic compounds (VOCs). DOE assessed air quality impacts by comparing resulting concentrations of these air pollutants against the NAAQS.

Churchill, Lyon, Mineral, Esmeralda, and Nye Counties are all in attainment for ***ozone (O_3)***. Ozone is generally recognized as a regional-scale air quality problem. The potential increase in the emissions of VOCs (a precursor to ozone formation) associated with rail line construction would be small in relation to the existing regional emissions of VOCs. Thus, the impact on ozone formation would not be anticipated to cause a violation of the ozone standard. (This conclusion was presented in the Draft Rail Alignment EIS, published in October 2007, relative to then-current primary and secondary 8-hour ozone standards of 0.08 parts per million, and remains unchanged relative to revised primary and secondary 8-hour ozone standards of 0.075 parts per million, effective on May 27, 2008 [see 3.3.4.2].)

Sections 4.3.4.3.1.1 through 4.3.4.3.1.5 describe potential exhaust emissions and air quality impacts from constructing the proposed rail line and railroad construction and operations support facilities along the Mina rail alignment in Churchill, Lyon, Mineral, Esmeralda, and Nye Counties.

4.3.4.3.1.1 Churchill County.

Emissions Appendix E describes the methodology DOE used to determine construction-related emissions. In Churchill County, the Mina rail alignment is anticipated to use the existing Union Pacific Railroad Hazen Branchline. Hence, the only construction emissions in Churchill County would be from the operation of construction materials trains through the county. Appendix E, Section E.3.1.2.1, provides additional detail on the Churchill County emissions inventory.

Table 4-172 compares the highest modeled annual total emissions under a 4-year construction schedule in Churchill County to the county's 2002 emissions estimates in the National Emission Inventory (DIRS 177709-MO0607NEI2002D.000). The table lists potential project-related emissions as a maximum and minimum range according to the possible lengths of the existing Union Pacific Railroad Hazen Branchline and new construction of rail line through the county, and increased equipment activity that would be necessary when construction was in rugged terrain.

Simulated construction-related emissions for VOCs, CO, NO_x, PM_{10}, $PM_{2.5}$, and SO_2 would be small fractions of the county's 2002 annual emissions for these air pollutants. Given that these emissions would be distributed over the entire length of the existing Union Pacific Railroad Hazen Branchline in Churchill County, 17 to 31 kilometers (11 to 20 miles), exceedance of any air quality standards is not likely.

As shown in Table 4-172, fugitive dust would be the principal source of particulate matter emissions. More than half of these fugitive dust emissions would be directly associated with rail line construction of Schurz alternative segment 6. About 1 percent of the overall fugitive dust emissions from roads associated with the alignment (including the alignment service road) would occur in Churchill County, or 27 metric tons (30 tons) per year.

4.3.4.3.1.2 Lyon County.

Emissions Appendix E describes the methodology DOE used to determine construction-related emissions. Section E.3.1.3.1 provides additional detail on the Lyon County emissions inventory.

Table 4-173 compares the highest annual total emissions under a 4-year construction schedule in Lyon County to the county's 2002 emissions estimates in the National Emission Inventory database (DIRS 177709-MO0607NEI2002D.000). The table lists potential project-related emissions as a maximum and minimum range according to the possible lengths of the existing and proposed rail line through the county, and increased equipment activity that would be necessary when construction was in rugged terrain.

Simulated construction-related emissions for VOCs, CO, NO_x, PM_{10}, $PM_{2.5}$, and SO_2 would be small fractions of the county's 2002 annual emissions for these air pollutants. Given that these emissions would be distributed over the entire length of the rail alignment in Lyon County, 61 to approximately 81 kilometers (38 to 51 miles), exceedance of any air quality standards is not likely.

As shown in Table 4-173, fugitive dust would be the principal source of particulate matter emissions. More than half of these fugitive dust emissions would be directly associated with rail line construction. About 3 percent of the overall fugitive dust emissions from roads associated with the alignment (including the alignment service road) would occur in Lyon County, or 91 metric tons (100 tons) per year. Construction camp 18C or 18D would contribute about 1 percent of the overall fugitive dust emissions within the county.

4.3.4.3.1.3 Mineral County.

Emissions Appendix E describes the methodology DOE used to determine construction-related emissions. Section E.3.1.4.1 provides additional detail on the Mineral County emissions inventory.

Table 4-174 compares the highest annual total emissions under a 4-year construction schedule in Mineral County to the county's 2002 emissions estimates in the National Emission Inventory database (DIRS 177709-MO0607NEI2002D.000). The table lists potential project-related emissions as a maximum and

Table 4-172. Maximum and minimum peak annual emissions anticipated from construction of a railroad along the Mina rail alignment through Churchill County, Nevada, compared to 2002 existing county emissions.

	Total emissions (tons per year)[a,b]											
	VOCs		CO		NO_x		PM_{10}		$PM_{2.5}$		SO_2	
Emissions source	Max. length[c]	Min. length[d]	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length
Construction exhaust	81	44	590	320	720	390	43	23	41	22	-	-
Construction fugitive dust	-	-	-	-	-	-	280	150	50	30	-	-
Totals	81	44	590	320	720	390	320	170	91	52	-	-
Off highway (2002)[e]	823		2,674		580		39		36		40	
Highway vehicles (2002)[e]	1,960		20,974		1,976		55		43		50	
All county sources (2002)[e]	4,788		30,312		2,776		5,773		1,252		308	

a. To convert tons to metric tons, multiply by 0.90718.
b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.
c. Maximum (Max.) length of rail alignment in Churchill County would be 31 kilometers (20 miles). (The maximum and minimum lengths along the complete rail alignment are not equal to the sum of the possible maxima or the minima in individual counties.)
d. Minimum (Min.) length of rail alignment in Churchill County would be 17 kilometers (11 miles).
e. Only includes anthropogenic (the influence of humans on the environment) source of emissions (DIRS 177709-MO0607NEI2002D.000).

Table 4-173. Maximum and minimum peak annual emissions anticipated from construction of a railroad along the Mina rail alignment through Lyon County, Nevada, compared to 2002 existing county emissions.

	Total emissions (tons per year)[a,b]											
	VOCs		CO		NO_x		PM_{10}		$PM_{2.5}$		SO_2	
Emissions source	Max. length[c]	Min. length[d]	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length
Construction exhaust	210	160	1,540	1,160	1,860	1,400	110	83	110	81	1	1
Construction fugitive dust	-	-	-	-	-	-	740	560	140	110	-	-
Totals	210	160	1,540	1,160	1,860	1,400	850	640	250	190	1	1
Off highway (2002)[e]	4,114		2,866		426		37		35		35	
Highway vehicles (2002)[e]	2,894		30,089		2,654		79		63		68	
All county sources (2002)[e]	4,696		35,321		8,315		7,990		1,245		673	

a. To convert tons to metric tons, multiply by 0.90718.

b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.

c. Maximum (Max.) length of rail alignment in Lyon County would be 81 kilometers (51 miles). (The maximum and minimum lengths along the complete rail alignment are not equal to the sum of the possible maxima or the minima in individual counties.)

d. Minimum (Min.) length of rail alignment in Lyon County would be 61 kilometers (38 miles).

e. Only includes anthropogenic (the influence of humans on the environment) source of emissions (DIRS 177709-MO0607NEI2002D.000).

Table 4-174. Maximum and minimum peak annual emissions anticipated from construction of a railroad along the Mina rail alignment through Mineral County, Nevada, compared to 2002 existing county emissions.

	Total emissions (tons per year)[a,b]											
	VOCs		CO		NO_x		PM_{10}		$PM_{2.5}$		SO_2	
Emissions source	Max. length[c]	Min. length[d]	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length
Construction exhaust	460	420	3,420	3,100	4,080	3,680	240	220	240	210	-	-
Construction fugitive dust	-	-	-	-	-	-	2,720	2,570	510	480	-	-
Totals	460	420	3,420	3,100	4,080	3,680	2,960	2,790	750	690	-	-
Off highway (2002)[e]	284		959		59		10		10		4	
Highway vehicles (2002)[e]	243		2,276		189		6		4		6	
All county sources (2002)[e]	1,386		3,402		273		1,800		480		25	

a. To convert tons to metric tons, multiply by 0.90718.

b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.

c. Maximum (Max.) length of rail alignment in Mineral County would be 171 kilometers (100 miles). (The maximum and minimum lengths along the complete rail alignment are not equal to the sum of the possible maxima or the minima in individual counties.)

d. Minimum (Min.) length of rail alignment in Mineral County would be 153 kilometers (95 miles).

e. Only includes anthropogenic (the influence of humans on the environment) source of emissions (DIRS 177709-MO0607NEI2002D.000).

minimum range according to the possible lengths of the existing and proposed rail line through the county, and increased equipment activity that would be necessary when construction was in rugged terrain.

Simulated construction-related emissions for VOCs, CO, PM_{10}, and $PM_{2.5}$ would be comparable to the county's 2002 annual emissions for these air pollutants. NO_x emissions would be 3,500 metric tons (3,800 tons) per year greater than the 2002 county-wide emissions. However, these emissions would be distributed over the entire length of the rail line in Mineral County, 153 to 171 kilometers (95 to 106 miles), and would not lead to a localized problem.

As shown in Table 4-174, fugitive dust would be the principal source of particulate matter emissions. More than half of these fugitive dust emissions would be directly associated with rail line construction. About 35 percent of the overall fugitive dust emissions from roads associated with the alignment (including the alignment service road) would occur in Mineral County, or 1,040 metric tons (1,150 tons) per year. Construction of the Staging Yard would contribute about 1 percent, construction camps 15, 16, and 17 about 1 percent each, and all wells about 4 percent to the overall fugitive dust emissions in the county.

Air Quality Impacts, Construction Activities DOE modeled air quality to determine how construction of the proposed railroad would be likely to impact air pollutant concentrations near Mina, Hawthorne, and Schurz, in Mineral County. In addition to the rail line, the air quality modeling included the impact from constructing the Staging Yard at Hawthorne. Appendix E, Section E.3.1.4.2, summarizes the modeling methodology DOE used to assess construction-related air quality impacts in Mineral County.

Table 4-175 shows the maximum modeled concentrations at any receptor point within the construction right-of-way of criteria pollutants that could be emitted during the construction phase near Mina. Tables 4-176 and 4-177 show the maximum modeled concentrations at any receptor point during the construction phase near Hawthorne and Schurz, respectively. In each case, DOE modeled a 3-year period using 3 years of actual meteorological data from 2004 through 2006. The following tables also list the highest background concentration (see Section 3.3.4 for the basis of the background concentration) and the relevant NAAQS for each air pollutant, and the maximum resulting concentration as a fraction of the NAAQS.

At Hawthorne, the maximum concentrations from construction of the proposed rail line would be below the NAAQS for all air pollutants and all averaging periods. For rail line construction at Mina and Schurz, under current, conservative estimates of emissions and dispersion from the associated activities, PM_{10} would exceed the 24-hour average NAAQS levels, while for Schurz the 24-hour $PM_{2.5}$ concentrations would also be above the NAAQS levels. However, each of these exceedances would apply only at the edge of the construction right-of-way and would only occur during the relatively short time of construction activities (less than 6 months). Air quality disposition modeling for Schurz shows that the highest simulated 24-hour PM_{10} and $PM_{2.5}$ concentrations in town, including background concentration, would be 105 and 25 micrograms per cubic meter, respectively, both of which would be well below the NAAQS levels. Similarly, air quality modeling in the town of Mina showed that the simulated maximum 24-hour PM_{10} and $PM_{2.5}$ concentrations, including background concentration, would be 128 and 28 micrograms per cubic meter, respectively, also below the NAAQS levels.

Table 4-178 shows the maximum concentrations at any modeled receptor point of criteria pollutants that would be emitted over the 3-year modeling period as a result of construction of the proposed Staging Yard at Hawthorne. The table also shows the highest background concentration (second highest for 24-hour PM_{10}) of each air pollutant (see Section 3.3.4 for the basis of the background concentration) and

Table 4-175. Maximum air pollutant concentrations in the construction right-of-way from construction of the proposed railroad near Mina, Nevada.

Averaging period	Air pollutant[a]		Background concentration[b]	Maximum project impact[c]	Maximum resulting concentration	NAAQS[d]	Maximum concentration (percent of standard)
1-hour	CO	ppm	1.8	2.2	4	35	11
3-hour	SO_2	ppm	0.072	< 0.0001	0.072	0.5	14
8-hour	CO	ppm	1.4	0.33	1.73	9	19
24-hour	PM_{10}	$\mu g/m^3$	99	68	167	150	111
	$PM_{2.5}$	$\mu g/m^3$	16[e]	7.9	23.9	35	68
	SO_2	ppm	0.025	< 0.0001	0.025	0.14	18
Annual	NO_2	ppm	0.004	0.002	0.006	0.053	11
	PM_{10}	$\mu g/m^3$	23	10	33	50[f]	66
	$PM_{2.5}$	$\mu g/m^3$	5.4	1.8	7.2	15	48
	SO_2	ppm	0.002	< 0.0001	0.002	0.03	7

a. CO = carbon monoxide; NO_2 = nitrogen dioxide; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; ppm = parts per million; SO_2 = sulfur dioxide; $\mu g/m^3$ = micrograms per cubic meter.
b. Sources: DIRS 182287-Hoelscher 2007, all for CO, SO_2, and NO_2; 40 CFR 50.4 through 50.11; DIRS 180073-TREX 2007, all.
c. < = less than.
d. NAAQS = National Ambient Air Quality Standards.
e. For comparison to the air quality standard, the 3-year average of the 98th percentile is 16 micrograms per cubic meter.
f. The U.S. Environmental Protection Agency revoked the annual PM_{10} standard effective December 18, 2006 (71 *FR* 60853, October 17, 2006), but the Nevada annual average PM_{10} standard remains in effect.

Table 4-176. Maximum air pollutant concentrations in the construction right-of-way from construction of the proposed railroad near Hawthorne, Nevada.

Averaging period	Air pollutant[a]		Background concentration[b]	Maximum project impact[c]	Maximum resulting concentration	NAAQS[d]	Maximum concentration (percent of standard)
1-hour	CO	ppm	1.8	1.3	3.1	35	9
3-hour	SO_2	ppm	0.072	< 0.0001	0.072	0.5	14
8-hour	CO	ppm	1.4	0.24	1.6	9	18
24-hour	PM_{10}	$\mu g/m^3$	99	46	145	150	97
	$PM_{2.5}$	$\mu g/m^3$	16[e]	5.7	21.7	35	62
	SO_2	ppm	0.025	< 0.0001	0.025	0.14	18
Annual	NO_2	ppm	0.004	0.003	0.007	0.053	13
	PM_{10}	$\mu g/m^3$	23	8	31	50[f]	62
	$PM_{2.5}$	$\mu g/m^3$	5.4	2.2	7.6	15	51
	SO_2	ppm	0.002	< 0.0001	0.002	0.03	7

a. CO = carbon monoxide; NO_2 = nitrogen dioxide; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; ppm = parts per million; SO_2 = sulfur dioxide; $\mu g/m^3$ = micrograms per cubic meter.
b. Sources: DIRS 182287-Hoelscher 2007, all for CO, SO_2, and NO_2; 40 CFR 50.4 through 50.11; DIRS 180073-TREX 2007, all.
c. < = less than.
d. NAAQS = National Ambient Air Quality Standards.
e. For comparison to the air quality standard, the 3-year average of the 98th percentile is 16 micrograms per cubic meter.
f. The U.S. Environmental Protection Agency revoked the annual PM_{10} standard effective December 18, 2006 (71 *FR* 60853, October 17, 2006), but the Nevada annual average PM_{10} standard remains in effect.

the relevant NAAQS for each air pollutant, and the maximum resulting concentration as a fraction of the NAAQS. Figure 4-28 shows the predicted second highest 24-hour PM_{10} concentration near the proposed site of the Staging Yard at Hawthorne to illustrate the construction-related air pollutant concentrations relative to the form of the NAAQS in this area.

Table 4-177. Maximum pollutant concentrations in the construction right-of-way from construction of the proposed railroad near Schurz, Nevada.

Averaging period	Air pollutant[a]		Background concentration[b]	Maximum project impact[c]	Maximum resulting concentration	NAAQS[d]	Maximum concentration (percent of standard)
1-hour	CO	ppm	1.8	4.9	6.7	35	19
3-hour	SO_2	ppm	0.072	< 0.0001	0.072	0.5	26
8-hour	CO	ppm	1.4	0.91	2.3	9	10
24-hour	PM_{10}	$\mu g/m^3$	99	180	279	150	186
	$PM_{2.5}$	$\mu g/m^3$	16[e]	27	43	35	124
	SO_2	ppm	0.025	< 0.0001	0.025	0.14	18
Annual	NO_2	ppm	0.004	0.008	0.012	0.053	23
	PM_{10}	$\mu g/m^3$	23	29	52	50[f]	103
	$PM_{2.5}$	$\mu g/m^3$	5.4	6.6	12	15	80
	SO_2	ppm	0.002	< 0.0001	0.002	0.03	7

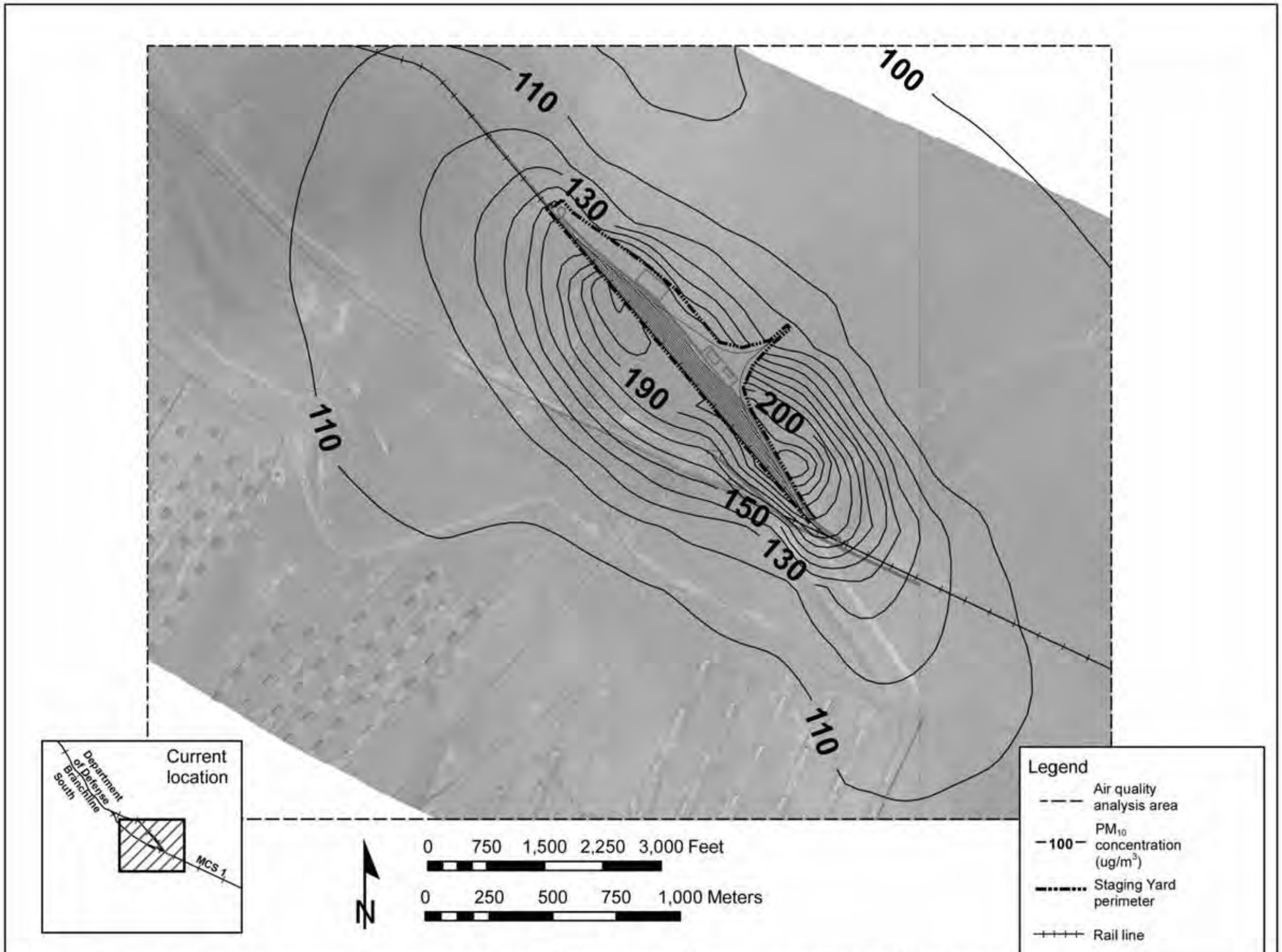
a. CO = carbon monoxide; NO_2 = nitrogen dioxide; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; ppm = parts per million; SO_2 = sulfur dioxide; $\mu g/m^3$ = micrograms per cubic meter.
b. Sources: DIRS 182287-Hoelscher 2007, all for CO, SO_2, and NO_2; 40 CFR 50.4 through 50.11; DIRS 180073-TREX 2007, all.
c. < = less than.
d. NAAQS = National Ambient Air Quality Standards.
e. For comparison to the air quality standard, the 3-year average of the 98th percentile is 16 micrograms per cubic meter.
f. The U.S. Environmental Protection Agency revoked the annual PM_{10} standard effective December 18, 2006 (71 *FR* 60853, October 17, 2006), but the Nevada annual average PM_{10} standard remains in effect.

Table 4-178. Maximum air pollutant concentrations at the facility fence line from construction of the proposed Staging Yard at Hawthorne, Nevada.

Averaging period	Air pollutant[a]		Background concentration[b]	Maximum project impact[c]	Maximum resulting concentration	NAAQS[d]	Maximum concentration (percent of standard)
1-hour	CO	ppm	1.8	4.9	6.7	35	19
3-hour	SO_2	ppm	0.072	0.001	0.073	0.5	15
8-hour	CO	ppm	1.4	0.83	2.2	9	25
24-hour	PM_{10}	$\mu g/m^3$	99	148	247	150	165
	$PM_{2.5}$	$\mu g/m^3$	16[e]	25	41	35	118
	SO_2	ppm	0.025	0.0002	0.025	0.14	18
Annual	NO_2	ppm	0.004	0.005	0.009	0.053	18
	PM_{10}	$\mu g/m^3$	23	28	51	50[f]	102
	$PM_{2.5}$	$\mu g/m^3$	5.4	5.7	11	15	74
	SO_2	ppm	0.002	< 0.0001	0.002	0.03	7

a. CO = carbon monoxide; NO_2 = nitrogen dioxide; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; ppm = parts per million; SO_2 = sulfur dioxide; $\mu g/m^3$ = micrograms per cubic meter.
b. Sources: DIRS 182287-Hoelscher 2007, all for CO, SO_2, and NO_2; 40 CFR 50.4 through 50.11; DIRS 180073-TREX 2007, all.
c. < = less than.
d. NAAQS = National Ambient Air Quality Standards.
e. For comparison to the air quality standard, the 3-year average of the 98th percentile is 16 micrograms per cubic meter.
f. The U.S. Environmental Protection Agency revoked the annual PM_{10} standard effective December 18, 2006 (71 *FR* 60853, October 17, 2006), but the Nevada annual average PM_{10} standard remains in effect.

The maximum concentrations from construction of the Staging Yard at Hawthorne would be below NAAQS for all air pollutants except for the 24-hour PM_{10} and $PM_{2.5}$ concentration at the facility fence line under the conservative modeling approach DOE employed here, and would only occur during the 12-month construction period. Also, as shown in Figure 4-28, air pollutant concentrations in the population centers farther from the facility than the fence line would have lower concentrations, below all applicable air quality standards.



Note: PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; ug/m^3 = micrograms per cubic meter; MCS = Mina common segment.

Figure 4-28. Simulated maximum modeled 24-hour PM_{10} concentrations, including background, from construction of the proposed Staging Yard near Hawthorne, Nevada.

In addition, under Nevada Administrative Code 445B.22037, DOE would be required to obtain a Surface Area Disturbance Permit Dust Control Plan, which would address in detail the best types of fugitive dust control methods to be used. Specifics as to the best control methods would depend on the specific layout, operation, and activity level at the Staging Yard. These details are not fully available at this time, but would be when DOE filed the Surface Disturbance Permit Dust Control Plan with the State of Nevada. More than one method to control fugitive dust could be necessary to prevent fugitive dust generation, and use of multiple methods to control fugitive dust must be addressed, if needed. The Permit Plan could require such measures as paving roads, cessation of operations when winds make control of fugitive dust difficult, and limitations on the areas worked per day. DOE anticipates that these measures would reduce the PM_{10} emissions, making an exceedance of the 24-hour PM_{10} NAAQS unlikely. Further, DOE could reduce this concern by acquiring additional land and moving public access (the fence line) farther away from the Staging Yard.

Air Quality Impacts, Quarry Activities DOE also performed simulations to determine potential impacts to air quality associated with activity at the potential Garfield Hills quarry near the town of Hawthorne (DIRS 180919-Nevada Rail Partners 2007, Appendices A and B; DIRS 183636-Shannon & Wilson 2007, pp. 24 to 27). Appendix E, Section E.3.1.4.2.2, describes the methodology DOE used to simulate quarry-related impacts to air quality.

Table 4-179 shows the maximum concentrations at any modeled receptor point of criteria pollutants that could be emitted from quarry-related activities over the 3-year period. The table also shows the highest background concentration of each air pollutant (see Section 3.3.4 for the basis of the background concentration) and the relevant NAAQS for each air pollutant, and the maximum resulting concentration as a fraction of the NAAQS.

The maximum concentrations from operation of the potential Garfield Hills quarry would be during the quarry construction, for which the results shows that concentrations would be below the NAAQS for all

Table 4-179. Maximum pollutant concentration at the facility fence line from operation of the potential Garfield Hills quarry during the construction phase.

Averaging period	Air pollutant[a]		Background concentration[b]	Maximum project impact[c]	Maximum resulting concentration	NAAQS[d]	Maximum concentration (percent of standard)
1-hour	CO	ppm	1.8	1.7	3.5	35	10
3-hour	SO_2	ppm	0.072	0.001	0.07	0.5	14
8-hour	CO	ppm	1.4	0.34	1.74	9	15
24-hour	PM_{10}	μg/m^3	99	201.	300	150	200
	$PM_{2.5}$	μg/m^3	16[e]	17.4	33.4	35	95
	SO_2	ppm	0.025	< 0.0001	0.03	0.14	18
Annual	NO_2	ppm	0.004	0.001	0.005	0.053	10
	PM_{10}	μg/m^3	23	23	46	50[f]	93
	$PM_{2.5}$	μg/m^3	5.4	2.9	8.3	15	55
	SO_2	ppm	0.002	< 0.0001	0.002	0.03	7

a. CO = carbon monoxide; NO_2 = nitrogen dioxide; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; ppm = parts per million; SO_2 = sulfur dioxide; μg/m^3 = micrograms per cubic meter.
b. Sources: DIRS 182287-Hoelscher 2007, all for CO, SO_2, and NO_2; 40 CFR 50.4 through 50.11; DIRS 180073-TREX 2007, all.
c. < = less than.
d. NAAQS = National Ambient Air Quality Standards.
e. For comparison to the air quality standard, the 3-year average of the 98th percentile is 16 micrograms per cubic meter.
f. The U.S. Environmental Protection Agency revoked the annual PM_{10} standard effective December 18, 2006 (71 *FR* 60853, October 17, 2006), but the Nevada annual average PM_{10} standard remains in effect.

air pollutants except the 24-hour PM_{10} and $PM_{2.5}$ concentration at the facility fence line under the conservative modeling approach DOE employed here. However, air pollutant concentrations in thepopulation centers farther from the facility than the fence line would have much lower concentrations.

In developing the quarry, under Nevada Administrative Code 445B.22037, DOE would be required to obtain a Surface Area Disturbance Permit Dust Control Plan, which would address in detail the best types of fugitive dust control methods to be used. Specifics as to the best control methods would depend on the specific layout, operation, and activity level at the quarry. These details are not fully available at this time, but would be when DOE filed the Surface Disturbance Permit Dust Control Plan with the State of Nevada. More than one method to control fugitive dust could be necessary to prevent fugitive dust generation, and use of multiple methods to control fugitive dust must be addressed, if needed. The Permit Plan could require such measures as paving roads and cessation of operations when winds make control of fugitive dust difficult, and the use of wet suppression during rock crushing, screening, and conveyor transfer. DOE anticipates that these measures would reduce the PM_{10} emissions, making an exceedance of the 24-hour PM_{10} NAAQS unlikely. During quarry operations, PM_{10} emissions would be more than 80 percent lower than during quarry construction and no exceedance of the 24-hour PM_{10} NAAQS would be expected. Further, DOE could reduce this concern by acquiring additional land and moving public access (the fence line) farther away from the quarry (see Chapter 7, Best Management Practices and Mitigation).

DOE did not model other construction activities (at access roads, construction camps, and wells) because emissions from those construction activities would be smaller than emissions during rail line construction and would be expected to show even lower concentrations during the operations phase; therefore, emissions would be well below NAAQS for all air pollutants.

4.3.4.3.1.4 Esmeralda County.

Emissions Appendix E describes the methodology DOE used to determine construction-related emissions. Section E.3.1.5.1 provides additional detail on the Esmeralda County emissions inventory.

Table 4-180 compares the highest annual total emissions under a 4-year construction schedule in Esmeralda County to the county's 2002 emissions estimates in the National Emission Inventory database (DIRS 177709-MO0607NEI2002D.000). The table lists potential project-related emissions as a maximum and minimum range according to the possible lengths of the rail line through the county, and increased equipment activity that would be necessary when construction was in rugged terrain.

Simulated construction-related emissions for VOCs, CO, NO_x, PM_{10}, and $PM_{2.5}$ would be much larger than the county's 2002 annual emissions for these air pollutants. The emissions of NO_x during rail line construction could increase emissions by 3,570 metric tons (3,940 tons) per year over the county's 2002 annual emissions. Similarly, emissions of PM_{10} and $PM_{2.5}$ could increase by as much as 1,570 and 480 metric tons (1,730 and 530 tons) per year, respectively, over the 2002 county annual emission values. VOCs and CO would increase by 190 and 1,750 metric tons (210 and 1,930 tons) per year, respectively, over the 2002 county annual emissions. However, these emissions would be distributed over the entire length of the rail alignment in Esmeralda County (134 to 175 kilometers [83 to 109 miles]), greatly reducing any air quality impacts and would not lead to a localized problem; thus, no air quality standard would be exceeded during the construction phase in Esmeralda County, as shown in Table 4-181 for Silver Peak.

As shown in Table 4-180, fugitive dust would be the principal source of particulate matter emissions. More than half of these fugitive dust emissions would be directly associated rail line construction. About 29 percent of the overall fugitive dust emissions from roads associated with the alignment (including the alignment service road) would occur in Esmeralda County, or 860 metric tons (950 tons) per year.

Table 4-180. Maximum and minimum peak annual emissions anticipated from construction of a railroad along the Mina rail alignment through Esmeralda County, Nevada, compared to 2002 existing county emissions.

	Total emissions (tons per year)[a,b]											
	VOCs		CO		NO_x		PM_{10}		$PM_{2.5}$		SO_2	
Emissions source	Max. length[c]	Min. length[d]	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length
Construction exhaust	470	360	3,420	2,640	4,100	3,150	240	190	240	180	3	2
Construction fugitive dust	-	-	-	-	-	-	2,710	2,340	500	430	-	-
Totals	470	360	3,420	2,640	4,100	3,150	2,950	2,530	740	610	3	2
Off highway (2002)[e]	10		75		29		3		3		3	
Highway vehicles (2002)[e]	144		1,372		118		3		3		3	
All county sources (2002)[e]	264		1,487		164		1,216		213		61	

a. To convert tons to metric tons, multiply by 0.90718.

b. CO = carbon monoxide; HC = hydrocarbons; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.

c. Maximum (Max.) length of rail alignment in Esmeralda County would be 175 kilometers (109 miles). (The maximum and minimum lengths along the complete rail alignment are not equal to the sum of the possible maxima or the minima in individual counties.)

d. Minimum (Min.) length of rail alignment in Esmeralda County would be 134 kilometers (83 miles).

e. Only includes anthropogenic (the influence of humans on the environment) source of emissions (DIRS 177709-MO0607NEI2002D.000).

Construction of the Maintenance-of-Way Facility would contribute less than 1 percent, construction camps 9 or 9A, 13A or 13B, and 14 would contribute about 1 percent each, and the wells would contribute about 4 percent to the overall fugitive dust emissions within the county.

Air Quality Impacts, Construction Activities DOE modeled air quality to determine how construction of the proposed rail line would be likely to impact air pollutant concentrations near Silver Peak, in Esmeralda County. Appendix E, Section 3.1.5.2.1 summarizes the modeling methodology DOE used to assess construction-related air quality impacts in Esmeralda County.

Table 4-181 lists the maximum concentrations at any receptor point within the modeled domain of criteria pollutants that could be emitted during the construction phase near Silver Peak. DOE modeled the effects near Silver Peak for a 3-year period using 3 years of actual meteorological data from 2004 through 2006. The table also lists the highest background concentration of each air pollutant (see Section 3.3.4 for the basis of the background concentration) since 1991 and the relevant NAAQS for each air pollutant, and the maximum resulting concentration as a fraction of the NAAQS.

Table 4-181. Maximum pollutant concentrations in the construction right-of-way from construction of the proposed railroad near Silver Peak, Nevada.

Averaging period	Air pollutant[a]		Background concentration[b]	Maximum project impact[c]	Maximum resulting concentration	NAAQS[d]	Maximum concentration (percent of standard)
1-hour	CO	ppm	0.2	2.5	2.7	35	8
3-hour	SO_2	ppm	0.002	< 0.0001	0.002	0.5	<1
8-hour	CO	ppm	0.2	0.45	0.65	9	7
24-hour	PM_{10}	$\mu g/m^3$	39	55	94	150	63
	$PM_{2.5}$	$\mu g/m^3$	12	6.5	19	35	54
	SO_2	ppm	0.002	< 0.0001	0.002	0.14	14
Annual	NO_2	ppm	0.002	0.002	0.004	0.053	7.5
	PM_{10}	$\mu g/m^3$	12	7.4	19.4	50[e]	39
	$PM_{2.5}$	$\mu g/m^3$	3.6	1.6	5.2	15	35
	SO_2	ppm	0.002	< 0.0001	0.002	0.03	7

a. CO = carbon monoxide; NO_2 = nitrogen dioxide; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; ppm = parts per million; SO_2 = sulfur dioxide; $\mu g/m^3$ = micrograms per cubic meter.
b. Sources: DIRS 147771-CRWMS M&O 1996, p. 13; DIRS 102877-CRWMS M&O 1999, p. 14; DIRS 147780-SAIC 1992, p. 13; DIRS 168842-DOE 2003, all; DIRS 173738-DOE 2002, all; DIRS 173740-DOE 2004, all; DIRS 176996-DOE 2005, p. 38; DIRS 179948-DOE 2006, p. 40; 40 CFR 50.4 through 50.11.
c. < = less than.
d. NAAQS = National Ambient Air Quality Standards.
e. The U.S. Environmental Protection Agency revoked the annual PM_{10} standard effective December 18, 2006 (71 *FR* 60853, October 17, 2006), but the Nevada annual average PM_{10} standard remains in effect.

Under the conservative modeling approach DOE employed, PM_{10} concentrations were the closest to the standard at 63 percent of the NAAQS, while all other pollutants were lower. Additionally, for any distance greater than immediately at the fence line where populations are likely to be, concentrations would be below the standard. Modeling results for the central area of Silver Peak show the highest 24-hour PM_{10} and $PM_{2.5}$ concentrations, including peak background concentration, are 94 and 19 $\mu g/m^3$ (micrograms per cubic meter), respectively, both of which are below the NAAQS levels.

Air Quality Impacts, Quarry Activities DOE also performed simulations to determine potential impacts to air quality associated with activity at the potential Malpais Mesa quarry near the town of Goldfield (DIRS 180919-Nevada Rail Partners 2007, Appendices A and B; DIRS 183636-Shannon &

Wilson 2007, pp. 24 to 27). Appendix E, Section E.3.1.5.2.2, describes the methodology DOE used to simulate quarry-related impacts to air quality.

Table 4-182 shows the maximum concentrations at any receptor point of criteria pollutants that would be emitted over the 3-year period and that would result from quarry-related activities. The table also shows the highest background concentration of each air pollutant (see Section 3.2.4 for the basis of the background concentration) since 1991 and the relevant NAAQS for each air pollutant, and the maximum resulting concentration as a fraction of the NAAQS. Modeling results show that the highest 24-hour PM_{10} and $PM_{2.5}$ concentrations, including peak background concentration, would be 71 and 15 $\mu g/m^3$, respectively, both of which are below the NAAQS levels.

Table 4-182. Maximum pollutant concentrations at the facility fence line from operation of the potential Malpais Mesa quarry during the construction phase.

Averaging period	Air pollutant[a]		Background concentration[b]	Maximum project impact[c]	Maximum resulting concentration	NAAQS[d]	Maximum concentration (percent of standard)
1-hour	CO	ppm	0.2	0.27	0.47	35	1
3-hour	SO_2	ppm	0.002	0.00004	0.002	0.5	0
8-hour	CO	ppm	0.2	0.048	0.25	9	3
24-hour	PM_{10}	$\mu g/m^3$	39	32	71	150	47
	$PM_{2.5}$	$\mu g/m^3$	12	2.6	14.6	35	42
	SO_2	ppm	0.002	0.00001	0.002	0.14	1
Annual	NO_2	ppm	0.002	0.0001	0.0021	0.053	4
	PM_{10}	$\mu g/m^3$	12	3.2	15.2	50[e]	30
	$PM_{2.5}$	$\mu g/m^3$	3.6	0.4	4	15	27
	SO_2	ppm	0.002	< 0.0001	0.002	0.03	7

a. CO = carbon monoxide; NO_2 = nitrogen dioxide; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; ppm = parts per million; SO_2 = sulfur dioxide; $\mu g/m^3$ = micrograms per cubic meter.
b. Sources: DIRS 182287-Hoelscher 2007, all; DIRS 179933-State of Nevada 2007, all; 40 CFR 50.4 through 50.11; DIRS 180073-TREX 2007, all.
c. < = less than.
d. NAAQS = National Ambient Air Quality Standards.
e. The U.S. Environmental Protection Agency revoked the annual PM_{10} standard effective December 18, 2006 (71 *FR* 60853, October 17, 2006), but the Nevada annual average PM_{10} standard remains in effect.

DOE did not model other construction activities (access roads, construction camps, and wells) because their emissions would be smaller than emissions during rail line construction and would be expected to show even lower concentrations; therefore, these emissions would be well below NAAQS for all air pollutants.

4.3.4.3.1.5 Nye County.

Emissions Appendix E describes the methodology DOE used to determine construction-related emissions. Section E.3.1.6.1 provides additional detail on the Nye County emissions inventory. The table lists potential project-related emissions as a maximum and minimum range according to the possible lengths of the proposed rail alignment through the county, and increased equipment activity that would be necessary when construction was in rugged terrain.

Simulated construction-related emissions for VOCs, SO_x, CO, PM_{10}, and $PM_{2.5}$ would be less than the county's 2002 annual emissions for these air pollutants. The emissions of NO_x during the construction phase could increase emissions by 1,770 metric tons (1,950 tons) per year over the county's 2002 annual emissions. Given that these emissions would be distributed over the entire length of the rail line in Nye County (126 to 148 kilometers [78 to 92 miles]), no air quality standards would be exceeded.

As shown in Table 4-183, fugitive dust would the principal source of particulate matter emissions. More than half of these fugitive dust emissions would be directly associated with rail line construction. About 32 percent of the overall fugitive dust emissions from roads associated with the alignment (including the alignment service road) would occur in Nye County, or 934 metric tons (1,030 tons) per year. Construction camps 9 or 9A, 10, 11, and 12 would contribute about 1 percent each, and all wells would contribute about 4 percent of the overall fugitive dust emissions within the county.

DOE did not model other construction activities (at access roads, construction camps, and wells) because emissions from those construction activities would be smaller than emissions during rail line construction and would be expected to show even lower concentrations; therefore, those emissions would be well below NAAQS for all air pollutants.

4.3.4.3.2 Operations Impacts

Exhaust emissions during the railroad operations phase would impact air quality, but these impacts would be small.

Appendix E describes the modeling approach and methodology DOE used to estimate operations exhaust emissions and impacts to air quality.

DOE evaluated exhaust emissions and impacts to air quality by county because the most complete and comprehensive emissions data are available only at the county level. To assess emissions impacts, DOE compared modeled operations emissions with 2002 annual county-wide emissions for NO_x, PM_{10}, $PM_{2.5}$, SO_2, CO, and VOCs. To assess impacts to air quality, DOE compared resulting concentrations of these air pollutants to the NAAQS. Churchill, Lyon, Mineral, Esmeralda, and Nye Counties are all in attainment for ozone. Ozone is generally recognized as a regional-scale air quality problem.
The potential increase in the emissions of VOCs (a precursor to ozone formation) associated with the operations phase would be small in relation to the existing regional emissions of VOCs. Thus, the impact on ozone formation would not cause a violation of the ozone standard. (This conclusion was presented in the Draft Rail Alignment EIS, published in October 2007, relative to then-current primary and secondary 8-hour ozone standards of 0.08 parts per million, and remains unchanged relative to revised primary and secondary 8-hour ozone standards of 0.075 parts per million, effective on May 27, 2008 [see 3.3.4.2].)

Sections 4.3.4.3.2.1 through 4.3.4.3.2.5 detail the potential emissions and air quality impacts during the railroad operations phase in Churchill, Lyon, Mineral, Esmeralda, and Nye Counties.

4.3.4.3.2.1 Churchill County.

Emissions Appendix E describes the methodology DOE used to assess operations-related emissions. Section E.3.2.2 provides additional detail on the Churchill County emissions inventory.

Table 4-184 compares the modeled highest annual total emissions during operation of the rail line in Churchill County to the county's 2002 National Emission Inventory database emissions estimates (DIRS 177709-MO0607NEI2002D.000). The table lists project-related emissions as a maximum and minimum range according to the possible lengths of the rail alignment through Churchill County.

The projected operations-related emissions for all air pollutants considered in this analysis would be much less than the county's 2002 annual emissions for these air pollutants. These emissions would be distributed over the entire length of the rail alignment through Churchill County (17 to 31 kilometers [11 to 20 miles]); thus, no air quality standard would be exceeded.

Table 4-183. Maximum and minimum peak annual emissions anticipated from construction of a railroad along the Mina rail alignment through Nye County, Nevada, compared to 2002 existing county emissions.

	Total emissions (tons per year)[a,b]											
	VOCs		CO		NO_x		PM_{10}		$PM_{2.5}$		SO_x	
Emissions source	Max. length[c]	Min. length[d]	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length
Construction[f] exhaust	410	350	2,970	2,560	3,530	3,030	210	180	200	170	3	2
Construction fugitive dust	0	0	0	0	0	0	2,190	2,010	440	400	0	0
Totals	410	350	2,970	2,560	3,530	3,030	2,400	2,190	640	570	3	2
Off highway (2002)[e]	372		1,967		219		30		28		24	
Highway vehicles (2002)[e]	1,469		15,375		1,155		35		28		31	
All county sources (2002)[e]	2,507		18,778		1,583		3,656		715		261	

a. To convert tons to metric tons, multiply by 0.90718.
b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.
c. Maximum (Max.) length of rail alignment in Nye County would be 148 kilometers (92 miles). (The maximum and minimum lengths along the complete rail alignment are not equal to the sum of the possible maxima or the minima in individual counties.)
d. Minimum (Min.) length of rail alignment in Nye County would be 126 kilometers (78 miles).
e. Only includes anthropogenic (the influence of humans on the environment) source of emissions (DIRS 177709-MO0607NEI2002D.000).
f. < = less than.

Table 4-184. Maximum and minimum peak annual emissions anticipated from operation of a railroad along the Mina rail alignment through Churchill County, Nevada, compared to 2002 existing county emissions.

Emissions source	Total emissions (tons per year)[a,b]											
	VOCs		CO		NO_x		PM_{10}		$PM_{2.5}$		SO_x	
	Max. length[c]	Min. length[d]	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length
Operations exhaust	-	-	2	1	10	6	-	-	-	-	-	-
Off highway (2002)[e]	823		2,674		580		39		36		40	
Highway vehicles (2002)[e]	1,960		20,974		1,976		55		43		50	
All county sources (2002)[e]	4,788		30,312		2,776		5,773		1,252		308	
Percent increase[f] (projected emission/county emission × 100)	< 0.1	< 0.1	< 0.1	< 0.1	0	0	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1

a. To convert tons to metric tons, multiply by 0.90718.
b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.
c. Maximum (Max.) length of rail alignment in Churchill County would be 17 kilometers (11 miles). (The maximum and minimum lengths along the complete rail alignment are not equal to the sum of the possible maxima or the minima in individual counties.)
d. Minimum (Min.) length of rail alignment in Churchill County would be 31 kilometers (20 miles).
e. Only includes anthropogenic (the influence of humans on the environment) source of emissions (DIRS 177709-MO0607NEI2002D.000).
f. < = less than.

4.3.4.3.2.2 Lyon County.

Emissions Appendix E describes the methodology DOE used to assess operations-related emissions. Section E.3.2.3 provides additional detail on the Lyon County emissions inventory.

Table 4-185 compares the modeled highest annual total emissions during operation of the rail line in Lyon County to the county's 2002 National Emission Inventory database emissions estimates (DIRS 177709-MO0607NEI2002D.000). The table lists project-related emissions as a maximum and minimum range according to the possible lengths of the rail alignment through Lyon County.

The projected operations-related emissions for all air pollutants considered in this analysis would be much less than the county's 2002 annual emissions for these air pollutants. These emissions would be distributed over the entire length of the rail alignment through Lyon County (61 to 81 kilometers [38 to 51 miles]); thus, no air quality standard would be exceeded.

4.3.4.3.2.3 Mineral County.

Emissions Appendix E describes the methodology DOE used to assess operations-related emissions. Section E.3.2.4.1 provides additional detail on the Mineral County emissions inventory.

Table 4-186 compares the modeled highest annual total emissions during operation of the rail line in Mineral County to the county's 2002 National Emission Inventory database emissions estimates (DIRS 177709-MO0607NEI2002D.000). The table lists project-related emissions as a maximum and minimum range according to the possible lengths of the rail alignment through the county.

The projected operations-related emissions for all air pollutants considered in this analysis would be much less than the county's 2002 annual emissions for these air pollutants. These emissions would be distributed over the entire length of the rail alignment through Mineral County (153 to 171 kilometers [95 to 106 miles]); thus, no air quality standard would be exceeded.

Air Quality Impacts DOE modeled air quality to determine how railroad operations would be likely to impact air pollutant concentrations near the towns of Mina, Hawthorne, and Schurz, and the Staging Yard at Hawthorne. Appendix E, Section E.3.2.4.2, summarizes the modeling methodology DOE used to assess operations-related impacts to air quality in Mineral County.

Table 4-187 lists the maximum concentrations at any modeled receptor point of the criteria pollutants that would result from operation of the proposed rail line near Mina. DOE modeled a 3-year period using 3 years of actual meteorological data from 2004 through 2006. The table also lists the highest background concentration of each air pollutant (see Section 3.3.4 for the basis of the background concentration) since 1991 and the relevant NAAQS for each air pollutant, and the maximum resulting concentration as a fraction of the NAAQS. Similarly, Tables 4-188 and 4-189 list the maximum concentrations for Hawthorne and Schurz, respectively. In each case, the maximum concentrations from operation of the proposed rail line would be below the NAAQS for all air pollutants. The maximum fraction of the NAAQS modeled at each location was for the 24-hour PM_{10} concentration with 66 percent at Mina, 66 percent at Hawthorne, and 67 percent at Schurz. Table 4-190 lists the maximum concentrations for operation of the Staging Yard at Hawthorne. Figure 4-29 shows the predicted second highest 24-hour PM_{10} concentration near the proposed site of the Staging Yard near Hawthorne to illustrate the operations-related air pollutant concentrations, in the form of the NAAQS, in the vicinity of the Yard.

Table 4-185. Maximum and minimum peak annual emissions anticipated from operation of a railroad along the Mina rail alignment through Lyon County, Nevada, compared to 2002 existing county emissions.

	Total emissions (tons per year)[a,b]											
	VOCs		CO		NO_x		PM_{10}		$PM_{2.5}$		SO_x	
Emissions source	Max. length[c]	Min. length[d]	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length
Operations exhaust	1	1	4	3	25	19	1	1	1	1	-	-
Off highway (2002)[e]	411		2,866		426		37		35		35	
Highway vehicles (2002)[e]	2,894		30,089		2,654		79		63		68	
All county sources (2002)[e]	4,696		35,321		8,315		7,990		1,245		673	
Percent increase[f] (projected emission/county emission × 100)	< 0.1	< 0.1	< 0.1	< 0.1	0	0	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1

a. To convert tons to metric tons, multiply by 0.90718.
b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.
c. Maximum (Max.) length of rail alignment in Lyon County would be 81 kilometers (51 miles). (The maximum and minimum lengths along the complete rail alignment are not equal to the sum of the possible maxima or the minima in individual counties.)
d. Minimum (Min.) length of rail alignment in Lyon County would be 61 kilometers (38 miles).
e. Only includes anthropogenic (the influence of humans on the environment) source of emissions (DIRS 177709-MO0607NEI2002D.000).
f. < = less than.

Table 4-186. Maximum and minimum peak annual emissions anticipated from operation of a railroad along the Mina rail alignment through Mineral County, Nevada, compared to 2002 existing county emissions.

	Total emissions (tons per year)[a,b]											
	VOC		CO		NO_x		PM_{10}		$PM_{2.5}$		SO_x	
Emissions source	Max. length[c]	Min. length[d]	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length
Operations exhaust	15	14	57	56	212	207	7	7	7	6	-	-
Off highway (2002)[e]	394		959		59		10		10		4	
Highway vehicles (2002)[e]	243		2,276		189		6		4		6	
All county sources (2002)[e]	1,386		3,402		273		1,800		480		25	
Percent increase[f] (projected emission/county emission × 100)	1	1	2	2	78	76	0	0	1	1	< 0.1	< 0.1

a. To convert tons to metric tons, multiply by 0.90718.
b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.
c. Maximum (Max.) length of rail alignment in Mineral County would be 171 kilometers (100 miles). (The maximum and minimum lengths along the complete rail alignment are not equal to the sum of the possible maxima or the minima in individual counties.)
d. Minimum (Min.) length of rail alignment in Mineral County would be 153 kilometers (95 miles).
e. Only includes anthropogenic (the influence of humans on the environment) source of emissions (DIRS 177709-MO0607NEI2002D.000).
f. < = less than.

Table 4-187. Maximum pollutant concentrations from operation of the proposed railroad near Mina, Nevada.

Averaging period	Air pollutant[a]		Background concentration[b]	Maximum project impact[c]	Maximum resulting concentration	NAAQS[d]	Maximum concentration (percent of standard)
1-hour	CO	ppm	1.8	0.003	1.8	35	5
3-hour	SO_2	ppm	0.072	0.00001	0.072	0.5	14
8-hour	CO	ppm	1.4	0.002	1.4	9	16
24-hour	PM_{10}	$\mu g/m^3$	99	0.05	99	150	66
	$PM_{2.5}$	$\mu g/m^3$	16[e]	0.04	16	35	46
	SO_2	ppm	0.025	0.000003	0.025	0.14	18
Annual	NO_2	ppm	0.004	0.0001	0.0041	0.053	8
	PM_{10}	$\mu g/m^3$	23	0.02	23	50[f]	46
	$PM_{2.5}$	$\mu g/m^3$	5.4	0.02	5.42	15	36
	SO_2	ppm	0.002	< 0.000001	0.002	0.03	7

a. CO = carbon monoxide; NO_2 = nitrogen dioxide; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; ppm = parts per million; SO_2 = sulfur dioxide; $\mu g/m^3$ = micrograms per cubic meter.
b. Sources: DIRS 182287-Hoelscher 2007, all for CO, SO_2, and NO_2; 40 CFR 50.4 through 50.11; DIRS 180073-TREX 2007, all.
c. < = less than.
d. NAAQS = National Ambient Air Quality Standards.
e. For comparison to the air quality standard, the 3-year average of the 98th percentile is 16 micrograms per cubic meter.
f. The U.S. Environmental Protection Agency revoked the annual PM_{10} standard effective December 18, 2006 (71 *FR* 60853, October 17, 2006), but the Nevada annual average PM_{10} standard remains in effect.

Table 4-188. Maximum pollutant concentrations from operation of the proposed railroad near Hawthorne, Nevada.

Averaging period	Air pollutant[a]		Background concentration[b]	Maximum project impact[c]	Maximum resulting concentration	NAAQS[d]	Maximum concentration (percent of standard)
1-hour	CO	ppm	1.8	0.01	1.81	35	5
3-hour	SO_2	ppm	0.07	< 0.0001	0.07	0.5	14
8-hour	CO	ppm	1.4	0.007	1.4	9	16
24-hour	PM_{10}	$\mu g/m^3$	99	0.17	99.2	150	66
	$PM_{2.5}$	$\mu g/m^3$	16[e]	0.14	16.1	35	46
	SO_2	ppm	0.025	< 0.00001	0.025	0.14	18
Annual	NO_2	ppm	0.004	0.0002	0.004	0.053	8
	PM_{10}	$\mu g/m^3$	23	0.07	23.1	50[f]	46
	$PM_{2.5}$	$\mu g/m^3$	5.4	0.07	5.5	15	37
	SO_2	ppm	0.002	< 0.0001	0.002	0.03	7

a. CO = carbon monoxide; NO_2 = nitrogen dioxide; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; ppm = parts per million; SO_2 = sulfur dioxide; $\mu g/m^3$ = micrograms per cubic meter.
b. Sources: DIRS 182287-Hoelscher 2007, all for CO, SO_2, and NO_2; 40 CFR 50.4 through 50.11; DIRS 180073-TREX 2007, all.
c. < = less than.
d. NAAQS = National Ambient Air Quality Standards.
e. For comparison to the air quality standard, the 3-year average of the 98th percentile is 16 micrograms per cubic meter.
f. The U.S. Environmental Protection Agency revoked the annual PM_{10} standard effective December 18, 2006 (71 *FR* 60853, October 17, 2006), but the Nevada annual average PM_{10} standard remains in effect.

Table 4-189. Maximum pollutant concentrations from operation of the proposed railroad near Schurz, Nevada.

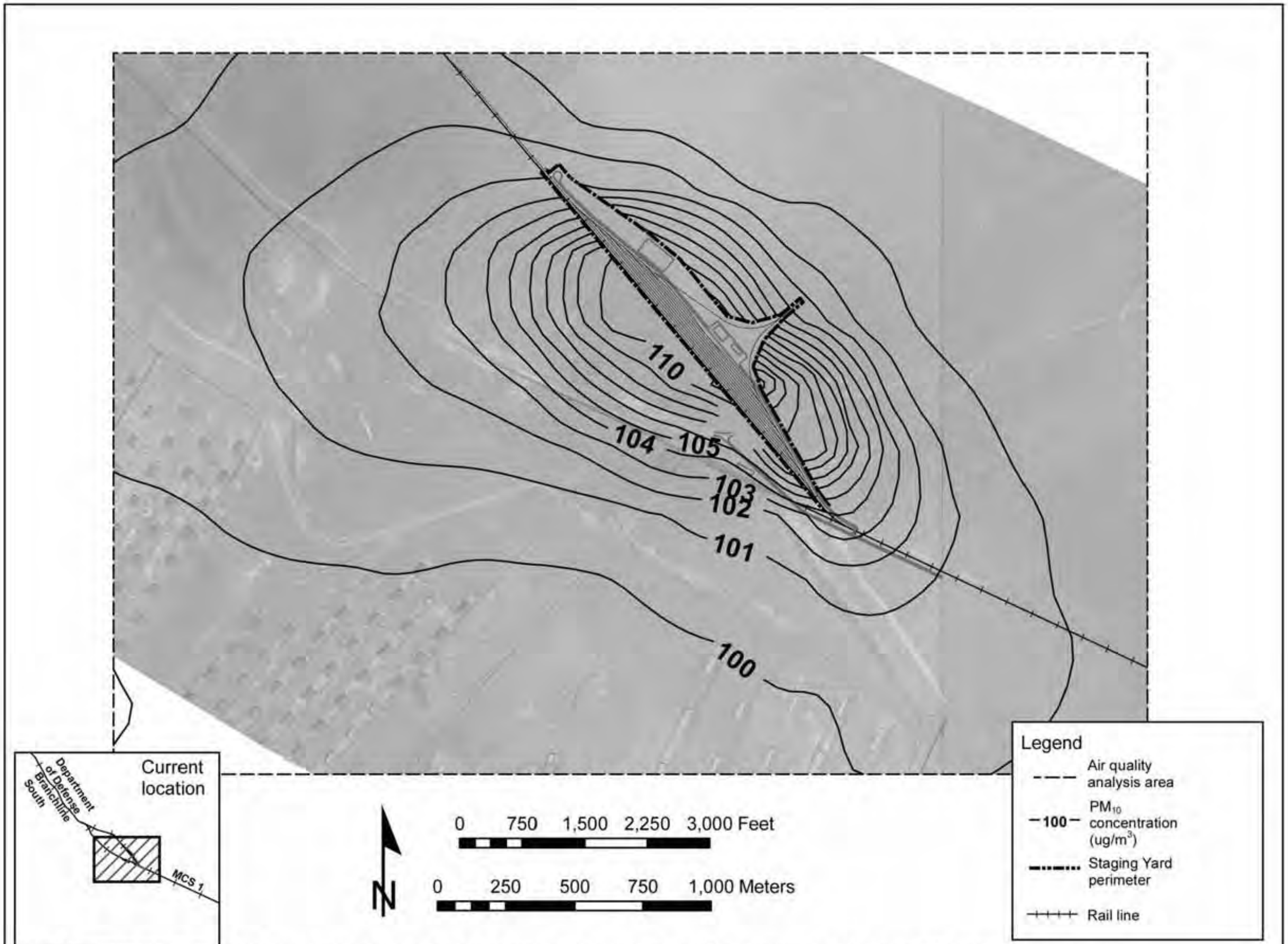
Averaging period	Air pollutant[a]		Background concentration[b]	Maximum project impact[c]	Maximum resulting concentration	NAAQS[d]	Maximum concentration (percent of standard)
1-hour	CO	ppm	1.8	0.01	1.81	35	5
3-hour	SO_2	ppm	0.072	< 0.00001	0.072	0.5	14
8-hour	CO	ppm	1.4	< 0.01	1.4	9	11
24-hour	PM_{10}	μg/m^3	99	0.57	100	150	67
	$PM_{2.5}$	μg/m^3	16[e]	0.51	16.5	35	47
	SO_2	ppm	0.025	< 0.00001	0.025	0.14	18
Annual	NO_2	ppm	0.004	0.001	0.005	0.053	9
	PM_{10}	μg/m^3	23	0.25	23.3	50[f]	47
	$PM_{2.5}$	μg/m^3	5.4	0.24	5.6	15	37
	SO_2	ppm	0.002	< 0.00001	0.002	0.03	7

a. CO = carbon monoxide; NO_2 = nitrogen dioxide; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; ppm = parts per million; SO_2 = sulfur dioxide; μg/m^3 = micrograms per cubic meter.
b. Sources: DIRS 182287-Hoelscher 2007, all for CO, SO_2, and NO_2; 40 CFR 50.4 through 50.11; DIRS 180073-Tribal Environmental Exchange Network 2007, all.
c. < = less than.
d. NAAQS = National Ambient Air Quality Standards.
e. For comparison to the air quality standard, the 3-year average of the 98th percentile is 16 micrograms per cubic meter.
f. The U.S. Environmental Protection Agency revoked the annual PM_{10} standard effective December 18, 2006 (71 *FR* 60853, October 17, 2006), but the Nevada annual average PM_{10} standard remains in effect.

Table 4-190. Maximum pollutant concentrations from operation of the proposed Staging Yard at

Averaging period	Air pollutant[a]		Background concentration[b]	Maximum project impact[c]	Maximum resulting concentration	NAAQS[d]	Maximum concentration (percent of standard)
1-hour	CO	ppm	1.8	1.1	2.9	35	8
3-hour	SO_2	ppm	0.07	< 0.001	0.07	0.5	15
8-hour	CO	ppm	1.4	0.04	1.44	9	16
24-hour	PM_{10}	μg/m^3	99	16.3	115	150	77
	$PM_{2.5}$	μg/m^3	16[e]	11	27	35	77
	SO_2	ppm	0.03	0.0002	0.03	0.14	18
Annual	NO_2	ppm	0.004	0.02	0.024	0.05	48
	PM_{10}	μg/m^3	23	5.3	28.3	50[f]	59
	$PM_{2.5}$	μg/m^3	5.4	4.8	10.2	15	68
	SO_2	ppm	0.002	< 0.0001	0.002	0.03	7

a. CO = carbon monoxide; NO_2 = nitrogen dioxide; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; ppm = parts per million; SO_2 = sulfur dioxide; μg/m^3 = micrograms per cubic meter.
b. Sources: DIRS 182287-Hoelscher 2007, all for CO, SO_2, and NO_2; 40 CFR 50.4 through 50.11; DIRS 180073-Tribal Environmental Exchange Network 2007, all.
c. < = less than.
d. NAAQS = National Ambient Air Quality Standards.
e. For comparison to the air quality standard, the 3-year average of the 98th percentile is 16 micrograms per cubic meter.
f. The U.S. Environmental Protection Agency revoked the annual PM_{10} standard effective December 18, 2006 (71 *FR* 60853, October 17, 2006), but the Nevada annual average PM_{10} standard remains in effect.



Note: PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; ug/m^3 = micrograms per cubic meter; MCS = Mina common segment.

Figure 4-29. Simulated maximum modeled 24-hour PM_{10} concentrations, including background, from operation of the proposed Staging Yard at Hawthorne, Nevada.

The maximum fraction of the NAAQS at the Staging Yard would be 77 percent for 24-hour $PM_{2.5}$ (DIRS 177709-MO0607NEI2002D.000). The table lists potential project-related emissions as a maximum and minimum range according to the possible lengths of the rail alignment through the county.

The projected operations-related emissions for all air pollutants considered in this analysis would be much less than the county's 2002 annual emissions for these air pollutants. These emissions would be distributed over the entire length of the rail alignment through Mineral County (153 to 171 kilometers [95 to 106 miles]); thus, no air quality standard would be exceeded.

4.3.4.3.2.4 Esmeralda County.

Emissions Appendix E describes the methodology DOE used to assess operations-related emissions. Section E.3.2.5.1 provides additional detail on the Esmeralda County emissions inventory.

Table 4-191 compares the modeled highest annual total emissions during the railroad operations phase in Esmeralda County to the county's 2002 National Emission Inventory database emissions estimates (DIRS 177709-MO0607NEI2002D.000). The table lists project-related emissions as a maximum and minimum range according to the possible lengths of the rail alignment through the county.

The projected operations-related emissions for all air pollutants considered in this analysis would be much less than the county's 2002 annual emissions for these air pollutants. These emissions would be distributed over the entire length of the rail alignment through Esmeralda County (134 to 175 kilometers [83 to 109 miles]); thus, no air quality standard would be exceeded.

Air Quality Impacts DOE modeled air quality to determine how the operations phase would be likely to impact air pollutant concentrations near Silver Peak. Appendix E, Section E.3.2.5.2, summarizes the modeling methodology DOE used to assess operations-related impacts to air quality in Esmeralda County.

Table 4-192 lists the maximum concentrations at any modeled receptor point of the criteria pollutants that would result from operation of the proposed rail line near Silver Peak. DOE modeled a 3-year period using 3 years of actual meteorological data from 2004 through 2006. The table also lists the highest background concentration of each air pollutant since 1991 (see Section 3.3.4 for the basis of the background concentration) and the relevant NAAQS for each air pollutant, and the maximum resulting concentration as a fraction of the NAAQS. The maximum concentrations from railroad operations near Silver Peak would be 34 percent for the 24-hour $PM_{2.5}$ standard, which is well below the NAAQS.

4.3.4.3.2.5 Nye County.

Emissions Appendix E describes the methodology DOE used to assess operations-related emissions. Section E.3.2.6 provides additional detail on the Nye County emissions inventory.

Table 4-193 compares the modeled highest annual total emissions during operation of the rail line in Nye County to the county's 2002 National Emission Inventory database emissions estimates (DIRS 177709-MO0607NEI2002D.000). The table lists project-related emissions as a maximum and minimum range according to the possible lengths of the rail alignment through the county.

The projected operations-related emissions for all air pollutants considered in this analysis would be much less than the county's 2002 annual emissions for these air pollutants. These emissions would be primarily from operation of the rail line, Cask Maintenance Facility, and Rail Equipment Maintenance Yard, with the bulk of the emissions associated with the operation of the Cask Maintenance Facility and Rail Equipment Maintenance Yard. The rail line emissions would be distributed over the entire length of the rail alignment through Nye County (126 to 148 kilometers [78 to 92 miles]); thus, no air quality standard

Table 4-191. Maximum and minimum peak annual emissions anticipated from operation of a railroad along the Mina rail alignment through

Emissions source	Total emissions (tons per year)[a,b]											
	VOCs		CO		NO_x		PM_{10}		$PM_{2.5}$		SO_x	
	Max. length[c]	Min. length[d]	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length
Operations exhaust	3	2	10	8	55	42	2	1	2	1	-	-
Off highway (2002)[e]	10		75		29		3		3		3	
Highway vehicles (2002)[e]	144		1,372		118		3		3		3	
All county sources (2002)[e]	264		1,487		164		1,216		213		61	
Percent increase[f] (projected emission/county emission × 100)	1	1	1	1	34	26	0	< 0.1	1	1	< 0.1	< 0.1

a. To convert tons to metric tons, multiply by 0.90718.
b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.
c. Maximum (Max.) length of rail alignment in Esmeralda County would be 175 kilometers (109 miles). (The maximum and minimum lengths along the complete rail alignment are not equal to the sum of the possible maxima or the minima in individual counties.)
d. Minimum (Min.) length of rail alignment in Esmeralda County would be 134 kilometers (83 miles).
e. Only includes anthropogenic (the influence of humans on the environment) source of emissions (DIRS 177709-MO0607NEI2002D.000).
f. < = less than.

Table 4-192. Maximum pollutant concentrations from operation of a railroad near Silver Peak, Nevada.

Averaging period	Air pollutant[a]		Background concentration[b]	Maximum project impact[c]	Maximum resulting concentration	NAAQS[d]	Maximum concentration (percent of standard)
1-hour	CO	ppm	0.2	0.004	0.2	35	< 1
3-hour	SO_2	ppm	0.002	0.00001	0.002	0.5	< 1
8-hour	CO	ppm	0.2	0.003	0.2	9	< 2
24-hour	PM_{10}	$\mu g/m^3$	39	0.07	39	150	< 26
	$PM_{2.5}$	$\mu g/m^3$	12	0.06	12	35	< 34
	SO_2	ppm	0.002	< 0.000001	0.002	0.14	< 1
Annual	NO_2	ppm	0.002	0.00008	0.002	0.053	< 4
	PM_{10}	$\mu g/m^3$	12	0.03	12	50[e]	< 24
	$PM_{2.5}$	$\mu g/m^3$	3.6	0.03	3.6	15	< 24
	SO_2	ppm	0.002	< 0.00001	0.002	0.03	< 7

a. CO = carbon monoxide; NO_2 = nitrogen dioxide; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; ppm = parts per million; SO_2 = sulfur dioxide; $\mu g/m^3$ = micrograms per cubic meter.
b. Sources: DIRS 182287-Hoelscher 2007, all; DIRS 179933-State of Nevada 2007, all; DIRS 180073-Tribal Environmental Exchange Network 2007, all.
c. < = less than.
d. NAAQS = National Ambient Air Quality Standards.
e. The U.S. Environmental Protection Agency revoked the annual PM_{10} standard effective December 18, 2006 (71 *FR* 60853, October 17, 2006), but the Nevada annual average PM_{10} standard remains in effect.

would be exceeded. Similarly, no air quality problems would be anticipated from operation of the Cask Maintenance Facility and Rail Equipment Maintenance Yard inside the Yucca Mountain Site boundary because the distance from those facilities to the nearest point of public access would be more than 11 kilometers (7 miles). At that distance, there would be no or small impacts on air quality from operation of the facilities.

4.3.4.4 Shared-Use Option

Impacts to air quality along the Mina rail alignment under the Shared-Use Option would be similar to those under the Proposed Action without shared use.

Under the Shared-Use Option, commercial entities could construct additional sidings of 300 meters (980 feet) in length at a number of locations along the rail alignment. Operationally, the Shared-Use Option would consist of up to 60 railcars pulled by three or four locomotives at a frequency of up to 18 additional one-way trips per week along the Mina rail alignment north of Schurz and 10 additional one-way trips south of Schurz.

The additional sidings would be placed parallel to track within the construction right-of-way and would not require additional rail roadbed foundation, only additional laying of track. Overall, additional construction-related emissions would be very small. Appendix E, Section E.3.3, describes the rationale for not conducting additional emissions inventory calculations or air quality simulations to assess construction-related impacts under the Shared-Use Option.

Appendix E, Section E.3.3, also describes the methodology DOE used to calculate potential emissions that would result from the five additional round trips per week of commercial train activity associated with the Shared-Use Option south of Schurz and nine round trips north of Schurz. For Churchill, Lyon, Mineral, Esmeralda, and Nye Counties, Tables 4-194 to 4-198 compare the minimum and maximum annual incremental emissions expected from operation of commercial trains under the Shared-Use Option

Table 4-193. Maximum and minimum peak annual emissions anticipated from operation of a railroad along the Mina rail alignment through Nye County, Nevada, compared to 2002 existing county emissions.

	Total emissions (tons per year)[a,b]											
	VOCs		CO		NO_x		PM_{10}		$PM_{2.5}$		SO_x	
Emissions source	Max. length[c]	Min. length[d]	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min length	Max length	Min length
Operation exhaust	48	48	185	183	481	474	14	14	13	13	1	1
Off highway (2002)[e]	372		1,967		219		30		28		24	
Highway vehicles (2002)[e]	1,469		15,375		1,155		35		28		31	
All county sources (2002)[e]	2,507		18,778		1,580		3,656		715		261	
Percent increase (projected emission/county emission × 100)	2	2	1	1	30	30	0	0	2	2	0	0

a. To convert tons to metric tons, multiply by 0.90718.
b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.
c. Maximum (Max.) length of rail alignment in Nye County would be 148 kilometers (92 miles). (The maximum and minimum lengths along the complete rail alignment are not equal to the sum of the possible maxima or the minima in individual counties.)
d. Minimum (Min.) length of rail alignment in Nye County would be 126 kilometers (78 miles).
e. Only includes anthropogenic (the influence of humans on the environment) source of emissions (DIRS 177709-MO0607NEI2002D.000).

with each county's 2002 National Emission Inventory database emissions (DIRS 177709-MO0607NEI2002D.000), based on the shortest and longest routes through the counties. Also shown is the range of peak county-wide emissions that would result from the Proposed Action, as discussed in Section 4.3.4.3, and the resulting range of peak emissions totals by county.

As shown in Tables 4-194 through 4-198, under the Shared-Use Option, total emissions would be increased marginally (as discussed above) beyond those associated with railroad operations under the Proposed Action. Likewise, the maximum air pollutant concentrations expected under the Shared-Use Option would be marginally increased. These levels have been shown to be low (see Tables 4-187, 4-188, 4-189 and 4-192). Therefore, DOE did not perform additional and separate air quality modeling of air pollutant concentrations for the Shared-Use Option.

4.3.4.5 Greenhouse Gases

Emissions, Construction Activities Appendix E, Section E.3.1, describes the methodology DOE used to determine construction-related emissions. Sections E.3.1.2 through E.3.1.6 provide detail on the inventory for each of the five counties through which the Mina rail alignment would pass. There are several atmospheric gases with the ability to contribute to global climate change, including carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and ozone (O_3). Of these, only CO_2 would contribute meaningful quantities from construction activities along the rail line and is thus the only gas considered in this analysis.

The methodology used to determine CO_2 emissions from construction activity along the rail line is identical to that described in Appendix E for other products of combustion. Emission factors for CO_2 from the Environmental Protection Agency's MOBILE6.2 and NONROAD (for Tier 1 equipment) models were coupled with construction activity values for each type of equipment associated with construction of the rail line. Running totals of emissions for each year of activity within each county were developed. Unlike criteria pollutants, however, CO_2 emissions are relevant only in aggregate. Thus, the emissions were aggregated into a single value for construction activity along the entire alignment for each of the 4 years of construction activity. Table 4-193a shows the highest annual emissions and the total emissions for construction of the entire Mina rail alignment under a 4-year construction schedule. The same total amount would be released under a longer construction schedule.

Table 4-193a. Carbon dioxide emissions from construction of the Mina rail alignment.

Activity	Total CO_2 emissions: Maximum length	Total CO_2 emissions: Minimum length
Peak annual (tons[a] per year)	1,097,000	898,000
Total 4-year construction phase (tons)	3,278,000	2,680,000

a. To convert tons to metric tons, multiply by 0.90718.

These values may be compared to the most recent (2005) overall U.S. emissions of CO_2 of 6,089,500,000 metric tons (6,712,525,000 tons) (DIRS 185248-EPA 2007). Thus, the peak year for the annual construction-related activity would increase the overall national CO_2 emissions by less than 995,177 metric tons (1,097,000 tons) (0.02 percent) over 2005 levels. U.S. emissions represent about 24 percent of the total global CO_2 emissions.

Emissions, Operations Activities Appendix E, Section E.2.2, describes the methodology DOE used to determine the operations emissions impact of the rail line over the life of the project. Sections E.3.2.2 through E.3.2.6 provide detail on the inventory for each of the five counties through which the Mina rail alignment would pass. There are several atmospheric gases with the ability to contribute to global climate change, including carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and ozone (O_3). Of these, only CO_2 would be released in meaningful quantities from operations activities along the rail line and is thus the only gas considered in this analysis of operations emissions. Appendix E, Section E.3.2.7, provides additional information on the calculation methodology for CO_2 operations emissions.

Running totals of emissions for each year of activity within each county were determined. Unlike criteria pollutants, however, CO_2 impacts are relevant only in aggregate. Thus, the emissions were aggregated into a single value for operations activity along the entire alignment for each of the maximum 50 years of rail operations activity. Table 4-193b shows the average annual emissions and the total emissions for operations over the entire Mina rail alignment assuming a maximum operations period of 50 years.

Table 4-193b. Carbon dioxide emissions from operation of the Mina rail alignment.

	Total CO_2 emissions	
	Maximum length	Minimum length
Operations average annual (tons[a] per year)	73,000	71,000
Total 50-year operations phase (includes shared use) (tons)	3,654,000	3,528,000

a. To convert tons to metric tons, multiply by 0.90718.

These values may be compared to the most recent (2005) overall U.S. emissions of CO_2 of 6,089,500,000 metric tons (6,712,525,000 tons) (DIRS 185248-EPA 2007, all). Thus, the average operational year would increase overall national CO_2 emissions by about 66,224 metric tons (about 73,000 tons) (0.001 percent) over 2005 levels.

Air Quality Impacts Unlike criteria pollutants, impacts of greenhouse gas emissions are global and cannot be attributed to any particular source, because greenhouse gases are well mixed throughout the global lower atmosphere such that anthropogenic climate change is directly related to the global concentration of CO_2 in the atmosphere. Local emissions are quantifiable and contribute to cumulative climate change impacts. Construction and operation of the Mina rail alignment would increase the state's CO_2 emissions as well as global CO_2 concentrations. Neither the State of Nevada nor the Federal Government has CO_2 emissions caps, thresholds, or targets. CO_2 emissions from the Proposed Action would add to state and national emissions, making a relatively small incremental contribution to cumulative emissions of CO_2. DOE is not aware of any methodology to correlate CO_2 emissions from specific projects to any specific impact on global climate change.

The potential impacts from climate change have most recently been identified and discussed by the Intergovernmental Panel on Climate Change (IPCC) in its fourth assessment report (DIRS 185132-IPCC 2007, all). This report describes an extensive peer review of analyses and a high degree of consensus on climate change issues among an international panel of contributing scientists. Studies such as the IPCC report support the premise that CO_2 emissions from the proposed project, together with global greenhouse gas emissions, would very likely have a cumulative impact on climate change. IPCC Working Group II identified the predicted consequences of climate change – specific to the project area, these include more frequent and intense heat waves and droughts; extended periods of high fire risk; and a decrease in mountain snow packs and an increase in winter flooding.

4.3.4.6 Summary

Potential impacts to air quality from construction and operation of the proposed railroad along the Mina rail alignment would be as follows:

- The project would not cause conflicts with state or regional air quality management plans.
- The highest increase in air emissions from railroad operations would occur in the vicinity of the operations support facilities.
- The highest increase in air pollutant emissions would occur during the construction phase.
- Air pollutant concentrations would not exceed the NAAQS during the construction or operations phase, with the exception of the 24-hour NAAQS for both PM_{10} and $PM_{2.5}$ that could be exceeded near the construction right-of-way at Mina and Schurz during the relatively short (less than 6 months) construction period, at the Staging Yard at Hawthorne, and at the potential Garfield Hills quarry. However, DOE would be required to obtain a Surface Area Disturbance Permit Dust Control Plan prior to quarry and Staging Yard development, and it is likely that requirements in the plan would reduce fugitive dust emissions, thus reducing the possibility of NAAQS exceedances.
- The highest increase in emissions would be for NO_x in Esmeralda County during the construction phase, where emissions could be 3,570 metric tons (3,940 tons) per year higher than the county's 2002 annual NO_x emissions.
- The Shared-Use Option would result in a slightly higher increase in air pollutant emissions and air pollutant concentrations than under the Proposed Action without shared use.

Annualized emissions for all air pollutants projected to be released during the construction phase would be greater than during the operations phase. Projected ambient concentrations of all air pollutants would be below the NAAQS, except for particulate matter during the construction phase, which could exceed the 24-hour NAAQS under some conditions. Therefore, the projected impacts throughout the region of influence, during both the construction and operations phases, would be small, except possibly in the vicinity of the potential Garfield Hills quarry, the Staging Yard at Hawthorne, and segments of the rail line (only during construction). Under the Shared-Use Option, there would be in an increase in emissions over those of the Proposed Action without shared use, but impacts to air quality would still be small. Table 4-199 summarizes impacts to air quality.

Table 4-194. Maximum and minimum peak annual incremental emissions anticipated from operation of commercial trains along the Mina rail alignment under the Shared-Use Option through Churchill County, Nevada, and county-wide total railroad operations emissions compared to 2002 existing county emissions.

	Total emissions (tons per year)[a,b]											
	VOCs		CO		NO_x		PM_{10}		$PM_{2.5}$		SO_x	
Emissions source	Max. length[c]	Min length[d]	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length
Commercial trains/shared use operations exhaust	1	1	3	2	17	9	1	1	1	1	1	1
Proposed railroad operations exhaust	0	0	2	1	10	6	-	-	-	-	0	0
Totals	1	1	6	3	26	14	1	1	1	1	1	1
Off highway (2002)[e]	823		2,674		580		39		36		40	
Highway vehicles (2002)[e]	1,960		20,974		1,976		55		43		50	
All county sources (2002)[e]	4,788		30,312		2,776		5,773		1,252		308	
Percent increase[f] (projected emission/county emission × 100)	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1

a. To convert tons to metric tons, multiply by 0.90718.
b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.
c. Maximum (Max.) length of rail alignment in Mineral County would be 31 kilometers (20 miles). (The maximum and minimum lengths along the complete rail alignment are not equal to the sum of the possible maxima or the minima in individual counties.)
d. Minimum (Min.) length of rail alignment in Mineral County would be 17 kilometers (11 miles).
e. Only includes anthropogenic (the influence of humans on the environment) source of emissions (DIRS 177709-MO0607NEI2002D.000).
f. < = less than.

Table 4-195. Maximum and minimum peak annual incremental emissions anticipated from operation of commercial trains under the Shared-Use Option through Lyon County, Nevada and county-wide total railroad operations emissions, compared to 2002 existing county emissions.

	Total emissions (tons per year)[a,b]											
	VOCs		CO		NO_x		PM_{10}		$PM_{2.5}$		SO_x	
Emissions source	Max. length[c]	Min length[d]	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length
Commercial trains/shared use operations exhaust	3	3	9	7	43	32	3	2	3	2	1	1
Proposed railroad operations exhaust	1	1	4	3	25	19	1	1	1	1	0	0
Totals	4	4	13	10	68	51	4	3	4	3	1	1
Off highway (2002)[e]	411		2,866		426		37		35		35	
Highway vehicles (2002)[e]	2,894		30,089		2,654		79		63		68	
All county sources (2002)[e]	4,696		35,321		8,315		7,990		1,245		673	
Percent increase[f] (projected emission/county emission × 100)	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1

a. To convert tons to metric tons, multiply by 0.90718.

b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.

c. Maximum (Max.) length of rail alignment in Lyon County would 81 kilometers (51 miles). (The maximum and minimum lengths along the complete rail alignment are not equal to the sum of the possible maxima or the minima in individual counties.)

d. Minimum (Min.) length of rail alignment in Lyon County would be 61 kilometers (38 miles).

e. Only includes anthropogenic (the influence of humans on the environment) source of emissions (DIRS 177709-MO0607NEI2002D.000).

f. < = less than.

Table 4-196. Maximum and minimum peak annual incremental emissions anticipated from operation of commercial trains along the Mina rail alignment under the Shared-Use Option through Mineral County, Nevada, and county-wide total railroad operations emissions compared to 2002 existing county emissions.

	Total emissions (tons per year)[a,b]											
	VOCs		CO		NO_x		PM_{10}		$PM_{2.5}$		SO_2	
Emissions source	Max. length[c]	Min length[d]	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length
Commercial trains/shared use operations exhaust	7	6	19	17	97	87	4	3	4	3	1	1
Proposed railroad operations exhaust	15	14	57	56	212	207	7	7	7	6	0	0
Totals	22	20	76	73	309	294	11	10	11	9	1	1
Off highway (2002)[e]	394		959		59		10		10		4	
Highway vehicles (2002)[e]	243		2,276		189		6		4		6	
All county sources (2002)[e]	1,386		3,402		273		1,800		480		25	
Percent increase[f] (projected emission/county emission × 100)	2	1	2	2	113	108	< 1	< 1	2	2	5	4

a. To convert tons to metric tons, multiply by 0.90718.
b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.
c. Maximum (Max.) length of rail alignment in Mineral County would be 171 kilometers (106 miles). (The maximum and minimum lengths along the complete rail alignment are not equal to the sum of the possible maxima or the minima in individual counties.)
d. Minimum (Min.) length of rail alignment in Mineral County would be 153 kilometers (95 miles).
e. Only includes anthropogenic (the influence of humans on the environment) source of emissions (DIRS 177709-MO0607NEI2002D.000).
f. < = less than.

Table 4-197. Maximum and minimum peak annual incremental emissions anticipated from operation of commercial trains along the Mina rail alignment under the Shared-Use Option through Esmeralda County, Nevada, and county-wide total railroad operations emissions compared to 2002 existing county emissions.

	Total emissions (tons per year)[a,b]											
	VOCs		CO		NO_x		PM_{10}		$PM_{2.5}$		SO_2	
Emissions source	Max. length[c]	Min length[d]	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length
Commercial trains/shared use operations exhaust	6	3	17	12	89	68	3	2	3	2	-	-
Proposed railroad operations exhaust	3	2	10	8	55	42	2	1	2	1	0	0
Totals	9	6	26	20	144	110	6	3	6	3	-	-
Off highway (2002)[e]	10		75		29		3		3		3	
Highway vehicles (2002)[e]	144		1,372		118		3		3		3	
All county sources (2002)[e]	264		1,487		164		1,216		213		61	
Percent increase[f] (projected emission/county emission × 100)	3	2	2	1	88	67	< 1	< 1	3	2	< 1	< 1

a. To convert tons to metric tons, multiply by 0.90718.
b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.
c. Maximum (Max.) length of rail alignment in Esmeralda County would be 175 kilometers (109 miles). (The maximum and minimum lengths along the complete rail alignment are not equal to the sum of the possible maxima or the minima in individual counties.)
d. Minimum (Min.) length of rail alignment in Esmeralda l County would be 134 kilometers (83 miles).
e. Only includes anthropogenic (the influence of humans on the environment) source of emissions (DIRS 177709-MO0607NEI2002D.000).
f. < = less than.

Table 4-198. Maximum and minimum peak annual incremental emissions anticipated from operation of commercial trains along the Mina rail alignment under the Shared-Use Option through Nye County, Nevada, and county-wide total railroad operations emissions compared to 2002 existing county emissions.

	Total emissions (tons per year)[a,b]											
	VOCs		CO		NO_x		PM_{10}		$PM_{2.5}$		SO_x	
Emissions source	Max. length[c]	Min length[d]	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length
Commercial trains/shared use operations exhaust	4	4	16	13	84	70	3	2	3	2	0	0
Proposed railroad operations exhaust	48	48	185	183	481	474	14	14	13	13	1	1
Totals	53	53	200	196	564	546	18	17	17	16	1	1
Off highway (2002)[e]	372		1,967		219		30		28		24	
Highway vehicles (2002)[e]	1,469		15,375		1,155		35		28		31	
All county sources (2002)[e]	2,507		18,778		1,580		3,656		715		261	
Percent increase[f] (projected emission/county emission × 100)	2	2	1	1	36	35	< 1	< 1	2	2	< 1	< 1

a. To convert tons to metric tons, multiply by 0.90718.

b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.

c. Maximum (Max.) length of rail alignment in Nye County would be 148 kilometers (92 miles). (The maximum and minimum lengths along the complete rail alignment are not equal to the sum of the possible maxima or the minima in individual counties.)

d. Minimum (Min.) length of rail alignment in Nye County would be 126 kilometers (78 miles).

e. Only includes anthropogenic (the influence of humans on the environment) source of emissions (DIRS 177709-MO0607NEI2002D.000).

f. < = less than.

Table 4-199. Summary of potential impacts to air quality – Mina rail alignment[a,b] (page 1 of 4).

County/rail line segment/facility	Construction impacts	Operations impacts
Rail line		
Churchill County		
Union Pacific Railroad Hazen Branchline; Schurz alternative segment 6	Construction activities would add less than the 2002 county-wide burden of SO_2, CO, NO_x, $PM_{2.5}$, PM_{10}, and VOCs. In addition, these emissions would be distributed over the length of the rail line in the county; thus, no air quality standard would be exceeded.	Operations activities would add less than about 1 percent to the 2002 county-wide burden of all criteria pollutants and would not lead to a violation of air quality standards.
Lyon County		
Union Pacific Railroad Hazen Branchline; Department of Defense Branchline North; Schurz alternative segments 1, 4, 5, and 6	Construction activities would add less than the 2002 county-wide burden of SO_2, CO, NO_x, $PM_{2.5}$, PM_{10}, and VOCs. In addition, these emissions would be distributed over the length of the rail line in the county; thus, no air quality standard would be exceeded.	Operations activities would add less than about 1 percent to the 2002 county-wide burden of all criteria pollutants and would not lead to a violation of air quality standards.
Mineral County		
Schurz alternative segments 1, 4, 5, and 6; Department of Defense Branchline South; Mina common segment 1	Construction activities would add less than the 2002 county-wide burden of SO_2 and VOCs. CO, $PM_{2.5}$, PM_{10}, and NO_x would each have an increase greater than the 2002 county-wide burden. However, these emissions would be distributed over the entire length of the rail line in the county; thus, no air quality standard would be exceeded.	Operations activities would add less than about 2 percent to the 2002 county-wide emissions for SO_2, CO, $PM_{2.5}$, PM_{10}, and VOCs, and about 80 percent for NO_x emissions; however, these increases should not lead to a violation of air quality standards.
	Modeling of emissions from construction of the rail line near Mina showed there is potential for the 24-hour PM_{10} NAAQS to be exceeded in the immediate vicinity of the rail line under some conditions. Within the town of Mina, concentrations would be below the NAAQS.	Modeling of emissions from operation of the rail line near Mina showed no air pollutant would exceed 70 percent of the NAAQS for any averaging period.
	Modeling of emissions from construction of the rail line near Hawthorne showed that no air pollutant would exceed the NAAQS.	Modeling of emissions from operation of the rail line near Hawthorne showed no air pollutant would exceed 70 percent of the NAAQS for any averaging period.
	Modeling of emissions during construction of the rail line near Schurz showed there is potential for the 24-hour PM_{10} and $PM_{2.5}$ NAAQS to be exceeded in the immediate vicinity of the rail line under some conditions. Within the town of Schurz, concentrations would be below the NAAQS.	Modeling of emissions from operation of the rail line near Schurz showed no air pollutant would exceed 70 percent of the NAAQS for any averaging period.

Table 4-199. Summary of potential impacts to air quality – Mina rail alignment[a,b] (page 2 of 4).

County/rail line segment/facility	Construction impacts	Operations impacts
Rail line (continued)		
Esmeralda County		
Mina common segment 1; Montezuma alternative segments 1, 2, and 3; Mina common segment 2	Construction activities would add less than the 2002 county-wide burden of SO_2. CO, VOCs, $PM_{2.5}$, PM_{10}, and NO_x would each have an increase greater than the 2002 county-wide burden. However, these emissions would be distributed over the entire length of the rail line in the county; thus, no air quality standard would be exceeded.	Operations activities would add less than 35 percent to the 2002 county-wide burden of all criteria pollutants and would not lead to a violation of air quality standards.
	Modeling of emissions from construction of the rail line near Silver Peak showed no air pollutant would exceed 70 percent of the NAAQS for any averaging period.	Modeling of emissions from operation of the rail line near Silver Peak showed no air pollutant would exceed 35 percent of the NAAQS for any averaging period.
Nye County		
Montezuma common segments 1 and 3; Mina common segment 2; Bonnie Claire alternative segments 2 and 3; common segment 5; Oasis Valley alternative segments 1 and 3; common segment 6	Construction activities would add less than the 2002 county-wide burden of SO_2, CO, PM_{10}, $PM_{2.5}$, and VOCs. NO_x would have an increase greater than the 2002 county-wide burden. However, emissions would be distributed over the entire length of the rail line in the county; thus, no air quality standard would be exceeded.	Operations activities would add less than about 35 percent to the 2002 county-wide burden of all criteria pollutants and would not lead to a violation of air quality standards.
Construction and operations support facilities		
Churchill County		
Access roads (including the alignment service road) Schurz alternative segment 6	About 39 percent of PM_{10} construction fugitive dust emissions would be from access roads. In no case would this be expected to lead to an exceedance of any air quality standards.	Operations would result in very small emissions from access roads.
Lyon County		
Access roads (including the alignment service road)	About 39 percent of PM_{10} construction fugitive dust emissions would be from access roads. In no case would this be expected to lead to an exceedance of any air quality standards.	Operations would result in very small emissions from access roads.
Construction camp 18C or 18D	Only about 1 percent of the fugitive dust emissions would be due to construction of the construction camp. In no case would construction camp emissions be expected to cause an exceedance of any air quality standards.	Construction camp would be reclaimed following the construction phase and would have no emissions during the operations phase.

Table 4-199. Summary of potential impacts to air quality – Mina rail alignment[a,b] (page 3 of 4).

County/rail line segment/facility	Construction impacts	Operations impacts
Construction and operations support facilities (continued)		
Mineral County		
Access roads (including the alignment service road)	About 39 percent of PM_{10} construction fugitive dust emissions would be from access roads. In no case would this be expected to lead to an exceedance of any air quality standards.	Operations would result in very small emissions from access roads.
Staging Yard at Hawthorne	Modeling of emissions from construction of the Staging Yard at Hawthorne found that the 24-hour PM_{10} and $PM_{2.5}$ NAAQS could be exceeded in the immediate vicinity of the Staging Yard under some conditions.	Modeling of emissions from operation of the Staging Yard at Hawthorne showed no air pollutant would exceed 80 percent of the NAAQS for any averaging period.
Quarry	Modeling of emissions from the potential Garfield Hills quarry indicates that the 24-hour PM_{10} and $PM_{2.5}$ NAAQS could be exceeded. However, the required Surface Disturbance Permit would greatly reduce PM_{10} and $PM_{2.5}$ emissions, making an exceedance of the NAAQS unlikely.	Quarries would be reclaimed following rail line construction and would have no emissions during the operations phase.
Construction camps 15, 16, and 17	Only about 3 percent of the fugitive dust emissions would be due to construction of the construction camps. In no case would construction camp emissions be expected to cause an exceedance of any air quality standards.	Construction camps would be reclaimed following the construction phase and would have no emissions during the operations phase.
Wells	Well construction would be responsible for about 4 percent of the fugitive PM_{10} emissions. In no case would the construction of the wells be expected to cause an exceedance of any air quality standards.	Operation of the wells would result in very small emissions because only a few wells would continue to operate after the completion of construction to serve as the water source for facility operations.
Esmeralda County		
Access roads (including the alignment service road)	About 39 percent of PM_{10} construction fugitive dust emissions would be from access roads. In no case would this be expected to lead to an exceedance of any air quality standards.	Operations would result in very small emissions from access roads.
Maintenance-of-Way Facility	Construction of the Maintenance-of-Way Facility would account for less than 1 percent of construction fugitive dust emissions. In no case would this be expected to cause an exceedance of any air quality standards.	The Maintenance-of-Way Facility would be responsible for less than 1 percent of the operations emissions in Esmeralda County and would not lead to a violation of air quality standards.
Quarries	Modeling of emissions from the operation of the potential quarry at Malpais Mesa during construction of the rail line shows no air pollutant would exceed 60 percent of the NAAQS for any averaging period.	Quarries would be reclaimed following the construction phase and have no emissions during the operations phase.

Table 4-199. Summary of potential impacts to air quality – Mina rail alignment[a,b] (page 4 of 4).

County/rail line segment/facility	Construction impacts	Operations impacts
Construction and operations support facilities (continued)		
Construction camp 14, 13A or 13B	Only about 3 percent of the fugitive dust emissions would be due to construction of the construction camps. In no case would construction camp emissions be expected to cause an exceedance of any air quality standards.	Construction camps would be reclaimed following the construction phase and have no emissions during the operations phase.
Wells	Well construction would be responsible for about 4 percent of the fugitive PM_{10} emissions. In no case would the construction of the wells be expected to cause an exceedance of any air quality standards.	Operation of the wells would result in very small emissions because only a few wells would continue to operate after the completion of the construction phase to serve as the water source for facility operations.
Nye County		
Access roads (including the alignment service road)	About 39 percent of PM_{10} construction fugitive dust emissions would be from access roads. In no case would this be expected to lead to an exceedance of any air quality standards.	Operations would result in very small emissions from access roads.
Construction camps 10, 11, and 12	Only about 4 percent of the fugitive dust emissions would be due to construction of the construction camps. In no case would construction camp emissions be expected to cause an exceedance of any air quality standards.	Construction camps would be reclaimed following the construction phase and have no emissions during the operations phase.
Wells	Well construction would be responsible for about 4 percent of fugitive PM_{10} emissions. In no case would the construction of the wells be expected to cause an exceedance of any air quality standards.	Operation of the wells would result in very small emissions because only a few wells would continue to operate after the completion of the construction phase to serve as the water source for facility operations.
Rail Equipment Maintenance Yard and Cask Maintenance Facility	Combined, construction of the Rail Equipment Maintenance Yard and Cask Maintenance Facility would account for less than 2 percent of fugitive dust emissions. In no case would these emissions be expected to cause an exceedance of any air quality standards.	Combined, the Rail Equipment Maintenance Yard and Cask Maintenance Facilities would be responsible for about 93 percent of the operations emissions in Nye County.
Nevada Railroad Control Center and National Transportation Operations Center	Construction dust and exhaust emissions would be very small.	Operation of the Nevada Railroad Control Facility would result in very small emissions.

a. Impacts to air quality under the Shared-Use Option would be similar to those under the Proposed Action without shared use.
b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds; NAAQS = National Ambient Air Quality Standards.

4.3.5 SURFACE-WATER RESOURCES

This section describes potential impacts to surface-water resources (***washes***, playas, ***floodplains***, and ***wetland*** areas) from constructing and operating the proposed railroad along the Mina rail alignment. Section 4.3.5.1 describes the methodology DOE used to analyze potential impacts; Section 4.3.5.2 describes potential construction impacts; Section 4.3.5.3 describes potential operations impacts; Section 4.3.5.4 describes potential impacts under the Shared-Use Option; and Section 4.3.5.5 summarizes potential impacts to surface-water resources.

4.3.5.1 Impact Assessment Methodology

As described in Section 3.3.5.1, the region of influence for surface-water resources would be limited in most cases to the nominal width of the rail line construction right-of-way. In some cases the region of influence would extend beyond the construction right-of-way. Construction and operations activities along the rail alignment could impact a larger distance from the rail line in cases where surface-water drainages could carry pollutants (such as petroleum-based lubricants and fuels) and eroded soil downstream of the rail line or in cases where floodwaters backed up on the upstream side of the rail line.

DOE evaluated potential impacts to surface-water resources based on a series of criteria, as listed in Table 4-200. There would be an impact if construction and operations would cause any of the conditions listed in Table 4-200. To avoid or limit adverse impacts to surface-water resources, the Department would comply with applicable laws, regulations, policies, standards, and directives, and implement best management practices (see Chapter 7). Most importantly, careful pre-planning of construction and operations activities would allow the Department to assess and minimize potential impacts before they occurred (see Section 2.1).

Table 4-200. Impact assessment criteria for surface-water resources (page 1 of 2).

Resource criteria	Basis for assessing adverse impact
Stormwater drainage	Would railroad construction or operations: • Alter stormwater discharges, which could adversely affect drainage patterns, flooding, and/or erosion and sedimentation • Alter infiltration rates, which could adversely affect (increase or decrease) the volume of surface water that flows downstream • Conflict with applicable stormwater management plans or ordinances
Surface-water quality	Would railroad construction or operations: • Contaminate public water supplies and other surface waters, exceeding water-quality criteria or standards established in accordance with the Clean Water Act, state regulations, or permits • Conflict with regional water-quality management plans or goals
Surface-water availability and uses	Would railroad construction or operations: • Alter the capacity of available surface-water resources such that human health, the environment, or personal property would be adversely affected • Conflict with established water rights or regulations protecting surface-water resources for future beneficial uses
Wetlands and waters of the United States	Would railroad construction or operations: • Cause filling of wetlands or otherwise alter drainage patterns such that wetlands or waters would be adversely affected

Table 4-200. Impact assessment criteria for surface-water resources (page 2 of 2).

Resource criteria	Basis for assessing adverse impact
Floodplains and floodwaters	Would railroad construction or operations: • Alter floodway or floodplain or otherwise impede or redirect flows such that human health, the environment, or personal property would be adversely affected • Conflict with applicable flood management plans or ordinances
Springs	Would railroad construction or operations: • Alter or contaminate springs such that human health, the environment, or personal property would be adversely affected

The areas where surface-water impacts would be greatest and where DOE would implement direct controls (such as erosion and sedimentation controls) would be within the construction right-of-way. The Department expects that the numbers and types of surface-water features within the construction right-of-way would have a direct relationship to the degree of impacts within this area. To evaluate potential impacts to surface water, the Department identified areas where there are drainage channels, floodplains, springs, and wetlands along the rail alignment (including those it would cross or cover) and identified the activities associated with construction or operations that would have the potential to impact these surface-water resources.

4.3.5.2 Construction Impacts

Section 3.3.5 describes surface-water resources along the Mina rail alignment. Table 4-201 lists the numbers of surface-water features within the nominal width of the rail line construction right-of-way and support facilities. The table includes estimates of the number of drainage channels the Mina rail alignment alternative segments and common segments would cross. DOE identified drainage channels using the National Hydrological Dataset, a U.S. Geological Survey dataset of hydrologic features. The table also identifies two subsets of the total number of drainage channel crossings. The first is the notable channels described in Section 3.3.5.2.1. The second subset is the washes DOE classified as ***waters of the United States*** during field studies in support of this Rail Alignment EIS.

This section also addresses impacts to surface-water quality, and water availability and usage. Springs are also evaluated because they are a significant source of surface water within and near the Mina rail alignment region of influence.

Floodplains and wetlands are two other important surface-water features the Department evaluated as part of this analysis. Appendix F, Floodplain and Wetlands Assessment, provides additional information on wetlands and floodplains the Mina rail alignment could encounter. Appendix F includes figures showing the locations of these surface-water features and provides more detail on their characteristics.

4.3.5.2.1 Impacts Common to the Entire Rail Alignment

The following sections describe common impacts identified and assessed for activities associated with construction of the proposed railroad along the Mina rail alignment. DOE would minimize impacts through the engineering design (see Chapter 2.2) and the implementation of best management practices (see Chapter 7).

4.3.5.2.1.1 Stormwater Drainage. Construction of the proposed railroad could result in both direct and indirect impacts to surface-water resources. Direct impacts would result from the temporary or permanent grading, dredging, rerouting, or filling of ***ephemeral*** or ***intermittent streambeds***. Indirect

Table 4-201. Summary of drainages the rail line and support facilities would cross – Mina rail alignment.

Rail line segments/facilities	Total[a]	Notable drainages[b]	Waters of the United States[c]
Schurz alternative segment 1	21	9	4
Schurz alternative segment 4	42	18	6
Schurz alternative segment 5	61	21	1
Schurz alternative segment 6	67	28	1
Mina common segment 1	141	123	0
Staging Yard at Hawthorne	3	0	0
Potential Gabbs Range quarry	2	0	0
Montezuma alternative segment 1	187	93	0
Maintenance-of-Way Facility (Silver Peak option)	0	0	0
Montezuma alternative segment 2	85	42	0
Maintenance-of-Way Facility (Klondike option)	2	1	0
Montezuma alternative segment 3	148	60	0
Mina common segment 2	3	0	0
Bonnie Claire alternative segment 2	31	11	0
Bonnie Claire alternative segment 3	23	9	0
Common segment 5	124	84	0
Oasis Valley alternative segment 1	24	15	2
Oasis Valley alternative segment 3	28	11	1
Common segment 6	43	20	14
Rail Equipment Maintenance Yard	1	0	0

a. All drainages identified in National Hydrologic Dataset (DIRS 177714-MO0607NHDFLM06.000).
b. Only includes drainages with stream order equal to or greater than two from the National Hydrologic Dataset (DIRS 177714-MO0607NHDFLM06.000).
c. Source: DIRS 180889-PBS&J 2007, Figures 3A through 3C.

impacts would include increases in ***nonpoint source pollution*** resulting from runoff from construction areas where surface grades and characteristics had been changed (such as the rail roadbed, support facilities, and access roads).

Cut and fill operations during rail line construction would cause the alteration of natural drainage patterns and runoff rates in some areas that could affect downgradient resources. Construction activities that could temporarily block surface drainage channels include moving large amounts of soil and rock to develop the track platform and constructing temporary access roads to reach construction initiation points and major structures, such as bridges, and movement of equipment to the construction initiation points. Depending on site conditions, construction could include regrading so that a number of minor drainage channels would collect in a single ***culvert*** or pass under a single bridge, resulting in water flowing from a single location on the downstream side rather than across a broader area. As a result, there would be some localized changes in drainage patterns.

Regrading and rerouting washes through channelization, including the installation of culverts and stabilization of existing stream banks, could increase the flow rate in relation to natural flow conditions. Culverts and improved channels would provide less resistance to flow so that the flow rate of runoff could increase as it passed through such a structure. The speed by which water flows through a drainage structure (a culvert, a bridge, or a stream channel) affects the erosive potential of the flow; therefore, the design of drainage structures must account for the potential for scour and erosion and incorporate outlet protection and velocity-dissipating devices that calm the flow and lessen its erosive potential. Without such protective measures, scour might occur, especially around bridge piers and abutments, where water flowing past a pier or abutment could erode the supporting soil and sediment around these structures. As the speed of flow increased, the chances for the entire streambed and bank to be exposed to scour and erosion would increase.

DOE would incorporate hydraulic modeling into the final design process to ensure that crossings are properly engineered so that they would not contribute to erosion and sediment pollution, and impacts to surface-water resources downstream of the rail line would be greatly minimized. Therefore, impacts associated with surface-water drainage patterns from rail line construction would be small.

DOE would employ standard engineering design practices to size and place culverts to move runoff water from one side of the track to the other. These culverts or other means of runoff control would be put in place as part of subgrade construction to prevent surface water from backing up or impeding flow. Preliminary rail line design includes various structures to accommodate drainage features the rail line would cross (DIRS 182824-Nevada Rail Partners 2007, p. ii). These structures include slab bridges with multiple piers spaced at 4-meter (13-foot) intervals; double cell bridges with multiple piers spaced at 10-meter (33-foot) intervals; shaft-supported bridge structures with spans between end shafts of 14 to 24 meters (45 to 80 feet); precast reinforced concrete box culverts with a maximum cross-section size of 3.7 meters by 3.7 meters (12 feet by 12 feet); and corrugated metal pipe culverts of various diameters.

Except in areas where drainage structures would cross a Federal Emergency Management Agency-designated 100-year floodplain, hydraulic design would be based on typical Class 1 freight railroad standard design criteria. Floodplain crossings are described in Section 4.3.5.2.1.6. Class 1 freight railroad standard criteria require that the ***50-year flood*** should not come into contact with the top (crown) of the culvert or the lowest point of the bridge, whichever is applicable. For the ***100-year flood***, these criteria require that the floodwaters should not rise above the ***subgrade elevation*** at the structure. To conform to these standards, DOE would use circular culverts where flow rates would be small (less than 4 cubic meters per second [140 cubic feet per second]). For larger flows (up to 28 cubic meters per second [1,000 cubic feet per second]), DOE would use box culverts. The Department would construct bridges where flows were larger and where the rail surface would not be tall enough to accommodate a sufficiently sized culvert, and would install the culverts with ***riprap*** around the exposed ends to protect the fill material from erosion (DIRS 182824-Nevada Rail Partners 2007, p. ii). Bridge abutments and piers would be similarly protected. In some places, training dikes or ***berms*** would be required to redirect flow and ensure that the flow would be conveyed through the structure. In places, channel improvements might be necessary for a short distance upstream and downstream of the rail line to intercept and effectively redirect flows through drainage structures.

50-year flood is a flood that has a 2-percent chance of being equaled or exceeded in any given year.

100-year flood is a flood that has a 1-percent chance of being equaled or exceeded in any given year. A base flood may also be referred to as a 100-year storm and the area inundated during the base flood is sometimes called the 100-year floodplain.

500-year flood is a flood that has a 0.2-percent chance of being equaled or exceeded in any given year.

Subgrade elevation of the rail line is the elevation of the top of the ***subballast***.

Subballast is a layer of crushed gravel that is used to separate the ***ballast*** and roadbed for the purpose of load distribution and drainage.

Ballast is crushed stone used to support the railroad ties and provide drainage.

DOE would analyze crossings on a case-by-case basis and propose culverts whenever feasible. Where there would be very wide and shallow depths of flow during a 100-year flood, or the flow would be divided into multiple natural channels that would cross the rail line, the Department would use a series of multiple culverts, potentially in concert with small bridges to span the main flow channel. In locations where there were very high fill conditions, it would be more economical to use multiple culverts than to construct a bridge (DIRS 182824-Nevada Rail Partners 2007, p. ii). Because DOE would design stormwater conveyance systems to safely convey design floods (50-year and 100-year) and would minimize concentration of flow to the greatest extent practicable, impacts on stormwater conveyance associated with construction of the rail line would be small.

Construction activities that disturbed the land surface, such as grading, excavation, or stockpiling, would have the potential to alter the rate at which water could infiltrate the disturbed areas. Depending on the type of disturbance, the infiltration rate could increase (for example, in areas with loosened soil) or decrease (for example, in areas where construction activities had compacted the soil or involved the installation of impermeable surfaces like asphalt pads, concrete surfaces, or buildings). Most of the land disturbance during the construction phase would result in surfaces with lower infiltration rates; that is, the surfaces would be less permeable than natural soil conditions and would cause an increase in runoff. The change in the amount of runoff that would actually reach the drainage channels would be minor, because construction would affect a small amount of the overall natural drainage area (DIRS 155970-DOE 2002, p. 4-24). Therefore, impacts associated with changes in stormwater infiltration and runoff rates would be small.

DOE would construct a rail alignment service road (up to 7.3 meters [24 feet] wide) along most of the rail line within the rail line construction right-of-way to support operations. Additional access roads could be needed to provide access to the construction support facilities, such as construction camps, wells, and quarries. DOE would improve all access roads as necessary in accordance with the parameters for rural roads as defined by the Nevada Department of Transportation and the American Association of State Highway and Transportation Officials (DIRS 180922-Nevada Rail Partners 2007, p. 4-20). The Department would excavate roadside ditches on both sides of the roadway as necessary to direct stormwater to drainage features and washes. Most access roads would likely have gravel surfaces, except for those to wells. Dip sections (depressions in a road that allow stormwater to flow across the road surface) would be used to convey ephemeral flows across the road surfaces (DIRS 180922-Nevada Rail Partners 2007, p. 4-20).

DOE would locate most wells along the two alignment access roads or adjacent to existing roads; however, construction of new access roads to distant wells might be required in four cases (total distance of less than 5.5 kilometers [3.5 miles]). These roads would be needed to reach the well sites and to accommodate temporary pipelines constructed to convey water to the construction right-of-way. DOE would construct temporary pipelines on top of the ground next to an existing road or a new access road (DIRS 180922-Nevada Rail Partners 2007, p. 4-12). The Department would position the temporary pipelines so they would not obstruct or redirect surface runoff or natural drainage channels. Therefore, there would be no adverse impacts to surface-water resources from construction of temporary pipelines.

Water would be required for compaction of fill material to construct the embankment areas of the rail roadbed. Compaction of fill would require approximately 6.4 billion liters (1.7 billion gallons) of water (DIRS 180875-Nevada Rail Partners 2007, p. 4-4). To stay within the plastic limits of the soil, fill would not be completely saturated, and runoff would be intentionally avoided. DOE would use standard erosion-control practices during compaction activities. Water would also be required for dust control along roads used to access the rail alignment during construction activities. Approximately 250 million liters (65 million gallons) of water would be required for dust control over a 3-year period. DOE would use standard construction dust-control measures. Water used for dust suppression in these areas would not be expected to result in runoff.

DOE would minimize construction impacts to stormwater drainage through engineering design (see Section 2.2) and implementation of best management practices (see Chapter 7). A National Pollutant

Discharge Elimination System General Construction Permit would be required for construction activities. In accordance with this permit, construction contractors would be required to prepare and submit a Stormwater Pollution Prevention Plan, which would be prepared consistent with state and federal standards for construction activities and would detail the best management practices that would be employed to minimize soil loss and degradation to nearby water resources. Design of the best management practices program would be based on practices listed in the *Best Management Practices Handbook* developed by the Nevada Division of Environmental Protection and the Nevada Division of Conservation Districts (DIRS 176309-NDEP 1994, all) and the *Storm Water Quality Manuals Construction Site Best Management Practices Manual* developed by the Nevada Department of Transportation (DIRS 176307-NDOT 2004, all).

Best management practices are structural and nonstructural controls that would be used to control nonpoint source pollution such as sedimentation and stormwater runoff. Structural controls are those best management practices that need to be constructed (such as detention or retention basins). Nonstructural controls refer to best management practices that typically do not require construction, such as planning, education, revegetation, or other similar measures. Sedimentation and stormwater runoff are typically addressed through the use of temporary and permanent best management practices, including techniques such as grading that would induce positive drainage; silt fences; and revegetation to minimize or prevent soil exposed during construction from becoming sediment to be carried offsite. Best management practices would be implemented, inspected, and maintained to minimize the potential for adverse impacts to downstream water quality. Chapter 7 describes best management practices in more detail.

4.3.5.2.1.2 Surface-Water Quality. Construction activities could adversely impact surface-water quality due to the potential for erosion and sediment during precipitation events. Sediment would generally be contained onsite through the use of best management practices, including erosion- and sedimentation-control measures. DOE would take appropriate and applicable measures to minimize alteration of natural drainage patterns, erosion, and sediment loading. These measures would reduce potential for increased erosion and subsequent sedimentation and ensure that any downstream water did not experience increases in sediment loading or turbidity that would threaten the beneficial use of that water. Standard engineering design practices would be employed and hydraulic modeling would be incorporated into the final design process to ensure that crossings are properly engineered so that they would minimize impacts to surface-water resources from erosion and sediment pollution. Therefore, the potential for off-site impacts to surface water from increased sediment loads would be small.

For the areas of the Mina rail alignment near surface-water bodies, ***contaminants*** could be released directly to surface water. The Mina rail alignment would encounter a wide variety of surface drainage features. As described in Section 3.3.5.2.1.1, the Carson River and the Walker River appear on the Nevada 303(d) list of impaired waters. Suspended solids are pollutants of concern in these areas. DOE would implement direct controls (such as erosion and sedimentation controls) within the construction right-of-way to minimize surface-water impacts (DIRS 180120-NDEP 2005, Appendix A).

Water-quality impacts are also possible from potential release and spread of contaminants (materials potentially harmful to human health or the environment), which could be released through an accidental spill or discharge. These types of releases could be localized if there was a small spill or widespread if precipitation or intermittent runoff carried contaminants away from the site of the spill. For the areas of the Mina rail alignment near surface-water bodies, contaminants could be released directly to surface water; however, there are only a few places where there are surface-water bodies along the rail alignment.

Section 4.3.12, Hazardous Materials and Waste, describes construction materials that could be mishandled (spilled), including petroleum products (such fuels and lubricants) and coolants (such as antifreeze). Incidental spills could also include solvents used for cleaning or for degreasing equipment.

The construction camps would include some bulk storage of hazardous materials, and supply trucks would routinely bring new materials and remove used materials and wastes (such as lubricants and coolants) from the construction sites (see Section 4.3.12). These activities would present some potential for incidental spills and releases, the significance of which would depend largely on the nature and volume of the material spilled and its location. A release or spill of pollutants to a stream or river, or stormwater runoff carrying pollutants to such receptors, would have the greatest potential to adversely impact surface-water quality.

The potential for water-quality impacts during the construction phase would be small because the environment along the Mina rail alignment is arid and there is little flowing water. To avoid or limit adverse impacts to surface-water resources, the Department would comply with applicable laws, regulations, policies, standards, and directives, and implement best management practices (see Chapter 7). Also, construction contractors would be required to comply with regulatory requirements for spill-prevention measures, reporting and remediating spills, and properly disposing of or recycling used materials (as described in Chapter 7). Common stormwater pollution control practices mandate that hazardous materials be stored inside facilities or have secondary containment or other protective devices and that spill control and containment equipment be stationed close to hazardous material (for example, fuel) storage. Thus, construction and operation of the railroad would not result in the violation of any applicable State of Nevada water-quality standards.

Sanitary sewage generated at construction camps would be treated onsite or collected and trucked to a ***wastewater treatment*** plant. A portable wastewater treatment facility could be installed at each construction camp. As a water conservation measure, the Department could use treated wastewater effluent (***gray water***) produced at the camps for dust suppression and soil compaction. These water conservation measures would help reduce the demands placed on groundwater wells. The portable wastewater treatment plants would be designed and operated so that generated effluent would not adversely impact the quality of surface water with which it comes in contact; therefore, impacts to surface-water quality from wastewater treatment operations during the construction phase would be small. There would be no on-site discharges of industrial wastewater during the construction phase.

The wastewater treatment process would result in the production of biosolids (sludge). DOE would store biosolids on the sites and allowed them to dry until the conditions specified in federal regulations (40 CFR Part 503) and state regulations are met. DOE would dispose of biosolids at a licensed facility in accordance with all applicable state and federal laws (DIRS 180922-Nevada Rail Partners 2007, p. 4-7).

4.3.5.2.1.3 Surface-Water Availability and Uses. See Section 4.3.2, Land Use and Ownership, for a discussion of impacts to manmade water systems.

4.3.5.2.1.4 Waters of the United States. Jurisdictional waters of the United States subject to Section 404 of the Clean Water Act include interstate waters and intrastate waters with a connection to interstate commerce, tributaries to such waters, and wetlands that are adjacent to waters of the United States. Section 404 prohibits discharge of dredged or fill material into jurisdictional waters if a practicable alternative exists that would be less damaging to the aquatic environment, or if the Nation's waters would be significantly degraded. In other words, it must be demonstrated that, to the extent practicable, steps have been taken to avoid impacts and that potential impacts to waters of the United States have been minimized and mitigation is provided for any remaining unavoidable impacts (if required). See Chapter 6, Statutory, Regulatory, and Other Applicable Requirements, for further discussion of the Clean Water Act Section 404 requirements.

The U.S. Army Corps of Engineers is responsible for determining whether drainages and wetlands along the rail alignment are regulated under Section 404; therefore, all conclusions in this analysis about the classification of washes and wetlands as waters of the United States are tentative. On June 5, 2007, the

U.S. Environmental Protection Agency and U.S. Army Corps of Engineers released interim guidance that addresses jurisdiction over waters of the United States under the Clean Water Act. Based on this guidance, it is likely that many of the drainages along the rail alignment that DOE currently considers to be waters of the United States might not be considered as such. If DOE selected the Mina rail alignment for construction of the proposed railroad, the Department would request that the U.S. Army Corps of Engineers determine the limits of jurisdiction under Section 404 along the rail alignment before beginning construction.

Estimates for potential fill area and quantity of fill for waters of the United States are provided in this section to support an understanding of compliance with Section 404 (see Table 4-202). These estimates were calculated based on the depth and width of the water body that would be crossed and the type of engineered structure planned for each crossing. For crossings with culverts, DOE assumed that culverts would be extended 12 meters (40 feet) on either side of the cut/fill boundary for the rail roadbed. For bridges over waters of the United States having a width of less than 3 meters (10 feet), DOE assumed that no fill would be placed in the channel. For bridges over wider channels, DOE assumed that there would be one bridge pier every 6 meters (20 feet) and that each pier would cover a surface area of 1.9 square meters (20 square feet). Fill estimates calculated for these crossings depend on channel depths. These fill estimates represent an upper bound estimate, because many of the drainages currently identified during this analysis as waters of the United States might not be considered waters of the United States under the new U.S. Army Corps of Engineers guidance. Table 4-202 also provides the estimated total amount of wetlands (jurisdictional and nonjurisdictional) requiring fill along the Mina rail alignment. The actual amount of wetlands classified as jurisdictional wetlands subject to regulation under Section 404 of the Clean Water Act will be made by the U.S. Army Corps of Engineers.

Table 4-202. Summary of waters of the United States and wetlands – Mina rail alignment common and alternative segments.[a]

Rail line segment	Waters of the United States crossings[b]	Waters of the United States fill area (acres)[c]	Waters of the United States fill volume (cubic feet)[d]	Wetlands fill area (acres)
Schurz alternative segment 1	4	0.10	640	0.005
Schurz alternative segment 4	6	0.13	670	0.005
Schurz alternative segment 5	1	0.0005	60	0.007
Schurz alternative segment 6	1	0.0005	60	0.007
Oasis Valley alternative segment 1	2 (bridged)	0	0	0
Oasis Valley alternative segment 3	1 (bridged)	0	0	0
Common segment 6	14	0.14	1,300	0

a. Source: DIRS 180889-PBS&J 2007, Figures 3A through 3C.
b. Any water of the United States within 12 meters (40 feet) of the construction footprint is considered to be crossed.
c. To convert acres to square meters, multiply by 4,046.9.
d. To convert cubic feet to cubic meters, multiply by 0.028317.

If DOE constructed the railroad along the Mina rail alignment there would be no practicable alternative to crossing some ***ephemeral streams*** that are waters of the United States. There are numerous ephemeral waters of the United States that flow perpendicular to the general direction of the rail line and the rail line would have to cross them. DOE would construct bridges across many of the ephemeral waters of the United States along the rail line, and very little or no fill in regulated stream channels would be required for those crossings. The Department would place culverts in the smaller ephemeral streams. Because the size of these regulated channels is generally less than 1 to 2 meters (3.3 to 6.6 feet), the area filled per crossing would typically be less than about 100 square meters (0.03 acre). The crossings would be designed so that they would not alter stream flow and best management practices (see Chapter 7) would be implemented to minimize sedimentation during and after construction.

Impacts to drainages classified as waters of the United States would be the same as impacts described in Section 4.3.5.2.1.1.

4.3.5.2.1.5 Wetlands. Executive Order 11990, *Protection of Wetlands*, requires that federal agencies "…take action to minimize the destruction, loss, or degradation of wetlands…" The Executive Order requires consideration of all wetlands regardless of whether they are regulated under Section 404 of the Clean Water Act. DOE regulations at 10 CFR Part 1022 direct that impacts to wetlands be avoided wherever possible and minimized to the extent practicable during construction projects. In accordance with Executive Order 11990 and 10 CFR Part 1022, this Rail Alignment EIS examines impacts to all wetlands regardless of whether they are considered jurisdictional under Section 404 of the Clean Water Act.

DOE conducted jurisdictional determinations of waters of the United States and adjacent wetlands as described in the *Waters of the U.S. Jurisdictional Determination Report for Yucca Mountain Project – Mina Rail Corridor* (DIRS 180889-PBS&J 2006, all). The jurisdictional determinations were conducted on public and accessible private lands pursuant to Section 404 of the Clean Water Act and Executive Order 11990, *Protection of Wetlands*, and in compliance with U.S. Army Corps of Engineers guidance.

A **functional assessment** is used to evaluate current wetland functions and predict potential changes to a wetland's functions that may result from proposed activities. A wetland is compared to similar wetlands that are relatively unaltered.

Hydrogeomorphic relates to the form or surface features of the land.

Under 10 CFR 1022, the Department is required to preserve and enhance the natural and beneficial values of wetlands. The values of wetlands are a function of the importance or worth of the functions that wetlands serve to society. Functions of wetlands include storage of water (floodwater protection), water filtration (wetlands can trap nutrients, sediment, and pollutants), and biological productivity (plant and animal ***habitat***). Impacts to these functions can eliminate or diminish the value of wetlands (DIRS 176797-EPA 2001, p. 1). Temporary or permanent filling or draining of wetlands would result in direct impacts to those resources. Actions in and around wetlands could result in indirect impacts, such as potential degradation of water quality and disruption of water flow. DOE would employ standard engineering design practices to move runoff water from one side of the track to the other. Culverts, channelization, or other means of runoff control would be put in place as part of subgrade construction to prevent surface water from backing up or impeding flow, and to minimize water level changes in wetland areas.

DOE conducted the functional assessment of wetlands for the Mina rail alignment in February 2008 to better characterize potential impacts (direct, indirect, and cumulative) to the functions served by wetlands in this area. Wetland functions are generally assessed to document functional losses that could occur due to a proposed impact. By assessing wetland functions, mitigation can be designed to provide wetland functions in a manner and capacity that offset proposed losses. The results of this assessment are documented in the *Rail Alignment for Geologic Repository at Yucca Mountain, Nevada Project, Wetland Technical Memorandum: Functional Assessment, Impacts, and Conceptual Mitigation* (DIRS 185340-URS 2008, all). Appendix F, Floodplain and Wetlands Assessment, of this Rail Alignment EIS further describes the wetland delineation and functional assessment, and provides a discussion of potential impacts and an alternatives analysis for the Mina rail alignment.

DOE would minimize filling of wetlands by keeping the rail line footprint to a minimum, constructing bridges that span stream channels and adjacent wetlands, and incorporating avoidance into rail line engineering and design to the extent practicable. DOE would mitigate loss of wetlands, as required under Section 404 of the Clean Water Act, by enhancing existing wetlands adjacent to or near the rail line that have been degraded by grazing and other impacts, or by creating new wetlands adjacent to or near the rail line. The exact acreage of wetlands to be enhanced or created would be determined in coordination with the U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency and would be based in part on the amount of wetlands that would have to be filled to construct the rail line, the function and quality of the wetlands that would be lost, and the likelihood of success of the methods used to enhance or replace wetlands. This section describes impacts to wetlands in the segment-specific sections.

4.3.5.2.1.6 Floodplains and Floodwaters. DOE has prepared a floodplain assessment (see Appendix F) for the area along the Mina rail alignment in accordance with the requirements of 10 CFR Part 1022. Appendix F includes figures that show the Federal Emergency Management Agency floodplain maps that cover the Mina rail alignment region of influence. DOE obtained floodplain data from the Agency, which has published Flood Insurance Rate Maps that, depending on the combination of alternative segments, cover only 20 percent of the Mina rail alignment (see Appendix F, Table F-2). The Agency has not mapped areas that are uninhabited. These floodplain maps depict, as applicable, the lateral boundaries or spread of water that could be expected in drainage channels or around collection basins from a 100-year and a ***500-year flood***.

DOE overlaid a map of the Mina rail alignment on the available floodplain maps and estimated the crossing distances for each alternative segment and common segment. Table 4-203 lists the crossing distances and the percentage of the area for which floodplain map coverage is available. Areas with little or no floodplain map coverage could contain floodplains not listed in the table. Appendix F discusses floodplains in more detail.

Construction activities would affect floodplains, either through direct alteration of the stream-channel cross section that would affect the flow pattern of the stream, or through indirect changes in the amount of impervious surfaces and additional water volume added to the floodplain. Based on Federal Emergency Management Agency floodplain maps and flood studies completed in the area of the Yucca Mountain Site, the Mina rail alignment would cross more than six floodplains.

Construction impacts associated with these floodplains would be similar to any other identified drainage areas (the alteration of natural drainage patterns and possible changes in erosion and sedimentation rates or locations). Construction in washes or other flood-prone areas could reduce the area through which floodwaters would naturally flow, which could cause water levels to rise on the upstream side of crossings.

Sedimentation would be likely to occur on the upstream side of crossings in areas where the flow of water was restricted enough to cause ponding. DOE would manage sedimentation of this type under a regular maintenance program (DIRS 155970-DOE 2002, p. 6-79). Therefore, impacts to floodplains from construction of the rail line that result in restrictions in flow and sedimentation would be small.

Construction within floodplains would cause direct impacts to floodplains. The Mina rail alignment would be in a region where flash flooding is the primary concern. Although such flooding can be violent and hazardous, it is generally limited in its extent and duration, limiting the potential for impacts associated with the proposed railroad; that is, any damage would be expected to be confined to a small portion of the rail line.

Although DOE would generally design rail line features to accommodate 100-year floods, based on typical Class 1 freight railroad standard design criteria (see Section 4.3.5.2.1.1), the final design process could also consider a range of flood frequencies and include a cost-benefit analysis in the selection of a

Table 4-203. 100-year floodplains the Mina rail alignment would cross.

Rail line segment	Percent covered by FEMA[b] floodplain maps	Floodplain crossing distance (miles)[a]		Floodplain description
		Mapped	Additional estimated	
Schurz alternative segment 1	0	0	0	No floodplains mapped.
Schurz alternative segment 4	0	0	0	No floodplains mapped.
Schurz alternative segment 5	0	0	0	No floodplains mapped.
Schurz alternative segment 6	0	0	0	No floodplains mapped.
Mina common segment 1	0	0	0	No floodplains mapped.
Montezuma alternative segment 1	0.1	0.006	0	The very southern end of Montezuma alternative segment 1 would cross a very small section of FEMA floodplains just before it joined with Mina common segment 2.
Montezuma alternative segment 2	10	1.2	0	The floodplain is located between the Stonewall Mountains and Cuprite Hills and is associated with Stonewall Flat.
Montezuma alternative segment 3	0.1	0.006	0	The very southern end of Montezuma alternative segment 3 would cross a very small section of FEMA floodplains just before it joined with Mina common segment 2.
Mina common segment 2	100	0.80	0	Floodplain extends downgradient of Stonewall Flat Playa to Lida Valley Alkali Flat Playa.
Bonnie Claire alternative segment 2	30	0	0	No floodplains identified.
Bonnie Claire alternative segment 3	78	1.2	0	Floodplains extending up tributaries of Lida Valley Alkali Flat Playa and up the Stonewall Pass wash from the Bonnie Claire Flat area of Sarcobatus Flat.
Common segment 5	74	0.19	0	Floodplain extending from Sarcobatus Flat up to Tolicha Wash.
Oasis Valley alternative segment 1	100	0.68	0	Floodplain of the Amargosa River within Thirsty Canyon.
Oasis Valley alternative segment 3	100	0.25	0	Floodplain of the Amargosa River within Thirsty Canyon.
Common segment 6	55	0.06	0	Beatty Wash floodplain extending from Amargosa River Floodplain.
		0.14[c]		Busted Butte Wash draining east side of Yucca Mountain to Fortymile Wash (rail line would cross wash and tributaries).

a. To convert miles to kilometers, multiply by 1.6093.
b. FEMA = Federal Emergency Management Agency.
c. There are no FEMA floodplain maps covering Busted Butte Wash on the eastern slope of Yucca Mountain. Estimates of floodplain crossings in this area are from DIRS 155970-DOE 2002, Figure 3-12 floodplain mapping efforts.

design frequency in accordance with standard rail line design guidelines and practices (DIRS 106860-AREA 1997, Volume 1, Section 3.3.2.2 c). In areas where drainage structures would cross a Federal Emergency Management Agency-designated 100-year floodplain, DOE would design the bridge to comply with Agency standards and appropriate county regulations. Federal Emergency Management Agency standards require that floodway surcharge (the difference between the 100-year flood elevation and the actual flood surface elevation) not exceed 0.3 meter (1 foot) at any location. These standards are designed to limit the impacts of floodwater to structures built in or adjacent to floodplains (DIRS 182824-

Nevada Rail Partners 2007, p. ii). By adhering to these standards, the Department would substantially limit the potential for adverse impacts to the population and resources located adjacent to floodplains.

Bridge constructing usually involves placing a portion of the bridge abutment in the floodplain (called encroachment). For this reason, the abutment can have some impact on the height of floodwaters upstream of the bridge. Excessive encroachment can result in increased scour potential at the abutments, piers, and the stream bottom through the bridge opening due to increases in flow velocities. Based on the conceptual design for the Mina rail alignment, there could be encroachments up to 30 percent of the floodplain width, which could result in an approximately 0.3-meter (1-foot) increase in water-surface elevation at the upstream side of the bridge where the floodplain is wide and shallow (DIRS 182824-Nevada Rail Partners 2007, p. ii).

DOE would reduce impacts to floodplains and the resources close to the floodplains by adhering to the design standards that limit the degree to which floodwaters would be allowed to rise. DOE used best available data to identify floodplains along the proposed Mina rail alignment. The floodplain analysis was conducted using currently accepted best practices. The Department would incorporate additional flood analysis and hydraulic modeling into the engineering design process to ensure that all crossings were designed to limit impacts to nearby populations and resources.

4.3.5.2.1.7 Springs. DOE designed the rail line to avoid springs and other surface-water resources whenever practicable. In the few cases where there would be springs within the construction right-of-way, the Department would incorporate avoidance and control measures into final engineering and design of the rail line in order to minimize impacts. To minimize temporary impacts, springs would be marked and avoided during rail line construction activities. In some cases, the springs would be located downgradient of rail line construction activities, and flooding and sedimentation resulting from extreme weather events could result in short-term, direct adverse impacts to water quality. Straw bale barriers or silt fences would be placed around downgradient springs to reduce the potential for erosion and runoff of sediments toward them. These measures would also be taken as necessary for springs located downgradient and outside the construction right-of-way, but identified within 1.6 kilometers (1 mile) of the proposed rail line. Therefore, impacts to springs from construction activities would be small.

DOE used best available data to identify springs along the proposed Mina rail alignment. Any additional springs identified later would be addressed during the final design phase of the railroad.

Section 4.3.6, Groundwater Resources, addresses impacts to springs from a groundwater-supply perspective. Section 4.3.2, Land Use and Ownership, further addresses any impacts to short- or long-term access for livestock operations, and public or private use. Section 4.3.7, Biological Resources, addresses any impacts to short- or long-term access by wildlife.

4.3.5.2.2 Impacts along Alternative Segments and Common Segments

4.3.5.2.2.1 Union Pacific Railroad Hazen Branchline (Hazen to Wabuska). DOE would not perform any construction activities along this portion of the Mina rail alignment. Therefore, there would be no impacts to surface-water resources along the existing Union Pacific Railroad Hazen Branchline.

4.3.5.2.2.2 Department of Defense Branchline North (Wabuska to the boundary of the Walker River Paiute Reservation). DOE would construct a passing siding within the existing right-of-way and no new land would be disturbed. DOE would not perform any additional construction activities along the existing branchline. The construction of the passing siding would not affect current drainage patterns. Therefore, there would be no impacts to surface-water resources along the existing Department of Defense Branchline North.

4.3.5.2.2.3 Department of Defense Branchline through Schurz. DOE would remove track, timber ties, and ballast, and grade the ballast section to a smooth surface along this branchline. This removal activity would not involve land disturbance outside the existing rail line right-of-way because these actions would be performed using equipment designed to move along the track. Impacts resulting from grading would be the same as those described in Section 4.3.5.2.1.1 and are expected to be limited to the existing right-of-way because of best management practices that would be used to control nonpoint source pollution, such as sedimentation and stormwater runoff.

4.3.5.2.2.4 Schurz Alternative Segments. The Schurz alternative segments would cross waters of the United States as summarized in Table 4-201, including the Walker River and tributaries to Walker River. Of the four waters of the United States that Schurz alternative segment 1 would cross, the amount of fill would range from 1.7 cubic meters (60 cubic feet) for the smallest drainage to 8.6 cubic meters (300 cubic feet) for the largest drainage. Of the six waters of the United States that Schurz alternative segment 4 would cross, the amount of fill would range from 1.7 cubic meters (60 cubic feet) for the smallest drainage to 10 cubic meters (360 cubic feet) for the largest drainage. Both Schurz alternative segments 5 and 6 would cross only one water of the United States, therefore the total amount of fill for this drainage would be 1.7 cubic meters (60 cubic feet). The total amount of fill for waters of the United States crossed by Schurz alternative segment 1 would cross would be 18 cubic meters (640 cubic feet) and 19 cubic meters (670 cubic feet) for Schurz alternative segment 4. Section 4.3.5.2.1.4 addresses common impacts to waters of the United States.

Suspended solids have been identified as a contributing factor in the failure of the Walker River to meet water-quality standards. Section 4.3.5.2.1.2 addresses common impacts to surface-water quality.

A survey for wetlands along the Mina rail alignment conducted by DOE in support of this Rail Alignment EIS identified emergent wetlands (WRN-1, WRN-2, WRN-3, and WRN-4) that would be crossed by the Schurz alternative segments (see Appendix F, Figure F-17). Emergent and scrub-shrub wetlands continue north and south beyond the region of influence. The total surface area for these wetlands is 0.065 square kilometer (16 acres). DOE would minimize impacts by constructing a bridge over the Walker River and its associated wetlands. The double-cell bridge would be about 300 meters (1,000 feet) long with 12-meter (40-foot) pier spacing (DIRS 180872-Nevada Rail Partners 2007, p. E-1). The only permanent fill will be the concrete pilings required to support the bridge piers. Using these methods, the only permanent fill or loss of wetlands would be a total of about 20 square meters (0.005 acre) for emplacement of about 10 piers in wetlands for Schurz alternative segments 1 and 4, or 28 square meters (0.007 acre) for emplacement of about 14 piers for Schurz alternative segments 5 and 6.

To construct a bridge over the Walker River, an approximately 18-meter (60-foot)-wide work area would be cleared of trees and other large vegetation along the alignment on both sides of the river. This would result in the temporary disturbance of about 0.002 square kilometer (0.55 acre) of wetlands for Schurz alternative segments 1 and 4, and 0.003 square kilometer (0.73 acre) of wetlands for Schurz alternative segments 5 and 6. Placement of piers and construction of the bridge in the active stream would occur during low flow (generally September through April). The boundaries of the work area would be fenced, flagged, or otherwise marked to minimize disturbances in wetlands. All staging areas and equipment yards would be staged in upland areas. To provide access for cranes and other heavy equipment to the stream channel, which is about 12 meters (40 feet) wide in this area, DOE would sink heavy mats made of wood or other solid material in all wetland areas and into the stream. There would be sufficient gaps between the mats to allow flow of water. DOE would not place any sand, gravel, or other loose fill in the stream channel. The mats would be removed from the channel after the bridge pilings were driven into the ground and the concrete bridge sections were erected over the channel. DOE would revegetate wetlands and other disturbed areas after completion of the bridge.

Using these methods, the only permanent fill or loss of wetlands would be a total of about 20 square meters (0.005 acre) for emplacement of about 10 piers in wetlands for Schurz alternative segments 1 and 4, or 28 square meters (0.007 acre) for emplacement of about 14 piers for Schurz alternative segments 5 and 6. By maximizing avoidance in this way, DOE would minimize permanent impacts to the maximum extent practicable. DOE would also implement best management practices such as constructing sediment ponds and installing hay bales or silt fences, which would minimize potential impacts during construction. Appendix F, Floodplain and Wetlands Assessment, provides additional information on construction of the bridge on wetlands. Section 4.3.5.2.1.5 addresses common impacts to wetlands.

There are no practicable design or construction options that would allow DOE to completely avoid impacting wetlands along the Mina rail alignment. The Department of Defense Branchline is south of the Walker River west of the town of Schurz. All Schurz alternative segments must connect to that branchline west of Schurz and cross the river to avoid the town and proceed to the east of Walker Lake. The wetlands along this reach of the Walker River are too wide to be completely spanned and bridge piers therefore must be placed in the wetlands.

Although the Federal Emergency Management Agency has not mapped this area, the Schurz alternative segments cross areas with ***ephemeral washes*** and playas where the potential for flash flooding exists. The Department would construct appropriate drainage structures (including box culverts along Schurz alternative segment 6 and a plate girder along Schurz alternative segment 1, 4, 5, or 6). DOE anticipates impacts from construction of the rail line in floodplains would be small (DIRS 180872-Nevada Rail Partners 2007, pp. 3-2 and 3-3). Section 4.3.5.2.1.6 addresses common impacts to floodplains and floodwaters.

The two springs identified along Schurz alternative segment 1, Double Spring and an unnamed spring, lie within the region of influence but outside the construction right-of-way. Section 4.3.5.2.1.7 addresses common impacts to springs.

Construction camps 18A, 18B, 18C, and 18D, as described in Section 3.3.5.3.4, would be within the construction right-of-way. Construction camp 18C, which would be adjacent to Schurz alternative segment 5, would overlie one small ephemeral wash, and construction camp 18D, which would be adjacent to Schurz alternative segment 6, would overlie two small ephemeral washes. The camps would not cross any waters of the United States or wetlands. Construction camp 18A, which would be adjacent to Schurz alternative segment 1, and construction camp 18B, which would be adjacent to Schurz alternative segment 4, do not overlie any surface-water features. Section 4.3.5.2.1.1 addresses common impacts to surface-water crossings.

4.3.5.2.2.5 Department of Defense Branchline South (Hawthorne to Common Segment 1). DOE would use the existing rail line along the Department of Defense Branchline South for operations along the Mina rail alignment. With the exception of a new siding that would be constructed within the existing right-of-way and the construction of construction camp 17 along the southern portion of the segment, DOE does not anticipate any other construction activities. Construction camp 17 would be 0.3 kilometer (0.2 mile) northeast of Hawthorne and 0.93 kilometer (0.57 mile) northeast of the rail segment. The construction camp would be on the Hawthorne Army Depot and would not require additional road construction. Construction camp 17 would overlie one notable wash. Aside from construction of this camp and the siding, DOE does not anticipate any other surface disturbances along this portion of the Mina rail alignment.

4.3.5.2.2.6 Mina Common Segment 1 (Gillis Canyon to Blair Junction). Mina common segment 1 would cross several ***notable drainages*** but no waters of the United States, as summarized in Table 4-201. These drainages are described in Section 3.3.5.3.6 as ephemeral washes and playas.

Notably, this segment crosses a large playa in Soda Spring Valley. Section 4.3.5.2.1.1 addresses common impacts to drainages.

There are no waters of the United States identified along Mina common segment 1 (DIRS 180889-PBS&J 2007, p. 7).

The National Wetland Inventory dataset identifies the playas in Soda Spring Valley and Alkali Flat as wetlands; however, DOE field studies in support of this Rail Alignment EIS confirmed no wetlands in these areas and therefore, no impact is anticipated (DIRS 180889-PBS&J 2007, Figure 4).

The Federal Emergency Management Agency has not mapped the area near Mina common segment 1; however, there are areas such as the Soda Springs playa where the potential for flash flooding exists. Section 4.3.5.2.1.6 addresses common impacts to floodplains and floodwaters.

The two springs identified along Mina common segment 1, Kinkaid Spring and an unnamed spring, would lie within the Mina rail alignment region of influence but outside the construction right-of-way. Section 4.3.5.2.1.7 addresses common impacts to springs.

Construction camps 14, 15, and 16, as described in Section 3.3.5.3.6, would be within the construction right-of-way of Mina common segment 1. Construction camp 16 would overlie one small ephemeral wash and one notable drainage, and construction camp 14 would overlie one small ephemeral wash and one notable drainage. The camps would not cross any waters of the United States or wetlands. Construction camp 15 would not overlie any surface water. Section 4.3.5.2.1.1 addresses common impacts to surface-water crossings.

4.3.5.2.2.7 Montezuma Alternative Segments. The Montezuma alternative segments would cross over several drainage features, including Jackson Wash and China Wash (Montezuma alternative segment 1) and Big Wash (Montezuma alternative segments 2 and 3). As shown in Table 4-201, the Montezuma alternative segments would cross numerous drainage channels. These drainages are described in Section 3.3.5.3.7 as ephemeral washes and playas. Notably, Montezuma alternative segments 2 and 3 would cross a large playa in Big Smoky Valley. Section 4.3.5.2.1.1 addresses common impacts to drainages.

There are no waters of the United States identified along the Montezuma alternative segments (DIRS 180889-PBS&J 2007, p. 7).

The National Wetland Inventory dataset identifies the playas in Big Smoky Valley (Montezuma alternative segments 2 and 3) and Stonewall Flat (Montezuma alternative segment 2) as wetlands; however, DOE field studies in support of this Rail Alignment EIS confirmed no wetlands in these areas and therefore, no impact is anticipated (DIRS 180889-PBS&J 2007, Figure 4).

Federal Emergency Management Agency flood maps only cover a small portion of the Montezuma alternative segments, near their southern termination. However, there are areas such as Big Smoky Valley, Clayton Valley, Stonewall Flat, and Montezuma Valley where the potential for flash flooding exists. Section 4.3.5.2.1.6 addresses common impacts to floodplains and floodwaters.

There are three springs identified along the Montezuma alternative segments – Hot Spring (Montezuma alternative segment 1), Slaughterhouse Spring (Montezuma alternative segment 2), and Rabbit Spring (Montezuma alternative segment 2). All three springs are within the Mina rail alignment region of influence but outside the construction right-of-way. Section 4.3.5.2.1.7 addresses common impacts to springs.

Construction camps 9, 9A, 13A, and 13B, as described in Section 3.3.5.3.7, would be within the construction right-of-way of the Montezuma alternative segments. Construction camp 9A would overlie one small ephemeral wash, and construction camp 13B would overlie one small ephemeral wash. The camps would not cross any waters of the United States or wetlands. Construction camps 9 and 13A would not overlie any surface water. Section 4.3.5.2.1.1 addresses common impacts to surface-water crossings.

4.3.5.2.2.8 Mina Common Segment 2. Mina common segment 2 would skirt two playas – Stonewall Flat Playa to the east and Alkali Flat Playa to the southwest. Mina common segment 2 would cross a drainage path that connects these two playas. These features are described in Section 3.3.5.3.8. Section 4.3.5.2.1.1 addresses common impacts to drainages.

There are no waters of the United States or wetlands along Mina common segment 2 (DIRS 180889-PBS&J 2007, pp. 7 and 9).

Federal Emergency Management Agency floodplain maps show a floodplain associated with the drainage path that connects Stonewall Flat Playa and Alkali Flat Playa, as indicated in Table 4-203. Where the Mina common segment would cross the floodplain, a drainage structure would be required that does not result in more than a 0.3-meter (1-foot) increase in water-surface elevations upstream of the crossing. Because of the engineering design process DOE would use and the regulatory requirements DOE would meet, impacts to surface-water drainage patterns would be small. Section 4.3.5.2.1.6 addresses common impacts to floodplains and floodwaters.

There are no springs identified or construction camps planned along Mina common segment 2.

4.3.5.2.2.9 Bonnie Claire Alternative Segments. Both of the Bonnie Claire alternative segments would cross an unnamed drainage channel that drains the area of Stonewall Mountain. Bonnie Claire alternative segment 3, the southwestern alternative segment, would also cross Alkali Flat Playa. These features are described in Section 3.3.5.3.9. Common impacts to drainages are addressed in Section 4.3.5.2.1.1.

There are no waters of the United States or wetlands identified along the Bonnie Claire alternative segments (DIRS 180889-PBS&J 2007, pp. 7 and 9).

Floodplain maps of the area show floodplains associated with the unnamed drainage channel that drains the area of Stonewall Mountain and Alkali Flat Playa; however, map coverage of the unnamed wash terminates just downstream (southwest) of Bonnie Claire alternative segment 3. The coverage stops at an old boundary of the Nevada Test and Training Range, but is close enough to the alternative segment that a reasonable estimate of the crossing distance could be made and included in Table 4-203. The area where Bonnie Claire alternative segment 2, the northeastern alternative segment, would cross the unnamed wash is far enough away from the limit of the floodplain map coverage that a crossing distance was difficult to estimate, which is why no value is shown in Table 4-203. Common impacts to floodplains and floodwaters are addressed in Section 4.3.5.2.1.6.

There are no springs identified or construction camps planned along the Bonnie Claire alternative segments.

4.3.5.2.2.10 Common Segment 5 (Sarcobatus Flat Area). Common segment 5 would cross numerous drainage channels, including Tolicha Wash and several unnamed washes, and would skirt playa areas of Sarcobatus Flat. These features are described in Section 3.3.5.3.10. Common impacts to drainages are addressed in Section 4.3.5.2.1.1.

There are no waters of the United States or wetlands identified along common segment 5 (DIRS 180889-PBS&J 2007, pp. 7 and 9).

Where common segment 5 would cross the floodplain associated with Tolicha Wash, a drainage structure would be required that would not result in more than a 0.3-meter (1-foot) increase in water-surface elevations upstream of the crossing. Playa areas near common segment 5 would be subject to occasional flooding and standing water, but the Federal Emergency Management Agency floodplain maps do not show that 100-year flood levels would reach this rail line segment. Common impacts to floodplains and floodwaters are addressed in Section 4.3.5.2.1.6.

There are no springs identified along common segment 5.

Construction camp 10, as described in Section 3.3.5.3.10, would be within the construction right-of-way and would overlie two small ephemeral washes and three notable drainages. The camp would not cross any waters of the United States or wetlands. Common impacts to surface-water crossings are addressed in Section 4.3.5.2.1.1.

4.3.5.2.2.11 Oasis Valley Alternative Segments. The Oasis Valley alternative segments would cross several washes and both would cross the Amargosa River, which is an ephemeral stream in this area. The northeastern alternative segment, Oasis Valley 3, would run within approximately 0.24 kilometer (0.15 mile) from Colson Pond. These features are described in Section 3.3.5.3.11. Common impacts to drainages are addressed in Section 4.3.5.2.1.1.

DOE field surveys of these areas identified two drainage channels along Oasis Valley alternative segment 1 and one drainage channel along Oasis Valley alternative segment 3 that would qualify as waters of the United States (DIRS 180889-PBS&J 2007, p. 7 and Figure 3B). Crossings of waters of the United States are summarized in Table 4-201. However, DOE would likely use bridges for these crossings. Therefore, the total amount of fill for waters of the United States the Oasis Valley alternative segments would cross would be very small. Common impacts to waters of the United States are addressed in Section 4.3.5.2.1.4.

DOE field surveys also identified a small isolated wetland, WT-15 (74 square meters [800 square feet]), that would be just outside the construction right-of-way, approximately 160 meters (530 feet) north of Oasis Valley alternative segment 1 (DIRS 183595-PBS&J 2006, p. 13 and Figure 4T). This wetland occurs within a slight topographic depression and does not have a surface-water connection to any nearby washes and would be regarded as isolated, and thus considered nonjurisdictional. There would be no direct impacts to this wetland during the construction phase because it would be outside the construction right-of-way and would be fenced or flagged. Indirect impacts such as sedimentation, erosion, and incidental spills would still be possible. Common impacts to wetlands are addressed in Section 4.3.5.2.1.5.

As shown in Table 4-203, both of these alternative segments would cross floodplains associated with Thirsty Canyon. Common impacts to floodplains and floodwaters are addressed in Section 4.3.5.2.1.6.

There are 25 springs within the region of influence of the Oasis Valley alternative segments, all of which would be outside the construction right-of-way. Oasis Valley alternative segment 3 would run within 200 to 520 meters (640 to 1,700 feet) of two unnamed springs. Oasis Valley alternative segment 1 would run within 480 to 610 meters (1,600 to 2,000 feet) of seven springs. Because the springs would be downstream of the rail line, there would be the potential for impacts from erosion and sedimentation during the construction phase. Common impacts to springs are addressed in Section 4.3.5.2.1.7.

Construction camp 11, as described in Section 3.3.5.3.11, would be within the Oasis Valley 1 construction right-of-way and would overlie one small ephemeral wash and two notable drainages. The camp would not cross any waters of the United States or wetlands. Common impacts to surface-water crossings are addressed in Section 4.3.5.2.1.1.

4.3.5.2.2.12 Common Segment 6 (Yucca Mountain Approach). Common segment 6 would cross several drainage features, including Beatty Wash, Tates Wash, Windy Wash, Busted Butte Wash (also known as Dune Wash), and unnamed tributaries of the Amargosa River, Busted Butte Wash, and Drill Hole Wash. These features are described in Section 3.3.5.3.12. Common impacts to drainages are addressed in Section 4.2.5.2.1.1.

Common segment 6 would cross 14 channels that qualify as waters of the United States, including two tributaries of the Amargosa River, Beatty Wash, seven tributaries to Beatty Wash, and four tributaries to Fortymile Wash. Of the 14 waters of the United States that common segment 6 would cross, the amount of fill would range from none for the smallest drainage to 9.9 cubic meters (350 cubic feet) for the largest drainage. The total amount of fill for waters of the United States that common segment 6 would cross would be 37 cubic meters (1,300 cubic feet).

There are no wetlands identified along common segment 6 (DIRS 180889-PBS&J 2007, p. 7).

Federal Emergency Management Agency floodplain maps provide coverage for the western portion of common segment 6, but the coverage terminates at approximately the point where the rail line would reach the Yucca Mountain Site boundary. In the areas covered by floodplain maps, the only floodplain along common segment 6 is one associated with Beatty Wash. The maps also show a floodplain associated with the unnamed wash from Crater Flat, but it does not extend up the wash as far as where common segment 6 would cross. DOE would build a large (370-meter [1,200-foot]-long) special-condition railroad bridge across Beatty Wash. Although the floodplain maps do not provide coverage for the area of the repository site on the east side of Yucca Mountain, there have been flood studies performed on several washes in that area, as described in the Yucca Mountain FEIS (DIRS 155970-DOE 2002, Figure 3-12 and pp. 3-38 and 3-39). If the Mina rail alignment is overlain on the figure of the floodplains in the Yucca Mountain FEIS (see Figure F-15 in Appendix F of this Rail Alignment EIS), it can be seen that common segment 6 would cross short stretches of 100-year floodplains associated with Busted Butte Wash and Drill Hole Wash before it terminated just prior to crossing a floodplain associated with Midway Valley Wash (also known as Sever Wash). Table 4-203 lists the estimated crossing distances for Beatty Wash, Busted Butte Wash, and Drill Hole Wash. Common impacts to floodplains and floodwaters are addressed in Section 4.3.5.2.1.6.

There are no springs identified along common segment 6.

Construction camp 12, as described in Section 3.3.5.3.12, would be within the common segment 6 construction right-of-way and would overlie one small ephemeral wash. The camp would not cross any waters of the United States or wetlands. Common impacts to surface-water crossings are addressed in Section 4.3.5.2.1.1.

4.3.5.2.3 Impacts from Constructing Facilities

4.3.5.2.3.1 Staging Yard. The Staging Yard would be constructed to the east of Hawthorne along Mina common segment 1. The disturbance area of the Staging Yard would be approximately 0.20 square kilometer (50 acres) and would include a 350-square-meter (3,800-square-foot) office, a 560-square-meter (6,000-square-foot) Satellite Maintenance-of-Way Facility, and a paved access road (DIRS 180872-Nevada Rail Partners 2007, pp. 3-1 and 3-2). The facility would overlie one notable wash; however, impacts to surface-water features would be small. Impacts to surface waters are summarized in Table 4-204.

4.3.5.2.3.2 Maintenance-of-Way Facility. There are two potential locations for the Maintenance-of-Way Facility along the Mina rail alignment, depending on the selected alternative segment. The Silver Peak option along Montezuma alternative segment 1 would be approximately 1.6 kilometers (1 mile) south of Silver Peak. The Klondike option along Montezuma alternative segment 2 or 3 would be 2.9

kilometers (1.8 miles) west of U.S. Highway 95 between Tonopah and Goldfield (DIRS 180872-Nevada Rail Partners 2007, pp. 4-4). The disturbance area of either potential location would be approximately 61,000 square meters (15 acres). There are no surface-water features in the area of either Maintenance-of-Way Facility option; therefore, there are no impacts to surface-water features.

4.3.5.2.3.3 Rail Equipment Maintenance Yard. Because there are no perennial surface waters in the area where the rail line would end at Yucca Mountain, potential impacts to surface-water features from the construction of rail line facilities in that area would be small (similar to the common impacts already described in Section 4.3.5.2.1.1). The Rail Equipment Maintenance Yard would overlie one ephemeral wash, but would not cross any waters of the United States. The Yard construction disturbance area, approximately 0.41 square kilometer (100 acres), would also include the train crew quarters, and could be the location for the Nevada Railroad Control Center and National Transportation Operations Center, and the Cask Maintenance Facility. Construction of the operations support facilities would include stormwater runoff control, as necessary, which would minimize the potential for contaminated runoff to reach any of the washes in the area; therefore, impacts related to construction of the Rail Equipment Maintenance Yard would be small.

4.3.5.2.4 Quarries

Each quarry facility would be comprised of three primary components: an operations plant, the quarry and production area, and possibly a railroad siding. The operations plant would include an office and administration complex, parking areas, services for fueling and maintenance, and sanitary facilities. Portable sanitary systems would be provided onsite; no water supply or wastewater treatment facilities would be provided at the quarry sites. The quarries would be close enough to construction camps that on-site residential facilities would not be necessary.

Ballast quarry operations would require the use of water, primarily to wash excavated rock during crushing and screening operations. Water usage quantities would vary depending on the specific quarry process selected to wash the rock during these operations. It is estimated that approximately 140,000 liters (38,000 gallons) of water would be needed per operational day at each quarry site (DIRS 180875-Nevada Rail Partners 2007, p. 3-1). Water used during these activities would also be used for dust suppression in these quarry areas. The wash water would be contained and recirculated through settling ponds. Relatively small quantities of water would also be used for dust suppression during drilling and blasting, truck loading and unloading, ballast stockpile and waste rock pile operations, and along access roads and in the quarry pit to suppress dust from truck and heavy equipment operations. Water used for dust suppression in these areas would not be expected to result in runoff from the quarry operational areas.

Overburden and waste rock removed from quarry areas would be stockpiled and later used for reclamation of the quarry sites. These piles would be stabilized or, if necessary, covered (for example, with mulch, netting, or synthetic stabilizer) to reduce the potential for erosion and runoff of sediments from these areas. Other best management practices that would be implemented include filter berms, straw-bale barriers, fences, or revegetation, as necessary. The change in the amount of runoff that would actually reach drainage channels would be minor, because construction would affect a small amount of the overall natural drainage areas.

Three separate programs established by the Clean Water Act are significant when reviewing activities associated with potential quarries. These include the establishment of water-quality standards pursuant to Section 303(c) of the Clean Water Act, National Pollutant Discharge Elimination System permit requirements set forth in Section 402 of the Clean Water Act, and dredge and fill requirements set forth in Section 404 of the Clean Water Act. General National Pollutant Discharge Elimination System permits would require that best management practices (including inventorying, assessment, prioritization, and identification and implementation of best management practices) be employed to meet water-quality standards. It is expected that any discharges associated with quarry operations would be managed with appropriate stormwater control systems that would effectively minimize off-site impacts from stormwater drainage. Thus, impacts to surface-water features associated with quarry operations would be small.

4.3.5.3 Railroad Operations Impacts

Potential impacts during the operations phase are addressed in relation to the impact assessment standards for surface-water resources identified in Table 4-200, including stormwater drainage and surface-water quality. Section 4.3.5.2.1 addresses surface-water availability, and floodplains and wetlands.

4.3.5.3.1 Operations Impacts Common to the Entire Rail Alignment

Operation of the proposed railroad would result in a small impact to surface waters beyond the permanent drainage alterations from construction. The rail roadbed would be expected to have runoff rates different from those of the natural terrain but, given the small size of the potentially affected areas within the overall drainage system, the impact on overall runoff quantities would be small. Thus, impacts related to stormwater increases would be limited to those localized areas where drainage patterns would be altered to convey storm flows.

Accumulation of surface water on the upgradient sides of the rail line in some areas could result from cut and fill operations during rail line construction and during operation of the railroad. There would be alteration of some natural drainage patterns. Standard engineering design and construction practices would be employed to minimize impacts to changes in surface-water drainage patterns and surface-water accumulation during rail line operations. Culverts, channelization, and other means of runoff control would be implemented to minimize the potential for water backing up. Section 4.3.5.2.1.1 states that a number of minor drainage channels would collect in a single culvert or pass under a single bridge, resulting in water flowing from a single location to the downstream side rather than across a broader area. As a result, there would be some accumulation during and following storm events and localized changes in drainage patterns, but this would be minimized.

Rail line maintenance would require periodic inspections of flood-prone areas (particularly after flood events) to verify the condition of the track and drainage structures. When necessary, sediment accumulating in these areas would be removed and disposed of appropriately. Similarly, eroded areas encroaching on the rail roadbed would be repaired. If the eroded areas had to be repaired often, that would be an indication that flow patterns had been changed and sediment was being moved as the water was cutting out a new channel. Regular inspection and maintenance of the rail line would help ensure that erosion and sedimentation problems were identified and addressed in a timely manner so that they did not contribute to upstream or downstream impacts. Therefore, impacts during the operations phase from sediment buildup and floodwater activity would be small.

The primary sources of potential surface-water ***contamination*** during the operations phase would be fuels (diesel and gasoline) and lubricants (oils and greases) required for equipment operation and maintenance. DOE would minimize the potential for contamination by managing spills and implementing best management practices.

4.3.5.3.2 Facility Operations

Activities at the facilities (including quarries) would adhere to a Spill Prevention, Control, and Countermeasures Plan to comply with environmental regulations and would also include a number of best management practices. The plan would describe the actions the Department would take to prevent, control, and remediate spills of fuel or lubricants. It would also describe the reporting requirements that would accompany the identification of a spill (DIRS 155970-DOE 2002, p. 4-23). Therefore, impacts to surface waters from facilities operations would be small.

Sanitary sewage generated at facilities would be contained and removed, sent to treatment facilities, or in some cases, disposed of through on-site septic systems. No industrial wastewater discharges would be expected from the operation of facilities. All wastewater collection and transfer systems would be designed and operated such that untreated wastewater would not be released to the environment; therefore, impacts to surface-water resources from facilities operations would be small.

4.3.5.3.3 Quarry Operations

Quarries would be reclaimed following the construction phase and would not be used during the operations phase. Therefore, there would be no impacts from quarry operations.

4.3.5.4 Shared-Use Option

4.3.5.4.1 Railroad Construction Impacts

Construction impacts to surface-water resources under the Shared-Use Option would be similar to those identified for the Proposed Action without shared use. The Shared-Use Option would involve the construction of additional sidings, which would be approximately 300 meters (980 feet) long and would be aligned parallel to the rail line within the construction right-of-way. Construction of these additional sidings would involve the same types of land disturbance as for the Proposed Action without shared use, but with minor additive impacts. As for the Proposed Action without shared use, potential impacts would be the release and spread of contaminants by precipitation or intermittent runoff events or, for portions of the rail line near surface-water bodies, possible release to the surface water; the alteration of natural drainage patterns or runoff rates that could affect downgradient resources; and the need for dredging or filling of perennial or ephemeral streams. However, the adverse impacts to surface-water resources from constructing additional sidings under the Shared-Use Option would add little to potential impacts described for the Proposed Action without shared use, because the same control measures would be in effect. Because construction of these additional sidings would not be a DOE action and there are uncertainties regarding the exact locations of needed commercial-use facilities, specific impacts of the Shared-Use Option to surface-water features were not analyzed.

4.3.5.4.2 Railroad Operations Impacts

Operations impacts under the Shared-Use Option would be similar to those identified for the Proposed Action without shared use. Use of a completed rail line from Mina to Yucca Mountain, including additional sidings, would result in small impacts to surface waters beyond the permanent drainage alterations that would result from construction. The rail roadbed would likely have runoff rates different from those of the natural terrain but, given the small size of the potentially affected areas in a single drainage system, the impact from shared-use operations on overall runoff quantities would be small.

Maintenance of the rail line and shared-use sidings would require periodic inspections of flood-prone areas (particularly after floods) to verify the condition of the track and drainage structures. When necessary, sediment accumulating in these areas would be removed and disposed of appropriately. Similarly, eroded areas encroaching on the rail roadbed would be repaired. Therefore, impacts from maintenance of the rail line related to sedimentation and erosion under the Shared-Use Option would be small.

General freight shipped on the proposed railroad could include mineral products, petroleum, agricultural products, or other commodities shipped or received by private companies. Spills of oil or hazardous substances carried on the rail line as general freight could affect surface-water resources. If a spill occurred, the potential for contamination to enter flowing surface water would present the greatest risk of a large contaminant migration until spills were contained and remediated. If there was no routinely flowing surface water, as is the condition for most areas along the Mina rail alignment, it is expected that released materials would not travel far or affect critical resources before corrective action could be taken. Compliance with regulatory requirements on reporting and remediating spills would result in a small probability of spills and, with specific regard to rail line operations, the overall risk of a transportation ***accident*** that could result in a release of a hazardous substance is considered to be small, as discussed in Section 4.3.10, Occupational and Public Health and Safety. Therefore, impacts to surface-water resources from potential accidental releases of contaminants from commercial rail shipments during operations under the Shared-Use Option would be small.

4.3.5.5 Summary

4.3.5.5.1 Impacts Common to the Entire Mina Rail Alignment

Construction and operation of a railroad along the Mina rail alignment could result in both direct and indirect impacts to surface-water resources (see Table 4-204). Direct impacts would include temporary or permanent grading, dredging, rerouting, or filling of surface-water resources. Indirect impacts would potentially increase or impede surface flow (see Sections 4.3.5.2 and 4.3.5.3). Also, nonpoint source pollution, primarily sedimentation, could result from stormwater runoff from areas where surface grades and characteristics would be changed (such as the rail roadbed and access roads) (see Section 4.3.5.2.1.2). Overall, impacts to surface-water resources from railroad construction and operations would be small.

Table 4-204. Summary of impacts to surface-water resources – Mina rail alignment (page 1 of 2).

	Proposed Action[a]	
Rail line segment/facility (county)	Construction impacts[b,c]	Operations impacts
Existing branchlines (Lyon and Mineral Counties)	Not applicable	No additional surface-water impacts are anticipated due to increased rail traffic.
All alternative segments and common segments (Lyon, Mineral, Churchill, Esmeralda, and Nye Counties)	Potential for increases in nonpoint source pollution, alteration of natural drainage patterns and runoff rates, temporary blockage of surface drainage channels, localized changes in drainage patterns, and increases in the flow rate in relation to natural flow conditions. Potential for release and spread of contaminants through an accidental spill or discharge. Potential impact from erosion and sediment loading and reduction of floodwater area flow.	Potential for fuel spills or release of contaminants. Drainage crossings (culverts and bridges) might cause floodwaters to back up.
Staging Yard at Hawthorne and Maintenance-of-Way Facility (Mineral and Esmeralda Counties)	Potential impact from erosion and sediment loading.	Potential for fuel spills or release of contaminants.
Potential quarries (Mineral and Esmeralda Counties)	Potential impact from erosion and sediment loading.	Potential impact from erosion and sediment loading.
Rail Equipment Maintenance Yard; Cask Maintenance Facility; Nevada Railroad Control Center and National Transportation Operations Center (Nye County)	Potential impact from erosion and sediment loading.	Potential for fuel spills during fueling, fuel transfer, or storage tank failure. Drainage crossings (culverts and bridges) might cause floodwaters to back up.

Table 4-204. Summary of impacts to surface-water resources – Mina rail alignment (page 2 of 2).

Rail line segment/facility (county)	Proposed Action[a]	
	Construction impacts[b,c]	Construction impacts[b,c]
Schurz alternative segment 1 (Lyon and Mineral Counties)	Of the 0.065 square kilometer (16 acres) of wetlands crossed in this area, 20 square meters (220 square feet) would be permanently filled to construct the bridge. Potential short-term impacts to wetlands from construction of the bridge over Walker River.	Permanent loss of wetlands.
Schurz alternative segment 4 (Lyon and Mineral Counties)	Of the 0.065 square kilometer (16 acres) of wetlands crossed in this area, 20 square meters (220 square feet) would be permanently filled to construct the bridge. Potential short-term impacts to wetlands from construction of the bridge over Walker River.	Permanent loss of wetlands.
Schurz alternative segment 5 (Lyon and Mineral Counties)	Of the 0.065 square kilometer (16 acres) of wetlands crossed in this area, 28 square meters (300 square feet) would be permanently filled to construct the bridge. Potential short-term impacts to wetlands from construction of the bridge over Walker River.	Permanent loss of wetlands.
Schurz alternative segment 6 (Lyon, Mineral, and Churchill Counties)	Of the 0.065 square kilometer (16 acres) of wetlands crossed in this area, 28 square meters (300 square feet) would be permanently filled to construct the bridge. Potential short-term impacts to wetlands from construction of the bridge over Walker River.	Permanent loss of wetlands.
Mina common segment 1 (Mineral and Esmeralda Counties)	Potential for impacts from erosion and sedimentation to spring.	No additional surface-water impacts are anticipated.
Montezuma alternative segment 1 (Esmeralda County)	Potential for impacts from erosion and sedimentation to spring.	No additional surface-water impacts are anticipated.
Oasis Valley alternative segment 3 (Nye County)	Potential for impacts from erosion and sedimentation to springs downstream of the rail line.	No additional surface-water impacts are anticipated.

a. Impacts under the Shared-Use Option would be similar to those under the Proposed Action without shared use.
b. Wetland filling estimates are based on the assumption that the construction right-of-way would be 30 meters (100 feet) wide.
c. Floodplain crossing distance is presented as a range. The minimum crossing distance is represented by the length of the rail line crossing Federal Emergency Management Agency mapped floodplains. The maximum value represents the minimum value in addition to the estimated crossing distance over floodplains that have not been mapped.

To evaluate potential impacts to surface-water resources, DOE identified areas where there are surface-water resources along the rail alignment (including those that would be crossed, filled, or covered) and identified the activities associated with construction or operations that would have the potential to affect these surface-water resources. Because of their importance in influencing the types and magnitude of potential impacts, Table 4-201 summarizes the numbers of surface-water features the Mina rail alignment would encounter. The table includes estimates of the total number of surface-water features the rail line, facilities, and quarries would cross (that is, drainage channels). The table also identifies two subsets of the total number of drainage channel crossings. The first is the notable channels described in Section 3.3.5.2.1, and the second includes drainage channels that would be classified as waters of the United States. A summary of waters of the United States and wetlands impacted along the Mina rail alignment is provided in Table 4-202. Table 4-203 lists the crossing distances and percentage of floodplain map coverage available for each common and alternative segment.

DOE would incorporate hydraulic modeling into the engineering design process to ensure that crossings were properly engineered so they would not contribute to erosion and sediment pollution. The design of drainage structures would account for scour and erosion and incorporate outlet protection and velocity-dissipating devices that would calm the flow and diminish its erosive potential. Because conveyance systems would be designed to safely convey increased flows during storm events (50-year and 100-year) and would minimize concentration of flow to the greatest extent practicable, impacts on stormwater drainage conveyance from construction of the rail line would be small.

DOE conducted the functional assessment of wetlands for the Mina rail alignment to better characterize potential impacts (direct, indirect, and cumulative) to the functions served by wetlands in this area. Wetland functions are generally assessed to document functional losses that could occur due to a proposed impact. By assessing wetland functions, mitigation can be designed to provide wetland functions in a manner and capacity that offset proposed losses. The results of this assessment are documented in the *Rail Alignment for Geologic Repository at Yucca Mountain, Nevada Project, Wetland Technical Memorandum: Functional Assessment, Impacts, and Conceptual Mitigation* (DIRS 185340-URS 2008, all). Appendix F, Floodplain and Wetlands Assessment, of this Rail Alignment EIS describes the wetland delineation and functional assessment in more detail and provides a discussion of potential impacts, and an alternatives analysis for the Mina rail alignment.

DOE would minimize filling of wetlands by keeping the rail line footprint to a minimum, constructing bridges that span stream channels and adjacent wetlands, and incorporating avoidance into rail line engineering and design to the extent practicable. DOE would mitigate loss of wetlands, as required under Section 404 of the Clean Water Act, by enhancing existing wetlands adjacent to or near the rail line that have been degraded by grazing and other impacts, or by creating new wetlands adjacent to or near the rail line. The exact acreage of wetlands to be enhanced or created would be determined in coordination with the U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency and would be based in part on the amount of wetlands that would have to be filled to construct the rail line, the function and quality of the wetlands that would be lost, and the likelihood of success of the methods used to enhance or replace wetlands.

In all instances where the alignment would cross or come close to a surface-water feature, that feature could be affected to some degree by railroad construction and operations; however, impacts would be substantially minimized through the engineering design process and the implementation of best management practices prior to, during, and after construction. Best management practices would include erosion-control measures, such as the use of silt fences and flow-control devices to reduce flow velocities and minimize erosion. Further, the Department would minimize filling of surface-water resources by incorporating avoidance into final engineering and design of the rail line, to the extent practicable.

4.3.5.5.2 Alternative Segment-Specific Impacts

The Mina alternative segments are adjacent to wetlands and some wetland fill would be unavoidable. DOE would construct a bridge at the Walker River crossing in part to minimize filling wetlands. Of the 0.065 square kilometer (16 acres) of wetlands delineated along the rail alignment, only about 20 square meters (0.005 acre) for Schurz alternative segments 1 and 4, or 28 square meters (0.007 acre) for Schurz alternative segments 5 and 6 would be permanently filled or lost to construct the alternative segment.

4.3.5.5.3 Preferred Alignment

Council on Environmental Quality NEPA implementing regulations require an agency to identify its preferred alternative, if one or more exists (40 CFR 1502.14[e]). For this Rail Alignment EIS, the DOE preferred alternative is to construct and operate a railroad along the Caliente rail alignment and to implement the Shared-Use option. DOE identified preferred alternative segments within the Caliente rail alignment based on an analysis of environmental impacts, engineering and cost factors, and regulatory compliance issues, including permit requirements and challenges, stakeholder preference, land-use conflicts, and uncertainties (see Table 2-30 of this Rail Alignment EIS).

The regulations that implement Section 404(b)(1) of the Clean Water Act (40 CFR Part 230) require a demonstration of the need to fill wetlands and other waters of the United States and a comparison among alternatives of the impacts to aquatic resources, so that the practicable alternative with the least impact to aquatic resources is selected. In addition, Executive Order 11990, *Protection of Wetlands*, requires federal agencies to avoid undertaking or providing assistance for new construction located in wetlands unless there is no practicable alternative to such construction and the proposed action includes all practicable measures to minimize harm to wetlands resulting from the proposed action.

The Mina Implementing Alternative would be environmentally preferable when compared to the Caliente Implementing Alternative. In general, the Mina Implementing Alternative would have fewer private-land conflicts, less surface disturbance, smaller wetlands impacts, and smaller air quality impacts than the Caliente Implementing Alternative. However, the Mina Implementing Alternative remains the nonpreferred alternative due to the objection of the Walker River Paiute Tribe to the transportation of spent nuclear fuel and high-level radioactive waste through its Reservation. DOE considered variations of the Mina rail corridor that would avoid the Walker River Paiute Reservation (DIRS 104792-YMP 1990, p. 17; DIRS 104795-CRWMS M&O 1995, p. 26), but excessive length of the route, land-use conflicts, and rugged terrain resulted in DOE eliminating these options from further study (DIRS 155970-DOE 2002, Section 2.3.3.1). Avoiding the Reservation would require the addition of 209.2 to 257.5 kilometers (130 to 160 miles) of track (to the approximately 321.9 kilometers (200 miles) of the Mina corridor) to avoid private lands and military installations and negotiate the terrain surrounding the Reservation. The route would have to pass between U.S. Navy bombing ranges, which the Navy plans to expand, and cross the rugged terrain of the Monte Cristo Mountains or the Gabbs Valley Range.

4.3.5.5.4 Mitigation Measures

In accordance with 10 CFR 1022.13(a)(3), DOE must address measures to mitigate the adverse impacts of actions in a floodplain or wetlands, including but not limited to, minimum grading requirements, runoff controls, design and construction constraints, and protection of ecologically sensitive areas. Whenever possible, DOE would avoid disturbing floodplains and wetlands and would minimize impacts to the extent practicable, if avoidance was not possible. Appendix F, Section F.4.4, discusses the floodplain and wetland mitigation measures that would be considered in the vicinity of the proposed rail alignment and, where necessary and feasible, implemented during railroad construction, operations, and maintenance. In general, DOE would minimize impacts to floodplains and wetlands through the implementation of engineering design standards and best management practices.

DOE has identified several measures to help avoid, minimize, or mitigate potential adverse impacts to floodplains and wetlands under the Proposed Action and Shared-Use Option. DOE has designed the rail alignment segments to avoid direct and indirect impacts to water resources wherever practicable. Due to the nature of rail line design and the construction activities that would be required to implement the design, the rail line cannot avoid crossing floodplains or wetlands. The engineering design process would ensure that the engineered structures used to pass water runoff from one side of the rail line to the other would do so in a way that would minimize impacts to floodplains and wetlands. Such impacts would be limited mostly to the construction phase and would be subject to Clean Water Act regulations. In most cases, DOE would minimize adverse impacts through the implementation of best management practices in concert with the permits and plans regulatory agencies would require. DOE would also develop a compensatory mitigation and monitoring plan for unavoidable impacts as part of its compliance with Section 404 of the Clean Water Act in coordination with the U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, and applicable land-management agencies such as the BLM.

For the area of unavoidable impacts to wetlands and other waters proposed by either alternative, federal law (33 CFR Part 320.4 (r)) would require compensatory mitigation. To fully assess the mitigation opportunities for project alternatives and options, a design-level investigation of opportunities for mitigation will be necessary. This investigation would include an assessment of available properties with potential to provide mitigation, discussion with landowners, and input from state and federal regulatory agency representatives. DOE would use the design-level investigation to develop a compensatory mitigation and monitoring plan for unavoidable impacts as part of its compliance with Section 404 of the Clean Water Act in coordination with the U.S. Army Corp of Engineers, U.S. Environmental Protection Agency, and applicable land-management agencies such as the BLM.

Temporary (short-term) impacts of construction, including vegetation trampling, soil compaction, and soil erosion, would be minimized by following best management practices, and would be mitigated by post-construction site restoration measures. Site restoration typically involves soil improvements, where necessary due to compaction, and revegetation using a native wetland seed mix (or woody plantings if such is impacted). DOE would stage equipment and supplies in upland areas and use construction mats or timber mats when heavy machinery must operate within wetlands. The majority of permanent direct wetland impacts would occur to pasture wetlands. More negligible impacts would occur at stream crossings if bridge piers cannot be designed outside of wetland riparian areas.

A variety of mitigation options exist for compensating wetland impacts. These include the following:

- On-site mitigation vs. off-site mitigation – On-site mitigation refers to conducting compensatory mitigation projects on the same parcel(s) where wetland impacts would occur. This is frequently the easiest option and may be the best one for minimizing the adverse impacts of developments in a given area. For example, if localized flooding is a problem, it is important to maintain local flood storage capability. Sometimes, however, on-site mitigation is not practicable (for example, for small wetland impacts) or is not the best option for replacing wetland functions. Off-site mitigation is when the mitigation site is not part of the development site. Instead, the mitigation project is constructed at some other appropriate site. Generally, off-site mitigation is located within the same basin as the impacted area such that overall functional mitigation is provided to the affected watershed. Mitigation banks are large wetland mitigation projects constructed by a public entity or private party to compensate for future wetland impacts. However, wetland mitigation banks are not considered an option due to the lack of available wetland mitigation bank servicing in this area of Nevada.
- Restoration, creation, and enhancement – Restoration is the reestablishment of wetland and/or other aquatic resource characteristics and function(s) at a site where they have ceased to exist, or exist in a substantially degraded state. Restoration activities generally garner the best mitigation ratio (such as acres restored for acres impacted) relative to creation or enhancement activities. Creation is the establishment of a wetland or other aquatic resource where one did not formerly exist. Enhancement activities can be conducted in existing wetlands or other aquatic resources that increase one or more aquatic functions. Enhancement generally provides higher mitigation ratios (more mitigation acreage needed) than restoration or enhancement activities.

When wetland impacts cannot be avoided, DOE will need to mitigate the loss of impacted wetland functions and area. This is typically done by restoring, creating, or enhancing wetlands.

Appendix F, Floodplain and Wetlands Assessment, Section F.4.4, describes in detail the best management practices and mitigation measures that would be implemented to minimize impacts from filling of wetlands and other waters that cannot be avoided. That section also describes the best management practices and conceptual mitigation measures that would be implemented along the preferred alignment to reduce the risk of flood damage; minimize the impacts of floods on human safety, health, and welfare; restore and preserve the natural and beneficial values served by floodplains; and reduce erosion and sedimentation.

4.3.6 GROUNDWATER RESOURCES

This section describes potential impacts to groundwater resources from constructing and operating the proposed railroad along the Mina rail alignment. To analyze potential impacts, DOE considered whether constructing and operating the railroad would result in:

- Possible damage to existing wells as a result of construction work
- Possible declines in groundwater levels or groundwater production rates at existing groundwater production wells, caused as a result of groundwater withdrawals to support rail alignment construction and operations
- Possible changes in discharge rates at existing springs, seeps, or other surface-water-rights locations as a result of the proposed groundwater withdrawals
- Possible changes in infiltration rates in disturbed areas
- Possible changes in groundwater quality at wells, springs, seeps, or other surface-water-right locations or in shallow groundwater as a result of the proposed groundwater withdrawals
- Possible subsidence of the ground surface as a result of the proposed groundwater withdrawals

Section 4.3.6.1 and Appendix G describe the methods DOE used to assess potential impacts to existing groundwater resources; Section 4.3.6.2 describes potential construction impacts; Section 4.3.6.3 describes potential impacts of operating the railroad along the Mina rail alignment under the Proposed Action; Section 4.3.6.4 describes potential impacts of operating the railroad along the Mina rail alignment under the Shared-Use Option; and Section 4.3.6.5 summarizes potential impacts to groundwater resources.

Section 3.3.6.1 describes the region of influence for groundwater resources for the Mina rail alignment. The section includes a discussion of existing wells and springs that fall within the Mina rail alignment region of influence that could be affected by new wells that would be installed and used to obtain water to support construction and operation of the proposed railroad.

4.3.6.1 Impact Assessment Methodology

DOE considered a variety of methods for obtaining water that would be needed to support construction and operation of the proposed rail line and railroad construction and operations support facilities along the Mina rail alignment. These methods include, but are not limited to, construction of new water wells; purchasing water from municipalities or other existing water-rights holders; or importing water from other groundwater ***hydrographic areas***. A combination of such methods could reduce potential impacts to groundwater resources. However, acquiring all required water from new wells would place the greatest amount of increased water ***demand*** on existing groundwater resources. Therefore, to develop a conservative or upper bound estimate analysis of potential impacts to groundwater resources, DOE assumed that it would obtain all water required for construction and operation of the rail line and railroad construction and operations support facilities from newly constructed wells. This Rail Alignment EIS does not analyze the impacts of obtaining water through other methods.

In this section, DOE evaluates the potential impacts associated with the following types of new water wells that would be installed and utilized to obtain water required for construction and operation of the proposed rail line and associated facilities:

- Construction-water wells – These temporary wells (DIRS 180888-Converse Consultants 2007, Section 2.1 and Table 2-2) would furnish approximately 87 percent of the total project water demand. The remaining 13 percent of total water demand would be provided by wells for quarries or permanent wells. Wells in this category include wells that would provide water for earthwork compaction during rail roadbed construction and wells that would supply water for temporary construction camps. Nearly all water obtained from wells to support rail roadbed construction within each hydrographic area would be pumped within a 1-year period. The average groundwater withdrawal (usage) rate for these wells would vary according to location. Water wells at construction camps would have production rates of 76 liters (20 gallons) per minute.

- Quarry water wells – These wells would supply water to support start-up and operation of quarry operations, with each quarry being in operation over an estimated period of about 2 years, following an initial start-up period. The average withdrawal rate for these wells would be approximately 91 liters (24 gallons) per minute.
- "Permanent" water wells – These wells would supply water to meet water requirements for rail sidings and railroad operations facilities and provide water for fire protection purposes. Average withdrawal rates for these wells would be very low (less than 3.8 liters [1 gallon] to approximately 16 liters [4.2 gallons] per minute). DOE would use these new wells during the 50 years of railroad operations.

DOE would submit applications to the Nevada State Engineer for approval of water rights for the new groundwater withdrawal wells. DOE would follow all applicable requirements under state water law in Nevada Revised Statute 533 in applying for and acquiring water rights for all phases of the Nevada rail line and ancillary facilities. Following the approval of water-rights applications, DOE would then install most of the new water wells adjacent to new access roads that would be constructed on either side of the rail roadbed and within the rail line construction right-of-way. DOE assumes that if it could not obtain adequate volumes of water from some of these new wells because of limited ***aquifer*** productivity (less than the required productivity for that location based on the water demand at the associated construction location), it would obtain the additional water required at those locations from other new wells proposed for installation either within the typical maximum 300-meter (1,000-foot)-wide construction right-of-way or from one or more of the proposed new wells simulated outside of that right-of-way. In these cases, the water would either be transported by truck or pumped through a temporary above-ground pipe within the construction right-of-way. Wells installed outside of the construction right-of-way would be installed as near as reasonably possible, based on ***hydrogeologic*** criteria, to the right-of-way, except for wells installed at the proposed quarry sites, which might or might not be at more remote locations.

DOE considered a number of factors to evaluate potential adverse impacts to groundwater resources. There could be an adverse impact if construction and operation of the rail line and railroad construction and operations support facilities would cause any of the conditions listed in Table 4-205.

Table 4-205. Impact assessment considerations for groundwater resources.

Resource criteria	Basis for assessing adverse impact
Groundwater availability and uses	• Adversely affect an existing aquifer. Adverse effects would include substantial depletion of groundwater supplies on a scale that would affect available capacity of a groundwater source for use by existing water-rights holders within the hydrographic area where groundwater withdrawal would occur or in any downgradient hydrographic area, interfere with groundwater recharge, or reduce discharge rates to existing springs, seeps, or other surface-water-right locations. • Conflict with established water rights, allotments, or regulations protecting groundwater resources.
Ground subsidence	• Cause subsidence of the ground surface (as a result of groundwater withdrawals).
Groundwater quality	• Contaminate a public water-supply aquifer and exceed federal, state, or local water-quality criteria.

To evaluate potential impacts to groundwater resources DOE considered:

- Potential changes to infiltration rates, with consequent changes to percolation rates of surface water to the groundwater system, that could be caused by the same disturbances evaluated in the surface-water impact analysis (also see Section 4.3.5, Surface-Water Resources).
- Potential changes to groundwater quality due to groundwater withdrawals or from accidental spills or releases.
- Potential impacts to aquifer users and uses resulting from withdrawal of groundwater from new wells to support water needs for construction and operation of the rail line and railroad construction and operations support facilities. DOE focused the impact analysis on aquifers and the existing groundwater users who withdraw water from the groundwater hydrographic areas that would serve as sources of water for construction and operation of the railroad. DOE compared the amount of water that would be required for construction and operation of a railroad along the Mina rail alignment and existing uses of groundwater in those groundwater hydrographic areas. Existing groundwater resources addressed in these evaluations include existing wells, springs, groundwater seeps and other surface-water-right locations. DOE considered potential impacts resulting from the following actions: (1) pumping from new wells to obtain water needed for rail roadbed construction (including water needed for earthwork, dust control, and construction camps), and (2) pumping from new wells installed to support quarry operations, rail sidings, and other railroad facilities.
- Potential for damage to existing wells from construction activities or potential ground subsidence as a result of the proposed groundwater withdrawals.

4.3.6.2 Construction Impacts

4.3.6.2.1 Construction Impacts Common to the Entire Rail Alignment

Impacts to groundwater or the land surface during construction of the Mina rail line could include: (1) potential changes in infiltration rates in disturbed areas with resulting changes in rates of percolation to groundwater (addressed in Section 4.3.5, Surface-Water Resources); (2) reduced flow to springs, seeps or other surface-water-right locations. or a reduction in available flow rates to one or more existing wells within the ***radius of influence*** of, or the radius of the ***cone of depression*** surrounding, purposed new wells; (3) possible damage to, or loss of, use of existing wells within the construction right-of-way; (4) degradation of groundwater quality resulting from groundwater withdrawals; or (5) potential ground subsidence.

As described in Section 4.3.5, construction of the rail line and railroad construction and operations support facilities would result in land-surface disturbance, such as grading, excavation, or stockpiling, that would alter the rate at which water could infiltrate the disturbed areas. Construction activities would disturb and temporarily loosen the ground, which could produce temporarily higher near-surface infiltration rates (see Section 4.3.5). This situation would typically be short lived; rail roadbed materials and disturbed areas associated with railroad facilities and ballast areas would become compacted and less porous, with most of the land disturbance during railroad and facilities construction likely resulting in surfaces with lower infiltration rates causing an increase in runoff. Even in the short term, localized changes in infiltration would likely cause no large-scale change in the amount of groundwater percolation ***recharge*** because the disturbed areas would be a very small percentage of the overall surface area of a hydrographic area (see Section 4.3.5). Therefore, changes to infiltration rates in the regions where construction would take place would be small, and adverse impacts associated with changes in stormwater infiltration rates would be small.

Most recharge to aquifers in the region is derived from precipitation falling in the higher parts of the inter-basin mountain ranges (see, for example, DIRS 103136-Prudic, Harrill, and Burbey 1993, pp. 2, 58, 84, and 88; DIRS 180759-Van Denburgh and Glancy 1970, Table 6). The climate in the region through which DOE would construct a railroad along the Mina rail alignment is generally arid. These factors combine to produce a deficit of shallow groundwater beneath many parts of the rail alignment, such as several valley floors it would cross. Estimated depths to groundwater beneath most of the hydrographic areas the rail line would cross range from approximately 15 to 150 meters (50 to 490 feet) or more below ground, with some localized areas where shallower groundwater occurs at depths ranging between 3 and less than 15 meters (10 and less than 50 feet) below ground. Areas of such shallower groundwater occurrence include portions of the Mason Valley, Walker Lake Valley (Schurz subarea), Rhodes Salt Marsh, Columbus Salt Marsh, Clayton Valley, and Oasis Valley hydrographic areas (DIRS 180887-Converse Consultants 2007, Plates 4-1 to 4-10; DIRS 180888-Converse Consultants 2007, Appendix B). However, with the exception of one portion of one alternative segment (Montezuma alternative segment 1) in the Clayton Valley hydrographic area (area 143) and a portion of Department of Defense Branchline North in the Mason Valley hydrographic area (area 108), areas of known shallower groundwater occurrence lie outside of the proposed rail alignment construction right-of-way (DIRS 180887-Converse Consultants 2007, Plates 4-1 to 4-10). Available hydrogeologic information suggests that shallow groundwater would occur infrequently, and on a localized basis, beneath the Mina rail alignment.

Other potential impacts include degradation of groundwater quality due to new sources of contamination that could come into direct contact with, or migrate to, groundwater. Construction-related materials that would be used in this arid environment, that could contaminate groundwater if spilled, include petroleum products (such as fuels and lubricants) and coolants (such as antifreeze) necessary to operate construction equipment. The infrequent occurrence of shallow groundwater beneath the Mina rail alignment (see Section 3.3.6) beneath the vast majority of the proposed Mina rail alignment indicates that the probability of contaminants reaching underlying groundwater would be low; therefore, DOE would not expect impacts to groundwater quality resulting from spills of hazardous or nonhazardous materials.

As described in Appendix G (Section G.1.1), pumping groundwater from a well that has a perforated zone that vertically spans an aquifer zone or extends vertically across portions of two vertically distinct aquifer units could induce water to flow vertically within the aquifer or between different aquifer units, or, if sufficient pressure head exists, potentially into the open environment (that is, to the ground surface). A review of published information (see Appendix G, Section G.1.1) regarding groundwater-quality characteristics in areas that would be crossed by the Mina rail alignment indicates that most areas of valley-fill deposits (alluvium) at the proposed well locations and underlying the alignment do not have poor-quality/highly mineralized groundwater. Based on an overlay of the proposed alignment onto a USGS statewide map showing estimates of total dissolved solids concentration in groundwater from basin-fill aquifers (DIRS 172905-USGS 1995, Figure 70), for most areas along the Mina alignment, concentrations of total dissolved solids in groundwater from alluvial aquifers are generally less than or equal to 500 to 1,000 milligrams per liter (mg/L) (equivalent to 500 to 1,000 parts per million [ppm] total dissolved solids in water). However, some portions along the proposed alignment could overlie poor to marginally poor-quality groundwater (total dissolved solids concentrations up to 3,000 mg/L or higher) in valley-fill deposits based on review of the previously mentioned water-quality map (DIRS 172905-USGS 1995, Figure 70). Those portions of the alignment are located in Rhodes Salt Marsh Valley (basin 119), Clayton Valley (basin 143), and Sarcobatus Flat (basin 146). Poor-quality (highly mineralized) groundwater areas are generally restricted to areas of discharge or to sink areas, including playas and areas near some thermals springs (DIRS 172905-USGS 1995, all). In Rhodes Salt Marsh Valley and Sarcobatus Flat, the proposed alignment comes very near (within one to several miles of) mapped playa areas underlain by groundwater having high estimated total dissolved solids concentrations, and in Clayton Valley, the alignment traverses a mapped playa area where high total dissolved solids concentrations in underlying groundwater are indicated (DIRS 172905-USGS 1995, Figure 70).

Groundwater underlying the playa area of Clayton Valley is considered a saturated chloride brine (DIRS 180887-Converse Consultants 2007, p. 47). Most wells in Clayton Valley are associated with industrial/mining uses and are related to the extraction of lithium-bearing brine (DIRS 180887-Converse Consultants 2007, p. 46 and Table 4-12), particularly the existing wells in the playa area that is crossed by the alignment (DIRS 180887-Converse Consultants 2007, Plate 4-3).

Within the previously mentioned hydrographic areas, it is anticipated that the following proposed well locations might intercept marginally poor to poor-quality groundwater: RSM-1a, RSM-2a, CL-8a, CL-9a, SaF5/9, and SaF6/10. All these proposed well locations target groundwater present within alluvial valley-fill deposits. Given the proposed depths of these wells and information obtained from review of well logs for existing wells in these areas, it is not likely that the proposed wells would intersect any aquifer units other than the host alluvial valley-fill deposit aquifer. Therefore, it would be highly unlikely for the proposed wells to induce the vertical flow of poor-quality groundwater into another aquifer unit.

A portion of the proposed Mina alignment would traverse near a playa area in the Sarcobatus Flat hydrographic area that is underlain by groundwater estimated to have a higher range of total dissolved solids concentrations. However, the proposed well locations (SaF5/9 and SaF6/10) along this portion of the alignment most likely would not intercept this poor-quality groundwater. These well locations are at least 3.2 kilometers (2 miles) from the playa area, and there is a domestic well and a municipal well approximately 1.6 kilometers (1 mile) away from the proposed SaF5/9 well location (and closer to the playa area), suggesting that groundwater along this portion of the alignment does not contain elevated total dissolved solids concentrations. The well log for the domestic well states that the water quality is good. The groundwater with the highest total dissolved solids contents occurs very near the playa area where groundwater is very shallow (within several feet of ground surface) (DIRS 106695-Malmberg and Eakin 1962, p. 20). The depth to groundwater at the proposed well locations SaF5/9 and SaF6/10 is estimated to be between 3 to 30 meters (10 to 100 feet) below ground surface. The SaF5/9 and SaF6/10 well locations are likely far enough away from the playa area that the targeted groundwater would have relatively low total dissolved solids concentrations.

Poor-quality groundwater, if it were to be intercepted in the ***screened*** zone of a well, might be able to reach the ground surface by the mechanism of artesian flow (in a free-flowing well). The top of the perforated intervals (screened zone) of each proposed well would not be less than about 3 meters (10 feet) below the ground surface, and could be much deeper; that is, up to several hundred meters (several hundred feet) below the ground surface. The new wells would be constructed in accordance with current standards and practices used for well construction. The annular space in each new well (space between the well casing and the borehole wall) alongside the screened zone in the well casing would be backfilled with clean, permeable, granular material, a low-permeability seal placed above this backfill zone, and the annular space above this seal would be filled with grout to minimize the possibility of vertical mixing of groundwater from different groundwater horizons. The length of the screened zone in each new well would also likely be limited to the minimum length needed to allow the desired groundwater pumping rate, thus minimizing the potential for well screens to cross multiple groundwater horizons/aquifer units. Available information for existing wells along the proposed Mina alignment also does not indicate the presence of artesian conditions in any of the areas where new wells are proposed. While confined conditions for groundwater might be encountered at two proposed Clayton Valley hydrographic area locations (Cl-8a and Cl-9a), the potentiometric surface depth in the completed wells is not expected to approach the elevation of the ground surface.

In summary, the potential for impacts to occur to the affected environment from vertical movement of poor-quality water within an aquifer or between different superadjacent aquifer units as a result of groundwater pumping in the newly proposed wells was evaluated using available information from published reports, well logs, and maps. For the reasons stated above, the potential for this type of impact to occur is considered to be small for the proposed Mina rail alignment.

As discussed in Section 4.3.11, Utilities, Energy, and Materials, ***sanitary wastes*** from the construction camps would be disposed of in accordance with all applicable regulatory requirements. By complying with regulatory requirements, it is expected that wastewater-related impacts to groundwater resources in these areas would be minimized.

Railroad construction activities might occur near one or more existing wells. However, based on the available data, DOE does not anticipate that construction would disturb any existing wells. In the unlikely event that wells are identified prior to rail roadbed construction that could be disturbed by construction activities, DOE would take steps to minimize impacts to those wells, such as advising well owners of planned activities and discussing with the owners measures needed to protect the well head (the portion of the well above the ground surface) during construction.

An estimated total of approximately 7.34 million cubic meters (5,950 ***acre-feet***) of water could be required to construct a railroad along the Mina rail alignment (DIRS 180875-Nevada Rail Partners 2007, p. 4-4). The actual amount of water required would depend on the specific combination of alternative rail segments that would be selected for construction (see Table 3-113). DOE would use water for earthwork compaction, control of excavation dust, workforce needs, and ballast production (DIRS 180875-Nevada Rail Partners 2007, p. 4-4). DOE has assumed that it would obtain all water from new wells. Over 87 percent of the total required project water demand is needed to support rail roadbed construction (DIRS 180875-Nevada Rail Partners 2007, Section 4.4.2). These construction water wells would be temporary wells and DOE assumes they would be used for up to a year (DIRS 180888-Converse Consultants 2007, Section 2.1 and Table 2-2). As discussed in Chapter 2, Proposed Action and Alternatives, DOE is considering a 4- to 10-year rail construction schedule.

The typical groundwater pumping scenario for rail roadbed construction wells assumes a 9-month effective pumping period with 3 months of lost production for each construction well because of adverse weather conditions or other factors such as equipment repairs. This provides for a conservative scenario, or upper bound estimate of groundwater withdrawal rates that would result in the largest potential impacts (greatest amounts of drawdown) to groundwater resources and existing groundwater users potentially situated within the region of influence of the proposed water wells. If the construction schedule were lengthened (for example, up to 10 years), less water would be required to support construction activities in any given year, thereby resulting in the same or reduced groundwater withdrawal rates and the same or reducing impacts to groundwater resources and existing groundwater users. Section 4.3.6.2.2 further describes the approach and methods DOE used to quantitatively evaluate potential site-specific impacts to groundwater resources.

Table 4-206 lists the proposed Mina rail alignment alternative segments and common segments and summarizes the estimated total construction-related water requirements (demands) within each hydrographic area. The table lists a range of water demand values for hydrographic areas associated with more than one alternative segment or common segment. The range of values consists of the minimum water demand and the maximum water demands based on the various possible combinations of alternative rail segments that could be constructed, for the 18 hydrographic areas that would be crossed by the Mina rail alignment. Figure 4-30 depicts the proposed Mina rail alignment, hydrographic areas the alignment would cross, and the range of estimated total water demands associated with railroad construction within each hydrographic area.

As described in Section 3.3.6, Table 3-113 identifies hydrographic areas that are considered to be ***designated groundwater basins***, and lists information about total annual committed resources and

Table 4-206. Estimated water requirements for railroad construction by hydrographic area – Mina rail alignment (page 1 of 3).

Hydrographic area[a] number and name	Perennial yield for hydrographic area (acre-feet)[b,c]	Total annual committed resources/pending annual duties for hydrographic area (acre-feet)[d]	Rail line segment or rail line segment combination[e]	Estimated water demand or possible range of construction water demand values within hydrographic area (acre-feet)[f]
108 – Mason Valley*	25,000	179,696/25,269	Department of Defense Branchline North	22
110A – Walker Lake (Schurz subarea)	1,500	637/2	Schurz alternative segment 1/Department of Defense Branchline South	475
			Schurz alternative segment 4/Department of Defense Branchline South	1,182
			Schurz alternative segment 5/Department of Defense Branchline South	706
			Schurz alternative segment 6/Department of Defense Branchline South	718
123 – Rawhide Flats	500	116/0	Schurz alternative segment 5	243
			Schurz alternative segment 6	913
110B – Walker Lake (Lake subarea)	700	2,093/0	Department of Defense Branchline South	46
110C – Walker Lake (Hawthorne subarea)	5,000	12,709/0	Department of Defense Branchline South/Mina common segment 1	143
121A – Soda Spring Valley (eastern part)*	6,000	3,168/0	Mina common segment 1	485
121B – Soda Spring Valley (western part)*	200	354/0	Mina common segment 1	174
119 – Rhodes Salt Marsh Valley	1,000	49/0	Mina common segment 1	276
118 – Columbus Salt Marsh Valley	4,000	1,764/0	Mina common segment 1	346
137A – Big Smoky Valley (Tonopah Flat)*	6,000	19,638/0	Mina common segment 1/Montezuma alternative segment 1	171
			Mina common segment 1/Montezuma alternative segment 2	413

Table 4-206. Estimated water requirements for railroad construction by hydrographic area – Mina rail alignment (page 2 of 3).

Hydrographic area[a] number and name	Perennial yield for hydrographic area (acre-feet)[b,c]	Total annual committed resources/pending annual duties for hydrographic area (acre-feet)[d]	Rail line segment or rail line segment combination[e]	Estimated water demand or range of construction water demand values within hydrographic area (acre-feet)[f]
143 – Clayton Valley	20,000	23,882/0	Montezuma alternative segment 1	1,080
142 – Alkali Spring Valley	3,000	2,596/0	Montezuma alternative segment 1	573
			Montezuma alternative segments 1/3/2	356
			Montezuma alternative segment 2/Mina common segment 2	632
144 – Lida Valley	350	72/0	Montezuma alternative segment 1/Mina common segment 2/Bonnie Claire alternative segment 2	570
			Montezuma alternative segment 1/Mina common segment 2/Bonnie Claire alternative segment 3	467
			Montezuma alternative segment 2/Mina common segment 2/Bonnie Claire alternative segment 2	376
			Montezuma alternative segment 2/Mina common segment 2/Bonnie Claire alternative segment 3	273
145 – Stonewall Flats	100	12/0	Montezuma alternative segment 2	48
146 – Sarcobatus Flat*	3,000	3,591/0	Bonnie Claire alternative segment 2/common segment 5	377
			Bonnie Claire alternative segment 3/common segment 5	460
228 – Oasis Valley	1,000	1,299/0	Common segment 5/Oasis Valley alternative segment 1/common segment 6	401
			Common segment 5/Oasis Valley alternative segment 3/common segment 6	574

Table 4-206. Estimated water requirements for railroad construction by hydrographic area – Mina rail alignment (page 3 of 3).

Hydrographic area[a] number and name	Perennial yield for hydrographic area (acre-feet)[b,c]	Total annual committed resources/pending annual duties for hydrographic area (acre-feet)[d]	Rail line segment or rail line segment combination[e]	Estimated water demand or range of construction water demand values within hydrographic area (acre-feet)[f]
229 – Crater Flat	220	1,147/82	Common segment 6	256
227A – Fortymile Canyon, Jackass Flats	580[g]	58/5	Common segment 6	572
Estimated lowest total water demand value (acre-feet) based on possible combinations of rail line segments				Approximately 5,750
Estimated highest total water demand value (acre-feet) based on possible combinations of rail line segments				Approximately 8,200
Current estimate of total water demand (acre-feet) – current best estimate (see text)				Approximately 5,950

a. Source: DIRS 106094-Harrill, Gates, and Thomas 1988, Summary, Figure 3, with the proposed rail alignment map overlay. An asterisk (*) indicates that the State of Nevada considers the hydrographic area a designated groundwater basin (DIRS 177741-State of Nevada 2005, all).

b. Source: DIRS 103406-Nevada Division of Water Planning 1992, Regions 10, 13, and 14, except hydrographic areas 227A, 228, and 229, for which the source is DIRS 147766-Thiel Engineering Consultants 1999, pp. 6 to 12. The perennial yield value shown for area 228 is the lowest value in range of estimated values (1,000 to 2,000 acre-feet per year) presented by Thiel Engineering Consultants 1999.

c. To convert acre-feet to cubic meters, multiply by 1,233.49. To convert acre-feet to gallons, multiply by 3.259×10^5.

d. Data for committed groundwater resources and pending annual duties are current as of the dates described in Section 3.3.6. Pending duties include underground duties but do not include duties for streams or springs. All values have been rounded to the nearest acre-foot.

e. Figures 3-190 through 3-196 show the locations of the Mina rail alignment alternative segments and common segments.

f. Water demand estimates are from DIRS 180888-Converse Consultants 2007, Table 2-3 and DIRS 180875-Nevada Rail Partners 2007, Table 4-3. All demand values rounded to the nearest acre-foot.

g. Based on a 1979 Designation Order by the State Engineer; there are no committed resources in area 227A. However, water-rights information from the NDWR indicates there are 58 acre-feet in committed resources for this area. The discrepancy appears to be related to the location of the boundary between areas 227A and 230 (Amargosa Desert) (DIRS 182821-Converse Consultants 2005, p. 29 and Table 4-45). The perennial-yield value shown for area 227A is the lowest estimated value presented in *Data Assessment & Water Rights/Resource Analysis of: Hydrographic Region #14 Death Valley Basin* (DIRS 147766-Thiel Engineering Consultants 1999, p. 8), for the entirety of hydrographic area 227A. The perennial yield estimate for area 277A is broken down into 300 acre-feet for the eastern third of the area and 580 acre-feet for the western two-thirds of the area.

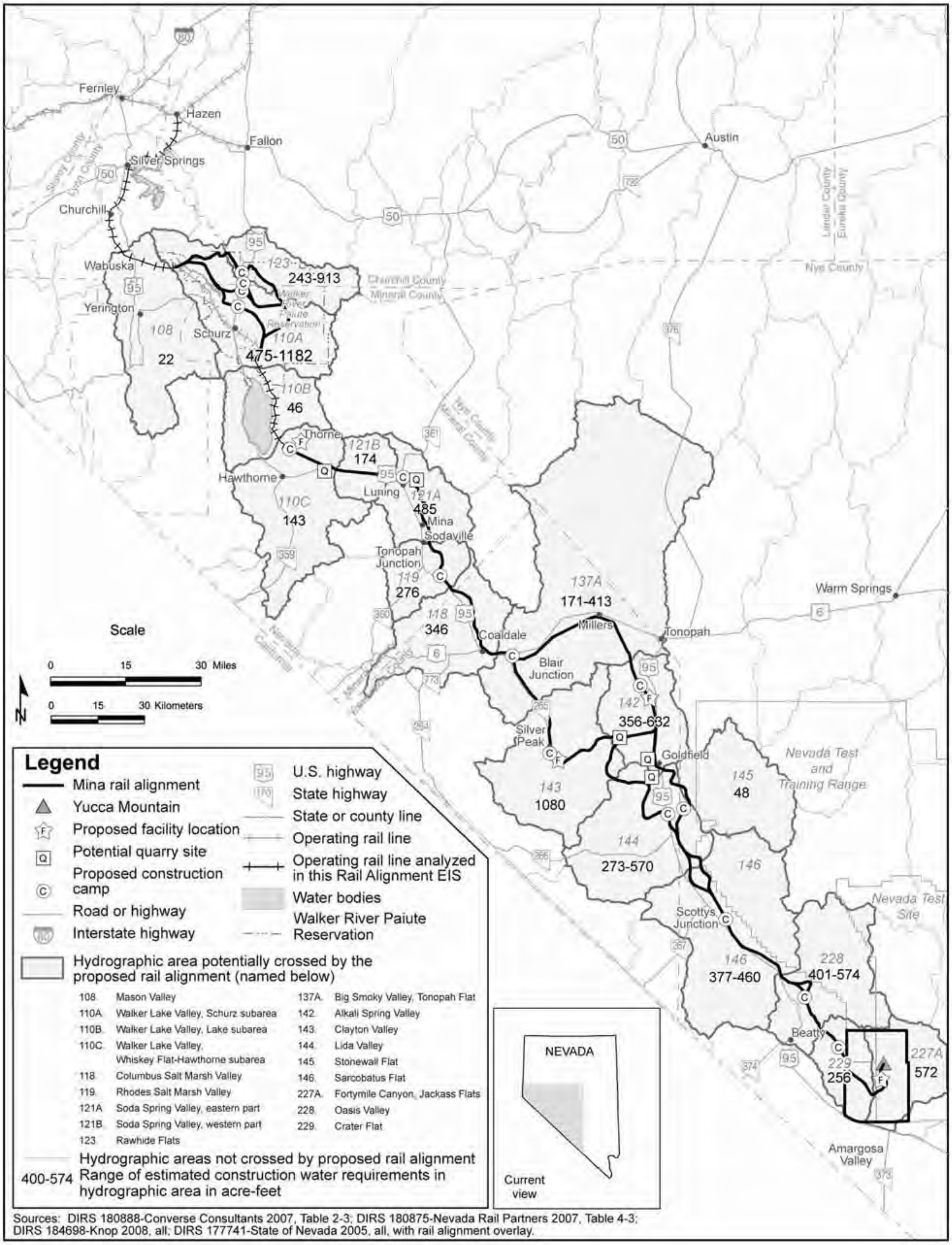


Figure 4-30. Estimated construction-water requirements along the Mina rail alignment.

pending annual duty amounts in the listed hydrographic areas. Seven of the 18 hydrographic areas that could be crossed by the alignment are designated groundwater basins.

Comparison of the information presented in Table 4-206 indicates that, depending on the specific combination of alternative segments selected for construction, where applicable, total water withdrawals could exceed annual ***perennial yield*** values for hydrographic areas 123, 144, and 229, and could be as high as 48 percent, 57 percent, 82 percent, 87 percent, and 99 percent of the annual perennial yield in hydrographic areas 145, 228, 110A, 121B, 227A, respectively. Water withdrawals would typically range from less than 1 percent to as high as approximately 28 percent of the annual perennial yield value for the remaining areas for the various possible theoretical combinations of alignment segments. It should be noted that, for all hydrographic areas crossed, approximately 87 percent of the groundwater withdrawals would be temporary withdrawals, occurring within 1 year or less, rather than long-term withdrawals. For evaluating potential impacts from the proposed groundwater withdrawals, it is also noteworthy that although available groundwater resources in some hydrographic areas might be deemed to be currently "overcommitted" as a whole (hydrographic areas 146, 228, and 229), one or more particular aquifers within a hydrographic area might not be overcommitted. Additionally, all water-rights appropriations might not be in service simultaneously.

The information in Tables 3-113 and 4-206 suggests that the selection of one alternative segment over another or different possible combinations of alignment segments over others would make no notable difference in the amount of water needed to support construction when compared to the annual committed resources for each hydrographic area, with the following exceptions:

- Construction of the Schurz alternative segment 1/Department of Defense Branchline South combination for construction through hydrographic area 110A (Walker Lake-Schurz subarea) would result in the lowest ratios of groundwater demand to perennial yield and groundwater demand to committed resources for this area, representing approximately 32 percent, and 75 percent, respectively, of the estimated annual perennial yield and the total annual committed resources of the hydrographic area. By comparison, construction of the Schurz alternative segment 4/Department of Defense Branchline South combination through hydrographic area 110A would result in the highest ratios of groundwater demand to perennial yield and groundwater demand to committed resources for this area (approximately 82 percent, and 190 percent, respectively, of the estimated annual perennial yield and the total annual committed resources of the hydrographic area). Construction of either the Schurz alternative segment 5/Department of Defense Branchline South or the Schurz alternative segment 6/Department of Defense Branchline South alternative segment combinations through area 110A would represent ratios of groundwater demand to perennial yield and groundwater demand to committed resources that are intermediate between those for these two options.
- Construction of Schurz alternative segment 5 within hydrographic area 123 (Rawhide Flats) would result in a groundwater demand representing approximately 49 percent of the estimated annual perennial yield and approximately 210 percent of the total committed resources of the hydrographic area, whereas constructing Schurz alternative segment 6 within hydrographic area 123 would result in a groundwater demand representing approximately 183 percent of the estimated annual perennial yield and approximately 790 percent of the total committed resources of the hydrographic area.
- Construction of the Montezuma alternative segment 2/Mina common segment 2/Bonnie Claire alternative segment 3 combination for construction through hydrographic area 144 (Lida Valley) would result in the lowest ratios of groundwater demand to perennial yield and groundwater demand to committed resources for this area, representing approximately 78 percent, and 380 percent, respectively, of the estimated annual perennial yield and the total annual committed resources of the hydrographic area. By comparison, construction of the Montezuma alternative segment 1/Mina

common segment 2/Bonnie Claire alternative segment 2 combination through hydrographic area 144 would result in the highest ratios of groundwater demand to perennial yield and groundwater demand to committed resources for this area (approximately 160 percent, and 790 percent, respectively, of the estimated annual perennial yield and the total annual committed resources of the hydrographic area). Construction of either the Montezuma alternative segment 2/Mina common segment 1/Bonnie Claire alternative segment 2 combination or the Montezuma alternative segment 2/Mina common segment 2/Bonnie Claire alternative segment 3 combination through area 144 would represent ratios of groundwater demand to perennial yield and groundwater demand to committed resources that are intermediate between those for these two options.

- Construction of the Mina common segment 1/Montezuma alternative segment 2 combination within hydrographic area 137A (Big Smoky Valley-Tonopah Flat) would result in a groundwater demand representing approximately 7 percent of the estimated annual perennial yield and approximately 3 percent of the total committed resources of the hydrographic area, whereas constructing the Mina common segment 1/Montezuma alternative segment 2 combination within hydrographic area 137A would result in somewhat lower ratios of groundwater demand to perennial yield and groundwater demand to committed resources for this area (approximately 21 percent of the estimated annual perennial yield and approximately 9 percent of the total committed resources of the hydrographic area).
- As described previously in Section 4.2.6, construction of Oasis Valley alternative segment 1 and common segments 5 and 6 within hydrographic area 128 (Oasis Valley) would result in a groundwater demand equaling approximately 41 percent of the estimated annual perennial yield and approximately 31 percent of the total annual committed resources of the hydrographic area. Construction of Oasis Valley alternative segment 3 and common segments 5 and 6 through hydrographic area 128 would result in a groundwater demand equaling approximately 57 percent of the estimated annual perennial yield and approximately 44 percent of the total annual committed resources of this hydrographic area.

DOE evaluated potential impacts to existing groundwater resources assuming that it would apply for permits to appropriate water from 77 to 110 new water wells, including from three to five new quarry water wells, to furnish all the water required to support rail line construction, construction camps, quarry operations, and operation of railroad operations support facilities, including sidings (DIRS 180888-Converse Consultants 2007, Table 2-1; DIRS 180875-Nevada Rail Partners 2007, Table 4-5). Each construction camp would need one new well.

Depending on location along the rail alignment, each well serving a construction camp would furnish water to just that camp, furnish water for construction of the rail roadbed, or furnish water for both construction of the rail roadbed and operation of a proposed facility (DIRS 180888-Converse Consultants 2007, Appendices A and C). The actual total number of wells required would depend on the specific alternative segments selected and flow rates achieved in completed wells.

New multiple-use wells would be installed in each hydrographic area along the Mina rail alignment, with the exception of area 227A, and used as sources of water supply. DOE assumed that each of the wells used to support rail roadbed construction would be pumped for a period not to exceed 1 year (for purposes of quantitative analysis, DOE assumed 9 months) (DIRS 180888-Converse Consultants 2007, Section 2.1). These wells would have the highest required water withdrawal rates. DOE could use quarry water wells, which would have lower production rates of approximately 91 liters (24 gallons) per minute, for up to 2 years. Wells to supply water for construction camps would be temporary and would have average production rates less than 76 liters (20 gallons) per minute. Wells supplying water for railroad operations support facilities and sidings would have the lowest average withdrawal rates (less than 3.8 liters [1 gallon] per minute to approximately 16 liters [4.2 gallons] per minute); these would be permanent wells (DIRS 180873-Nevada Rail Partners 2007, Table 2-2; DIRS 180888-Converse Consultants 2007, Section 2.1).

DOE would construct, and plans to subsequently decommission, all new water wells in accordance with applicable State of Nevada well-construction standards. After DOE completed construction of the rail line, some wells would remain in operation to supply water to railroad operations support facilities located near sidings, rail yards, or other locations along the rail line during the operations phase. As was the case for wells that could be installed to support the Caliente rail alignment construction, DOE currently plans that wells not needed for operation of the Mina rail line or for quarries would be properly abandoned in compliance with State of Nevada regulations, and the well sites and temporary access roads would be reclaimed (DIRS 180875-Nevada Rail Partners 2007, Section 4.4.4; DIRS 180922-Nevada Rail Partners 2007, Section 4.4.4) in accordance with applicable requirements. Prior to abandonment (decommissioning) of groundwater wells, DOE will investigate whether there are other parties (for example, ranchers, the BLM, county governmental agencies) interested in using groundwater wells to obtain water or monitor groundwater conditions, and work with those parties to ensure they can use the wells upon completion of the railroad. Those interested parties would be responsible for following Nevada laws to obtain water rights, if necessary, and would also be responsible for obtaining right-of-way from the BLM (Table 7-2).

DOE assumed that proposed new well sites outside the typical maximum 300-meter (1,000-foot)-wide rail alignment construction right-of-way would consist of a drilling pad approximately 5,700 square meters (1.4 acres) or smaller in area (DIRS 180888-Converse Consultants 2007, Section 3.4). On the basis of analysis of available data on hydrogeologic characteristics along the proposed alignment, DOE assumed that one new well would be installed at each drilling pad (DIRS 180888-Converse Consultants 2007, Appendix A). Areas identified as potential locations for such well sites would be adjacent to documented existing land disturbances, including existing improved or unimproved roadways. If necessary, DOE would construct temporary access roads to accommodate 0.10- to 0.15-meter (4- to 6-inch)-diameter temporary aboveground pipelines that would transport water from these wells to the area of the construction right-of-way. Impacts that might result from the construction and temporary use of such water transfer pipelines are evaluated in the sections of this Rail Alignment EIS that address applicable resources or media (such as Biological Resources, Cultural Resources, and Land Use and Ownership). After construction of the rail line was complete, some wells would remain in operation to supply water to railroad operations support facilities near sidings, rail yards, or other locations along the rail alignment during the operations phase.

Well water would be piped through the temporary aboveground pipelines to temporary in-ground storage basins (reservoirs), inflatable bladders (“pillow tanks”), or rigid storage tanks within the construction right-of-way to provide storage capacity to meet daily construction needs. For planning purposes, DOE assumed that temporary water-storage reservoirs, if used, would be approximately 30 by 30 meters (100 feet by 100 feet) wide and approximately 3 meters (10 feet) deep, and would be used to store the daily water production from wells. Storage tanks or inflatable bladders, if used, could vary in their storage capacity up to approximately 190,000 liters (50,000 gallons) or more, depending on water demands and water withdrawal rates required for specific locations along the construction right-of-way. Open storage basins or reservoirs, if used, would be surrounded by a fence to mitigate the potential to attract wildlife (Section 4.3.7).

In determining the quantity of water that can be appropriated from a specific hydrographic area, requirements contained in the applicable State of Nevada statutes are considered. This authority includes the ability to grant appropriation requests in hydrographic areas that are designated groundwater basins or in cases where such appropriations would cause an exceedance of an area’s estimated perennial yield.

DOE evaluated the potential impacts to groundwater resources as a result of withdrawal of groundwater from the proposed new water wells. For analysis purposes, each new well was assumed to be pumped, with one exception, at an average withdrawal rate of up to approximately 850 liters (225 gallons) per minute, or approximately (0.5 cubic foot) per second (DIRS 180888-Converse Consultants 2007, Appendix A). Actual groundwater withdrawal rates at several of the proposed new wells could likely be less than 0.5 cubic foot per second, based on hydrogeologic limitations associated with the specific aquifers involved; however, DOE considered the effects of groundwater withdrawals at this production rate in order to help assess the degree of flexibility available for possibly utilizing some proposed new wells at the 0.5-cubic-foot-per-second withdrawal rate more than, or in lieu of, other proposed wells, based on potential differences in well productivity that might occur between the new wells. At one proposed new well location, due to existing groundwater-quality conditions in areas surrounding the proposed well location, it is assumed that the average withdrawal rate could be as high as 1,300 liters (350 gallons) per minute, or approximately (0.78 cubic foot) per second. An analysis of potential impacts due to groundwater withdrawal at this well location is described in Section 4.3.6.2.2.

Any groundwater withdrawal would decrease the availability of water in a portion of the aquifer within the cone of depression induced within the aquifer surrounding a groundwater-production well. However, as described previously, DOE would obtain approximately 87 percent of all the water required for construction of the proposed rail line along the Mina rail alignment from new temporary rail roadbed construction wells. The withdrawal of groundwater from new wells to support railroad construction would not be likely to result in long-term adverse impacts to the groundwater aquifers that are targeted for meeting project water demands for the following reasons:

- For the proposed new groundwater withdrawals, hydrogeologic impact analysis results (see Section 4.3.6.2.2 and Appendix G) show that short-term direct impacts on groundwater availability in aquifers resulting from proposed groundwater withdrawals where the new wells would be pumped at the withdrawal rate of 852 liters (225 gallons) per minute, approximately (0.5 cubic foot) per second, would be limited in aerial extent. Analytical results indicate that the maximum calculated lateral extent of the drawdown feature (the cone of depression) that would be induced at any location within the host aquifers from the proposed groundwater withdrawals would be approximately 0.8 kilometer (0.5 mile), and in most cases less at the proposed well locations. With the exception of three locations in the Oasis Valley hydrographic area (see Section 4.3.6.2.2.11) and possibly one location in the Columbus Salt Marsh hydrographic area (see Section 4.3.6.2.2.4), withdrawals of groundwater from the proposed new water wells at the 0.5-cubic-foot-per-second withdrawal rate would not be expected to impact existing groundwater users (owners of active pumping wells) or impact discharge rates or groundwater quality at nearby springs. Sections 4.3.6.2.2.4 and 4.3.6.2.2.11 describe best management practices that would be implemented to avoid potential impacts at these otherwise affected locations.
- For areas where proposed new water wells would be installed near the boundary between adjacent hydrographic areas, groundwater withdrawals would not be likely to affect downgradient hydrographic areas because: (1) there are no identified existing wells, springs, seeps, or other surface-water-right locations in downgradient groundwater basins that are within 1.6 kilometers (1 mile) of any of these proposed well water withdrawal locations (see Figures 3-190 through 3-196), or (2) available hydrogeologic information indicates either that no significant inter-basin groundwater (under) flow is inferred to be occurring in the areas downgradient of the proposed well locations (see Figure 3-188) or, in three cases (proposed well locations SSa-3, BSa-4a, and LV7 on Figures 3-192, 3-193, and 3-195, respectively) where the proposed well locations are located near such a boundary and in the general vicinity of such inferred underflow areas, the wells are located at least 2.3 to 4 kilometers (1.4 to 2.5 miles) upgradient of the hydrographic area boundary. Because the distances of these well locations from the hydrographic area boundary in these three cases are significantly greater

than the maximum range (0.8 kilometer to 1 kilometer [0.5 to 0.6 mile]) of pumping-induced radii of influence surrounding the proposed well locations, pumping at these locations should have a negligible effect on existing inter-basin underflow patterns or flow rates and thus would have a very small effect on groundwater resources in downgradient hydrographic areas.

- Long-term direct impacts to groundwater resources would not be likely because most of the total project water demand would be used over a short period to support railroad construction. Most water demands within any given hydrographic area would occur over approximately 9 months under an assumed 4-year railroad construction schedule; therefore, long-term impacts resulting from their use would be small.
- Direct impacts to downgradient groundwater resources would be unlikely for the reasons stated above; indirect impacts to groundwater resources in adjacent downgradient hydrographic areas also would not be likely.

New wells that are proposed to be installed outside of the construction of right-of-way of some alignment segments to support railroad construction or quarries would be located on either grazing land, on Walker River Paiute Reservation land, or, for one proposed quarry, partly on BLM-managed grazing land and partly on Hawthorne Army Depot property (see Section 4.3.2). Direct or indirect impacts to these land areas from construction and use of such wells are expected to be small and capable of being minimized through the use of appropriate planning and mitigation measures as required (Section 4.3.2).

Several of the proposed railroad operations support facilities and sidings would overlie hydrographic areas that are designated by the Nevada State Engineer as designated groundwater basins. Construction-water demand for these facilities would be low compared to the amount of water required for railroad construction. These facilities include the Staging Yard at Hawthorne in hydrographic area 110C, the Maintenance-of-Way Facility at either Silver Peak in hydrographic area 143 or Klondike in hydrographic area 142, the Rail Equipment Maintenance Yard in hydrographic area 227A, and proposed sidings in several hydrographic areas (Figures 3-191, 3-193, 3-194, and 3-196). DOE assumed that water demand for constructing these railroad facilities and sidings would be met by installing new wells.

Details on the water requirements activity and groundwater impacts at the railroad operations facilities and sidings are provided in the *Facilities Design Analysis Report Mina Rail Corridor, Task 10: Facilities, Rev. 00* (DIRS 180873-Nevada Rail Partners 2007, Sections 2.1.5 and 3.6) and in the *Repository Surface Design Engineering Files Report* (DIRS 104508-CRWMS M&O 1999, Tables III-1 and II-2). The Staging Yard at Hawthorne, Maintenance-of-Way Facility, and Rail Equipment Maintenance Yard would require only limited amounts of water, with water required for operations estimated to range from approximately 11,000 to 23,000 liters (3,000 to 6,000 gallons) per day at the facilities, which is equivalent to 7.9 to 16 liters (2.1 to 4.2 gallons) per minute. Sidings would require less than 625 liters (165 gallons) per day, which is equivalent to less than 3.8 liters (1 gallon) per minute (DIRS 180873-Nevada Rail Partners 2007, Table 2-2). DOE derived operations water requirements from estimated staffing and shift projections, a 190-liter (50-gallon) per day per capita use ratio, estimated shop process needs, and a multiplier of 1.5 to account for miscellaneous water needs (DIRS 180873-Nevada Rail Partners 2007, Section 2.1.5). Water needed for meeting emergency water storage capacity requirements (for fire safety) are estimated to range from 420,000 to 830,000 liters (110,000 to 220,000 gallons). Water needs for meeting water storage requirements at each facility could be readily met using a new small production-rate well. The water demand for operation of the Cask Maintenance Facility is estimated at approximately 40,000 liters (10,500 gallons) per day, which is equivalent to approximately 26 liters (7 gallons) per minute (DIRS 104508-CRWMS M&O 1999, Table III-1). Owing to the very small required well production rates for wells supporting operations of these facilities and sidings, the magnitude of short-term or long-term impacts on the host aquifer for the individual facility water wells would be small. For this reason, DOE did not perform quantitative impact analyses for water wells that would support facilities operations or sidings.

Water consumption rates during the period of use of construction camps during the peak output year have been estimated at approximately 76 liters (20 gallons) per minute, which is equivalent to approximately 110,000 liters (29,000 gallons) per day (DIRS 180888-Converse Consultants 2007, Table 2-1). Water consumption rates during the period of use of quarries have been estimated at approximately 91 liters (24 gallons) per minute, which is equivalent to 131,000 liters (34,560 gallons) per day (DIRS 180888-Converse Consultants 2007, Table 2-1). New wells proposed for supplying water to support construction camp and quarry operations were considered when performing the quantitative impact analyses.

Construction of the Cask Maintenance Facility would require approximately 4,400 cubic meters (approximately 3.6 acre-feet, or 1.176 million gallons) of water, with construction estimated to occur over approximately 2 years (DIRS 104508-CRWMS M&O 1999, Table III-2). The amount of water needed to construct the other railroad facilities (Staging Yard at Hawthorne, Maintenance-of-Way Facility, and Rail Equipment Maintenance Yard) would range from approximately 14,000 to 200,000 cubic meters, which is equivalent to 11.5 to 161.1 acre-feet, or 3.75 to 52.5 million gallons (DIRS 180873-Nevada Rail Partners 2007, Table 2-2). No water is required for constructing the rail sidings (DIRS 180873-Nevada Rail Partners 2007, Table 2-2). When compared to the total annual ***committed groundwater resources*** listed in Table 4-206, the direct short-term impacts to groundwater resources in the respective hydrographic areas due to water withdrawals associated with construction of railroad facilities and sidings would be small, and long-term direct and indirect impacts on groundwater resources also would be small.

DOE also assessed the potential for the proposed groundwater withdrawals to cause ground subsidence in areas of the proposed withdrawals. Groundwater pumping-induced ground subsidence has been observed at some locations in the western United States, including the Las Vegas Valley of Nevada, the Santa Clara Valley and San Joaquin Valley areas of California, and other selected locations in Texas, New Mexico, and Arizona, and selected other locations overseas. The subsidence that has occurred is primarily related to prolonged groundwater withdrawal at rates that exceed the estimated annual recharge to the affected groundwater system. The estimated annual recharge to the aquifer systems in each of these localities is often less than approximately 50 percent of the total average annual groundwater pumped from these aquifers. In the Las Vegas Valley, groundwater withdrawals between 1955 and 1990 ranged from approximately 49.4 to 108.5 million cubic meters (40,080 to over 88,000 acre-feet) per year, with the maximum groundwater withdrawal occurring in 1968 (108.9 million cubic meters [88,290 acre-feet]) (DIRS 181390-Bell et al. 2002, p. 156). Estimates of annual recharge rate to the Las Vegas Valley aquifer system range from approximately 30.6 to 72.2 million cubic meters (25,000 to 59,000 acre-feet) per year, indicating that groundwater withdrawal rates in the Las Vegas Valley have typically exceeded, sometimes by a factor of more than two, natural recharge rates over a period of decades (DIRS 181390-Bell et al. 2002, p. 156). Groundwater withdrawals of over 12.1 billion cubic meters (9.8 million acre-feet) per year in the San Joaquin Valley resulted in withdrawal overdrafts of at least 4.93 billion cubic meters (4 million acre-feet) per year during the 1950s and 1960s (DIRS 181392-Poland, ed. 1984, p. 264). Annual groundwater pumping rates in each of these areas have exceeded their respective annual groundwater recharge rates between the mid-1940s to 1950s and the 1990s.

Interbedded fine- and coarse-grained sediments underlie each of these areas. Where impermeable caliche horizons occur within alluvial fan deposits or poorly ***permeable*** clay horizons occur within fine-grained material, groundwater is under confined or partially confined conditions, frequently exhibiting artesian flow conditions (for example, DIRS 181390-Bell et al. 2002, p. 56). Continued groundwater pumping in excess of the yearly recharge has reduced the artesian pressures in these aquifer systems resulting in an increase in vertical loads, or effective stresses. The increased effective stresses result in the compaction of the underlying sediments and corresponding ground subsidence.

An evaluation of the proposed new groundwater withdrawal wells for the Mina rail alignment indicates that most of the wells would be developed in unconsolidated alluvial sediments, with a few completed in consolidated bedrock aquifers. Subsidence is not expected to be an issue in consolidated bedrock aquifers because these aquifers are not susceptible to compaction during pumping.

Of the wells developed in unconsolidated alluvial sediments, a relatively small percentage would be developed in confined alluvial sediments. In general, subsidence is not expected to be an issue for pumping unconfined alluvial aquifers, because the major reported cases of land subsidence due to groundwater withdrawals involve pumping from confined aquifers.

Groundwater withdrawals from confined alluvial aquifers, at the withdrawal rates expected for this project, and if they exceeded recharge rates, could, in theory, result in some small amount of subsidence within the radius of influence associated with each pumping well. However, no known subsidence effects have been documented for pre-existing pumping wells in these hydrographic areas, many of which are being pumped at rates much higher than the range of pumping rates proposed for this project. In addition, the area of disturbance within the radius of influence surrounding each well represents an extremely small percentage of the total area of the host aquifer within hydrographic area. Finally, the duration of pumping for approximately 90 percent of the proposed total groundwater withdrawals would be on the order of 1 year or less within each hydrographic area crossed by the alignment. The pumping rates required, the total volume of groundwater that would be withdrawn from each hydrographic area, and the pumping timeframes involved are much smaller than the pumping rates, water volumes removed, and the prolonged periods of pumping that were involved at locations where ground subsidence has been observed, such as the Las Vegas Valley, Santa Clara Valley, and San Joaquin Valley. For these reasons, the potential for ground subsidence to occur as a result of the construction and operation of a railroad along the Mina rail alignment would be small.

4.3.6.2.2 Construction Impacts for Specific Alternative Segments and Common Segments

DOE evaluated potential site-specific impacts to groundwater resources from constructing and operating a railroad along the Mina rail alignment. This section summarizes the approach and methodologies DOE used to quantitatively evaluate the extent of potential hydrogeologic impacts from withdrawing groundwater to support construction of the rail line and railroad construction and operations support facilities. Appendix G provides a more detailed description of the approach and methodology. Section 3.3.6 summarizes the existing groundwater resources along each of the alternative segments and common segments.

To evaluate potential impacts of proposed groundwater withdrawals from new water wells on existing wells, springs, seeps and other surface-water-right locations, DOE reviewed proposed well locations, well construction details, estimated groundwater depths, and proposed groundwater withdrawal rates and timeframes (DIRS 182822-Converse Consultants 2006, all; DIRS 180888-Converse Consultants 2007, all). Unless otherwise noted, the sources for all spring, seep, and other surface-water-right location and well data in this section are as follows:

- DIRS 182821-Converse Consultants 2005, all; DIRS 180887-Converse Consultants 2007, all
- The Nevada Division of Water Resources (NDWR) water-rights database and water-well log database, and other datasets (DIRS 182759-Converse Consultants 2007, all; DIRS 183990-Luellen 2007, all; DIRS 183991-Luellen 2007, all)
- Data from the U.S. Geological Survey (USGS) National Water Information System (NWIS) database (DIRS 176325-USGS 2006, all; DIRS 177294-MO0607USGSWNVD.000, all)

- The U.S. Geological Survey (USGS) National Hydrographic Datasets (DIRS 177712-MO0607NHDPOINT.000, all; DIRS 177710-MO0607NHDWBDYD.000, all)
- Geographic Names Information Systems databases on springs in Nevada (DIRS 176979-MO0605GISGNISN.000, all)

For initial screening purposes, if DOE identified an existing well, spring, seep, or other surface-water-right location within a 1.6-kilometer (1-mile) radius (buffer distance) of a proposed new water well, DOE selected that proposed well location as a candidate for conducting a groundwater hydrogeologic impacts evaluation. When DOE found no existing well or PER well location, spring, seep, or other surface-water-right location in this initial search radius, it extended the search distance outward from the proposed well location to identify the nearest spring, seep, or other surface-water-right location or existing well within a 2.8-kilometer (1.75-mile) radius (buffer distance) of the proposed new well and determined its hydrogeologic and construction characteristics. In addition to the above screening processes, and before completing impacts analyses, for a selected set of new groundwater withdrawal well locations where the well was specifically targeted for installation within a fault zone or an extensive ***fracture*** zone, the locations of existing wells and springs, seeps, or other surface-water-right locations up to 9.7 kilometers (6 miles) away from each such proposed well were identified. These larger search distances were considered to: (1) allow evaluation of potential simultaneous drawdown effects involving individual private wells having higher pumping rates that might be located in the general vicinity; and (2) assess the potential for a fault zone or extensive fracture zone present at the proposed new well location to act as a conduit for groundwater flow (possibly resulting in a groundwater drawdown effect over a larger distance).

DOE then searched the NDWR water-rights database and well-log databases to confirm the identity, use, and water-rights status and appropriated annual ***duty*** and diversion rate, if any, associated with each existing well located within these buffer distances. DOE included domestic wells and considered the appropriated annual duty and diversion rate for each well with a water right in hydrogeologic impacts analyses to estimate potential hydrogeologic impacts from groundwater withdrawals at the proposed well location. In some cases, using the available information, DOE could not positively correlate wells listed in the USGS NWIS database to any well listed in the NDWR water-rights database or the NDWR well-log database. For such wells, DOE did not perform quantitative impacts analyses for these wells. For impacts analysis purposes, DOE considered the locations of known domestic wells with respect to the proposed alignment and relative to proposed new well locations. Figures 3-190 through 3-196 show the approximate locations of existing wells, including domestic wells, and springs, seeps, or other surface-water-right locations within the 1.6-kilometer (1.5-mile) screening level region of influence.

DOE reviewed available geologic and hydrogeologic information to confirm the hydrogeologic characteristics of known and potential aquifers in areas near proposed wells. Appendix G provides a detailed list of published geologic and hydrogeologic reports and maps and water resource appraisal reports that were reviewed prior to completing the groundwater resource impacts analysis calculations. Where applicable, for the closest existing well having a water right, DOE identified water appropriations information (annual appropriated groundwater duty, well use period, and authorized groundwater diversion rate) and documented the information for subsequent use in analysis.

In addition, wells for which water-rights applications had been submitted to the State Engineer and that had been assigned a status of "permitted (PER)" by the State Engineer at the time the data were acquired were considered when conducting the groundwater resources impact analyses for existing water-rights locations. As described in Section G.1.2.1 of Appendix G, the impact analyses considered PER water-rights locations as far away as 2.8 kilometers (1.75 miles) from proposed new wells.

DOE also considered the potential for cumulative impacts to groundwater resources to occur as a result of the combined impacts from pumping at the proposed new rail alignment-related well locations and pumping at proposed future well locations (for which water-rights applications had been submitted to the State Engineer and that had been assigned a status of either "Ready for Action [RFA]," or "Ready for Action, Protested [RFP]" at the time the data were acquired). The analyses considered RFA and RFP water-rights locations as far away as 2.4 kilometers (1.75 miles) from proposed new wells. No RFA or RFP water-rights locations were identified within a 2.4 kilometer region around the proposed new well locations for the Mina alignment.

DOE used the information obtained from the geologic and hydrogeologic data reviews to identify an appropriate analytical method or methods to determine the magnitude of drawdown that would be created in the aquifer as a result of the proposed groundwater withdrawals, and determine the amount of simultaneous drawdown created, where applicable, due to groundwater pumping from the nearest existing pumping well. For purposes of analysis, fractured consolidated rock aquifers were treated as homogeneous, ***isotropic***, equivalent porous media. For a selected set of new groundwater withdrawal well locations where the well was determined to be located in the vicinity of faults or extensive fracture systems or specifically targeted for installation within a major fault zone or an extensive fracture zone (DIRS 180888-Converse Consultants 2007, Appendix B), additional evaluations of hydrogeologic data and/or additional analyses were performed.

In cases where a proposed well was determined to be oriented lateral to a mapped fault or fracture zone, the fault or fracture zone was treated as a potential no-flow ***barrier*** if it was located sufficiently close to the proposed new well to be within the region of influence from pumping at that well location. In such cases, the calculations included a specific method (image well method) to simulate the potential effects of the fault or fracture zone on groundwater flow behavior.

Hydraulic tests performed in faulted and fractured consolidated rock aquifers at a few wells in the region of the Nevada Test Site indicate that when a pumping well pumps groundwater from a high-***permeability*** zone associated with a fault, that fault zone might act as a conduit for transmitting hydraulic responses from the pumping well over larger-scale (on the order of kilometers) distances. Results from pump tests conducted at these wells often indicate that very complex hydrogeologic conditions, including heterogeneous hydraulic rock properties, the presence of complex structural systems controlling flow, and other non-isotropic conditions, exist at these test sites. For these reasons, where a proposed new well was identified as targeting a specific fault or fracture system that could act as a high-permeability conduit, DOE identified the locations of existing wells and springs up to 9.7 kilometers (6 miles) away from each such proposed well. In these cases, DOE reviewed available data on existing wells, including PER wells, and proposed RFA or RFP wells, and springs, seeps, and other surface-water-right locations and locations of known (mapped) faults and fracture zones within the 9.7-kilometer radius surrounding each new well location and compared these with the locations of the proposed well to estimate the likelihood of a hydraulic connection occurring between the proposed well and existing wells, including PER wells (and proposed RFA and RFP well locations – see Chapter 5), springs, seeps, or other surface-water-right locations beyond a distance of 2.4 kilometers (1.5 miles) but within the approximately 9.7-kilometer distance. Additional details regarding the treatment of faults and extensive fracture systems as conduits (or barriers) to flow in the impacts analyses are described in Appendix G.

DOE calculated a region of influence for each well and determined how far from the well the aquifer would be affected by the drawdown. For analysis purposes, DOE assumed that (1) it would obtain all water for railroad construction from new groundwater wells, and (2) groundwater might be pumped at the nearest existing well with a water right, nearest existing domestic well, or nearest PER well (or proposed RFA or RFP well location – see Chapter 5) if approved, implemented, and put into operation simultaneously with groundwater withdrawal activity at the new well or wells. If existing wells with water rights or PER wells (or RFA or RFP well locations – see Chapter 5) were found to be farther away from the proposed new well than the sum of the radii of influence associated with both wells, DOE concluded that there would be no impacts to the nearest existing well. If the nearest spring, seep, or other surface-water-right location was found to be beyond the calculated radius of influence of the proposed new well, DOE concluded that there would be no impacts to the spring, seep, or other surface-water-right location.

For each analysis completed, with the exception of one proposed new well location (Cl-1a in Clayton Valley, as described in Section 4.3.6.2.2.5), DOE assessed the potential impacts to existing wells with water rights from imposing a pumping rate of 852 liters (225 gallons) per minute at each proposed well, considering the possibility of intersecting cones of depression from the simultaneous pumping of the nearest existing well with a water right, nearest existing domestic well, and/or nearest PER well (and/or RFA or RFP well location – see Chapter 5), as applicable, and the proposed new well. The pumping rate assumed for the nearest well was the average withdrawal rate required to realize the total appropriated annual or seasonal duty value for that well or a greater value, if that well had a formal appropriated water right, over the authorized period of use. The exceptions included existing wells for which the average pumping rate calculated based on the total appropriated duty value was very low and much smaller than the authorized (short-term) diversion rate for that well, and those existing wells for which NDWR-issued certificates list only a diversion rate but do not specify an authorized annual duty. In those cases, to conservatively bound impact analysis results, DOE used the diversion rate to calculate the well's radius of influence. For domestic wells, an average pumping rate of 190 liters (50 gallons) per minute was assumed.

Sections 4.3.6.2.2.1 through 4.3.6.2.2.12 describe potential impacts to existing springs, seeps or other surface-water-right locations, existing wells, and well locations that have been assigned a PER status. Table 4-206 lists information about the hydrographic areas the rail line would cross and the estimated volume of water DOE would need to construct each set of Mina rail alignment alternative and common segments across each hydrographic area.

Figures 3-190 through 3-196 show the approximate locations of the proposed new water wells. DOE assumed that appropriation applications for new water wells represent a viable mechanism for obtaining the water required to support construction and operation of the railroad and the Shared-Use Option. This approach does not predispose the final outcome of decisions regarding the approval or denial of such appropriation applications; however, the analysis assumes that such applications would, in theory, be accepted, and that groundwater withdrawal would occur at the proposed new well as designed. This analysis approach provides a conservative framework for estimating potential impacts to groundwater resources resulting from groundwater withdrawals within the respective hydrographic areas crossed by the rail alignment.

4.3.6.2.2.1 Department of Defense Branchline North. Department of Defense Branchline North begins at a new siding to be installed along the Union Pacific Railroad Hazen Branchline near Wabuska. Most of the Department of Defense Branchline North segment overlies hydrographic area 108. Groundwater contour maps (DIRS 180887-Converse Consultants 2007, Plate 4-10 and 4-12) developed for hydrographic areas 108 and 110A do not indicate any areas underlying the proposed Department of Defense Branchline North segment where groundwater depths less than on the order of 3 meters (10 feet) or more would be anticipated to occur.

One new well is proposed within hydrographic area 108 to support water needs associated with operation of a new rail siding. Due to the anticipated small required withdrawal rate for this well (likely to be less than 3.8 liters [1 gallon] per minute), impacts to existing groundwater resources from this well would be small. Therefore, the new well proposed to support construction of the new siding at the beginning of

Department of Defense Branchline North is not likely to have an adverse impact on the local groundwater uses or users.

4.3.6.2.2.2 Schurz Alternative Segments (Walker River Paiute Reservation). The Schurz alternative segments would cross hydrographic areas 110A (Walker Lake Valley-Schurz subarea) and/or 123 (Rawhide Flats). New wells in these hydrographic areas could be between 15 and 230 meters (50 and 750 feet) deep (DIRS 180888-Converse Consultants 2007, Appendix A). The target aquifer for proposed wells would be alluvial valley-fill or alluvial fan deposits (DIRS 180888-Converse Consultants 2007, Appendix B).

Figures 3-190 and 3-191 show the approximate locations of USGS NWIS wells and known existing NDWR wells, existing springs, and proposed new wells along the Schurz alternative segments. Assuming that a proposed average groundwater withdrawal rate of 852 liters (225 gallons) per minute could be applied at each proposed new right-of-way well location and each well location outside of the construction right-of-way that would be used within the Walker River Paiute Reservation, analysis results (Table 4-207) indicate that there would be no impacts to existing wells and springs, seeps, or other surface-water-right locations near the proposed Schurz alternative segments from pumping at the proposed well locations. Where the closest existing well or spring to a proposed new well was found to be located more than 2.4 kilometers (1.5 miles) away from that proposed new well location, no quantitative impacts analysis calculations were completed.

Table 4-207. Summary of calculated radii of influence for proposed new wells for the Mina rail alignment – Schurz alternative segments.

Well number/aquifer type[a]	Distance to nearest well or nearest spring (miles)[b]	Radius of influence at base-case pumping rate (miles)	Radius of influence at 225 gallons[c]-per-minute pumping rate (miles)	Radius of influence for nearest well at assumed pumping rate (miles)
WLa-3a/AVF	0.68 (well)	Not applicable[d]	0.24	0.08

a. Aquifer types are abbreviated as follows: AVF = alluvial valley fill; VRA = volcanic rock aquifer; CRA = carbonate rock aquifer; OTH = other: fluvial-lacustrine (stream-lakebed derived) deposits, Cenozoic bedrock unit, or other consolidated rock unit (for example, limestone/dolomite, conglomerate, mudstone, and others).
b. To convert miles to kilometers, multiply by 1.6093.
c. To convert gallons to liters, multiply by 3.78533.
d. No calculation was completed for reasons stated in text.

As noted in Sections 3.3.6.3.1 and 3.3.6.3.2, land the Schurz alternative segments would cross includes lands occupied by the Walker River Paiute Reservation. As described in Sections 3.3.6.3.1 and 3.3.6.3.2, the Nevada Division of Water Resources Well Log and Water Rights Databases are incomplete with respect to existing wells present in hydrographic areas 110A and 123.

Therefore, DOE does not have a complete record of the total groundwater usage on the reservation. In accordance with Council on Environmental Quality NEPA implementing regulations (Section 1502.22), DOE has used the resources that are available to evaluate potential adverse impacts to groundwater usage on the Walker River Paiute Reservation.

A new well (see Figure 3-190) might be installed in area 110A (well WLa-1c) in the same general area where several mapped faults exist. Several northeast-striking faults are mapped on the south edge of the Desert Mountains and might pass through the general area of this proposed well location (DIRS 180888-Converse Consultants 2007, Appendix B). There are no known existing wells or springs, seeps, or other surface-water-right locations within approximately 9.7 kilometers (6 miles) of this proposed well location that are known to be associated with the same fault system or potentially related major fault zones.

Available information (such as DIRS 180887-Converse Consultants 2007, Plate 4-10) suggests that in two to three selected areas along the proposed Mina rail alignment in hydrographic area 110A, groundwater might be as shallow as 3 meters (about 10 feet) below the ground surface, and possibly might be less (see Tables 3-115 through 3-117). Data suggest that the groundwater depth might be as shallow as 0 meter (0 foot); that is, that groundwater might occur at the ground surface at some location(s) in hydrographic area 110A (DIRS 180887-Converse Consultants 2007, p. 89). However, groundwater contour maps (DIRS 180887-Converse Consultants 2007, Plates 4-10 and 4-11) developed for hydrographic area 110A suggest that one or more areas might underlie the proposed Schurz alternative segments where groundwater depths of 3 meters (10 feet), or possibly less, might be anticipated to occur. Shallow groundwater conditions (DIRS 180887-Converse Consultants 2007, Plate 4-10) could occur beneath a short stretch of the westernmost part of the S 5&6 alternative segment and beneath a short length of the westernmost part of the S 1&4 alternative segment, and possibly beneath a short stretch of the S1 alternative segment in the general area around well location WLa-3a (Figure 3-190).

Excavation work required for constructing the Schurz alternative segments S 1&4 and S 5&6 of the Mina rail alignment would be limited to approximately less than 1.5 meters (5 feet) below the ground surface or less, and for the Schurz alternative segment S1 of the Mina rail alignment would be limited to approximately less than 1 meter (2 feet) below the ground surface or less (DIRS 180871-Nevada Rail Partners 2007, Sheets 1,5, and 6). Most earthwork done in these areas would involve the placement and compaction of fill rather than excavation work. Although the possibility of excavation work intercepting shallower groundwater in these two areas does exist, the probability of intercepting large areas of groundwater in these alignment segment stretches is considered to be small. If shallow groundwater were to be encountered, standard engineering controls (as described in Section 4.3.5.2.1.1) would be employed to minimize potential impacts to groundwater potentially disturbed by excavation activities.

4.3.6.2.2.3 Department of Defense Branchline South Segment (Walker Lake Valley Area). Department of Defense Branchline South would overlie the southern part of hydrographic area 110A and would continue southward across area 110B (Walker Lake Valley-Lake subarea). Groundwater contour maps (DIRS 180887-Converse Consultants 2007, Plates 4-9 and 4-10) developed for hydrographic area 110A do not indicate any areas underlying the proposed Department of Defense Branchline South segment where groundwater depths less than 3 meters (10 feet) or more would be anticipated to occur. One new well (at location WLa-5a) is proposed within hydrographic area 110A for supplying water to support water needs associated with railroad construction and operation of a new rail siding. Figures 3-190 and 3-191 show the approximate location of this proposed new water well. The target aquifer for this proposed well would be an alluvial fan deposit (DIRS 180888-Converse Consultants 2007, Appendix B).

There are no existing springs, seeps, or other surface-water-right locations, no existing USGS NWIS wells, and no existing NDWR water wells within 1.6 kilometers (1 mile) of proposed well location WLa-5a. Withdrawal of groundwater from proposed well location WLa-5a would therefore not be expected to impact existing springs or existing water wells in area 110A. Additionally, the proposed well at WLa-5a is located approximately 1.6 kilometers north of the southern boundary of hydrographic area 110A, which is significantly greater than the estimated 0.8-kilometer (0.5-mile) or smaller radius of the pumping-induced cone of depression that would likely surround this proposed well location. For this reason, and because the area south of location WLa-5a is also not an area where inter-basin groundwater flow is inferred to be occurring (Figure 3-188), pumping at this location should have a very small effect on existing groundwater resources in area 110A and on groundwater resources in the adjacent hydrographic area (area 110B).

4.3.6.2.2.4 Mina Common Segment 1. Mina common segment 1 would overlie most of hydrographic area 110C (Walker Lake Valley-Whiskey Flat-Hawthorne subarea), would continue southeastward across hydrographic areas 121B (Soda Spring Valley-western part), 121A (Soda Spring

Valley-eastern part), 119 (Rhodes Salt Marsh Valley), and 118 (Columbus Salt Marsh Valley), and continue into the western portion of hydrographic area 137A (Big Smoky Valley-Tonopah Flat). Beginning at a point northeast of Luning, Mina common segment 1 would change its direction from eastward-to-southeastward to more southward-to-southeastward. Figures 3-191 through 3-193 show Mina common segment 1 and the approximate locations of new wells DOE could install to meet construction-water demands and locations of existing wells and existing springs, seeps, or other surface-water-rights locations in the vicinity of Mina common segment 1. Assuming that a proposed average groundwater withdrawal rate of 852 liters (225 gallons) per minute was to be applied at each proposed new right-of-way well location and well location outside of the nominal 300-meter (1,000-foot)-wide construction right-of-way, analysis results (Table 4-208) indicate that, with one possible exception (CSM-2a, described below), no impacts would be expected to occur to existing wells or springs near Mina common segment 1 from pumping at the proposed new well locations along Mina common segment 1.

Table 4-208. Summary of calculated radii of influence for proposed new wells for the Mina rail alignment – Mina common segment 1.

Well number/aquifer type[a]	Distance to nearest well or nearest spring (miles)[b,c]	Radius of influence at base-case pumping rate (miles)	Radius of influence at 225 gallons[d]-per-minute pumping rate (miles)	Radius of influence for nearest well at assumed pumping rate (miles)
WLa-3a/AVF	0.68 (well)	Not applicable[e]	0.24	0.08
WLc-2a/AVF	0.56[f] (well)	Not applicable[e]	0.45	0.29
SSb-2/AVF	0.45 (spring)	Not applicable[e]	0.30	Not applicable[g]
SSa-4/AVF	> 1.00 (well)	Not applicable[e]	0.50	0.34
SSa-2/AVF	> 1.00 (well)	Not applicable[e]	0.50	0.06
SSa-3/AVF	> 1.00 (well)	Not applicable[e]	0.72	0.18
CSM-3a/AVF	> 1.0 (well)	Not applicable[e]	0.30	0.01
CSM-2a/AVF	0.24 (spring)[h]	Not applicable[e]	0.55	0.09[i]
CSM-2a/AVF	0.85 (well)	Not applicable[e]	0.55	0.09[i]

a. Aquifer types are abbreviated as follows: AVF = alluvial valley fill; VRA = volcanic rock aquifer; CRA = carbonate rock aquifer; OTH = other: fluvial-lacustrine (stream-lakebed derived) deposits, Cenozoic bedrock unit, or other consolidated rock unit (for example, limestone/dolomite, conglomerate, mudstone, and others).
b. To convert miles to kilometers, multiply by 1.6093.
c. > = greater than.
d. To convert gallons to liters, multiply by 3.78533.
e. No calculation was completed for reasons stated in the text.
f. Spring is associated with a vested surface-water right.
g. For this not applicable entry, no calculation was done because the feature is a spring.
h. Spring might no longer be discharging (see text).
i. The radius of influence is associated with a well having a water right.

One new well is proposed at location CSM-2a in the Columbus Salt Marsh Valley (hydrographic area 118), as shown on Figure 3-193. North-trending faults lie along the western front of the Monte Cristo Range in this area. The presence of a nearby spring might be related to the Eastern Columbus fault zone (DIRS 180888-Converse Consultants 2007, Appendix B). Based on the best available information, it cannot be conclusively demonstrated that the proposed well at location CSM-2a would be installed in a fault zone. Therefore, it is not possible to infer a direct hydraulic connection between any existing wells and springs, seeps, or other surface-water-right locations located within 9.7 kilometers (6 miles) of the proposed well at location CSM-2a.

The proposed withdrawal rate in this new well is approximately 852 liters (225 gallons) per minute or less. The closest groundwater resource feature (spring or existing well) appears to be a spring. This spring is described in a water resources appraisal report published in 1970 (DIRS 180759-Van Denburgh and Glancy 1970, Plate 1 and Table 16) as “Spring 8aaa,” located approximately 370 meters (1,230 feet) north-northwest of the site (see Figure 3-193). It should be noted that this spring is not included in the USGS National Hydrologic Point Data Database (DIRS 177712-MO0607NHDPOINT.000, all), or the NDWR water-rights database (DIRS 182759-Converse Consultants 2007, all; DIRS 183991-Luellen 2007, all). Analysis results indicate that, for a scenario where the spring is assumed to be present and be in direct hydraulic connection with the water-producing zone in the proposed well at location CSM-2a, the spring would not be expected to be affected by groundwater withdrawal at site CSM-2a if the average withdrawal rate at site CSM-2a is limited to approximately 150 liters (40 gallons) per minute or less. This potential spring was included as a possible existing hydrogeologic feature in the impact analysis calculations to represent a very conservative scenario. The spring was reported to have a very low rate of discharge of 1.9 liters (0.5 gallon) per minute in the 1970 report, and, given that this spring is not included in the other springs databases described above, it is considered likely that the spring no longer exists today (that is, there is no groundwater discharge occurring at this location). In the unlikely event that this spring might still exist, impacts to that spring could be eliminated by reducing the average withdrawal rate at location CSM-2a to approximately 150 liters per minute or less. In this case, the remaining balance of make-up water required could be obtained at another proposed well location, provided that well was sufficiently far away from known existing springs, seeps, or other surface-water-right locations and active pumping wells. Alternatively, additional water could be obtained from an existing water-rights holder or proposed well CSM-2a could be moved to a point sufficiently distant from the spring, if present, to preclude the cone of depression from the well from reaching the spring. For the first scenario (purchasing water from an existing well owner), a separate application might need to be submitted to the State Engineer to request approval of a change in the manner of use and/or a change in the place of use of the water relative to its current manner and place of use.

If Spring 8aaa no longer exists, the potential impact on the next closest existing groundwater resource, a Nevada Division of Water Resources (NDWR) well, was also evaluated. Analysis results (Table 4-208) indicate that this well would not be expected to be impacted by the proposed groundwater withdrawal activity at location CSM-2a.

4.3.6.2.2.5 Montezuma Alternative Segment 1. Montezuma alternative segment 1 would cross a portion of hydrographic area 137A (Big Smoky Valley-Tonopah Flat), and then cross hydrographic area 143 (Clayton Valley), then proceed into and then exit hydrographic area 142 (Alkali Spring Valley), after which it would re-enter hydrographic area 143, then cross hydrographic area 144 (Lida Valley). Figures 3-193 and 3-194 show the approximate locations of existing wells, existing springs, and proposed new wells within the typical maximum 300-meter (1,000-foot)-wide rail line construction right-of-way to meet water demands along Montezuma alternative segment 1. As of March 31, 2007, there were no pending annual duties assigned to hydrographic areas 137A, 142, 143, or 144 (see Table 4-206).

DOE could install one new well at proposed well location Cl-1a southwest of the community of Silver Peak in hydrographic area 143 (Clayton Valley). This well location (see Figure 3-194) would be southwest of an existing well field that services Silver Peak. The proposed production rate in the new well installed at this location is approximately 1,300 liters (350 gallons) per minute or less. This withdrawal rate is higher than the anticipated withdrawal rate for other proposed new wells along the

Mina alternative ***rail route*** because groundwater underlying much of Clayton Valley is too brackish for human consumption (DIRS 180760-Albers and Stewart 1981, p. 2). Therefore sources of better-quality groundwater for use in rail roadbed construction and for supplying water for a proposed construction camp are very limited in this area.

The nearest existing spring, seep, or other surface-water-right location, domestic well, or well with a known water right to proposed well location Cl-1a is a municipal well (DIRS 182759-Converse Consultants 2007, all; DIRS 182899-NDWR 2007, all) approximately 1,190 meters (3,905 feet) from location Cl-1a (see Figure 3-194). Under a scenario where both wells are assumed to be pumped simultaneously, the cones of depression from the two wells would likely not intersect each other, and as a result, groundwater pumping at location Cl-1a at the 1,300-liters (350-gallons)-per-minute withdrawal rate would not be expected to impact pumping at the existing municipal well (see Table 4-209).

Table 4-209. Summary of calculated radii of influence for proposed new wells for the Mina rail alignment – Montezuma alternative segment 1.

Well number/aquifer type[a]	Distance to nearest well or nearest spring (miles)[b,c]	Radius of influence at base-case pumping rate (miles)	Radius of influence at 225 gallons[d]-per-minute pumping rate (miles)	Radius of influence for nearest well at assumed pumping rate (miles)
Cl-1a/AVF	0.74 (well)	Not applicable[e]	0.54	0.14
Cl-8a/AVF	> 1 (spring)	Not applicable[e]	0.31	0.10[f]
Cl-9a/AVF	> 1 (well)	Not applicable[e]	0.31	0.05
Li-3a/AVF	> 1 (well)	Not applicable[e]	0.61	0.03

a. Aquifer types are abbreviated as follows: AVF = alluvial valley fill; VRA = volcanic rock aquifer; CRA = carbonate rock aquifer; OTH = other: fluvial-lacustrine (stream-lakebed derived) deposits, Cenozoic bedrock unit, or other consolidated rock unit (for example, limestone/dolomite, conglomerate, mudstone, and others).
b. To convert miles to kilometers, multiply by 1.6093.
c. > = greater than.
d. To convert gallons to liters, multiply by 3.78533.
e. No calculation was completed for reasons stated in text.
f. The radius of influence is associated with a well having a water right.

There are no known existing wells or springs within 1.6 kilometers (1 mile) or within the potential radius of influence of these proposed alternative well locations (Table 4-209).

A proposed alternate well location (Li-5a) in Lida Valley, if used in lieu of proposed well location Li-1a (see Figure 3-194), could require construction of a separate access road whereas no separate access road would be required for a well at location Li-1a (DIRS 180875-Nevada Rail Partners 2007, Figure G-14). There are no existing wells or existing springs within 1.6 kilometers of the proposed Li-5a well location. The potential for impacts to occur to groundwater resources from such an access road would be small, for the reasons previously described in Section 4.3.6.2.1.

Two proposed new locations (As-2a and As-3a) are situated in an area (Figure 3-194) where several northeast-striking faults exist in bedrock to the southwest of these well locations. The possibility exists that these faults might project through the general vicinity of these proposed well locations (DIRS 180888-Converse Consultants 2007, Appendix B). However, based on the best available information, it cannot be conclusively demonstrated that the proposed well at locations As-2a and As-3a would be installed in a fault zone. Therefore, it is not possible to infer a direct hydraulic connection between any existing wells and springs located within 9.7 kilometers (6 miles) of the proposed wells at the As-2a and As-3a locations.

Available information (such as DIRS 180887-Converse Consultants 2007, Plate 4-3) suggests that in one selected area along the proposed Montezuma alternative segment 1 in hydrographic area 143, groundwater could be less than 3 meters (about 10 feet) below the ground surface (See Table 3-119). Shallow groundwater conditions (DIRS 180887-Converse Consultants 2007, Plate 4-3) could occur beneath a stretch of this alternative segment east and southeast of Silver Peak (Figure 3-194). However, construction work for this portion of Montezuma alternative segment 1 is expected to involve very minimal excavation, if any, and primarily involve placement and compaction of fill materials rather than excavation work (DIRS 180871-Nevada Rail Partners 2007, Sheets 23 and 24). The probability of intercepting large areas of groundwater in this alternative segment stretch is therefore considered to be very small. If shallow groundwater were to be encountered, standard engineering controls (as described in Section 4.3.5.2.1.1) would be employed to minimize potential impacts to groundwater potentially disturbed by excavation activities.

4.3.6.2.2.6 Montezuma Alternative Segment 2. Montezuma alternative segment 2 would cross a portion of hydrographic area 137A (Big Smoky Valley-Tonopah Flat Valley), then continue on through Area 142 (Alkali Spring Valley), and finally end in hydrographic area 144 (Lida Valley). Figures 3-193 and 3-194 show the approximate locations of existing wells, existing springs, and proposed new wells within the rail line construction right-of-way to meet water demands along Montezuma alternative segment 2.

DOE proposes to install up to 15 new wells to support the construction of Montezuma alternative segment 2. Groundwater impacts analyses were conducted for the proposed new wells for which existing wells or existing springs are present within the potential region of influence. Results of the analyses (Table 4-210) indicate that application of the withdrawal rate of approximately 852 liters (225 gallons) per minute at these proposed new well locations would not impact existing users and uses of groundwater resources in any of the hydrographic areas Montezuma alternative segment 2 would cross.

A new well (BSa-3a) might be installed in area 137A (see Figure 3-193) between prominent fault zones. Both north-south fault zones might promote enhanced groundwater flow within stratified ***colluvium***/alluvium in this general area (DIRS 180888-Converse Consultants 2007, Appendix B). Based on the best available information, it cannot be conclusively demonstrated that the proposed well at location BSa-3a would be installed in a fault zone. Therefore, it is not possible to infer a direct hydraulic connection between any existing wells and springs, seeps, or other surface-water-right locations within 9.7 kilometers (6 miles) of the proposed well at location BSa-3a.

Table 4-210. Summary of calculated radii of influence for proposed new wells for the Mina rail alignment – Montezuma alternative segment 2.

Well number/aquifer type[a]	Distance to nearest well or nearest spring (miles)[b,c]	Radius of influence at base-case pumping rate (miles)	Radius of influence at 225 gallons[d]-per-minute pumping rate (miles)	Radius of influence for nearest well at assumed pumping rate (miles)
Bsa-1a/AVF	> 1.0 (well)	Not applicable[e]	0.50	0.03
Bsa-2a/AVF	> 1.0 (spring)	Not applicable[e]	0.34	0.02
Bsa-3a/AVF	> 1.00 (well)	Not applicable[e]	0.53	0.04
As-1b/AVF	> 1.00 (well)	Not applicable[e]	0.52	0.38
As-2b/AVF	> 1.00 (well)	Not applicable[e]	0.52	0.32

a. Aquifer types are abbreviated as follows: AVF = alluvial valley fill; VRA = volcanic rock aquifer; CRA = carbonate rock aquifer; OTH = other: fluvial-lacustrine (stream-lakebed derived) deposits, Cenozoic bedrock unit, or other consolidated rock unit (for example, limestone/dolomite, conglomerate, mudstone, and others).
b. To convert miles to kilometers, multiply by 1.6093.
c. > = greater than.
d. To convert gallons to liters, multiply by 3.78533.
e. No calculation was completed for reasons stated in text.

Available information (such as DIRS 180887-Converse Consultants 2007, Plate 4-4, and p. 51) suggests that in one area along the proposed Montezuma alternative segment 2 in hydrographic area 137A, groundwater might be less than 3 meters (about 10 feet) below the ground surface (see Table 3-120). Shallow groundwater conditions (DIRS 180887-Converse Consultants 2007, Plate 4-3) could occur beneath a stretch of this alternative segment east and southeast of Silver Peak (Figure 3-194). However, construction work for this portion of Montezuma alternative segment 1 is expected to involve very minimal excavation, if any, and primarily involve placement and compaction of fill materials rather than excavation work (DIRS 180871-Nevada Rail Partners 2007, Sheets 35 through 37). The probability of intercepting large areas of groundwater in this alternative segment stretch is therefore considered to be very small. If shallow groundwater were to be encountered, standard engineering controls (as described in Section 4.3.5.2.1.1) would be employed to minimize potential impacts to groundwater potentially disturbed by excavation activities.

4.3.6.2.2.7 Montezuma Alternative Segment 3. Montezuma alternative segment 3 would begin in the western part of hydrographic area 137A, then travel south through the middle of hydrographic area 142, then proceed westward to briefly enter hydrographic area 143, then proceed in an eastward direction where it would end in the southeastern portion of hydrographic area 144. Figures 3-193 and 3-194 show the approximate locations of existing wells, springs, seeps, or other surface-water-right locations and proposed new wells within the rail line construction right-of-way to meet water demands along Montezuma alternative segment 3. DOE proposes to install a total of up to 14 new wells to support the construction of Montezuma alternative segment 3. Groundwater impacts analyses were conducted for the proposed new wells for which existing wells, springs, seeps, or other surface-water-right locations are present within the potential region of influence. Results of the groundwater impacts evaluation show that imposing an average pumping rate of 852 liters (225 gallons) per minute at these 14 proposed new wells would not impact the local groundwater users and uses in any of the hydrographic areas that Montezuma alternative segment 3 would cross.

Assuming proposed base-case average and sensitivity analysis groundwater production rates at each new well location, the impacts assessment results indicate that existing wells, springs, seeps, or other surface-water-right locations near Montezuma alternative segment 3 would be outside the radius of influence of the proposed new water wells. For this reason, no quantitative impacts analysis calculations were completed for new well locations proposed for this portion of the Mina rail alignment.

4.3.6.2.2.8 Mina Common Segment 2. Mina common segment 2 would be entirely in hydrographic area 144 and would be approximately 5 kilometers (3.1 miles) long, proceeding from the northwest to the southeast. Figures 3-194 and 3-195 show a map view of Mina common segment 2.

There are no proposed wells, no existing USGS NWIS wells, no existing NDWR wells and no existing springs, seeps, or other surface-water-right locations within 1.6 kilometers (1 mile) of the centerline of Mina common segment 2. Proposed wells from Montezuma alternative segments 1, 2, or 3 would be used for obtaining water needed to support the construction of Mina common segment 2. Therefore, groundwater impacts resulting from construction of Mina common segment 2 are presented in Sections 4.3.6.2.2.5, 4.3.6.2.2.6, and 4.3.6.2.2.7.

4.3.6.2.2.9 Bonnie Claire Alternative Segments. Figure 3-195 shows the approximate locations of proposed new water wells DOE could use to support construction of these alternative segments. Evaluation of proposed new wells and information regarding existing groundwater wells and springs, seeps, or other surface-water-right locations in the area where the Bonnie Claire alternative segments would cross indicate, for cases where groundwater pumping is assumed at the projected base-case average required withdrawal rates and where the hypothetical maximum withdrawal rate of 852 liters (225 gallons) per minute is assumed at each location, that known existing wells, springs, seeps, or other surface-water-right locations along Bonnie Claire alternative segments 2 and 3 would be outside the radius of influence of proposed water wells along this portion of the Mina rail alignment. There are no existing USGS NWIS wells, no existing NDWR wells, and no springs, seeps, or other surface-water-right locations within 1.6 kilometers (1 mile) of the centerlines of Bonnie Claire alternative segment 2 or 3 (see Figure 3-195) or within an expanded search radius of 2.8 kilometers (1.75 miles) around each proposed new well. For this reason, no quantitative impacts analysis calculations were completed for new well locations proposed for this portion of the Mina rail alignment.

4.3.6.2.2.10 Common Segment 5 (Sarcobatus Flat Area). Figures 3-195 and 3-196 show the approximate locations of proposed new wells that DOE could use to support construction of common segment 5.

Assuming proposed base-case average and sensitivity analysis groundwater withdrawal rates at each new well location, the impacts assessment results (Table 4-211) indicate that existing wells, springs, seeps, or other surface-water-rights locations near common segment 5 would be outside the radius of influence of the proposed new water wells. Where the closest existing well, spring, seep, or other surface-water-right location to a proposed new well was found to be located more than 2.8 kilometers (1.75 miles) away from that proposed new well location, no quantitative impacts analysis calculations were completed.

Table 4-211. Summary of calculated radii of influence for proposed new wells for the Mina rail alignment – common segment 5.

Well number/aquifer type[a]	Distance to nearest well or nearest spring (miles)[b,c]	Radius of influence at base-case pumping rate (miles)	Radius of influence at 225 gallons[d]-per-minute pumping rate (miles)	Radius of influence for nearest well at assumed pumping rate (miles)
SaF4/AVF	> 1.00 (well)	0.28	0.57	0.13
SaF5/9/AVF	> 1.00 (well)	0.25	0.44	0.88
SaF7/11/AVF	0.94 (well)	0.22	0.39	0.04
OV24/25/26/AVF	> 1.00 (well)	0.19	0.24	0.04

a. Aquifer types are abbreviated as follows: AVF = alluvial valley fill; VRA = volcanic rock aquifer; CRA = carbonate rock aquifer; OTH = other: fluvial-lacustrine (stream-lakebed derived) deposits, Cenozoic bedrock unit, or other consolidated rock unit (for example, limestone/dolomite, conglomerate, mudstone, and others).
b. To convert miles to kilometers, multiply by 1.6093.
c. > = greater than.
d. To convert gallons to liters, multiply by 3.78533.

4.3.6.2.2.11 Oasis Valley Alternative Segments. A potential concern in this area is that shallow groundwater, if used for meeting potable water needs at a rail siding, construction camp, or quarry, could have elevated fluoride levels. However, deeper groundwater northeast of Beatty could be of higher quality.

Figure 3-196 shows the approximate locations of proposed new water wells within the Oasis Valley alternative segments 1 and 3 construction rights-of-way. Specific siting and use considerations for new wells that would be installed along this portion of the rail alignment are summarized below. Impacts to existing springs, seeps, or other surface-water-right locations in this area (Section 3.3.6.3.11) could be eliminated by employing the following best management practices or mitigation strategies:

- For Oasis Valley alternative segment 1, up to three proposed new wells at locations OV3 and OV4, and up to two new wells at location OV5, sited within valley-fill alluvial materials, could be used to obtain water needed to support rail line construction. Alternatively, or in combination with these wells, a series of alternate wells approximately 7.2 kilometers (4.5 miles) northwest of proposed well location OV4 (at locations OV24, OV25, and OV26 on Figure 3-196), would also be used to supply water, for the same purpose, to a rail alignment water-demand location in the vicinity of proposed well locations OV3, OV4, and OV5. Locations OV24 through OV26 would be within the proposed rail alignment construction right-of-way, and in valley-fill alluvium. A series of springs on the Upper Oasis Valley Ranch (DIRS 169384-Reiner et al. 2002, Figure 7; DIRS 181909-Fridrich et al. 2007, all) are within approximately 1 kilometer (0.6 mile) of proposed well locations OV3, OV4, and OV5. Section 3.3.5, Surface-Water Resources, discusses other springs in this area. Wells at locations OV3, OV4, and OV5 would be between approximately 15 and 30 meters (50 and 100 feet) deep, while wells at locations OV24, OV25, and OV26 would be between approximately 30 and 46 meters (100 and 150 feet) deep (DIRS 182822-Converse Consultants 2006, Appendix B). For a 4-year construction schedule, the total combined average withdrawal rate for wells at locations OV3 and OV4, taken together with that for alternative wells at locations OV24 and OV25, would be approximately 410 liters (approximately 109 gallons) per minute (DIRS 182822-Converse Consultants 2006, Appendix A). For the same schedule, the total combined withdrawal rate for wells at locations OV5, together with that for alternative wells at location OV26, would be approximately 150 liters (approximately 40 gallons) per minute. The total required water withdrawal would be divided between these well locations (Figure 3-196).

- For Oasis Valley alternative segment 3, up to two proposed new wells at locations OV13, sited at the same location as OV5 under Oasis Valley alternative segment 1, could be used to obtain water needed to support railroad construction. Alternatively, or in combination with these wells, up to two alternate wells at location OV24, sited at the same location as OV24 under the Oasis Valley alternative segment 1 (see Figure 3-196), would also be used to supply water to a rail alignment water-demand location in the vicinity of proposed well location OV13. Wells at these locations would have the same depth as the corresponding wells at these locations under Oasis Valley alternative segment 1. For a 4-year construction schedule, the total combined withdrawal rate for wells at location OV13, taken together with that for alternative wells at location OV24, would be approximately 340 liters (approximately 89 gallons) per minute ([DIRS 182822-Converse Consultants 2006, Appendix A). The total required water withdrawal would be divided between these well locations (see Figure 3-196).
- Analysis results (Table 4-212) indicate that pumping groundwater from wells at locations OV3, OV4, and OV5, under Oasis Valley alternative segment 1, and pumping from wells at location OV13, under Oasis Valley alternative segment 3, would need to be limited to a total of approximately 76 liters (approximately 20 gallons) per minute or less at each location, under each alternative segment, to preclude possible reductions in discharge rates and water quality at the Upper Oasis Valley Ranch springs. The remaining water needed to support construction activities in this portion of the rail alignment would be obtained from proposed alternate well locations OV24, OV25, and/or OV26. For Oasis Valley alternative segment 1, the total combined net withdrawal that would be met through the use of wells at alternate well locations would be approximately 340 liters (89 [109 + 40 − 20 − 20 − 20] gallons) per minute. For Oasis Valley alternative segment 3, the total combined net production from wells at location OV24 would be approximately 261 liters (69 [89 – 20]) gallons) per minute.

Evaluation of the effects of proposed groundwater withdrawals from proposed wells at locations OV9, OV12, OV17, OV18, OV19, OV20, and OV21 for Oasis Valley alternative segment 3 indicate that there would be no expected impact to known existing wells, including PER wells, or RFA or RFP wells (none identified), springs, seeps, or other surface-water-right locations in the Oasis Valley area.

Existing USGS NWIS wells (OVU-Dune Well, OVU-Middle ET Well, OVU-Lower ET Well, and Well ER-OV2) within approximately 0.32 to 0.48 kilometer (0.2 to 0.3 mile) of the proposed new wells at locations OV3, OV4, and OV5 on Oasis Valley alternative segment 1 (see Section 3.3.6.3.11) are shallow groundwater monitoring wells owned and installed by the U.S. Geological Survey. All of these wells have no current or projected beneficial use and are used solely for monitoring purposes. An existing well cluster of USGS NWIS wells (ER-OV-01, ER-OV-06a, and ER-OV-6a2) is approximately 1.9 kilometers (1.2 miles) northeast of the proposed new wells at location OV20/OV21 on Oasis Valley alternative

Table 4-212. Summary of calculated radii of influence for proposed new wells for the Mina rail alignment – Oasis Valley alternative segments.

Well number/aquifer type[a]	Distance to nearest well or nearest spring (miles)[b]	Radius of influence at base-case pumping rate (miles)	Radius of influence at 225 gallons[c]-per-minute pumping rate (miles)	Radius of influence for nearest well at assumed pumping rate (miles)
OV3/4/5/AVF	0.40 (spring)	0.17 [d]	Not applicable[d,e]	Not applicable[f]
OV9/AVF	0.49 (well)	0.10	0.37	0.11[g]
OV12/18/19/20/21/AVF and OTH	0.60 (spring)	0.30	0.35	0.11[g]
OV6/8/14/16/AVF	0.86 (spring)	0.35	0.49	0.02[h]

a. Aquifer types are abbreviated as follows: AVF = alluvial valley fill; VRA = volcanic rock aquifer; CRA = carbonate rock aquifer; OTH = other: fluvial-lacustrine (stream-lakebed derived) deposits, Cenozoic bedrock unit, or other consolidated rock unit (for example, limestone/dolomite, conglomerate, mudstone, and others).
b. To convert miles to kilometers, multiply by 1.6093.
c. To convert gallons to liters, multiply by 3.78533.
d. Base case pumping rate was limited to 20 gallons per minute.
e. For this not applicable case, no calculation was completed for reasons stated in the text.
f. For this not applicable case, no calculation was performed because the nearest resource feature is a spring.
g. The radius of influence is associated with a domestic well.
h. The radius of influence is associated with a well having a water right.

segment 3. These are also shallow groundwater monitoring wells owned and installed by the U.S. Geological Survey. These wells have no current or projected beneficial use and are used solely for monitoring purposes.

Alternatively, for Oasis Valley alternative segment 1, up to four proposed new wells could be installed at proposed alternative well locations OV6 and OV8 west of the Amargosa River in the Oasis Valley area (see Section 3.3.6.3.11 and Figure 3-196). For Oasis Valley alternative segment 3, these alternate well locations are designated OV14 and OV16 but the wells would have the same characteristics and same required production rates. These alternate wells would support earthwork construction and would be between 30 and 46 meters (100 and 150 feet) deep. The total combined required withdrawal rate for this set of wells would be approximately 510 liters (136 gallons) per minute (DIRS 182822-Converse Consultants 2006, Appendix A). Analysis results (Table 4-212) indicate that pumping groundwater from these wells at the required base-case withdrawal rates would not be expected to impact discharge rates and/or water quality at a group of springs (identified in records as Ute Springs and Manley Springs) approximately 0.64 kilometer (0.4 mile) to 0.97 kilometer (0.6 mile) east of the OV14 and OV16 locations.

For two proposed new well locations associated with the Oasis Valley alternative segments, the targeted water zone is a possibly water-bearing detachment fault system (DIRS 182822-Converse Consultants 2006, Appendices A and B and Maps 14a and 14b). A proposed well location (well location OV5 or OV15, depending on alternative segment) could be installed in the southern portion of hydrographic area 228, within the typical maximum 300-meter (1,000-foot)-wide construction right-of-way of common segment 6 (see Figure 3-196). A new well (see Section 3.3.6.3.11 and Figure 3-196) might be installed in the southern part of the Oasis Valley hydrographic area near the area boundary, approximately 0.8 kilometer (0.5 mile) west of common segment 6 (well location OV22 or OV23, depending on alternative segment). The target water source at this location would be a possibly water-bearing detachment fault system (DIRS 182822-Converse Consultants 2006, Appendix B). There are no known existing wells or springs within approximately 9.7 kilometers (6 miles) of either of these proposed well locations that are known to be associated with the same fault system as, or with potentially related major fault zones in either of these proposed well locations, should these wells be used for obtaining water required at corresponding rail alignment water-demand stations.

Available information suggests that shallow groundwater might be encountered in one isolated area beneath a stretch of the OV1 alternative segment in Oasis Valley where the OV1 segment crosses near the Upper Oasis Valley Ranch Springs area (see Figures 3-82 and 3-196, Volume II of this Rail Alignment EIS; DIRS 182821-Converse Consultants 2005, Plate 4-3; DIRS 169384-Reiner et al. 2002, Plate 2 and Figure 3). Water-level data from existing wells (such as the OVU-Middle ET Well and OVU-Lower ET Well) located in the Upper Oasis Valley Ranch Springs area (DIRS 169384-Reiner et al. 2002, Plate 2) show groundwater levels less than 2.4 to 3 meters (8 to 10 feet) below the ground surface in this general area.

Excavation work required for constructing this stretch of the OV1 alternative segment would be limited to less than about 1.5 meters (5 feet) below the ground surface (DIRS 182674-Nevada Rail Partners 2007, Sheets 56 and 57). Most earthwork done in this area would involve the placement and compaction of fill rather than excavation work. Although the possibility of excavations intercepting shallower groundwater in this area does exist, the probability of intercepting large areas of groundwater in this alternative segment stretch is considered to be small. If shallow groundwater were to be encountered, standard engineering controls (as described in Section 4.3.5.2.1.1) would be employed to minimize potential impacts to groundwater potentially disturbed by excavation activities.

4.3.6.2.2.12 Common Segment 6 (Yucca Mountain Approach). Figure 3-195 shows the approximate locations of proposed new wells along this common segment. There are 1.41 million cubic meters (1,147 acre-feet) and 72,000 cubic meters (58 acre-feet) of annual committed groundwater resources in hydrographic areas 229 and 227A, respectively. There are 101,000 cubic meters (82 acre-feet) of documented pending annual duties in area 229 and approximately 6,170 cubic meters (5 acre-feet) of documented pending annual duties in area 227A. Tables 3-113 and 4-206 indicate that water withdrawal required within hydrographic area 229 for construction of common segment 6 would exceed the estimated annual perennial yield for that hydrographic area. However, except for smaller-magnitude water requirements (on the order of 3.8 liters [1 gallon] per minute) associated with a proposed rail siding (DIRS 182822-Converse Consultants 2006, Table 2-1) and a proposed construction camp (approximately 76 liters [20 gallons] per minute), water requirements for common segment 6 would be required for only 9 months (DIRS 182822-Converse Consultants 2006, Appendix A).

There are a total of 17 USGS NWIS wells, four NDWR wells with water rights, no NDWR domestic wells, and no springs, seeps, or other surface-water-right locations within approximately 1.6 kilometers (1 mile) of the centerline of common segment 6, as shown on Figure 3-82. Up to two new water wells are proposed at location CF4. These wells would furnish water for earthwork compaction and would be between approximately 370 and 460 meters (1,200 and 1,500 feet) deep. Although there is one USGS NWIS well approximately 1.5 kilometers (0.9 mile) northeast of this location, that well is a groundwater test/monitoring well (NC-EWDP-18P) installed to test subsurface characteristics and monitor groundwater conditions downgradient of the Yucca Mountain Repository site. This well has no current or projected beneficial use, and is used only for monitoring purposes (DIRS 182821-Converse Consultants 2005, Plate 4-2 and Appendix A; DIRS 176808-Nye County Nuclear Waste Repository Project Office 2002, all).

As shown in Table 3-113, the perennial yield for the western two-thirds of hydrographic area 227A is approximately 720,000 cubic meters (580 acre-feet) and committed groundwater resources are very low. Appropriations for new wells could be pursued in this area to meet railroad construction-water needs and water demands for rail line construction and for the railroad operations support facilities near the end of the rail line at Yucca Mountain.

Water required for railroad construction and operations through area 227A would be acquired as part of the water inventory of approximately 530,000 cubic meters (430 acre-feet) per year proposed for appropriation in area 227A to support construction and operation of a repository at Yucca Mountain. The total estimated water demand for construction of the portion of common segment 6 within area 227A is approximately 710,000 cubic meters (572 acre-feet). Water requirements associated with the construction and operation of proposed rail facilities in area 227A are described in Section 4.3.6.2.1. If the amount of water required to support railroad construction and operations exceeds the current amount proposed for appropriation, the schedule for railroad construction or for water acquisition could be modified to reduce peak water demands, or an additional temporary water appropriation for railroad construction could be sought (DIRS 182821-Converse Consultants 2005, p. 15).

Assuming proposed base-case average and sensitivity analysis groundwater withdrawal rates at each new well location, the impacts assessment results indicate that existing wells, including PER wells, and springs, seeps, and other surface-water-right locations near common segment 6 would be located beyond an expanded search radius of 2.8 kilometers (1.75 miles) around each proposed new well. For this reason, no quantitative impacts analysis calculations were completed for new well locations proposed for this portion of the Mina rail alignment**.**

Geologic information (for example, DIRS 176904-Workman et al. 2002, all) indicates that a mapped northwest-southeast trending fault trace might be located in close proximity to proposed rail alignment-related well location CF-3 in hydrographic area 229 (Crater Flat). A well installed at location CF-3 therefore might intercept a (water-bearing) fault zone. Similarly, the geologic map prepared by Workman et al. (DIRS 176904-Workman et al. 2002, all) indicates that proposed well location CF-4 in the Crater Flat hydrographic area might be located in close proximity to one of more mapped north-south to northeast-southwest trending fault traces; therefore, a well installed at location CF-4 might also intercept one or more (water-bearing) fault zones.

An existing well having an associated well log located within 9.7 kilometers (6 miles) of proposed well location CF-3 (to the southwest of location CF-3) appears to be located near the same mapped fault trace as (or a mapped fault trace that might be directly associated with) the fault that might be intercepted by a proposed well at location CF-3. Similarly, an existing well having an associated well log located within 9.7 kilometers of proposed well location CF-4 (to the north-northwest of location CF-4) appears to be located near a mapped fault trace that could be the same as (or a mapped fault trace that might be directly associated with) one or more of the faults that could be intercepted by a proposed well at location CF-4. However, both of these existing wells are monitoring wells. Because the existing wells do not have a beneficial use, the possibility of groundwater conduit flow resulting from pumping at proposed well locations CF-3 and/or CF-4 causing impacts on these existing wells is not evaluated further.

4.3.6.3 Operations Impacts

Overall, potential impacts to groundwater resources from operating the proposed railroad along the Mina rail alignment under the Proposed Action or under the Shared-Use Option would be small.

Rail line operations facilities would need water for daily operation. However, other than relatively limited water quantities required for maintaining fire-protection water-tank reserves at rail sidings and meeting relatively low water needs for operations personnel at selected facility locations along the rail line, there would be no continued need for any large-scale pumping wells once construction of the railroad is completed. Possible changes to recharge characteristics, and resulting changes in percolation rates to groundwater, if any, in the areas of railroad operations facilities would be the same as those at the completion of construction of the rail line.

By complying with applicable regulations, it is expected that impacts to groundwater resources from disposal of wastewater would be minimized (see Section 4.3.11, Utilities, Energy, and Materials).

4.3.6.4 Impacts under the Shared-Use Option

Impacts to groundwater under the Shared-Use Option would be similar to those identified for the Proposed Action without shared use. Under the Shared-Use Option, additional commercial rail sidings would be constructed as a third track alongside passing sidings (see Figure 2-54). The total length of commercial rail sidings would be relatively small compared to the total length of the rail line. Under the Shared-Use Option, water needs for construction of the rail line would increase only by approximately 150,000 cubic meters (119 acre-feet).

For purposes of analysis, DOE assumed that the commercial sidings would be in the same hydrographic areas as analyzed for the Proposed Action without shared use. Impacts would be similar to those described for the Proposed Action without shared use; additional impacts to groundwater resources in these areas would be small.

The commercial-only facilities that would be constructed under the Shared-Use Option would likely be close to DOE-owned and -operated rail facilities and would likely overlie the same hydrographic areas identified for the Proposed Action without shared use. Overall, the impacts would be similar to those described for the Proposed Action without shared use and would be small.

Impacts to groundwater under Shared-Use Option operations would be similar to those identified for operations under the Proposed Action without shared use (Section 4.3.6.3). Use of the completed rail line from Wabuska to Yucca Mountain, including any additional sidings, would have a small impact on groundwater resources. There would be no continued need for water along the additional sidings, and possible changes to recharge, if any, would be the same as those at the completion of construction.

The commercial-only facilities would require water for daily operation. Water demand to operate these facilities has not been determined, but DOE assumes this demand would be small. Therefore, the additional impacts to groundwater resources would likely be small and overall would be similar to those described for the Proposed Action without shared use.

4.3.6.5 Summary

This section summarizes and characterizes potential impacts to groundwater resources from constructing and operating the proposed rail line and railroad construction and operations support facilities along the Mina rail alignment. The potential for impacts to groundwater resources resulting from physical disturbance of the ground surface during the construction phase would be small. Proposed groundwater withdrawals would locally affect groundwater flow patterns and groundwater availability. Impacts on downgradient groundwater basins (hydrographic areas) due to the proposed groundwater withdrawals would be very small. Impacts on groundwater resources due to groundwater withdrawals at proposed quarry locations and rail facility locations would also be very small. As discussed in Section 4.1, DOE would implement best management practices as part of the Proposed Action to avoid, minimize, or otherwise reduce impacts to groundwater resources. Chapter 7 describes best management practices and mitigation measures.

For the case of groundwater withdrawals from proposed wells to support a 4-year rail construction schedule, analysis results indicate that, based on anticipated hydrogeologic conditions, existing known wells, springs, seeps, and other surface-water-right locations are not expected to fall within the radius of influence of the proposed new wells, except for possibly location CSM-2a in Columbus Salt Marsh Valley, and selected proposed new well locations in the Oasis Valley area (if the restrictions and use limitations discussed for these well locations as described below were not followed). The proposed groundwater withdrawal at each new production well would create a drawdown feature in the portion of the ***saturated zone*** immediately surrounding that well, locally affecting groundwater flow patterns and water availability in the portion of the aquifer immediately surrounding the well. The effects in each case where projected average production rates are assumed to occur at the proposed well locations would be limited in extent to a maximum horizontal distance of approximately 0.8 to 1 kilometer (approximately 0.5 to 0.6 mile) or less in a few instances and generally a much smaller distance.

As noted above, impacts analysis results indicate at one proposed well location along the portion of the proposed Mina rail alignment that would be unique to the alignment (that is, distinct from the rail line segments that would be common to both the Mina and Caliente rail alignments as described in Section 4.2.6), proposed groundwater withdrawals, if unmitigated, could impact existing groundwater resources and/or an existing groundwater user.

At proposed well location CSM-2a, there is potentially a spring located within the calculated region of influence of this pumping location. It should be noted that available information suggests that this spring, noted in a report from 1970 as having a very small flow rate, might no longer exist (that is, no longer discharge). If this potential spring location was excluded from consideration in the impact analysis calculations, there would be no impact to nearby groundwater uses or users due to the pumping at location CSM-2a. In the unlikely event that this spring might still exist, impacts to that spring could be eliminated by reducing the average withdrawal rate at location CSM-2a to approximately 150 liters (40 gallons) per minute or less. In this case, the remaining balance of make-up water required could be obtained at another proposed well location provided that well is sufficiently far away from known existing springs and active pumping wells. Alternatively, the location of proposed well CSM-2a could be moved to a point located sufficiently distant from the spring, if present, to preclude the cone of depression from the well from reaching the spring.

Analysis results (see Tables 4-207 through 4-212) for the rail line segments that would be common to both the Mina and Caliente rail alignments indicate that certain restrictions or use prohibitions would need to be factored into the final siting and use of some specific proposed new groundwater well locations (mostly with respect to potential higher well-productivity scenarios) at selected locations in the Oasis Valley hydrographic area (proposed well locations OV3, OV4, OV5/OV13) in order to preclude impacts on existing groundwater resources. The resources that could be affected if such restriction for use prohibitions were not followed include springs (locations OV3, OV4, and OV5/13).

Wells having the largest withdrawal rates would be expected to be those that are designed for use as supply wells for earthwork compaction; groundwater withdrawals from these wells would occur over a period of less than 1 year (typically over a 9-month pumping period). For a longer railroad construction schedule (up to 10 years), groundwater withdrawal rates from new wells could be the same or reduced for most well locations compared to those described in this section. For this longer schedule, the magnitude of potential impacts to existing groundwater users from groundwater withdrawals would be equal to or less than that determined for the 4-year railroad construction schedule.

Collectively, the impacts analysis results indicate that the effects of groundwater withdrawals from the proposed new wells at the range of production rates that may be required for this project would be localized in nature and extent. The impacts caused by the majority of water withdrawals and the wells having the highest production rates (those associated with construction of the rail roadbed) would be short term in duration. Additionally, for those areas where proposed new water wells would be near a boundary between adjacent hydrographic areas, downgradient hydrographic areas would not be likely to be affected by the proposed groundwater withdrawals because (1) there are no identified existing groundwater users associated with the downgradient groundwater basins within 1.6 kilometers (1 mile) of any of these proposed well-water withdrawal locations, and (2) available hydrogeologic information indicates that significant inter-basin groundwater (under) flow is not occurring in the areas downgradient of the proposed well locations.

DOE compared hydrogeologic conditions occurring at the proposed withdrawal well locations and required groundwater withdrawal durations and proposed groundwater withdrawal rates for new wells to hydrogeologic conditions and groundwater withdrawal rates and pumping durations that have occurred at certain locations in the western United States where ground subsidence has been observed as a result of prolonged, large-scale groundwater withdrawals. Comparison results indicate that the potential for ground subsidence to occur as a result of proposed groundwater withdrawals in the hydrographic areas crossed by the Mina rail alignment is low, both during the construction and operations phases.

Table 4-213 summarizes potential impacts to groundwater resources from constructing and operating the proposed railroad along the entire Mina rail alignment.

Table 4-213. Summary of potential impacts to groundwater resources – Mina rail alignment.

Resource	Proposed Action
Groundwater availability and uses	*Construction* - Analysis results indicate that proposed groundwater withdrawals would locally affect groundwater flow patterns and water availability in the portion of the aquifer immediately surrounding each new withdrawal well. The effects resulting from application of assumed withdrawal rates of 852 liters (225 gallons) per minute at proposed well locations, and an initially proposed withdrawal rate of 1,300 liters (350 gallons) per minute at one proposed well location (Cl-1a), would be limited in extent. Analysis results indicate that the radius of influence of the cone of depression created in the aquifer in each case averages approximately 0.64 kilometer (0.4 mile) for the proposed new well locations, with a maximum horizontal distance of approximately 1.1 kilometers (0.72 mile) indicated at one proposed well location. Hydrogeologic effects resulting from use of the proposed new wells for supporting rail roadbed construction would be temporary in nature. Proposed groundwater withdrawals at selected proposed well locations in the Oasis Valley hydrographic areas (OV3, OV4, and OV5/13), could, if unmitigated, likely impact existing groundwater users or existing groundwater resources during the construction of a railroad along the Mina rail alignment. Proposed groundwater withdrawals from proposed well CSM-2a in the Columbus Salt Marsh Valley hydrographic area, could, depending on whether a small-discharge rate spring might still exist in the nearby vicinity, impact discharge rates at that spring. One or more specific mitigation measures described earlier in this section, as needed, and if implemented at these locations, would effectively avoid such potential impacts. *Construction and operations* - Physical disruption of existing groundwater resource features such as existing wells, springs, seeps, or other surface-water-right locations resulting from railroad construction and operations would be precluded by designing the rail line to avoid such features. Hydrogeologic impacts to existing groundwater resource features, such as existing wells; water-rights locations that have been assigned a permitted (PER) status by the State Engineer; springs; seeps; or other surface-water-right locations (if present within the region of influence of and potentially in hydraulic connection with proposed groundwater withdrawal well water-bearing zones), due to railroad construction- and operations-related groundwater withdrawals would be small. Potential cumulative impacts, if any, associated with currently proposed future well locations and assigned a "Ready for Action" or "Ready for Action, Protested" status by the State Engineer are addressed in Chapter 5. *Operations* - Owing to the very small groundwater withdrawal rates needed to support railroad operations, potential impacts to groundwater resources from operating the railroad from Wabuska to Yucca Mountain under the Proposed Action would be small.
Ground subsidence	*Construction* - The temporary duration of the vast majority (approximately 87 percent) of the total groundwater withdrawals required for railroad construction indicates that the potential for the proposed groundwater withdrawals to cause subsidence of the ground surface is small. *Operations* - Owing to the very small groundwater withdrawal rates needed to support railroad operations, the potential for the groundwater withdrawals needed to support railroad operations to cause subsidence of the ground surface is small.
Groundwater quality	*Construction and operations* - The impact to groundwater resources of contaminants that might be released by construction equipment during railroad construction or during rail system operation would be small because of generally deep groundwater depths beneath most of the alignment. *Construction and operations* - The impact of proposed groundwater withdrawals on groundwater quality would be small to negligible. The proposed withdrawals would not conflict with water-quality standards protecting groundwater resources.

4.3.7 BIOLOGICAL RESOURCES

This section describes potential impacts to biological resources (vegetation, wildlife, special status species, State of Nevada game species, and wild horses and burros) from constructing and operating the proposed railroad along the Mina rail alignment. Potential impacts are reported and described as either direct or indirect, and either long term or short term.

There could be short-term impacts to biological resources in the rail line construction right-of-way during the construction phase. These impacts would be short term because DOE would restore disturbed lands not required for railroad operations with appropriate vegetation immediately after construction was complete.

There would be long-term impacts to biological resources in areas where there would be unavoidable impacts that would result in a change in the natural setting that could last beyond the 50-year operations phase. These areas would include the rail roadbed, along access roads, and in facility and quarry footprints. For biological resources, such impacts are identified for areas of the maximum edge of cut and toe of slope for fill (see Section 2.2.2.6).

Section 4.3.7.1 describes the methods DOE used to assess potential impacts to biological resources; Section 4.3.7.2 describes impacts under the Proposed Action; Section 4.3.7.3 describes impacts under the Shared-Use Option; and Section 4.3.7.4 summarizes impacts. Section 6.3.7 summarizes laws and regulations governing the protection of biological resources. Appendix H provides more detail on the methods DOE used to assess potential impacts to biological resources.

4.3.7.1 Impact Assessment Methodology

For this analysis, DOE calculated potential direct, long-term impacts to biological resources based on the footprint of the rail roadbed. The footprint would be within the nominal width of the construction right-of-way, and is the area that would involve clearing of vegetation, excavation, and filling to support the rail line. The width of the footprint would fluctuate along the alignment due to topography, cut and fill requirements, and land use, and to avoid or minimize impacts to other resources (such as water and structures). This area would experience direct, long-term impacts.

DOE coordinated with personnel from pertinent federal, state, and local agencies to identify potential impacts to biological resources. Where possible, the Department has quantified potential impacts (such as habitat loss due to construction and operations activities).

Although the Department would minimize the use of the area between the edge of the construction footprint and the outside edge of the construction right-of-way, DOE took a conservative approach and analyzed the short-term impacts to biological resources within this area. This approach overstates impacts as DOE would likely not disturb a large portion of this area.

For facilities that would be outside the nominal width of the construction right-of-way (such as quarries and railroad operations support facilities), the area DOE assessed for potential impacts was the maximum construction footprint of each facility. In order to assess potential impacts, the Department performed a spatial Geographical Information System analysis to compare the footprints of these facilities with biological resources information.

Where possible, this section reports potential impacts to biological resources quantitatively. Potential species-specific impacts are reported qualitatively as either small, moderate, or large, as defined in Section 4.1. DOE estimated impacts based on the amount of change to or loss of the resource from the baseline conditions described in Section 3.3.7, and considered the following criteria for determining the level of change in conditions:

- Direct effects would be-
  - Long-term loss of vegetation (land-cover types)
  - Short-term disturbance to habitat and vegetation
  - Long-term and short-term species displacement or alteration of access to important year-round or seasonal habitat during the construction and operations phases (including watering areas and other key areas)
  - Long-term loss of potential habitat (species-specific land-cover types)
  - Short-term disturbance to habitat and vegetation
  - The risk of trains colliding with wildlife
- Indirect effects would be-
  - Changes in land use that could affect movement patterns and migratory patterns
  - Displacement of species after construction that could add additional stress to other areas and habitat

The assessment of impacts to biological resources considers the potential for continued engineering and site evaluation and planning efforts (see Chapter 2), compliance with applicable requirements (see Chapter 6), and implementation of best management practices (see Chapter 7) to minimize or avoid impacts. This section reports potential direct impacts for the entire rail alignment and specific rail line segments.

DOE expects that there would be small indirect impacts, if any, to biological resources from changes in land use and post-construction displacement, because of the large expanses of land in the area and the types of current uses that tend to be less intrusive than normal development and rural or urban expansion.

DOE concluded from the groundwater impact analysis that project-related groundwater withdrawals would not result in changes to water levels at springs; therefore, there would be no impacts to vegetation, wildlife, special status species, state of Nevada game species, wild horses or burros associated with those springs (see Section 4.3.5, Surface-Water Resources).

4.3.7.1.1 Vegetation

DOE began the assessment of impacts to vegetation resources quantitatively and qualitatively by reviewing available resource data and field surveys. The Department considered the potential direct impacts to land-cover types from railroad construction and operations activities. To assess potential direct impacts from the loss or disturbance of most land-cover types, DOE compared the area of a land-cover type that could be disturbed during the construction and operations phases to the land-cover types present within the affected mapping zones. For ecologically important and relatively uncommon land-cover types within the entire mapping zone, such as ***riparian*** and marsh habitats, DOE compared the area of a land-cover type that would be disturbed (within the construction right-of-way and facilities footprints) to the land-cover type present within the study area, as defined in Section 3.3.7.1.2. The Department used this information to quantitatively estimate the potential loss of habitat and to determine qualitatively whether the loss of habitat would result in a small, moderate, or large impact.

DOE also evaluated potential impacts from noxious or ***invasive plant species*** based on the potential for railroad construction or operations activities to introduce or spread noxious or invasive species.

4.3.7.1.2 Wildlife

DOE assessed potential impacts to wildlife communities qualitatively by reviewing the land-cover types that could be affected during railroad construction and operations and identifying the wildlife species likely to be present within those areas. Habitat loss with these communities would be the primary driver of impacts to wildlife and is the focus of this analysis. The Department also evaluated potential impacts from railroad operations on wildlife.

4.3.7.1.3 Special Status Species

DOE assessed potential impacts to special status species (threatened and ***endangered species***; ***BLM-designated sensitive species***; and State of Nevada-designated sensitive and protected species) qualitatively by reviewing the potential for a species to occur within the study area and the region of influence; species habitat that would be affected; and the potential mechanisms for impact. The primary impact would be from the loss of habitat, which is the focus of this analysis. DOE also evaluated impacts from railroad operations on special status species.

4.3.7.1.4 State of Nevada Game Species

DOE assessed potential impacts to State of Nevada Game Species, as defined in Section 3.3.7.2.4, based on the potential for loss of important foraging habitat, the potential for loss of important water sources, the potential displacement of game, and the potential disruption of movement patterns.

4.3.7.1.5 Wild Horses and Burros

DOE assessed potential adverse impacts to wild horses and burros based on the potential for loss of important foraging habitat, the potential for loss of important watering areas, and the potential for impacts to individual ***herd management areas***.

4.3.7.2 Environmental Impacts

This section describes potential impacts to biological resources from construction and operation of a railroad along the Mina rail alignment under the Proposed Action. To minimize redundancy and provide clear and concise reporting of potential impacts, Section 4.3.7.2.1 describes impacts common to all rail line segments and construction and operations support facilities and how each biological resource could be affected. Section 4.3.7.2.2 describes rail line segment- and facility-specific impacts. Tables list the amount of departure from baseline conditions (see Section 3.3.7) based on the indicators described above.

4.3.7.2.1 Environmental Impacts Common to the Entire Mina Rail Alignment

This section describes potential short-term and long-term impacts to each biological resource that could result from railroad construction along the Mina rail alignment.

4.3.7.2.1.1 Vegetation. Construction of the rail line and facilities along the Mina rail alignment would directly impact a diverse mix of vegetation communities and land-cover types. Tables 4-214, 4-215, 4-216, and 4-217 list the land-cover types associated with the Mina rail alignment common segments, alternative segments, quarries, and operations support facilities that would be affected during the construction phase. The primary construction-related impacts to vegetation communities during the construction phase would be the physical short-term or long-term removal of vegetation and compaction of the soil.

Table 4-214. Short-term and long-term impacts to land-cover types[a] by common segment.

Land-cover type[c]	Area covered by common segment (acres)[b]							
	Mina CS1[d]		Mina CS2		CS5		CS6	
	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts
Barren Lands, Non-Specific	16.9	1.87	0	0	0	0	0	0
Great Basin Pinyon-Juniper Woodland	0	0	0	0	3.04	0	0	0
Inter-Mountain Basins Active and Stabilized Dune	23.9	0.17	0	0	0	0	0	0
Inter-Mountain Basins Big Sagebrush Shrubland	0	0	0	0	1.5	0.02	0	0
Inter-Mountain Basins Cliff and Canyon	0.13	0	0	0	0	0	0	0
Inter-Mountain Basins Greasewood Flat	144	11.9	0	0	0	0	0	0
Inter-Mountain Basins Mixed Salt Desert Scrub	7,190	604	229	14.5	0	0	0	0
Inter-Mountain Basins Playa	149	13.2	0	0	0	0	0	0
Inter-Mountain Basins Semi-Desert Shrub Steppe	139	11.9	15.3	0.79	210.1	12.3	441	58.4
Invasive Annual and Biennial Forbland	4.39	0.43	0	0	0	0	0	0
Invasive Annual Grassland	1.22	0.17	0	0	0	0	0	0
Mojave Mid-Elevation Mixed Desert Scrub	0	0	0	0	344	23.3	785	94.02
North American Warm Desert Bedrock Cliff and Outcrop	0	0	0	0	0	0	13.3	0.99
North American Warm Desert Playa	0	0	0	0	0.46	0	4.17	0.49
Sonora-Mojave Creosotebush-White Bursage Desert Scrub	0	0	0	0	722	58	2,008.7	246
Sonora-Mojave Mixed Salt Desert Scrub	0	0	0	0	1,470	107.8	19.3	2.44
Totals[d]	7,670.31	644.03	243.89	15.32	2,751.1	201.42	3,271.47	402.34

a. Source: DIRS 174324-NatureServe 2004, all.
b. To convert acres to square kilometers, multiply by 0.0040469.
c. The following land-cover types occur within the study area but are not listed above due to no impact in the construction right-of-way: Developed, Open Space - Low Intensity; Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland, Inter-Mountain Basins Montane Sagebrush Steppe; Inter-Mountain Basins Wash; and North American Arid West Emergent Marsh.
d. Totals might differ from the sums of values due to rounding.

Table 4-215. Short-term and long-term impacts to land-cover types[a] by alternative segment (page 1 of 2).

	Area covered by alternative segment (acres)[b]													
	Schurz alternative segments								Montezuma alternative segments					
	S1		S4		S5		S6		MN1		MN2		MN3	
Land-cover type	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts
Barren Lands, Non-Specific	0	0	0	0	0	0	0	0	47.02	4.26	0.84	0.27	0	0
Developed, Medium - High Intensity	0	0	0	0	0	0	0	0	0	0	2.77	1.07	0	0
Developed, Open Space - Low Intensity	0	0	0	0	0	0	0	0	0	0	7.15	1.06	0	0
Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland	3.45	0	3.19	0.31	3.94	0.37	403	0	0	0	0	0	0	0
Great Basin Pinyon-Juniper Woodland	0	0	0	0	0	0	0	0	17.4	1.28	0	0	0	0
Great Basin Xeric Mixed Sagebrush Shrubland	0	0	0	0	0	0	0	0	317	44.2	51.6	2.49	288	34.4
Inter-Mountain Basins Active and Stabilized Dune	12.5	6.53	6.28	4.46	3.65	2.26	4.55	2.95	0.12	0	8.84	0	8.84	0
Inter-Mountain Basins Big Sagebrush Shrubland	0	0	0	0	0.65	0	0.70	0	668	74.5	346	39	724	74.2
Inter-Mountain Basins Cliff and Canyon	0	0	0	0	0	0	0.22	0	0	0	0	0	0	0
Inter-Mountain Basins Greasewood Flat	102.9	43.8	54.6	20.45	54.02	18.2	52.8	17.6	216	15.3	1,420	83.6	1,370	81.4
Inter-Mountain Basins Mixed Salt Desert Scrub	545	255	745	450.3	1,077	537	1,107	578	5,750	598	5,830	439	6,880	513
Inter-Mountain Basins Playa	3.79	1.59	0	0	0	0	0.36	0.29	707.7	51.3	232	17.8	232	17.8
Inter-Mountain Basins Semi-Desert Grassland	0	0	0.48	0.69	0.80	0.30	1.36	0.36	0	0	0	0	0	0
Inter-Mountain Basins Semi-Desert Shrub Steppe	0	0	0	0	6.91	4.25	8.68	5.87	83.5	8.66	112	8.09	97.5	8.24
Invasive Annual and Biennial Forbland	0	0	0	0	0.11	0	0	0	0	0	0	0	0	0
Invasive Annual Grassland	0	0	0	0	7.01	0	7.01	0	0	0	0	0	0	0
Mojave Mid-Elevation Mixed Desert Scrub	0	0	0	0	0	0	0	0	0	0	1.91	0.52	1.91	0.52
Totals[c]	667.26	306.6	809.2	476.21	1,154.09	561.97	1,186.71	604.65	7,810.28	797.5	8,015.2	592.14	9,602.25	729.56

Table 4-215. Short-term and long-term impacts to land-cover types[a] by alternative segment (page 2 of 2).

Land-cover type	Area covered by alternative segment (acres)[b]							
	Bonnie Claire alternative segments				Oasis Valley alternative segments			
	BC2		BC3		OV1		OV3	
	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts
Great Basin Pinyon-Juniper Woodland	0	0	0	0	0	0	0	0
Great Basin Xeric Mixed Sagebrush Shrubland	1.64	0	0	0	0	0	0	0
Inter-Mountain Basins Big Sagebrush Shrubland	71.30	5.32	11.2	0.79	0	0	0	0
Inter-Mountain Basins Mixed Salt Desert Scrub	461	49.8	419	35.6	0	0	0	0
Inter-Mountain Basins Playa	0	0	1.72	0.03	0	0	0	0
Inter-Mountain Basins Semi-Desert Shrub Steppe	148	13.9	231	17.1	30	5.40	28.2	5.70
Mojave Mid-Elevation Mixed Desert Scrub	442	36.5	320.06	32	22.6	3.48	4.26	0.64
North American Warm Desert Lower Montane Riparian Woodland and Shrubland	0	0	0	0	0	0	4.67	0
North American Warm Desert Playa	0	0	0	0	33.9	4.72	9.07	2.46
Sonora-Mojave Creosotebush-White Bursage Desert Scrub	198	13.2	373	33	506.8	5.46	710.4	77
Sonora-Mojave Mixed Salt Desert Scrub	74.4	6.13	25.4	2.21	55.03	7.39	219	21.6
Totals	1,396.34	124.85	1,381.38	120.73	648.43	75.59	975.6	107.38

a. Source: DIRS 174324-NatureServe 2004, all.
b. To convert acres to square kilometers, multiply by 0.0040469.
c. Totals might differ from sum of values due to rounding.

Table 4-216. Short-term and long-term impacts to land-cover types[a] by quarry.

Land-cover type	Area covered by quarry (acres)[b]									
	Garfield Hills		Gabbs Range		North Clayton		ES-7		Malpais Mesa	
	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts
Great Basin Xeric Mixed Sagebrush Shrubland	0	0	0	0	6.74	25.3	32.3	83.5	39.8	34
Inter-Mountain Basins Big Sagebrush Shrubland	0.56	0.01	0	0	8.99	69.5	34	135	64.3	287
Inter-Mountain Basins Mixed Salt Desert Scrub	96.7	245	74.5	164	75.3	235	9.11	58.1	29.3	180.1
Inter-Mountain Basins Semi-Desert Shrub Steppe	0	0	0.27	0.61	4.82	13.7	0	4.16	0.99	15.9
Totals[c]	97.3	245	74.6	164	95.9	344	75.4	281	134	517

a. Source: DIRS 174324-NatureServe 2004, all.
b. To convert acres to square kilometers, multiply by 0.0040469.
c. Totals might differ from sum of values due to rounding.

Table 4-217. Short-term and long-term impacts to land-cover types[a] by facility.

Land-cover type	Area covered by facility (acres)[b]							
	Staging Yard at Hawthorne		Klondike option Maintenance of Way Facility		Silver Peak option Maintenance of Way Facility		Rail Equipment Maintenance Yard	
	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts
Great Basin Xeric Mixed Sagebrush Shrubland	0	0	0	0	0	0	0	0
Inter-Mountain Basins Active and Stabilized Dune	0	0.45	0	0	0.08	0	0	0
Inter-Mountain Basins Greasewood Flat	3.05	3.05	67.4	6.24	4.49	0.29	0	0
Inter-Mountain Basins Mixed Salt Desert Scrub	261	65.9	83.5	3.16	16	1.01	0	0
Inter-Mountain Basins Playa	0	0	0	0	147	12.2	0	0
Inter-Mountain Basins Semi-Desert Grassland	0	0	0	0	0	0	0	0
Inter-Mountain Basins Semi-Desert Shrub Steppe	0	0	2.04	0	0	0	24.2	9.62
Mojave Mid-Elevation Mixed Desert Scrub	0	0	0	0	0	0	14.4	3.66
Sonora-Mojave Creosotebush-White Bursage Desert Scrub	0	0	0	0	0	0	108.4	60.01
Sonora-Mojave Mixed Salt Desert Scrub	0	0	0	0	0	0	2.72	1.72
Totals[c]	264	66.4	152.94	9.4	167.57	13.5	149.72	75.01

a. Source: DIRS 174324-NatureServe 2004, all.
b. To convert acres to square kilometers, multiply by 0.0040469.
c. Totals might differ from sum of values due to rounding.

Areas where there could be short-term impacts to vegetation include the area from the outer edge of the construction right-of-way to the toe of slope of the rail roadbed, construction camps, and material laydown areas. Disturbance to vegetation associated with these areas would result in relatively small impacts compared to the amount of available specific land-cover types within the Great Basin and Mojave Deserts. Impacts in the area between the outer edge of the roadbed footprint and the outer edge of the construction right-of-way would be short term because DOE would implement best management practices. These practices would minimize disturbance and promote effective restoration efforts, including stockpiling and replacing topsoil, reseeding of native species, monitoring for success, and in most cases the eventual return of a native vegetation community.

Areas where there could be long-term impacts include the rail line construction right-of-way and the footprints of facilities. The amount of vegetation loss under the rail line and facility footprints would be relatively small compared to the amount of available specific land-cover types within the Great Basin and Mojave Deserts. The removal of vegetation for the rail line would be linear and for part of its length, would be adjacent to an existing state highway and other roadways. Therefore, impacts related to fragmentation of vegetation communities would be relatively small and would not be expected to disrupt the dispersal of seeds across the rail bed.

Wildfire can have impacts on biological resources and livestock habitat outside of the construction right-of-way depending on the plants, plant communities, and/or wildlife species, including domestic animals. Plan response varies with fire severity, plant growth stage, season, climate, site history, successional status, site characteristics, and many other factors. Wildlife species in turn are differently affected by floristic changes brought on by fire. Some wildfires are a necessity for those fire-dependent plant species and are a part of the ecosystem process. Human-caused fires can also have those types of effects but generally are considered to have adverse effects on species in these arid ecosystems due to timing and/or size. For the purpose of this analysis, wildfire effects would be considered a natural event and have both beneficial and adverse impacts on plant species, and in turn, wildlife species and domestic animals, including horses and burros. The potential for human-caused fires is difficult to describe but is estimated to be small based on mitigation measures described in Chapter 7, Table 7-1, which includes control of brush and weeds along the rail roadbed, monitoring to identify overheated wheel bearings, and development of water sources at sidings to assist in the control and minimization of human-caused fires.

Clearing vegetation and disturbing soil during construction activities could create habitat suitable for potential colonization by ***noxious weeds*** and invasive plant species. In addition, linear disturbances such as the rail line and access roads that cross relatively undisturbed regions have the potential to increase the spread of noxious weeds and invasive plant species, with the increase in traffic or human activity. If noxious weeds and invasive species were to become established along the rail alignment, they could spread to adjacent areas and affect intact plant communities beyond the initial area of disturbance.

DOE would implement best management practices during and after the construction phase to prevent the establishment of noxious weeds and invasive species. Such practices would include limiting the grading of surfaces and surface disturbance to the immediate area of construction; planting stockpiles of topsoil retained for more than a year; establishing staging areas in previously disturbed areas when practicable; applying approved herbicides; and revegetating disturbed areas not needed for the operations phase (see Chapter 7). As a result, potential impacts from the spread of noxious weeds and invasive species would be minimized or avoided, and would be small.

Additionally, the watering of land surfaces during construction activities for such purposes as soil stabilization, ballast cleaning, vehicle washing, and dust suppression could encourage the growth of noxious weeds and invasive species. However, watering would primarily occur on road surfaces where weeds would not become established. DOE would implement best management practices to limit the watering of land surfaces to the extent practicable (see Chapter 7). Short-term impacts from introduction and spread of noxious weeds and invasive species would be very small during the construction phase; long-term impacts would be small over the entire length of the rail alignment.

4.3.7.2.1.2 Wildlife. Potential impacts to wildlife during the construction phase would consist of the loss of suitable habitat (land-cover types), disturbance to habitat, displacement of or limited access to important year-round or seasonal habitat during the construction phase, change in movement patterns, and the potential increase in the risk of wildlife collisions with vehicles along access roads. Reduced vegetation could limit forage for wildlife, such as big game or bird species, and could reduce or limit habitat for ground-dwelling mammals in the area. These impacts are reported as direct short- or long-term losses of land-cover types or habitat. To reduce redundancy, direct impacts from habitat disturbance and displacement and changes in wildlife movement and potential collisions with trains and automobiles are described in segment- and facility-specific sections. Wildlife collisions with trains would be minimal over most of the alignment due to the amount of sight distance, low speeds of trains, and area for escape beside the tracks.

Wildlife species that use underground habitats and were present within the construction right-of-way could be crushed or smothered during rail line construction. However, DOE would implement best management practices (such as conducting clearance surveys for the presence of sensitive species and their habitat) before and during the construction phase to minimize adverse impacts to wildlife. The more mobile wildlife species, such as kit fox, bobcats, badgers, mountain lions, and rabbits, would be less likely to incur mortality, as they would be able to avoid the construction area, resulting in a short-term impact to these species due displacement or avoidance of the area.

Cuts into steep hillsides, depending on design, could encourage wildlife to congregate in the cut areas, resulting in a potential increase of collisions with trains and possible fatalities. Access roads adjacent to the rail line would allow animals to move off the tracks to avoid oncoming trains. Therefore, the potential for mortality of animals congregating in cut areas would be small. Additionally, sight distance and the slow speeds of the trains would help minimize potential collisions. Cuts would also have the potential to slightly disrupt movement patterns of some wildlife species. However, this impact would be small because animals would be able to travel around cuts to move up or down the hillsides.

Construction of additional access roads and the improvement of existing access roads could increase traffic during the construction phase and in the short term could increase wildlife fatalities from vehicle collisions and potentially disturb wildlife habitat from the increase in off-road vehicle traffic. However, the degree and magnitude of impacts would be species-specific and would depend on the existing habitat range of the species.

The generation of ***solid waste*** at construction camps could increase the occurrence of coyotes and ravens, indirectly increasing the death rate of the prey of these two species. As part of the worker education program, all personnel would be trained on the proper way to dispose of waste. Therefore, this potential indirect impact would be small.

Draw-down of ground-fed springs and seeps and the consequent reduction in associated riparian habitat due to the use of groundwater during construction activities could indirectly impact wildlife species that depend on riparian habitat. However, DOE has proposed the placement of wells such that there should be no impact to groundwater from the use of the wells during the construction phase. (See Sections 3.3.6 and 4.3.6, Groundwater Resources, for the analysis of wells and groundwater use.) There could be impacts to aquatic species in streams and springs in the construction area due to sedimentation and erosion, but such impacts would be small because DOE would implement best management practices to prevent sedimentation and erosion throughout the construction phase (see Chapter 7).

The Migratory Bird Treaty Act (16 U.S.C. 703 through 712) protects migratory birds, their eggs, and occupied nests, but it does not protect their habitat. Therefore, long-term impacts to migratory bird species as a result of the proposed project could result from loss of suitable nesting and foraging habitat where large amounts of vegetation (for example, junipers and pinyon pines) are removed or where rock outcrops or cliffs are disturbed for construction purposes (see Appendix H, Table H-4 for a list of all bird species that could occur in construction right-of-way). Short-term impacts could include birds avoiding the area during construction activities. However, to avoid or minimize adverse impacts to migratory birds during the construction phase, DOE would implement best management practices, including minimizing groundbreaking activities in nesting habitat during the critical nesting period, which the BLM defines as May 1 through July 15 (see Chapter 7). If groundbreaking or land-clearing activities had to be conducted during the bird nesting season, DOE would conduct surveys for the nests of migratory birds before beginning those activities. All activities that would harm nesting birds or result in nest abandonment would be prohibited.

4.3.7.2.1.3 Special Status Species. A review of the Nevada Natural Heritage Program database for the 16-kilometer (10-mile)-wide study area, which extends 8 kilometers (5 miles) on either side of the centerline of the rail alignment (see Section 3.3.7.1.2), documented 54 special status species that have the potential to occur within the study area. Potential impacts to special status wildlife species would include loss of and disturbance to potential foraging and nesting habitat, avoidance of the area that could change movement patterns, and disturbance from the increase of noise.

The loggerhead shrike is known to occur along the entire Mina rail alignment where suitable habitat is present. There could be small, short-term impacts to this species from increased human activity and noise during construction of sidings along existing rail line and construction of new rail line. Loggerhead shrikes occupy a wide range of habitat; therefore, there would be no long-term impacts to the population or viability of this species.

The western burrowing owl potentially occurs along the entire Mina rail alignment where suitable habitat is present. There could be small, short-term impacts to this species from increased human activity and noise during construction of sidings along existing rail line and construction of new rail line. Burrowing owls occupy a wide range of habitat; therefore, there would be no long-term impacts to the population or viability of this species.

It is possible that some individual cacti and yucca plants would be removed during the construction phase, resulting in a small impact to individual plants. However, construction activities would not threaten cacti or yucca populations.

4.3.7.2.1.4 State of Nevada Game Species. The rail line would cross areas recognized by the BLM and the Nevada Department of Wildlife as habitat for game species (see Figures 3-221 through 3-223). Direct impacts to game species during rail line construction would include loss of foraging habitat, disturbance from noise, potential fatality from collisions with trains, and a short-term avoidance of year-round or seasonal habitat, migratory corridors, and water sources during construction activities. Because of the relatively low density of game animals in the study area, their mobility, and the presence of humans and machines, such impacts would be small. Potential impacts to game species would be greatest in the areas under active construction. After sections of the rail line were completed, potential impacts would be related to trains crossing the area to move workers and materials to active construction locations. It is possible that individual game animals could collide with moving trains and be injured or killed. However, the likelihood of such collisions would be low, because most game animals would likely avoid oncoming trains whenever possible.

During rail line construction there would be a potential for short-term impacts from the potential for disruption of movement patterns of game species within an area or along migratory corridors, which could disturb individuals or groups of animals and cause animals to avoid the construction areas. Game species are large, mobile animals and would be able to avoid contact with humans at construction sites and would likely move temporarily to other areas during construction activities. These changes in movement or habitat-use patterns would affect relatively low numbers of individuals at any one time; therefore, changes in utilization of the water or forage resources in the region would be small.

There could be direct impacts to the various game populations if animals avoid water sources close to construction activities. Water sources are found only along certain portions of the Mina rail alignment and there could be small, short-term impacts to individuals and groups of animals if they are unable to reach those water sources. There would be no impact on the overall populations of State of Nevada game species due to avoidance of adjacent water resources during construction. Other potential impacts to State of Nevada game species would be similar to those described for wildlife, and would be small.

4.3.7.2.1.5 Wild Horses and Burros. This section identifies the magnitude of potential adverse impacts to wild horses and burros due to potential displacement and loss of their habitat or vegetation for grazing.

Construction activities within herd management areas would result in a long-term loss of forage, potential for collisions with trains, the short-term loss of year-round or seasonal habitat, and the potential to disrupt wild horse and burro movement patterns. Appendix H describes specific herd management areas that could be affected during the construction phase.

The removal of vegetation during the construction phase would result in a long-term loss of potential forage for wild horses and burros. However, the amount of vegetation permanently removed in the rail line, facility, and quarry footprints would be relatively small compared to the available forage within the affected herd management area. Vegetation removal would likely result in an overall small impact to the associated herd management area. Tables in segment- and facility-specific sections list the potential loss of forage due to construction of the proposed railroad.

The potential changes in movement or habitat-use patterns would affect relatively low numbers of individuals at any one time due to the localized nature of the construction; therefore, changes in utilization of the water or forage resources in the region would be small. Generally, wild horses and burros avoid contact with humans and therefore would likely move temporarily to other areas during construction activities. DOE would also minimize impacts to herd management areas by fencing off temporary ponds or reservoirs that are used during construction activities to prevent herds from utilizing those water sources, which could otherwise change herd movement patterns. The loss of potential forage and habitat and the temporary short-term loss of access due to construction activities and noise would be similar for each affected herd management area.

4.3.7.2.2 Segment-Specific Construction Impacts

Sections 4.3.7.2.2.1 through 4.3.7.2.2.20 describe potential short- and long-term direct impacts to biological resources from the construction of specific alternative segments and common segments, quarries, and facilities along the Mina rail alignment. The discussion in Section 4.3.7.2.1 for the impacts to biological resources common to all of the segments is not repeated. Rather, tables provide information necessary to report direct impacts to the specific biological resources associated with each alternative segment, common segment, quarry, and facility. Where DOE would utilize existing rail lines, a brief discussion of the impacts is provided; any operations impacts are reported in Section 4.3.7.2.3.

4.3.7.2.2.1 Union Pacific Railroad Hazen Branchline (Hazen to Wabuska), Existing Rail Line. DOE would not perform any ground-disturbing activities along this portion of the Mina rail alignment. Therefore, there would be no construction-related impacts to biological resources along this existing rail line. (See Section 4.3.7.2.3 for a description of potential impacts during the operations phase.)

4.3.7.2.2.2 Department of Defense Branchline North (Wabuska to the Boundary of the Walker River Paiute Reservation), Existing Rail Line. This segment is an existing rail line that connects to the Union Pacific Railroad Hazen Branchline just east of Wabuska and would connect to one of the Schurz alternative segments near the Walker River. DOE would construct a siding within the construction right-of-way of this existing rail line, which would result in some small, short-term, construction-related impacts.

Special Status Species

Threatened and Endangered Species: There are no federally threatened, endangered, candidate, or proposed species known to occur within the study area of the Department of Defense Branchline North; therefore, there would be no impact.

BLM- and State of Nevada-Designated Sensitive/Protected Species: There are no species that are known to occur within the study area of the Department of Defense Branchline South, except the loggerhead shrike and western burrowing owl, which potentially occur within the study area of the entire Mina rail alignment. These potential impacts would be small and short term due to avoidance of the area during construction of the siding. However, the area has been previously disturbed and these species do not likely nest within the footprint of the siding; therefore, there would be no loss of habitat.

State of Nevada Game Species The existing rail line occurs within designated yearlong habitat for both mule deer and pronghorn antelope. Potential impacts would be small and short term due to temporary avoidance of the area during the construction of the siding. Any potential impacts from operation of the rail line are discussed in Section 4.3.7.2.3.

Wild Horses and Burros There are no designated herd management areas that occur within the study area of the Department of Defense Branchline North. Therefore, there would be no impacts on wild horses and burros as a result of construction of the siding.

Table 4-218 summarizes potential impacts to biological resources that have the potential to occur within or near the existing Department of Defense Branchline North. Section 4.3.7.2.3 describes potential impacts during the operations phase.

4.3.7.2.2.3 Schurz Alternative Segments, Rail Line Construction.

Vegetation The Schurz alternative segments, located primarily on the Walker River Paiute Reservation, would pass through several land-cover types. The dominant land-cover type that would be affected along all the Schurz alternative segments would be Inter-Mountain Basins Mixed Salt Desert Scrub, followed by Inter-Mountain Basins Greasewood Flat. Playas and sand dunes are common in this area, and some would likely be affected by the Schurz alternative segments. Sites of this type, depending on annual precipitation levels, support special status plants such as the dune sunflower, oryctes, and Wassuk beardtongue. However, the areas through which the alternative segments would pass are disturbed and occupied (in some areas dominated) by noxious and invasive weeds such as halogeton *(Halogeton glomeratus),* Russian thistle *(Salsola kali),* and cheatgrass *(Bromus tectorum*). The extent of noxious and invasive weed colonizations in these areas makes it unlikely that special plant species would be present.

Table 4-218. Summary of potential impacts to biological resources from constructing a siding along Department of Defense Branchline North.

Resource/impact type	Extent of impact
Wildlife	
Noise and human activity	Small impact
Special status species	
Threatened and endangered species and habitat	No species or habitat present
BLM- and State of Nevada-designated sensitive/protected species	
Loggerhead shrike (*Lanius ludovicianus*)	Small impact due to avoidance
Western burrowing owl (*Athenes cunicularia*)	Small impact due to avoidance
State of Nevada game species	
Pronghorn antelope	Small impact due to avoidance
Mule deer	Small impact due to avoidance
Wild horses and burros	No impact

However, potential suitable habitat for special status plant species could be affected during construction along any of the Schurz alternative segments.

Schurz alternative segment 1 would result in a long-term impact to 1.03 square kilometers (255 acres) of Inter-Mountain Basins Mixed Salt Desert Scrub and 0.18 square kilometer (44 acres) of Inter-Mountain Basins Greasewood Flat (see Table 4-215). The overall impact from the loss of this vegetation would be small because these are the predominant land-cover types and are abundant in the region.

Schurz alternative segment 4 would result in a long-term impact to 1.82 square kilometers (450 acres) of Inter-Mountain Basins Mixed Salt Desert Scrub and 0.08 square kilometer (20 acres) of Inter-Mountain Basins Greasewood Flat (see Table 4-215). The impact from the loss of this vegetation would be small because these are the predominant land-cover types and are abundant in the region.

Schurz alternative segment 5 would pass on the south side of the Terrill Mountains and to the north of the Calico Hills through a narrow valley. There would be a long-term impact to 2.17 square kilometers (537 acres) of Inter-Mountain Basins Mixed Salt Desert Scrub and 0.07 square kilometer (18 acres) of Inter-Mountain Basins Greasewood Flat (see Table 4-215). This would result in an overall small impact, if any, to the land-cover types given the current condition of the affected vegetative communities and the relatively small percentage of these land-cover types that would be affected within the Nellis mapping zone.

Schurz alternative segment 6 would result in a long-term impact to 2.34 square kilometers (578 acres) of Inter-Mountain Basins Mixed Salt Desert Scrub and 0.07 square kilometer (17 acres) of Inter-Mountain Basins Greasewood Flat (see Table 4-215). This alternative segment would pass on the northwest side of the Terrill Mountains, which also supports some scattered patches of winterfat communities. Potential impacts from the loss of this vegetation would be small to moderate due to the quality and value of the plant communities in that area.

Schurz alternative segments 1, 4, 5, 6, and a bridge over the Walker River could affect riparian and wetland vegetation communities. Schurz alternative segments 1 and 4 would run parallel to the Walker River for about 10 kilometers (6 miles) and would cause a long-term impact to less than 0.01 square kilometer (about 0.31 acre) of Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland and would temporarily impact another 0.03 kilometers (6.6 acres [see Table 4-215]). DOE would use best management practices, comply with the requirements of the Clean Water Act, and reduce the construction footprint to as little as 8 to 20 meters (6 to 65 feet) within identified wetlands to minimize adverse impacts to riparian habitat. Rail line construction would not alter the natural flow or stream channel of the Walker River.

Wildlife Because of the potential impacts to riparian and wetland habitats described above, Schurz alternative segments 1 and 4 could result in direct impacts to various wildlife populations if wildlife avoided riparian or aquatic habitats close to construction activities. Most of the impact would be short term (see Table 4-215) because construction would not alter the natural flow or stream channel characteristics of the Walker River. These potential impacts would be small. Other impacts to wildlife species would be similar to those described in Section 4.3.7.2.1.2.

Special Status Species

Threatened and Endangered Species: The Lahontan cutthroat trout has been documented in the Walker River downstream of the Weber Dam and in areas outside the rail line construction right-of-way. The species has been absent from areas upstream from the dam because it obstructs their seasonal migration. There is suitable habitat for Lahontan cutthroat trout upstream of the Weber Dam, which would be within the construction right-of-way for all of the Schurz alternative segments where they would cross the Walker River. However, the species has been absent from this area for years because the dam obstructs upstream seasonal migration. Weber Dam is currently being renovated and will include a fish ladder that will enable Lahontan cutthroat trout to migrate north of the dam. Should this species return to the area upstream of the Weber Dam, there would be direct impacts to this threatened fish as a result of bridge construction across the Walker River. Short-term impacts would include pile-driving, the presence of timber mats in parts of the stream, and in-water work. This would cause turbidity and sedimentation downstream where potential Lahontan trout would migrate if the new fish ladder was in operation. DOE would apply appropriate best management practices and timing restrictions to minimize impacts to any Lahontan trout during bridge construction. These impacts would be small and short term, and Lahontan cutthroat trout would be expected to recover within 3 years after the end of construction activities.

There is potential marginal foraging and roosting habitat for the southwestern willow flycatcher within the construction right-of-way along Schurz alternative segments 1 and 4 where they would parallel the Walker River. No occurrences of this species have been documented within the study area for these segments, but there is marginal habitat within the construction right-of-way. There would be direct impacts to the willow flycatcher due to the restriction of the habitat. There could be direct impacts in the form of noise disturbances to transient southwestern willow flycatchers during construction activities if the birds used habitat within the vicinity of active construction areas. Any noise disturbance impacts would be small given that there are no recorded occurrences for the southwestern willow flycatcher within the construction right-of-way for any of the Schurz alternative segments.

Habitat for the western yellow-billed cuckoo, a ***candidate species***, is similar to the habitat of the southwestern willow flycatcher. Potentially suitable habitat for this species is present along Schurz alternative segments 1 and 4 where they would parallel the Walker River. However, there are no documented occurrences of the western yellow-billed cuckoo within the construction right-of-way for any of the Schurz alternative segments. Therefore, there would be no direct impacts to the western yellow-billed cuckoo due to the destruction of habitat. There could be direct impacts in the form of noise disturbances to migratory western yellow-billed cuckoos during construction activities if the birds used habitat in the vicinity of active construction areas. However, these impacts would be small given that there are no recorded occurrences of the western yellow-billed cuckoo within the construction right-of-way for any of the Schurz alternative segments.

Potentially suitable nesting or winter roosting habitat for the bald eagle is present within the study area for Schurz alternative segments 1 and 4 where they would parallel the Walker River. However, there are no documented nest sites within the construction right-of-way of the Schurz alternative segments. Areas up and down river of Weber Dam, which is approximately 0.8 kilometer (0.5 mile) west of the Schurz alternative segments, have been reported to provide winter habitat for this species (DIRS 182302-Miller Ecological Consultants 2005, p. 3-35). If wintering or migrating eagles were in the area during construction activities, increased noise and human activity would likely deter them from using the area or would cause them to leave the area of disturbance. Any noise impacts are expected to be small and short term, and would not affect the population of bald eagles in Nevada because this species does not nest or roost in the study area.

BLM- and State of Nevada-Designated Sensitive/Protected Species: The western burrowing owl potentially occurs along the entire Mina rail alignment where suitable habitat is present. However, no burrowing owl nests have been documented within the study area. Potential impacts to this species from construction of the Schurz alternative segments would result from burrows used by nesting owls being covered over or collapsing during rail line construction. Burrowing owls occupy a wide range of habitat; therefore, any potential impact would be small and short term.

White-faced ibis have been observed in the study area of Schurz alternative segments 1 and 4 below the Weber Dam on the Walker River. There could be direct impacts in the form of noise disturbances to white-faced ibis during construction activities if the birds used habitat in the vicinity during these activities. However, these impacts would be small given that there are no recorded occurrences of the ibis within the construction right-of-way for any of the Schurz alternative segments.

Swainson’s hawks have been reported flying and roosting in the area around Weber Reservoir and Weber Dam (DIRS 182302-Miller Ecological Consultants 2005, p. 3-31) outside of the construction right-of-way of the Schurz alternative segments. No evidence of nesting was reported. There could be direct impacts in the form of noise disturbances to Swainson’s hawks during construction activities if the birds used habitat in the vicinity of active construction areas. However, these impacts would be small and short term given that this species would only be present as a transient and there are no recorded occurrences of the Swainson’s hawk within the construction right-of-way for any of the Schurz alternative segments.

The loggerhead shrike is known to occur along the entire Mina rail alignment where suitable habitat is present. However, nest sites for this species have not been documented within the study area or construction right-of-way of the Schurz alternative segments. There could be direct impacts to this species as a result of increased noise and human activity or long-term removal of suitable habitat during construction of the Schurz alternative segments. These impacts would be small and short term. Loggerhead shrikes occupy a wide range of habitat; therefore, there would be no long-term impacts to the population or viability of this species.

The river otter might occur in the Walker River or Weber Reservoir. There could be direct impacts to this species as a result of increased noise and human activity during rail line construction. These impacts would be small and short term given that there are no reported occurrences of this species in the construction right-of-way and DOE does not expect to alter aquatic habitats.

There could be potential impacts to several bat species, listed in Table 3-133, during rail line construction as a result of a temporary increase of noise and human activity. However, these impacts would be small and short term. No bats have been documented roosting within the construction right-of-way of the Schurz alternative segments.

Wassuk beardtongue has been observed on the east side of the Wassuk Range, but the Walker River and U.S. Highway 95 would be between the rail line and this population; thus, there would be no impact on this species' population.

The nearest population of oryctes is approximately 1.4 kilometers (0.8 mile) east of the southern terminus of Department of Defense Branchline South; there would be a small impact, if any, to this species' population due to the potential loss of individual plants and suitable habitat during construction.

The dune sunflower has been observed 1.8 kilometers (1.1 miles) north of Schurz alternative segment 6, near U.S. Highway 95. However, impacts to suitable habitat would not be likely; therefore, there would be no impact on this species as result of construction of Schurz alternative segment 6. There is a documented occurrence of the dune sunflower about 0.8 kilometer (0.5 mile) from Schurz alternative segment 1. Potential habitat could be adversely affected, resulting in a small impact from construction of Schurz alternative segment 1; however, there would likely be no impact to occupied habitat.

There is potential habitat for Cima milkvetch in the Calico Hills and Terrill Mountains. This species typically occurs on slopes. Because the rail line would be constructed in the valley, impacts to this species would not be likely.

State of Nevada Game Species The Schurz alternative segments would not cross any documented game habitat.

Wild Horses and Burros The Horse Mountain Herd Management Area would be north of and adjacent to Schurz alternative segment 6. There are currently no wild horses or burros within this herd management area due to recent modifications in the primary water source once used by herds (DIRS 181843-Westover 2007, all). Therefore, there would be no impacts to wild horses and burros.

Table 4-219 summarizes potential impacts to biological resources that have the potential to occur within or near the Schurz alternative segments. Section 4.3.7.2.3 describes impacts during the railroad operations phase.

4.3.7.2.2.4 Department of Defense Branchline South (end of Schurz Alternative Segments to Mina Common Segment 1). This existing rail line would connect the Schurz alternative segments with Mina common segment 1. DOE would construct a siding along this existing branchline within the existing right-of-way, which would result in some small, short-term, construction-related impacts. However, most impacts would be a result of railroad operations and are described in Section 4.3.7.2.3.

Vegetation There would be no construction impacts to vegetation associated with this existing rail line. Operations impacts are described in Section 4.3.7.2.3.1.

Wildlife There would be direct impacts to various wildlife populations if wildlife avoided the area close to construction activities. These potential impacts would be small and short term, because the area has been previously disturbed and the surrounding habitat provides habitat primarily for a suite of disturbance-tolerant species. Other impacts to wildlife species would be similar to those described in Section 4.3.7.2.1.2. Operations impacts are described in Section 4.3.7.2.3.2.

Special Status Species There would be no construction impacts to special status plants, because none are documented to occur in the construction right-of-way.

Table 4-219. Summary of potential impacts to biological resources from rail line construction along the Schurz alternative segments.

Resource/impact type	Extent of impact, Schurz 1	Extent of impact, Schurz 4	Extent of impact, Schurz 5	Extent of impact, Schurz 6
Wildlife				
Loss of vegetation or land-cover type (long term)	306.6 acres[a]	476 acres	562 acres	604.7 acres
Construction-related disturbance to vegetation or land-cover type (short term)	667 acres	809.8 acres	1,150 acres	1190 acres
Loss of riparian and water-related habitats (long term)[b]	0	0.31 acre	0.37 acre	0
Construction-related disturbance to riparian habitats (short term)[b]	3.45 acres	3.19 acres	3.94 acres	4.03 acres
Wildlife water resources	Small impact	No impact	Small impact	No impact
Special status species				
<u>Threatened and endangered species and habitat</u>				
Lahontan cutthroat trout (*Onchorhynchus clarki henshawi*)	Potential for small impact	Potential for small impact	Potential for small impact	Potential for small impact
Southwestern willow flycatcher (*Empidonax traillii extimus*)	Small impact	Small impact	Small impact	Small impact
Western yellow-billed cuckoo (*Coccyzus americanus occidentalis*)	Small impact	Small impact	Small impact	Small impact
<u>BLM- and State of Nevada-designated sensitive/protected</u>				
Bald eagle	No impact	No impact	No impact	No impact
River otter (*Lontra canadensis*)	No impact	No impact	No impact	No impact
Bat species (see Table 3-133)	Small impact	Small impact	Small impact	Small impact
Western burrowing owl (*Athenes pallidus*)	Small impact	Small impact	Small impact	Small impact
Swainson's hawk (*Buteo swainsoni*)	Small impact	Small impact	Small impact	Small impact
Loggerhead shrike (*Lanius ludovicianus*)	Small impact	Small impact	Small impact	Small impact
Cima milkvetch (*Astragalus cimae* var. *cimae*)	No impact	No impact	No impact	No impact
Dune sunflower (*Helianthus deserticola*)	Small impact	No impact	No impact	No impact
Oryctes (*Oryctes nevadensis*)	Small impact	Small impact	Small impact	No impact
Wassuk beardtongue (*Penstemon rubicundus*)	No impact	No impact	No impact	No impact
State of Nevada game species	No designated game habitat within study area.			
Wild horses and burros	No impact	No impact	No impact	No impact

a. To convert acres to square kilometers, multiply by 0.0040469.
b. Total includes wetlands, seeps, streams, and riparian areas combined; < = less than.

Threatened and Endangered Species: There are no documented occurrences of federally listed plants or wildlife within the construction right-of-way; therefore, there would be no impacts to listed species within or near Department of Defense Branchline South.

BLM- and State of Nevada-Designated Sensitive and Protected Species: The loggerhead shrike is known to occur along the entire Mina rail alignment where suitable habitat is present. Potential impacts to this species from the construction of a siding along this branchline would be small and short term due to noise and the increase in human activity during construction. However, loggerhead shrikes occupy a wide range of habitat; therefore, there would be no long-term impacts to the population or viability of this species.

The western burrowing owl potentially occurs along the entire Mina rail alignment where suitable habitat is present. Potential impacts to this species from the construction of a siding along this branchline would be small and short term due to noise and the increase in human activity during construction. However, burrowing owls occupy a wide range of habitat; therefore, there would be no long-term impact to the population or viability of this species.

Oryctes has previously been found 1.39 kilometers (0.86 mile) from the existing rail line; however, there were no observations of this species during the 2006 survey. No other BLM- or State of Nevada-designated species are documented to occur within the area. There would be no impact to this species as a result of construction of the siding. Any potential impacts to oryctes along Department of Defense Branchline South would occur from operation of the rail line (see Section 4.3.7.2.3.1).

State of Nevada Game Species There would be direct impacts to pronghorn antelope and mule deer if they avoided the area close to construction activities due to temporarily increased noise and visual disturbances. These potential impacts would be small and short term. Operations impacts are described in Section 4.3.7.2.3.4.

Wild Horses and Burros There are no designated herd management areas adjacent to or intersecting Department of Defense Branchline South. Therefore, there would be no impacts to wild horses and burros associated with construction of a siding along this existing rail line.

Table 4-220 summarizes potential impacts to biological resources that have the potential to occur within or near the existing Department of Defense Branchline North.

Table 4-220. Summary of potential impacts to biological resources from constructing a siding along Department of Defense Branchline South.

Resource/impact type	Extent of impact
Wildlife	
Noise and human activity	Small impact
Special status species	
Threatened and endangered species and habitat	No species or habitat present
BLM and State of Nevada-designated sensitive/protected species	
Loggerhead shrike (*Lanius ludovicianus*)	Small impact due to avoidance
Western burrowing owl (*Athenes cunicularia*)	Small impact due to avoidance
Oryctes (*Oryctes nevadensis*)	No impact
State of Nevada game species	
Pronghorn antelope	Small impact due to avoidance
Mule deer	Small impact due to avoidance
Wild horses and burros	No impact

4.3.7.2.2.5 Staging Yard at Hawthorne Facility Construction.

Vegetation Construction of the Staging Yard at Hawthorne would not result in any long-term impacts to vegetation. There would be a short-term impact to 1.06 square kilometers (261 acres) of Inter-Mountain Basins Mixed Salt Desert Scrub and a long-term loss of 0.27 square kilometer (66 acres) of Inter-Mountain Basins Mixed Salt Desert Scrub. The overall impact would be small because most of the land where DOE would construct the Staging Yard is currently disturbed.

Wildlife There would be direct impacts to various wildlife populations if wildlife avoided the area close to construction activities due to temporarily increased noise and human activity or the long-term loss of 0.27 square kilometer (66 acres) of salt desert scrub habitat. These potential impacts would be small and short term, because the area has been previously disturbed and likely supports a disturbance-tolerant wildlife community. Other impacts to wildlife species would be similar to those described in Section 4.3.7.2.1.2. Operations impacts are described in Section 4.3.7.2.3.2.

Special Status Species

Threatened and Endangered Species: There are no documented occurrences of federally listed plants or wildlife within the study area; therefore, there would be no impacts to listed species within or near the Staging Yard at Hawthorne.

BLM- and State of Nevada-Designated Sensitive or Protected Species: Potential impacts to loggerhead shrike and the western burrowing owl would be small and short term due to the loss of potential habitat and potential displacement. Potential occupied and suitable habitat for oryctes could be affected as a result of constructing the Staging Yard. There are no other documented occurrences of BLM- or State of Nevada-designated sensitive or protected species.

State of Nevada Game Species There would be direct impacts to pronghorn antelope if they avoided the area close to construction activities due to temporarily increased noise and visual disturbances. These potential impacts would be small and short term. Operations impacts are described in Section 4.3.7.2.3.4.

Wild Horses and Burros There are no designated herd management areas at or near the proposed Staging Yard location; therefore, there would be no impact to wild horses and burros.

Table 4-221 summarizes potential impacts to biological resources that have the potential to occur within or near the proposed Staging Yard location at Hawthorne.

4.3.7.2.2.6 Mina Common Segment 1, Rail Line Construction.

Vegetation Mina common segment 1 would result in a long-term impact to 2.45 square kilometers (604 acres) of Inter-Mountain Basins Mixed Salt Desert Scrub. This land-cover type is typical of sandy and alkaline soils and is common throughout the Nellis mapping zone. A small amount of Inter-Mountain Basins Greasewood Flat (0.05 square kilometer [12 acres]) and Inter-Mountain Basins Semi-Desert Shrub Steppe vegetation (0.05 square kilometer) would also be affected in the long term. The proposed rail line would parallel U.S. Highway 95 and would be constructed on top of an historic rail roadbed in some areas. Overall impacts to the existing land-cover types would be small because the highway corridor currently fragments the vegetation, and DOE would reduce impacts to vegetation by utilizing the existing historic rail roadbed.

Mina common segment 1 would pass through Soda Spring Valley. This area supports three separate locations of the Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland land-cover type. It is highly unlikely that these land-cover types would be affected by rail line construction along Mina common segment 1, because they are not present within the construction right-of-way. Any potential impact to the associated playas would be short term and occur within the ephemeral washes. DOE would minimize such impacts by incorporating appropriate drainage structures into the engineering design.

Table 4-221. Summary of potential impacts to biological resources from construction of the Staging Yard at Hawthorne.

Resource/impact type	Extent of impacts
Wildlife	
Loss of vegetation or land-cover type (long term)	66.4 acres[a]
Construction-related disturbance to vegetation or land cover type (short term)	264 acres
Loss of riparian and water-related habitats (long term)[b]	0
Construction-related disturbance to riparian habitats (short term)[b]	0
Wildlife water resources	No impact
Special status species	
Threatened and endangered species and habitat	No species or habitat present
BLM- and State of Nevada-designated sensitive/protected species	
Loggerhead shrike (*Lanius ludovicianus*)	Small impact to potential habitat
Western burrowing owl (*Athenes cunicularia*)	Small impact to potential habitat
Oryctes (*Oryctes nevadensis*)	Small impact to suitable habitat
State of Nevada game species	
Pronghorn antelope	Small impact
Wild horses and burros	No impact

a. To convert acres to square kilometers, multiply by 0.0040469.
b. Total includes wetlands, seeps, streams, and riparian areas combined.

Wildlife Construction of Mina common segment 1 would create a long-term impact to 2.61 square kilometers (644 acres) of potential wildlife habitat, predominantly Inter-Mountain Basins Mixed Salt Desert Scrub land-cover type. However, much of the vegetation within this area is already disturbed.

The disturbed habitat is of relatively low value to wildlife because it parallels U.S. 95 and lies adjacent to the Hawthorne Army Depot. Because species that use this habitat are likely disturbance-tolerant, impacts to wildlife from construction of Mina common segment 1 would be small, but long term. The aquatic habitat at Soda Spring is of relatively high value because water is scarce in this part of the study area. Impacts to this habitat are expected to be moderate and long term.

Special Status Species

Threatened and Endangered Species: The Railroad Valley spring fish, a ***threatened species***, has been documented to occur within the springs near Sodaville (Figure 3-212). However, the spring does not

occur within the construction right-of-way; therefore, there would be no impact on this species as a result of construction of Mina common segment 1.

BLM- and State of Nevada-Designated Sensitive or Protected Species: Common loons have been documented to occur on Walker Lake (DIRS 182302-Miller Ecological Consultants 2005, p. 3-32). Large numbers of loons stop at Walker Lake during the spring and fall migration (DIRS 182895-Boise State University 2007, all). Construction activities would not impact Walker Lake; therefore, there would be no impacts to common loons.

The western snowy plover has been documented to occur within the study area near Walker Lake and the Hawthorne Army Depot. Because of the lack of specificity of some Nevada Natural Heritage Program data, it is not clear how close this observation was to the Mina common segment 1 construction right-of-way, but it might have been in the construction right-of-way or as far away as 2.8 kilometers (1.75 miles). This species is not federally listed in this part of its range. There could be direct impacts to the western snowy plover due to the destruction of habitat or the short-term increase of noise and human activity during construction if the birds used habitat in the vicinity during these activities. These impacts could be small and short term to long term depending on the level of use by this species in the construction right-of-way.

The western burrowing owl potentially occurs throughout the entire Mina rail alignment where suitable habitat is present. However, no burrowing owl nests have been documented within the study area. Potential impacts to this species from construction of Mina common segment 1 would result from burrows used by nesting owls being covered over or collapsing during rail line construction. Burrowing owls occupy a wide range of habitat. Therefore, there would be no long-term impacts to the population or viability of this species.

White-faced ibis likely occur at Walker Lake in the Mina common segment 1 study area, although they have not been documented to breed there. There could be direct impacts in the form of noise disturbances to white-faced ibis during construction if the birds used habitat in the vicinity during these activities. However, these impacts would be small given that there are no recorded occurrences of the ibis within the construction right-of-way for Mina common segment 1 and construction would have no effect on Walker Lake.

The loggerhead shrike is known to occur throughout the entire Mina rail alignment where suitable habitat is present. Nest sites for this species have not been documented within the Mina common segment 1 study area or construction right-of-way. There could be direct impacts to this species as a result of increased noise and human activity or long-term removal of suitable habitat during rail line construction along Mina common segment 1. These impacts would be small and short term; 2.61 square kilometers (645 acres) of potentially suitable habitat for this species would be removed. Loggerhead shrikes occupy a wide range of habitat; therefore, there would be no long-term impact to the population or viability of this species.

There could be potential impacts to several bat species, listed in Table 3-133, during rail line construction as a result of temporarily increased noise and human activity. However, these impacts would be small and short term. No bats have been documented nesting or roosting within the Mina common segment construction right-of-way.

Tiehm buckwheat has been found in the vicinity of Mina common segment 1. However, it is highly unlikely individuals or any potential habitat for this species would be affected and there would be no impact.

Sodaville milkvetch is known to occur near Sodaville, 2.5 kilometers (1.5 mile) from Mina common segment 1. It is a water-related species and is likely associated with Soda Spring, which would not be affected by the rail line construction along Mina common segment 1. Therefore, there would be no impacts to this species.

Oryctes has been observed within the Soda Spring Valley north of Mina, 0.5 kilometer (0.3 mile) from Mina common segment 1. Occupied and suitable habitat could be altered or destroyed as a result of rail line construction along Mina common segment 1, resulting in a small impact to the population of this species. The alignment would impact less than 0.01 square kilometer (0.17 acre) of the Inter-Mountain Basins Active and Stabilized Dune land-cover type and would have a small impact on potential habitat for this species. There would be no impact on the viability of the population of this species.

State of Nevada Game Species There would be direct impacts to pronghorn antelope and mule deer if they avoided the area close to construction activities due to temporarily increased noise and visual disturbances. These potential impacts would be small and short term. Operations impacts are described in Section 4.3.7.2.3.4.

Wild Horses and Burros Mina common segment 1 would run adjacent to the Pilot Mountain Herd Management Area (Figure 3-214). The rail line would not intersect designated wild horse and burro habitat, but the increased human activity during construction could cause herds to avoid the low-elevation areas associated with the proposed alignment. Given that the Pilot Mountain Herd Management Area encompasses about 1,937 square kilometers (477,985 acres), there would be small, if any, short-term impacts due to potential avoidance of the area during construction.

Table 4-222 summarizes the potential impacts to biological resources that have the potential to occur within or near Mina common segment 1.

Table 4-222. Summary of potential impacts to biological resources from rail line construction along Mina common segment 1.

Resource/impact type	Extent of impact, Mina common segment 1
Wildlife	
Loss of vegetation or land-cover type (long term)	644 acres[a]
Construction-related disturbance to vegetation or land-cover type (short term)	7,670 acres
Loss of riparian and water-related habitats (long term)[b]	0
Construction-related disturbance to riparian habitats (short term)[b]	0
Wildlife water resources	Small
Special status species	
Threatened and endangered species and habitat	
Railroad Valley springfish (*Crenichthys nevadae*)	No impact
BLM- and State of Nevada-designated sensitive/protected species	
Bat species (see Table 3-133)	Small impact
Common loon (*Gavia immer*)	No impact
Western snowy plover (*Charadrius alexandrinus nivosus*)	Small impact
White-faced ibis (*Plegadis chihi*)	Small impact
Western burrowing owl (*Athenes pallidus*)	Small impact
Loggerhead shrike (*Lanius ludovicianus*)	Small impact
Sodaville milkvetch (*Astragalus lentiginosus var. sesquimetralis*)	No impact
Tiehm buckwheat (*Eriogonum tiehmii*)	No impact
Oryctes (*Oryctes nevadensis*)	Small impact
State of Nevada game species	
Pronghorn antelope	Small impact
Mule deer	Small impact
Wild horses and burros	No impact to small impact

a. To convert acres to square kilometers, multiply by 0.0040469.
b. Total includes wetlands, seeps, streams, and riparian areas combined.

4.3.7.2.2.7 Garfield Hills Quarry, Quarry Construction.

Vegetation The proposed Garfield Hills quarry would result in a long-term impact to 0.99 square kilometer (245 acres) of Inter-Mountain Basins Mixed Salt Desert Scrub. However, this area is sparsely vegetated and the overall impacts on vegetation would be small.

The quarry pit would be constructed within a series of ephemeral washes. There is no riparian vegetation within the washes. However, any ephemeral flows could be altered as a result of construction.

Wildlife Construction of the Garfield Hills quarry would remove approximately 0.99 square kilometer (245 acres) of potential wildlife habitat in the long term, primarily Inter-Mountain Basins Mixed Salt Desert Scrub and a small percentage of Inter-Mountain Basins Big Sagebrush Shrubland. This habitat is sparsely vegetated and likely supports a disturbance-tolerant suite of wildlife species. Therefore, impacts from development of the quarry would be small, but long term.

Special Status Species

Threatened and Endangered Species: There are no documented occurrences of federally listed plants or wildlife within the study area; therefore, there would be no construction impacts to listed species within or near the proposed Garfield Hills quarry. Operations impacts are described in Section 4.3.7.2.3.3.

BLM Special Status and State of Nevada Protected Species: The western burrowing owl potentially occurs throughout the entire Mina rail alignment where suitable habitat is present. However, no burrowing owl nests have been documented within the study area. Potential impacts to this species from construction of a quarry at Garfield Hills would result from burrows used by nesting owls being covered over or collapsing during quarry construction. Burrowing owls occupy a wide range of habitat; therefore, there would be no long-term impact to the population or viability of this species.

The loggerhead shrike is known to occur throughout the entire Mina rail alignment where suitable habitat is present. However, nest sites for this species have not been documented within the quarry footprint. There could be direct impacts to this species as a result of increased noise and human activity or long-term removal of suitable habitat during construction of a quarry at Garfield Hills. These impacts would be small and short term because 0.99 square kilometer (244 acres) of potentially suitable habitat for this species would be removed. Loggerhead shrikes occupy a wide range of habitat; therefore, there would be no long-term impact to the population or viability of this species.

There could be potential impacts to several bat species, listed in Table 3-133, during construction of the proposed quarry as a result of temporarily increased noise and human activity, and long-term removal or modification of potential roosting habitat. However, these impacts would be small and short term. No bats have been documented roosting within the quarry footprint.

There is good potential habitat for Wassuk beardtongue within the series of washes at the potential quarry site. However, the closest recorded occurrence of this species is outside the quarry study area. Therefore, it is unlikely that any individual plants would be affected, and this species has a wide distribution range. Thus, there would be no impacts on this species population.

State of Nevada Game Species There would be no impacts to State of Nevada game species, as the Garfield Hills quarry would not cross any documented game habitat.

Wild Horses and Burros The proposed Garfield Hills quarry does not occur within any designated wild horse and burro management area. The closest herd management area is the Garfield Herd

Management Area to the south approximately 11 kilometers (7 miles). Therefore, there would be no impact to wild horses and burros as a result of the construction and operation of the Garfield Hills quarry.

Table 4-223 summarizes the potential impacts to biological resources that have the potential to occur within or near the proposed quarry. Operations impacts are discussed in Section 4.3.7.2.3.

Table 4-223. Summary of potential impacts to biological resources from construction of a quarry at Garfield Hills.

Resource/impact type	Extent of impact
Wildlife	
Loss of vegetation or land-cover type (long term)	245 acres[a]
Construction-related disturbance to vegetation or land-cover type (short-term)	97.2 acres
Loss of riparian and water-related habitats (long term)[b]	0
Construction-related disturbance to riparian habitats (short term)[b]	0
Wildlife water resources	No impact
Special status species	
Threatened and endangered species and habitat	No species or habitat present
BLM- and State of Nevada-designated sensitive/protected species	
Bat species (see Table 3-133)	Small impact
Western burrowing owl (*Athenes pallidus*)	Small impact
Loggerhead shrike (*Lanius ludovicianus*)	Small impact
Wassuk beardtongue (*Penstemon rubicundus*)	No impact
State of Nevada game species	No designated game habitat within study area of quarry
Wild horses and burros	No impact

a. To convert acres to square kilometers, multiply by 0.0040469.
b. Total includes wetlands, seeps, streams, and riparian areas combined.

4.3.7.2.2.8 Gabbs Range Quarry, Quarry Construction.

Vegetation Construction of the potential Gabbs Range quarry would result in a long-term impact to 0.66 square kilometer (164 acres) of Inter-Mountain Basins Mixed Salt Desert Scrub. There are also some scattered patches of winterfat that occur within and surrounding the proposed site. Potential impacts from the loss of a portion of the Inter-Mountain Basins Mixed Salt Desert Scrub land-cover type would be small. However, the loss of any winterfat community could result in a moderate impact because this vegetative cover is uncommon in the Nellis mapping zone and is considered highly valuable for wildlife.

There is no riparian or water-related vegetation present within the study area of the quarry; therefore, there would be no impact on riparian or water-related vegetation as a result of construction of the quarry site.

Special Status Species

Threatened and Endangered Species: There are no documented occurrences of federally listed plants or wildlife within the study area; therefore, there would be no construction impacts to listed species within or near the potential Gabbs Range quarry.

BLM- and State of Nevada-Designated Sensitive or Protected Species: Potential impacts to the loggerhead shrike and western burrowing owl would be the same as those described in the previous section for the Garfield Hills quarry.

Potential habitat for the Wassuk beardtongue occurs within and near the proposed quarry site; however, there are no known occurrences in the vicinity. There would be no impact on this species.

There could be potential impacts to several bat species, listed in Table 3-133, during construction of the proposed quarry as a result of a temporary increase of noise and human activity, and long-term removal or modification of potential roosting habitat. However, these impacts would be small and short term. No bats have been documented roosting within the quarry footprint.

State of Nevada Game Species There would be direct impacts to pronghorn antelope if they avoided the area close to construction activities due to temporarily increased noise and visual disturbances. These potential impacts would be small and short term because the area has been previously disturbed and provides habitat primarily for a suite of disturbance-tolerant species. Operations impacts are described in Section 4.3.7.2.3.4.

Wild Horses and Burros The potential Gabbs Range quarry site is within the Pilot Mountain Herd Management Area. Any potential impacts to wild horses and burros would be short term as a result of the increase in human activity in the area, which could cause herds to avoid the area during construction and operations activities. The loss of vegetation from quarry construction would not be likely to affect available forage for herds, given that the Pilot Mountain Herd Management Area is relatively large, encompassing 1,937 square kilometers (477,985 acres) of higher-elevation shrub-steppe. There are several ***wildlife guzzlers*** in the area, but most occur northeast to east of the quarry site. The quarry would not interfere with any potential conduits to and from guzzlers within the herd management area.

Table 4-224 summarizes the impacts to biological resources that have the potential to occur within or near the potential quarry site. Operations impacts are described in Section 4.3.7.2.3.

4.3.7.2.2.9 Montezuma Alternative Segments, Rail Line Construction.

Vegetation Several different land-cover types would be affected as a result of the Montezuma alternative segments (Table 4-215).

Construction of Montezuma alternative segment 1 could result in long-term impacts to 2.42 square kilometers (598 acres) of Inter-Mountain Basins Mixed Salt Desert Scrub, 0.21 square kilometer (51 acres) of Inter-Mountain Basins Playa, 0.3 square kilometer (74 acres) of Inter-Mountain Basins Big Sagebrush Shrubland, and 0.18 square kilometer (44 acres) of Great Basin Xeric Mixed Sagebrush Shrubland (see Table 4-215), resulting in a small impact. This segment would parallel U.S. Highway 265 to Silver Peak, then parallel an alkali lake and existing road, which is surrounded by disturbed lands. Therefore, there would be minimal fragmentation of vegetation across the landscape, which would result in an overall small impact. There are also some patches of winterfat communities within the Montezuma Range (below the pinyon-juniper zone). Potential loss of this community type would result in a moderate impact given its infrequency and high value to wildlife within the Nellis mapping zone.

Construction of Montezuma alternative segment 2 could result in a long-term impact to 1.78 square kilometers (439 acres) of Inter-Mountain Basins Mixed Salt Desert Scrub, 0.34 square kilometer (84 acres) of Inter-Mountain Basins Greasewood Flat, and 0.16 square kilometer (39 acres) of Inter-Mountain Basins Big Sagebrush Shrubland (see Table 4-215). The overall impact as a result of construction would be small given the amount of these land-cover types within the Nellis mapping zone.

Table 4-224. Summary of potential impacts to biological resources from construction of the potential Gabbs Range quarry.

Resource/impact type	Extent of impact
Wildlife	
Loss of vegetation or land-cover type (long term)	164 acres[a]
Construction-related disturbance to vegetation or land-cover type (short term)	74.6 acres
Loss of riparian and water-related habitats (long term)[b]	0
Construction-related disturbance to riparian habitats (short term)[b]	0
Wildlife water resources	No impact
Special status species	
Threatened and endangered species and habitat	No species or habitat present
BLM- and State of Nevada-designated sensitive/protected species	
Bat species (see Table 3-133)	Small impact
Western burrowing owl (*Athenes pallidus*)	Small impact
Loggerhead shrike (*Lanius ludovicianus*)	Small impact
Wassuk beardtongue (*Penstemon rubicundus*)	No impact
Greater sage-grouse	Small impact
State of Nevada game species	
Pronghorn antelope	Small impact
Wild horses and burros	Small impact

a. To convert acres to square kilometers, multiply by 0.0040469.
b. Total includes wetlands, seeps, streams, and riparian areas combined.

This portion of the rail alignment would parallel U.S. Highway 95 and would leave the highway corridor, intersect the Montezuma Valley, and follow an abandoned rail roadbed, which would minimize potential adverse impacts from fragmentation. However, there is a large winterfat community in the Montezuma Valley; therefore, the overall impact from the construction of this segment in this area would be moderate due to the loss of vegetative community type.

Construction of Montezuma alternative segment 3 would create a long-term impact to 2.08 square kilometers (513 acres) of Inter-Mountain Basins Mixed Salt Desert Scrub, 0.33 square kilometer (82 acres) of Inter-Mountain Basins Greasewood Flat, 0.90 square kilometer (222 acres) of Inter-Mountain Basins Mixed Salt Desert Scrub, 0.14 square kilometer (35 acres) of Great Basin Xeric Mixed Sagebrush Shrubland, and 0.30 square kilometers (74 acres) of Inter-Mountain Basins Big Sagebrush Shrubland (see Table 4-215). This portion of the rail alignment would parallel U.S. Highway 95 for 35 kilometers (22 miles) and would leave the highway corridor, intersect the Montezuma Valley, and follow an abandoned rail roadbed, which would minimize potential adverse impacts from fragmentation. However, there is a large winterfat community within the Montezuma Valley; therefore, the overall impact from the construction of this segment in this area would be moderate due to the loss of this vegetative community type.

There is no riparian or water-related vegetation present within the study area; therefore, there would be no impact on riparian or water-related vegetation as a result of construction of Montezuma alternative segments 1, 2, and 3.

Special Status Species

Threatened and Endangered Species: There are no threatened, endangered, candidate, or proposed species known to occur within the study area of the Montezuma alternative segments. Therefore, there would be no impact as a result of construction of any of the alternative segments.

BLM- and State of Nevada-Designated Sensitive or Protected Species: There is potentially suitable habitat for the pygmy rabbit within the study area of the Montezuma alternative segments, including Inter-Mountain Basins Mixed Salt Desert Scrub and Inter-Mountain Basins Big Sagebrush Shrubland land-cover types. However, there are no known occurrences of this species within the study area. Construction of Montezuma alternative segments 1, 3, and 5 would result in a small, long-term impact due to the loss of potentially suitable habitat.

Potential long-term impacts to the pale kangaroo mouse and the dark kangaroo mouse would be small and due to the loss of potential suitable habitat from the construction of Montezuma alternative segments 1, 2, and 3. Short-term impacts would result from avoidance of the active construction areas due to the temporary increase in noise and human presence in the area.

The ferruginous hawk has been observed near Montezuma alternative segments 2 and 3. Potential impacts to this species would be small and short term due to the increase in noise and human presence during construction. However, there would be no long-term impact because less than 0.01 square kilometer of pinyon-juniper habitat would be removed for construction of Montezuma alternative segment 1.

Potentially suitable habitat for the northern goshawk is present along Montezuma alternative segments 1 and 3 where they would intersect pinyon-juniper habitat. However, this species has not been documented in the study area. Potential impacts would result from removal of potential nesting or roosting habitat (trees) during rail line construction. However, it is likely that there would be no impact considering the amount of pinyon-juniper that would be removed compared to the amount within the area.

There could be potential impacts to several bat species, listed in Table 3-133, during construction of Montezuma alternative segments 1, 2, and 3 as a result of a temporary increase of noise and human activity and long-term removal or modification of potential roosting or nesting habitat. However, these impacts would be small and short term. No bats have been documented nesting or roosting within the construction right-of-way; however, there is ample suitable habitat for bats within the study area of all alternative segments and it is highly likely that bats occupy the area.

The long-term loss of Inter-Mountain Basins Big Sagebrush Shrubland and Great Basin Xeric Mixed Sagebrush Shrubland could adversely affect sagebrush-dependant species such as Brewer’s sparrow and sage thrasher. Overall impact would be small and short term due to possible displacement, but potential impacts would also be long term due to the loss of habitat.

Eastwood milkweed has been historically observed west of Tonopah about 8 kilometers (5 miles) from Montezuma alternative segments 2 and 3. It is possible that rail line construction could impact occupied and suitable Eastwood milkweed habitat. This would result in an overall small impact to this species due to reduced suitable habitat, potential loss of individuals, and the reduced opportunity for this species to expand its range.

There is potential habitat for Cima milkvetch within the southeast-facing side of the Montezuma Range where there are multi-colored clay hills. Construction of either Montezuma alternative segment 1 or Montezuma alternative segment 3 could result in the loss of some potential habitat; however, there would likely be no impact on this species.

Pahute Mesa beardtongue has been documented within the Montezuma Range 5.5 kilometers (3.4 miles) from Montezuma alternative segments 2 and 3. It is possible that individual plants and suitable habitat for this species would be adversely affected as a result of rail line construction along Montezuma alternative segments 2 and 3. However, the overall impact would be small and would not affect the viability of this species because there is ample suitable habitat in the area.

There is potential habitat for Nevada dune beardtongue near Montezuma alternative segments 2 and 3 along the portion from Blair Junction to Lone Mountain. There are some patches of vegetated dunes along this route. There would likely be no impact on this species because there are no known occurrences in the construction right-of-way and no occurrences in the study area.

State of Nevada Game Species Short-term, direct impacts to pronghorn antelope and mule deer would result due to construction activities and the temporary increased noise and visual disturbance. In addition, there would be a loss of foraging habitat. However, these impacts would be small as a result of constructing all the alternative segments considering these land-cover types relative to the amount within the entire Nellis mapping zone. Montezuma alternative segment 1 would cross some greater sage-grouse habitat. The impact from construction would be small.

Wild Horses and Burros Montezuma alternative segment 1 would run to the east of and adjacent to the Silver Peak Herd Management Area. The Montezuma alternative segments would be within and adjacent to the Montezuma Peak Herd Management Area. Due to current starvation and genetics issues, all horses were removed from the Silver Peak Herd Management Area. Therefore, impacts to wild horses and burros would be negligible.

Table 4-225 summarizes potential impacts to biological resources that have the potential to occur within or near the alternative segments. Operations impacts are described in Section 4.3.7.2.3.5.

4.3.7.2.2.10 Klondike Option - Maintenance-of-Way Facility, Facility Construction.

Impacts to biological resources associated with development of the Klondike option for the Maintenance-of-Way Facility would be similar to those discussed above for Montezuma alternative segments 2 and 3. Refer to Table 4-217 for short-term and long-term impacts to land-cover types from construction of this facility.

4.3.7.2.2.11 North Clayton Quarry, Quarry Construction.

Vegetation Construction of the potential North Clayton quarry would have a long-term impact on 0.95 square kilometer (235 acres) of Inter-Mountain Basins Mixed Salt Desert Scrub and 0.28 square kilometer (69 acres) of Inter-Mountain Basins Big Sagebrush Shrubland.

This land-cover type and its existing good condition in the area of the potential quarry site support wildlife habitat and wild horse and burro habitat. Therefore, the overall impact would be moderate due to the loss of this vegetative cover and fragmentation.

There is no riparian or water-related vegetation present within the study area of the quarry.

Special Status Species

Threatened and Endangered Species: There are no documented occurrences of federally listed plants or wildlife within the study area.

BLM- and State of Nevada-Designated Sensitive or Protected Species: Potentially suitable habitat for the ferruginous hawk may occur within the footprint of the potential quarry. Potential impacts to this species would be small and short term due to the removal of 1.39 square kilometers (343 acres) of potential foraging habitat.

Potentially suitable habitat for the northern goshawk is present along Montezuma alternative segments 1 and 3 where it intersects with Great Basin Pinyon-Juniper Woodland habitat. However, this species has not been documented in the study area. Potential impacts would result from removal of potential foraging habitat during construction of the quarry. This impact would be small because this species is dependent on woodland habitats, which are not within the footprint of the proposed quarry site.

There could be potential impacts to several bat species, listed in Table 3-133, during construction of the quarry as a result of a temporary increase of noise and human activity and long-term removal or modification of potential roosting habitat. However, these impacts would be small and short term. No bats have been documented roosting within the quarry footprint; however, there is ample suitable habitat for bats within the study area and it is highly likely that bats occupy the area.

State of Nevada Game Species There would be short-term, direct impacts to pronghorn antelope and mule deer if they avoided the area close to construction activities due to the temporary increased noise and visual disturbances. In addition, there would be a long-term impact due to a loss of potential

Table 4-225. Summary of potential impacts to biological resources from rail line construction along the Montezuma alternative segments (page 1 of 2).

Resource/impact type	Extent of impact, Montezuma 1	Extent of impact, Montezuma 2	Extent of impact, Montezuma 3
Wildlife			
Loss of vegetation or land-cover type (long term)	797 acres[a]	592 acres	731 acres
Construction-related disturbance to vegetation or land-cover type (short term)	7,810 acres	8,015 acres	9,620 acres
Loss of riparian and water-related habitats (long term)[b]	0	0	0
Construction-related disturbance to riparian habitats (short term)[b]	0	0	0
Wildlife water resources	No impact	No impact	No impact
Special status species			
Threatened and endangered species and habitat	No impact	No impact	No impact
BLM- and State of Nevada-designated sensitive/protected species			
Pygmy rabbit (*Brachylagus idahoensis*)	Small impact to potential habitat	Small impact to potential habitat	Small impact to potential habitat
Pale kangaroo mouse (*Microdipidops pallidus*)	Small impact to potential habitat	Small impact to potential habitat	Small impact to potential habitat
Dark kangaroo mouse (*Microdipidops megacephalus albiventer*)	Small impact to potential habitat	Small impact to potential habitat	Small impact to potential habitat
Bat species (see Table 3-133)	Small impact	Small impact	Small impact
Western burrowing owl (*Athenes pallidus*)	Small impact	Small impact	Small impact
Northern goshawk (*Accipiter gentiles*)	No impact	No impact	No impact
Ferruginous hawk (*Buteo regalis*)	Small impact	No impact	Small impact
Loggerhead shrike (*Lanius ludovicianus*)	Small impact	Small impact	Small impact
Sage thrasher (*Oreoscotes montanus*)	Small impact to potential habitat	Small impact to potential habitat	Small impact to potential habitat

Table 4-225. Summary of potential impacts to biological resources from rail line construction along the Montezuma alternative segments (page 2 of 2).

Resource/impact type	Extent of impact, Montezuma 1	Extent of impact, Montezuma 2	Extent of impact, Montezuma 3
Special status species (continued)			
Brewer's sparrow (*Spizella breweri*)	Small impact to potential habitat	Small impact to potential habitat	Small impact to potential habitat
Eastwood milkweed (*Asclepias easwoodiana*)	No impact	Small impact	Small impact
Cima milkvetch (*Astragalus cimae* var. *cimae*)	No impact	No impact	No impact
Nevada dune beardtongue (*Penstemon arenarius*)	No impact	No impact	No impact
Pahute Mesa beardtongue (*Penstemon pahutensis*)	No impact	Small impact	Small impact
State of Nevada game species			
Pronghorn antelope	Small impact	Small impact	Small impact
Mule deer	Small impact	Small impact	Small impact
Wild horses and burros	No impact	No impact	No impact

a. To convert acres to square kilometers, multiply by 0.0040469.
b. Total includes wetlands, seeps, streams, and riparian areas combined.

forage habitat. However, these impacts would be small considering the amount of land-cover type affected in relation to the amount within the entire Nellis mapping zone. Operations impacts are addressed in Section 4.3.7.2.3.4.

Wild Horses and Burros The potential North Clayton quarry would be constructed within the Montezuma Peak Herd Management Area. A 2006 BLM census flight located 58 wild horses and 18 burros in the herd management area. Construction of this quarry could result in a small impact due to the small loss of available forage and the short-term avoidance of the area during construction and operations activity.

Table 4-226 summarizes potential impacts to biological resources that have the potential to occur within or near the potential North Clayton quarry. Operations impacts are described in Section 4.3.7.2.3.

4.3.7.2.2.12 Silver Peak Option - Maintenance-of-Way Facility, Facility Construction.

Impacts to biological resources associated with construction of the Maintenance-of-Way Facility at Silver Peak would be similar to those discussed above for Montezuma alternative segment 1. Refer to Table 4-217 for a quantification of short-term and long-term impacts to land-cover types from construction of this facility.

4.3.7.2.2.13 Malpais Mesa Quarry, Quarry Construction.

Vegetation Construction of the potential Malpais Mesa quarry would result in a long-term impact to 1.16 square kilometers (287 acres) of Inter-Mountain Basins Big Sagebrush Shrubland and 0.73 square kilometer (180 acres) of Inter-Mountain Basins Mixed Salt Desert Scrub. The overall impact would be moderate due to the loss of this vegetative cover and fragmentation of habitat.

There is no riparian or water-related vegetation present within the study area of the quarry; therefore, there would be no impact on riparian or water-related vegetation as a result of constructing a quarry at this site.

Table 4-226. Summary of potential impacts to biological resources from construction of the North Clayton quarry.

Resource/impact type	Extent of impact
Wildlife	
Loss of vegetation or land-cover type (long term)	344 acres[a]
Construction-related disturbance to vegetation or land-cover type (short term)	95.9 acres
Loss of riparian and water-related habitats (long term)[b]	0
Construction-related disturbance to riparian habitats (short term)[b]	0
Wildlife water resources	No impact
Special status species	
Threatened and endangered species and habitat	No species or habitat present
BLM- and State of Nevada-designated sensitive/protected species	
Bat species (see Table 3-133)	Small impact
Western burrowing owl (*Athenes pallidus*)	Small impact
Northern goshawk (*Accipiter gentiles*)	Small impact
Ferruginous hawk (*Buteo regalis*)	Small impact
Loggerhead shrike (*Lanius ludovicianus*)	Small impact
State of Nevada game species	
Pronghorn antelope	Small impact
Mule deer	Small impact
Wild horses and burros	Small impact

a. To convert acres to square kilometers, multiply by 0.0040469.
b. Total includes wetlands, seeps, streams, and riparian areas combined.

Special Status Species

Threatened and Endangered Species: There are no documented occurrences or suitable habitat for any federally listed or candidate species within the study area of the proposed quarry site.

BLM- and State of Nevada-Designated Sensitive or Protected Species: Potential impacts to bat species would result from disturbance or alteration of mineshafts, caves, talus slopes with cracks, crevices, and cliff faces during cut and fill or quarry operations. The overall impact on bats would be short term and small due to temporary avoidance during construction activities.

State of Nevada Game Species There is no designated habitat for State of Nevada game species within the proposed quarry footprint. However, designated mule deer yearlong habitat occurs adjacent to the proposed quarry site, and designated pronghorn antelope yearlong habitat occurs to the north approximately 8 kilometers (5 miles) (Figures 3-222 and 3-223). Potential impacts would be due to avoidance of the area because of an increase in noise during construction activity.

Wild Horses and Burros Impacts on wild horses and burros would be the same as described in Section 4.3.7.2.2.11 for the North Clayton quarry.

Table 4-227 summarizes potential impacts to biological resources that have the potential to occur within or near the potential Malpais Mesa quarry. Operations impacts are discussed in Section 4.3.7.2.3.

Table 4-227. Summary of potential impacts to biological resources from construction of the Malpais Mesa quarry.

Resource/impact type	Extent of impact
Wildlife	
Loss of vegetation or land-cover type (long term)	517 acres[a]
Construction-related disturbance vegetation or land-cover type (short term)	134 acres
Loss of riparian and water-related habitats (long term)[b]	0
Construction-related disturbance to riparian habitats (short term)[b]	0
Wildlife water resources	No impact
Special status species	
Threatened and endangered species and habitat	No species or habitat present
BLM- and State of Nevada-designated sensitive/protected species	
Bat species (see Table 3-133)	Small impact
Western burrowing owl (*Athenes pallidus*)	Small impact
Loggerhead shrike (*Lanius ludovicianus*)	Small impact
State of Nevada game species	
Pronghorn antelope	Small impact due to avoidance
Mule deer	Small impact due to avoidance
Wild horses and burros	No impact

a. To convert acres to square kilometers, multiply by 0.0040469.
b Total includes wetlands, seeps, streams, and riparian areas combined.

4.3.7.2.2.14 ES-7 Quarry, Quarry Construction.

Vegetation Construction of potential quarry ES-7 would result in a long-term impact to 0.55 square kilometer (135 acres) of Inter-Mountain Basins Big Sagebrush Shrubland, 0.34 square kilometer (84 acres) of Great Basin Xeric Mixed Sagebrush Shrubland, and 0.24 square kilometer (58 acres) of Inter-Mountain Basins Mixed Salt Desert Scrub. Sagebrush communities are highly valuable within the Nellis mapping zone; therefore, the overall impact would be moderate due to the loss of this vegetative cover and fragmentation of habitat.

There is no riparian or water-related vegetation present within the study area of the quarry; therefore, there would be no impact on riparian or water-related vegetation as a result of construction of the quarry site.

Special Status Species

Threatened and Endangered Species: There are no documented occurrences or suitable habitat for any federally listed or candidate species within the study area of the proposed quarry site.

BLM- and State of Nevada-Designated Sensitive or Protected Species: There could be potential impacts to bat species from constructing the proposed Goldfield quarry, which would include the disturbance or alteration of mineshafts, caves, talus slopes with cracks, crevices, and cliff faces during cut and fill or quarry operations. Potential impacts to bat habitats from construction activities would be small.

Potential impacts to the loggerhead shrike would result from the long-term loss of potential suitable habitat. The impact would be small since this species would be temporarily displaced, and there is ample suitable habitat throughout the region.

Potential impacts to the Western burrowing owl would result from loss of potential suitable habitat and possible crushing of burrows. Potential impacts would be small since this species occupies various land-cover types throughout the region.

There would be a loss of potential suitable habitat for the dark kangaroo mouse and the pale kangaroo mouse. However, there are no documented occurrences of this species within the construction right-of-way; therefore, potential impact would be small.

State of Nevada Game Species The proposed quarry ES-7 would cross year-round mule deer habitat (see Figure 3-222). Potential impacts to this species would include long-term loss of habitat and increased noise and human activity. However, these impacts would be expected to be small because year-round mule deer habitat is abundant in the area, and the quarry would affect only a small portion of this habitat.

Wild Horses and Burros Impacts on wild horses and burros would be the same as described in Section 4.3.7.2.2.11 for the North Clayton quarry.

Table 4-228 summarizes potential impacts to biological resources that have the potential to occur within or near potential quarry ES-7.

Table 4-228. Summary of potential impacts to biological resources from construction of potential quarry ES-7.

Resource/impact type	Extent of impact
Wildlife	
Loss of vegetation or land-cover type (long term)	281 acres[a]
Construction-related disturbance to vegetation or land-cover type (short term)	75.4 acres
Loss of riparian and water-related habitats (long term)[b]	0
Construction-related disturbance to riparian habitats (short term)[b]	0
Wildlife water resources	No impact
Special status species	
Threatened and endangered species and habitat	No species or habitat present
BLM- and State of Nevada-designated sensitive/protected species	
Bat species (see Table 3-133)	Small impact to potential habitat
Western burrowing owl (*Athenes pallidus*)	Small impact to potential habitat
Loggerhead shrike (*Lanius ludovicianus*)	Small impact to potential habitat
Pale kangaroo mouse (*Microdipidops pallidus*)	Small impact to potential habitat
Dark kangaroo mouse (*Microdipidops megacephalus albiventer*)	Small impact to potential habitat
State of Nevada game species	
Mule deer	Small impact to potential habitat
Pronghorn antelope	Small impact to potential habitat
Wild horses and burros	Small impact

a. To convert acres to square kilometers, multiply by 0.0040469.
b. Total includes wetlands, seeps, streams, and riparian areas combined.

4.3.7.2.2.15 Mina Common Segment 2 (Stonewall Flat Area), Rail Line Construction.

Vegetation Mina common segment 2 would pass primarily through Inter-Mountain Basins Mixed Salt Desert Scrub, creating a long-term impact to 0.06 square kilometer (15 acres) of this land-cover type. It would pass through a small portion of Inter-Mountain Basins Big Sagebrush Shrubland (less than 0.01

square kilometer), which is relatively common in the area and could provide habitat for various sagebrush community-obligate species. The amount of vegetation loss in these land-cover types associated with construction of Mina common segment 2 would be small in relation to the amount of these land-cover types that exist within the mapping zone. Therefore, the potential impacts of this loss of vegetative communities would be small. Construction of Mina common segment 2 would not impact any riparian or water-related vegetation.

Wildlife There would be direct impacts to various wildlife populations if wildlife avoided habitats close to construction activities. Any potential impact would be small and short term. Other impacts to wildlife species would be similar to those described in Section 4.3.7.2.1.2.

Special Status Species

Threatened and Endangered Species: There are no documented occurrences of federally listed plants or wildlife within the study area; therefore, there would be no impacts to listed species within or near Mina common segment 2.

BLM- and State of Nevada-Designated Sensitive or Protected Species: Although there are no documented occurrences of special status species in the common segment 2 study area, there is a potential for some to be present, and thus affected by, rail line construction along Mina common segment 2. These are summarized in Table 4-229.

State of Nevada Game Species There would be no impacts to State of Nevada game species because Mina common segment 2 would not cross any designated game habitat.

Wild Horses and Burros Mina common segment 2 would pass through the Stonewall Herd Management Area. Potential impacts to burros in the Stonewall Herd Management Area would be similar to those described in Section 4.3.7.2.1.5, but would occur in a different area. Burro population estimates indicate that as many as 34 resident burros could be affected.

Table 4-229 summarizes impacts to biological resources along Mina common segment 2.

4.3.7.2.2.16 Bonnie Claire Alternative Segments, Rail Line Construction. Table 4-230 summarizes potential direct impacts to biological resources from rail line construction along the Bonnie Claire alternative segments.

Vegetation The area of the Bonnie Claire alternative segments represents a transition in vegetative communities. Sagebrush communities occur less frequently as the rail alignment progresses south to southeast into the Mojave mapping zone.

Construction of Bonnie Claire alternative segment 2 could result in long-term impacts to 0.02 square kilometer (5 acres) of Inter-Mountain Basins Big Sagebrush Shrubland, 0.20 square kilometer (49 acres) of Inter-Mountain Basins Mixed Salt Desert Scrub, .06 square kilometer (14 acres) of Inter-Mountain Basins Semi-Desert Shrub Steppe, 0.15 square kilometer (37 acres) of Mojave Mid-Elevation Mixed Desert Scrub, 0.05 square kilometer (13 acres) of Sonora-Mojave Creosotebush-White Bursage Desert Scrub, and 0.02 square kilometer (6 acres) of Sonora-Mojave Mixed Salt Desert Scrub. Construction of Bonnie Claire alternative segment 3 could result in long-term impacts to less than 0.01 square kilometer (0.8 acres) of Inter-Mountain Basins Big Sagebrush Shrubland, 0.14 square kilometer (35 acres) of Inter-Mountain Basin Mixed Salt Desert Scrub, .07 square kilometer (17 acres) of Inter-Mountain Basin Semi-Desert Shrub Steppe, 0.13 square kilometer (32 acres) of Mojave Mid-Elevation Mixed Desert Scrub,

Table 4-229. Summary of potential impacts to biological resources from rail line construction along Mina common segment 2.

Resource/impact type	Extent of impact
Wildlife habitat	
Loss of vegetation or land-cover type (long term)	15.3 acres[a]
Construction-related disturbance to vegetation or land-cover type (short term)	244 acres
Loss of riparian and water-related habitats (long term)[b]	0
Construction-related disturbance to riparian habitats (short term)[b]	0
Wildlife water resources	No impact
Special status species	
Threatened and endangered species and habitat	No species or habitat present
BLM- and State of Nevada-designated sensitive/protected species	
Bat species (see Table 3-133)	Small impact
Western burrowing owl (*Athenes pallidus*)	Small impact
Loggerhead shrike (*Lanius ludovicianus*)	Small impact
State of Nevada game species	No impact
Wild horses and burros	Small impact

a. To convert acres to square kilometers, multiply by 0.0040469.
b. Total includes wetlands, seeps, streams, and riparian areas combined.

0.13 square kilometer (33 acres) of Sonora-Mojave Creosotebush-White Bursage Desert Scrub, and less than .01 square kilometer (2 acres) of Sonora-Mojave Mixed Salt Desert Scrub (see Section 3.3.7 and Table 4-215).

Rail line construction along the Bonnie Claire alternative segments would not impact any riparian or water-related vegetation.

Special Status Species

Threatened and Endangered Species: There are no threatened, endangered, candidate, or proposed species that occur within the study area of the Bonnie Claire alternative segments.

BLM- and State of Nevada-Designated Sensitive or Protected Species: As summarized in Table 4-230, there would be small impacts to BLM- and State of Nevada-designated sensitive and protected species from rail line construction along the Bonnie Claire alternative segments.

State of Nevada Game Species As summarized in Table 4-230, there would be small potential impacts to game species along the Bonnie Claire alternative segments.

Wild Horses and Burros The Bonnie Claire alternative segments would pass through the Stonewall Herd Management Area. Potential impacts to the herd management area and the wild horses and burros would be a small loss of vegetation for foraging.

4.3.7.2.2.17 Common Segment 5 (Sarcobatus Flat Area), Rail Line Construction. Table 4-231 summarizes potential direct impacts to biological resources from rail line construction along common segment 5.

Table 4-230. Summary of potential impacts to biological resources from rail line construction along the Bonnie Claire alternative segments.

Resource/impact type	Extent of impact, Bonnie Claire 2	Extent of impact, Bonnie Claire 3
Wildlife		
Loss of vegetation or land-cover type (long term)	125 acres[a]	120.7 acres
Construction-related disturbance to habitat (short term)	1,400 acres	1,380 acres
Loss of riparian and water-related habitats (long term)[b]	0	0
Construction-related disturbance to riparian habitats (short term)[b]	0	0
Wildlife water resources	No impact	No impact
Special status species		
Threatened and endangered species and habitat	No species or habitat occurrence	No species or habitat occurrence
BLM- and State of Nevada-designated sensitive/protected species		
Loggerhead shrike (*Lanius ludovicianus*)	Small impact to potential habitat	Small impact to potential habitat
Western burrowing owl (*Athenes cunicularia*)	Small impact to potential habitat	Small impact to potential habitat
Bat species (see Table 3-133)	Small impact to potential habitat	Small impact to potential habitat
Nevada game species		
Mule deer	Small impact	Small impact
Pronghorn antelope	Small impact	Small impact
Wild horses and burros	Small impact to potential habitat	Small impact to potential habitat

a. To convert acres to square kilometers, multiply by 0.0040469.
b. Total includes wetlands, seeps, streams, and riparian areas combined.

Vegetation As discussed in Section 3.3.7 and shown in Table 4-214, common segment 5 would pass through a small area of Great Basin Juniper Woodland, which would be temporarily affected during rail line construction activities. This land-cover type is relatively common on the lower mountain slopes in the area and likely provides roosting and nesting habitat for some raptors.

Construction of common segment 5 could result in long-term impacts to 0.05 square kilometer (12 acres) of Inter-Mountain Basins Semi-Desert Shrub Steppe, 0.09 square kilometer (23 acres) of Mojave Mid-Elevation Mixed Desert Scrub, 0.23 square kilometer (58 acres) of Sonora-Mojave Creosotebush-White Bursage Desert Scrub, and 0.44 square kilometer (108 acres) of Sonora-Mojave Mixed Salt Desert Scrub. The potential impacts on these land-cover types would be small because the amount of vegetation loss associated with rail line construction along common segment 5 would be small in relation to the amount of these land-cover types within the mapping zone. Common segment 5 would affect a small portion of Inter-Mountain Basins Big Sagebrush Shrubland, which provides habitat for various sagebrush community-obligate species. Rail line construction along common segment 5 would not impact any riparian or water-related vegetation.

Table 4-231. Summary of potential impacts to biological resources from rail line construction along common segment 5.

Resource/impact type	Extent of impact
Wildlife	
Loss of vegetation or land-cover type (long term)	201.4 acres[a]
Construction-related disturbance to habitat (short term)	2,750 acres
Loss of riparian and water-related habitats (long term)[b]	0
Construction-related disturbance to riparian habitats (short term)[b]	0
Wildlife water resources	No impact
Special status species	
Threatened and endangered species and habitat	No species or habitat occurrence
BLM- and State of Nevada-designated sensitive/protected species	
Loggerhead shrike (*Lanius ludovicianus*)	Small impact to potential habitat
Western burrowing owl (*Athenes cunicularia*)	Small impact to potential habitat
Ferruginous hawk (*Buteo regalis*)	Small impact to potential habitat
Bat species (see Table 3-133)	Small impact to potential habitat
Nevada dune beardtongue (*Penstemon arenarius*)	Small impact to potential habitat
Oasis Valley speckled dace (*Rhinichthys osculus* ssp. 6)	Small impact to potential habitat
State of Nevada game species	
Pronghorn antelope	Small impact due to avoidance
Desert bighorn sheep	Small impact due to avoidance
Mule deer	Small impact due to avoidance
Wild horses and burros	Small impact to potential habitat

a. To convert acres to square kilometers, multiply by 0.0040469.
b. Total includes wetlands, seeps, streams, and riparian areas combined.

Special Status Species

Threatened and Endangered Species: There are no threatened, endangered, candidate, or proposed species that occur within the study area of common segment 5.

BLM- and State of Nevada-Designated Sensitive or Protected Species: As summarized in Table 4-231, there would be small impacts to BLM- and State of Nevada-designated sensitive and protected species from rail line construction along common segment 5. Habitat for the burrowing owl and loggerhead shrike are present along common segment 5 and are discussed in Section 4.3.7.2.1, Environmental Impacts Common to the Entire Mina Rail Alignment. Some isolated sand dunes provide habitat for the Nevada dune breadtonge (*Penstemon arenarius*). Rail line construction would create a small impact to the habitat. Occasional stands of pinyon juniper provide habitat for the ferruginous hawk (*Buteo regalis*). Impacts to this species would be small and short term.

Habitat for the Oasis Valley speckled dace is confined to streams in southern Nye County. Impacts to potential habitat for this species would be small and short term due to the proposed construction of a bridge across Oasis Valley that would temporarily increase turbidity in the stream. After construction, the impact would be minimal.

State of Nevada Game Species There is designated pronghorn antelope yearlong habitat to the north of the rail alignment in the Gold Flat area (see Figure 3-223). Potential impacts, if any, to antelope as a result of rail line construction along common segment 5 would be small. Common segment 5 would pass near desert bighorn sheep and mule deer yearlong habitat. It is possible that desert bighorn sheep and mule deer would pass through the area of the rail line, which along common segment 5 would be adjacent to an existing transportation corridor (U.S. Highway 95). Although it is likely that desert bighorn sheep and mule deer use this area during migration, there are no designated game ***movement corridors*** along or near common segment 5. Thus, impacts to these species would be small and short term, primarily from avoidance of the area during construction activities.

Wild Horses and Burros Common segment 5 would not pass through any wild horse and burro herd management areas. However, burro activity in the region is likely based on local utilization patterns. Potential impacts to wild horses and burros would be small.

4.3.7.2.2.18 Oasis Valley Alternative Segments, Rail Line Construction. Table 4-232 summarizes potential direct impacts to biological resources from rail line construction along the Oasis Valley alternative segments.

Vegetation There is water-related and riparian habitat present within the study area of the Oasis Valley alternative segments. Oasis Valley alternative segments 1 and 3 would cross the Thirsty Canyon/Oasis Valley Wash area. Oasis Valley alternative segment 3 would run within 0.7 kilometer (0.4 mile) of Colson Pond and across the Amargosa River drainage (see Section 3.3.5.3.11).

The Amargosa River receives ephemeral flows during high precipitation events; it does not carry water most of the year. There would be no impacts to Colson Pond and engineering design would include appropriate structures (a culvert and bridge) to minimize impacts to the Amargosa River drainage. Within the Oasis Valley alternative segment 3 construction right-of-way, construction activities would temporarily impact 0.02 square kilometer (4.67 acres) of the North American Warm Desert Lower Montane Riparian Woodland and Shrubland land-cover type.

Potential impacts would be short term from rail line construction along Oasis Valley alternative segment 3, which would only cross this land-cover type. Given the small amount of this land-cover type within the mapping zone and its high value for wildlife, the impacts on riparian and water-related vegetation would be moderate, but short term. However, DOE would use drainage structures and best management practices to minimize erosion, runoff, and the subsequent impacts to riparian vegetation along the Oasis Valley alternative segments.

Construction of Oasis Valley alternative segment 1 could result in long-term impacts to 0.02 square kilometer (5 acres) of Inter-Mountain Basis Semi-Desert Shrub Steppe, 0.01 square kilometer (3 acres) of Mojave Mid-Elevation Mixed Desert Scrub, 0.02 square kilometer (5 acres) of North American Warm Desert Playa, 0.22 square kilometer (54 acres) of Sonora-Mojave Creosotebush-White Bursage Desert Scrub, 0.22 square kilometer (7 acres) of Sonora-Mojave Mixed Salt Desert Scrub. Construction of Oasis Valley alternative segment 3 could result in long-term impacts to 0.02 square kilometer (6 acres) of Mojave Mid-Elevation Mixed Desert Scrub, less than 0.01 square kilometer (2 acres) of North American Warm Desert Playa, and 0.09 square kilometer (22 acres) of Sonora-Mojave Mixed Salt Desert Scrub.

Special Status Species

Threatened and Endangered Species: There are no threatened, endangered, candidate or proposed species that occur within the study area of the Oasis Valley alternative segments.

BLM- and State of Nevada-Designated Sensitive or Protected Species: The black woollypod, a BLM-designated sensitive plant species, is known to occur along the Beatty Wash section of common segment 6. The closest known occurrence of this species is 0.3 kilometer (0.2 mile) from common segment 6. Construction of the Oasis Valley alternative segments could result in small impacts due to

Table 4-232. Summary of potential impacts on biological resources from rail line construction along the Oasis Valley alternative segments.

Resource/impact type	Extent of impact, Oasis Valley 1	Extent of impact, Oasis Valley 3
Wildlife		
Loss of vegetation or land-cover type (long term)	75.6 acres[a]	107.40 acres
Construction-related disturbance to habitat (short term)	648 acres	976 acres
Loss of riparian and water-related habitats (long term)[b]	0	0
Construction-related disturbance to riparian habitats (short term)[b]	0	4.67 acres
Wildlife water resources	No impact	No impact
Special status species		
Threatened and endangered species and habitat	No species or habitat occurrence	No species or habitat occurrence
BLM- and State of Nevada-designated sensitive/protected species		
Black woollypod (*Astragalus funereus*)	Small impact to species and potential habitat	Small impact to species and potential habitat
Loggerhead shrike (*Lanius ludovicianus*)	Small impact to potential habitat	Small impact to potential habitat
Western burrowing owl (*Athenes cunicularia*)	Small impact to potential habitat	Small impact to potential habitat
Oasis Valley speckled dace (*Rhinichthys osculus* spp. [unnamed])	No impact	No impact
Oasis Valley pyrg (*Pyrgulopsis micrococcus*)	No impact	No impact
Amargosa toad (*Bufo nelsoni*)	No impact	No impact
Bat species (see Table 3-133)	Small impact to potential habitat	Small impact to potential habitat
State of Nevada game species		
Mule deer	Small impact	Small impact
Desert bighorn sheep	Small impact	Small impact
Wild horses and burros	Small impact to potential habitat	Small impact to potential habitat

a. To convert acres to square kilometers, multiply by 0.0040469.
b. Total includes wetlands, seeps, streams, and riparian areas combined.

loss of suitable habitat and possible individuals present during construction. However, the black woollypod appears to adapt well to disturbed areas, thus, anticipated impacts to this species habitat and population would be small from rail line construction along the Oasis Valley alternative segments.

The Oasis Valley speckled dace occurs in the Amargosa River drainage and Fleur de Lis Spring near the towns of Springdale and Beatty, less than 1.6 kilometers (1 mile) southwest from Oasis Valley alternative segment 1. This subspecies has a very limited range and is only known from this watershed in Oasis Valley. Specific distribution of this fish varies with available water. Because of the distance of this habitat from construction activities, there should be no impacts to the Oasis Valley speckled dace during rail line construction.

The Oasis Valley pyrg is an ***endemic*** snail of the springs found in Oasis Valley. This species has not been documented closer than 4 kilometers (2.5 miles) from the rail alignment and suitable habitat for this species would not occur within the construction right-of-way. Therefore, rail line construction would not impact this species.

The Amargosa toad occurs along the Amargosa River drainage and has been recorded in Oasis Valley, 1.4 kilometers (0.84 mile) from Oasis Valley alternative segment 1 and 1.9 kilometers (1.2 miles) from Oasis Valley alternative segment 3. Typical habitat for this species is near open water, such as springs, seeps and ponds, and the riparian vegetation generally associated with wet areas. In these instances, the presence of moist soil might be sufficient for suitable habitat. There are no open waters that would be within the construction right-of-way, and all seeps and springs within Oasis Valley and Thirsty Canyon would be outside and downgradient of the construction right-of-way. Therefore, it is unlikely that the Amargosa toad would occur within the construction right-of-way.

State of Nevada Game Species The Oasis Valley alternative segments would pass within mule deer limited range (see Figure 3-222) and would be near designated desert bighorn sheep yearlong habitat (see Figure 3-221). Oasis Valley supports riparian vegetation and ephemeral flows that are highly valuable as a potential water source and for forage. Colson Pond, which also provides a potential water source for these species, is 0.7 kilometer (0.4 mile) from Oasis Valley alternative segment 3. However, impacts from rail line construction along the Oasis Valley alternative segments would be very small and very short term.

Wild Horses and Burros The Oasis Valley alternative segments would pass through northern portions of the Bullfrog Herd Management Area. Potential impacts to the herd management area and the wild horses and burros would be small losses of vegetation for foraging and grazing.

4.3.7.2.2.19 Common Segment 6 (Yucca Mountain Approach), Rail Line Construction.

Table 4-233 summarizes potential direct impacts to biological resources (vegetation, threatened and endangered species, special status species, State of Nevada big game, and wild horses and burros) from rail line construction along common segment 6.

Table 4-233. Summary of potential impacts on biological resources from rail line construction along common segment 6 (page 1 of 2).

Resource/impact type	Extent of impacts
Wildlife	
Loss of vegetation or land-cover type (long term)	402.4 acres[a]
Construction-related disturbance to habitat (short term).	3,270 acres
Loss of riparian and water-related habitats (long term)[b]	0
Construction-related disturbance to riparian habitats (short term)[b]	0
Wildlife water resources	No impact
Special status species	
Threatened and endangered species and habitat	
Desert tortoise (*Gopherus agassizii*)	Small impact to species and habitat
BLM- and State of Nevada-designated sensitive/protected species	
Black woollypod (*Astragalus funereus*)	Small impact to species and habitat
Rock purpusia (*Ivesia arizonica* var. *saxosa*)	No impact
Loggerhead shrike (*Lanius ludovicianus*)	Small impact to habitat
Western burrowing owl (*Athenes cunicularia*)	Small impact to habitat

Table 4-233. Summary of potential impacts on biological resources from rail line construction along common segment 6 (page 2 of 2).

Resource/impact type	Extent of impacts
Special status species (continued)	
BLM- and State of Nevada-designated sensitive/protected species (continued)	
Oasis Valley speckled dace (*Rhinichthys osculus* spp. [unnamed])	No impact
Oasis Valley pyrg (*Pyrgulopsis micrococcus*)	No impact
Amargosa toad (*Bufo nelsoni*)	No impact
Chuckwalla (*Sauromalus ater*)	Small impact to habitat
Bat species (see Table 3-133)	Small impact to habitat
Impacts to State of Nevada game species	
Desert bighorn sheep (*Ovis canadensis*)	Moderate, short-term impact to migration corridor
Mule deer	Small impact to habitat
Wild horses and burros	Small impact to forage habitat and avoidance

a. To convert acres to square kilometers, multiply by 0.0040469.
b. Total includes wetlands, seeps, streams, and riparian areas combined.

Vegetation As discussed in Section 3.3.7 and shown in Table 4-214, common segment 6 would pass through mostly Sonora-Mojave Creosotebush-White Bursage Desert Scrub and Mojave Mid-Elevation Mixed Desert Scrub. Construction of common segment 6 could result in long-term impacts to 0.24 square kilometer (59 acres) of Inter-Mountain Basin Semi-Desert Shrub Steppe, 0.38 square kilometer (94 acres) of Mojave Mid-Elevation Mixed Desert Scrub, less than .01 square kilometer (1 acre) of North American Warm Desert Bedrock Cliff and Outcrop, less than .01 square kilometer (about 0.49 acre) of North American Warm Desert Playa, 1 square kilometer (246 acres) of Sonora-Mojave Creosotebush-White Bursage Desert Scrub, and less than 0.01 square kilometer (2 acres) of Sonora-Mojave Mixed Salt Desert Scrub.

Rail line construction along common segment 6 would not impact water-related vegetation.

Special Status Species

Threatened and Endangered Species: Common segment 6 would be in an area of low-density desert tortoise habitat (the northernmost extent of the desert tortoise range), and the extent of habitat loss would result in small impacts.

The potential for desert tortoise to occur or be encountered in the common segment 6 construction right-or-way would be low. The overall impact on the desert tortoise as a result of constructing a rail line and facilities along common segment 6 would be small.

Construction of the proposed rail line, well sites, and construction camps along common segment 6 would result in the potential for species fragmentation, potential species loss, and disturbance of desert tortoise habitat along the southwestern section of common segment 6 from Beatty south to Yucca Mountain (see Figure 3-213). The rail line would not cross any areas of U.S. Fish and Wildlife Service-designated critical habitat. Potential direct impacts to desert tortoises during construction activities could include tortoise injury or mortality from being buried in their burrows or being crushed by construction equipment or other vehicles on access roads. Although these losses would cause a small decrease in the number of individual tortoises in the vicinity of the rail line, there would be no long-term impacts to the survival of this species. Indirect impacts would result from the fragmentation of habitat. A total of 5.61 square kilometers (1,387 acres) of desert tortoise habitat would be disturbed by rail line and facilities construction along common segment 6 (see Table 4-234).

Table 4-234. Amount of desert tortoise habitat that would be disturbed during construction of the rail line and facilities along common segment 6.

Source of disturbance	Amount of habitat disturbed (acres)[a]
Rail roadbed and adjacent access roads	1,100
Access road to Beatty Wash bridge and well site 14	10
Access road to well site 15	2
Construction camp 12	25
Access road to construction camp 12	50
Rail Equipment Maintenance Yard	200
Total	1,387

a. To convert acres to square kilometers, multiply by 0.0040469.

BLM- and State of Nevada-Designated Sensitive/Protection Species: The black woollypod, a BLM-designated sensitive plant species, is known to occur along the Beatty Wash portion of common segment 6. The closest known occurrence of this species is 0.3 kilometer (0.2 mile) from common segment 6. Rail line construction along common segment 6 could result in small impacts from the loss of suitable habitat and individual plants. However, the black woollypod appears to adapt well to disturbed areas; thus, anticipated impacts to this species' habitat and population would be small. In addition, DOE would implement best management practices (see Chapter 7) to avoid or minimize plant mortality.

Rock purpusia has been documented approximately 13 kilometers (8 miles) from common segment 6. The loss of a small percentage (less than 0.01 square kilometer [about 1 acre]) of the North American Warm Desert Bedrock Cliff and Outcrop land-cover type would be a long-term impact as a result of rail line construction along common segment 6. There would be possible loss of suitable habitat (rock crevices and cliffs); however, there would be no impact on this species.

There is suitable habitat for the Amargosa toad in Oasis Valley west of common segment 6. This common segment would not cross any suitable habitat; thus, impacts to this species would be highly unlikely. However, any potential impact to this species would be limited to the northern portion of common segment 6 where it would connect to the Oasis Valley alternative segments (see Section 4.3.7.2.2.18).

Habitat for the Oasis Valley speckled dace is found in the neighboring Oasis Valley. It is unlikely that speckled dace exist in the area that would be crossed by common segment 6 due to lack of persistent streams of ponds. Therefore, no impacts to speckled dace would occur. The Oasis Valley pyrg requires habitat similar to the speckled dace and no impact is expected for this segment.

Chuckwalla have been documented in the southeastern foothills of Yucca Mountain adjacent to common segment 6. This area represents the chuckwalla's northernmost range in southern Nevada. Construction activities in this area could result in the loss of habitat for this species and possible loss of individuals. This would be a small overall impact to this species.

State of Nevada Game Species Common segment 6 would intersect a designated desert bighorn sheep migratory corridor near Beatty Wash (see Figure 3-221). There is also yearlong desert bighorn sheep habitat southwest of common segment 6. Impacts would be moderate, but mostly short term, due to possible displacement from the designated migratory corridor during construction activities. There is also mule deer habitat along common segment 6 (see Figure 3-222). Impacts to mule deer habitat would be small.

Wild Horses and Burros Common segment 6 would pass through central portions of the Bullfrog Herd Management Area. Impacts to the herd management area and any wild horses and burros in the area would be similar – a small loss of vegetation for grazing. Burro activity south of Beatty Wash and in the Crater Flat area would likely shift temporarily to other locations farther away from the disturbance of human activity. Burro population estimates for this area suggest that 34 burros could be affected. There are no known populations of wild horses along common segment 6.

4.3.7.2.2.20 Common Segment 6 (Yucca Mountain Approach), Facilities Construction. Table 4-235 summarizes potential direct impacts to biological resources (vegetation, threatened and endangered species, special status species, State of Nevada big game, and wild horses and burros) from construction of facilities along common segment 6.

Vegetation The Rail Equipment Maintenance Yard would occupy an area of 0.41 square kilometer (100 acres). There are several different land-cover types in the area, but most of the land cover is Sonora-Mojave Creosotebush-White Bursage Desert Scrub. Construction of the Rail Equipment Maintenance Yard would impact 0.24 square kilometer (60 acres) in the long term and 0.44 square kilometer (108 acres) in the short term.

Special Status Species

Threatened and Endangered Species: Potential impacts to the desert tortoise would be similar to those described in Section 4.3.7.2.2.19. Construction of the Rail Equipment Maintenance Yard would result in a loss of tortoise habitat (see Table 4-234); however, areas of critical habitat would not be affected. The increase in human activity in the area would increase the risk of vehicle collisions with tortoise on access roads. Although these losses would cause a small decrease in the number of individual tortoises in the vicinity of this facility, there would be no impacts to the long-term survival of this species. Therefore, potential impacts to the desert tortoise as a result of the facility would be small.

Potential impacts to special status species would be similar to the impacts described in Section 4.3.7.2.2.19.

State of Nevada Game Species The Rail Equipment Maintenance Yard would be within mule deer limited range (see Figure 3-222). Potential impacts would be similar as those described in Section 4.3.7.2.1.5. Potential impacts would be small due to the infrequent occurrence of mule deer in the area. However, any existing mule deer would likely avoid the area due to increased human activity and noise.

Wild Horses and Burros Potential impacts to wild horses and burros would be similar to the impacts described in Section 4.3.7.2.2.19.

4.3.7.2.3 Operations Impacts Common to the Entire Mina Rail Alignment

4.3.7.2.3.1 Vegetation. DOE would expect activities during railroad operations to remain within the operations right-of-way or disturbed areas after construction was complete; therefore, there would be no ongoing operations impacts to land-cover types. There could be long-term impacts in the form of a changed use of the land-cover types from construction of the rail roadbed, access roads, and all associated facilities, as described above in Section 4.3.7.2.1.1.

Table 4-235. Summary of potential impacts on biological resources from construction of facilities along common segment 6.

Resource/impact type	Extent of impact
Wildlife	
Loss of vegetation or land-cover type (long term)	74.1 acres[a]
Construction-related disturbance to habitat (short term)	151 acres
Loss of riparian and water-related habitats (long term)[b]	0
Construction-related disturbance to riparian habitats (short term)[b]	0
Wildlife water resources	No impact
Special status species	
Threatened and endangered species and habitat	
Desert tortoise (*Gopherus agassizii*)	Small impact to species and habitat
BLM- and State of Nevada-designated sensitive/protected species	
Black woollypod (*Astragalus funereus*)	Small impact to species and potential habitat
Rock purpusia (*Ivesia arizonica* var. *saxosa*)	No impact
Loggerhead shrike (*Lanius ludovicianus*)	Small impact to habitat
Western burrowing owl (*Athenes cunicularia*)	Small impact to habitat
Oasis Valley speckled dace (*Rhinichthys osculus* spp. [unnamed])	No impact
Oasis Valley pyrg (*Pyrgulopsis micrococcus*)	No impact
Amargosa toad (*Bufo nelsoni*)	No impact
Chuckwalla (*Sauromalus ater*)	Small impact to habitat
Bat species (see Table 3-133)	Small impact to habitat
State of Nevada game species	
Desert bighorn sheep (*Ovis canadensis*)	Small impact to habitat
Mule deer	Small impact to habitat
Wild horses and burros	Small impact to forage habitat

a. To convert acres to square kilometers, multiply by 0.0040469.
b. Total includes wetlands, seeps, streams, and riparian areas combined.

Water-Related/Riparian Habitat DOE would not expect railroad operations activities to result in continuing land-disturbing activities outside of areas disturbed and developed during the construction phase. For this reason, DOE would expect no additional direct loss of water-related or riparian habitat during operations activities. However, water-related and riparian habitat adjacent to the proposed rail line or associated facilities could be affected in the event of a train derailment resulting in the spill of diesel fuel into these habitats. The likelihood of and the severity of impacts from such spills would be small because DOE would implement best management practices to help prevent such occurrences (see Chapter 7).

Noxious Weeds and Invasive Species DOE would not anticipate additional direct habitat disturbances during railroad operations. However, continued use of the rail line, facilities, and the associated access roads would continue to provide a mechanism for dispersal of seeds and rootable fragments of invasive and noxious plant species.

Similar to best practices utilized in the construction phase, during the operations phase DOE would implement best management practices and BLM-prescribed and -approved methods to prevent the establishment of noxious weeds or invasive plant species (see Chapter 7).

4.3.7.2.3.2 Wildlife. Potential direct impacts to wildlife from railroad operations collisions with trains could occur during the operations phase. DOE estimates that approximately 17 one-way trains per week would utilize the track during the operations phase. While some individual animals could be lost from collisions with trains, the impact on wildlife communities would be small. Because some wildlife species in the area are often more active at night, nighttime collisions with trains would be possible if the trains were to operate during the night. Again, DOE would expect small impacts to the nocturnal wildlife communities.

Construction of communication towers, bridges, or any other structures that would provide raptors, crows (*Corvus brachyrhynchos*), and ravens (*Corvus corax*) with additional perches would increase predation pressure on the local small animal populations such as reptiles, rodents, and small birds. This could result in a potential negative indirect impact on the small animals, but a positive indirect impact on the predatory species. Some long-term structures, such as bridges, if designed to include bat roosting and hibernation sites, could provide additional habitat resulting in a positive indirect impact to bat species.

Noise from trains would disturb wildlife species close to the rail line throughout the operations phase of the project. However, this disturbance would diminish with distance from the track and over time because some wildlife species would become acclimated to daily disturbances from passing trains. Noise from the trains and human presence at facilities associated with the rail line could cause wildlife species to move away from the tracks during the period of disturbance (short-term avoidance) and possibly cause changes in migratory patterns (long-term displacement).

Wildlife habitat and associated species adjacent to the proposed rail line or facilities could be affected in the event of a train derailment resulting in the spill of diesel fuel into these habitats. Forage, prey species, nesting and spawning habitat, and sources of drinking water could become contaminated. This potential impact would have greater ramifications for aquatic species. The likelihood of and the severity of impacts from such spills would be small because DOE would implement best management practices to help prevent such occurrences (see Chapter 7).

4.3.7.2.3.3 Special Status Species.

Threatened and Endangered Species General impacts to vegetation and wildlife from railroad operations addressed above under Sections 4.3.7.2.3.1 and 4.3.7.2.3.2 also apply to the threatened and endangered species described below.

Railroad operations would result in potential short-term impacts to southwestern willow flycatchers and western yellow-billed cuckoos in the form of noise from passing trains and human activities if these species used habitat within the vicinity during these activities. However, these impacts would be small given that there are no recorded occurrences and only marginal suitable migratory habitat for the flycatcher and cuckoo along the Mina rail alignment. Further, the area where potentially suitable habitat for these species occurs is near the existing Union Pacific Railroad Hazen Branchline and existing roads, and therefore, these species would likely already be acclimated to such disturbances.

Railroad operations would result in potential short-term and long-term disturbances to bald eagles. If bald eagles were present in the vicinity of the rail line when a train passed through or in the vicinity of facilities when people were present, the noise and presence of humans could startle the eagles or deter them from using the area for the duration of the disturbance; however, these impacts would be expected to be very small.

No impacts are expected to the Railroad Valley springfish during the operations phase because habitat for this species is far from the operations right-of-way and would not be disturbed.

Potential impacts to desert tortoises from habitat fragmentation would be small. Although there is no available documentation of tortoise behavior related to rail lines, it is possible that desert tortoises could use culverts installed within washes under the rail line to cross from one side of the rail line to the other.

Utility lines, buildings, or communication towers installed to support railroad operations might provide additional nesting and perching sites for the common raven, a frequent predator of juvenile tortoises. Therefore, the presence of these structures could increase juvenile tortoise mortality.

BLM- and State of Nevada-Designated Sensitive and Protected Species Potential impacts to vegetation and special status plants associated with railroad operations would be from the possible introduction of invasive plant species by trains or maintenance vehicles. Invasive species could take hold in disturbed areas and essentially out-compete native species for resources. Potential impacts to vegetation could also result in the event of train derailment and possible associated spill of diesel fuel. The likelihood of and the severity of impacts from such spills would be small because DOE would implement best management practices to help prevent such occurrences (see Chapter 7).

Any active sage-grouse mating and nesting areas located close to the Mina rail alignment would be adversely affected by noise and vibration from the daily operations and maintenance activities during the breeding season. This could result in reduced nesting success especially during the incubation period when birds would be frightened from their nests, exposing the eggs to predation. However, only one historic sage-grouse lek was identified in the construction right-of-way. DOE surveyed the area on May 13, 2005, for signs of recent use or individual birds, but there was no evidence that sage-grouse still occupy the area even though suitable habitat was present at the time. Therefore, there would be no impacts on sage-grouse breeding and nesting areas during the operations phase, unless sage-grouse were to occupy this area in the future.

In general, passing trains would initially disturb BLM special status and state-protected wildlife close to the rail line. However, this disturbance would diminish with distance from the track and over time as animals became acclimated to daily disturbances. Individual animals could occasionally be killed or injured in collisions with trains. Nevertheless, impacts to animals near the rail line would be small because of the infrequency of trains using the rail line.

Operation of facilities associated with the rail line would create a potential disturbance to BLM special status and state-protected wildlife species due to the presence of humans and associated noise. This could result in short-term avoidance of an area or lead to long-term displacement, depending on the degree of disturbance.

Habitat for BLM special status and state-protected wildlife species and associated species adjacent to the proposed rail line or associated facilities could be affected in the event of train derailment resulting in the spill of diesel fuel into these habitats. Forage, prey species, nesting and spawning habitat, and sources of drinking water could become contaminated. This potential impact would have greater ramifications for aquatic species. The likelihood of and the severity of impacts from such spills would be small because DOE would implement best management practices to help prevent such occurrences (see Chapter 7).

Nevada State-Protected Cacti, Yucca, and Conifers There would be no impacts to cacti, yucca, or conifers as a result of railroad operations. There would be no impacts to these state-protected plant species as there would be no additional loss of conifer habitat or individual conifer trees, cacti, and yucca as a result of railroad operations. Pursuant to BLM protocols, during railroad operations DOE would monitor the cacti and yucca that had been salvaged and replanted during the construction phase.

Migratory Birds Impacts to migratory bird species during the operations phase would be limited to potential disturbances from passing trains (noise and vibration), facility operations, and maintenance activities. Impacts such as altered behavior and nest abandonment could occur initially. However, noise and vibration disturbances would diminish with distance from the track, and over time, birds could become acclimated to daily disturbances.

In the event of a train derailment resulting in the spill of diesel fuel into surrounding vegetation, foraging habitat, prey species, and water sources for migratory birds could be adversely affected. The likelihood of and the severity of impacts from such spills would be small because DOE would implement best management practices to help prevent such occurrences (see Chapter 7).

4.3.7.2.3.4 State of Nevada Protected Game Species. Direct impacts to game species during the operations phase would consist of long-term habitat loss within the construction right-of-way. Game species habitat would be affected in the long term in areas where DOE would construct the proposed rail line and associated roads and facilities.

Direct impacts to game species in the form of collisions with trains would also occur during the operations phase. It is estimated that approximately 17 one-way trains per week would utilize the track during the operations phase. Again, mortality rates from collisions would not be expected to be sizeable because game animals are fairly agile and would usually be able to move out of the way of oncoming trains. While some individual animals could be lost from collisions with trains, the impact on game communities would be small.

Noise from trains would disturb game species close to the rail line throughout the operations phase of the project; however, this disturbance would diminish with distance from the track and over time as the game species became acclimated to daily disturbances from passing trains. Noise from the trains could cause game species to move away from the tracks and possibly cause changes in migratory patterns before game species became acclimated to the noise.

The rail roadbed itself would represent an attractive nuisance to antelope, because they prefer a vantage point from which to survey the surrounding areas for predators. However, as noted above, antelope are agile and would usually be able to avoid oncoming trains.

The finished rail line would bisect game habitat and movement corridors. However, because the rail line would not be fenced, once the animals became acclimated to the presence of the rail line they would be able to move freely across the rail line and impacts to game movements would be small.

Operation of support facilities would create a potential disturbance to game species due to the presence of humans and associated noise. This could result in short-term avoidance or long-term displacement of game species from the area.

In the rare event of a possible train derailment resulting in the spill of diesel fuel into surrounding vegetation, foraging habitat and sources of drinking water could become contaminated. The likelihood of and the severity of impacts from such spills would be small because DOE would implement best management practices to help prevent such occurrences (see Chapter 7).

4.3.7.2.3.5 Wild Horses and Burros. Direct impacts to wild horses and burros during the operations phase would consist of long-term habitat loss where the footprints of the rail line and associated maintenance roads would intersect herd management areas.

There would also be potential direct impacts to wild horses and burros in the form of collisions with trains. DOE estimates that approximately 17 one-way trains per week would utilize the rail line during the operations phase. Again, death rates from collisions are not expected to be sizeable because wild horses and burros are fairly agile and would usually be able to move out of the way of oncoming trains.

While some individual animals could be lost from collisions with trains, the impact on wild horse and burro communities would be small.

Noise from trains could disturb wild horses and burros close to the rail line throughout the operations phase of the project; however, this disturbance would diminish with distance from the track and over time the wild horses and burros would become acclimated to daily disturbances from passing trains. Noise from the trains could cause wild horses and burros to move away from the tracks and possibly cause changes in migratory patterns. However, because the rail line would not be fenced, once the animals became acclimated to its presence they would be able to move freely across the rail line. Therefore, potential impacts to wild horse and burro movements, as discussed in Section 4.3.7.2.1.5, would be small.

4.3.7.3 Impacts under the Shared-Use Option

The Shared-Use Option would require construction of commercial sidings and facilities. All such construction would be immediately adjacent to the rail line and would have impacts similar to those under the Proposed Action without shared use. The Shared-Use Option would mean an increase in train traffic. Therefore, DOE would expect special status species, State of Nevada game species, and wild horse and burro interactions with train traffic (collisions, change in movement patterns, altered behavior, and nest abandonment) to be slightly larger than those interactions with rail traffic under the Proposed Action without shared use. This slight increase in train traffic would result in small impacts to the wildlife communities.

4.3.7.4 Summary

Table 4-236 summarizes potential impacts to biological resources from constructing and operating the proposed rail line along the Mina rail alignment.

Adverse impacts to vegetation communities would be small in relation to the abundance of the vegetation communities in the region, with minimal loss of unique or particularly sensitive communities.

There would be impacts to water-related and riparian habitats from construction of Schurz alternative segments 1 and 6; however, impacts would be mostly short term during construction of a bridge across the Walker River.

Potential adverse impacts related to noxious and invasive species would include increased risk of these species becoming established in disturbed areas and encroaching on adjacent undisturbed habitat. DOE would implement best management practices (see Chapter 7) and BLM-prescribed and -approved methods to prevent the establishment of noxious weeds or invasive plant species.

Although impacts to wildlife habitats and individual populations could occur as a result of the rail line construction, impacts would be small and would not impact the continued existence of any wildlife species.

There would be the potential for impacts to threatened or endangered species during rail line construction. Potential impacts to desert tortoise would be small. DOE would implement best management practices to protect this species (see Chapter 7). Localized and minor loss of roosting and foraging habitat for the southwestern willow flycatcher and western yellow-billed cuckoo could occur as a result of the Proposed Action. However, since these species do not nest along the rail alignment, impacts would be small and limited to transient individuals.

Habitat for several special status species would be disturbed and individuals of several of the species could be disturbed, injured, or killed from the construction and operation of the proposed rail line and associated facilities. Potential impacts to federally listed species would likely require consultation with the U.S. Fish and Wildlife Service in accordance with Section 7 of the Endangered Species Act.

Overall, there would be a loss of conifer habitat and individual conifer trees. Pursuant to BLM protocols DOE would salvage and replant the minimal amounts of cacti and yucca removed during the construction phase; however, there would likely be some loss of individual cacti and yucca along the proposed rail line.

Overall, potential impacts to migratory birds would be short-term noise disturbances during construction and long-term habitat loss during the operations phase. These impacts would not have an adverse impact on migratory birds.

Although there would be impacts to game habitats and potential impacts to individuals or populations from constructing the proposed rail line, impacts would be small and would not significantly impact the continued existence of game species.

Although there would be impacts to herd management areas and potential impacts to individuals or wild horse and burro populations from constructing the proposed rail line along the Mina rail alignment, impacts would be small and would not significantly impact the management strategies utilized within the herd management areas.

Direct impacts to wildlife and wild horses and burros from the operation of the rail line would consist of potential collisions of wildlife with trains and short-term disruption of activities (such as foraging, nesting, and resting) due to the disturbance from noise caused by passing trains and from noise and presence of humans at rail facilities. Direct impacts would also include potential contamination of forage, prey species, nesting and spawning habitat, and sources of drinking water in the rare event of train derailment and associated spill of diesel fuel. Indirect impacts could include possible changes to predator/prey interactions due to the construction of towers and other structures that would provide new perch habitat for raptors and other predatory birds.

Table 4-236. Summary of potential impacts to biological resources from constructing and operating the railroad along the Mina rail alignment (page 1 of 6).

	Land cover (acres)[a]		Introduction/ proliferation of noxious/invasive weeds		Loss of riparian and water-related habitats (acres)		Threatened and endangered species		Special status species		Herd management areas/ Nevada game species	
Segment/ facility	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term
Union Pacific Railroad Hazen Branchline	0.00	0.00	No impact	Small	0.00	0.00	No impact	No impact	No impact	No impact	No impact	No impact
Department of Defense Branchline North	0.00	0.00	No impact	Small	0.00	0.00	No impact	No impact	Small impact to loggerhead shrike and burrowing owl	Small impact to loggerhead shrike and burrowing owl	Small impact to pronghorn antelope and mule deer	No impact
Schurz 1	667	306.6	Small	Small	3.45	0.00	Small impact to Lahontan cutthroat trout, western yellow-billed cuckoo, and southwestern willow flycatcher	No impact	Small impact to bats, loggerhead shrike, western burrowing owl, Swainson's hawk, dune sunflower, and oryctes	Small impact to bats, loggerhead shrike, and western burrowing owl	No impact	No impact
Schurz 4	809.8	476	Small	Small	3.19	0.31	Small impact to Lahontan cutthroat trout, western yellow-billed cuckoo, and southwestern willow flycatcher	No impact	Small impact to bats, loggerhead shrike, western burrowing owl, Swainson's hawk, white-faced ibis, and oryctes	Small impact to bats, loggerhead shrike, and western burrowing owl	No impact	No impact
Schurz 5	1,150	562	Small	Small	3.94	0.37	Small impact to Lahontan cutthroat trout, western yellow-billed cuckoo, and southwestern willow flycatcher	No impact	Small impact to bats, loggerhead shrike, western burrowing owl, Swainson's hawk, and oryctes	Small impact to bats, loggerhead shrike, and western burrowing owl	No impact	No impact
Schurz 6	1,190	604.7	Small	Small	4.03	0.00	Small impact to Lahontan cutthroat trout, western yellow-billed cuckoo, and southwestern willow flycatcher	No impact	Small impact to bats, loggerhead shrike, western burrowing owl, and Swainson's hawk	Small impact to bats, loggerhead shrike, and western burrowing owl	No impact	No impact

Table 4-236. Summary of potential impacts to biological resources from constructing and operating the railroad along the Mina rail alignment (page 2 of 6).

Segment/ facility	Land cover (acres)[a]		Introduction/ proliferation of noxious/invasive weeds		Loss of riparian and water-related habitats (acres)		Threatened and endangered species		Special status species		Herd management areas/ Nevada game species	
	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term
Department of Defense Branchline South	0.00	0.00	No impact	Small	0.00	0.00	No impact	No impact	Small impact to loggerhead shrike and burrowing owl	Small impact to loggerhead shrike,and burrowing owl	Small impact to pronghorn antelope and mule deer	No impact
Staging Yard at Hawthorne	264	66.4	No impact	Small	0.00	0.00	No impact	No impact	Small impact loggerhead shrike, burrowing owl, and oryctes	No impact	Small impact to pronghorn antelope	Small impact to pronghorn antelope
Mina common segment 1	7,670	644	Small	Small	0.00	0.00	No impact	No impact	Small impact to bats, white-faced ibis, western burrowing owl, loggerhead shrike, oryctes, and western snowy plover	Small impact to western burrowing owl, loggerhead shrike, and western snowy plover	Small impact to pronghorn antelope, mule deer, and Pilot Mountain Herd Management Area	Small impact to pronghorn antelope, mule deer, and Pilot Mountain Herd Management Area
Garfield Hills quarry	97.2	245	No impact	Small	0.00	0.00	No impact	No impact	Small impact to western burrowing owl, loggerhead shrike, and Wassuk beardtongue	Small impact to western burrowing owl and loggerhead shrike	No impact	No impact
Gabbs Range quarry	74.6	164	No impact	Small	0.00	0.00	No impact	No impact	Small impact to western burrowing owl and loggerhead shrike	Small impact to western burrowing owl and loggerhead shrike	Small impact to pronghorn antelope and Pilot Mountain Herd Management Area	Small impact to pronghorn antelope and Pilot Mountain Herd Management Area
Montezuma 1	7,810	797	Small	Small	0.00	0.00	No impact	No impact	Small impact to bats, western burrowing owl, pygmy rabbit, pale kangaroo mouse, dark kangaroo mouse, ferrugious hawk, sage thrasher, Brewer's sparrow, and loggerhead shrike	Small impact to bats, western burrowing owl, pygmy rabbit, pale kangaroo mouse, dark kangaroo mouse, ferrugious hawk, sage thrasher, Brewer's sparrow, and loggerhead shrike	Small impact to mule deer, greater sage-grouse, and Montezuma Peak Herd Management Area	Small impact to mule deer and greater sage-grouse; no impact to Montezuma Peak Herd Management Area

Table 4-236. Summary of potential impacts to biological resources from constructing and operating the railroad along the Mina rail alignment (page 3 of 6).

Segment/ facility	Land cover (acres)[a]		Introduction/ proliferation of noxious/invasive weeds		Loss of riparian and water-related habitats (acres)		Threatened and endangered species		Special status species		Herd management areas/ Nevada game species	
	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term
Montezuma 2	8,015	592	Small	Small	0.00	0.00	No impact	No impact	Small impact to bats, pale kangaroo mouse, dark kangaroo mouse, pygmy rabbit, western burrowing owl, loggerhead shrike, sage thrasher, Brewer's sparrow, Pahute Mesa beardtongue, Eastwood milkweed, Nevada dune beardtongue, and ferruginous hawk	Small impact to bats, pale kangaroo mouse, dark kangaroo mouse, pygmy rabbit, western burrowing owl, sage thrasher, Brewer's sparrow, and loggerhead shrike	Small impact to mule deer and Montezuma Peak Herd Management Area	Small impact to mule deer, no impact to Montezuma Peak Herd Management Area
Montezuma 3	9,620	731	Small	Small	0.00	0.00	No impact	No impact	Small impact to bats, pale kangaroo mouse, dark kangaroo mouse, pygmy rabbit, western burrowing owl, loggerhead shrike, Pahute Mesa beardtongue, Eastwood milkweed, Nevada dune beardtongue, northern goshawk, sage thrasher, Brewer's sparrow, and ferruginous hawk	Small impact to bats, pale kangaroo mouse, dark kangaroo mouse, pygmy rabbit, sage thrasher, Brewer's sparrow, western burrowing owl, and loggerhead shrike	Small impact to bighorn sheep, pronghorn antelope; no impact to Montezuma Peak Herd Management Area	Small impact to bighorn sheep, pronghorn antelope, no impact to Montezuma Peak Herd Management Area
Klondike option – Maintenance-of-Way Facility	153	9.40	No impact	Small	0.00	0.00	No impact	No impact	Small impact to pale kangaroo mouse, dark kangaroo mouse, bats, western burrowing owl, sage thrasher, Brewer's sparrow, loggerhead shrike, Eastwood milkweed, and Nevada dune beardtongue	Small impact to pale kangaroo mouse, dark kangaroo mouse, bats, western burrowing owl, sage thrasher, Brewer's sparrow, and loggerhead shrike	Small impact to mule deer, pronghorn antelope, and Montezuma Peak Herd Management Area	Small impact to mule deer, pronghorn antelope, and Montezuma Peak Herd Management Area

Table 4-236. Summary of potential impacts to biological resources from constructing and operating the railroad along the Mina rail alignment (page 4 of 6).

Segment/ facility	Land cover (acres)[a]		Introduction/ proliferation of noxious/invasive weeds		Loss of riparian and water-related habitats (acres)		Threatened and endangered species		Special status species		Herd management areas/ Nevada game species	
	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term
North Clayton quarry	95.9	344	No impact	Small	0.00	0.00	No impact	No impact	Small impact to bats, western burrowing owl, loggerhead shrike, northern goshawk, and ferruginous hawk	Small impact to bats, western burrowing owl, and loggerhead shrike	Small impact to pronghorn antelope, mule deer, and Montezuma Peak Herd Management Area	Small impact to pronghorn antelope, mule deer, and Montezuma Peak Herd Management Area
Silver Peak option Maintenance-of-Way Facility	167	13.5	No impact	Small	0.00	0.00	No impact	No impact	Small impact to pale kangaroo mouse, dark kangaroo mouse, bats, western burrowing owl, loggerhead shrike, Eastwood milkweed, ferrugious hawk, sage thrasher, Brewer’s sparrow, and Nevada dune beardtongue	Small impact to pale kangaroo mouse, dark kangaroo mouse, bats, ferrugious hawk, sage thrasher, Brewer’s sparrow, western burrowing owl, and loggerhead shrike	Small impact to mule deer, greater sage-grouse, and Montezuma Peak Herd Management Area	Small impact to mule deer, greater sage-grouse, and Montezuma Peak Herd Management Area
Malpais Mesa quarry	135	517	No impact	Small	0.00	0.00	No impact	No impact	Small impact to bats, loggerhead shrike, and western burrowing owl	Small impact to bats, loggerhead shrike, and western burrowing owl	Small impact to mule deer, pronghorn antelope, and Montezuma Peak Herd Management Area	Small impact to mule deer, pronghorn antelope, and Montezuma Peak Herd Management Area
Goldfield quarry ES-7	75.4	281	No impact	Small	0.00	0.00	No impact	No impact	Small impact to bats, dark kangaroo mouse, pale kangaroo mouse, loggerhead shrike, western burrowing owl, and Eastwood milkweed	Small impact to bats, dark kangaroo mouse, pale kangaroo mouse, loggerhead shrike, and western burrowing owl	Small impact to mule deer, pronghorn antelope, and Montezuma Peak Herd Management Area	Small impact to mule deer, pronghorn antelope, and Montezuma Peak Herd Management Area

Table 4-236. Summary of potential impacts to biological resources from constructing and operating the railroad along the Mina rail alignment (page 5 of 6).

Segment/ facility	Land cover (acres)[a]		Introduction/ proliferation of noxious/invasive weeds		Loss of riparian and water-related habitats (acres)		Threatened and endangered species		Special status species		Herd management areas/ Nevada game species	
	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term
Mina common segment 2	244	15.3	Small	Small	0.00	0.00	No impact	No impact	Small impact to bats, western burrowing owl, and loggerhead shrike	No impact	Small impact to Stonewall Herd Management Area	Small impact to Stonewall Herd Management Area
Bonnie Claire 2	1,400	125	Small	Small	0.00	0.00	No impact	No impact	Small impact to bats, loggerhead shrike, and western burrowing owl	Small impact to bats, loggerhead shrike, and western burrowing owl	Small impact on mule deer, pronghorn antelope, bighorn sheep, and Stonewall Herd Management Area	Small impact on mule deer, pronghorn antelope, bighorn sheep, and Stonewall Herd Management Area
Bonnie Claire 3	1,380	120.7	Small	Small	0.00	0.00	No impact	No impact	Small impact to bats, loggerhead shrike, and western burrowing owl	Small impact to bats, loggerhead shrike, and western burrowing owl	Small impact on mule deer, pronghorn antelope, bighorn sheep, and Stonewall Herd Management Area	Small impact on mule deer, pronghorn antelope, bighorn sheep, and Stonewall Herd Management Area
Common segment 5	2,750	201.4	Small	Small	0.00	0.00	No impact	No impact	Small impact on bats, loggerhead shrike, western burrowing owl, Oasis Valley speckled dace, ferruginous hawk, and Nevada dune beardtongue	No to small impact on bats, loggerhead shrike, and western burrowing owl	Small impact to pronghorn antelope, bighorn sheep, and mule deer	No impact

Table 4-236. Summary of potential impacts to biological resources from constructing and operating the railroad along the Mina rail alignment (page 6 of 6).

Segment/ facility	Land cover (acres)[a]		Introduction/ proliferation of noxious/ invasive weeds		Loss of riparian and water-related habitats (acres)		Threatened and endangered species		Special status species		Herd management areas/ Nevada game species	
	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term
Oasis Valley 1	648	75.6	Small	Small	0.00	0.00	No impact	No impact	Small impact to bats, loggerhead shrike, western burrowing owl, and black woollypod	Small impact to bats, loggerhead shrike, and western burrowing owl	Small impact on mule deer, desert bighorn sheep, and Bullfrog Herd Management Area	Small impact to Bullfrog Herd Management Area
Oasis Valley 3	976	107.4	Small	Small	4.67	0.00	No impact	No impact	Small impact to bats, loggerhead shrike, western burrowing owl, and black woollypod	Small impact to bats, loggerhead shrike, and western burrowing owl	Small impact on mule deer, desert bighorn sheep, and Bullfrog Herd Management Area	Small impact to Bullfrog Herd Management Area
Common segment 6	3,270	402.4	Small	Small	0.00	0.00	Small impact to desert tortoise	Small impact to desert tortoise	Small impact to bats, loggerhead shrike, western burrowing owl, chuckwalla, and black woollypod	Small impact to bats, loggerhead shrike, western burrowing owl, and chuckwalla	Moderate impact on desert bighorn sheep; small impact on mule deer and Bullfrog Herd Management Area	Small impact to Bullfrog Herd Management Area
Rail Equipment Maintenance Yard	150	75.03	No impact	Small	0.00	0.00	Small impact to desert tortoise	Small impact to desert tortoise	Small impact to bats, loggerhead shrike, western burrowing owl, chuckwalla, and black woollypod	Small impact to bats, loggerhead shrike, western burrowing owl, and chuckwalla	Moderate impact on bighorn sheep; small impact to mule deer and Bullfrog Herd Management Area	Small impact to bighorn sheep and Bullfrog Herd Management Area

a. To convert acres to square kilometers, multiply by 0.0040469.

4.3.8 NOISE AND VIBRATION

This section describes potential noise and vibration impacts from constructing and operating a railroad along the Mina rail alignment. Section 4.3.8.1 describes the methodology DOE used to assess potential impacts; Section 4.3.8.2 describes potential construction impacts; Section 4.3.8.3 describes potential operations impacts; Section 4.3.8.4 describes potential impacts under the Shared-Use Option; and Section 4.3.8.5 summarizes potential impacts from noise and vibration.

Section 3.3.8.1 describes the region of influence for the analysis of noise and vibration impacts along the Mina rail alignment. Appendix I, Noise and Vibration Impact Assessment Methodology, provides more information on the fundamentals of analyzing noise.

4.3.8.1 Impact Assessment Methodology

The approach for analyzing potential noise impacts is based on measurements of current ***ambient noise*** levels (see Section 3.3.8.2), noise modeling for future activities (proposed railroad construction and operations), and identification of changes in noise levels that receptors within the region of influence would experience.

To establish a baseline for determining if there would be an increase in noise, DOE measured ambient noise in the study area at five representative locations along the rail alignment: Silver Springs, Schurz, Mina, Silver Peak, and Goldfield (see Section 3.3.8.2). DOE chose these locations because they are representative of the few populated areas near the existing Union Pacific Railroad Hazen Branchline and the Mina rail alignment.

DOE used several criteria to determine the level of potential impacts from noise and vibration along the rail alignment. For noise impacts from construction activities, DOE used U.S. Department of Transportation, Federal Transit Administration, methods (DIRS 177297-Hanson, Towers, and Meister 2006, all) and construction noise guidelines listed in Table 4-237.

Table 4-237. Federal Transit Administration construction noise guidelines.[a,b]

Land use	8-hour L_{eq} (dBA) Day	8-hour L_{eq} (dBA) Night	30-day average DNL (dBA)
Residential	80	70	75[c]
Commercial	85	85	80[d]
Industrial	90	90	85[d]

a. Source: DIRS 177297-Hanson, Towers, and Meister 2006, p. 12-8.
b. dBA = A-weighted decibels; DNL = day-night average noise level; L_{eq} = equivalent sound level.
c. In urban areas with very high ambient noise levels (DNL greater than 65 dBA), DNL from construction projects should not exceed existing ambient + 10 dBA.
d. 24-hour L_{eq}, not DNL.

For operation of trains during the construction and operations phases, DOE analyzed noise impacts under established STB criteria. The STB has environmental review regulations for noise analysis (49 CFR 1105.7e(6)), with the following criteria:

- An increase in noise exposure as measured by a ***day and night average noise level*** (DNL) of 3 dBA or more
- An increase to a noise level of 65 DNL or greater

If the estimated noise-level increase at a location would exceed either criterion, the STB then estimates the number of affected noise-***sensitive receptors*** (such as schools, libraries, residences, retirement communities, and nursing homes). The two components (3 dBA increase, 65 DNL) of the STB criteria are implemented separately to determine an upper bound of the area of potential noise impact. However, current noise research indicates that both criteria must be met to cause an adverse noise impact (DIRS 173225-STB 2003, p. 4-82). That is, noise levels would have to be greater than or equal to 65 DNL and increase by 3 dBA or more for an adverse noise impact to occur.

The approach for analyzing potential vibration impacts is based on estimates of project-generated vibration and measurements of current ambient vibration conditions (see Section 3.3.8). To evaluate potential vibration impacts from construction and operation activities, DOE used Federal Transit Administration building vibration damage and human annoyance criteria. Under these criteria, if vibration levels exceeded 80 VdB (human annoyance criterion for infrequent events) or if the vibration levels (measured as ***peak particle velocity***) exceeded 0.20 inch per second for fragile buildings or 0.12 inches per second for extremely fragile historic buildings, then there could be a vibration impact (DIRS 177297-Hanson, Towers, and Meister 2006, all). Appendix I provides more information on the vibration metrics used in this study.

Day-night average noise level (DNL): The energy average of A-weighted decibel (dBA) sound levels over 24 hours; includes an adjustment factor for noise between 10 p.m. and 7 a.m. to account for the greater sensitivity of most people to noise during the night. The effect of nighttime adjustment is that one nighttime event, such as a train passing by between 10 p.m. and 7 a.m., is equivalent to 10 similar events during the daytime.

A-weighted decibels (dBA): A measure of noise level used to compare noise from various sources. A-weighting approximates the frequency response of the human ear.

To establish a baseline for determining if there would be an increase in vibration, DOE measured ambient vibration in the study area at five representative locations: Silver Springs, Schurz, Mina, Silver Peak, and Goldfield (see Section 3.3.8).

4.3.8.2 Construction Impacts

Noise and vibration levels created by construction equipment vary greatly depending on such factors as the type of equipment, the specific model, the operation being performed, and the condition of the equipment. In addition, the proximity of the equipment to noise- and vibration-sensitive locations, duration of the activity, and time of day will influence the effects of construction noise and vibration. The results of this assessment reflect the ***uncertainty*** about the exact details of construction activities that would be required. However, the analysis assumes extreme combinations of equipment and operations known at this time that conservatively estimate upper-bound construction noise and vibration levels.

4.3.8.2.1 Construction Noise

The Federal Transit Administration construction noise analysis method suggests using the two noisiest pieces of equipment to estimate noise levels at sensitive locations (DIRS 177297-Hanson, Towers, and Meister 2006, p. 12-7). For this analysis, DOE used heavy trucks and bulldozers as the two noisiest pieces of equipment, based on the types of construction equipment that would be needed (DIRS 182825-Nevada Rail Partners 2007, Appendix B). There would be no pile driving near populated areas, so no pile-driving noise analysis is required.

DOE developed 8-hour construction noise-level estimates by assuming that a bulldozer (with a noise emission level of 85 dBA at 15 meters [50 feet]) would be at full operation for 8 hours at a given location along a common segment or alternative segment at the approximate minimum distance to the nearest residential receptor anywhere along the Mina rail alignment. Tables 4-238 and 4-239 list estimated construction noise levels for Mina, Silver Peak, and Goldfield. In addition, based on the construction schedule, the analysis conservatively assumed that 15 bulldozers would be operating simultaneously in the same general area. DOE also assumed that trucks (with a noise emission level of 88 dBA at 15 meters) would be at full power at the same general area for 8 hours per day. Based on the construction schedule, DOE conservatively assumed that 27 trucks would be operating simultaneously in the same general area. These analyses assume that there would be no construction activities during the night.

Table 4-238. Estimated construction noise levels along the Mina rail alignment (8-hour L_{eq}).[a]

Location (segment)	Approximate distance to nearest receptor (feet)[b]	8-hour bulldozer L_{eq}	8-hour truck L_{eq}	Total 8-hour L_{eq} (dBA)[a]
Mina (Mina common segment 1)	2,700	62	67	69
Silver Peak (Montezuma alternative segment 1)	1,500	67	73	74
Goldfield (Montezuma alternative segment 2)	820	72	78	79

a. dBA = A-weighted decibels; L_{eq} = equivalent sound level.
b. To convert feet to meters, multiply by 0.3048.

Table 4-239. Estimated construction noise levels along the Mina rail alignment (30-day DNL).[a]

Location (segment)	Approximate distance to nearest receptor (feet)[b]	30-day bulldozer DNL	30-day truck DNL	Total 30-day DNL (dBA)
Mina (Mina common segment 1)	2,700	47	53	54
Silver Peak (Montezuma alternative segment 1)	1,500	53	58	59
Goldfield (Montezuma alternative segment 2)	820	58	63	64

a. dBA = A-weighted decibels; DNL = day-night average noise level.
b. To convert feet to meters, multiply by 0.3048.

The distances from construction activities to the nearest receptors would be great; therefore, construction noise levels would be below the Federal Transit Administration noise guidelines listed in Table 4-237.

There would be construction noise associated with removal of the existing Department of Defense track through Schurz, but this noise would be temporary and no adverse impact would be expected.

The Maintenance-of-Way Facility would be the only railroad operations support facility within the general vicinity of a populated area. However, this facility would be much farther from Silver Peak than the proposed rail line and, consequently, construction of the facility would produce lower noise levels. Therefore, there would be no adverse noise impacts from construction of associated rail facilities.

4.3.8.2.2 Construction Vibration

DOE based the construction vibration analysis on Federal Transit Administration methods (DIRS 177297-Hanson, Towers, and Meister 2006, all). Construction vibration should be assessed in cases where there is a significant potential for impact from construction activities. Such activities include blasting, pile driving, drilling, or excavation close to ***sensitive structures***. No pile driving is planned near populated areas, so pile-driving vibration analysis is not required.

Based on the proposed construction equipment and Federal Transit Administration vibration data, DOE estimated potential ground-borne vibration levels due to construction activity. Table 4-240 lists estimated vibration levels associated with potential bulldozer activity.

Table 4-240. Estimated construction vibration levels along the Mina rail alignment.

Location (segment)	Approximate distance to nearest receptor (feet)[a]	Peak particle velocity (inches per second)
Mina (Mina common segment 1)	2,700	0.000078
Silver Peak (Montezuma alternative segment 1)	1,500	0.000201
Goldfield (Montezuma alternative segment 2)	820	0.0005

a. To convert feet to meters, multiply by 0.3048.

The vibration levels listed in Table 4-240 are below Federal Transit Administration building vibration damage criteria (0.20 inch per second for fragile buildings, and 0.12 inch per second for extremely fragile historic buildings). Therefore, DOE would expect no damage to buildings due to vibration during construction. In addition, because of relatively low vibration levels and the temporary nature of construction, human annoyance due to construction vibration would be low.

Blasting operations could be required as part of the excavation process to accommodate the rail roadbed in hilly areas. Uncertainty about the need for and the exact locations of blasting operations is typical at this phase of the proposed project. If blasting were needed and would occur near populated areas, DOE would assess potential blasting noise and vibration and take measures to minimize these temporary impacts, if any.

None of the railroad operations support facilities would be near receptors; therefore, there would be no adverse vibration impacts from construction of these facilities.

4.3.8.2.3 Construction-Train Noise

As the rail roadbed, track, and bridges were completed, construction trains would be employed to move railroad ties, ballast, and other rail-construction equipment to other construction areas. Up to 16 one-way trains per day could pass by certain receptor locations, such as those in Mina and Silver Peak, during a 4-year construction phase. Up to eight trains per day could pass by certain receptor locations on the Union Pacific Railroad Hazen Branchline in Silver Springs during the construction period. If the construction period was extended up to 10 years, the same total amount of construction trains would operate, but at a lower average number of trains per day. This analysis conservatively uses the higher number of 16 trains per day for Mina and Silver Peak and 8 trains per day for Silver Springs. As with operations trains, locomotive horn sounding at grade crossings would be the dominant noise source.

Using the equations in Appendix I, Section I.2.1, and analytical methods described in that appendix, DOE generated construction-train noise contours for Silver Springs (on the Union Pacific Railroad Hazen Branchline) and for two other populated areas near the Mina rail alignment: Mina and Silver Peak. Figures 4-31 through Figures 4-34 show 65 DNL noise contours for construction-train activity in these areas.

DOE estimates that 34 receptors would be included within the construction-train 65 DNL contours in Silver Springs, and 7 receptors would be included within the 65 DNL contours in Wabuska. These noise impacts would be adverse but temporary because they would occur only during the construction phase. There would be no receptors within the construction-train 65 DNL contours in Mina and Silver Peak. DOE estimates that 713 receptors would be included within the construction-train 3 dBA increase contours in Silver Springs (see Figure 4-35), and 15 receptors would be included within the 3 dBA increase contours in Wabuska (see Figure 4-36). There would be no receptors within the 3 dBA increase contour in Mina as shown in Figure 4-37. However, as shown in Figure 4-38, approximately 12 receptors would be included within the 3 dBA increase contour in Silver Peak. DOE estimates that 190 receptors would be included within the 3 dBA increase contour in Goldfield.

There would be no adverse noise impacts associated with these receptors because they would not experience a 3 dBA increase and also be exposed to 65 DNL or greater noise levels. The purpose of the 3 dBA increase component of STB noise guidelines is to identify potential impact areas and areas where train noise would be particularly audible. However, because transportation noise sources are audible throughout the United States, the audibility of train noise itself does not constitute an adverse noise impact.

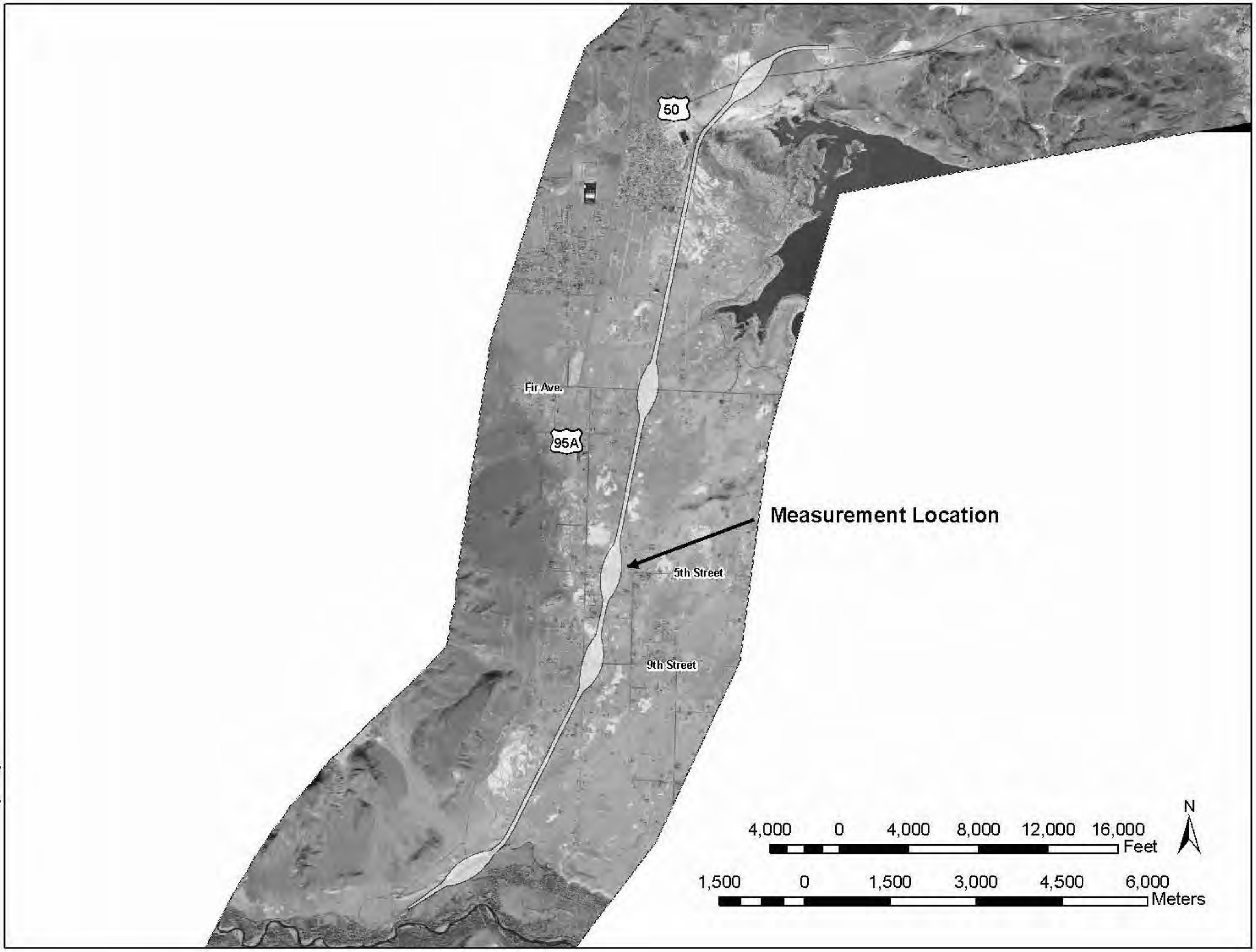


Figure 4-31. Construction-train 65 DNL contour, Silver Springs, Nevada.

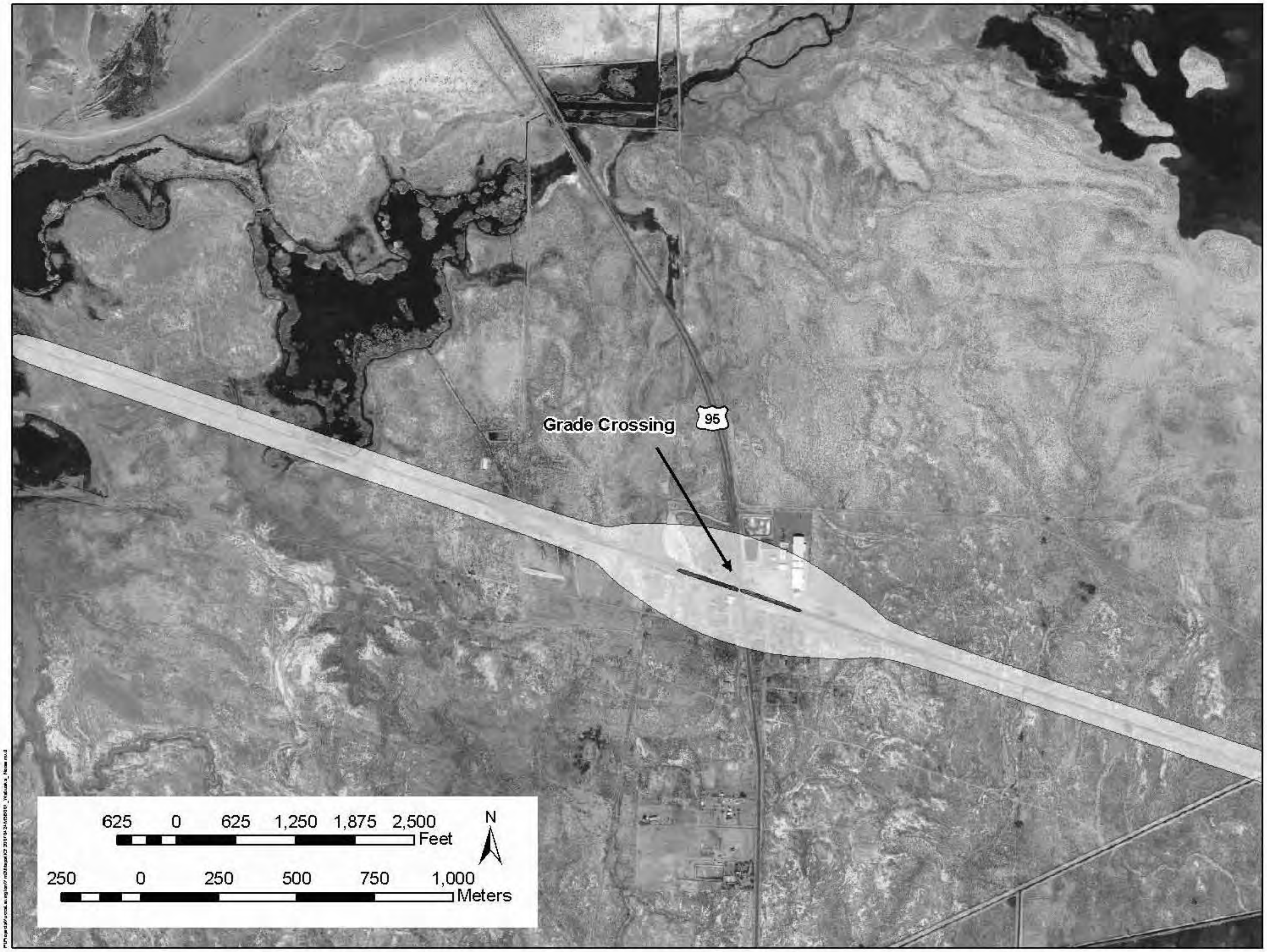


Figure 4-32. Construction-train 65 DNL contour, Wabuska, Nevada.

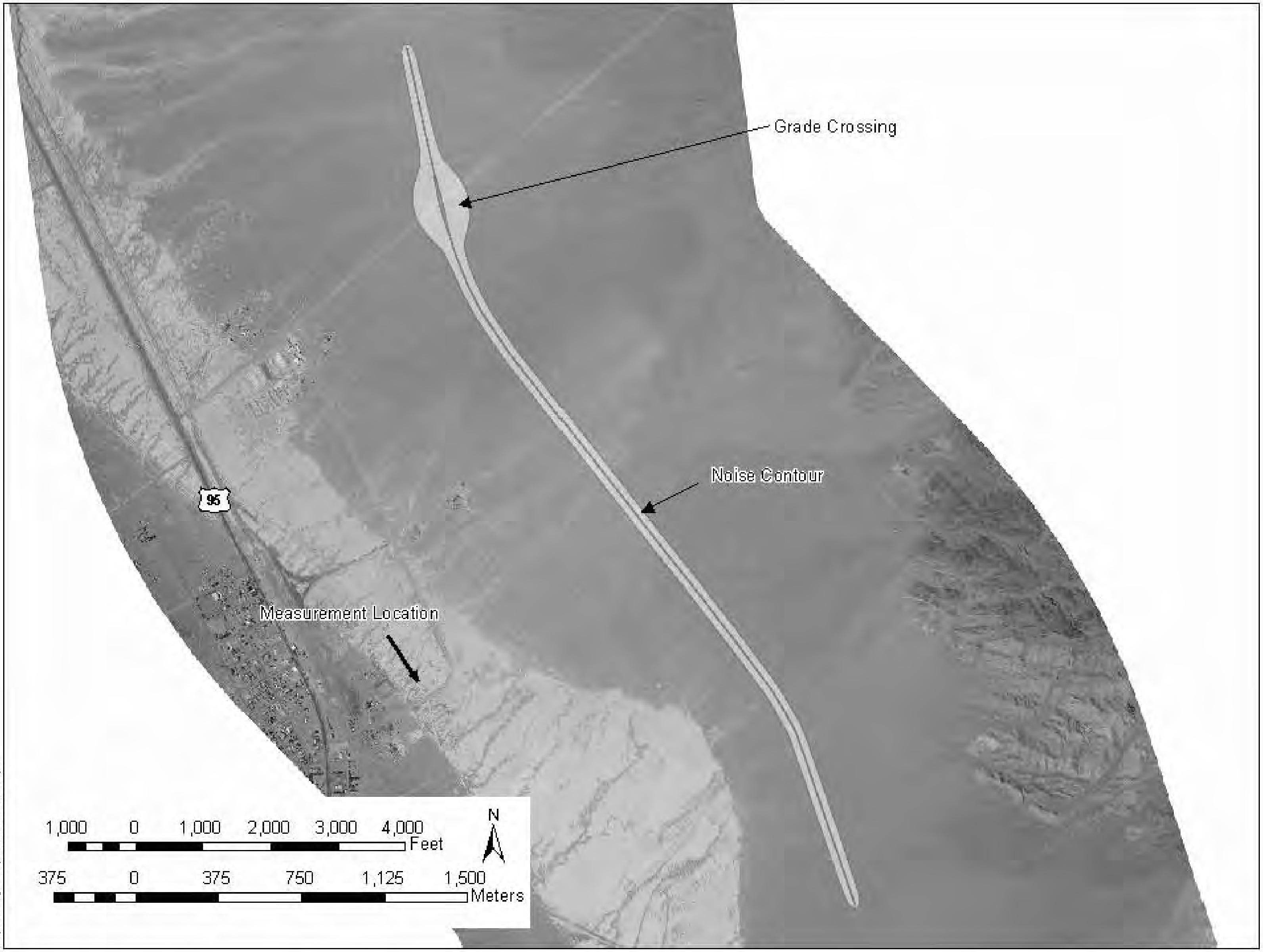


Figure 4-33. Construction-train 65 DNL contour, Mina, Nevada.

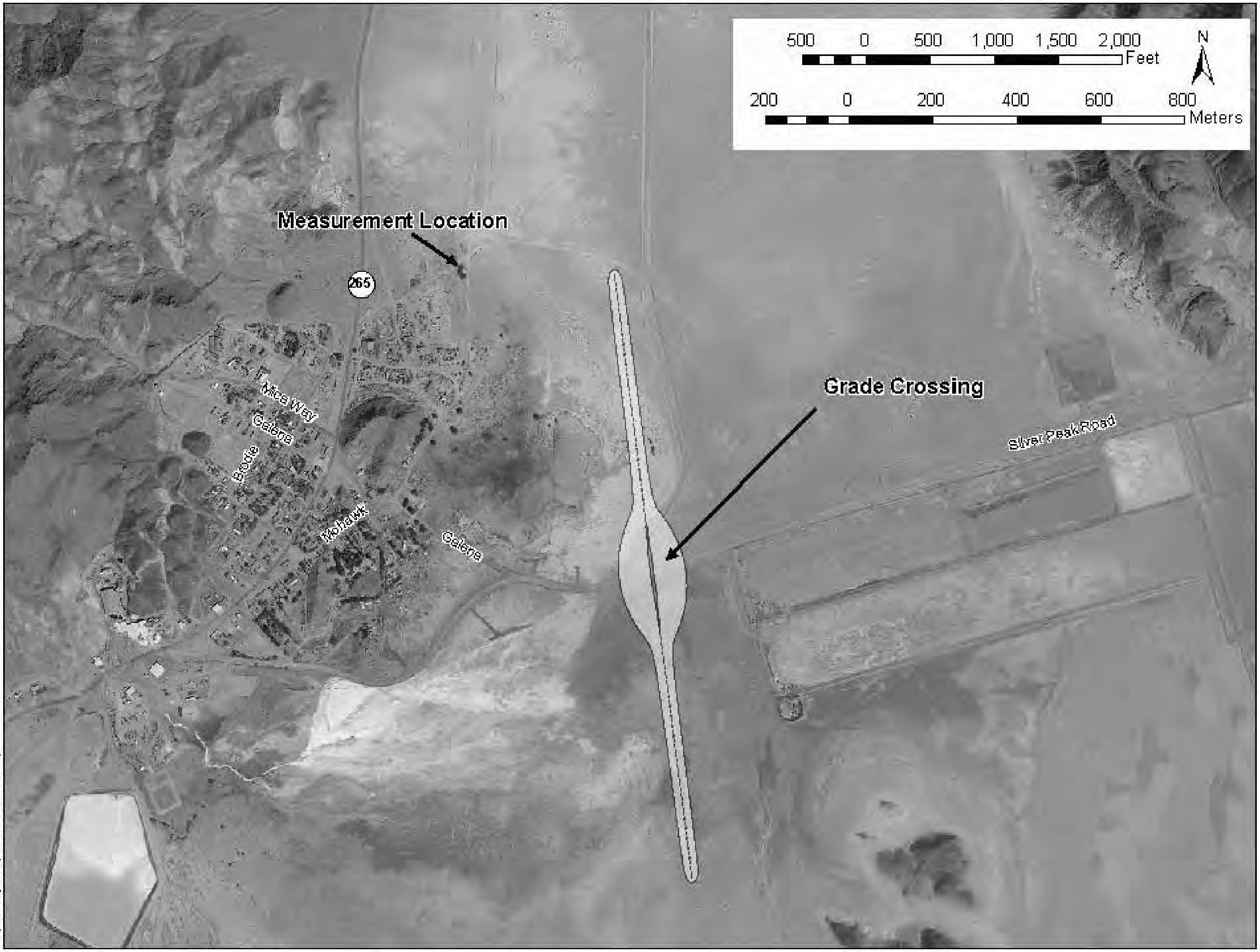


Figure 4-34. Construction-train 65 DNL contour, Silver Peak, Nevada.

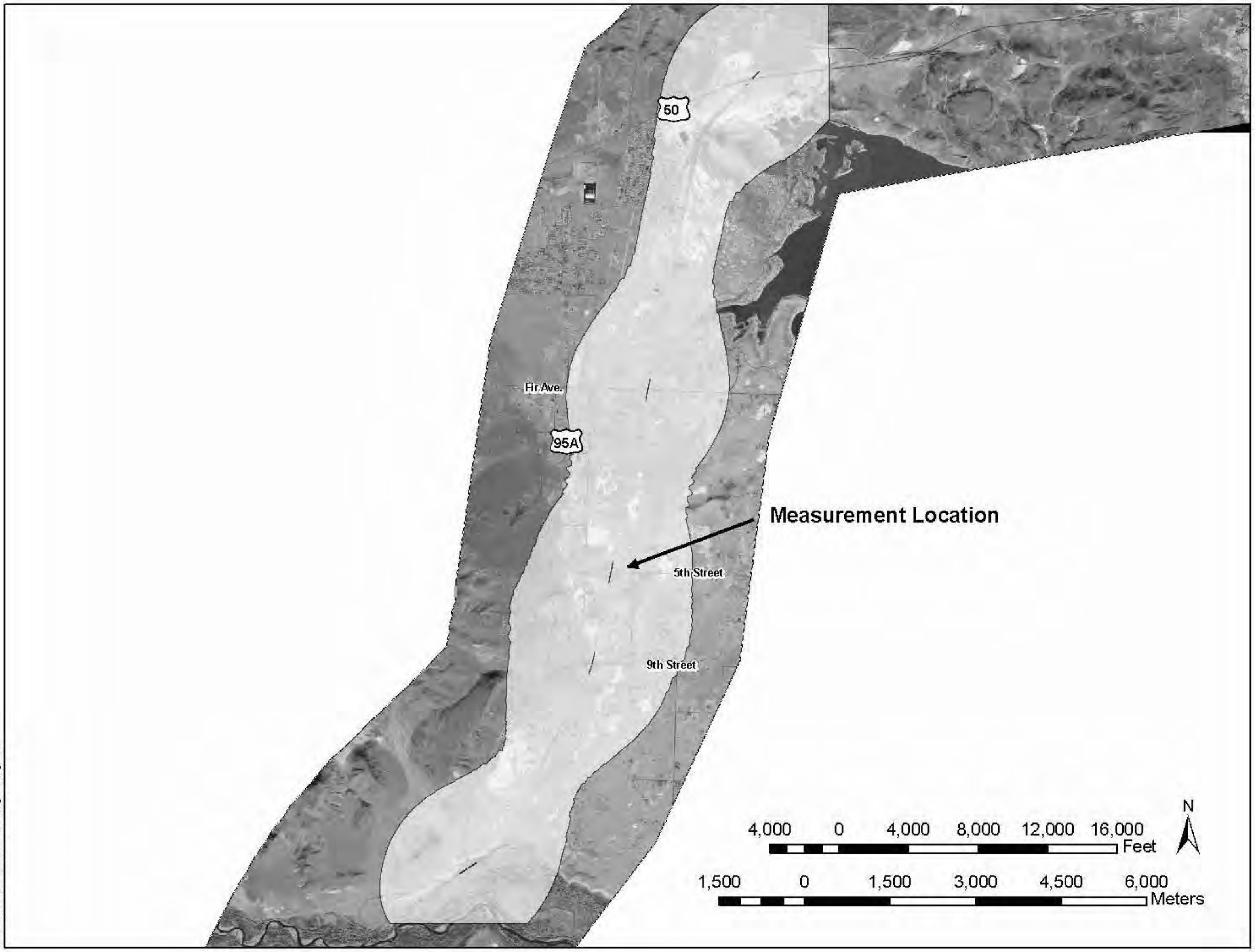


Figure 4-35. Construction-train 3 dBA increase contour, Silver Springs, Nevada.

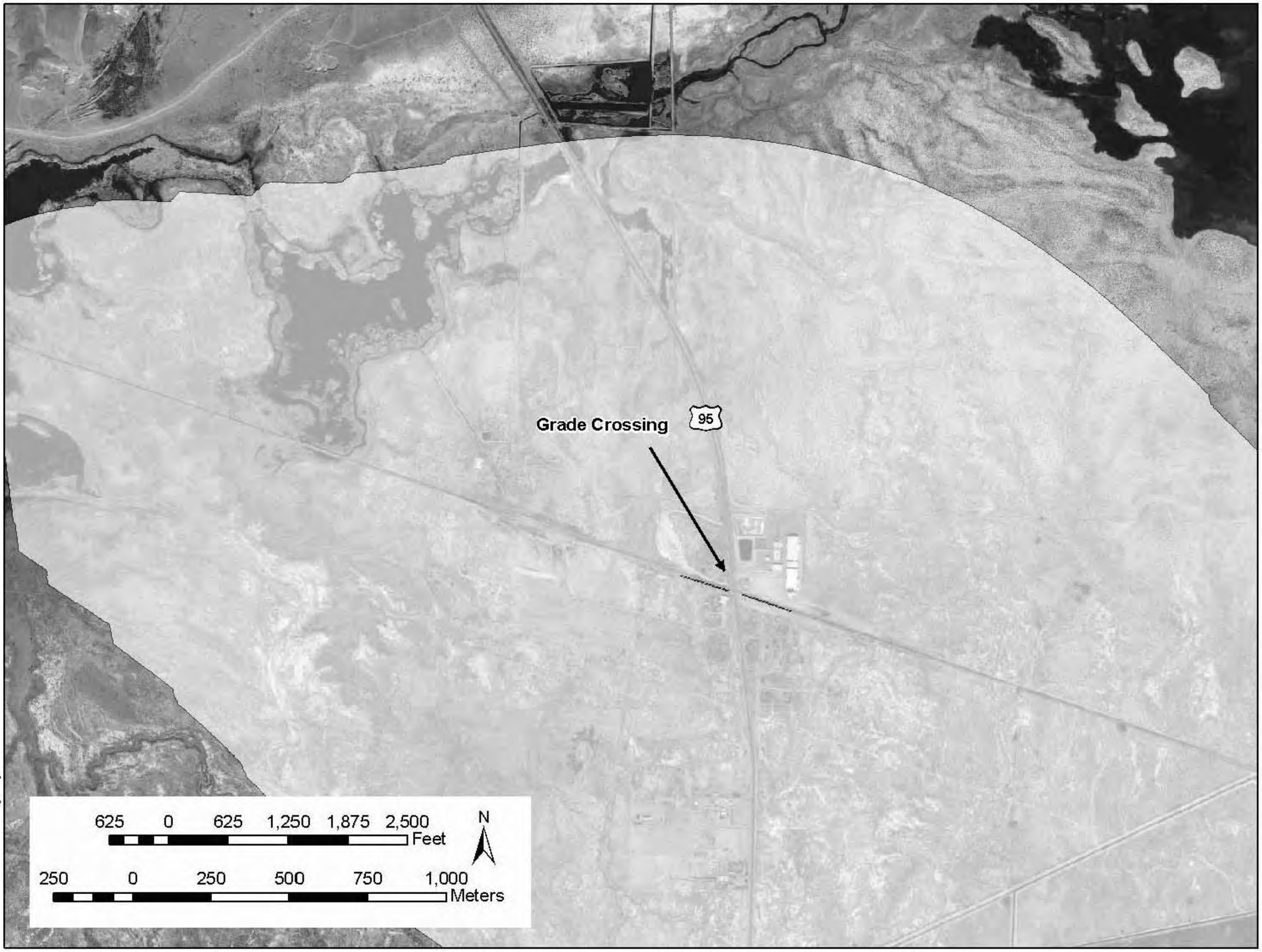


Figure 4-36. Construction-train 3 dBA increase contour, Wabuska, Nevada.

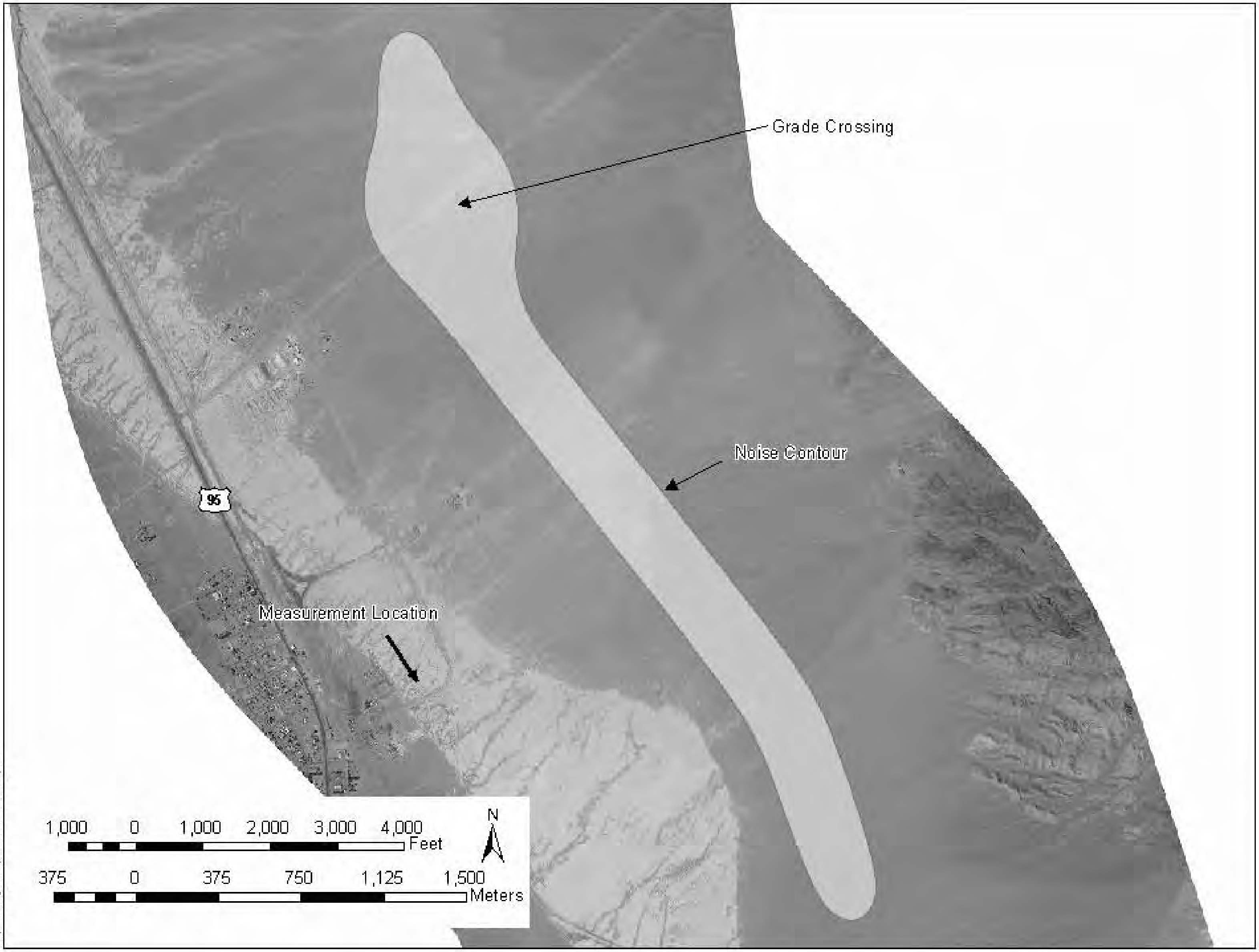


Figure 4-37. Construction-train 3 dBA increase contour, Mina, Nevada.

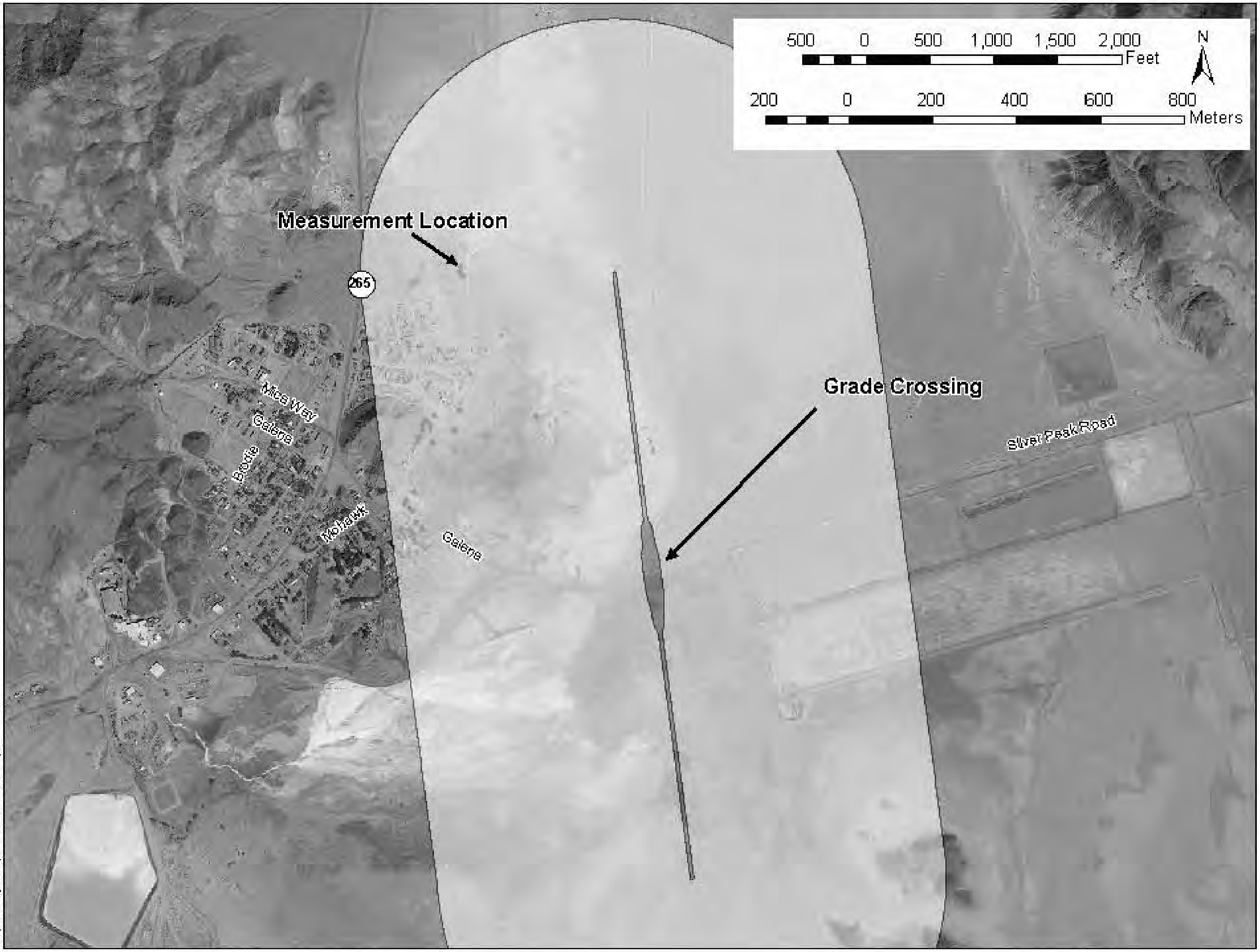


Figure 4-38. Construction-train 3 dBA increase contour, Silver Peak, Nevada.

4.3.8.2.4 Construction-Train Vibration

Construction trains would travel at lower speeds than operations trains. Because vibration is a function of train speed, construction-train vibration would be lower than operations-train vibration (see Section 4.3.8.3.4). Freight trains operating at 80 kilometers (50 miles) per hour would produce an annoyance-based vibration contour extending approximately 24 meters (80 feet) from the tracks (DIRS 177297-Hanson, Towers, and Meister 2006, p. 10-3). There are no buildings within approximately 24 meters of the Mina rail alignment, so operations trains would produce no adverse vibration impacts; therefore, there would be no adverse vibration impacts from construction trains.

Construction-train cars carrying ballast could weigh more than operations-train cars; therefore, those cars could produce higher levels of vibration. The locomotive itself would be considered representative of heavier cars. However, typically the locomotive produces the highest vibration level during a train passby, which would determine the maximum passby vibration level. Because operations-train and construction-train locomotives would be similar, the higher-speed operations locomotive would generate the highest level of vibration.

4.3.8.2.5 Quarry-Site Noise

Noise sources associated with potential quarry operations during the construction phase include blasting, rock crushing, heavy-equipment operation, and truck traffic.

There are no receptors in the immediate vicinity of the potential Garfield Hills, Gabbs Range, North Clayton, and Malpais Mesa quarry sites. Therefore, there would be no noise impacts associated with operation of these quarries during rail line construction.

At potential quarry ES-7 west of Goldfield, there would be blasting and rock-crushing activities at least 1,500 meters (5,000 feet) away from receptors in west Goldfield. While quarry noise would likely be audible in west Goldfield, this distance and the intervening topography, which would act as a barrier to and would attenuate noise, would make it unlikely that there would be adverse noise impacts from this quarry.

4.3.8.2.6 Quarry-Site Vibration

Vibration sources associated with operations at potential quarries during the construction phase include blasting, rock crushing, heavy-equipment operation, and truck traffic. Peak overpressures and ground-borne vibration associated with blasting can be an issue in relation to the structural integrity of buildings close to blasting activities.

There are no receptors in the immediate vicinity of the potential Garfield Hills, Gabbs Range, North Clayton, and Malpais Mesa quarry sites. Therefore, there would be no vibration impacts associated with operation of these quarries during the construction phase.

At potential quarry ES-7 west of Goldfield, there would be blasting and rock-crushing activities at least 1,500 meters (5,000 feet) away from receptors in west Goldfield. Because of this large distance between quarry activities and receptors, it is unlikely that ground-borne vibration would be perceptible at receptor locations; therefore, there would be no adverse vibration impacts.

4.3.8.3 Operations Impacts

The primary sources of noise considered in the analysis for railroad operations were wayside train noise and horn noise. Wayside noise refers collectively to all train-related operations noise adjacent to the operations right-of-way, excluding locomotive warning-horn noise. Wayside noise results from steel train wheels contacting steel rails (wheel-rail noise) and from locomotive exhaust and engine noise. The amount of noise created by the wheels on the rails would depend on train speed; the amount of engine noise created by the locomotive would depend on the throttle setting. Wheel squeal can sometimes occur on curved sections of track where the radius of curvature of the track is small. There would be horn noise in the vicinity of grade crossings to warn motorists and pedestrians of approaching trains; this noise is assessed separately from wayside noise.

Operation of any of the Schurz alternative segments would eliminate future noise from operation of the Department of Defense Branchline through Schurz.

4.3.8.3.1 Wayside Noise

Appendix I describes the methodology DOE used to estimate wayside noise during the operations phase. Wheel-rail noise would vary as a function of speed and could increase by as much as 15 dBA if wheels or rails were in poor condition (DIRS 174623-Kaiser 1998, all). One of the most common causes of additional noise from wheels is the formation of flat surfaces on wheels caused by wheels sliding during hard braking.

The main components of locomotive noise are the exhaust of the diesel engines, cooling fans, general engine noise, and the wheel-rail interaction. Noise associated with the engine exhaust and cooling fans usually dominates; this noise would depend on the throttle setting (most locomotives have eight throttle settings), not on locomotive speed. Tests have shown that locomotive noise levels change by about 2 dBA for each step change in throttle setting, meaning that noise levels increase by about 16 dBA as the locomotive throttle is moved from notch one to notch eight (DIRS 174623-Kaiser 1998, all). Because locomotive engineers constantly adjust throttle settings as necessary, only rough estimates of throttle settings are usually available for noise projections. Numerous field measurements of freight train operations indicate that locomotive noise can be projected with reasonable accuracy by assuming a base condition of throttle position six and adjusting noise levels when better information about typical throttle position is known.

Given the maximum train passby noise level of freight cars and a locomotive under a specific set of reference conditions, the noise models allow estimation of the maximum train passby noise level, the noise exposure level, the DNL, and other noise metrics for varying distances from the track, varying train speeds, and varying schedules.

The spent nuclear fuel and high-level radioactive waste train used to model noise impacts for this analysis would consist of two to three locomotives and four to eight railcars (one to five ***cask cars***, two ***buffer cars***, and one escort car). The average length of the cars would be about 18 to 27 meters (59 to 89 feet), and the length of the locomotives would be 23 meters (75 feet), for a total train length ranging from 118 to 285 meters (390 to 940 feet).

Trains would operate along the rail line at a top speed of 80 kilometers (50 miles) per hour. Because train speed has a direct correlation to noise generated, DOE used the top train speed to conservatively estimate potential noise levels. Table 4-241 lists distances to the wayside 65 DNL noise contour along the Mina rail alignment, assuming an average of 2.4 trains per day (based on 17 one-way trips per week). The average of 2.4 trains per day includes ***cask*** trains, maintenance-of-way trains, and repository supply and construction trains.

Table 4-241. Summary of distances to 65 dBA DNL along the Mina rail alignment.[a]

Area	Speed in miles per hour[b,c]	Distance in feet[d] to 65 dBA DNL contour		Noise level increase (dBA)[c]
		Wayside	Horn	
Silver Springs	50	56	250	0 to 12
Mina	50	56	250	0
Silver Peak	50	56	250	0 to 6
Goldfield	50	56	250	0 to 10

a. dBA = A-weighted decibels; DNL = day-night average noise level.
b. To convert miles per hour to kilometers per hour, multiply by 1.6093.
c. Actual speeds would be lower.
d. To convert feet to meters, multiply by 0.3048.

4.3.8.3.2 Horn Noise

The key components in projecting noise exposure from horn noise are the horn sound level, the duration of the horn noise, the distance of the receptor from the tracks, and the number of trains running during daytime and nighttime hours.

For safety reasons, the Federal Railroad Administration requires train engineers to sound horns when approaching most grade crossings unless a Quiet Zone has been established. Horn sounding is generally not required at private crossings. Federal Railroad Administration regulations at 49 CFR 229.129 require all lead locomotives to have an audible warning device that produces a minimum sound level of 96 dBA at a distance of 30 meters (100 feet) in front of the locomotive. In general, locomotive engineers are required to sound the locomotive warning horn at grade crossings in order to warn motorists of a train approaching a crossing. However, communities may apply to the Federal Railroad Administration for a Quiet Zone wherein horns are not sounded as long as certain safety standards are met. Supplementary safety measures, such as four-quadrant gates, and median barriers can be used in accordance with Federal Railroad Administration regulations in order to establish a Quiet Zone.

Most freight train audible warning devices are air horns. The maximum sound level of the air horns can usually be adjusted to some degree by adjusting the air pressure. Maximum sound levels are typically 105 to 110 dBA at 30 meters (100 feet) in front of the trains, well above the 96 dBA minimum value required by the Federal Railroad Administration. Additional noise sources associated with grade crossings would be the grade crossing bells that would start sounding just before the gates were lowered, and idling road traffic that must wait at the crossing. Because train horns create high noise levels, noise exposure would be dominated by horn noise near any grade crossing where sounding horns is required. The analysis assumes that trains would be equally likely to occur at any hour of the day or night. Table 4-241 does not include adjustments for building or terrain shielding. At distances beyond approximately 30 meters, obstructions such as buildings or terrain could act as a partial acoustic shield, causing a noise reduction of approximately 5 to 10 dBA. As one of the final steps in the noise modeling process, where appropriate, DOE included adjustments for building shielding, based on International Organization for Standardization standard number ISO 9613-2 *Acoustics – Attenuation of Sound During Propagation Outdoors – Part 2: General Method of Calculation* (DIRS 176684-ISO 1996, all).

4.3.8.3.3 Railroad Operations Noise Impacts

Table 4-241 lists approximate distances to the wayside for train noise without horns and horn-noise contours from the centerline of the rail alignment in Silver Springs, Mina, Silver Peak, and Goldfield. These distances do not include the effects of building shielding. Also shown are potential increases in noise in relation to ambient noise conditions, which would vary between and within the areas where DOE took ambient noise measurements. Ambient noise refers to existing conditions in the region of influence.

At present, there is no train activity in Mina, Silver Peak, or Goldfield, but there is train activity in Silver Springs.

Figures 4-39 through 4-43 show modeled 65 DNL contours in Silver Springs, Wabuska, Mina, Silver Peak, and Goldfield. DOE counted receptors that would be included in the contours in accordance with STB procedures (DIRS 173225-STB 2003, all). These figures show that eight receptors would be included in the 65 DNL contours in Silver Springs and one receptor would be included in Wabuska. These nine receptors would experience an adverse noise impact because they would be exposed to 65 DNL and a 3 dBA increase. Should the Mina rail alignment (currently a nonpreferred alternative) be selected, DOE would investigate mitigation methods for these nine receptors. Mitigation methods could include building sound insulation or the development of a Quiet Zone.

Figures 4-44 through 4-48 show 3 dBA increase contours in Silver Springs, Wabuska, Mina, Silver Peak, and Goldfield. Table 4-242 shows the number of receptors included in the noise contours.

Table 4-242. Mina Implementing Alternative receptor counts.

	Silver Springs	Wabuska	Mina	Silver Peak	Goldfield
Greater than or equal to 65 DNL + 3 dBA[a,b]	8	1	0	0	0
Less than 65 DNL + 3 dBA[c]	567	20	0	8	87

a. dBA = A-weighted decibels; DNL = day-night average noise level.
b. Adverse noise impact.
c. No adverse noise impact. The purpose of the 3 dBA-increase criterion is to identify potential impact areas where train noise would be particularly audible.

4.3.8.3.4 Railroad Operations Vibration Impacts

At certain times, such as when a locomotive is idling near a residential building, trains can produce low-frequency airborne noise, which in turn can cause structural vibrations. However, trains generally do not produce enough airborne noise or ground-borne vibrational energy to cause building damage.

DOE evaluated the potential impacts from vibration during railroad operations by using train-induced vibration levels as a function of distance from a rail line, along with vibration levels likely to result in building damage or annoyance, in combination with information on the location of residences or other buildings in relation to the rail line.

Unlike noise, vibration impacts are evaluated on the basis of maximum level. A freight train traveling at 80 kilometers (50 miles) per hour will generate a vibration velocity level of 95 decibels with respect to 1 micro-inch per second (VdB), measured 3 meters (10 feet) from the tracks (DIRS 177297-Hanson, Towers, and Meister 2006, p. 10-3). This level of vibration is substantially lower than levels that can cause cosmetic building damage (0.20 inch per second), nominally a vibration velocity of 106 VdB, or 100 VdB, assuming a crest factor of 2 (DIRS 176857-Martin 1980, all). This level of vibration is even lower than that which can cause structural damage (126 VdB) (DIRS 175495-Nicholls, Johnson, and Duvall 1971, all). There are no buildings within 3 meters of the Mina rail alignment, so there would be no adverse vibration impacts to buildings.

According to the Federal Transit Administration, a vibration velocity of 80 VdB or above constitutes an impact in terms of human annoyance for infrequent train events (that is, fewer than 70 events per day). For a freight train traveling 80 kilometers (50 miles) per hour, this annoyance impact distance extends approximately 24 meters (80 feet) from the tracks (DIRS 177297-Hanson, Towers, and Meister 2006, p. 10-3). There are no residential buildings within this distance of the Mina alignment; therefore, DOE expects no adverse vibration impacts related to annoyance.

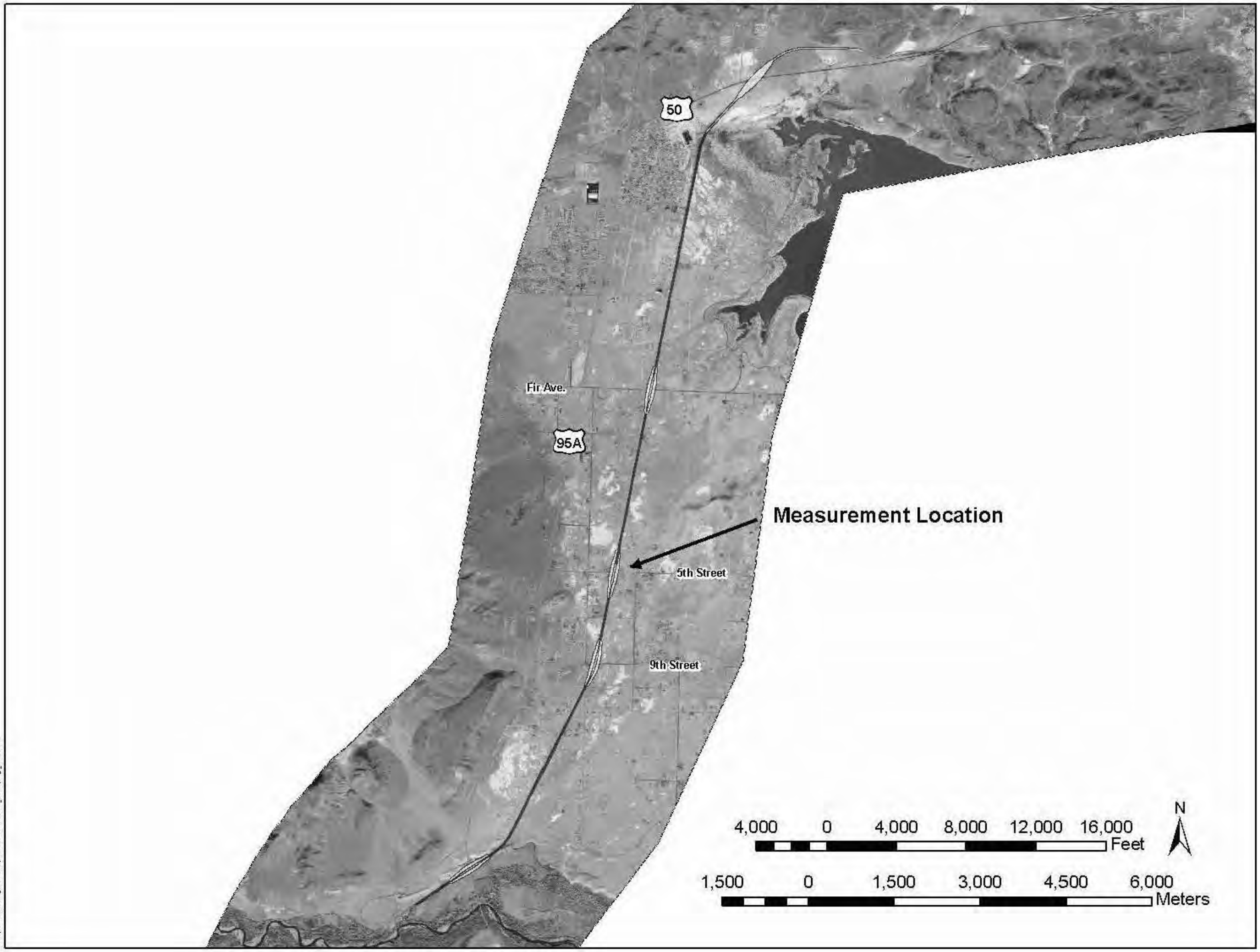


Figure 4-39. 65 DNL contour, Silver Springs, Nevada.

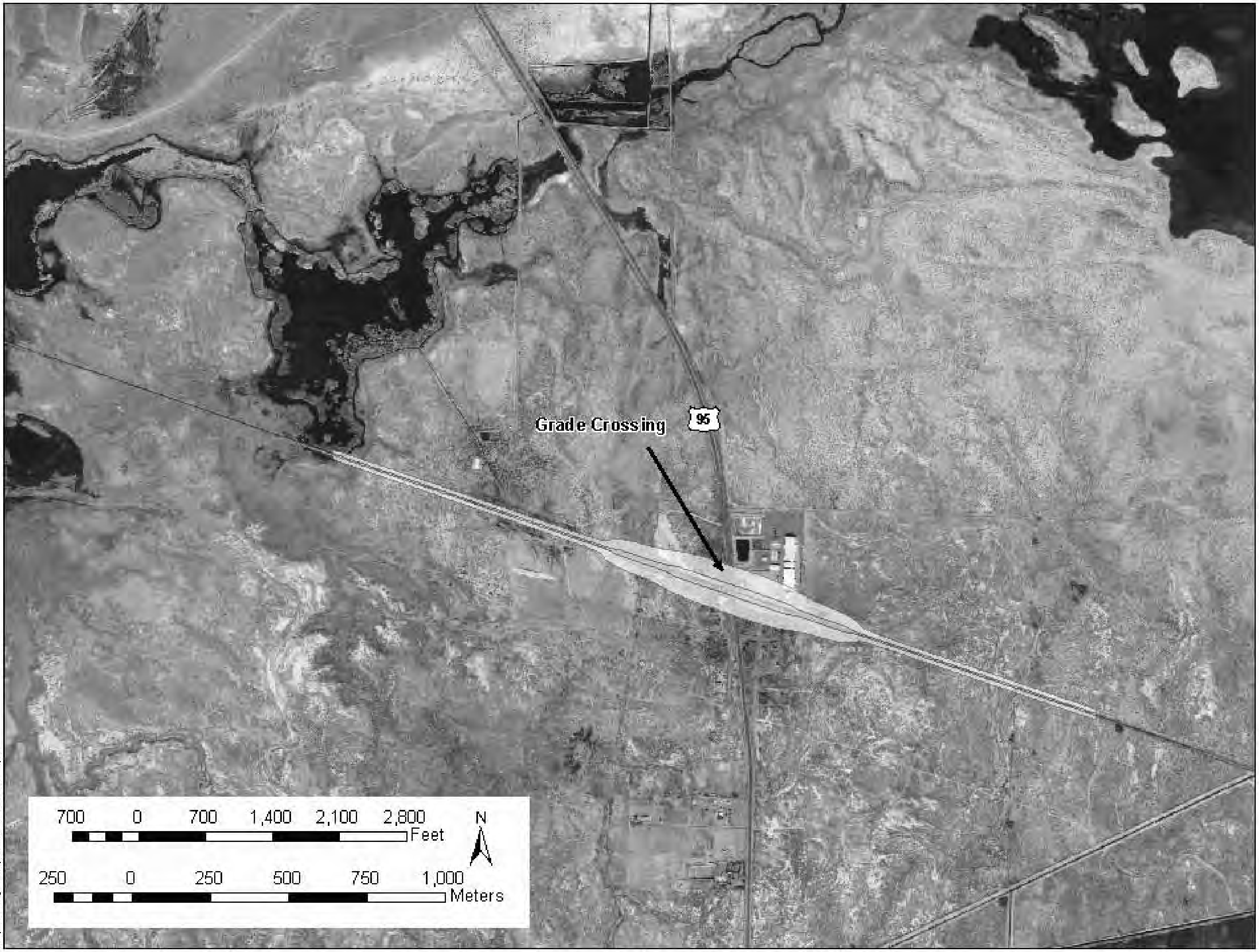


Figure 4-40. 65 DNL contour, Wabuska, Nevada.

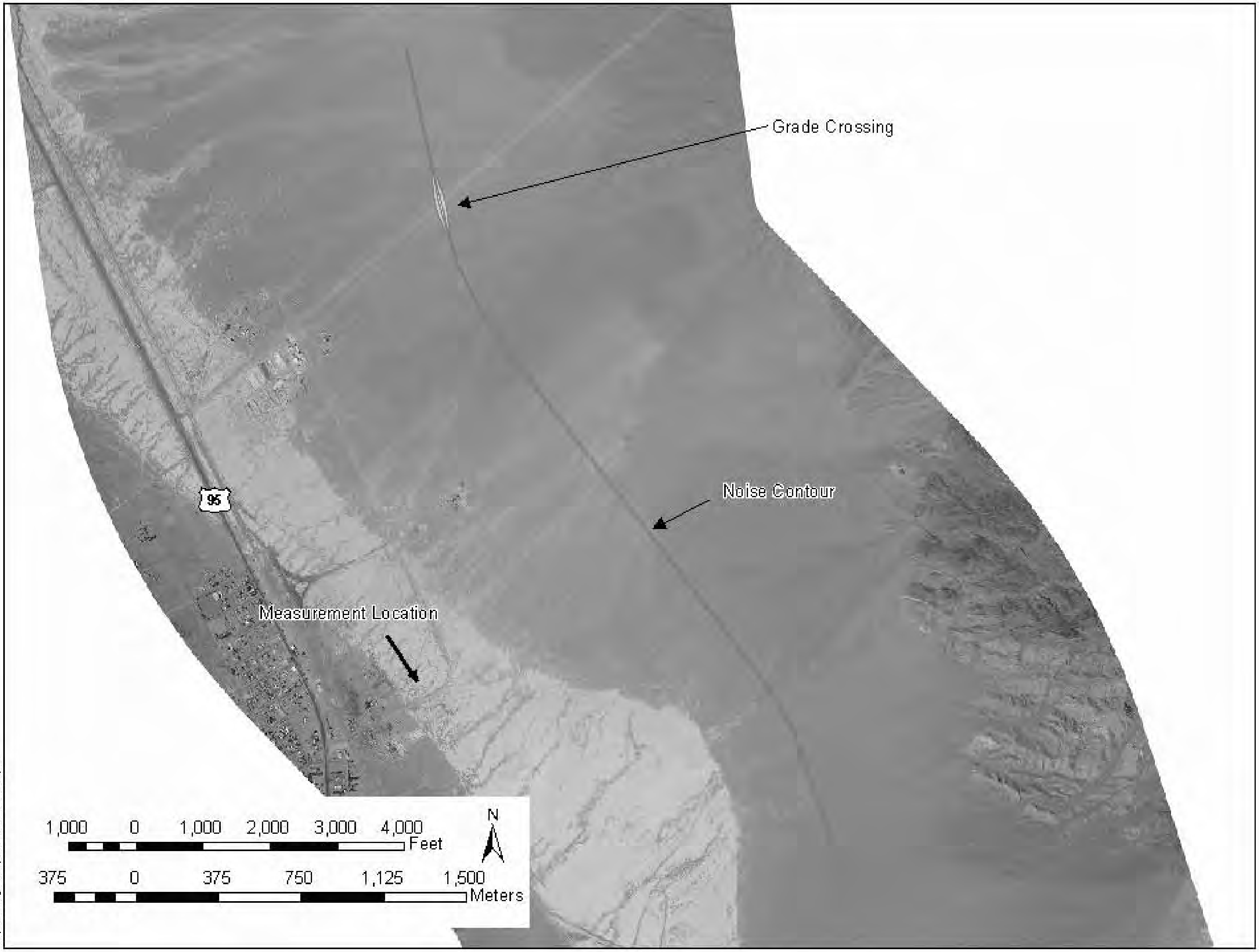


Figure 4-41. 65 DNL contour, Mina, Nevada.

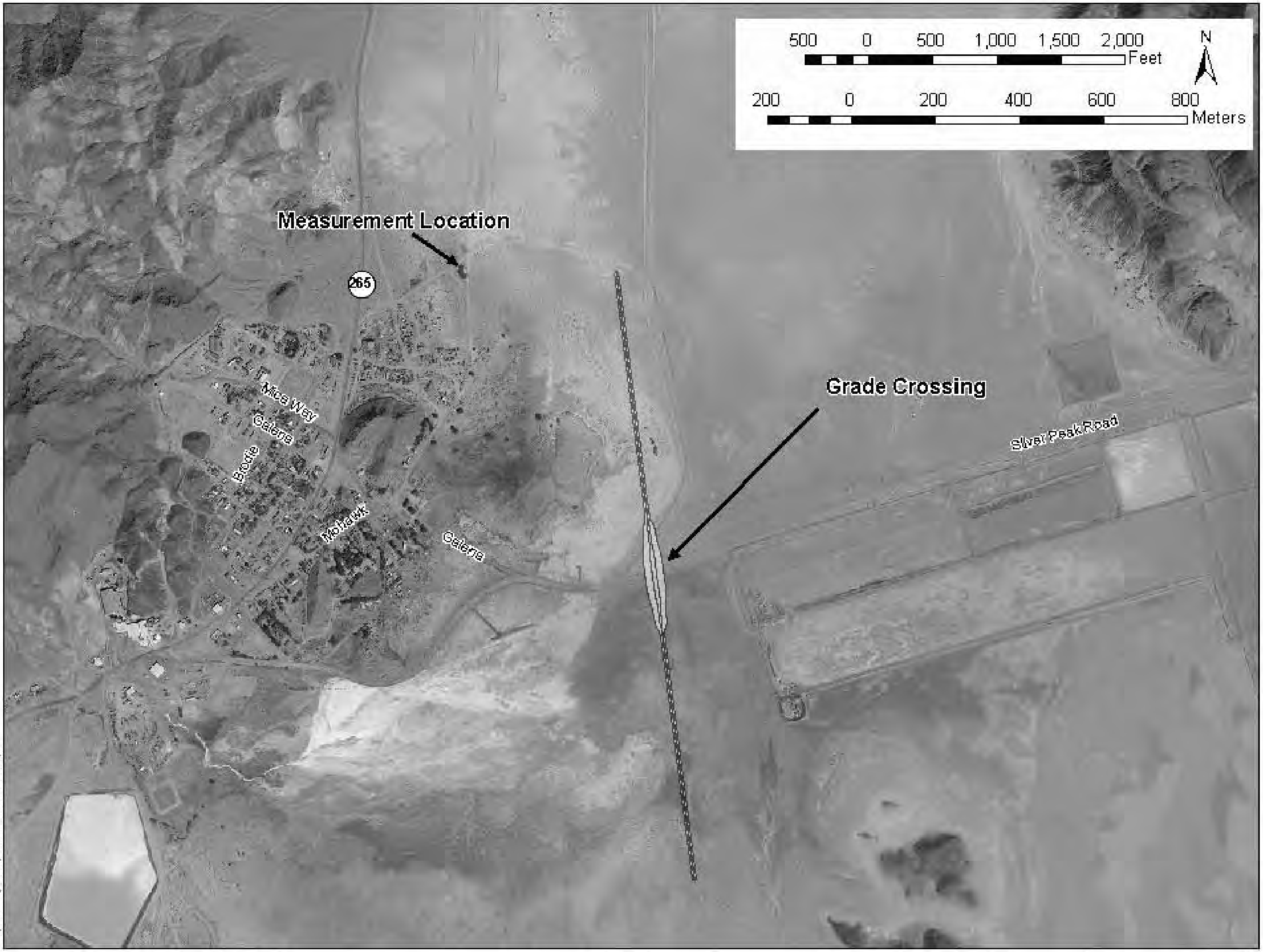


Figure 4-42. 65 DNL contour, Silver Peak, Nevada.

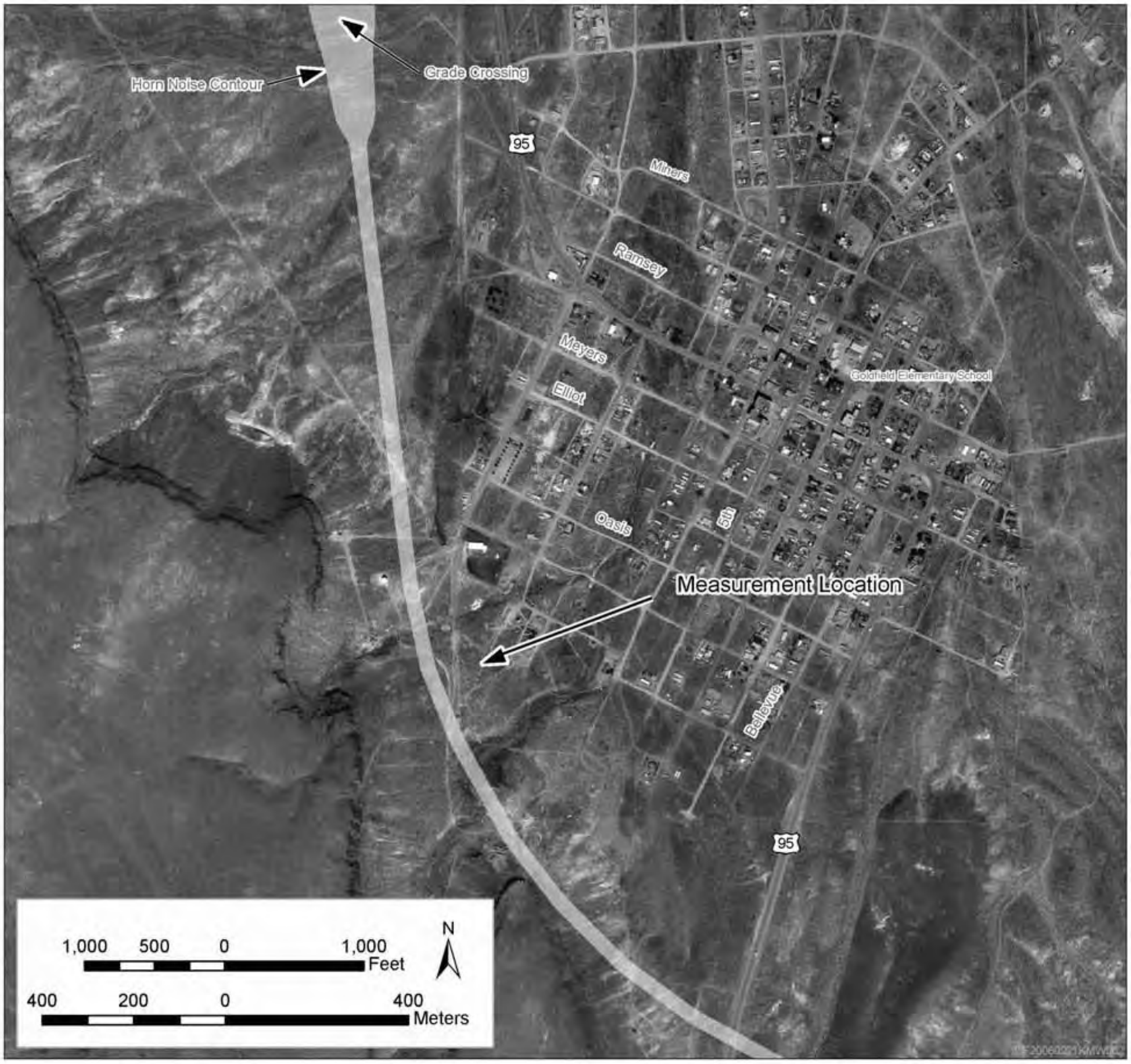


Figure 4-43. 65 DNL contour, Goldfield, Nevada.
(Source: DIRS 174497-Keck Library 2004, filename 37117F21.sid.)

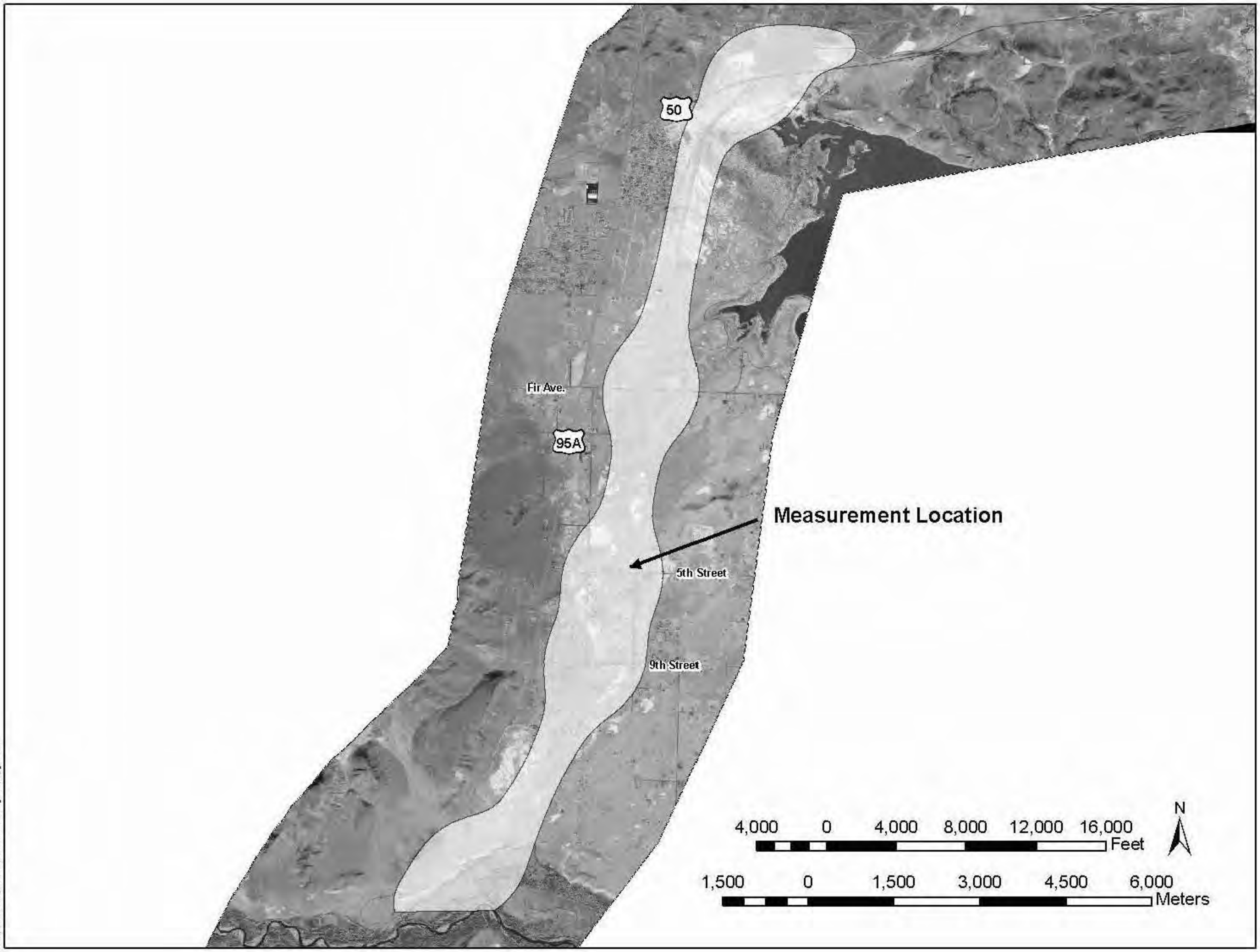


Figure 4-44. 3 dBA increase contour, Silver Springs, Nevada.

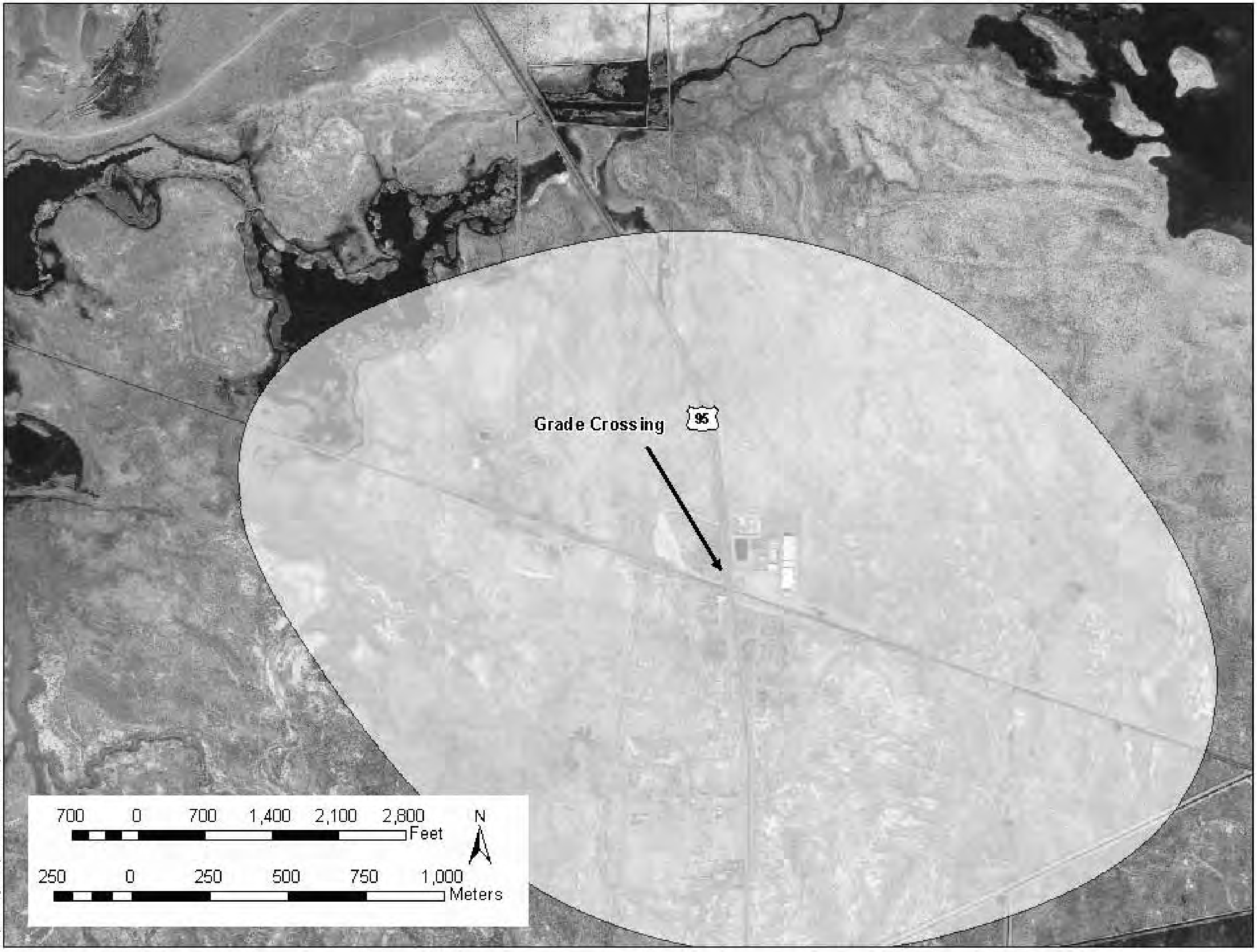


Figure 4-45. 3 dBA increase contour, Wabuska, Nevada.

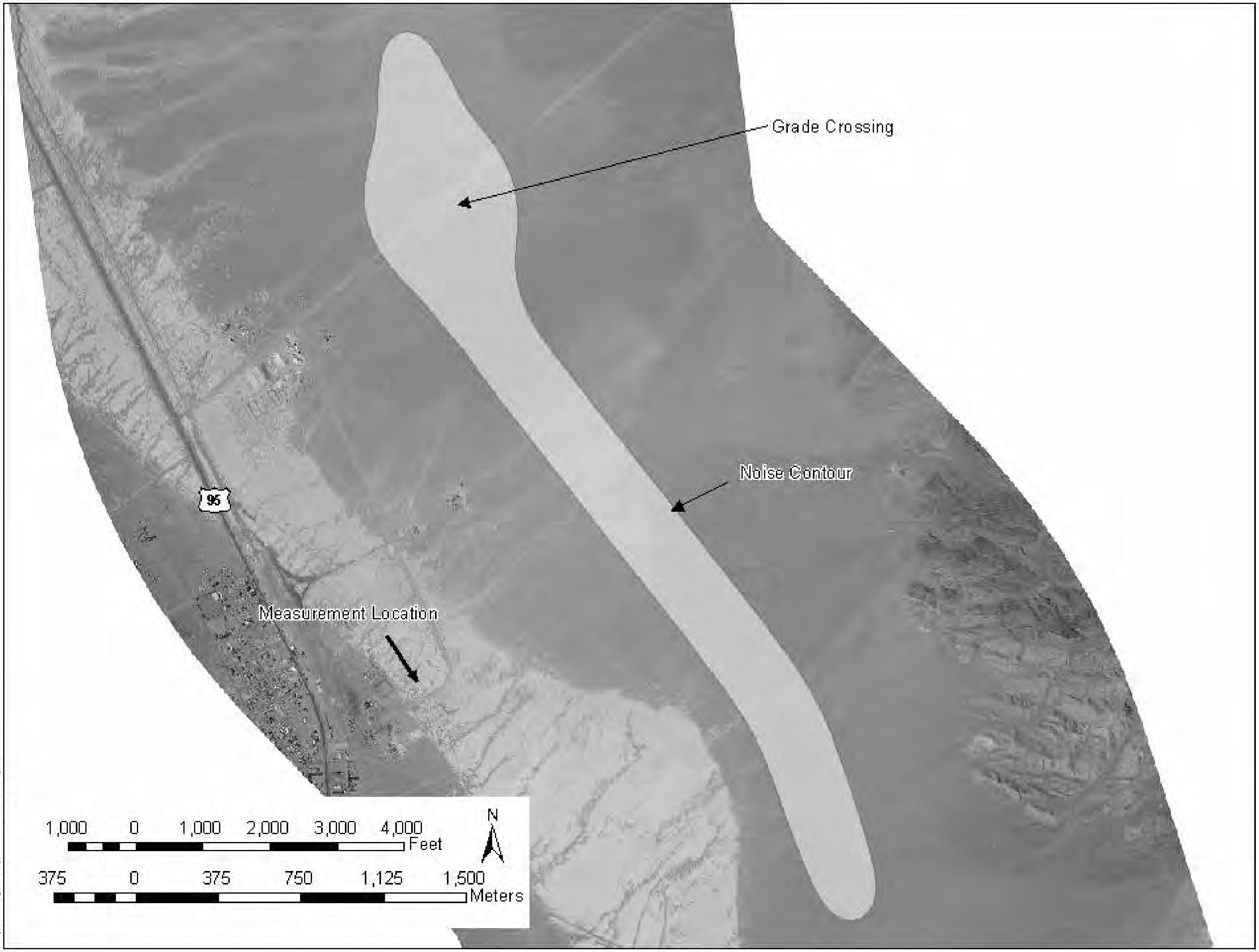


Figure 4-46. 3 dBA increase contour, Mina, Nevada.

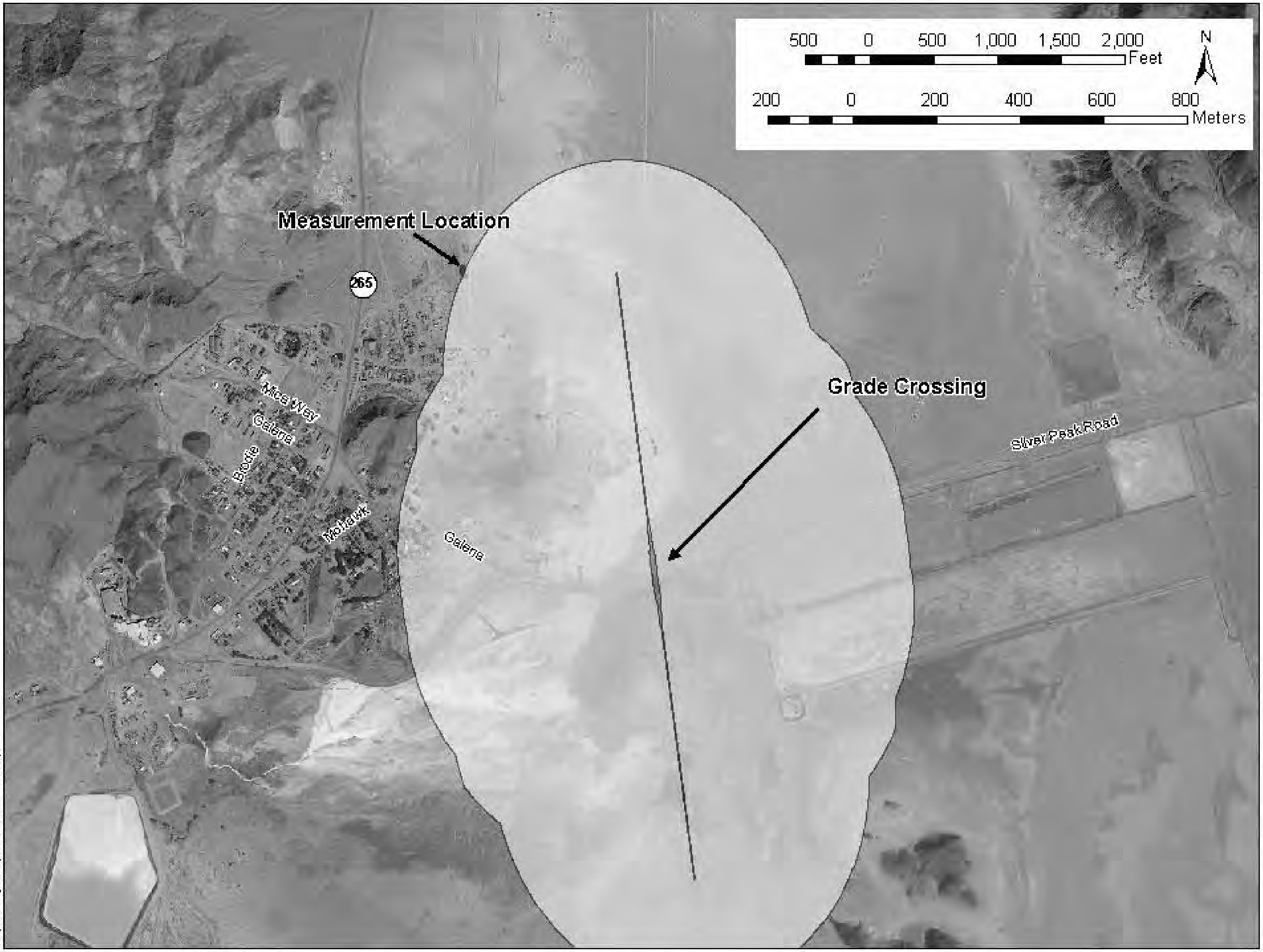


Figure 4-47. 3 dBA increase contour, Silver Peak, Nevada.

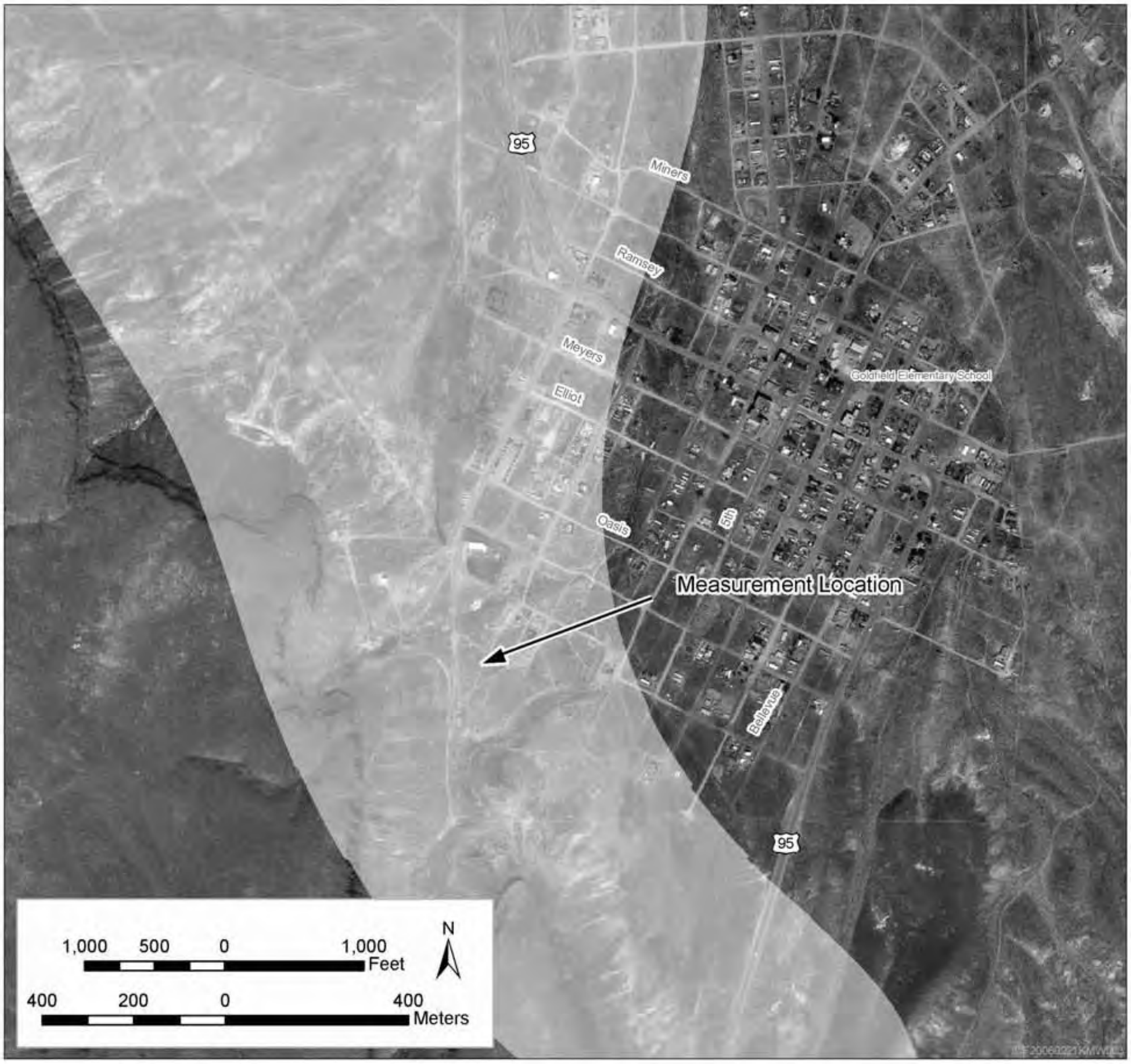


Figure 4-48. 3 dBA increase contour, Goldfield, Nevada.
(Source: DIRS 174497-Keck Library 2004, filename 37114F21.sid.)

Operation of any of the Schurz alternative segments would eliminate future vibration from operation of the Department of Defense Branchline through Schurz.

4.3.8.4 Impacts of the Shared-Use Option

The Shared-Use Option could result in increased train operations because DOE would allow commercial shippers to use the rail line. Such increased operations could result in increased noise impacts because DNL is a function of the number of train events per day. Increased train operations would not affect vibration impacts because vibration is evaluated on a maximum-level basis only.

The typical train under the Shared-Use Option would consist of three to four locomotives and up to 60 railcars. The average length of a car would be 18 meters (60 feet) for a total length (railcars only) of 1,100 meters (3,600 feet). Trains would operate along the rail line at a top speed of 80 kilometers

(50 miles) per hour. Table 4-243 shows distances to the wayside 65 DNL noise contour, assuming an average of 5 trains per day (the Proposed Action plus Shared-Use Option train volumes).

Table 4-243. Summary of distances to 65 dBA DNL under the Mina rail alignment Shared-Use Option in Silver Springs, Mina, Silver Peak, and Goldfield.[a]

Area	Train speed in miles[b] per hour	Distance in feet[c] to 65 dBA DNL contour		Noise-level increase (dBA)
		Wayside	Horn	
Silver Springs	50	66	300	0 to 13
Mina	50	66	300	0
Silver Peak	50	66	300	0 to 6
Goldfield	50	66	300	0 to 10

a. dBA = A-weighted decibels; DNL = day-night average noise level.
b. To convert miles to kilometers, multiply by 1.6093.
c. To convert feet to meters, multiply by 0.3048.

The shared-use 65 DNL contours include eight receptors in Silver Springs and one receptor in Wabuska. These nine receptors would experience an adverse noise impact because they would be exposed to 65 DNL and a 3 dBA increase. If DOE selected the Mina rail alignment (currently a non-preferred alternative), DOE would investigate mitigation methods for these nine receptors, such as the development of a Quiet Zone. There would be no receptors included in the shared-use 65 DNL contours for Mina, Silver Peak, or Goldfield.

DOE estimates that 722 receptors would be included in the shared-use 3 dBA increase contour in Silver Springs, 24 receptors in Wabuska, no receptors in Mina, and 12 receptors in Silver Peak. DOE estimates that 37 receptors would be within the shared-use 3 dBA increase contour in Goldfield. The total estimated number of receptors included within the shared-use 3 dBA increase contour would be 795.

4.3.8.5 Summary

Table 4-244 lists potential noise and vibration impacts related to construction and operation of the proposed railroad along the Mina rail alignment.

During the construction phase, noise levels along the Mina rail alignment would be lower than adverse impact criteria (see Table 4-237). During the operations phase, estimated noise levels at nine receptor locations would be higher than impact criteria (65 DNL, with a 3 dBA or greater increase from the baseline); therefore, there would be adverse noise impacts associated with railroad operations at those locations. Under the Mina Implementing Alternative, DOE would investigate mitigation methods for these nine receptors, such as building sound insulation or the development of a Quiet Zone.

During the construction and operations phases, vibration levels would not exceed the Federal Transit Administration damage criteria of 0.20 inch per second for fragile buildings, and 0.12 inch per second for extremely fragile historic buildings (see Table 4-240); therefore, DOE would expect no building damage due to vibration. In addition, train-generated vibration levels would be lower than Federal Transit Administration human annoyance criterion.

Table 4-244. Summary of potential impacts from noise and vibration as a result of constructing and operating the proposed railroad along the Mina rail alignment.[a]

Location (county)	Construction impacts	Operations impacts
Silver Springs (Lyon County)	There would be no impact from vibration, which would fall below Federal Transit Administration criteria. DOE estimates that 34 receptors would be included within the construction-train 65 DNL contours in Silver Springs, and 7 receptors would be included within the 65 DNL contours in Wabuska. These noise impacts would be considered temporary adverse impacts. There would be no adverse impact from vibration, which would fall below Federal Transit Administration criteria.	There would be adverse noise impacts at eight receptors in Silver Springs and one receptor in Wabuska. There would be no adverse impact from vibration, which would fall below Federal Transit Administration criteria.
Mina (Mineral County)	There would be no adverse construction noise or vibration impacts. There would be no adverse impact from the operation of construction trains. No receptors would fall within the 3 dBA increase contour or the 65 DNL contours.	There would be no adverse impacts from noise from the operation of trains along the rail alignment. There would be no adverse impact from vibration, which would fall below Federal Transit Administration criteria.
Silver Peak (Esmeralda County)	There would be no adverse construction noise or vibration impacts. There would be no adverse impact from the operation of construction trains.	There would be no adverse impacts from noise from the operation of trains along the rail alignment. There would be no adverse impact from vibration, which would fall below Federal Transit Administration criteria.
Goldfield (Montezuma alternative segment 2) (Esmeralda County)	Noise from construction activities would fall below Federal Transit Administration guidelines. There would be no adverse impact from vibration, which would fall below Federal Transit Administration criteria. There would be no adverse impact from the operation of construction trains. No receptors within the 65 DNL contours.	There would be no adverse impacts from the operation of trains along the rail alignment. No receptors would fall within the 65 DNL contours. There would be no adverse impact from vibration, which would fall below Federal Transit Administration criteria.
Quarries		
Railroad quarry ES-7 (Esmeralda County)	The nearest receptor would be approximately 4,900 feet[b] away from ES-7; therefore, potential impacts would be small.	The nearest receptor would be approximately 4,900 feet[b] away from ES-7; therefore, potential impacts would be small.
Rail line construction and operations support facilities	No impact. There would be no receptors near these facilities.	No impact. There would be no receptors near these facilities.

a. Adverse impacts under the Shared-Use Option would be the same as those under the Proposed Action without shared use.
b. To convert feet to meters, multiply by 0.3048.

4.3.9 SOCIOECONOMICS

This section describes potential impacts to socioeconomic conditions (employment and income, population and housing, public services, and transportation) from constructing and operating the proposed railroad along the Mina rail alignment. This section does not attribute socioeconomic impacts to the rail line alternative segments; rather, it describes impacts of the Proposed Action as a whole on the region of influence. Section 4.3.9.1 describes the methodology DOE used to assess potential impacts; Section 4.3.9.2 describes potential construction impacts; Section 4.3.9.3 describes potential operations impacts; Section 4.3.9.4 describes potential impacts under the Shared-Use Option; and Section 4.3.9.5 summarizes potential impacts.

Section 3.3.9.1 describes the region of influence for the socioeconomic analysis.

4.3.9.1 Impact Assessment Methodology

DOE analyzed socioeconomic impacts by comparing projected conditions in the region of influence during the construction and operations phases with projected baseline conditions (without the project) described in Section 3.3.9. Sections 4.3.9.1.1 through 4.3.9.1.4 describe the methods DOE used to estimate impacts to socioeconomic conditions.

4.3.9.1.1 Employment and Income

Both the projections of baseline employment and income conditions (without the project) and projections of conditions during the construction and operations phases came from the Regional Economic Models, Inc., *Policy Insight* model (DIRS 182251-REMI 2007, all; DIRS 179558-Bland 2007, all; DIRS 180690-Bland 2007, all; DIRS 180689-Bland 2007, all) described in Section 3.3.9 and Appendix J, Socioeconomics. Impacts are stated in terms of the number of jobs, ***gross regional product***, ***real disposable income***, and state and local government spending. Direct economic effects are the changes in jobs, gross regional product, and income in sectors that would supply directly needed goods and services, such as heavy-duty equipment, during railroad construction and operations. Indirect or secondary economic effects are the changes in sectors that would supply goods and services to the direct sectors (such as the production of construction material components). Secondary effects also would include the spending of income earned from the project (known as indirect effects). The extent to which a local economy could supply goods and services to the proposed project would be constrained by its level of economic development. DOE has assessed adverse impacts qualitatively in terms of disruption of economic activity, particularly for mining and agricultural operations.

Gross regional product is the value of all final goods and services produced in a specified region.

Real disposable income is the value of total after-tax income received; it is the income available for spending or saving.

DOE used runs of the *Policy Insight* model to estimate construction impacts over 5 years and operations impacts over 52 years (DIRS 182251-REMI 2007, all; DIRS 179558-Bland 2007, all; DIRS 180690-Bland 2007, all; DIRS 180689-Bland 2007, all). The actual construction phase would range from 4 to 10 years. DOE expects the construction phase to last a minimum of 4 years and 6 months, so the Department modeled a fifth year. Because impacts, described in this analysis as peak changes from the baseline (without the project), would be strongest and most concentrated under a shorter construction schedule, DOE modeled only the 5-year construction phase. Construction-related impacts under a 10-year schedule would be bounded by the analysis described. Noteworthy impacts associated with a longer construction phase are identified, as appropriate. For the operations phase, this analysis assumes that the first 2 years represent a transition period. During these 2 years (2015 and 2016), the railroad support facilities would be operational. Starting in 2017, DOE would begin shipping spent nuclear fuel and high-level radioactive waste to Yucca Mountain; the shipping campaign would span up to 50 years, with up to 50 years of active shipping.

Because the socioeconomic impacts would vary depending on the county in which DOE placed the Nevada Railroad Control Center and National Transportation Operations Center, DOE modeled two different scenarios for both the construction and operation phases. Scenario 1 has the Nevada Railroad Control Center and National Transportation Operations Center in Mineral County near the beginning of the proposed rail line; Scenario 2 has these facilities in Nye County near the end of the rail line.

4.3.9.1.2 Population and Housing

DOE estimated population impacts by comparing project-related increases or decreases at the county level against the projected population figures without the project. These estimates came from the same *Policy Insight* model runs used to estimate employment and income. Population changes are related to changes in employment; as employment increases in an area, permanent population could also increase, although increases in population typically lag behind increases in employment. DOE assessed impacts on housing by evaluating worker and permanent population increases associated with railroad construction and operations against county and community housing-capacity information. Bureau of Census age distributions are used in the analysis because they are based on the Decennial Census, with data gathered through a well-known methodology. As a result, the age distributions are consistently generated across all jurisdictions.

4.3.9.1.3 Public Services

DOE assessed impacts to public services as changes to the county or community baseline capacity (assuming no railroad), as described in Section 3.3.9. There would be positive impacts when there were project-related enhancements that the community could also access. Adverse impacts would occur when increased demand exceeded the capacities of public services or hastened the deterioration of a particular public service, resulting in a lower level of service to community users.

4.3.9.1.4 Transportation Infrastructure

There could be an adverse impact on roadways within the region of influence if construction or operation of the proposed railroad would degrade the ***level of service*** of a roadway to unacceptable levels (below a level of service of C) as a result of project-related traffic. Section 3.3.9.3.5.1 includes a definition of levels of service. As discussed in Section 3.3.9, existing annual average daily traffic data for the major roadways within the Mina rail alignment region of influence were provided by the Nevada Department of Transportation. Baseline levels of service of the roadways were then projected using the Highway Capacity Manual guidelines. To assess the impacts the railroad would have on the roadways, DOE added potential project-related vehicles to baseline traffic volumes and then estimated new levels of service. Because railroad operations along the Mina rail alignment would require operating trains along the existing Union Pacific Railroad Hazen Branchline and Department of Defense Branchlines, DOE compared new rail traffic volumes on the proposed rail line to baseline rail conditions. The Department estimated road-traffic delay at highway-rail grade crossings based on the additional rail traffic along the existing rail segments between Hazen and Thorne. All roads that would cross the new rail segments at grade have very low traffic, and DOE did not estimate delay at grade crossings for these segments. Section 4.3.10, Occupational and Public Health and Safety, provides the safety analysis (traffic accidents and fatalities) for the proposed railroad along the Mina rail alignment.

4.3.9.2 Rail Line Construction Impacts

The Mina Implementing Alternative includes construction and operation of the rail line and its associated construction and operations support facilities. Inputs to the analysis using the *Policy Insight* model (DIRS 182251-REMI 2007, all; DIRS 179558-Bland 2007, all; DIRS 180690-Bland 2007, all; DIRS 180689-Bland 2007, all) included construction and operations costs, or labor needs, or both when available. The inputs also accounted for the differences between expected project-related wages and average wages, by county and economic sector, contained in the *Policy Insight* model. Project-related wages would generally be higher than the average wages embedded in the model.

The common social and economic activities and changes associated with the construction of the proposed railroad would include:

- A period of brief, intense elevation in project-related employment
- Population increases
- A slightly slower rate of growth in the level of employment as the economy moved from the construction phase to the operations phase
- Some effects on public services (such as health care), particularly where construction activities were concentrated near communities
- Some effects on transportation resources

The equivalent of 1,100 full-time workers would be required during the grading phase of the construction phase, but fewer workers would be required as construction activities moved toward completion (this number reflects full-time work over a typical annual work year of approximately 2,000 hours [accounting for weekends, holidays, and vacation and sick days], and a construction phase of 54 months). More than 1,100 people would be performing this work, because not all employees would work full time. DOE used *Policy Insight* population projections to assess population-related impacts (for example, impacts to housing stock, ***infrastructure***, public services) related to the total number of actual employees resulting from the project. DOE would establish up to 10 temporary construction camps along the rail alignment to house workers.

Construction impacts for employment, income, and population are drawn from model runs of *Policy Insight* (DIRS 182251-REMI 2007, all; DIRS 179558-Bland 2007, all; DIRS 180690-Bland 2007, all; DIRS 180689-Bland 2007, all), which used a 5-year modeling period. As mentioned above, the actual construction phase would range from 4 to 10 years; impacts associated with the longer construction phase are noted as appropriate. However, levels of impacts would be higher and more concentrated under the modeled 5-year schedule.

4.3.9.2.1 Employment and Income

Direct employment and income impacts would stem from the hiring of construction workers and their spending of wages. Workers would have the option of shopping in towns near the construction camps, or relying on the cafeterias, drug stores, and non-perishables markets at the construction-camp commissaries (DIRS 180922-Nevada Rail Partners 2007, p. 4-5). Indirect impacts could result from employment of workers by businesses that supply goods and services in support of construction work, including the construction and operation of construction camps, where services such as catering, utility supply, and waste disposal would be needed. For purposes of this analysis, and consistent with the methodology established in the Yucca Mountain FEIS, DOE assumes that most construction workers would live in Clark County (DIRS 155970-DOE 2002, Section 4.1.6.2.1) and reside in construction camps. DOE makes this assumption because the construction sectors in Lyon, Mineral, Nye, and Esmeralda Counties are not large enough to provide enough workers for the construction activities. This section also considers an alternative analysis, which assumes that half of the construction workers for the Mina rail alignment reside in the combined Washoe County-Carson City area, and the other half reside in Clark County. The analysis considers this second scenario because Washoe County and Carson City may be more likely than Clark County to supply construction workers for the northern portions of the Mina rail alignment. Therefore, for the purposes of this second scenario, the analysis presents socioeconomic impacts for the combined area of Washoe County-Carson City. This analysis also assumes, like the Yucca Mountain FEIS, that employees at Nye County facilities at or near the repository have residences consistent with historical patterns; that is, that 80 percent of employees at Nye County facilities reside in Clark County and 20 percent of employees at Nye County facilities reside in Nye County. Appendix J, Section J.1.8, presents a sensitivity analysis that assumes a modified residency pattern for Nye County facilities, with 80 percent of employees residing in Nye County and 20 percent of employees residing in Clark County.

Table 4-245 lists potential changes in economic measures during the construction phase for the two modeled scenarios. Appendix J describes the analysis in more detail. Each scenario includes the impact of constructing the proposed rail line and railroad construction and operations support facilities. DOE modeled employment of construction workers and some support workers as beginning in 2010 and ending in 2014. All construction-related economic impact values are presented in 2006 dollars. Table 4-245 lists the estimated changes to current trends (without construction of the railroad) in employment and income for each year of the construction phase. The discussion of the data in the table attempts to identify and address the largest deviations ("peak" changes) from the current trends without the railroad as a way to show the upper bounds of potential impacts.

In all five counties, changes to the baseline (conditions without the proposed railroad) would be similar under the two scenarios. In Lyon County, the increase in peak employment would represent 0.02 percent of the total projected employment levels in Lyon County in the absence of the project. The peak construction-related impact to real disposable income would be 0.03 percent above the baseline, gross regional product would be 0.04 percent above the baseline, and state and local government spending would be 0.01 percent above the baseline.

In Mineral County, the increase in peak employment would represent 6.1 percent of the total projected employment levels in Mineral County in the absence of the project. The peak construction-related impact to real disposable income would be 4.5 percent above the baseline, gross regional product would be 14.1 percent above the baseline, and state and local government spending would be 1.8 percent above the baseline. Residents would likely feel the peak changes to employment and gross regional product.

DOE also considered construction-related impacts to the Walker River Paiute Reservation. If one of the four construction camps proposed in Mineral County is instead placed on the Walker River Paiute Reservation, the Reservation would benefit from increased employment, gross regional product, and real disposable income. The increase in peak employment would be up to 20 additional jobs. The peak construction-related impact to gross regional product would be up to $1.4 million, and the impact to real disposable income would be up to $386,000 (DIRS 180691-Bland 2007, all).

In Nye County, the project-related increase in employment at peak would correspond to 0.6 percent of the total projected employment levels in Nye County without the project. The peak construction-related impact to real disposable income would be a 0.4-percent increase above the baseline, gross regional product would be 1 percent above the baseline, and state and local government spending would correspond to a 0.2-percent increase above the baseline.

In Esmeralda County, the project-related increase in employment at peak would correspond to 13.9 percent of the total projected employment levels without the project. The peak construction-related impact to real disposable income would be a 27-percent increase above the baseline, gross regional product would be 57 percent above the baseline, and state and local government spending would correspond to a 4.6-percent increase above the baseline.

In Clark County, the peak increase in real disposable income, gross regional product, and ***total employment*** would correspond to an increase of one-tenth of 1 percent of the baseline in Clark County. The peak construction-related impacts to state and local government spending would correspond to less than one tenth of 1 percent above the respective baseline, meaning that all impacts, if any, would be small in such a large economy.

Table 4-245. Estimated changes in economic measures during the construction phase – Mina rail alignment[a,b] (page 1 of 3).

	Construction year				
County/scenario/measure	2010	2011	2012	2013	2014
Lyon County					
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Mineral County					
Employment	3	3	3	2	1
State and local government spending	$6,520	$16,900	$27,962	$33,268	$34,101
Real disposable income	$160,757	$282,879	$326,263	$220,986	$125,666
Gross regional product	$352,619	$137,754	$167,778	$121,819	$58,443
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County					
Employment	3	3	3	2	1
State and local government spending	$6,329	$16,743	$27,752	$33,085	$33,482
Real disposable income	$157,131	$282,381	$325,845	$220,515	$116,478
Gross regional product	$346,203	$137,475	$167,778	$121,689	$53,273
Mineral County					
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Mineral County					
Employment	117	130	148	85	55
State and local government spending	$459,810	$588,945	$698,629	$577,043	$542,342
Real disposable income	$4,314,597	$4,898,513	$5,283,557	$3,131,169	$2,200,068
Gross regional product	$22,262,760	$20,265,795	$21,002,441	$10,961,257	$2,676,024
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County					
Employment	115	130	148	85	46
State and local government spending	$456,768	$586,287	$696,276	$574,973	$518,367
Real disposable income	$4,284,540	$4,894,110	$5,280,437	$3,128,990	$1,707,379

Table 4-245. Estimated changes in economic measures during the construction phase – Mina rail alignment[a,b] (page 2 of 3).

County/scenario/measure	Construction year 2010	2011	2012	2013	2014
Mineral County (continued)					
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County (continued)					
Gross regional product	$20,826,000	$20,264,400	$21,001,570	$10,960,699	$2,363,470
Nye County					
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Mineral County					
Employment	80	66	108	108	39
State and local government spending	$238,000	$257,000	$362,000	$398,000	$392,000
Real disposable income	$3,639,000	$1,813,000	$4,302,000	$5,193,000	$2,387,000
Gross regional product	$7,563,000	$4,848,000	$11,184,000	$13,432,000	$4,110,000
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County					
Employment	66	108	111	45	19
State and local government spending	$256,000	$362,000	$404,000	$406,000	$380,000
Real disposable income	$1,812,000	$4,302,000	$5,335,000	$2,642,000	$1,705,000
Gross regional product	$4,847,000	$11,184,000	$14,241,000	$5,510,000	$2,222,000
Esmeralda County					
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Mineral County					
Employment	26	28	64	51	48
State and local government spending	$189,000	$213,304	$305,965	$287,829	$323,463
Real disposable income	$5,363,000	$5,654,654	$8,576,141	$6,150,721	$4,987,123
Gross regional product	$7,406,000	$2,699,197	$15,912,004	$14,882,404	$11,612,400
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County					
Employment	26	28	64	51	48
State and local government spending	$189,000	$213,291	$306,005	$287,943	$323,549
Real disposable income	$5,362,000	$5,654,610	$8,577,399	$6,153,042	$4,987,247
Gross regional product	$7,406,000	$2,699,190	$15,912,094	$14,882,574	$11,612,413

Table 4-245. Estimated changes in economic measures during the construction phase – Mina rail alignment[a,b] (page 3 of 3).

County/scenario/measure	Construction year				
	2010	2011	2012	2013	2014
Clark County					
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Mineral County					
Employment	1,753	1,761	1,812	758	379
State and local government spending	$1,481,000	$2,773,020	$4,009,160	$4,187,717	$4,057,289
Real disposable income	$98,054,000	$99,703,540	$105,692,250	$48,364,419	$29,022,634
Gross regional product	$137,080,000	$143,171,330	$152,243,780	$68,719,646	$37,249,419
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County					
Employment	1,740	1,760	1,818	769	386
State and local government spending	$1,470,000	$2,763,540	$4,005,810	$4,196,088	$4,074,022
Real disposable income	$97,309,000	$99,672,300	$106,058,280	$49,024,989	$29,562,624
Gross regional product	$136,071,000	$143,091,000	$152,743,620	$69,674,787	$37,954,566

a. Sources: DIRS 179558-Bland 2007, all; DIRS 180690-Bland 2007, all; DIRS 180689-Bland 2007, all.
b. Model does not discriminate non-county regions, such as the Walker River Paiute Reservation.

If half of the construction workers come from the Washoe County-Carson City area, then there would be construction-related socioeconomic impacts to this region. These results are presented in Table 4-246 as a sensitivity analysis. The peak increase in real disposable income, gross regional product, and total employment would correspond to an increase of less than three-tenths of 1 percent of the baseline. The peak construction-related impacts to state and local government spending would correspond to less than one-tenth of 1 percent above the respective baseline, meaning that all impacts, if any, would be small in such a large economy.

The major economic activities that could be adversely affected by construction of the proposed railroad along the Mina rail alignment are mining and grazing interests. Economic activities could be disrupted during the construction phase, which could range from 4 to 10 years. Impacts on private lands (other than patented mining claims) would be small, because as discussed in Section 3.3.2, the Mina rail alignment would lie mostly within BLM-administered public land. DOE would anticipate impacts to private land mainly in the Goldfield area.

There also could be disruption of economic activity from construction impacts on the transportation infrastructure as the movement of construction equipment and supplies temporarily disrupted traffic flow along local road systems. Under the 4-year construction schedule, DOE traffic modeling predicts that construction of the rail line itself would not affect traffic volume on local roads, but that construction of facilities might. Construction of the Maintenance-of-Way Facility and the Staging Yard would affect traffic on U.S. Highway 95 in the vicinity of Tonopah and Hawthorne; however, the level of service would remain the same in both locations. DOE would limit the impact of these disruptions by measures such as limiting road closures to low-traffic periods. Construction of the facilities inside the Yucca Mountain Site boundary near the repository (the Rail Equipment Maintenance Yard, the Cask Maintenance Facility, and possibly the Nevada Railroad Control Center and National

Table 4-246. Alternative analysis for estimated changes in economic measures in Washoe County-Carson City during the construction phase – Mina rail alignment.[a]

County/scenario/measure	Construction year 2010	2011	2012	2013	2014
Washoe County-Carson City[b]					
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Mineral County					
Employment	809	824	798	268	159
State and local government spending	$690,016	$1,271,038	$1,757,619	$1,718,730	$1,626,718
Real disposable income	$45,080,673	$46,549,836	$46,325,305	$17,239,105	$11,966,869
Gross regional product	$56,693,801	$59,920,164	$60,034,931	$21,979,836	$13,866,185
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County					
Employment	809	824	798	268	159
State and local government spending	$689,598	$1,270,620	$1,757,340	$1,718,451	$1,626,300
Real disposable income	$45,068,400	$46,554,300	$46,332,000	$17,245,800	$11,969,100
Gross regional product	$56,651,400	$59,915,700	$60,037,164	$21,988,764	$13,850,569

a. This table does not list data for Clark County, but under the alternative analysis, Clark County impacts would be approximately half of the Clark County impacts identified in Table 4-245.
b. Source: DIRS 181590-Bland 2007, all.

Transportation Operations Center) would affect traffic on U.S. Highway 95 at the entrance to the Yucca Mountain Site, resulting in a drop in level of service from a B to a C at peak times during the construction phase.

There would be fewer such impacts under a 10-year construction schedule, because worker trips and materials shipments would be spread over a longer period. As discussed in Section 4.3.11, the supplies needed for construction would not create shortages at a local, regional, or national level. Primary materials include steel for rails and concrete for rail ties, bridges, and drainage structures. These materials are available regionally and nationally; purchasing would not be expected to create demand and supply impacts, and there should be no harmful price effects.

There could be some reductions in mining- and agriculture-related employment and income because of construction-related land disturbances. The nominal width of the rail line construction right-of-way would include land upon which there are grazing and mining activities. The construction right-of-way might be narrower in certain locations to minimize impacts to lands with mining claims, or wider in other places (such as cut and fill areas and bridges) that could affect parcels adjoining the construction right-of-way where mining and agricultural activities take place.

As discussed in Section 4.3.2.2.1.2, the only mining claims that would be within the rail line construction right-of-way are associated with Mina common segment 1 and Montezuma alternative segments 1, 2, and 3. Although DOE would reduce the area of disturbance to minimize impacts to these claims, Mina common segment 1 would intersect 388 mining claims, Montezuma alternative segment 1 would intersect 202 claims, Montezuma alternative segment 2 would intersect 153, and Montezuma alternative segment 3 would intersect up to 249 (see Section 4.3.2.2.6).

Should parties with existing mining claims have plans to explore, develop, or produce minerals on claims within the construction right-of-way, these plans might require accommodations to allow for both railroad construction and mining activities to proceed. Such accommodations might have economic consequences. DOE recognizes that mineral exploration and development is strongly tied to the price of mineral commodities. However, foreseeable impacts to mining from railroad construction would be very small because the mineral production in affected districts is only a small percentage of overall mineral production in Nevada. Further, construction would only temporarily affect the filing of new claims. However, individuals and localized areas could feel the impacts more severely.

As described in Section 4.3.2.2.3.2, wherever the rail line would cross a grazing allotment, DOE quantified the amount of forage loss in animal unit months in accordance with BLM standards. Factors that influence the determination of permitted animal unit months include quantity and quality of forage; type of forage; season in which the forage will be grazed; kind and mix of grazing animals; presence of water; topography; soil, climate, and disturbance regimes; wildlife cover; proper use factor; and management objectives. In 2001, the State of Nevada Department of Agriculture commissioned a report, *Nevada Grazing Statistics Report and Economic Analysis for Federal Lands in Nevada*, in which one animal unit month was assigned a value of $53.40 in direct and indirect contributions to the economy (DIRS 176949-Resource Concepts 2001, p. 47). DOE used this value to estimate economic losses due to impacts to grazing. Section 4.3.2, Land Use and Ownership, describes, for each potentially affected grazing allotment, the potential impacts to grazing activities from a land-use perspective.

Grazing allotments within the Mina rail alignment construction right-of-way would be affected in Mineral, Esmeralda, and Nye Counties for a total potential loss of up to 326 animal unit months and $17,400 to the local economy during each year of construction activity. This is a conservative estimate, because it assumes DOE would select only the most disruptive alternative segments. Table 4-247 summarizes animal unit month loss information presented in Section 4.3.2 and the corresponding economic impact. Table 4-247 only lists portions of the Mina rail alignment that would result in a loss (for example, the Bonnie Claire alternative segments are not included because none would affect animal unit months on nearby allotments). DOE calculated the totals to two significant figures by adding common segments and the most conservative alternative segment losses.

Table 4-247. Segment-specific annual economic impacts to grazing allotments during construction of the proposed rail line – Mina rail alignment.

Rail line segment	Animal unit months lost[a,b]	Value ($)
Mina common segment 1	111	5,900
Montezuma alternative segment 1	43	2,300
Montezuma alternative segment 2	52	2,800
Montezuma alternative segment 3	59	3,200
Oasis Valley alternative segment 1	8	400
Oasis Valley alternative segment 3	12	600
Common segment 6	17	900
Totals[c]	199	10,600

a. Figures for animal unit months lost for the Facilities at the Interface with the Union Pacific Railroad Mainline include impacts from associated quarries and the Staging Yard.
b. The values shown are worst-case values of the animal unit months that would be lost for 1 year (per year during proposed railroad construction and operations). The table lists only those portions of the rail alignment that would result in a loss.
c. Totals might differ from sums of values due to rounding.

Of the totals, about 111 of the animal unit months and $5,900 would be lost in Mineral County, 59 animal unit months and $3,200 would be lost in Esmeralda County, and 29 animal unit months and $1550 would be lost in Nye County. As presented in Table 3-139, Mineral, Esmeralda, and Nye Counties were projected to have gross regional products of $131 million, $25.7 million, and $1.16 billion, respectively, in 2007. In economies of these scales, the overall impacts of grazing losses would be small. However, individuals and localized areas could feel the impacts more severely. The BLM could elect to redraw the boundaries of grazing allotments to address these effects.

During the construction phase, there could be an additional impact from construction trains colliding with cattle. DOE would compensate ranchers for any such losses of cattle in accordance with Nevada Revised Statutes 705.150 to 705.200.

The potential economic impacts to prime farmland areas are described in relation to employment and lost market value of crops. As discussed in Section 4.3.1.2.1.3, up to 15,000 square meters (3.6 acres) of prime farmland soils would be lost under the Mina Implementing Alternative. This calculated amount of prime farmland is based on the total disturbed area, and is therefore an upper-bound measurement. Table 4-248 lists the estimated impacts to prime farmland.

Table 4-248. Potential impacts to prime farmland – Mina rail alignment.[a]

Rail line segment	Number of acres[b] affected	Market value of crops per acre ($)	Workers per acre	Market value lost ($)	Employment lost
Schurz alternative segment 1					
Lyon County	2.6	510	0.01	1,326	0.03
Schurz alternative segment 4					
Lyon County	2.9	510	0.01	1,479	0.03
Schurz alternative segment 5					
Lyon County	3.6	510	0.01	1,836	0.04
Schurz alternative segment 6					
Lyon County	3.5	510	0.01	1,780	0.04

a. Source: DIRS 173571-USDA 2004, Tables 1 and 7.
b. To convert acres to square kilometers, multiply by 0.0040469.

Based on data from Nevada's Census of Agriculture, DOE estimated the market value of crops lost from prime farmland as less than $2,000 in Lyon County regardless of the Schurz alternative segment selected. DOE also estimates that less than one job would be lost in Lyon County under the Mina Implementing Alternative. The other counties in the Mina rail alignment region of influence would not experience any impacts because the rail line would not cross prime farmland in these counties.

4.3.9.2.2 Population and Housing

Population changes are related to changes in employment. DOE modeled employment of construction workers and some support workers as beginning in 2010 and ending in 2014, and estimated population impacts for the same period. Table 4-249 lists the estimated changes to population during the construction phase for each of the modeled scenarios. Appendix J describes the analysis in more detail. In Esmeralda and Lyon Counties and Washoe County-Carson City, population changes would be identical under either scenario. The peak population increases would be largely due to indirect employment effects.

In Lyon County, the peak estimated population change attributed to railroad construction along the Mina rail alignment would be an increase of eight people, which would correspond to a 0.01-percent increase in the Lyon County projected 2014 population level without the project. Two of these people would be school-aged children, according to the age distribution of Lyon County published by the Bureau of Census (DIRS 181384- U.S. Census Bureau [n.d.]).

Table 4-249. Estimated changes to population during railroad construction – Mina rail alignment.[a,b]

Location	2010	2011	2012	2013	2014
Lyon County	2	4	7	8	8
Mineral County					
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Mineral County	35	51	64	64	63
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County	34	50	64	64	60
Nye County					
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Mineral County	23	27	51	83	86
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County	23	51	84	89	88
Esmeralda County	5	8	18	27	33
Clark County					
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Mineral County	387	717	1,024	1,057	1,011
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County	385	714	1,023	1,059	1,015

a. Sources: DIRS 179558-Bland 2007, all; DIRS 180690-Bland 2007, all; DIRS 180689-Bland 2007, all.
b. Model does not discriminate non-county regions, such as the Walker River Paiute Reservation.

In Mineral County, the peak estimated population change attributed to railroad construction along the Mina rail alignment would be an increase of 64 people, which would correspond to a 1.4-percent increase in the Mineral County projected 2013 population level without the project. Twelve of these people would be school-aged children, according to the age distribution of Mineral County published by the Bureau of Census (DIRS 181384-U.S. Census Bureau [n.d.]).

In Esmeralda County, the peak population gain of 33 people would translate to approximately five additional school-aged children, according to the age distribution of Esmeralda County published by the Bureau of Census (DIRS 175922-Bureau of Census 2000, all). The *Policy Insight*-estimated population gain attributed to railroad construction along the Mina rail alignment represents a 3.1-percent increase in the projected 2014 population level for Esmeralda County without the project.

In Nye County, the peak population increase would be 89 people, about 16 of whom would be school-aged children, according to the age distribution of Nye County published by the Bureau of Census (DIRS 181384-U.S. Census Bureau [n.d.]). The estimated population gain attributed to construction of the proposed railroad along the Mina rail alignment would be less than a 1-percent increase over Nye County's projected population level without the project for all construction years.

In Clark County, the peak population increase would be 1,059 people. Of this increase, about 191 people would be school-aged children, according to the age distribution of Clark County published by the Bureau of the Census (DIRS 171297-Bureau of the Census 2004, all). The estimated population increase attributed to construction of the proposed railroad along the Mina rail alignment would represent less than a 1-percent increase over Clark County's projected population level without the project for all construction years.

If half of the construction workers for the project come from Washoe County-Carson City, then the peak population increase would be 384 people (Table 4-250). The estimated population increase attributed to

Table 4-250. Alternative analysis for estimated changes to population in Washoe County-Carson City during railroad construction – Mina rail alignment.[a]

Location	2010	2011	2012	2013	2014
Washoe County-Carson City[b]	160	291	397	384	359

a. This table does not list data for Clark County, but under the alternative analysis, Clark County impacts would be approximately half of the Clark County impacts identified in Table 4-249.
b. Source: DIRS 181590-Bland 2007, all.

construction of the proposed railroad along the Mina rail alignment would represent less than a 1-percent increase over the region's projected population level without the project for all construction years.

Impacts on housing infrastructure would be small during the construction phase because most construction workers would be housed in construction camps at strategic locations along the rail alignment, rather than in nearby communities. If construction workers elected not to stay in the camps, motels or recreational vehicle parks could substitute as housing options. As discussed in Section 3.3.9.3.3, lodging is available along U.S. Highway 95 and 95A in and around Yerington, Hawthorne, Walker Lake, Mina, Goldfield, Beatty, and Town of Amargosa Valley. These towns offer 21 motels with a total of 733 rooms, and 13 recreational vehicle parks with a total of 412 spaces. These lodging options could not accommodate all workers and completely substitute for construction camps.

Some contractors could elect to use commercially available facilities to house construction personnel, such as those in Yerington, Hawthorne, Walker Lake, Mina, Goldfield, Beatty, and Town of Amargosa Valley. As indicated in Section 3.3.9.3.3, it appears there would be sufficient vacant housing stock in these areas to meet the needs of construction personnel.

4.3.9.2.3 Public Services

Impacts to public services at the county level would likely be small because the population projections with the project show very limited increases in overall counts. An additional demand on local health-care capacity would be the primary impact on public services. The area that is likely to experience the greatest impact is southern Nye County, where the Rail Equipment Maintenance Yard, the Cask Maintenance Facility, and the Nevada Railroad Control Center and National Transportation Operations Center would be.

4.3.9.2.3.1 Health Care. As presented in Section 4.3.10, Occupational and Public Health and Safety, during the construction phase, DOE expects approximately 620 total recordable and ***lost workday cases*** among involved and noninvolved workers; that is, approximately 120 per year. Construction workers would be served by one of the health services centers at each construction camp to be staffed by four medical personnel who would rotate shifts (DIRS 180922-Nevada Rail Partners 2007, p. 4-6). In addition, Nevada Test Site personnel could provide medical services for construction workers along common segment 6 as they do at present for workers at the Yucca Mountain Site. As is the practice at both the Nevada Test Site and the Yucca Mountain Site, medical evacuation services from Las Vegas would transport cases to facilities in Clark County or in Utah as needed.

Nevertheless, to conservatively estimate potential impacts to health-care capacity in the region of influence, DOE assumed that all of the accident and injury cases would be treated at existing facilities in Nye County. This addition of approximately 120 cases per year (related to the less than 1-percent increase in population attributable to the construction effort) could have a small adverse impact on the existing health-care capacity in Nye County. As described in Section 3.3.9.3.4, Nye County is considered medically underserved. The Nye Regional Medical Center in Tonopah has ambulance services, but lacks surgical facilities. The new hospital in Pahrump increased the county capacity to respond to routine and emergency and surgical needs, but the 25-bed increase in capacity might not be sufficient to meet current needs. Thus, any additional number of cases could affect the capacity of Nye County to address the health-care needs of local users.

4.3.9.2.3.2 Education. Although there are only 39 schools in Lyon, Mineral, Nye, and Esmeralda Counties, it is unlikely that the capacities of these schools would be affected by railroad construction. DOE would not expect workers to be accompanied by their families and children because the availability of work camps and the use of 1- to 2-week work shifts would encourage workers to work from camps and return home on their weeks off to established residences in these counties, Clark County, or other Nevada counties. Any small increase in the number of children could be accommodated by the school systems, which have student-to-teacher ratios that are comparable to the national average.

4.3.9.2.3.3 Fire Protection. As discussed in Section 3.3.9.3.4, Lyon, Mineral, Nye, and Esmeralda Counties all meet fire-suppression needs with volunteers, with the exception of Pahrump, which has a paid fire department. In addition, three of the four fire districts in Lyon County are part of a quad-county partnership with Douglas County, Storey County, and Carson City. Although most communities characterized in the region of influence are currently able to provide adequate protection (except for Pahrump, which is currently underserved), any increased demand would move them closer to the limit that existing resources (personnel and equipment) could address. However, each construction camp would have personnel dedicated to fire response, and water wells and a water-tank trailer that would be used to respond to fire emergencies at the camps and construction areas. Because of this and low population increases expected for volunteer-reliant Lyon, Mineral, and Esmeralda Counties, construction-phase activities would not have an adverse impact on fire-protection capacity in the region of influence.

4.3.9.2.3.4 Law Enforcement. Because workers would be dispersed along the rail alignment, and given the low crime rate in the counties that would be directly affected (Lyon, Mineral, Nye, and Esmeralda) (particularly in comparison to the substantially higher Clark County and national crime rates), it is unlikely that the incidence of crime would increase to the extent that existing law enforcement services became inadequate. In other words, project-related increases in crime would be unlikely to overwhelm existing services. Additionally, construction camps would be staffed with security personnel (DIRS 180922-Nevada Rail Partners 2007, pp. 4-4 to 4-7). Accommodations could be made to decrease the possibility of adverse impacts to local law enforcement capacity. Although civil or domestic issues requiring law enforcement interface would be handled by the appropriate authorities, there have been no detailed discussions on protocols and working relationships.

4.3.9.2.4 Transportation Infrastructure

4.3.9.2.4.1 Traffic Impacts. The increased traffic required to support proposed railroad construction would have some additional impacts on existing roadways. Key roads likely to be affected are portions of U.S. Highway 95. At present, these roads are mainly operating at levels of service A or B as defined in Section 3.3.9.3.5, except for a stretch south of U.S. Highway 6 in Tonopah that is currently operating at level of service C. There could be impacts along these routes, particularly in communities that are near construction sites for the railroad operations support facilities. Areas where local road systems could be most affected are Hawthorne in Mineral County; Tonopah, Beatty, Town of Amargosa Valley, and at the entrance to the Yucca Mountain Site in Nye County; and Goldfield and Coaldale in Esmeralda County. The busiest roads within the transportation region of influence, in the Hazen, Silver Springs, and Wabuska areas, would not be affected by railroad construction or operations because no new rail lines or facilities are proposed in these areas.

Railroad construction would generate vehicle trips during facilities construction, both from the movement of materials and from workers traveling to and from the work sites. Truck traffic would be highest at the beginning and end of the construction phase while equipment was brought in and taken away, and could therefore adversely impact traffic conditions during specific weeks. However, trucks could be directed to move during off-peak hours to minimize their impacts on local traffic. Additionally, most construction materials for the Staging Yard and Maintenance-of-Way Facility would be transported by rail; therefore, there would be limited truck trips associated with the movement of materials for these facilities. For both reasons, the analysis does not account for transportation of materials, focusing instead on the transportation of workers to and from the work sites.

Construction of the rail line itself would not be likely to adversely affect traffic volumes on local roads, because much of the construction material would be transported by rail. Workers would be housed in construction camps close to work sites, which would place only limited pressure on the transportation infrastructure, mainly at the end of a work week and possibly over the weekend when travel to local towns might increase. Therefore, the analysis of impacts to levels of service focuses on construction of the railroad operations support facilities.

The level of service analysis evaluates the additional traffic volume in terms of the "peak hour," which is the hour with the highest volume of traffic during a study period, usually a peak period. For example, DOE estimated that the movement of employees for the Rail Equipment Maintenance Yard and the Cask Maintenance Facility would require approximately 600 trips per day and 300 trips during the peak hour at the height of construction activities. The traffic analysis assumes that each employee would generate two vehicle trips per day, one of which would be during the peak hour.

The level of service analysis in this section is conservative because it assumes construction activities during a peak period when all workers are working simultaneously. DOE estimated the number of workers assigned to each facility (DIRS 180874-Nevada Rail Partners 2007, Appendix D, Table 2; DIRS 181425-MTS 2007, p. 5). Table 4-251 lists the estimated number of vehicle trips during the construction phase.

Table 4-251. Estimated highway trips during construction of the railroad operations support facilities – Mina rail alignment.[a]

Facility	Number of daily vehicle trips	Number of peak hour vehicle trips
Employees for construction of the Staging Yard	220	110
Employees for construction of the Maintenance-of-Way Facility	120	60
Employees for construction of the Rail Equipment Maintenance Yard and Cask Maintenance Facility	600	300

a. Sources: DIRS 180874-Nevada Rail Partners 2007, Appendix D, Table 2; DIRS 181425-MTS 2007, p. 5.

Based on the estimated increases in traffic volumes listed in Table 4-251, DOE calculated the effect on the level of service of the affected roadways during peak hour traffic for construction of the three key facilities. All affected roadways were assumed to be configured as two-lane, non-divided paved highways.

The Staging Yard would be near Hawthorne along Mina common segment 1, potentially affecting traffic levels along U.S. Highway 95 and State Route 359. Construction of the Staging Yard would not degrade the level of service on either road, which would remain at levels C and A, respectively.

The Maintenance-of-Way Facility would be approximately 1.6 kilometers (1 mile) south of Silver Peak (Montezuma alternative segment 1) or near Klondike, about 2.9 kilometers (1.8 miles) west of U.S. Highway 95 between Tonopah and Goldfield (Montezuma alternative segment 2 or 3). Its construction could affect traffic levels on local roads, including U.S. Highway 95 between Tonopah and Goldfield. The analysis assumes that all traffic is channeled through U.S. Highway 95, which is the most heavily traveled road in the region. Construction of the Maintenance-of-Way Facility would not degrade the level of service, which would remain at B.

Construction of the Rail Equipment Maintenance Yard, the Cask Maintenance Facility, and possibly the Nevada Railroad Control Center and National Transportation Operations Center would affect traffic on U.S. Highway 95 near the entrance to the Yucca Mountain Site, degrading its level of service from B to C during the peak hour. Level C would still represent stable traffic flow, but would mark the beginning of the range of flow that would become affected by interactions with others in the traffic stream.

4.3.9.2.4.2 Traffic Delay at Grade Crossings. DOE examined the potential for delays at grade crossings along existing rail lines in the region of influence and along the proposed rail line. Rail-highway crossings can be a source of delay to motorists because trains have movement priority. The delay analysis at grade crossings concentrates on the existing rail line between Hazen and Thorne because grade separation is not planned for any of these existing rail-highway intersections. DOE did not estimate delay at grade crossings for new rail segments because all major roads (U.S. Highways 95 and 6, and State Route 361) would be grade separated, and all roads that would cross the new rail segments at grade have very low traffic.

DOE estimated road traffic delay at rail-highway grade crossings based on the additional rail traffic from construction trains along the existing rail segments between Hazen and Thorne. Over the 4-year construction period, DOE estimated that eight one-way trains per day would be necessary (DIRS 180874-Nevada Rail Partners 2007, Appendix A, p. A-9). This estimate does not account for ballast trains, since they would not originate in Hazen, but at quarries along the rail alignment.

DOE calculated blocked crossing time per train according to the speed and length of trains, and determined crossing delay per stopped vehicle based on blocked crossing time, road arrival, and road departure rates. The Department calculated the total number of vehicles delayed per day as a function of the number of daily trains, average daily road traffic volume, and blocked crossing time. Total delay per day is the product of crossing delay per stopped vehicle and total number of vehicles delayed per day. Appendix J includes a detailed description of the methodology DOE used to calculate delay at grade crossings.

Table 4-252 summarizes total daily delay at each grade crossing analyzed. The maximum average delay per vehicle would be 1.70 seconds, up from 0.36 second without the additional construction rail traffic. Therefore, the maximum average delay at grade crossings caused by the additional rail traffic under the Proposed Action would be 1.34 seconds per vehicle, which represents a very small impact. The level of service on any of the analyzed intersections would not be degraded due to delay at grade crossings from additional rail traffic.

4.3.9.2.4.3 Impacts to Existing Rail Lines. DOE examined the impacts of additional construction rail traffic to existing rail traffic along the Union Pacific Railroad Hazen Branchline and Department of Defense Branchlines. At present, these existing branchlines operate a few trains per week that would continue after construction of the proposed railroad. From Hazen to Wabuska, there are approximately two Union Pacific Railroad trains per week that operate on the Hazen Branchline. For purposes of analysis in this Rail Alignment EIS, DOE estimated that approximately two Union Pacific Railroad trains en route to Wabuska and two Department of Defense trains en route to the Hawthorne Army Depot would run from Hazen to Hawthorne per week. During the construction phase, there would be five additional trains per day, which would be a substantial increase in the number of existing trains.

Table 4-252. Delay at highway-rail grade crossings during the construction phase – Mina rail alignment.

Federal Railroad Administration Crossing ID Number	Road name	County/ Reservation	Number of vehicles delayed per day		Average delay per vehicle (seconds)		Total delay per day (vehicle-minutes)	
			Existing	With proposed rail line	Existing	With proposed rail line	Existing	With proposed rail line
740906Y	Bango Road	Churchill	0	0	0.03	0.41	0.01	0.18
740907F	City Street	Churchill	0	0	0.03	0.41	0.00	0.01
740912C	U.S. Highway 50	Lyon	3	21	0.03	0.42	1.00	15.00
740914R	Fir Avenue	Lyon	1	9	0.03	0.42	0.47	6.70
740915X	5th Street	Lyon	1	8	0.03	0.42	0.38	5.50
740916E	9th Street	Lyon	1	13	0.03	0.42	0.64	9.00
740918T	U.S. Highway 95A	Lyon	3	28	0.03	0.42	1.40	20.00
740919A	Fort Churchill PA	Lyon	0	2	0.03	0.41	0.11	1.60
740920U	Adrian Valley	Lyon	0	0	0.03	0.41	0.01	0.10
740922H	Church Hill	Lyon	0	1	0.03	0.41	0.06	0.85
740923P	Thompson Smelter	Lyon	0	1	0.03	0.41	0.06	0.80
740925D	U.S. Highway 95A	Lyon	3	28	0.03	0.42	1.40	20.00
740927S	Mason Valley Road	Lyon	0	0	0.02	1.60	0.01	0.45
740945P	Walker Lake North	Mineral	0	0	0.02	1.60	0.00	0.03
740946W	Nolan	Mineral	0	0	0.02	1.60	0.00	0.42
740947D	Near Nolan	Mineral	0	0	0.02	1.60	0.00	0.07
740948K	Walker Lake South	Mineral	0	0	0.02	1.60	0.00	0.35
740951T	Thorne	Mineral	1	4	0.36	1.70	0.86	4.00

Because there is very little traffic currently operating along the existing rail segments, DOE would not expect that existing trains would experience long delays, especially because train traffic would be coordinated to avoid delays. Therefore, impacts of new construction rail traffic on existing rail traffic would be moderate.

4.3.9.3 Railroad Operations Impacts

The common social and economic activities and changes associated with the operations phase would include:

- Increases in project-related employment, particularly associated with railroad operations support facilities
- Slight population increases associated with employment increases
- Some pressure on housing in southern Nye County where the Cask Maintenance Facility, Rail Equipment Maintenance Yard, and possibly the Nevada Railroad Control Center and National Transportation Operations Center would be located
- Continued effects on mining and agriculture
- Possible effects on public services (health and education)
- Possible effects on transportation infrastructure

4.3.9.3.1 Employment and Income

Local impacts during the operations phase would be linked to the location of facilities, size of the workforce, and the extent to which the community would provide goods and services to facilities and workers. Table 4-253 lists the estimated number of full-time-equivalent workers that would be required for each railroad operations support facility. DOE used these employment figures as input to the *Policy Insight* model.

Table 4-253. Estimated average employment by railroad operations support facility – Mina rail alignment.[a]

Facility	Location	Workforce (full-time equivalent)
Staging Yard	Hawthorne	40
Cask Maintenance Facility	Inside the Yucca Mountain Site boundary near the repository	30
Nevada Railroad Control Center/National Transportation Operations Center	Mineral County or collocated with the Rail Equipment Maintenance Yard	15
Maintenance-of-Way Facility	Esmeralda County	40
Rail Equipment Maintenance Yard	Inside the Yucca Mountain Site boundary near the repository	25

a. Sources: DIRS 180873-Nevada Rail Partners 2007, Table 2-1; DIRS 180874-Nevada Rail Partners 2007, Table 3.

As it did for railroad construction, DOE modeled two scenarios for railroad operations – one with the Railroad Control Center and National Transportation Operations Center in Mineral County (Scenario 1), Nevada and the other with these facilities in Nye County (Scenario 2).

DOE modeled employment of operations workers and some support workers as beginning in 2015 and ending in 2067. Table 4-254 lists the economic impacts of both scenarios during the operations phase. All operations-related economic impact values are given in 2006 dollars.

The employment impacts on the Walker River Paiute Reservation are included in the estimates for Mineral County. The economic forecasting model is unable to discriminate impacts for the Reservation.

In Lyon County, increases in economic measures would be similar under the two scenarios; however, the larger increases would be under Scenario 1, with the Nevada Railroad Control Center and National Transportation Operations Center in Mineral County. However, all increases would represent less than a 1-percent average annual increase over the projected annual average without the project. See Table 3-136 for baseline employment data.

In Mineral County, the greater increases would be under Scenario 1, with the Nevada Railroad Control Center and National Transportation Operations Center in Mineral County. The total increased employment in Mineral County would average about 58 jobs annually over the operations phase. This would represent a 2.6-percent increase above the projected annual average employment level without the project. The peak operations-related impact to real disposable income, gross regional product, and state and local government spending would correspond to 2.8-, 1.9-, and 1.5-percent increases, respectively, above the projected levels for each measure without the project.

In Nye County, the greater increases in economic measures would be for Scenario 2, with the Nevada Railroad Control Center and National Transportation Operations Center in Nye County. However, all

Table 4-254. Estimated changes in average annual economic measures during the operations phase – Mina rail alignment.[a]

Location/scenario	Total employment	Real disposable income	Gross regional product	State and local government expenditures
Lyon County				
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Mineral County	1	$207,887	$107,280	$46,680
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County	1	$155,125	$74,945	$35,205
Mineral County				
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Mineral County	58	$3.6 million	$4.2 million	$599,000
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County	38	$2.3 million	$3.3 million	$344,000
Nye County				
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Mineral County	22	$2.2 million	$3.7 million	$419,000
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County	27	$2.6 million	$4.6 million	$479,000
Esmeralda County				
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Mineral County	62	$4.6 million	$11.2 million	$776,000
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County	62	$4.6 million	$11.2 million	$776,000
Clark County				
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Mineral County	85	$11.4 million	$12.8 million	$1.3 million
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County	98	$12.7 million	$14.8 million	$1.4 million

a. Sources: DIRS 179558-Bland 2007, all; DIRS 180690-Bland 2007, all; DIRS 180689-Bland 2007, all.

increases would represent less than a 1-percent average annual increase over the projected annual average without the project.

In Esmeralda County, changes in economic measures during the operations phase would be nearly identical under the two scenarios. The annual average change in employment would be an average increase of 62 jobs over the baseline during the operations phase. This peak impact would represent a 14-percent increase above the projected level without the project. The average increases in economic indicators would be $4.6 million above the baseline for real disposable income, $11.2 million above the baseline for gross regional product, and $776,000 above the baseline for state and local government spending. These impacts represent 10-, 24-, and 10-percent increases, respectively, above the projected levels for each measure without the project.

In Clark County, the greater increases in economic measures would be observed under Scenario 2, with the Nevada Railroad Control Center and National Transportation Operations Center in Nye County. However, all increases would represent less than a one-tenth of 1-percent average annual increase over the projected annual average without the project.

If half of the construction workers come from the combined area of Washoe County and Carson City, then there will be socioeconomic impacts that linger into the operations phase of the Proposed Action. The greater increases in economic measures would be observed under Scenario 1, with the Nevada Railroad Control Center and National Transportation Operations Center in Mineral County (see Table 4-255). However, all increases would represent less than a one-tenth of 1-percent average annual increase over the projected annual average without the project.

Table 4-255. Alternative analysis for estimated changes in average annual economic measures in Washoe County-Carson City during the operations phase – Mina rail alignment.[a]

Location/scenario	Total employment	Real disposable income	Gross regional product	State and local government expenditures
Washoe County-Carson City[b]				
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Mineral County	28	$3.6 million	$3.8 million	$405,000
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County	27	$3.6 million	$3.6 million	$393,000

a. This table does not list data for Clark County, but under the alternative analysis, Clark County impacts would be approximately half of the Clark County impacts identified in Table 4-254.
b. Source: DIRS 181590-Bland 2007, all.

Section 4.3.11, Utilities, Energy, and Materials, describes impacts related to the use of construction materials and fossil fuel during the construction and operations phases.

The small economic impacts to mining and agriculture identified for the construction phase would continue during the operations phase. As for the construction phase, there would be a risk of trains colliding with cattle. DOE would compensate ranchers for any loss of cattle during railroad operations in accordance with Nevada Revised Statutes 705.150 to 705.200. Train and track inspection and maintenance activities would be confined to areas disturbed by construction activities, so there would be no additional disturbances to the physical environment. There could be some areas that were disturbed during construction activities that would not be affected during operations (for example, staging areas), and on which agricultural and mining activities could be resumed. Areas disturbed during construction but not needed for operations would be reclaimed in accordance with BLM guidance.

4.3.9.3.2 Population and Housing

Population changes would be related to changes in employment. DOE modeled employment of railroad operations workers and some support workers as beginning in 2015 and ending in 2067. Population impacts are estimated for the same period. Table 4-256 lists estimated population changes for the two modeled scenarios during the operations phase.

Table 4-256. Estimated changes to population during railroad operations – Mina rail alignment[a]

Location	Average change in population
Lyon County	
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Mineral County	9
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County	7
Mineral County	
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Mineral County	66
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County	38
Nye County	
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Mineral County	86
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County	98
Esmeralda County	
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Mineral County	76
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County	76
Clark County	
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Mineral County	280
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County	310

a. Sources: DIRS 179558-Bland 2007, all; DIRS 180690-Bland 2007, all; DIRS 180689-Bland 2007, all.

The population impacts on the Walker River Paiute Reservation are included in the estimates for Mineral County. The economic forecasting model is unable to discriminate impacts for the Reservation.

In Lyon County, Scenario 1 would result in an average gain of nine people annually above the projected levels without the project. Of this increase, about two people would be school-aged children, according to the age distribution of Lyon County published by the Bureau of the Census (DIRS 181384-U.S. Census Bureau [n.d.], all). The estimated average annual population increase attributed to the operations phase would be less than 1 percent above Lyon County's projected population annual average without the project.

At the county level, Lyon County would be able to absorb the increased demand for housing. At present, there are 1,272 vacant housing units in Lyon County (see Table 3-140).

In Mineral County, Scenario 1 would result in an average gain of 66 people annually above the projected levels without the project. Of this increase, about 13 people would be school-aged children, according to the age distribution of Mineral County published by the Bureau of the Census (DIRS 181384-U.S. Census Bureau [n.d.], all). The estimated average annual population increase attributed to the operations phase would be 1.6 percent above Mineral County's projected population annual average without the project.

At the county level, Mineral County might be able to absorb the increased demand for housing. At present there are 669 vacant housing units in Mineral County (see Table 3-140).

In Nye County, the greater average increase in population would be under Scenario 2, with an average gain of 98 people annually above the projected levels without the project. Of this increase, about 17 would be school-aged children, according to the age distribution of Nye County published by the Bureau of the Census (DIRS 181384-U.S. Census Bureau [n.d.], all). The estimated average annual population increase attributed to the operations phase would be less than 1 percent above Nye County's population projected annual average level without the project.

At the county level, Nye County, with 2,625 vacant housing units, would likely be able to absorb the increased demand for housing. Within the county, workers would likely choose to live in southern Nye County, where the Cask Maintenance Facility, Rail Equipment Maintenance Yard, and possibly the Nevada Railroad Control Center and National Transportation Operations Center would be. The 1,058 vacant housing units in Pahrump could accommodate increased demand, though it should be noted that Pahrump has been undergoing a substantial population increase recently (more than 25 percent between 2000 and 2004). Future increases in population are expected, which will place additional demand on the current housing stock. Therefore, project-worker demand for housing in the community would have the potential to create small impacts on the supply of available housing. No impact is expected on housing availability in the Tonopah area; the number of operations workers residing in that community would likely be small, and there would be adequate vacant housing available in the community to accommodate this increase, as discussed in Section 3.3.9.

In Esmeralda County, the average increase in population would be the same under either scenario, with an average gain of 76 people annually above the projected levels without the project. Of this increase, about 12 would be school-aged children, according to the age distribution of Esmeralda County published by the Bureau of the Census (DIRS 175922-Bureau of Census 2000, all). The estimated average annual population increase attributed to the operations phase is 7 percent above the baseline.

At the county level, Esmeralda County, with 378 vacant housing units, would likely be able to absorb the increased demand for housing. At the local level, no impact is expected on housing availability in Goldfield or Tonopah, which are both close to Klondike and Silver Peak, the two alternative locations for where the Maintenance-of-Way Facility would be. The number of operations workers residing in either community would likely be small, and there would be adequate vacant housing available, as discussed in Section 3.3.9.3.3.

In Clark County, the greater average increase in population would be under Scenario 2, with an average gain of 310 people annually above the projected levels without the project. Of this increase, about 56 would be school-aged children, according to the age distribution of Clark County published by the Bureau of the Census (DIRS 171297-Bureau of the Census 2004, all). The estimated average annual population increase attributed to the operations phase would be a less than one-tenth of 1-percent increase above Clark County's projected population annual average level without the project.

If half of the construction workers came from Washoe County and Carson City, then there would be population impacts that linger into the operations phase. The greater average increase in population for this combined region would be under Scenario 1, with an average gain of 81 people annually above the projected levels without the project (see Table 4-257). The estimated average annual population increase would be less than one-tenth of 1-percent increase above the combined region's projected population annual average level without the project.

Table 4-257. Alternative analysis for estimated changes to population in Washoe County-Carson City during railroad operations – Mina rail alignment.[a]

Location	Average change in population
Washoe County-Carson City[b]	
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Mineral County	81
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County	79

a. This table does not list data for Clark County, but under the alternative analysis, Clark County impacts would be approximately half of the Clark County impacts identified in Table 4-256.
b. Source: DIRS 181590-Bland 2007, all.

4.3.9.3.3 Public Services

Railroad operations along the Mina rail alignment would result in small impacts to health-care capacity in Lyon, Mineral, Nye, and Esmeralda Counties and on education infrastructure in southern Nye County (Pahrump). The exact extent of impacts to other public services would depend on the total number of workers and their residential locations, and operations activities in relation to existing system capacity. However, workers could create small to moderate impacts in the form of additional demand for fire-protection services in Lyon, Mineral, Nye, and Esmeralda Counties.

4.3.9.3.3.1 Health Care. The increased demand for health care associated with the railroad operations support facilities could result in small adverse impacts to the existing health service capacity. As discussed in Section 3.3.9.3.4, Lyon, Mineral, Nye, and Esmeralda Counties are all considered medically underserved. This analysis assumes that there will be no health-care support for the project on the Walker River Paiute Reservation.

In particular, population impacts associated with facilities in southern Nye County could place increased demand on the health-care system in the county. The peak average increase in Nye County's permanent population would be 98 people (0.22 percent above the projected population without the project, or less than one-quarter of 1 percent), and it is assumed that many of these people would reside in or near Pahrump. Pahrump does have preventive care clinics and a new hospital although, as noted in Section 4.3.9.2.3.1, it is not clear whether the hospital is able to serve the routine and emergency health-care needs of the local population. Increased demand related to project increases in workers and permanent population, however small, could adversely affect the capacity of Pahrump's health-care system to meet local needs. If the Nevada Railroad Control Center and National Transportation Operations Center were in Mineral County instead of Nye County, the impacts to the health-care system in Nye County would be slightly less. Under this scenario, Nye County's permanent population would increase by 86 people, which would represent a 0.19-percent average increase.

4.3.9.3.3.2 Education. As indicated in Section 4.3.9.3.2, the annual impact to schools in Lyon, Mineral, Nye, and Esmeralda Counties that would result from the increase in population would average about two, 13, 17, and 12 additional pupils, respectively. The operations phase workforce could place limited strains on the education system in Mineral and Nye Counties, resulting in a small, if any, impact. The exact extent of this impact would depend on the final location of railroad operations support facilities, where workers choose to reside, whether workers relocated families and children, the ages of children, and the capacities of particular schools in 2015 and later.

In Nye County, DOE estimates a peak average annual increase of 132 people above the county's projected population without the project in 2066. The addition of these workers and permanent population to the county would have the potential to increase the number of children in the school system by 23.

The location of railroad facilities at the end of the line could result in many workers and their families residing in Pahrump. As noted in Section 3.3.9, independent of the proposed railroad, Pahrump is experiencing a fairly rapid increase in its population, and all schools are functioning at or above maximum design capacity. Further baseline population increases are predicted, meaning that even without project-related impacts, school capacity would become strained in the future. While any additional increases to the projected baseline population would increase the need for school capacity, the estimated additional 23 students associated with the proposed railroad would be a small incremental increase in relation to the school population increases Pahrump is experiencing at present. Therefore, the projected project-related impact would be small in comparison with the impact related to other factors.

Impacts in Esmeralda County would be limited because the number of resident workers at the Maintenance-of-Way Facility would be small; the elementary school system in Esmeralda County can accommodate an additional 100 students (DIRS 174970-Arcaya 2005, all); and students can attend high school in Tonopah, where there are elementary, middle, and high school facilities. The influx of operations-phase workers to Tonopah or Goldfield would not adversely affect school capabilities.

4.3.9.3.3.3 Fire Protection. As discussed in Section 4.3.9.2.3.3, Lyon, Mineral, Nye, and Esmeralda Counties all meet fire-suppression needs with volunteers, with the exception of Pahrump's paid fire department. At present, most communities characterized in the region of influence are able to provide adequate protection (except for Pahrump, which is currently underserved), but increased demand on these services could move them closer to the limit that existing resources (personnel and equipment) could address. Increases to permanent county populations could result in small to moderate impacts in Lyon, Mineral, Nye, and Esmeralda Counties, and particularly in Pahrump, where, as noted in Section 3.3.9, fire-protection capabilities are already overextended. With the Cask Maintenance Facility collocated with the Rail Equipment Maintenance Yard, and most workers and their families residing in Pahrump, these additional demands on the fire-protection capabilities of Pahrump could affect the system's ability to meet the community's needs.

4.3.9.3.3.4 Law Enforcement. Given the low crime rates in Lyon, Mineral, Nye, and Esmeralda Counties, it is not likely that population increases would increase the incidence of crime to the extent that the existing level of law enforcement services would become inadequate to meet the demand.

4.3.9.3.4 Transportation Infrastructure

4.3.9.3.4.1 Traffic Impacts. There would be fewer road traffic impacts during the operations phase than during the construction phase because there would be considerably fewer workers during the operations phase. DOE estimates that a total of 150 employees would be needed to operate the railroad operations support facilities. A total of 70 employees would be working at the Nevada Railroad Control Center and National Transportation Operations Center, Rail Equipment Maintenance Yard, and Cask

Maintenance Facility. Additionally, 40 employees would work at the Staging Yard, and 40 would work at the Maintenance-of-Way Facility (DIRS 180874-Nevada Rail Partners 2007, Appendix D, Table 4). Table 4-258 summarizes the projected number of vehicle trips that would be generated during the operations phase, assuming that each of these employees would generate two trips per day, one of them during the peak hour. The affected road segments would be the same as the ones considered in the analysis for the construction phase (see Section 4.3.9.2.4.1).

Table 4-258. Projected highway trips during operation of the railroad operations support facilities – Mina rail alignment.[a]

Facility	Number of daily vehicle trips	Number of peak hour vehicle trips
Employees for operation of the Staging Yard	80	40
Employees for operation of the Maintenance-of-Way Facility	80	40
Employees for operation of the facilities inside the Yucca Mountain Site boundary near the repository	140	70

a. Source: DIRS 180874-Nevada Rail Partners 2007, Appendix D, Table 4.

DOE determined that the projected trips listed in Table 4-258 for the three key areas could result in the following impacts to traffic:

- Operations at the Staging Yard would have a small impact on traffic along U.S. Highway 95 and State Route 359, and levels of service would remain at C and A, respectively (no degradation in level of service).
- Operations at the Maintenance-of-Way Facility would have a small impact on traffic along U.S. Highway 95 between Tonopah and Goldfield, and level of service would remain at B (no degradation in level of service).
- Operations at the facilities inside the Yucca Mountain Site boundary near the repository would affect traffic along U.S. Highway 95 near the entrance to the Yucca Mountain Site, which would degrade the level of service from B to C.

4.3.9.3.4.2 Traffic Delay at Grade Crossings. As in Section 4.3.9.2.4.2, DOE examined the effects of the Mina Implementing Alternative on delay at grade crossings along existing rail lines in the region of influence and along the proposed rail line. Rail-highway crossings can be a source of delay to motorists because trains have movement priority. The delay analysis at grade crossings concentrates on the existing rail line between Hazen and Thorne because grade separation is not planned for any existing rail-highway intersections. Delay at grade crossings was not estimated for new rail segments because all major roads (U.S. Highways 95 and 6, and State Route 361) would be grade separated, and all roads that would cross the new rail line at grade have very low traffic.

DOE estimated road traffic delay at rail-highway grade crossings based on the additional rail traffic at the existing rail segments between Hazen and Thorne. Over the 50-year operations phase, there would be a maximum of 17 one-way trains per week, including cask trains, maintenance-of-way trains, and repository supply trains (DIRS 180874-Nevada Rail Partners 2007, Appendix A, p. A-9). To provide a conservative estimate, DOE assumed that all trains would originate in Hazen. Assuming that trains would only travel on weekdays, an average of approximately 3.4 trains per day would be expected.

DOE calculated blocked crossing time per train according to the speed and length of trains, and determined crossing delay per stopped vehicle based on blocked crossing time, road arrival, and road departure rates. The Department calculated the total number of vehicles delayed per day as a function of the number of daily trains, average daily road traffic volume, and blocked crossing time. Total delay per day is the product of crossing delay per stopped vehicle and total number of vehicles delayed per day. Appendix J includes a detailed description of the methodology DOE used to calculate delay at grade crossings.

Table 4-259 summarizes total daily delay at each grade crossing analyzed. The maximum average delay per vehicle would be 0.48 second, up from 0.36 second without the additional rail traffic. Therefore, the maximum average delay at grade crossings caused by the additional rail traffic under the Proposed Action would be 0.12 second per vehicle, which would represent a very small impact. The level of service on any of the analyzed intersections would not be degraded due to delay at grade crossings from additional rail traffic.

Table 4-259. Delay at highway-rail grade crossings during the operations phase – Mina rail alignment.

Federal Railroad Administration Crossing ID Number	Road name	County/ Reservation	Number of vehicles delayed per day		Average delay per vehicle (seconds)		Total delay per day (vehicle-minutes)	
			Existing	With proposed rail line	Existing	With proposed rail line	Existing	With proposed rail line
740906Y	Bango Road	Churchill	0	0	0.03	0.08	0.01	0.03
740907F	City Street	Churchill	0	0	0.03	0.08	0.00	0.00
740912C	U.S. Highway 50	Lyon	3	7	0.03	0.08	1.10	2.90
740914R	Fir Avenue	Lyon	1	3	0.03	0.08	0.47	1.30
740915X	5th Street	Lyon	1	2	0.03	0.08	0.38	1.00
740916E	9th Street	Lyon	1	4	0.03	0.08	0.64	1.70
740918T	U.S. Highway 95A	Lyon	3	9	0.03	0.08	1.40	3.80
740919A	Fort Churchill PA	Lyon	0	1	0.03	0.08	0.11	0.30
740920U	Adrian Valley	Lyon	0	0	0.03	0.08	0.01	0.02
740922H	Church Hill	Lyon	0	0	0.03	0.08	0.06	0.16
740923P	Thompson Smelter	Lyon	0	0	0.03	0.08	0.06	0.15
740925D	U.S. Highway 95A	Lyon	3	9	0.03	0.08	1.40	3.80
740927S	Mason Valley Road	Lyon	0	0	0.02	0.14	0.01	0.04
740945P	Walker Lake North	Mineral	0	0	0.02	0.14	0.00	0.00
740946W	Nolan	Mineral	0	0	0.02	0.14	0.00	0.04
740947D	Near Nolan	Mineral	0	0	0.02	0.14	0.00	0.01
740948K	Walker Lake South	Mineral	0	0	0.02	0.14	0.00	0.03
740951T	Thorne	Mineral	1	2	0.36	0.48	0.86	1.20

4.3.9.3.4.3 Impacts to Existing Rail Traffic. DOE examined the impacts of additional rail traffic to existing rail traffic along the Union Pacific Railroad Hazen Branchline and Department of Defense Branchlines. These existing branchlines currently operate a few trains per week that would continue after the proposed railroad was constructed. From Hazen to Wabuska, there are approximately two Union Pacific Railroad trains per week that operate on the Hazen Branchline. For purposes of analysis in this Rail Alignment EIS, DOE estimated that approximately two Union Pacific Railroad trains en route to Wabuska and two Department of Defense trains en route to the Hawthorne Army Depot would run from Hazen to Hawthorne per week. During the operations phase, there would be between three and four additional trains per day, which is a significant increase to the number of existing trains. Because there is very little traffic currently operating along the existing rail segments, it is not expected that existing trains would face long delays, especially because train traffic would be coordinated to avoid delays. Therefore, impacts of new rail traffic on existing rail traffic would be moderate.

4.3.9.4 Impacts under the Shared-Use Option

The Shared-Use Option could result in additional facilities to support commercial use of the DOE railroad. Shared-use facilities could include access sidings in any of the following areas: Hawthorne, Luning, Mina, Goldfield, Silver Peak, and the Beatty area. Consideration of the Shared-Use Option addresses only those impacts that are reasonably foreseeable based on existing conditions in the affected communities.

4.3.9.4.1 Construction Impacts under the Shared-Use Option

Because commercial entities or local governments would build commercial sidings at the locations of selected passing sidings (to the extent practicable), the incremental effort to construct the commercial sidings would be reduced. While there would be a need for some additional materials and labor, the increase over that needed under the Proposed Action without shared use would be small. As discussed in the following sections, DOE would expect impacts on population and housing; employment and income; public services; and transportation resources to be small under the Shared-Use Option, and similar to those under the Proposed Action without shared use.

4.3.9.4.1.1 Population and Housing. Given the minimal increase in economic activity that would be associated with railroad construction under the Shared-Use Option, there would be no to low population changes and attendant pressures on the available housing stock.

4.3.9.4.1.2 Employment and Income. There could be very limited increases in employment and income associated with construction under the Shared-Use Option. These increases would be similar to the changes in employment and income associated with construction under the Proposed Action without shared use. There could be limited loss of economic activity associated with land acquisition for the commercial-siding and parking-area rights-of-way, but DOE would expect such impacts, if any, to be small.

4.3.9.4.1.3 Public Services. Railroad construction under the Shared-Use Option would impact existing public services similar to the Proposed Action without shared use. Given the minimal incremental change in labor and population under the Shared-Use Option, impacts to health care, education, law enforcement, and fire-protection services would be small.

4.3.9.4.1.4 Transportation Infrastructure. The volume of daily and peak-hour trips that would be generated during railroad construction under the Shared-Use Option would be consistent with the volumes generated under the Proposed Action without shared use. For purposes of this analysis, DOE assumed that commercial access sidings and facilities would be constructed at the same time as the rail line, although it could also occur at a later date. There would be little increased traffic volume beyond that described for the Proposed Action without shared use.

The construction approach under the Shared-Use Option would be the same as that described for the Proposed Action without shared use, with construction being phased and best management practices implemented. Because, to the extent practicable, commercial sidings would be built at the locations of selected passing sidings, the incremental effort to construct commercial-use sidings would be minimized. There would be no need for additional construction camps and no need for new roads because the temporary access roads would also be used for commercial siding construction. Therefore, although there would be a need for some additional materials and labor under the Shared-Use Option, there would be little increase beyond that described for the Proposed Action without shared use. Based on the lengths of track involved under the Shared-Use Option, the incremental impacts to traffic from constructing the additional sidings would be a small fraction of the overall impacts for railroad construction under the Proposed Action without shared use. Thus, impacts to the transportation infrastructure under the Shared-Use Option would be small.

Traffic delay impacts at highway-rail grade crossings from construction trains would be consistent with the delay impacts under the Proposed Action without shared use.

4.3.9.4.2 Operations Impacts under the Shared-Use Option

The impact assessment for railroad operations under the Shared-Use Option draws on information from a DOE analysis (DIRS 180694-Ang-Olson and Gallivan 2007, all), as described in Section 2.2.6. In the near term, commercial shippers using the DOE railroad would be existing nearby companies that currently transport materials and goods by truck.

Under a DOE-funded cooperative agreement, Nye County commissioned a study of the potential economic benefits to Lincoln, Nye, and Esmeralda Counties during construction and operation of the proposed railroad along the Caliente rail alignment (DIRS 174090-Wilbur Smith Associates 2005, all). This 2005 report was updated in 2007 by a Nye County consultant and included the Mina rail alignment (DIRS 185244-Nuclear Waste Project Office 2007, all). Information from the Nye County 2007 report is presented in Sections 4.3.9.4.2.1 and 4.3.9.4.2.2. In the near term, commercial shippers using the DOE railroad would be existing nearby companies that currently transport materials and goods by truck.

4.3.9.4.2.1 Population and Housing. It is not likely that there would be noticeable increases in population associated with railroad operations under the Shared-Use Option. Increases in economic activity and associated indicators, particularly in terms of employment, would likely be limited and therefore would not generate substantial changes in permanent population. Therefore, DOE would expect no impacts on housing under the Shared-Use Option.

Nye County's 2007 report (DIRS 185244-Nuclear Waste Project Office 2007, all) estimated increases in employment and income (see Section 4.3.9.4.2.2) due to shared use. Based on Nye County's estimated increase in wages, DOE used the REMI *Policy Insight* model to estimate that the increase in population would be approximately 500 after 10 years of operations, an increase of less than 1 percent (DIRS 185435-Bland 2008, all). If the Nye County employment and income estimates were to be realized, then the impacts might be larger than DOE expects, although still small. As discussed in Chapter 7, DOE would establish monitoring programs in counties containing the Nevada railroad to evaluate future impacts and potential mitigation related to the Nevada railroad, including those from shared use and transportation issues arising from the repository.

4.3.9.4.2.2 Employment and Income. Shared use of the DOE railroad could allow business activity to develop and expand in the region of influence, which would result in some employment and income benefits. For some companies, especially those involved in the shipment of heavy or bulk products, the rail line could allow firms to access new markets and to ship greater quantities of products to existing and new markets.

Based on the DOE analysis (DIRS 180694-Ang-Olson and Gallivan 2007, all), and as described in Section 2.2.6, overall potential commercial shipments are estimated at 2,465,000 metric tons (2,711,000 tons) or 27,110 carloads annually, with shipments of stone estimated at 878,000 metric tons (966,000 tons) or 9,660 carloads (consisting primarily of outgoing decorative rock); nonmetallic minerals at 251,000 metric tons (276,000 tons) or 2,760 carloads (consisting primarily of pozzolan); and petroleum products at 13,000 metric tons (14,000 tons) or 140 carloads (consisting of incoming crude oil).

Based on these shipments, increases in revenue might generate small direct and indirect employment and income impacts.

Therefore, access to commercial rail service could support business expansion and revenue increases for firms in Mineral and Nye Counties. These increases in revenue might generate small direct and indirect employment and income impacts. However, there are a number of factors, such as a firm's overall business objectives and planning decisions, which would influence the extent to which revenue translated into increased hiring or increased income.

Nye County, in its recent 2007 report (DIRS 185244-Nuclear Waste Repository Project Office 2007, all) estimated there would be approximately 230 direct jobs created in Nye County as a result of increased economic activity from shared use. This would be approximately 1 percent of the baseline number of direct jobs (23,000) estimated by DOE for 2025 (Table 3-60). Including indirect jobs, the total increase in jobs estimated by Nye County would be approximately 350 (1.5 percent of the baseline), and total new wages brought into the county would be approximately $7.6 million.

Railroad operations under the Shared-Use Option would generate small employment and income impacts. It is expected that a crew of three people would be needed to operate the commercial train service. As discussed in Section 2.2.4.1, depending on the total travel time for the commercial train, a crew change point might be needed. Train crews would use local commercial facilities for sleeping and provision needs, causing some small, but positive, impacts to employment and income. There might also be small economic benefits associated with maintenance of the commercial rail facilities by a commercial contractor.

4.3.9.4.2.3 Public Services. Because the impacts to population and employment would be so small in Lyon, Mineral, Esmeralda, Nye, and Clark Counties, impacts to public services under the Shared-Use Option would be unlikely in any of these counties.

4.3.9.4.2.4 Transportation Infrastructure. Under the Shared-Use Option, commercial rail service would begin after the completion of construction. During railroad operations, trains carrying casks would have priority over trains carrying commercial shipments in terms of time in transit. Up to 18 one-way commercial trains per week would run along the rail line (DIRS 180694-Ang-Olson and Gallivan 2007, all). For comparison, an average total of 17 one-way trains would run between Hazen and the repository per week carrying casks and other materials for ***maintenance-of-way activities*** (DIRS 175036-BSC 2005, Table 4.2). The commercial trains (not including the locomotives) would consist of up to 60 cars and would be approximately 1,100 meters (3,600 feet) long. Depending on the weight of the train, three or four locomotives would be required (DIRS 176756-Ang-Olson and Khan 2005, all).

Commercial trains would haul a range of products to and from businesses, including stone and other nonmetallic minerals, oil and petroleum products, and nonradioactive waste materials. DOE expects the operating characteristics of these trains to be similar to those typical of freight train operations. The Nevada Railroad Control Center would control and coordinate commercial rail service movements and would therefore maintain overall safety of operations along the rail line.

The volume of daily and peak-hour vehicle trips that would be generated during operations under the Shared-Use Option would be consistent with operations under the Proposed Action without shared use. There would be little increase in traffic volumes beyond those described in Section 4.3.9.2.4.1.

During operation of commercial service on the rail line, there would be an increase in truck traffic to and from the commercial sidings as compared to the Proposed Action without shared use. DOE assumed that under the Proposed Action without shared use, private companies near the rail line would continue to ship and receive freight using truck-only transport. Under the Shared-Use Option, some of those shipments would be diverted to rail, with trucks accessing the commercial sidings. The reduced number of truck shipments that would result from rail shipment would offset the adverse impacts due to the additional increase in number of trucks under the Shared-Use Option. Therefore, DOE would anticipate little increase in adverse impacts to the traffic levels of service of nearby roadways.

Road traffic delay impacts at highway-rail grade crossings would be higher than under the Proposed Action without shared use because of the additional commercial trains. Over the 50-year operations phase, there would be up to 18 one-way commercial trains per week (DIRS 180694-Ang-Olson and Gallivan 2007, all). To provide a conservative estimate, DOE assumed all trains would originate in Hazen. Assuming that trains would only travel on weekdays, an average of approximately 3.6 commercial trains per day would be expected. Even though the train length could vary based on the number of railcars, DOE used the maximum train length (with 60 railcars and four locomotives) in this analysis. Because there would be approximately 3.4 trains per day operating along the rail line (including cask trains, maintenance-of-way trains, and repository supply/construction trains), DOE considered a total of seven trains per day in the analysis.

Table 4-260 summarizes total daily delay at each grade crossing analyzed. The maximum average delay per vehicle would be 2.5 seconds, up from 0.02 second without the additional rail traffic. Therefore, the maximum average delay at grade crossings caused by the additional rail traffic under the Proposed Action would be about 2.5 seconds per vehicle, which would represent a very small impact. The level of service on any of the analyzed intersections would not be degraded due to delay at grade crossings from additional rail traffic.

Table 4-260. Delay at highway-rail grade crossings during the operations phase – Mina rail alignment Shared-Use Option.

Federal Railroad Administration Crossing ID Number	Road name	County/ Reservation	Number of vehicles delayed per day		Average delay per vehicle (seconds)		Total delay per day (vehicle-minutes)	
			Existing	With proposed rail line	Existing	With proposed rail line	Existing	With proposed rail line
740906Y	Bango Road	Churchill	0	0	0.03	0.55	0.01	0.24
740907F	City Street	Churchill	0	0	0.03	0.55	0.00	0.01
740912C	U.S. Highway 50	Lyon	3	24	0.03	0.57	1.00	21.00
740914R	Fir Avenue	Lyon	1	10	0.03	0.57	0.47	9.10
740915X	5th Street	Lyon	1	8	0.03	0.57	0.38	7.50
740916E	9th Street	Lyon	1	14	0.03	0.57	0.64	12.50
740918T	U.S. Highway 95A	Lyon	3	31	0.03	0.58	1.40	27.40
740919A	Fort Churchill PA	Lyon	0	2	0.03	0.56	0.11	2.20
740920U	Adrian Valley	Lyon	0	0	0.03	0.55	0.01	0.13
740922H	Church Hill	Lyon	0	1	0.03	0.56	0.06	1.20
740923P	Thompson Smelter	Lyon	0	1	0.03	0.56	0.06	1.10
740925D	U.S. Highway 95A	Lyon	3	31	0.03	0.58	1.40	27.00
740927S	Mason Valley Road	Lyon	0	0	0.02	2.50	0.01	0.70
740945P	Walker Lake North	Mineral	0	0	0.02	2.50	0.00	0.05
740946W	Nolan	Mineral	0	0	0.02	2.50	0.00	0.65
740947D	Near Nolan	Mineral	0	0	0.02	2.50	0.00	0.11
740948K	Walker Lake South	Mineral	0	0	0.02	2.50	0.00	0.54
740951T	Thorne	Mineral	1	4	0.36	2.20	0.86	5.30

4.3.9.5 Summary

Table 4-261 summarizes the potential socioeconomic impacts of constructing and operating the proposed railroad along the Mina rail alignment. Impacts under the Shared-Use Option would be the same as those under the Proposed Action without shared use; however, DOE recognizes the uncertainty in increased economic development.

Potential socioeconomic impacts from construction and operation of the proposed railroad along the Mina rail alignment include the following:

- Population increases in all of the counties in the region of influence during the construction phase. The greatest percentage increase in population would be in Esmeralda County (3.1 percent) and Mineral County (1.4 percent).
- Population increases in all of the counties in the region of influence during the operations phase. The greatest percentage increase in population would be in Esmeralda County (7 percent) and Mineral County (1.6 percent).
- Employment increases in all of the counties in the region of influence during the construction phase. The greatest percentage increase in employment would be in Esmeralda County (14 percent) and Mineral County (6.1 percent).
- Employment increases in all of the counties in the region of influence during the operations phase. The greatest percentage increase in employment would be in Esmeralda County (14 percent) and Mineral County (2.6 percent).
- Real disposable income increases in all of the counties in the region of influence during the construction phase. The greatest percentage increase in real disposable income would be in Esmeralda County (27 percent) and Mineral County (4.5 percent).
- Real disposable income increases in all of the counties in the region of influence during the operations phase. The greatest percentage increase in real disposable income would be in Esmeralda County (10 percent) and Mineral County (2.8 percent).
- Gross regional product increases in all of the counties in the region of influence during the construction phase. The greatest percentage increase in gross regional product would be in Esmeralda County (57 percent) and Mineral County (14 percent).
- Gross regional product increases in all of the counties in the region of influence during the operations phase. The greatest percentage increase in gross regional product would be in Esmeralda County (24 percent) and Mineral County (1.9 percent).
- State and local government spending increases in all of the counties in the region of influence during the construction phase. The greatest percentage increase in state and local government spending would be in Esmeralda County (4.6 percent) and Mineral County (1.8 percent).
- State and local government spending increases in all of the counties in the region of influence during the operations phase. The greatest percentage increase in state and local government spending would be in Esmeralda County (9.9 percent) and Mineral County (1.5 percent).
- Impacts to public services and transportation are discussed in Table 4-261.

Table 4-261. Summary of impacts to socioeconomic conditions – Mina rail alignment[a,b] (page 1 of 5).

County	Construction	Operations
Walker River Paiute Reservation	Population and housing: not analyzed Employment and income • Assuming one of the construction camps is placed on the Walker River Paiute Reservation: - Up to 20 additional jobs - Up to $1.4 million in gross regional product - Up to $386,000 in real disposable income Public services: not analyzed Transportation infrastructure: not analyzed	Population and housing: included in the Mineral County estimates because the forecasting model cannot discriminate impacts to the Reservation Employment and income: included in the Mineral County estimates because the forecasting model cannot discriminate impacts to the Reservation Public services: not analyzed Transportation infrastructure: not analyzed
Washoe County/ Carson City	Population and housing • Population: < 1 percent increase Employment and income • Employment: < 0.3 percent increase • Real disposable income: < 0.3 percent increase • Gross regional product: < 0.3 percent increase • State and local government spending: < 0.1 percent increase Public services: no noticeable impacts Transportation: no noticeable impacts	Population and housing • Population: < 0.1 percent increase Employment and income • Employment: < 0.1 percent increase • Real disposable income: < 0.1 percent increase • Gross regional product: < 0.1 percent increase • State and local government spending: < 0.1 percent increase Public services: no noticeable impacts Transportation: no noticeable impacts

Table 4-261. Summary of impacts to socioeconomic conditions – Mina rail alignment[a,b] (page 2 of 5).

County	Construction	Operations
Churchill	Population and housing: not analyzed Employment and income: not analyzed Public services: not analyzed Transportation: • Rail impacts on existing rail traffic: moderate	Population and housing: not analyzed Employment and income: not analyzed Public services: not analyzed Transportation: • Rail impacts on existing rail traffic: moderate
Lyon	Population and housing • Population: 0.01 percent increase Employment and income • Employment: 0.02 percent increase • Real disposable income: 0.03 percent increase • Gross regional product: 0.04 percent increase • State and local government spending: 0.01 percent increase Public services: no noticeable impacts Transportation: • Traffic impacts to local highways: no change in level of service • Delay impacts on road traffic at grade crossings: small • Rail impacts on existing rail traffic: moderate	Population and housing • Population: < 0.01 percent increase Employment and income • Employment: 0.01 percent increase • Real disposable income: 0.01 percent increase • Gross regional product: 0.01 percent increase • State and local government spending: 0.01 percent increase Public services • Small impacts to health-care services due to population increases in a medically underserved area • Small impacts to fire-protection services due to population increases • Addition of two students to schools due to population increases Transportation: • Traffic impacts to local highways: no change in level of service • Delay impacts on road traffic at grade crossings: small • Rail impacts on existing rail traffic: moderate

Table 4-261. Summary of impacts to socioeconomic conditions – Mina rail alignment[a,b] (page 3 of 5).

County	Construction	Operations
Mineral	Population and housing: • Population: 1.4 percent increase Employment and income: • Employment: 6.1 percent increase • Real disposable income: 4.5 percent increase • Gross regional product: 14 percent increase • State and local government spending: 1.8 percent increase • Small impacts to mining Public Services: no noticeable impacts Transportation: • Traffic impacts to local highways: no change in level of service • Delay impacts on road traffic at grade crossings: small • Rail impacts on existing rail traffic: moderate	Population and housing: • Population: 1.6 percent increase Employment and income • Employment: 2.6 percent increase • Real disposable income: 2.8 percent increase • Gross regional product: 1.9 percent increase • State and local government spending: 1.5 percent increase • Small impacts to mining Public services: • Small impacts to health-care services due to population increases in a medically underserved area • Small impacts to fire-protection services due to population increases • Addition of 13 students due to population increases Transportation • Traffic impacts to local highways: no change in level of service • Delay impacts on road traffic at grade crossings: small • Rail impacts on existing rail traffic: moderate
Nye	Population and housing • Population: 0.16 percent increase Employment and income • Employment: 0.6 percent increase • Real disposable income: 0.4 percent increase • Gross regional product: 1 percent increase • State and local government spending: 0.2 percent increase	Population and housing • Population: 0.3 percent increase • County-wide population increase of 98 could place strain on supply of 1,058 vacant housing units in Pahrump Employment and income • Employment: 0.1 percent increase • Real disposable income: 0.1 percent increase • Gross regional product: 0.2 percent increase • State and local government spending: 0.1 percent increase

Table 4-261. Summary of impacts to socioeconomic conditions – Mina rail alignment[a,b] (page 4 of 5).

County	Construction	Operations
Nye continued	Public services: • Small impacts to health-care services due to population increases in a medically underserved area	Public services: • Moderate impacts to health-care services due to population increases in a medically underserved area • Moderate impacts to fire-protection services in Pahrump due to population increases in an underserved area • Addition of 17 school-aged children to overcrowded schools
	Transportation • Traffic impacts to local highways: level of service on U.S. Highway 95 near access to the Yucca Mountain Site would degrade from B to C • Delay impacts on road traffic at grade crossings: small	Transportation • Traffic impacts to local highways: level of service on U.S. Highway 95 near access to the Yucca Mountain Site would degrade from B to C • Delay impacts on road traffic at grade crossings: small
Esmeralda	Population and housing • Population: 3.1 percent increase	Population and housing • Population: 7 percent increase
	Employment and income • Employment: 14 percent increase • Real disposable income: 27 percent increase • Gross regional product: 57 percent increase • State and local government spending: 4.6 percent increase • Small impacts to mining	Employment and income • Employment: 14 percent increase • Real disposable income: 10 percent increase • Gross regional product: 24 percent increase • State and local government spending: 9.9 percent increase • Small impacts to mining
	Public services: no noticeable impacts	Public services • Small impacts to health-care services due to population increases in a medically underserved area • Small impacts to fire-protection services due to population increases • Addition of 12 students to schools
	Transportation • Traffic impacts to local highways: no change in level of service • Delay impacts on road traffic at grade crossings: small	Transportation • Traffic impacts to local highways: no change in level of service • Delay impacts on road traffic at grade crossings: small

Table 4-261. Summary of impacts to socioeconomic conditions – Mina rail alignment[a,b] (page 5 of 5).

County	Construction	Operations
Clark	Population and housing • Population: 0.04 percent increase Employment and income • Employment: 0.1 percent increase • Real disposable income: 0.1 percent increase • Gross regional product: 0.1 percent increase • State and local government spending: 0.04 percent increase Public services: no noticeable impacts	Population and housing • Population: < 0.01 percent increase Employment and income • Employment: < 0.1 percent increase • Real disposable income: < 0.1 percent increase • Gross regional product: < 0.1 percent increase • State and local government: < 0.1 percent increase Public services: no noticeable impacts
Throughout region of influence	Employment and income • Up to 326 animal unit months lost, valued at $17,400	Employment and income • Continued lack of access to up to 326 animal unit months, valued at $17,400

a. Impacts under the Shared-Use Option would be the same as those under the Proposed Action without shared use.
b. < = less than.

4.3.10 OCCUPATIONAL AND PUBLIC HEALTH AND SAFETY

This section describes potential nonradiological and radiological health and safety impacts to workers and the public from construction and operation of the proposed railroad along the Mina rail alignment, including ***incident-free transportation*** and transportation accident scenarios and acts of sabotage or terrorism. Section 4.3.10.1 describes the impact assessment methodology, Section 4.3.10.2 describes potential impacts associated with the Proposed Action, Section 4.3.10.3 describes potential impacts associated with the Shared-Use Option, and Section 4.3.10.4 summarizes potential impacts.

Incident-free transportation: Routine transportation in which cargo travels from origin to destination without being involved in an accident.

Accident: An unplanned sequence of events that leads to undesirable adverse consequences.

Section 3.3.10.1 describes the region of influence for nonradiological and radiological impacts.

Appendix K, Radiological Health and Safety, describes the methods and data DOE used to assess radiological impacts for this Rail Alignment EIS.

4.3.10.1 Impact Assessment Methodology

4.3.10.1.1 Nonradiological Occupational Impact Assessment Methodology

Nonradiological impacts to occupational health and safety would include impacts to workers from exposure to physical hazards and nonradioactive ***hazardous chemicals*** during construction and operation of the proposed rail line and associated facilities. DOE estimated such impacts using occupational incident rates for total ***recordable cases***, lost workday cases, and fatalities. Total recordable cases are defined as the total number of work-related injuries or illnesses that resulted in fatalities, days away from work, job transfer or restriction, or other cases as identified in *Occupational Safety and Health Administration (OSHA) Form 300, Log of Work-Related Injuries and Illnesses* (DIRS 175488-OSHA [n.d.], all). Recordable cases of work-related injury or illness include fatality; loss of consciousness; injury or illness resulting in one or more days away from work; administration of medical treatment other than first aid; and other workplace injury or illness diagnosed by a physician or other health-care professional. OSHA defines lost workday cases as injuries or illnesses resulting in loss of 1 or more work days, not including the day the injury or illness occurred.

This section also discusses potential exposure of workers to physical (nonradiological) hazards related to transportation accidents and cask-handling accidents. Impacts to occupational and public health and safety from exposures to hazards associated with other resource areas are also discussed separately in this section. These include air quality hazards (potential occupational exposures to criteria and ***toxic air pollutants***, including diesel particulate matter and carbon monoxide, and to nonradiological ***hazardous air pollutants***) and noise hazards (potential occupational exposure to noise). Public exposure to air pollutants and noise are discussed in more detail in Section 4.3.4, Air Quality and Climate, and Section 4.3.8, Noise and Vibration. Hazards associated with other specific resource areas discussed in this section include biological hazards and dust and soils hazards.

DOE estimated nonradiological occupational impacts by multiplying the number of labor hours worked by involved and noninvolved construction workers and operations workers by workplace health and safety incident rates in units of number of occurrences per hour worked for involved workers and noninvolved workers. The workplace incident rates DOE used for this analysis are U.S. Department of Labor, Bureau of Labor Statistics, data for 2005 (DIRS 179129-BLS 2007, all; DIRS 179131-BLS 2006, all).

The nonradiological occupational health and safety impact analysis is based on health and safety incident statistics defined as follows (DIRS 155970-DOE 2002, p. F-17):

- Fatalities, regardless of the time between the injury and death, or the length of the illness
- Lost workday cases, other than fatalities, that result in lost workdays
- Nonfatal cases without lost workdays that result in transfer to another job, termination of employment, medical treatment (other than first aid), loss of consciousness, or restriction of work or motion

DOE estimated the frequency of occurrence of such incidents based on the specific activity (construction or operations) and the number of activity-specific worker labor hours.

Table 4-262 cites U.S. Department of Labor, Bureau of Labor Statistics, incident rate data DOE used to estimate total recordable cases, lost workday cases, and fatalities for involved and noninvolved workers during construction and operation of the proposed railroad. Involved workers are defined for the purposes of this analysis as personnel who would be directly involved in construction or operations activities. Noninvolved workers are defined for the purposes of this analysis as personnel who would be involved in management, administration, and security. The Bureau of Labor Statistics compiled the health and safety statistics by employment sector, including the Heavy and Civil Engineering Construction Sector; Management of Companies and Enterprises Sector; Transportation and Warehousing: Rail Transportation Sector; Support Activities for Transportation Sector; Non-Metallic Mineral Manufacturing (Batch Plant Construction and Operation); and Mining and Support Activities for Mining (Quarry Construction and Operation involved and noninvolved workers). Fatality incident statistics are compiled by employment sector, including Construction; Professional and Business Services; Transportation and Warehousing; Mining (Quarry Construction and Operation); and Manufacturing (Batch Plant Construction and Operation).

The Bureau of Labor Statistics incident rate data cited in Table 4-262 and used in the occupational health and safety analysis in this Rail Alignment EIS represent national average data for public and private sector entities conducting specific types of activities (for example, heavy and civil construction) and reporting incidents resulting from those activities. These national average incident rates reflect the wide range of occupational health and safety performance of the reporting public and private sector entities and are therefore not necessarily representative of the occupational health and safety performance DOE would achieve in constructing and operating the rail line and facilities under the Proposed Action. DOE presented information in Table F-5 of the Yucca Mountain FEIS (DIRS 155970-DOE 2002, Yucca Mountain Project Worker Industrial Safety Loss Experience, Table F-5, p. F-21) that shows better worker safety experience than that presented in Table F-4 (DIRS 155970-DOE Health and Safety Statistics for Estimating Industrial Safety Impacts Common to the Workplace, Table F-4, p. F-20) as the basis for projections of impacts in the Yucca Mountain FEIS. For example, during the 30-month period during which DOE constructed the 5-mile-long Exploratory Studies Facility tunnel at the Yucca Mountain Repository Site, involving 5.7 million total labor hours worked (equivalent to 825 construction full-time-equivalent workers and 2,015 non-construction full-time-equivalent workers), there were no fatalities. DOE anticipates that the actual incident rates for construction and operation of the proposed rail line and facilities will similarly be below the values that would be expected from statistical data.

The U.S. Department of Labor, Mine Safety and Health Administration, reports occupational nonfatal incident and fatality incident data for stone, quarry, and mill operations (surface mining). In 2005, a total of nine fatalities were reported in sand and gravel surface mining for 37,258 full-time-equivalent workers and a total of five fatalities were reported in stone surface mining for 34,744 full-time-equivalent workers. This corresponds to a total fatal incident rate of 20.3 fatalities per 100,000 full-time-equivalent workers.

Table 4-262. U.S. Department of Labor, Bureau of Labor Statistics, incident rate data for estimating industrial safety impacts common to the workplace.[a]

	Total recordable cases incidents per 100 FTEs[b]		Lost workday cases per 100 FTEs[b]		Fatalities per 100,000 FTEs[b]	
Activity	Involved	Noninvolved	Involved	Noninvolved	Involved	Noninvolved
Construction						
Rail line	5.6	2.4	3.1	1.3	11	3.5
Facilities	5.6	2.4	3.1	1.3	11	3.5
Quarry/ballast-site construction and operations	4.1	3.9	2.7	2.2	25.6	3.5
Batch plant construction and operations	9.1		3.8		2.4	
Operations						
Rail line	2.5	2.4	1.9	1.3	17.6	3.5
Facilities	5.5	2.4	3.4	1.3	17.6	3.5

a. Sources: DIRS 179129-BLS 2007, Table 1. Incidence rates (1) of nonfatal occupational injuries and illnesses by selected industries and case types, 2005; DIRS 179131-BLS 2006, Number of fatal work injuries, 1992-2005, Number and rate of fatal occupational injuries by major occupation groups, 2005.
b. One full-time-equivalent worker is defined as 2,000 labor hours worked.

This is lower than the fatality incident rate of 25.6 fatalities per 100,000 full-time-equivalent workers reported by the Bureau of Labor Statistics for all mining activities. DOE used the Bureau of Labor Statistics fatality incident rate to estimate the fatalities associated with quarry and ballast-site construction, operations, and reclamation for the purposes of maintaining consistency with the Bureau of Labor Statistics incident rate data for other rail line and facilities construction and operations activities (DIRS 178746-MSHA 2006, all; DIRS 178747-MSHA 2006, all; DIRS 178748-MSHA 2006, all).

The statistics for recordable cases and lost workday cases for rail line and associated facility construction for involved workers are applicable to the Heavy and Civil Engineering Construction Sector, and statistics for noninvolved workers are applicable to the Management of Companies and Enterprises Sector. The statistics for total recordable cases and lost workday cases for rail line operations for involved workers are applicable to the Transportation and Warehousing: Rail Transportation Sector. The statistics for rail line facility operations for involved workers are applicable to the Support Activities for Transportation Sector. The statistics for noninvolved workers are applicable to the Management of Companies and Enterprises Sector. Statistics for fatalities are applicable to the Construction Sector and Transportation and Warehousing Sector for involved workers and to the Professional and Business Services Sector for noninvolved workers.

All Bureau of Labor Statistics data used in this Rail Alignment EIS are for 2005. These statistics are summarized in Table 4-262 and are applied to estimate the total recordable cases, lost workday cases, and fatalities for the construction and operation of the railroad and associated facilities.

DOE performed the following steps as part of the nonradiological occupational health and safety impact calculations:

1. DOE obtained full-time-equivalent data for each phase of construction and operation of the proposed rail line and associated facilities from the following documents: The numbers of full-time-equivalent ***worker years*** for each rail line construction and operations activity were obtained from Appendix D of the *Air Quality Emissions Factors and Socioeconomic Input-Mina Rail Corridor,*

Rev 00, April 20, 2007 (DIRS 180874-Nevada Rail Partners 2007, all), and the Personnel Breakdown Per Camp shown as Table 4-2 and the schedule shown as Figure 7-A, MRC Construction Schedule, from the Construction Plan, Rev 00, April 30, 2007 (DIRS 180875-Nevada Rail Partners 2007, all). The numbers of full-time-equivalent worker years for each railroad facility construction and operations activity were obtained from Appendix D of the *Air Quality Emissions Factors and Socioeconomic Input - Mina Rail Corridor*, Rev 00, April 20, 2007 (DIRS 180874-Nevada Rail Partners 2007, all). A "full-time-equivalent" is defined as 2,000 labor hours worked per year. It is not necessarily the case that all 2,000 hours of an annual full-time-equivalent would be worked by the same individual. For example, train engineers operate on a crew schedule based on the number of train trips. Therefore, the 2,000 hours per year worked for one full-time-equivalent for the labor category "train engineer" may comprise several individual train engineers.

2. DOE categorized full-time-equivalent workers for construction and operations as either "involved" workers or "noninvolved" workers depending on the specific activity of the worker identified. For purposes of this analysis, involved workers are defined as workers directly involved in construction or operations activities. Noninvolved workers are defined as workers performing management, administration, or security functions.

   The incident statistics used in the calculation are reported by the Bureau of Labor Statistics for calendar year 2005 (DIRS 179129-BLS 2007, all; DIRS 179131-BLS 2006, all).

   Incident rate statistics for total recordable cases, lost workday cases, and fatalities differ for involved and noninvolved workers.

   - All rail line workers are categorized as involved workers.
   - Facilities operations workers in job categories including "management," "administration," "clerical," and "security" are categorized as "noninvolved" workers.
   - Facilities operations workers in other job categories are categorized as "involved" workers.

   The Bureau of Labor Statistics compiles health and safety statistics by employment sector, including the Heavy and Civil Engineering Construction Sector; Management of Companies and Enterprises Sector; Transportation and Warehousing: Rail Transportation Sector; and Support Activities for Transportation Sector. The statistics for total recordable cases and lost workday cases for rail line and associated facilities construction for involved workers are applicable to the Heavy and Civil Engineering Construction Sector, and statistics for noninvolved workers are applicable to the Management of Companies and Enterprises Sector. The statistics for total recordable cases and lost workday cases for rail line operations for involved workers are applicable to the Transportation and Warehousing: Rail Transportation Sector, statistics for railroad facility operations for involved workers are applicable to the Support Activities for Transportation Sector, and statistics for noninvolved workers are applicable to the Management of Companies and Enterprises Sector. Statistics for fatalities are applicable to the Construction Sector and Transportation and Warehousing Sector for involved workers and to the Professional and Business Services Sector for noninvolved workers. All Bureau of Labor Statistics data used in this Rail Alignment EIS are for 2005.

3. Full-time-equivalent workers for construction of the rail line include the following activities.

   - Rail line construction

4. Full-time-equivalent workers for construction of railroad facilities include the following facilities.

   - Concrete batch plant construction

- Concrete batch plant operation
- Water-well drilling
- Construction camp construction
- Construction camp operation
- Quarry construction
- Quarry operation
- Staging Yard
- Maintenance-of-Way Facility
- Nevada Railroad Control Center and National Transportation Operations Center
- Cask Maintenance Facility
- Rail Equipment Maintenance Yard
- Facility access roads

5. Full-time-equivalent workers for operation of the railroad facilities include the following facilities.

   - Staging Yard
   - Maintenance-of-Way Facility
   - Nevada Railroad Control Center and National Transportation Operations Center
   - Cask Maintenance Facility
   - Rail Equipment Maintenance Yard

6. DOE identified construction full-time-equivalent workers for each year of the construction schedule for the rail line and each facility. The full-time-equivalent workers for each year are summed to calculate the total involved full-time-equivalent workers and total noninvolved full-time-equivalent workers for the rail line and each facility.

7. Full-time-equivalent worker data for involved workers and noninvolved workers are multiplied by incident rates published by the U.S. Department of Labor, Bureau of Labor Statistics, for various employment sector categories applied to involved and noninvolved construction workers and operations workers to estimate the number of incidents for construction and operation of the rail line and associated facilities for the Proposed Action and Shared-Use Option. Employment sector categories for the Bureau of Labor Statistics incident rate data applied to involved and noninvolved workers are described above in Step 2.

Sections 4.3.10.2 and 4.3.10.3 discuss nonradiological impacts to the public from construction and operation of the proposed rail line and associated facilities under the Proposed Action and the Shared-Use Option. These nonradiological impacts include air quality impacts, noise impacts, and transportation (traffic accident and fatality) impacts. The methodologies for estimating these impacts from specific resource areas are described in the respective sections of this Rail Alignment EIS. Potential impacts from occupational exposure to workplace dust and noise during construction and operation of the Proposed Action and the Shared-Use Option are also discussed in Sections 4.3.10.2 and 4.3.10.3.

4.3.10.1.2 Radiological Impact Assessment Methodology

Radiation is the emission and propagation of energy through space or through a material in the form of waves or bundles of energy called photons, or in the form of high-energy subatomic particles. Radiation generally results from atomic or subatomic processes that occur naturally. The most common kind of radiation is electromagnetic radiation, which is transmitted as photons. Electromagnetic radiation is emitted over a range of wavelengths and energies. Humans are most commonly aware of visible light, which is part of the spectrum of electromagnetic radiation. Radiation of longer wavelengths and lower energy includes infrared radiation, which heats material when the material and the radiation interact, and radio waves. Electromagnetic radiation of shorter wavelengths and higher energy (more penetrating) includes ***ultraviolet radiation*** (which causes sunburn), X-rays, and gamma radiation.

Ionizing radiation is radiation that has sufficient energy to displace ***electrons*** from atoms or molecules to create ions. It can be electromagnetic (for example, X-rays or gamma radiation) or subatomic particles (for example, alpha, beta, or ***neutron*** radiation). The ions have the ability to interact with other atoms or molecules; in biological systems, this interaction can cause damage in the tissue or organism.

Radioactivity is the property or characteristic of an unstable atom to undergo spontaneous transformation (to disintegrate or decay) with the emission of energy as radiation. Usually the emitted radiation is ionizing radiation. The result of the process, called radioactive decay, is the transformation of an unstable atom (a ***radionuclide***) into a different atom, accompanied by the release of energy (as radiation) as the atom reaches a more stable, lower energy configuration.

Radioactive decay produces three main types of ionizing radiation—***alpha particles***, ***beta particles***, and ***gamma*** or ***X-rays***. Neutrons emitted during nuclear fission are another type of ionic radiation. These types of ionizing radiation can have different characteristics and levels of energy and, thus, varying abilities to penetrate and interact with atoms in the human body. Because each type has different characteristics, each requires different amounts of material to stop (shield) the radiation. Alpha particles are the least penetrating and can be stopped by a thin layer of material such as a single sheet of paper. However, if radioactive atoms (radionuclides) emit alpha particles in the body when they decay, there is a concentrated deposition of energy near the point where the radioactive decay occurs. Shielding beta particles requires thicker layers of material such as several reams of paper or several inches of wood or water. Shielding from gamma rays, which are highly penetrating, requires very thick material such as several inches to several feet of heavy material (for example, concrete or lead). Deposition of the energy by gamma rays is dispersed across the body in contrast to the local energy deposition by an alpha particle. Some gamma radiation will pass through the body without interacting with it. Shielding from neutrons, which are also highly penetrating, requires materials that contain light elements such as hydrogen.

In a ***nuclear reactor***, heavy atoms such as uranium and plutonium can undergo another process, called ***fission***, after the absorption of a subatomic particle (usually a neutron). In fission, a heavy atom splits into two lighter atoms and releases energy in the form of radiation and the kinetic energy of the two new lighter atoms. The new lighter atoms are called ***fission products***. The fission products are usually unstable and undergo radioactive decay to reach a more stable state.

Some of the heavy atoms might not fission after absorbing a subatomic particle. Rather, a new ***nucleus*** is formed that tends to be unstable (like fission products) and undergo radioactive decay.

The radioactive decay of fission products and unstable heavy atoms is the source of the radiation from spent nuclear fuel and high-level radioactive waste that makes these materials hazardous in terms of potential human-health impacts.

Radiation that originates outside of an individual's body is called external or direct radiation. Such radiation can come from an X-ray machine or from radioactive materials that directly emit radiation, such as radioactive waste or radionuclides in soil. ***Exposure*** to direct radiation can be mitigated by placing shielding, such as lead, between the source of the radiation and the exposed individual. Internal radiation originates inside a person's body following intake of radioactive material or radionuclides through ingestion or inhalation. Once in the body, the fate of a radioactive material is determined by its chemical behavior and how it is metabolized. If the material is soluble, it might be dissolved in bodily fluids and transported to and deposited in various body organs; if it is insoluble, it might move rapidly through the gastrointestinal tract or be deposited in the lungs.

Exposure to ionizing radiation is expressed in terms of absorbed dose, which is the amount of energy imparted to matter per unit mass. Often simply called ***dose***, it is a fundamental concept in measuring and quantifying the effects of exposure to radiation. The unit of absorbed dose is the ***rad***. The different types of radiation mentioned above have different effects in damaging the cells of biological systems. ***Dose equivalent*** is a concept that considers the absorbed dose and the relative effectiveness of the type of ionizing radiation in damaging biological systems, using a radiation-specific quality factor. The unit of dose equivalent is the ***rem***. In quantifying the effects of radiation on humans, other types of concepts are also used. The concept of ***effective dose equivalent*** is used to quantify effects of radionuclides in the body. It involves estimating the susceptibility of the different tissue in the body to radiation to produce a tissue-specific weighting factor. The weighting factor is based on the susceptibility of that tissue to ***cancer***. The sum of the products of each affected tissue's estimated dose equivalent multiplied by its specific weighting factor is the effective dose equivalent. The potential effects from a one-time ingestion or inhalation of radioactive material are calculated over a period of 50 years to account for radionuclides that have long ***half-lives*** and long residence time in the body. The result is called the committed effective dose equivalent. The unit of effective dose equivalent is the rem. Total effective dose equivalent is the sum of the committed effective dose equivalent from radionuclides in the body plus the dose equivalent from radiation sources external to the body (also in rem). All estimates of radiation dose in this Rail Alignment EIS, unless specifically noted otherwise, are total effective dose equivalents, which are quantified in terms of rem or millirem (mrem).

More detailed information on the concepts of radiation dose and dose equivalent are in publications of the National Council on Radiation Protection and Measurements (DIRS 101857-NCRP 1993, all) and the International Commission on Radiological Protection (DIRS 101836-ICRP 1991, all).

The factors used to convert estimates of radionuclide intake (by inhalation or ingestion) or external exposure to radionuclides (by ***groundshine*** or ***cloudshine*** [immersion]) to radiation dose are called dose conversion factors or dose coefficients. The International Commission on Radiological Protection and federal agencies such as the U.S. Environmental Protection Agency (EPA) publish these factors (DIRS 172935-ICRP 2001, all; DIRS 175544-EPA 2002, all). They are based on original recommendations of the International Commission on Radiological Protection (DIRS 101836-ICRP 1991, all).

The radiation dose to an individual or to a group of people can be expressed as the total dose received or as a ***dose rate***, which is dose per unit time (usually an hour or a year). ***Collective dose*** is the total dose to an exposed population. ***Person-rem*** is the unit of collective dose. Collective dose is calculated by summing the individual dose to each member of a population. For example, if 100 workers each received 0.1 rem, the collective dose would be 10 person-rem (100 persons × 0.1 rem).

Exposures to radiation or radionuclides are often characterized as being acute or chronic. Acute exposures occur over a short period, typically 24 hours or less. Chronic exposures occur over longer periods (months to years); they are usually assumed to be continuous over a period, even though the dose rate might vary. For a given dose of radiation, chronic radiation exposure is usually less harmful than acute exposure because the dose rate (dose per unit time, such as rem per hour) is lower, providing more opportunity for the body to repair damaged cells.

The radiation dose estimates discussed in this Rail Alignment EIS are associated with exposure to radiation at low dose rates. Such exposures can be chronic (continuous or nearly continuous), such as those to workers who are security escorts. In some instances, exposures to low levels of radiation would be intermittent (for example, infrequent exposures to an individual from radiation emitted from ***shipping casks*** as they are transported). Cancer induction is the principal potential risk to human health from exposure to low levels of radiation. However, this cancer induction is a statistical process because exposure to radiation conveys only a chance of developing cancer, not a certainty. Furthermore, other causes, such as exposure to chemical agents, can induce cancer in individuals.

Cancer is the principal potential risk to human health from exposure to low or chronic levels of radiation. Radiological health impacts are expressed as the incremental changes in the number of expected fatal cancers (referred to as ***latent cancer fatalities***) for populations and as the incremental increases in lifetime probabilities of contracting a fatal cancer for an individual. The estimates are based on the dose received and on dose-to-health-effect conversion factors recommended by the Interagency Steering Committee on Radiation Standards (DIRS 174559-Lawrence 2002, all). The Interagency Steering Committee on Radiation Standards is comprised of eight federal agencies (the Environmental Protection Agency, the Nuclear Regulatory Commission, DOE, the Department of Defense, the Department of Homeland Security, the Department of Transportation, the Occupational Safety and Health Administration, and the Department of Health and Human Services), three federal observer agencies (the Office of Science and Technology Policy, the Office of Management and Budget, and the Defense Nuclear Facilities Safety Board), and two state observer agencies (Illinois and Pennsylvania). The Committee estimated that, for the general population and workers, a collective dose of 1 person-rem would yield 6×10^{-4} excess latent cancer fatalities.

Sometimes, calculations of the number of latent cancer fatalities associated with radiation dose do not yield whole numbers, and, especially in environmental applications, can yield numbers less than 1.0. For example, if each individual in a population of 100,000 received a total radiation dose of 0.001 rem, the collective radiation dose would be 100 person-rem and the corresponding estimated number of latent cancer fatalities would be 0.06 (100,000 persons × 0.001 rem × 0.0006 latent cancer fatalities per person-rem). How should one interpret a nonintegral number of latent cancer fatalities, such as 0.06? The answer is to interpret the result as a statistical estimate. That is, 0.06 is the average number of latent cancer fatalities that would result if the same exposure situation were applied to many different groups of 100,000 people. For most groups, no one would incur a latent cancer fatality from the 0.001 rem radiation dose each member would have received. In a small fraction of the groups (about 6 percent), one latent cancer fatality would result; in exceptionally few groups, two or more latent cancer fatalities would occur. The average number of latent cancer fatalities over all of the groups would be 0.06. The most likely outcome for any single group is 0 latent cancer fatalities.

DOE estimated radiological impacts for incident-free transportation, transportation accident risks and the consequences of severe transportation accidents, and transportation sabotage events. Radiation doses were estimated for two groups, workers and members of the public. For each group, radiation doses were estimated for the collective population and ***maximally exposed individuals***. For members of the public, the collective population was the population within 800 meters (0.5 mile) of the rail line or Staging Yard and was determined using U.S. Census data. The distances of the maximally exposed individuals from the rail line or Staging Yard were determined using geographic information system (GIS) data and imagery. The 800-meter distance is based on the distance used to estimate radiation doses in *Environmental Survey of Transportation of Radioactive Materials to and from Nuclear Power Plants* (DIRS 185281-NRC 1972, p. 110).

For transportation accidents, radiation doses were estimated out to 80 kilometers (50 miles) from the accident. This distance is based on the distance used in to estimate radiation doses from accidents in *Environmental Survey of Transportation of Radioactive Materials to and from Nuclear Power Plants* (DIRS 185281-NRC 1972, p. 94). The analysis of potential radiological occupational and public health and safety impacts in this Rail Alignment EIS includes all of those potentially exposed individuals discussed in Section 3.3.10 of this Rail Alignment EIS. No spent nuclear fuel or high-level waste would be transported during the construction period. Therefore, there would be no construction-related radiation dose to workers or the public related to radioactive materials transportation during respository construction activities.

The U.S. Department of Energy (DOE) Department of Environment Safety and Health guidance in *Recommendations for the Preparation of Environmental Assessments and Environmental Impact Statements*, Second Edition, December 2004 (DIRS 178579-DOE 2004, all), requires that radiological impacts be estimated, no matter how small the population. Therefore, the radiological impact analyses in this Rail Alignment EIS are applied to various populations of potentially exposed individuals.

4.3.10.1.3 Nonradiological Transportation Impact Assessment Methodology

DOE based the transportation impact analyses on guidelines from the American Institute of Chemical Engineers with respect to chemical transportation risk analyses (DIRS 182284-CCPS 1995, all). The methodology presented in this section uses both qualitative and quantitative components. The number of fatalities and accidents resulting from vehicular and train travel were based on fatality and accident rates provided by Federal Railroad Administration and Nevada Department of Transportation statistics. The rates were used in combination with the specifics of an operation (for example, total distance traveled, route length, and number of trips) to estimate the likelihood of accidents and fatalities. The estimated number of potential vehicular traffic fatalities was based on assuming a total distance traveled from workers commuting during both the construction and operations phases. The estimates for potential rail traffic fatalities and accidents were also based on assuming total distances traveled from material/equipment transport during construction and shipment during operations. Traffic accidents under the Shared-Use Option were qualitatively analyzed based on a proportional comparison to the Proposed Action. Rail line fatalities associated with the Shared-Use Option were evaluated by revising the analyses for the additional rail traffic levels.

4.3.10.2 Proposed Action

4.3.10.2.1 Nonradiological Occupational Impacts

Nonradiological health and safety addresses potential exposure of construction and operations workers to physical hazards, and nonradioactive chemical hazards generated from construction and operations. This section also summarizes impacts associated with nonradiological occupational health and safety from specific resource areas, including biological hazards, dust and soils hazards, air quality hazards, and noise hazards.

4.3.10.2.1.1 Workers. Tables 4-263 and 4-264 summarize nonradiological impacts to workers from industrial hazards associated with construction and operation of the proposed rail line and associated facilities under the Proposed Action. Table 4-263 summarizes impacts for construction and operation of the rail line. Table 4-264 summarizes impacts for construction and operation of facilities. In general, rail line construction would create hazards that are common to heavy construction and earthmoving operations. Accidents that commonly occur at construction workplaces are:

- Trip and fall
- Object falls on worker
- Electrocution
- Asphyxiation (confined space or other)
- Penetrating wounds
- Dermal exposure skin injury
- Jobsite vehicle accident injury
- Hearing injury
- Object in eye
- Welding or laser eye injury
- Injury from trench or slope collapse
- Injury from explosion

Similar types of workplace accidents can occur during operation and maintenance of the proposed rail line and facilities. Workplace incidents also include incidents such as heat stress and workplace exposure to hazardous chemicals. These types of workplace accidents and incidents are included in the Bureau of Labor Statistics incident rate for total recordable cases, lost workday cases, and fatalities summarized in Table 4-262.

DOE would adopt a rigorous safety program that would enable workers to avoid most common accidents as required by DOE Order O 440.1A, *Worker Protection Management for DOE Federal and Contractor Employees*, as codified in 10 CFR Part 851. Chapter 7 of this Rail Alignment EIS describes mitigation measures and safety management practices to address workplace hazards. In accordance with 10 CFR Part 851 DOE would also be required to comply with applicable regulations under 29 CFR Part 1910, *Occupational Health and Safety Standards*, 29 CFR Part 1926, *Safety and Health Regulations for Construction*, and 29 CFR Part 1960, *Basic Program Elements for Federal Employee Occupational Safety and Health Programs and Related Matters* (Section 11.4, Table 11-4, pp. 1 to 3). Code of Federal Regulations 29 Part 1926 applies to DOE contractors; 29 CFR 1960 (Basic Elements for Federal Employees OSHA) applies to DOE employees; and 10 CFR 851.23 also requires DOE to apply American Council of Government Industrial Hygienist Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices when the Threshold Limit Values are lower (more protective) than permissible exposure limits in 29 CFR 1910.

Table 4-263 includes nonradiological impacts from proposed railroad construction and operations, but does not include facilities construction and operations. Construction impacts are estimated for activities occurring during the minimum 4.5-year construction phase, including construction of the rail line

Rail line operations impacts include impacts to train crews and escort and security personnel. The numbers of full-time equivalent workers for each rail line construction and operations activity, summarized in Table 4-263, were obtained from Appendix D of the *Air Quality Emissions Factors and Socioeconomic Input-Mina Rail Corridor*, Rev 00, April 20, 2007 (DIRS 180874-Nevada Rail Partners 2007, Appendix D) and the schedule shown as Figure 7-A, MRC Construction Schedule, from the Construction Plan, Rev 00, April 30, 2007 (DIRS 180875-Nevada Rail Partners 2007, Figure 7-A).

Rail line construction support facilities include:

- Construction of the construction camps
- Operation of the construction camps
- Construction of ballast quarries
- Operation of ballast quarries
- Construction of water wells
- Operation of water wells
- Construction of concrete batch plants
- Operation of concrete batch plants

Table 4-263. Estimated impacts to workers from nonradiological industrial hazards during proposed railroad construction and railroad operations under the Proposed Action.[a,b]

Group and industrial hazard category	Construction			Operations		
	FTEs[c]	Labor hours worked	Incidents	FTEs[c]	Labor hours worked	Incidents
Involved workers	5,233	10.5 million		1,471	2.9 million	
Total recordable cases[d]			292			37
Lost workday cases			162			28
Fatalities			0.60			0.26
Noninvolved workers	1,290	2.6 million		0	0	
Total recordable cases[d]			32			0
Lost workday cases			18			0
Fatalities			0.05			0
Totals[e]	6,523	13.0 million		1,471	2.9 million	
Total recordable cases[d]			324			37
Lost workday cases			179			28
Fatalities			0.65			0.26

a. Calculations are based on U.S. Department of Labor, Bureau of Labor Statistics, incident rates in Table 4-262 and full-time-equivalent worker year data from Appendix D of the *Air Quality Emissions Factors and Socioeconomic Input-Mina Rail Corridor*, Rev 0, April 20, 2007 (DIRS 180874-Nevada Rail Partners 2007) and Table 4-2 and Figure 7-A, MRC Construction Schedule, from the Construction Plan, Rev 0, April 30, 2007 (DIRS 180875-Nevada Rail Partners 2007). All rail line construction workers are considered to be involved workers with the exception of construction camp operating workers.
b. Totals include rail line construction, quarry construction and operations, concrete batch plant construction and operations, construction camp construction and operations, construction train operations, and water-well construction and operations. Totals do not include construction or operation of rail line facilities.
c. FTE = full-time-equivalent worker; one FTE is defined as 2,000 labor hours worked. FTE and labor hours worked values are calculated over the minimum 4.5-year construction phase and 50-year operations phase of the Proposed Action.
d. Total recordable cases include injury and illness.
e. Totals might differ from sums of values due to rounding.

Facility construction and operations impacts include impacts to facility construction workers and facility operations workers during the minimum 4.5-year construction phase and 50-year operations phase for the facilities. Table 4-264 summarizes the nonradiological impacts of constructing and operating rail line construction support facilities and rail line operations support facilities under the Proposed Action, including the Rail Equipment Maintenance Yard, the Staging Yard, the Nevada Railroad Control Center and National Transportation Operations Center, the Maintenance-of-Way Facility, and the Cask Maintenance Facility. The numbers of full-time-equivalent worker years for each rail line facility construction and operations activity were obtained from Appendix D of the *Air Quality Emissions Factors and Socioeconomic Input-Mina Rail Corridor*, Rev 00, April 20, 2007 (DIRS 180874-Nevada Rail Partners 2007, Appendix D).

Construction and operations workers under the Proposed Action could potentially be exposed to nonradiological hazardous chemicals related to operation and maintenance of construction equipment and facility equipment, including maintenance-of-way and management of fleet. Such activities are anticipated to include welding, metal degreasing, painting, and related activities. Occupational health and safety impacts could also result from worker exposure to fuels, lubricants, and other materials used in construction, operation, and maintenance of the proposed rail line and facilities.

Rail Line Construction Construction of the proposed rail line would involve 13.0 million labor hours corresponding to a total of 6,527 full-time-equivalent construction workers.

Table 4-264. Estimated impacts to workers from nonradiological industrial hazards during facility construction and facility operations under the Proposed Action.[a,b]

Group and industrial hazard category	Construction			Operations		
	FTEs[c]	Labor hours worked	Incidents	FTEs[c]	Labor hours worked	Incidents
Involved workers	1,340	2.7 million		5,850	11.7 million	
Total recordable cases[d]			75			322
Lost workday cases			41			199
Fatalities			0.01			1.03
Noninvolved workers	0	0		1,650	3.3 million	
Total recordable cases[d]			0			40
Lost workday cases			0			21
Fatalities			0			0.06
Totals[e]	1,340	2.7 million		7,500	15.0 million	
Total recordable cases[d]			75			361
Lost workday cases			41			220
Fatalities			0.01			1.09

a. Source: Calculation based on U.S. Department of Labor, Bureau of Labor Statistics, incident rates in Table 4-262 and full-time-equivalent worker year data in Appendix D of the *Air Quality Emissions Factors and Socioeconomic Input-Mina Rail Corridor*, Rev 0, April 20, 2007 (DIRS 180874-Nevada Rail Partners 2007, Appendix D).
b. Totals include construction and operation of the Staging Yard, Maintenance-of-Way Facility, Cask Maintenance Facility, Nevada Railroad Control Center and National Transportation Operations Center, and Rail Equipment Maintenance Yard. Totals do not include construction or operation of the rail line.
c. FTE = full-time-equivalent worker; one FTE is defined as 2,000 labor hours worked. FTE and labor hours worked values are calculated over the minimum 4.5-year construction phase and 50-year operations phase of the Proposed Action.
d Total recordable cases include injury and illness.
e. Totals might differ from sums of values due to rounding.

For the purposes of this Rail Alignment EIS, nonradiological impacts associated with construction of the proposed rail line are reported separately from the nonradiological impacts associated with construction of the facilities. Table 4-263 summarizes nonradiological occupational health and safety impacts associated with construction of the proposed rail line, not including the Rail Equipment Maintenance Yard, Staging Yard, or other facilities.

Facilities Construction Construction of railroad construction support facilities and railroad operations support facilities, including the Staging Yard, Nevada Railroad Control Center and National Transportation Operations Center, Maintenance-of-Way Facility, Cask Maintenance Facility, and Rail Equipment Maintenance Yard, would involve approximately 1,335 full-time-equivalent construction workers corresponding to approximately 2.7 million labor hours. Table 4-264 summarizes the nonradiological impacts of construction of the rail line facilities under the Proposed Action.

Railroad Operations Operation of the proposed rail line would take place over a period of 50 years and involve approximately 50 rail line operations personnel, corresponding to approximately 2.9 million labor hours.

For the purposes of this Rail Alignment EIS, nonradiological impacts associated with operation of the proposed rail line are reported separately from the nonradiological impacts associated with operation of the facilities. Table 4-263 lists nonradiological occupational health and safety impacts associated with operation of the proposed rail line, not including the Rail Equipment Maintenance Yard or Staging Yard, or other facilities.

Overall railroad operations including cask trains, maintenance-of-way trains, and repository construction and supply trains correspond to approximately 8,200,000 train-kilometers over the 50-year period of operations for the 570-kilometer (354-mile) Mina rail alignment based on transporting 9,495 casks and an additional two maintenance-of-way trains and one repository construction and supply train per week. The 37 total recordable cases and 28 lost workday cases over the 50-year operations phase (Table 4-263) correspond to 4.5 total recordable cases and 3.4 lost workday cases per million train-kilometers traveled.

Railroad Facilities Operations Operation of the rail line facilities under the Proposed Action, including the Staging Yard, Nevada Railroad Control Center and National Transportation Operations Center, Maintenance-of-Way Facility, Cask Maintenance Facility, and the Rail Equipment Maintenance Yard would take place over a period of 50 years and involve approximately 150 full-time-equivalent operations workers per year of operation, corresponding to approximately 15.0 million labor hours over the 50-year operations phase (DIRS 180874-Nevada Rail Partners 2007; DIRS 180875-Nevada Rail Partners 2007, all). Table 4-264 summarizes the nonradiological impacts of operation of the facilities under the Proposed Action. The 361 total recordable cases and 220 lost workday cases over the 50-year operations phase (Table 4-264) correspond to 44 total recordable cases and 27 lost workday cases per train-kilometers traveled.

Impacts from Specific Resource Areas Workers constructing the proposed rail line and associated facilities could be exposed to a variety of hazards associated with specific resource areas. These include biological hazards, dust and soils hazards, air quality hazards, transportation accidents, and noise hazards. Transportation hazards include wild horses and burros, and free-range livestock. Biological hazards include potential human-health effects from rodent-borne diseases, soil-borne diseases, insect-borne diseases, and venomous animals. Dust and soils hazards include potential human-health effects from exposure to inhalable soils and dusts containing hazardous constituents and potential occupational encounters with unexploded ordnance. Construction workers could also be exposed to air quality hazards, including potential human- health effects of exposure to fugitive dust, diesel engine exhaust, and other air emissions associated with construction activities. Workers could also be exposed to noise hazards from operation of equipment. Operations workers, in particular maintenance-of-way workers, could also be exposed to similar hazards. Impacts associated with specific resource areas are discussed in the paragraphs that follow.

Biological Hazards: Biological hazards are any virus, bacteria, fungus, parasite, or other living organism that can cause a disease or otherwise harm human beings. Biological hazards that may be encountered by workers constructing and operating the proposed rail line and associated facilities include disease-causing organisms and venomous animals. Diseases potentially encountered when performing construction activities include West Nile virus, Valley Fever, Hantavirus, and rabies. Venomous animals potentially encountered include spiders, snakes, scorpions, bees, wasps, and other insects. These biological hazards are described in the following sections. The recorded incidence rates of these biological hazards in the region of influence in Nevada are small, according to statistics published by state and federal agencies including the U.S. Centers for Disease Control and the Nevada State Health Division, as cited below. Therefore, DOE would expect small impacts to construction or operations workers from these biological hazards.

- **Venomous Animals –** Nevada is home to five venomous snake species: Sidewinder, Mohave, Speckled, Western Diamondback, and Great Basin rattlesnakes (*Crotalus* spp.). These types of rattlesnakes may inhabit the open grasslands and desert habitat in the construction and operations areas. The Gila Monster, a venomous lizard, also occurs in southern Nevada. There are several types of scorpions (such as *paruroctonus* spp.) native to Nevada that may occur in construction and operations areas. Scorpions are venomous and are most active at night. A scorpion sting would require medical treatment, but for the species of scorpions found in Nevada, would not be fatal. Black widow spiders

(*Latrodectus mactans*) and brown recluse spiders (*Loxosceles recluse*) may also occur in construction areas. Bites from these spiders would require medical treatment and are potentially fatal if untreated. Other types of spider bites are generally harmless to most people. Spider bites usually occur when someone is reaching into dark, out-of-the way places. Bees, including Africanized Swarming Bees, and wasps also occur in southern Nevada.

- **West Nile Virus –** West Nile virus is a mosquito-borne virus that can cause illness in humans, including meningitis or arboviral encephalitis, a brain inflammation. Mosquitoes acquire the virus from birds and pass it on to other birds, and occasionally to humans. Mosquitoes spread this virus after they feed on infected birds and then bite other birds, people, or certain domestic animals. The virus is not spread by person-to-person contact. West Nile virus occurs primarily in the late summer or early autumn, although the mosquito season is generally April through October. About 80 percent of people who are infected with West Nile virus exhibit no symptoms, or at most, experience symptoms similar to the flu. People with mild infections, referred to as West Nile fever, may experience fever, headache, body ache, skin rash, and swollen lymph glands. More severe infection can result in more serious symptoms, including high fever, headache, disorientation, coma, tremors, occasional convulsions, and paralysis. This form is referred to as West Nile meningitis or encephalitis. In 2004, a total of 44 cases of West Nile virus were reported in Nevada, including 23 cases in Clark County, 15 cases in Churchill County, and one case in Lyon County. Of the 44 West Nile virus cases, 19 involved West Nile fever. In 2005, 31 cases of West Nile virus were reported in Nevada, including eight cases in Clark County and three cases in Nye County (DIRS 177618-USGS 2006, all). No human cases of West Nile virus were reported in Nye, Esmeralda, Mineral, or Storey Counties in 2004 (DIRS 175028-USGS 2005, all; DIRS 175026-NSHD 2005, all). In 2006 there were a total of 123 reported cases of West Nile virus, including 12 cases in Churchill County, 16 cases in Lyon County, two cases in Nye County, and three cases in Clark County (DIRS 178696-USGS 2007, all). Incident rates of West Nile Virus are affected by the population density and availability of water.

- **Valley Fever –** The technical name for Valley Fever is *Coccidioidomycosis*. It is caused by *Coddidioides immitis*, a fungus that lives in soil. Fungus spores become wind-borne and may be inhaled into the lungs, where infection can occur. Valley Fever is not contagious from person to person. It appears that after one exposure, the body develops immunity. The Valley Fever fungus is established in the Southern Nevada region of influence. Infection rates, as reflected by positive skin tests, are 2 to 3 percent per year in highly endemic regions, and activities associated with heavy dust exposure (such as excavation, agricultural labor) increase infection rates (DIRS 175021-Barnato, Sanders, and Owens 2001, p. 1). About 60 percent of people who breathe the spores do not develop any symptoms. About one out of every 200 persons infected with Valley Fever develops the disseminated form, in which the disease spreads beyond the lungs through the bloodstream causing meningitis. Meningitis is a potentially fatal inflammation of the membrane around the brain and the spinal cord.

- **Hantavirus –** A 1993 outbreak of fatal respiratory illness on an Indian Reservation in the Four Corners area (where the states of Arizona, New Mexico, Colorado, and Utah meet) led to the identification of Hantavirus as the causative agent. Hantavirus is a rodent-borne disease. The route of exposure is believed to be inhalation of aerosolized virus, and/or ingestion of rodent excreta through contaminated food or water. Rodent bites and direct contact with broken skin or mucous membranes are also potential sources of infection. Symptoms include pneumonia, fever, and other flu-like symptoms. In 24 to 48 hours after symptoms appear, potentially fatal respiratory failure may occur. As of March 2007, there have been 465 recorded cases of Hantavirus in the United States, with 18 of the cases recorded in Nevada (DIRS 181391-CDC 2007, all). DOE has implemented procedures for decontamination of any rodent excreta encountered by construction workers during construction activities at the Yucca Mountain Site to prevent Hantavirus infection of workers.

- **Rabies –** Rabies may be a hazard to construction and operations workers through accidental contact with mammalian species in construction and operations areas. The route of exposure is a bite or scratch from an infected animal, or non-bite exposure through inhalation of aerosolized rabies virus. Rabies has been reported in Nevada in bats but not in terrestrial animals (DIRS 177449-Krebs et al. 2005, p. 1917). The incubation period of rabies is variable, ranging from less than 10 days to greater than 6 years, and post exposure treatment is necessary following true exposure unless the subject has been vaccinated. Absent post exposure treatment, the first symptoms may be noted within 30 to 90 days of exposure. Once symptoms occur, death may occur in less than 1 week following the development of initial symptoms, usually as a result of respiratory failure. No human cases of rabies were reported in Nevada between January 2000 and September 2005, the latest period for which data are available (DIRS 177449-Krebs et al. 2005, p. 1920).

Dust and Soils Hazards: Dust and soils hazards include potential occupational exposure to hazardous inhalable soils and dust, including the minerals crystalline silica, cristobalite, and ***erionite***, and potential occupational encounters with unexploded ordnance. These hazards are discussed below.

- **Inhalable Dust –** Construction activities such as blasting, scarifying, and excavating create dust that can be inhaled by workers.

Some types of rock and associated soils may contain hazardous minerals such as crystalline silica, cristobalite, and erionite. It is unlikely that any fugitive particulates generated in the construction areas would contain a concentration of crystalline silica, eronite, or cristobalite that would result in exceedance of occupational exposure limits for these materials. Inhaling dust originating from these types of rock and containing these minerals can lead to disease such as silicosis if adequate precautions are not taken when working in dusty areas. However, DOE recognizes the potential for exposure to crystalline silica, cristobalite, or erionite during the development of quarries for production of hard rock ballast, in ballast placement, rock cuts, and other types of excavation. Of the three mineral dust hazards mentioned above, crystalline silica is the most common in hard rock ballast because it is a material of relative abundance in granite and quartz. DOE would be required to comply with Occupational Safety and Health Administration workplace guidance for mineral dusts (29 CFR 1910-1000, Table Z-3, Mineral Dusts).

DOE would therefore conduct routine monitoring of occupational dust exposure during quarry construction and operations and during rail alignment construction activities, such as ballast placement, with the potential for such exposure. DOE would apply best management practices and engineering controls such as application of water for dust suppression and washing the ballast before placement in order to minimize the potential for occupational exposure to dust, and an industrial hygienist would take mineral dust measurements to identify if any potential exposure hazards are present. In the event that these monitoring activities identify potential occupational exposure at levels exceeding Occupational Safety and Health Administration occupational exposure standards for silica, DOE would implement additional processing and engineering controls to mitigate, prevent, or reduce exposures to silica to below occupational exposure standards. Therefore, impacts associated with occupational exposure to these materials are anticipated to be small.

- **Unexploded Ordnance –** Portions of the construction area may have unexploded ordnance in surface or in subsurface locations. The potential areas of concern for unexploded ordnance are sections west of the Nevada Test and Training Range and within the Nevada Test Site. These include areas south of Goldfield and north of Beatty Wash and the area between the southeastern shore of Walker Lake and the Hawthorne Depot. Unexploded ordnance may include shell casings, projectiles, or fragments, and may include live small arms ammunition, bombs, and rockets. These types of unexploded ordnance may have been generated from historical Air Force and other military training activities in the region. Sections of rail alignment and associated facility locations north and east of Goldfield are considered clear of unexploded ordnance at this time. An unexploded-ordnance specialist would develop a plan, including evaluation of types of unexploded ordnance possible, depths, etc. Unexploded-ordnance technicians would be present and screen ahead of the construction crew in areas where there is potential for unexploded ordnance.

DOE would coordinate with the U.S. Air Force, Army, and Navy concerning proposed construction activities and would follow standard and established procedures for unexploded ordnance.

Air Quality Hazards: Construction workers could be exposed to air quality hazards, including potential human-health effects of occupational exposure to stationary and area source emissions associated with construction activities. Operations workers, in particular maintenance-of-way workers, could also be exposed to similar air quality hazards.

Stationary and area source emissions associated with the construction phase include exhaust emissions from on-site vehicles and heavy construction equipment, and fugitive dust from excavation and construction activities. Stationary and area source emissions associated with the operations phase would include emissions from locomotive fueling stations and locomotive and rail line maintenance operations. Section 4.3.4, Air Quality and Climate, describes stationary source and area source emissions associated with construction and operation of the rail line and associated facilities.

Exposure of construction and operations workers to vehicle exhaust emissions and other air emissions would be subject to exposure standards, including standards established under 10 CFR Part 851. Threshold Limit Values established by the Occupational Safety and Health Administration and American Council of Government Industrial Hygienists would apply to occupational exposure to vehicle exhaust emissions and other air emissions. DOE would apply administrative controls and conduct workplace monitoring to control exposure to below applicable standards.

Noise Hazards: Workers conducting construction and operations activities under the Proposed Action could be exposed to noise from operation of heavy construction equipment, operation of locomotives, or from conducting blasting operations. Potential sources of occupational noise exposure, applicable noise exposure standards, and requirements for controlling noise exposure are described in this section and further described in Section 4.3.8.

- **Roadbed/Track Structure Construction Noise Exposure –** DOE would require employers of construction workers exposed to heavy equipment noise to comply with Occupational Safety and Health Administration regulation 29 CFR 1910.95 to avoid effects of excessive noise exposure. Hearing damage is related to absolute noise level and duration of exposure. Table 4-265 shows Occupational Safety and Health Administration noise level limits that would require hearing protection. Code of Federal Regulations 10 Part 851 requires DOE to use American Conference of Governmental Industrial Hygienists Threshold Limit Values as occupational exposure standards. Table 4-265 also shows the Threshold Limit Values.

DOE would be required to administer a continuing, effective hearing conservation program whenever employees would be exposed to noise equal to or exceeding an 8-hour time-weighted average sound level of 85 A-weighted decibels.

- **Railroad Worker Noise Exposure –** Railroad operators are required to comply with Federal Railroad Administration Regulation 49 CFR 229.121 for worker exposure to locomotive cab noise. Applicable noise levels, the exceedance of which would require hearing protection, are shown in Table 4-265.

Table 4-265. Occupational noise exposure limits.[a]

Duration per day, hours	Sound level (decibels slow response)	ACGIH[b] Threshold Limit Value
8	90	85
6	92	86
4	95	88
3	97	89
2	100	91
1.5	102	92
1	105	94
0.5	110	97
0.25 or less	115	100

a. Sources: 29 CFR 1910.95, 30 CFR 62.130; 10 CFR 851.
b. ACGIH = American Conference of Governmental Industrial Hygienists.

- **Ballast Quarry Noise Exposure –** Employers of quarry workers supplying ballast for the rail bed would be required to comply with Mine Safety and Health Administration Regulation 30 CFR 62. Applicable Mine Safety and Health Administration noise levels, the exceedance of which would require hearing protection, are shown in Table 4-265. Noise levels above 115 dBA are not permitted under the regulation (30 CFR 62.130).

4.3.10.2.2 Radiological Impacts

This section discusses the radiological impact for workers and members of the public during construction and operation of the railroad and facilities such as the Staging Yard, the Rail Equipment Maintenance Yard, the Maintenance-of-Way Facility, and the Cask Maintenance Facility. Both incident-free impacts and radiological accident risks are discussed. Also discussed are the impacts from severe transportation accidents and from acts of sabotage.

For the portion of the Mina rail corridor that originates at Hazen and terminates at the repository, the radiological impacts from incident-free transportation for members of the public were estimated to be 8.2×10^{-4} latent cancer fatality. For workers, these impacts were estimated to be 0.33 latent cancer fatality. The radiological accident risks for this portion of the Mina rail corridor were estimated to be 7.4×10^{-6} latent cancer fatality.

4.3.10.2.2.1 Workers.

Rail Line and Facilities Construction No spent nuclear fuel or high-level radioactive waste or other radioactive materials would be transported along the rail line during the construction period. Therefore, that there would be no radiological worker health and safety impacts related to radioactive materials transportation associated with construction of the proposed rail line or associated facilities under the Proposed Action.

Railroad Operations Potential occupational radiological impacts to workers associated with incident-free operation of the rail line and rail line facilities are described below. Occupational radiological impacts are quantified in terms of latent cancer fatalities. Occupational radiation doses (effective dose equivalent) are also reported.

Incident-Free Transportation: During the shipment of spent nuclear fuel and high-level radioactive waste from Hazen to the Staging Yard at Hawthorne to the repository, workers would potentially be

Radiation Levels Emitted From Transportation Casks

The radiological impact analysis for spent nuclear fuel and high-level radioactive waste transportation assumes that the external radiation levels emitted from each transportation cask will be at the regulatory limit of 10 millirem per hour at a distance of 2 meters (6.6 feet). This assumption would tend to overestimate the radiation dose to workers and the public because not all casks will be loaded with spent nuclear fuel or high-level radioactive waste that has the characteristics that would result in the cask external dose rate being at the regulatory limit. In its report *Assessment of Incident Free Transport Risk for Transport of Spent Nuclear Fuel to Yucca Mountain Using RADTRAN 5.5*, the Electric Power Research Institute noted that more than 40 percent of the spent nuclear fuel shipped is likely to have been stored for times greater than 20 years (DIRS 185330-EPRI 2005, p. 5-2). The longer spent nuclear fuel is stored, the lower the radiation dose would be when the spent nuclear fuel is shipped, and cask external dose rates would be lower than the regulatory limit. Section J.1.3.2.4 of the Yucca Mountain FEIS discussed this issue. The Yucca Mountain FEIS analysis estimated that the cask dose rate would be 50 to 70 percent of the regulatory limit. Based on this analysis, DOE expects that the radiological risks to workers and the public from incident-free transportation would be 50 to 70 percent of the values estimated in this Rail Alignment EIS.

exposed to direct radiation from 9,495 shipping casks. These workers would include rail transportation crew members, security escorts, workers potentially exposed when trains with loaded shipping casks passed the Maintenance-of-Way Facility, and workers potentially exposed when trains with loaded shipping casks passed trains with unloaded casks or other materials at sidings. A buffer railcar would separate the escorts from the last shipping cask in the train. Escorts would be located in an escort railcar at a distance of 39 meters (128 feet) from this shipping cask. A buffer railcar would also separate the crew members from the first shipping cask in the train. These workers would be shielded by the engine of the locomotive and unexposed. Workers at the Maintenance-of-Way Facility would be located 60 meters (200 feet) from the rail line and workers at sidings would be located 7.6 meters (25 feet) from the rail line. The methods and data used to estimate the radiation doses for these workers are described in Appendix K.

As discussed in Chapter 2, there are a number of possible combinations of common segments and alternative segments that could make up the rail alignment from Hazen to the Staging Yard at Hawthorne to the Rail Equipment Maintenance Yard. For the radiological impacts analyses, four specific alignments were evaluated: (1) the alignment with the highest population within the region of influence, (2) the shortest alignment, (3) the longest alignment, and (4) the alignment with the lowest population within the region of influence. These alignments are described in Table 3-146.

Table 4-266 lists the radiation doses and impacts for the workers along these four alignments. The collective radiation dose for these workers is estimated to be 310 to 320 person-rem. In the potentially exposed population of workers, the probability of a latent cancer fatality is estimated to be 0.18 to 0.20.

The ***maximally exposed worker*** would be a security escort. This worker is estimated to receive a radiation dose of 25 rem over the entire operations phase, based on a 0.5 rem per year administrative dose limit for repository facilities (DIRS 174942-BSC 2005, Section 4.9.3.3) and assuming that a person could work for up to 50 years escorting shipments. The probability of a latent cancer fatality for this worker is estimated to be 0.015. Security escort workers and other rail line workers would be subject to a radiation protection program. Workers, including security escort workers, would not be exposed to radiation in excess of the administrative dose limit for repository facilities of 0.5 rem per year. This requirement may in some cases limit the number of hours per year that workers are permitted to work as security escorts to less than 2,000 hours per year.

Lifetime Dose to the Maximally Exposed Worker

The lifetime radiation exposure for the maximally exposed individual worker is estimated to be 25 rem based on the assumption that he or she would receive an annual administrative limit of 500 millirem per year for a 50-year working life escorting shipments. The use of the maximum annual results based on the administrative dose limit of 500 millirem would tend to overestimate the actual exposure of the maximally exposed individual worker, even assuming that the worker remained in the same job for 50 years, which is unlikely.

Industry experience indicates that the worker radiation doses will be much lower. For example, Progress Energy has conducted a total of 210 shipments which includes 375 casks and 5,205 spent fuel assemblies. All shipments were conducted by rail using IF-300 casks (DIRS 185461-Edwards 2008, all). Forty-four of those shipments were from the Robinson plant to the Brunswick plant. Thirty-seven shipments were from the Robinson plant to the Harris plant. One hundred twenty-nine shipments were from the Brunswick plant to the Harris plant. During these shipments, all shipment escorts, train crew, and passengers were monitored for radiation exposure using thermoluminescent dosimeters. Dose rates at 2 meters from the cask were measured at less than 2 millirem per hour and during these shipments there has been zero recordable radiation dose to escorts, crew and passengers. The collective radiation dose for crews loading, unloading and decontaminating the casks at the shipping and receiving plants is generally less than 0.250 person-rem for a shipment, which includes the combined dose for all workers supporting the shipping and receiving plants.

- **Staging Yard at Hawthorne, Rail Workers, Inspectors, and Escorts –** When shipping casks arrived at the Staging Yard, the railcars containing the shipping casks would be removed from the train, an inspection would be conducted, and the railcars would be transferred to the train for transport to the Rail Equipment Maintenance Yard. The escorts that had accompanied the shipping cask from its origin would also be present during this inspection. Involved workers such as rail workers, inspectors, and escorts would potentially be exposed to direct radiation from 9,495 shipping casks over the entire shipping campaign. Inspectors would be located 1 meter (3.3 feet) from the shipping cask. Escorts wouldbe located further away, at a distance of 30 meters (100 feet) from the shipping cask. Noninvolved workers at the Staging Yard would be located at a distance of 100 meters (330 feet) from the shipping casks. The methods and data used to estimate the radiation doses for these workers are described in Appendix K.

Table 4-266. Estimated radiological impacts for workers along the proposed rail alignment.

Group	Radiation dose	Latent cancer fatality
Maximally exposed worker[a] (annual)	0.50 rem per year	0.00030
Maximally exposed worker (50-year operation)	25 rem[b]	0.015[b,c]
Worker population	310 to 340 person-rem	0.18 to 0.20[d]

a. The maximally exposed worker is a security escort.
b. Total for 50 years of operation.
c. The estimated probability of a latent cancer fatality for an exposed individual worker.
d. The estimated number of latent cancer fatalities in an exposed worker population.

Table 4-267 lists the radiation doses and impacts for the workers involved with these activities. The analysis assumed that noninvolved workers would also potentially be exposed to direct radiation during these activities.

The collective radiation dose for involved and noninvolved workers is estimated to be 250 person-rem. In the potentially exposed population of workers, the probability of a latent cancer fatality is estimated to be 0.15. The maximally exposed worker would be an escort or inspector. This worker is estimated to receive a radiation dose of 25 rem over the 50 years of operation, based on a 0.5 rem per year administrative dose limit for repository facilities (DIRS 174942-BSC 2005, Section 4.9.3.3) and assuming

Table 4-267. Estimated radiological impacts for rail workers, inspectors, and escorts at the Staging Yard.

Group	Radiation dose	Latent cancer fatality
Maximally exposed worker (annual)[a]	0.50 rem per year	0.00030
Maximally exposed worker (50-year operation)	25 rem[b]	0.015[b,c]
Worker population (involved workers)	240 person-rem	0.14[d]
Worker population (noninvolved workers)	10 person-rem	0.0063
Worker population (total)	250 person-rem	0.15

a. The maximally exposed worker is an escort or security escort.
b. Total for 50 years of operation.
c. The estimated probability of a latent cancer fatality for an exposed individual worker.
d. The estimated number of latent cancer fatalities in an exposed worker population.

that a person could work for up to 50 years at the Staging Yard. The probability of a latent cancer fatality for this worker is estimated to be 0.015. Staging Yard workers and other facilities workers would be subject to a radiation protection program. Workers, including Staging Yard workers, would not be exposed to radiation in excess of the administrative dose limit for repository facilities of 0.5 rem per year. This requirement may in some cases limit the number of hours per year that workers are permitted to work at the Staging Yard to less than 2,000 hours per year.

- **Rail Equipment Maintenance Yard –** Under the Proposed Action, a Rail Equipment Maintenance Yard would be constructed and operated to transfer cask cars to the repository. The workers at this facility would potentially be exposed to direct radiation from handling 9,495 shipping casks over 50 years of shipping. The radiation doses for these workers would be similar to the radiation doses for handling dedicated rail shipments at other rail yards and are described in Neuhauser et al. (2000) (DIRS 155430-Neuhauser, Kanipe, and Weiner 2000, Section 3.5.2).

Table 4-268 summarizes the radiation doses and impacts for workers involved in these activities. The collective radiation dose for these workers is estimated to be 16 person-rem. In the potentially exposed population of workers, the probability of a latent cancer fatality is estimated to be 0.0096.

The individual radiation dose for workers at this facility was estimated to be 0.013 rem per year. The probability of a latent cancer fatality for this worker is estimated to be 7.6×10^{-6}. If this individual worked at the facility for 50 years, their radiation dose would be 0.64 rem. The probability of a latent cancer fatality for this worker is estimated to be 0.00038.

Table 4-268. Estimated radiological impacts for workers at the Rail Equipment Maintenance Yard.

Group	Radiation dose	Latent cancer fatality
Maximally exposed worker (annual)	0.013 rem per year	7.6×10^{-6}[c]
Maximally exposed worker (50-year operation)	0.64[a] rem	0.00038[b]
Worker population	16[a] person-rem	0.0096[c]

a. Total for 50 years of operation.
b. The estimated probability of a latent cancer fatality for an exposed individual worker.
c. The estimated number of latent cancer fatalities in an exposed worker population.

- **Cask Maintenance Facility –** Under the Proposed Action, Cask Maintenance Facility operations would include testing, inspection, certification, incidental repair, and minor decontamination and modification of the transportation casks. Impacts to workers from activities at the Cask Maintenance Facility were based on the impacts for a similar facility, the Alaron Regional Service Facility, located in Wampum, Pennsylvania. This facility provides treatment, decontamination, compaction, and repackaging services for generators of radioactively contaminated materials. One of the services provided by Alaron is the decontamination of spent nuclear fuel casks, which is similar to the activities that would occur at the Cask Maintenance Facility. The activities at Alaron are discussed in DIRS 181886-NRC 1989, all, and DIRS 151227-Blasing et al. 1998, all.

Radiation dose from cask handling and maintenance activities at the Cask Maintenance Facility could result in radiation dose to workers, primarily as a result of exposure to "crud." Crud is the term used to describe contamination on the outside of spent nuclear fuel and would consist of the radionuclides Co-60, Mn-54, Fe-55, and Zn-65. Crud may be present in reactor spent nuclear fuel pools and may contaminate the inside of the cask during loading, even if the spent nuclear fuel has been placed in canisters. For the radionuclides contained in crud, average radionuclide inventories at the Alaron Regional Service Facility would consist of about 4.7 Ci of Co-60, 0.32 Ci of Mn-54, 7.6 Ci of Fe-55, and 0.061 Ci of Zn-65. Not all of this radionuclide inventory would be from the decontamination of spent nuclear fuel casks; some of the radionuclide inventory would be as a result of other services provided at the Alaron Regional Service Facility.

Workers at Alaron were estimated to receive an individual radiation dose of 0.04 rem per month. Over the course of a year, a worker would receive a radiation dose of 0.48 rem. This radiation dose was used to estimate the radiation dose to a worker at the Cask Maintenance Facility. The probability of a latent cancer fatality for this worker is estimated to be 0.00029.

Based on the total number of workers at the Cask Maintenance Facility, the collective radiation dose at the Cask Maintenance Facility would be 14 person-rem per year. In the potentially exposed population of workers, the probability of a latent cancer fatality is estimated to be 0.0086. Table 4-269 summarizes these impacts and also presents impacts for the entire duration of operations.

- **Other Railroad Facility Operations –** Under the Proposed Action, other railroad facilities would be constructed and operated, including the Maintenance-of-Way Facility, and Nevada Railroad Control Center and National Transportation Operations Center. Radiological health impacts to workers operating these facilities are anticipated to be minimal, as casks would not be loaded or unloaded at these facilities.

Risk Terms

A risk value of 1×10^{-4} is equivalent to 1 in 10,000.
A risk value of 1×10^{-6} is equivalent to 1 in 1,000,000.
A risk value of 1×10^{-8} is equivalent to 1 in 100,000,000.

Note that the dose calculations for rail facility operations workers in Table 4-266 above include radiological exposure to workers at the Maintenance-of-Way Facility and at sidings who would be potentially exposed when the cask train passes by.

4.3.10.2.2.2 Public.

Construction No spent nuclear fuel or high-level radioactive waste or other radioactive materials would be transported along the rail line during the construction period. Therefore, there would be no radiological public health and safety impacts related to radioactive materials transportation associated with construction of the proposed rail line or associated facilities under the Proposed Action.

Table 4-269. Estimated radiological impacts for workers at the Cask Maintenance Facility.

Group	Radiation dose	Latent cancer fatality
Maximally exposed worker (annual)	0.48 rem per year	0.00029[c]
Maximally exposed worker (50-year operation)	24[a] rem	0.014[b,c]
Worker population (annual)	14 person-rem per year	0.0086[c]
Worker population (50–years operation)	720[a] person-rem	0.43[a,c]

a. Total for 50 years of operation.
b. The estimated probability of a latent cancer fatality for an exposed individual worker.
c. The estimated number of latent cancer fatalities in an exposed worker population.

Operations

Incident-Free Rail Transportation:

- **Public along the Proposed Rail Line –** During the shipment of spent nuclear fuel and high-level radioactive waste from the Staging Yard to the Rail Equipment Maintenance Yard, residents and other people located along the proposed rail line would potentially be exposed to direct radiation from the 9,495 shipping casks that would pass by while being transported from the Staging Yard to the repository. ***Dedicated trains*** would be used for all shipments of spent nuclear fuel, high-level radioactive waste, and all other materials transported to or from the repository. Under incident-free circumstances, the dedicated trains would not stop anywhere along the rail line when transporting spent nuclear fuel or high-level radioactive waste from the Staging Yard to the repository. Also, under the Proposed Action, no passenger trains and no other freight trains would use the rail line; only trains transporting spent nuclear fuel, high-level radioactive waste, or other materials between the Staging Yard and the repository would use the rail line. Therefore, under incident-free conditions, no members of the public would share the rail line during radioactive materials transportation, and thus there would be no exposures of any members of the public sharing the transportation route or exposures of any members of the public located at stops along the route during transportation of radioactive materials. The collective population was the population within 800 meters (0.5 mile) of the rail line and was determined using U.S. Census data. The distance of the maximally exposed individual from the rail line was determined using geographic information system (GIS) data and imagery. The methods and data used to estimate the impacts from direct radiation for the public along the rail line are described in Appendix K.

As discussed in Chapter 2, there are a number of possible combinations of common segments and alternative segments that could make up the rail alignment from Hazen to the Staging Yard at Hawthorne to the Rail Equipment Maintenance Yard. For the radiological impacts analyses, four specific alignments were evaluated. These alignments are described in Table 3-146.

Table 4-270 lists the potential radiological impacts for members of the public from incident-free transportation along the proposed rail line. Under the assumed conditions, the collective radiation dose for members of the public is estimated to be 1.4 person-rem. The probability of a latent cancer fatality based on the estimated dose would be 8.1×10^{-4} to 8.5×10^{-4}. The maximally exposed individual is a

The exposed population surrounding the proposed Cask Maintenance Facility is within an area 84 kilometers (52 miles) away from the facility and the population in this area is assumed to be exposed at the same level as the maximally exposed individual. This assumption would tend to overestimate the total population dose to the public from the Cask Maintenance Facility.

resident who lives 18 meters (60 feet) from the rail line. This individual is assumed to be exposed to each of the 9,495 shipping casks that pass by on the rail line. The radiation dose for this individual is estimated to be 0.0078 rem. The probability of a latent cancer fatality for this individual based on the estimated dose and the assumptions would be 4.7×10^{-6}.

Table 4-270. Estimated radiological impacts for the public along the proposed rail line.

Group	Radiation dose	Latent cancer fatality
Maximally exposed individual[a]	0.0078[b] rem	4.7×10^{-6}[c]
Population	1.4 person-rem	8.1×10^{-5} to 8.5×10^{-4}[d]

a. The maximally exposed individual is a resident located 18 meters (60 feet) from the rail line.
b. Total for 50 years of operation.
c. The estimated probability of a latent cancer fatality for an individual within the region of influence.
d. The estimated number of latent cancer fatalities in the population within the region of influence.

- **Public Near the Staging Yard –** The public surrounding the Staging Yard location at Hawthorne would potentially be exposed to direct radiation from 9,495 shipping casks over the entire shipping campaign.

The collective population was the population within 800 meters (0.5 mile) of the edge of the Staging Yard and was determined using U.S. Census data. For the maximally exposed individual, the distance was from the center of the Staging Yard and was determined using geographic information system (GIS) data and imagery. The methods and data used to estimate the radiation doses for members of the public are described in Appendix K.

Table 4-271 lists the radiation doses and impacts for the public near the Staging Yard at Hawthorne. Based on 2000 Census data, there are no people who reside within 800 meters (2,620 feet) of the Hawthorne Staging Yard. There is, however, a business located 660 meters (2,170 feet) from the Staging Yard. The radiation dose for a person at this business is estimated to be 0.00018 rem over the entire shipping campaign, assuming that an individual was exposed to each of the 9,495 shipping casks for a period of 2 hours per cask. The probability of a latent cancer fatality for this individual based on the estimated dose and the assumptions would be 1.1×10^{-7}.

Table 4-271. Estimated radiological impacts for the public at the Staging Yard at Hawthorne.

Group	Radiation dose	Latent cancer fatality
Maximally exposed individual[a]	0.00018 rem[b]	1.1×10^{-7}[c]
Population[d]		

a. The maximally exposed individual is a person located at a business 660 meters (2,170 feet) from the Staging Yard.
b. Total for 50 years of operation.
c. The estimated probability of a latent cancer fatality for an individual within the region of influence.
d. According to 2000 Census data, there are no people residing within 800 meters (2,620 feet) of the Staging Yard.

- **Cask Maintenance Facility –** Under the Proposed Action, Cask Maintenance Facility operations would include testing, inspection, certification, incidental repair, and minor decontamination and modification of the transportation casks. Impacts to members of the public from activities at the Cask Maintenance Facility were based on the impacts for a similar facility, the Alaron Regional Service Facility, located in Wampum, Pennsylvania. This facility provides treatment, decontamination, compaction, and repackaging services for generators of radioactively contaminated materials. One of the services provided by Alaron is the decontamination of spent nuclear fuel casks, which is similar to the activities that would occur at the Cask Maintenance Facility. The activities at Alaron are discussed in DIRS 181886-NRC 1989, all, and DIRS 151227-Blasing et al. 1998, all.

At the Alaron Regional Service Facility, the maximally exposed member of the public was located 300 meters (984 feet) from the facility. The radiation dose for this individual from emissions through all environmental pathways was estimated to be 2.0×10^{-9} rem per year. The probability of a latent cancer fatality for this individual is estimated to be 1.2×10^{-12}. The radiation dose and latent cancer fatality risk for members of the public from emissions from the Cask Maintenance Facility would be much lower, because the public is located much further from the facility. For example, the nearest site boundary is 11 kilometers (7 miles) from the repository, while at Alaron, the maximally exposed member of the public was located 300 meters (984 feet) from the facility.

The ***total population*** within 84 kilometers (52 miles) of the Cask Maintenance Facility is estimated to be about 118,000 people in the year 2067. If all of these people were exposed at the same level as the maximally exposed member of the public, the resulting collective radiation dose would be 0.00023 person-rem per year. In this potentially exposed population, the probability of a latent cancer fatality is estimated to be 1.4×10^{-7}. Table 4-272 summarizes these impacts and also presents impacts for the entire duration of operations.

Table 4-272. Estimated radiological impacts for the public from the Cask Maintenance Facility.

Group	Radiation dose	Latent cancer fatality
Individual member of the public (annual)	2.0×10^{-9} rem per year	1.2×10^{-12}[a]
Individual member of the public (50 years)	1.0×10^{-7}	6.0×10^{-11}[a,b]
Collective members of the public (annual)	0.00023 person rem per year	1.4×10^{-7}[c]
Collective members of the public (50 years)	0.012 person-rem[b]	7.0×10^{-6}[b,c]

a. The estimated probability of a latent cancer fatality for an individual within the region of influence.
b. Total for 50 years of operation.
c. The estimated number of latent cancer fatalities in the population within the region of influence.

Accidents: To quantify the potential radiological impacts of transportation accidents, two types of analyses were performed. The first analysis provided an estimate of the radiological accident risks associated with transporting spent nuclear fuel and high-level radioactive waste along the Mina rail alignment. The analysis of radiological accident risks takes into account a spectrum of accidents ranging from higher-probability accidents of low severity to hypothetical high-severity accidents that have a correspondingly low probability of occurrence. Accident risks included:

- Accidents in which there was no breach of containment and no deformation of shielding
- Accidents in which no release of radioactive material occurred, but where there was a deformation of shielding because of lead shield displacement
- Accidents in which radioactive material was released from the shipping cask

Radiological accident risks were defined as the probability of occurrence of an accident multiplied by the consequences of the accident, summed over a complete spectrum of accidents. This quantity is known as "***dose risk***."

The second analysis provided an estimate of the consequences of severe transportation accidents, known as maximum reasonably foreseeable transportation accidents. Historically, the maximum reasonably foreseeable transportation accident is defined as a transportation accident with a frequency of about 1×10^{-7} per year. However, in this analysis, the consequences of severe transportation accidents with frequencies as low as 3×10^{-18} per year are presented.

Nonradiological accidents are discussed in Section 4.3.10.2.3 below.

- **Accident Risks –** The methods and data used to estimate radiological accident risks are discussed in Appendix K. The impacts from these accidents are listed in Table 4-273. The risks from radiological accidents are estimated to be 7.4×10^{-6} to 7.6×10^{-6} latent cancer fatality.

Table 4-273. Estimated radiological accident risks from potential transportation accidents along the proposed rail line.

Risk	Accident dose risk[a]	Latent cancer fatality[a]
Radiological accident risk	1.2×10^{-2} to 1.3×10^{-2}	7.4×10^{-6} to 7.7×10^{-6}

a. Radiological accident dose risk is the sum of the products of the probabilities and consequences in person-rem of all potential transportation accidents. This sum is converted to latent cancer fatalities using the conversion factor of 0.0006 latent cancer fatality per person–rem.

- **Maximum Reasonably Foreseeable Accident –** Severe accidents having a frequency of about 1×10^{-7} per year are known as ***maximum reasonably foreseeable accidents***. Accidents with frequencies below 1×10^{-7} per year are generally not reasonably foreseeable. In this Rail Alignment EIS, the maximum reasonably foreseeable transportation accident has a frequency of about 7×10^{-7} per year. This accident involves a long duration, high-temperature fire that would engulf a cask. The methods and data used to estimate the impacts of this accident are discussed in Appendix K.

For the four evaluated rail alignments described in Table 3-146, there were no urban areas as defined in U.S. Census Bureau population data. However, there were suburban areas and rural areas. Suburban areas are defined as areas with a population density between 139 and 3,326 people per square mile. Rural areas were defined as areas with a population density less than 139 people per square mile. Using alignment-specific 2000 Census population data escalated to the year 2067, the average population density in suburban areas along the alignments was 542 to 589 people per square kilometer (1,400 to 1,530 people per square mile), near Silver Springs, Nevada. The average population density along rural areas, escalated to the year 2067, ranged from 3.94 to 4.33 people per square kilometer (10.2 to 11.2 people per square mile).

Table 4-274 presents estimates of the impacts of this severe accident. If the maximum reasonably foreseeable accident were to occur in a suburban area, the population radiation dose would be 2,000 person-rem. Under the assumed conditions, based on the estimated dose, there would be 1.2 latent cancer fatalities. If the maximum reasonably foreseeable accident were to occur in a rural area, the collective radiation dose would be 15 person rem. Under the assumed conditions, the probability of a latent cancer fatality based on the estimated dose and the assumptions would be 8.9×10^{-3}. Because these risks would be for the entire population, the risk for any single individual would be small..

In either a suburban area or rural area, the radiation dose from the maximum reasonably foreseeable transportation accident for the ***maximally exposed individual*** located 330 meters (1,100 feet) from the accident would be 34 rem. The probability of a latent cancer fatality for that individual based on the estimated dose and the assumptions would be 0.020.

The radiation dose to a first responder would range from 0.14 to 2.0 rem. The probability of a latent cancer fatality for this first responder based on the estimated dose and the assumptions would range from 8.2×10^{-5} to 0.0012.

Table 4-274. Estimated radiological impacts from the maximum reasonably foreseeable transportation accident scenarios for suburban and rural areas.[a,b]

Impact	Suburban area[c]	Rural area[c]
Impacts to population		
Population dose (person-rem)	2,000	15
Latent cancer fatalities	1.2	8.9×10^{-3}
Impacts to maximally exposed individuals		
Maximally exposed individual dose (rem)	34	34
Probability of a latent cancer fatality	0.020	0.020
Impacts to first responder		
Maximally exposed responder dose (rem)	0.14 to 2.0	0.14 to 2.0
Probability of a latent cancer fatality	8.2×10^{-5} to 0.0012	8.2×10^{-5} to 0.0012

a. There are no urban areas for the four specific alignments.
b. Accident frequency is estimated to be 7 × 10-7 per year.
c. Radiological impacts were based on low wind speeds and stable atmospheric conditions. These were defined as Class F stability and a wind speed of 2.9 feet per second.

- **Accidents at the Cask Maintenance Facility –** Under the Proposed Action, Cask Maintenance Facility operations would include testing, inspection, certification, incidental repair, and minor decontamination and modification of the transportation casks. Impacts to members of the public from activities at the Cask Maintenance Facility were based on the impacts for a similar facility, the Alaron Regional Service Facility, located in Wampum, Pennsylvania. This facility provides treatment, decontamination, compaction, and repackaging services for generators of radioactively contaminated materials. One of the services provided by Alaron is the decontamination of spent nuclear fuel casks, which is similar to the activities that would occur at the Cask Maintenance Facility. The activities at Alaron are discussed in *Environmental Assessment for Alaron Corporation* and *Environmental Assessment Renewal of Materials Licenses for Alaron Corp* (DIRS 181886-NRC 1989, all; DIRS 151227-Blasing et al. 1998, all).

A fire at the Alaron Regional Service Facility was estimated to result in a radiation dose of 0.00045 rem to a member of the public at a distance of 50 meters (164 feet) from the facility and a radiation dose of 0.000011 rem to a member of the public at a distance of 300 meters (984 feet) from the facility. The probability of a latent cancer fatality for these individuals is estimated to be 2.7×10^{-7} and 6.5×10^{-9}, respectively. For a similar fire at the Cask Maintenance Facility, the impacts would be much lower, because the public is located much further from the facility, about 11 kilometers (7 miles), as opposed to 50 to 300 meters at Alaron.

The total population within 84 kilometers (52 miles) of the Cask Maintenance Facility is estimated to be about 118,000 people in the year 2067. If all of these people were exposed at the same level as the member of the public located 300 meters (984 feet) from the facility, the resulting collective radiation dose would be 1.3 person-rem. The probability of a latent cancer fatality based on the estimated dose and the assumptions would be 7.6×10^{-4}.

Severe Transportation Accidents: An Opposing Viewpoint

The State of Nevada has provided analyses that indicate that the consequences of severe transportation accidents would be much higher than those in this Rail Alignment EIS. For example, the state has estimated that the long-term consequences of a rail accident in a rural area could result in seven to 614 latent cancer fatalities in the exposed population (DIRS 181756-Lamb, Resnikoff, and Moore 2001, Table 41), while DOE estimates that about one latent cancer fatality would occur in the exposed population.

The state estimated these consequences using computer programs that DOE developed and uses. However, the state's analysis used values for parameters that would be at or near their maximum values. DOE guidance for the evaluation of accidents in environmental impact statements (DIRS 172283-DOE 2002, p. 6) specifically cautions against the evaluation of scenarios for which conservative (or bounding) values are selected for multiple parameters because the approach yields unrealistically high results.

DOE's approach to accident analysis estimates the consequences of severe accidents having frequencies as low as 1×10^{-7} per year (1 in 10 million) (DIRS 172283-DOE 2002, p. 9) using realistic yet cautious methods and data. DOE believes that the State of Nevada estimates are unrealistic and that they do not represent the reasonably foreseeable consequences of severe transportation accidents.

Evaluation of Transportation Sabotage

Transportation Sabotage Considerations – In response to the terrorist attacks of September 11, 2001, and to intelligence information that has been obtained since then, the U.S. Government has initiated nationwide measures to reduce the threat of sabotage. These measures include security enhancements to prevent terrorists from gaining control of commercial aircraft, such as (1) more stringent screening of airline passengers and baggage by the Transportation Security Administration, (2) increased presence of federal air marshals on many flights, (3) improved training of flight crews, and (4) hardening of aircraft cockpits. Additional measures have been imposed on foreign passenger carriers and domestic and foreign cargo carriers, as well as charter aircraft.

For the accident analysis for the proposed Cask Maintenance Facility, DOE has assumed that the entire population would be exposed at the same level as a member of the public located 300 meters (984 feet) from the facility, even though the nearest public would be located about 11 kilometers (7 miles) from the Cask Maintenance Facility. This assumption would tend to overestimate the collective population dose that would result from a fire at the facility.

Beyond these measures to reduce the potential for terrorists to gain control of an aircraft, DOE has adopted an approach that focuses on ensuring that safety and security requirements are adequate and effective in countering and mitigating the effects of sabotage events that involve transportation casks. The Federal Government has greatly improved the sharing of intelligence information and the coordination of response actions among federal, state, and local agencies. DOE has been an active participant in these efforts; it now has regular and frequent communications with other federal, state, and local government agencies and industry representatives to discuss and evaluate the current threat environment, to assess the adequacy of security measures at DOE facilities and, when necessary, to recommend additional actions. In addition to its domestic efforts, DOE is a member of the International Working Group on Sabotage for Transport and Storage Casks, which is investigating the consequences of sabotage events and exploring opportunities to enhance the physical protection of casks.

In addition, the Nuclear Regulatory Commission (NRC) has promulgated rules (10 CFR 73.37) and interim compensatory measures (67 *FR* 63167, October 10, 2002) specifically to protect the public from harm that could result from sabotage of spent nuclear fuel casks. The purposes of these security measures are to minimize the possibility of sabotage and to facilitate recovery of spent nuclear fuel shipments that could come under the control of unauthorized persons. These measures include the use of armed escorts to accompany all shipments, safeguarding of the detailed shipping schedule information, monitoring of shipments through satellite tracking and a communication center with 24-hour staffing, and coordination of logistics with state and local law enforcement agencies, all of which would contribute to shipment security. The Department has committed to following these rules and measures (see 69 *FR* 18557, April 8, 2004).

The Department, as required by the Nuclear Waste Policy Act, as amended (NWPA) (42 U.S.C. 10101 *et seq.*), would use Nuclear Regulatory Commission-certified shipping casks. Each cask design must meet stringent requirements for structural, thermal, shielding, and criticality performance and confinement integrity for routine (incident-free) and accident events. Spent nuclear fuel is protected by the robust metal structure of the shipping cask, and by cladding that surrounds the fuel pellets in each fuel rod of an assembly. Further, the fuel pellets in each fuel rod of an assembly, and the fuel is in a solid form, which would tend to reduce dispersion of radioactive particulates beyond the immediate vicinity of the cask, even if a sabotage event were to result in a breach of the multiple layers of protection.

Based on this knowledge, the Department has analyzed plausible threat scenarios, required enhanced security measures to protect against these threats, and developed emergency planning requirements that would mitigate potential consequences for certain scenarios. DOE would continue to modify its approach to ensuring safe and secure shipments of spent nuclear fuel and high-level radioactive waste, as appropriate, between now and the time of shipments.

For the reasons stated above, DOE believes that under general credible threat conditions the probability of a sabotage event that would result in a major radiological release would be low. Nevertheless, because of the uncertainty inherent in the assessment of the likelihood of a sabotage event, DOE has evaluated events in which a military jet or commercial airliner would crash into a spent nuclear fuel cask or a modern weapon (high-energy density device) would penetrate a spent nuclear fuel cask (see Consequences of Potential Sabotage Events below).

Consequences of Potential Sabotage Events – Whether acts of sabotage or terrorism would occur, and the exact nature and location of the events or the magnitude of the consequences of such acts if they were to occur, is inherently uncertain—the possibilities are infinite. Nevertheless, the Yucca Mountain FEIS and, consistent with Departmental guidance (DIRS 172283-DOE 2002, all), this Rail Alignment EIS took a hard look at the consequences of potential acts of sabotage or terrorism during the transport of spent nuclear fuel and high-level radioactive waste by evaluating two fundamentally different scenarios: one involving aircraft and one involving a weapon or device that struck a transportation cask loaded with commercial spent nuclear fuel. DOE estimated the consequences of these scenarios without regard to their probability of occurrence; that is, DOE assumed the scenarios would occur and under conditions that would reasonably maximize the consequences.

To estimate the consequences of aircraft crashes, DOE identified the aircraft parts most likely to penetrate a transportation cask, identified the military and commercial aircraft most likely to be involved in a crash in an urban area (for example, Las Vegas, Nevada), and estimated the speed of the aircraft at impact (DIRS 155970-DOE 2002, Section J.3.3.1). DOE first considered the ability of aircraft parts to penetrate a transportation cask and concluded that the parts with the highest chance of penetration would be the engines and engine shafts. Based on flight information from Nellis Air Force Base, DOE selected the F-15 and F-16 high-performance jet fighters, which represent more than 70 percent of military flight operations. For the commercial aircraft analysis, DOE selected the B-767, a relatively large and widely used jet. Lastly, DOE selected aircraft impact speeds of 550 kilometers per hour (340 miles per hour).

Based on this analysis, DOE determined that neither the engine nor engine shafts of any of the three aircraft would penetrate the wall of a transportation cask to a sufficient depth to cause a release of radioactive materials. Further analysis determined that if the impact and resultant fire caused a cask seal to fail, little radiation would escape and there would be less than 0.65 latent cancer fatality in the affected urban population. In the rural and suburban areas along the Mina rail alignment, the impacts would be even lower.

In selecting the high-energy density devices, DOE first performed a survey of weapons and devices that might be capable of penetrating a full-size spent nuclear fuel cask. From the many different types of weapons and devices the survey considered, the Department selected four general types for further evaluation: conical-shaped charges, contact-breaching charges, platter charges, and pyrotechnic torches. Analyses that subjected both simulated and actual spent nuclear fuel truck casks to the four types of high-energy density devices provided data for selection of a high-energy density device that would show the greatest potential to penetrate a full-size spent nuclear fuel cask and disperse its contents. As DOE reported in the Yucca Mountain FEIS (DIRS 155970-DOE 2002, Section 6.2.4.2.3), two specific high-energy density devices were chosen for more detailed analysis. The first high-energy density device was designed to produce the maximum cavity volume from its explosive impact, was near the weight limit that a single individual could carry, and had been used in the full-scale cask penetration test of a spent nuclear fuel truck cask. The second high-energy density device was an anti-tank weapon that was designed to achieve maximum penetration depth in an armored vehicle and could be delivered remotely using a launch and guidance system. DOE then modeled the incidents and benchmarked the results against the physical tests.

To assess the consequences of a weapon or device (also referred to as a high-energy density device) that penetrated a transportation cask, DOE selected a rail cask and two possible high-energy density devices, one of which had been shown through various physical tests to penetrate a cask. The rail cask for the analysis was based on a conceptual design similar in construction to casks the Nuclear Regulatory Commission has certified, such as the NAC-STC, NUHOMS MP187, NUHOMS MP197, HI-STAR 100, and others.

To estimate the potential consequences of a sabotage event in which a high-energy density device penetrated a rail cask, DOE, in the Yucca Mountain FEIS, referred to *Projected Source Terms for Potential Sabotage Events Related to Spent Fuel Shipments* to obtain estimates of the fraction of spent nuclear fuel materials that would be released (release fractions) (DIRS 104918-Luna et al. 1999, all). In this Rail Alignment EIS, the Department used the more recent release fraction estimates from “Release Fractions from Multi-Element Spent Fuel Casks Resulting from HEDD [high-energy density device] Attack” (DIRS 181279-Luna 2006, all) to estimate the consequences of such events involving spent nuclear fuel in rail casks. These more recent estimates of release fractions (DIRS 181279-Luna 2006, all) are based on the release fractions estimated in 1999 from *Projected Source Terms for Potential Sabotage Events Related to Spent Fuel Shipments* (DIRS 104918-Luna et al. 1999, all), but they also incorporate data from additional tests sponsored by *Gesellschaft für Anlagen - und Reaktorsicherheit* in Germany and conducted in France in 1994 that were not available for the 1999 report. These additional test data suggest that the consequences of the sabotage event DOE analyzed in the Yucca Mountain FEIS could be overstated by a factor of between 2.5 and 12.

The potential impacts of sabotage were assessed for rail shipments from Hazen to the Staging Yard at Hawthorne to the Rail Equipment Maintenance Yard. As with the maximum reasonably foreseeable accidents discussed in the Accidents section, four specific rail alignments were evaluated. The methods and data used to estimate the impacts of potential sabotage events are described in Appendix K.

For the four specific alignments there were no urban areas, as defined in U.S. Census Bureau population data. However, there were suburban areas and rural areas. Using alignment-specific 2000 Census population data escalated to the year 2067, the average population density in suburban areas along the alignments was 542 to 589 people per square kilometer (1,400 to 1,530 people per square mile) near Silver Springs, Nevada. The average population density along rural areas, escalated to the year 2067, ranged from 3.94 to 4.33 people per square kilometer (10.2 to 11.2 people per square mile).

The impacts of potential sabotage events are listed in Table 4-275. If a sabotage event occurred in a suburban area, the collective radiation dose is estimated to be 4,700 person-rem. The total latent cancer fatalities for people exposed during a sabotage event is estimated to be 2.8. If a sabotage event occurred in a rural area, the collective radiation dose is estimated to be 35 person-rem. The total latent cancer fatalities for people exposed during this sabotage event is estimated to be 0.021. Because these risks would be for the entire population, the risk for any single individual would be small.

In either a suburban or rural area, the maximally exposed individual would be located 100 meters (330 feet) from the sabotage event. The radiation dose for the maximally exposed individual is estimated to be 27 rem. The probability of a latent cancer fatality for the maximally exposed individual is estimated to be 0.016. [ED1]

The State of Nevada, in its scoping comments and comments on DOE's EISs related to Yucca Mountain, recommended that the DOE sabotage analysis address postulated attacks that involved, for example, multiple weapons, combinations of weapons that were designed to maximize release and dispersal of radioactive materials, environmental and population conditions unique to specific locations and locations with high symbolic value, large groups of well-trained adversaries, suicide attacks, and infiltration of trucking and railroad companies. The State of Nevada also suggested that DOE consider the potential for human error to exacerbate the consequences of such attacks on a transportation cask.

Table 4-275. Estimated radiological impacts for a sabotage event involving a rail shipping cask for suburban and rural areas.[a,b]

Impact	Suburban area[c]	Rural area[c]
Impacts to populations		
Population dose (person-rem)	4,700	35
Latent cancer fatalities	2.8	0.021
Impacts to maximally exposed individuals		
Maximally exposed individual dose (rem)	27	27
Probability of a latent cancer fatality	0.016	0.016

a. There are no urban areas for the four specific alignments.

b. Impacts are based on a sabotage event with High Energy Density Device 1 (DIRS 181279-Luna 2006, all).

c. Based on neutral atmospheric conditions and moderate wind speeds. These were defined as Class D stability class and a wind speed of 15 feet per second.

In support of the State of Nevada's contention that DOE has underestimated the potential consequences of a sabotage or terrorist attack, the state commissioned a study to reevaluate the DOE sabotage analysis and concluded that a scenario that used a high-energy density device, such as an antitank missile, would result in consequences about 10 times greater than those DOE estimated (DIRS 181892-Lamb et al. 2002, p. 19). The state has asserted that the antitank missile would penetrate both sides of a truck or rail cask and cause a much greater release than that DOE estimated (DIRS 181892-Lamb et al. 2002, p. 18), but has provided no credible scientific evidence for this assertion.

Nevada's assertion of higher consequences is contrary to the results of the DOE computer modeling, which the Department benchmarked to physical test results and which demonstrated that a weapon such as that in the state's study would not perforate both sides of the cask (DIRS 104918-Luna et al. 1999, all). In addition, the higher consequences the state predicted were a result of the selection of parameter values that are either incorrect, are based on views not generally accepted by the scientific community, or when taken together inappropriately result in compounding the adverse consequences of the scenarios analyzed. To illustrate:

- Cesium is a key contributor to dose in a release from a cask. In a spent nuclear fuel rod, cesium may reside in three locations: in the gap between the cladding and the fuel pellet, at fuel grain boundaries, and in the fuel matrix. The amount of cesium in the gap between the cladding and the fuel pellet ranges from 0.21 to 10.50 percent of the total cesium inventory, with an average of about 2.95 percent (DIRS 169987-BSC 2004, Table 6-3). The amount of cesium at the fuel grain boundaries ranges from 0.19 to 1.23 percent of the total cesium inventory, with an average of about 0.19 percent of the total cesium inventory (DIRS 169987-BSC 2004, Table 6-3). Collectively, the cesium inventory for the gap between the cladding and the fuel pellet and at the fuel grain boundaries is often referred to as the "gap inventory" and ranges from 0.40 to 11.73 percent of the total cesium inventory, with an average of about 3.7 percent (DIRS 169987-BSC 2004, Table 6-3). In accidents involving spent nuclear fuel, this cesium may be rapidly released if the cladding is ruptured.

  In Luna et al. (DIRS 104918-Luna et al. 1999, all), the release of cesium during a sabotage event had two components: the release of the cesium gap inventory in the disrupted spent nuclear fuel rods, and the release of cesium from the fuel matrix in the disrupted spent nuclear fuel rods. All the cesium in the matrix of the disrupted rods was assumed to be released to the cask cavity during a sabotage event. Because much more cesium is present in the fuel matrix than in the gap, the release of cesium was dominated by the release of cesium from the matrix, not the release of cesium from the gap. This is in contrast to most accidents involving spent nuclear fuel, where often only the gap inventory is released when the cladding is ruptured, and there is no release from the fuel matrix.

  To estimate its cesium release fraction, the state considered a DOE-funded study that estimated the cesium inventory in the gap to be as high as 9.9 percent, 33 times higher than the gap inventory the state said was used in the Luna study. The state apparently assumed that the entire cesium release fraction was proportional to the gap inventory, and accordingly multiplied the total release fraction used by Luna by 33. The state's approach is incorrect because it does not recognize that all of the cesium inventory, that is, the cesium in the gap and that in the matrix, was released to the cask cavity in the Luna study. By increasing the total release fraction by a factor of 33, the state's analysis effectively released 33 times the entire amount of cesium in the disrupted spent nuclear fuel rods, which is clearly incorrect.

- In this Rail Alignment EIS, DOE used the dose-to-health-effect conversion factor of 0.0006 latent cancer fatality per person-rem that both the Interagency Steering Committee on Radiation Standards (DIRS 174559-Lawrence 2002, all) and current DOE guidance (DIRS 178579-DOE 2004, pp. 22 to 24) recommend. This value is consistent with the lethality-adjusted cancer risk coefficients from the *2007 Recommendations of the International Commission on Radiological Protection*, 0.00041 per person-rem for workers and 0.00055 per person-rem for individuals among the general population (DIRS 182836-ICRP 2008, p. 53); the dose-to-health-effect conversion factors published by the National Research Council in the *Health Risks from Exposure to Low Levels of Ionizing Radiation, BEIR VII Phase 2* (DIRS 181250-National Research Council 2006, p. 15), which ranged from 0.00041 to 0.00061 latent cancer fatality per person-rem for solid cancers and 0.000050 to 0.000070 latent cancer fatality per person-rem for leukemia; and the age-specific dose-to-health-effect conversion factor published by the Environmental Protection Agency, 0.000575 latent cancer fatality per person-rem (DIRS 153733-EPA 2000, Table 7.3, p. 179).

The Dose and Dose Rate Effectiveness Factor (DDREF) is used to account for the lower cancer risks of radiation exposures at low doses and low dose rates as compared with radiation exposures at high doses and high dose rates. The State of Nevada used a dose-to-health-effect conversion factor of 0.001 latent cancer fatality per person-rem, which the state estimated by not including a DDREF (that is, by using a DDREF of 1) (DIRS 181892-Lamb et al. 2002, p. 7). The state cites as support for this argument an article by Pierce and Preston. In response, DOE notes that the use of a DDREF of 1.5 to 2 is supported by both the National Research Council (DIRS 181250-National Research Council 2006, p. 15) and the International Commission on Radiological Protection (DIRS 182836-ICRP 2008, p. 53).

The state also points out that the dose-to-health-effect conversion factor depends on age and gender. However, the dose-to-health-effect conversion factors developed by the International Commission on Radiological Protection, the National Research Council, and the Environmental Protection Agency already consider age and gender and so no further adjustment to the dose-to-health-effect conversion factor is necessary.

- The degree of dispersal of radioactive particles is proportional to the height at which the radioactive particles are released; the lower the height at which the particles are released, the less the dispersion and the higher the consequences. In its study, the state used a release height for all particles of 1.508 meters (4.95 feet) for a truck cask and 2.08 meters (6.82 feet) for a train cask (DIRS 181892-Lamb et al. 2002, p. 6). These release heights are not realistic because they do not account for plume rise as a result of the explosive action of a high-energy density device. In contrast, DOE accounted for plume rise by using multiple release heights and estimated that 4 percent of the release would occur at a height of 1 meter (3.3 feet), 16 percent at 16 meters (52 feet), 25 percent at 32 meters (100 feet), 35 percent at 48 meters (160 feet), and 20 percent at 64 meters (210 feet) (DIRS 157144-Jason Technologies 2001, p. 189). Indeed, the state acknowledged that an increase in the release height would result "in a decrease in the dose to the MEI [maximally exposed individual]" (DIRS 181892-Lamb et al. 2002, p. 6).
- The meteorological conditions at the time of release from a cask have a bearing on the consequences. The state chose to use stable atmospheric conditions (Class F stability), which represent plume concentrations that would not be exceeded 95 percent of the time in its analysis (DIRS 181892-Lamb et al. 2002, p. 6). In contrast, because it is not possible to forecast the environmental conditions that might exist during an act of sabotage, DOE used neutral atmospheric conditions (Class D stability), which represent plume concentrations that would not be exceeded 50 percent of the time.

DOE recognizes that it could analyze scenarios with, for example, higher aircraft impact velocities or weapons with greater destructive capabilities, or it could postulate scenarios with combinations of factors, such as human error and suicide attacks, as the state suggested, that could produce a much broader range of consequences that are more detrimental than those this Rail Alignment EIS estimates. As an initial matter, for an act of sabotage or terrorism to be carried out, the persons responsible for such acts would have to overcome the security measures in place. The intent of safeguards and security measures (see Transportation Sabotage Considerations) is to thwart such attacks and, in any event, the measures would tend to minimize the consequences of such an attack. The scenarios DOE analyzed are conservative because the Department did not consider the effectiveness of such measures, and that such measures would make the likelihood of a sabotage event even lower.

Further, and setting aside the security measures that would be in place, the effectiveness of a sabotage event would depend on a number of critical factors such as the ability to deliver the weapon perpendicular to the circular surface of a relatively small object (a rail cask is about 2.26 meters [7.4 feet] in diameter and 5.18 meters [17 feet] long), which might be in transit and thus a moving target, the extent to which the individual had the knowledge to select and the training to use the appropriate weapon, and whether the weapon was at the optimal distance from the cask.

As with any aspect of environmental impact analysis, it is always possible to postulate scenarios that could produce higher consequences than previous estimates. In eliminating the requirement that agencies conduct a worst-case analysis, the Council on Environmental Quality has pointed out that "one can always conjure up a worse 'worst case'" by adding more variables to a hypothetical event (50 *FR* 32234, August 8, 1985), and that "'worst case analysis' is an unproductive and ineffective method … one which can breed endless hypothesis and speculation" (51 *FR* 15620, April 25, 1986). As indicated in the Council on Environmental Quality regulations that implement NEPA, an agency has a responsibility to address reasonably foreseeable significant adverse effects. The evaluation of impacts is subject to a "rule of reason," ensuring analysis is based on credible scientific evidence useful to the decisionmaking process. In applying the rule of reason, an agency does not need to address remote and highly speculative consequences in its EIS. The crafting and analysis of the scenarios the state suggested would be based on conjecture and would not have the support of credible scientific evidence.

DOE has required enhanced security measures to protect against plausible threat scenarios and developed emergency planning requirements that would mitigate potential consequences for certain scenarios. For all the reasons discussed above, DOE believes that under general threat conditions, the probability of a sabotage event against a transportation cask that carried spent nuclear fuel or high-level radioactive waste that could result in a major radiological release would be low. Nevertheless, DOE has taken a hard look by examining potential, but fundamentally different, sabotage scenarios.

4.3.10.2.3 Nonradiological Transportation Impacts

4.3.10.2.3.1 Construction Impacts.

Nonradiological Roadway Accidents During construction, personnel and equipment would be moved initially by truck and other vehicles, and could be moved by rail once portions of the rail line were completed. Such movements of equipment and personnel could lead to roadway accidents.

DOE estimates that the construction phase would involve approximately 2,160 full-time-equivalent workers during the first three years, 750 full-time-equivalent workers in the fourth year, and 370 full-time-equivalent workers in the last year for a total of 7,600 full-time-equivalent workers, not including the Cask Maintenance Facility (DIRS 174083-WPI 2003, all; DIRS 180874-Nevada Rail Partners 2007, Appendix D, Tables 1 and 2). The construction phase would take a minimum of 4 years and 6 months. The Cask Maintenance Facility construction would involve additional 150 workers for 88 weeks.

In total, this suggests that there would be 7,600 full-time workers involved in the construction of the rail line and associated facilities over the minimum 4.5-year construction project and an additional 260 full-time-equivalent workers for construction of the Cask Maintenance Facility. The exact distribution over time is not significant for the traffic safety calculations, which are aggregated over the total construction time. In other words, if the construction phase were assumed to take place over a 10-year period, this would only mean that fewer workers would be making more trips; this would result in a similar total number of trips as the minimum 4.5-year construction phase.

For each year, it is assumed that each worker would make two trips per day over five days a week for 50 weeks a year (that is 2,000 hours per year full-time-equivalent workers). To provide a conservative upper bound estimate of roadway accidents, DOE assumed that all workers would individually make daily vehicle trips on roadways, even though it is likely that many rail line construction workers would reside in construction camps linked to work sites by access roads. Each trip is assumed to be 80 kilometers (50 miles) in length, which translates to approximately 40,000 kilometers (25,000 miles) per year per worker. While the distances involved for portions of this construction project are obviously much greater, a worker might travel hundreds of miles each way every one to two weeks and stay in the construction camps between these longer trips. This travel pattern would result in approximately the same distance traveled per worker. Collectively, the total number of miles driven by all workers would be approximately 315 million kilometers (190 million miles).

Based on a fatal accident rate of 1.65 fatalities per 100 million vehicle-kilometers (2.66 per 100 million vehicle-miles) (DIRS 180484-FHWA 2006, p. 1, Section V, Tables FI-20 and VM-2) traveled for light trucks or passenger cars in rural areas in Nevada, approximately six fatalities could occur due to the movement of workers during construction of the rail line and facilities.

These estimates would not vary among the proposed specific alignments, because the number of potential fatalities is based on the total distance traveled and is not dependent on the minor difference in the length or location of the alternative segments. Therefore, the predicted accident rates are the same for each specific alignment.

Nonradiological Rail Line Accidents During the construction phase, there are expected to be up to 368 loaded trains servicing the Schurz area, 1,116 for the Mina common segment 1 and Montezuma areas, and 1,260 for the Mina common segment 2 area (DIRS 180874-Nevada Rail Partners 2007, Appendix A) as the portions of the rail line that had already been completed were used to bring critical materials to the various staging areas (the length of line constructed from a particular staging area would influence the number of trains used on each segment of the partially completed rail line). A shorter construction phase would result in more trains per day, and a more extended construction phase would likely experience the lower end of the range of expected train volume.

Given the variability in the number of trains per day or year, this analysis focuses on the total number of inbound loaded and outbound unloaded construction trains, which is predicted to be 5,488 ([368 + 1,116 + 1,260] × 2). These trains would travel at speeds between 24 and 64 kilometers (15 and 40 miles) per hour depending on both the load carried and the area in which they operate. It is assumed that each train would travel one-half of the total route length (accounting for only new rail segments), or approximately 230 kilometers (144 miles) on average. Therefore, the total number of train-kilometers would be approximately 1.3 million kilometers (787 thousand miles). The total expected number of loaded railcars (including locomotives) during the construction phase are 8,240 for the Schurz area, 25,020 for the Mina common segment 1 and Montezuma areas, and 30,540 for the Mina common segment 2 area. The total number of inbound loaded and outbound unloaded construction railcars is predicted to be 127,600 ([8,240 + 25,020 + 30,540] × 2), resulting in approximately 29 million railcar-kilometers (18 million railcar-miles).

The transportation safety impacts of concern during construction focus on rail-related accidents and worker and public fatalities. Based on the same rail accident rates described in the operations phase (Section 4.3.10.2.3.2), accidents associated with train-kilometers and railcar-kilometers are calculated. A total of two rail accidents would be expected to occur for the entire set of estimated train and railcar movements during construction.

Based on Federal Railroad Administration statistics, the fatality rate for workers is 3.46×10^{-10} fatality per railcar-kilometer traveled, and the rate for occupants of other vehicles and pedestrians is 1.11×10^{-8} fatality per railcar-kilometer traveled (DIRS 178016-DOT 2005, Chapter 1, all). Rates were derived by considering fatalities associated with freight train operations only (fatalities associated with passenger train operations were omitted for more applicable rates). As a result, the worker category considers worker-on-duty, worker-not-on-duty, contractor-on-duty, and contractor-other. Public fatalities include both trespassers and nontrespassers. Because passenger operations are not relevant to the Proposed Action, there is no consideration of the passengers-on-train category.

Based on these fatality rates, a total of 0.4 fatality (that is, not more than one) would be expected to occur for the entire set of estimated railcar movements during construction. No detectable difference is expected for the specific alignments, as the total variation in route lengths is small (greatest difference would be between Schurz alternative segments 6 and 1, which is a 20-kilometer [13-mile] difference).

Many movements of rail-mounted construction equipment are also anticipated. This equipment would travel fairly short distances each day to conduct activities such as setting out railroad ties or preparing the ballast. These movements have not been included in the count of train-kilometers as they would occur in controlled work areas and in very small increments, rather than at any measurable speed in a publicly accessible area.

4.3.10.2.3.2 Operations Impacts.

Nonradiological Roadway Accidents The assessment of impacts to transportation safety begins with accidents, such as may be experienced by any vehicle, independent of cargo. These accidents typically result in injuries or fatalities to drivers or operators, other motorists, or pedestrians, and could result from the movement of cargo.

Approximately 210 workers would be involved in the operation of the rail line and the facilities. Each year it is assumed that each worker would make two trips per day, over 5 days a week, for 50 weeks a year. It is assumed that each trip would be 80 kilometers (50 miles). This would result in 40,000 kilometers (25,000 miles) per year per worker. Collectively, over the 50-year operations phase, the total number of kilometers driven by workers would be approximately 420 million kilometers (263 million miles).

Based on a fatal accident rate of 1.65 fatalities per 100 million vehicle-kilometers (2.66 per 100 million vehicle-miles) traveled for light trucks or passenger cars in rural areas in Nevada (DIRS 180484-FHWA 2006, p. 1, Section V, Tables FI-20 and VM-2), approximately seven fatalities would be expected due to the movement of workers during operation of the rail line and facilities over 50 years of operation. These estimates are not specific to the specific alignments, because the small variations in length and location of the alternative segments would not significantly affect the total distance traveled.

Nonradiological Rail Line Accidents The rail transportation safety analysis for the operations phase of the Proposed Action assesses the impacts of transportation, rail facilities, and grade crossings.

Rail Alignment: The proposed rail line would range from 521 to 571 kilometers (approximately 255 to 285 miles) in length, depending on which alternative segments are chosen. Given the similarities in the lengths of the alternative segments, the longest specific alignment has been selected to conservatively estimate the overall accident risks for the rail line.

This analysis includes both dedicated railcar cask trains and other trains not involving casks from the Staging Yard to the Rail Equipment Maintenance Yard. A typical spent nuclear fuel or high-level radioactive waste train would have two to three locomotives, followed by a buffer car, one to five cask cars, another buffer car, and an escort car. two engines, followed by a buffer car, three cask cars, another buffer car, and an escort car. The actual number of casks per train could vary from one to five, while the number of locomotives could vary from two to three. The total number of casks that would be moved by rail is 9,495. Based on TSM (Total System Model) runs, there would be 2,833 trains carrying loaded casks and an equal number carrying empty casks. Therefore, to determine the impacts of moving cask cars, the analysis considers 5,666 trains (2,833 × 2) involving cask cars. The TSM runs also give the total number of railcars involved in cask trains, with an average of 8.54 cars per train (3.35 cask cars, 2.19 locomotives, two buffer cars, and one escort car). Over the 50-year operations phase, there would be approximately 48,408 railcars associated with cask trains.

In addition to trains involving cask cars, there are also other types of trains that would be operating along the rail line, including maintenance-of-way trains (two one-way trains per week), and repository supply and construction trains (seven one-way trains per week). The total number of trains not involving casks would be 23,400 over 50 years of operation. The total number of railcars not carrying casks would be 58,338, accounting for both loaded and unloaded cars (DIRS 180876-Nevada Rail Partners 2007, Section 4.0, Table 1).

The total number of railcars (all kinds) moved under the Proposed Action would be approximately 106,746 (48,408 + 58,338), considering both directions of travel. Based on the same fatality rates used in the construction analysis, namely 3.46×10^{-10} fatalities per worker per railcar-kilometer, and 1.11×10^{-8} fatalities per pedestrian per railcar-kilometer, 0.7 fatality (that is not more than one) would be expected to occur for the entire set of estimated railcar movements during operation.

The interchange tracks at the Staging Yard would operate like a typical large siding or other similar types of rail yards, so the hazards associated with its operation would be the potential for transport accidents. However, because the buffer cars, cask cars, and escort car would be separated as a unit from the trains used to transport the casks from their origins, there would be limited changes for derailments involving the cask cars on the Staging Yard tracks. Accidents in yards typically occur as individual cars are handled, not with complete sets of cars. Accidents during the handling of railcars also occur at very low speeds, further limiting the chance of an accident. Because the trains are expected to enter the interchange track from the branchline at normal track speed, the accident rate for the interchange tracks at the Staging Yard would be based on mainline accident rates rather than yard accident rates.

Accident rates for rail transportation are generally presented as either accidents per train-kilometers or a combination of accident rates based on both train-kilometers and railcar-kilometers, considering these two classes of accident causes separately. Review of Federal Railroad Administration statistics and industry data on the distribution of track classes produced the accident rates given in Table 4-276 for Track Class 3 (DIRS 180220-Bendixen and Facanha 2007, all). These rates include derailments and collisions from a variety of causes, including track failures resulting from geological hazards. These accident rates reflect railroad operations involving general freight service. Dedicated train service, which would be used to move cask railcars to the Rail Equipment Maintenance Yard, would follow stringent safety regulations.

Table 4-276. Estimated rail accident rates.[a]

Accident location	Accident rate per train-mile	Accident rate per car-mile	Combined accident rate per train-mile for 8-car train
Mainline track	1.2×10^{-6}	2.7×10^{-8}	1.4×10^{-6}

a. Source: DIRS 180220-Bendixen and Facanha 2007, all.

Additionally, dedicated train service has increased control and command capabilities, since shorter trains allow better visual monitoring from the locomotive and the escort car. Therefore, the accident rates here included provide a conservative estimate of the number of accidents involved in the operations of the rail line.

While not all accidents would lead to derailments of any railcars, any accident is likely to require the train to be inspected and other precautions to be taken. Hence, this analysis conservatively considers all accidents involving cask cars. In addition, a number of design and operating changes for dedicated trains have been predicted to reduce accident rates for dedicated trains, but to maintain conservatism, these potential benefits are not considered here.

Based on the lengths of each alternative segment and common segment, and the combined accident rate for an 8.54-car train (that is, 8.95×10^{-7} accident per train-kilometer), the predicted accident counts are given in Table 4-277 for the full set of cask shipments expected during the entire operations phase (that is, the analysis considers the 5,666 trains involving cask cars, which includes both directions). For accidents not involving cask trains, the total number of accidents was calculated by adding the accidents associated with the number of trains and the accidents associated with the number of railcars. For purposes of this analysis, DOE used the longest specific alignment. Because the upper bound of the accident rate is so small for the specific alignments, there would be no discernable difference.

As shown in Table 4-277, a total of approximately three accidents involving cask trains would occur over the 50-year operations phase. While potential consequences could involve environmental damage, evacuation costs, and human-health impacts, the focus of the frequency analysis is on scenarios that could lead to human-health impacts as discussed in greater detail elsewhere in this section. The total number of accidents involving trains that do not carry casks would be approximately 11 for 50 years of operation. Therefore, the total number of predicted rail accidents would be approximately 14.

Rail Facilities: The analysis of potential incidents at rail facilities was based on the types of activities and operations that are expected to be carried out at such facilities. The scenarios of concern relate primarily to transportation accidents at the Staging Yard. The likelihoods of accidents are based on both available failure and accident rates, and on the number of switchovers that would need to be made. The results for accident potential at the Staging Yard are included within the calculations for Table 4-277.

The Rail Equipment Maintenance Yard and the geologic repository operations area interface are essentially rail yards in terms of the operations that would occur there: train make-up and car switching. Casks would be removed from the railcars at the geologic repository operations area and empty casks would be placed back onto railcars at the Rail Equipment Maintenance Yard. The results for accident potential at the Rail Equipment Maintenance Yard and the geologic repository operations area interface are also included within the calculations for Table 4-277 (common segment 6).

Grade Crossings: DOE also examined the consequences of the Proposed Action on delay and safety conditions for at-grade crossings along the proposed rail alignment. Delay considerations are discussed in Section 4.3.9. The examination of grade-crossing safety typically considers the expected number and locations of grade crossings, the volume of both vehicle and rail traffic at crossings, the nature of road traffic (for example, trucks versus passenger vehicles), the design and safety features of the crossings, and train and vehicle speeds in the vicinity of any crossings. Grade-crossing collisions reported as train accidents are included in the number of rail accidents estimated in Table 4-277. Accidents at grade crossings are accounted for in the rail accident estimates included in this analysis.

Grade-crossing safety is influenced by the type of protection installed at each crossing. Most of the crossings for this project would involve very low-usage unpaved roads that would mainly involve passive warning systems (such as cross-bucks and stop signs), or paved roads that might have active warning systems (such as flashing lights and gates). The exception is the existing rail segment between Hazen and Wabuska, which crosses public roads with moderate traffic (that is, U.S. Highway 50 in Silver Springs and U.S. Highway 95A in Churchill and Wabuska). Even with the additional rail traffic generated by the Proposed Action, these grade crossings would not meet any of the conditions established by the U.S. Department of Transportation to be considered for grade separation (such as maximum highway and train speed, average daily road and rail traffic, crossing exposure, vehicle delay) (DIRS 180695-DOT 2002, all). Although grade-separated crossings are not mandatory for this project, DOE would be providing up to five grade-separated crossings on state and federal highways as identified in Chapter 2. The numbers of crossings with each type of protection are listed in Table 4-278 for each rail line alternative segment and common segment. Table 2-23 provides a detailed list of grade crossings.

Table 4-277. Estimated number of predicted rail accidents.[a]

Rail alignment segment	Segment length (longest alternative segment, in miles)[b]	Predicted number of accidents	
		Involving cask trains	Not involving cask trains
Union Pacific Railroad Hazen Branchline	43	0.35	1.28
Department of Defense Branchline North	5	0.04	0.15
Schurz alternative segments	45	0.37	1.34
Department of Defense Branchline South	22	0.18	0.65
Mina common segment 1	72	0.61	2.22
Montezuma alternative segments	88	0.71	2.60
Mina common segment 2	2.1	0.02	0.06
Bonnie Claire alternative segments	13	0.11	0.39
Common segment 5	25	0.20	0.74
Oasis Valley alternative segments	9	0.07	0.26
Common segment 6 (including Rail Equipment Maintenance Yard)	32	0.26	0.95
Total	355	2.91	10.63

a. During 50-year operation.
b. To convert miles to kilometers, multiply by 1.6093.

4.3.10.2.3.3 Transportation of Munitions. Under the Mina Implementing Alternative, any of the Schurz alternative segments would route existing rail traffic, including munitions shipments and other shipments to and from the Hawthorne Army Depot, around the town of Schurz, and the existing Department of Defense Branchline through Schurz would no longer be used. A safe distance would be maintained between munitions trains and cask trains at all times at the Staging Yard. Therefore, munitions trains would not represent a hazard to cask trains.

U.S. Army quantity-distance calculations provide an assessment of the distance to public traffic routes and distance to inhabited buildings for storage or transportation of munitions. Public traffic route distances consider the transient nature of the exposure and are calculated as 60 percent of the inhabited building distance (DIRS 181032-Dillingham 2007, all).

According to Department of the Army Pamphlet 385-64, Table 5-1, a distance to public traffic route of 725 meters (2,380 feet) and a distance to inhabited building of 1,210 meters (3,970 feet) apply to munitions shipments of the types made along the existing rail line. The Army has indicated that there should be an easement of at least 725 meters on either side of the tracks (no building) along the entire route. This is based on 60 percent of the inhabited building distance of 1,210 meters (DIRS 181032-Dillingham 2007, all). There are no inhabited buildings identified within this distance for any of the Schurz alternative segments, as shown in Figure 4-49. As the figure shows, the closest point along any of the four Schurz alternative segments to the town of Schurz is 6.1 kilometers (3.8 miles) for Schurz alternative segment 1, 10.5 kilometers (6.6 miles) for Schurz alternative segment 4, 10.6 kilometers (6.6 miles) for Schurz alternative segment 5, and 12.1 kilometers (7.6 miles) for Schurz alternative segment 6. As also shown in the figure, there are only four grade crossings for Schurz alternative segments 1, 4, and 5, and only three grade crossings for Schurz alternative segment 6, compared with the nine grade crossings in the town of Schurz along the existing Department of Defense Branchline.

Table 4-278. Number of grade crossings with primary roads.[a]

Rail alignment segment	Passive protection	Active protection	Grade separation
Union Pacific Railroad Hazen Branchline[b]	7	6	None
Schurz alternative segments	None	None	1
Department of Defense Branchlines	1	None	None
Mina common segment 1	None	None	2
Montezuma alternative segments	None-1[c]	None-1[c]	None-1[c]
Mina common segment 2	None	None	None
Bonnie Claire alternative segments	None	None	None
Common segment 5	None	1	None
Oasis Valley alternative segments	1	None	None
Common segment 6	None	None	None
Totals	9/10	7/8	3/4

a. This list does not include all grade crossings.
b. The Union Pacific Railroad Hazen Branchline is part of the region of influence for the purposes of the transportation impact assessment; however, it is not part of the Mina rail alignment.
c. This depends on the specific alternative segment.

4.3.10.3 Shared-Use Option

4.3.10.3.1 Nonradiological Impacts

4.3.10.3.1.1 Impacts to Workers. Railroad construction and operations nonradiological occupational health and safety impacts for the Shared-Use Option would be approximately the same as for the Proposed Action, based on the construction and operation of the proposed rail line. It is assumed that construction of the proposed rail line for the Shared-Use Option would require approximately the same number of workers and labor hours, and approximately the same amount of construction materials and equipment as would construction of the proposed rail line for the Proposed Action.

Rail line facility construction and operations nonradiological occupational health and safety impacts for the Shared-Use Option would be approximately the same as for the Proposed Action, based on the construction and operation of the proposed rail line and associated facilities. It is assumed that the construction of the railroad facilities under the Shared-Use Option would require approximately the same number of workers and labor hours, and approximately the same amount of construction materials and equipment as would construction of the facilities under the Proposed Action, and that the configuration and operation of the facilities, including emergency response systems, would be the same for both the Proposed Action and Shared-Use Option.

4.3.10.3.1.2 Impacts from Specific Resource Areas. Rail line construction and operations nonradiological occupational health and safety impacts related to the specific resource areas discussed in Section 4.3.10.2.1.1 would be approximately the same for the Shared-Use Option as for the Proposed Action, based on the construction and operation of the proposed rail line.

4.3.10.3.2 Radiological Impacts

4.3.10.3.2.1 Impacts to Workers. It is anticipated that worker health and safety impacts from the Shared-Use Option are similar to those for the Proposed Action, with the exception of radiological occupational exposure impacts. One difference would be the number of times a loaded cask train would pass workers at sidings. For the Proposed Action, there could be up to about 30 passes involving loaded cask trains and other trains over the life of the rail shipping campaign. A cask train could pass more than one shared-use train between the Staging Yard and the Yucca Mountain Site boundary (DIRS 180876-Nevada Rail Partners 2007, all). This would result in a collective radiation dose of 0.0013 person-rem for these workers. This is equivalent to a probability of a latent cancer fatality of 7.7×10^{-7}. For the Shared-Use Option, there could be up to about 60 passes involving loaded cask trains and other trains over the life of the rail shipping campaign. A cask train could pass more than one shared-use train between the Staging Yard and the Yucca Mountain Site boundary. This would result in a collective radiation dose of 0.0028 person-rem for these workers. This is equivalent to a probability of a latent cancer fatality of 1.7×10^{-6}.

4.3.10.3.2.2 Impacts to the Public. It is anticipated that radiological health and safety impacts for the Shared-Use Option would be similar to those for the Proposed Action with the exception of radiological occupational exposure impacts. The additional trains that would be operated for the Shared-Use Option would not involve transportation of radioactive materials and therefore there would be no additional exposure to the public.

4.3.10.3.3 Nonradiological Transportation Impacts

4.3.10.3.3.1 Construction Impacts.

Nonradiological Roadway Accidents Under the Shared-Use Option, any increase beyond what is described under the Proposed Action for roadway accidents and fatalities would be minimal. The collective impact would be expected to be less than 1 percent of the overall risk calculated for construction of the Proposed Action rail line. Therefore, impacts are considered to be the same as those identified for the Proposed Action.

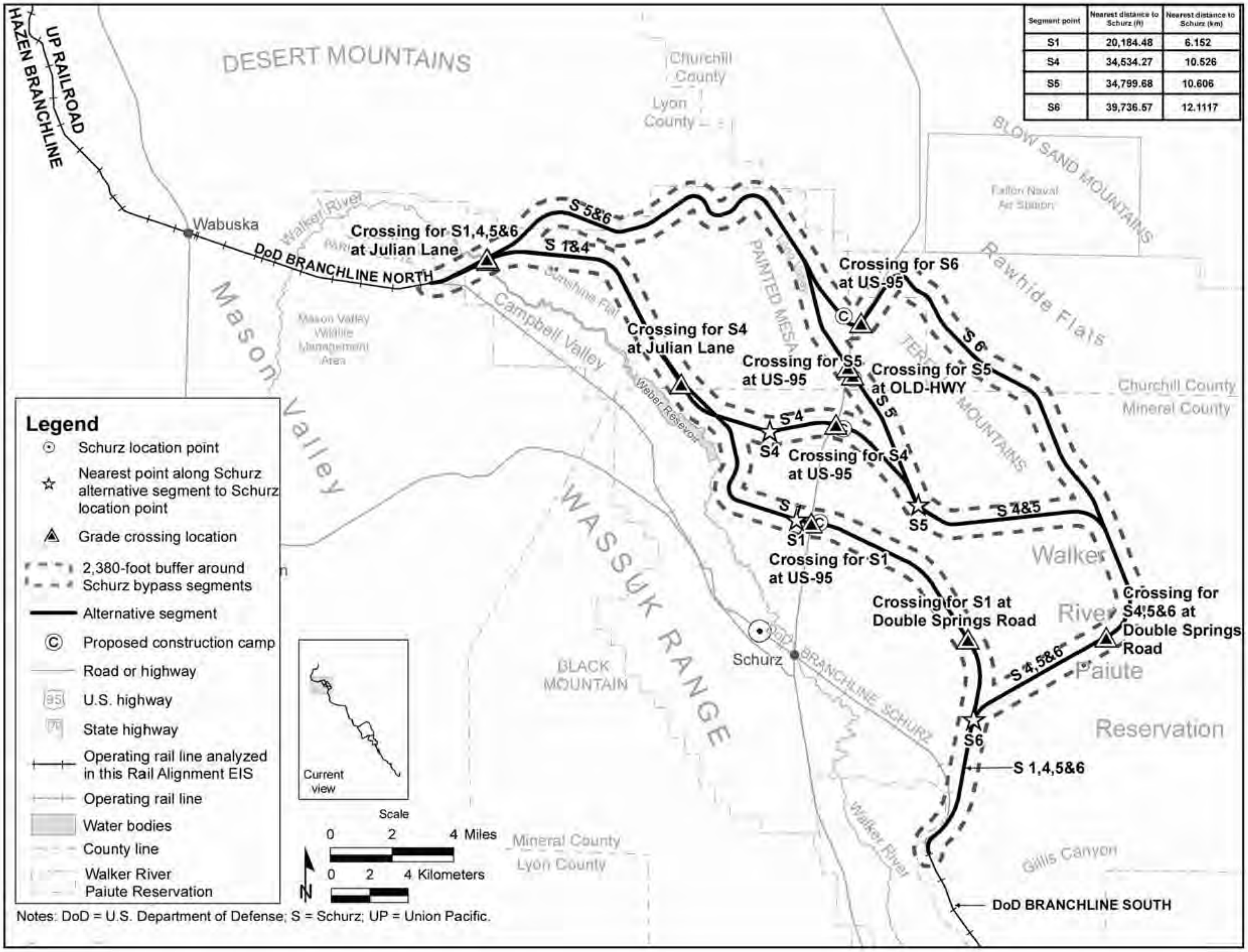
Nonradiological Rail Line Accidents No commercial rail transports would be conducted during construction of the Shared-Use Option. Under the Shared-Use Option, any increase beyond what is described under the Proposed Action for rail line accidents and fatalities would be minimal. The collective impact would be expected to be less than 1 percent of the overall risk calculated for construction of the Proposed Action rail line. Therefore, impacts are considered to be the same as those identified for the Proposed Action.

4.3.10.3.3.2 Operations Impacts.

Nonradiological Roadway Accidents Under Shared-Use Option operations, any increase beyond what is described under the Proposed Action for roadway accidents and fatalities would be minimal. Impacts are considered to be the same as those identified for the Proposed Action.

Nonradiological Rail Line Accidents The rail transportation safety analysis for the operations phase of the Shared-Use Option assesses the impacts of transportation, rail facilities, and grade crossings.

Rail Alignment: The Shared-Use Option differs from the Proposed Action only in the amount and type of traffic that would use different portions of the proposed rail line and the composition of some of the trains in terms of both length and materials categories. Up to ten commercial train trips (five round trips) a week would expected along the entire alignment, and up to eight commercial train trips (four round trips) a week would be expected from Hazen to the Schurz area. Each train would consist of up to four locomotives and up to 60 railcars (DIRS 180694-Ang-Olson and Gallivan 2007, all). For comparison, an average total of 17 one-way trains would run between the Staging Yard and the geologic repository per week carrying casks, repository construction and supplies materials, and other materials for maintenance-of-way activities. It is anticipated that the trains would travel at 64 kilometers per hour (40 miles per hour). The addition of the commercial trains would have a small impact on the potential for an accident involving a cask car, as operational procedures and controls regarding both scheduling and the use of



Segment point	Nearest distance to Schurz (ft)	Nearest distance to Schurz (km)
S1	20,184.48	6.152
S4	34,534.27	10.526
S5	34,799.68	10.606
S6	39,736.57	12.1117

Figure 4-49. Inhabited building distance for Schurz bypass segments.

sidings would restrict the interactions of the two types of trains. Trains carrying cask cars would take precedent. The overall density of trains on the proposed rail line would still be considered low, even with the commercial trains added in, so additional risk of an accident involving cask cars due to increased traffic densities would be minimal.

During the peak level of transportation operations along the rail line, there could be 17 trains servicing the repository each week (eight cask trains, seven repository construction and supplies trains, and two maintenance-of-way trains, or 17 one-way trips), and 18 commercial trains (nine round trips). During these peak years, the transportation safety impacts associated with nonradiological risks might increase by approximately 100 percent. Over the full 50-year operating lifetime of the rail line, the Shared-Use Option could result in an additional 46,800 trains, considering each direction separately (18 one-way trains per week). Assuming that 10 trains would travel the full length of the rail line and eight trains would travel from Hazen to Schurz, an additional 17.9 million train-kilometers would be generated over 50 years. Based on a list of potential shippers, demand estimates were developed (DIRS 180694-Ang-Olson and Gallivan 2007, all). A total of 524 weekly carloads are expected to be shipped along different portions of the rail line. According to the location and demand of each potential shipper, it was estimated that each loaded car would travel an average of 188 kilometers (117 miles). Considering both directions of travel, this would result in approximately 512 million car-kilometers over 50 years (524 cars × 52 weeks × 50 years × 188 kilometers × 2). Assuming the same rail fatality and accident rates included in Sections 4.3.10.2.3.1 and 4.3.10.2.3.2, respectively, a total of six additional fatalities and 22 additional accidents would be expected to occur for the entire set of estimated railcar movements during Shared-Use Option operations. Rail accidents are not allocated to specific rail line segments due to the uncertainty of where those accidents will occur.

In general, the operating characteristics of these commercial trains are unknown at this time; therefore, the travel times and operational movements of these trains cannot be described. However, the Nevada Railroad Control Center described under the Proposed Action would control and coordinate commercial rail service movements and would therefore maintain overall safety of operations along the rail line to minimize potential rail accidents.

Rail Facilities: The Rail Equipment Maintenance Yard and the geologic repository operations area interface would not be affected by any shared use of the proposed rail line because commercial shippers would not use the DOE Rail Equipment Maintenance Yard. Many of the commercial railcars would be dropped off along the way at intermittent commercial facilities. As a result, the commercial service end-of-line facility would have significantly less car handling than the Rail Equipment Maintenance Yard, and operations at the commercial facility would have no impact on the number of accidents involving the cask cars.

Grade Crossings: The increased number of trains under the Shared-Use Option would slightly increase the potential for accidents because of the increased number of trains crossing each at-grade crossing (with a maximum of nine round trips per week). However, because this volume of commercial traffic would be low, adverse impacts would be small. Delay considerations were included in Section 4.3.9. Even with the additional rail traffic from the Shared-Use Option, the grade crossings would still not meet any of the conditions established by the U.S. Department of Transportation to be considered for grade separation (DIRS 180695-DOT 2002, all).

4.3.10.4 Summary

This section summarizes nonradiological occupational health and safety impacts, public and occupational radiological impacts, and nonradiological transportation impacts under the Proposed Action and the Shared-Use Option for the Mina rail alignment.

Alignment segments and facility locations are not relevant to the nonradiological transportation impacts analysis or to the nonradiological occupational health and safety impacts analysis. Nonradiological occupational health and safety impacts depend on the number of construction and operations full-time-equivalent workers. Nonradiological transportation impacts depend on the number of construction and operations full-time-equivalent workers and the number of casks transported. Therefore, there are no important differences among alignments or facility locations in relation to nonradiological transportation impacts or nonradiological occupational health and safety impacts.

Radiological impacts for the Mina rail alignment are estimated based on the longest-distance alignment, the shortest-distance alignment, the alignment with the highest population density, and the alignment with the lowest population density. There are no important differences among alignments with respect to radiological impacts for the Mina rail alignment.

All nonradiological transportation impacts for construction and operations, including vehicle-related fatalities, rail-related accidents, and rail-related fatalities, are considered to be long-term impacts. Nonradiological occupational health and safety incidents for construction and operation could be either short term (such as lost workday cases involving short-term disability) or long term (such as lost workday cases involving long-term disability). However, because there is no way to distinguish the duration of a specific lost workday case, for example, all nonradiological occupational health and safety impacts are deemed to be long-term impacts. All radiological impacts from railroad and facility operations are considered long-term impacts because such impacts would be experienced over the 50-year operating life of the railroad. Nonradiological transportation impacts, nonradiological occupational health and safety impacts, and radiological impacts would be direct impacts.

4.3.10.4.1 Nonradiological Occupational Impacts

Tables 4-279 and 4-280 summarize nonradiological impacts to workers from industrial hazards associated with railroad construction and operations under the Proposed Action. Impacts to involved workers and noninvolved workers and total impacts are shown in Table 4-263 for rail line construction and operations and in Table 4-264 for associated facility construction and operations. No construction or operations activities would occur under the No-Action Alternative. Therefore, there would be no occupational or public health and safety impacts associated with the No-Action Alternative.

Table 4-279. Estimated impacts to workers from nonradiological industrial hazards during rail line construction and operations under the Proposed Action.

	Construction		Operations	
	Labor hours worked	Incidents	Labor hours worked	Incidents
	13.0 million		2.9 million	
Total recordable cases		325		37
Lost workday cases		180		28
Fatalities		0.65		0.26

Table 4-280. Estimated impacts to workers from nonradiological industrial hazards during rail line facility construction and operations under the Proposed Action.

Group and industrial hazard category	Construction		Operations	
	Labor hours worked	Incidents	Labor hours worked	Incidents
	2.7 million		15.0 million	
Total recordable cases		75		361
Lost workday cases		42		220
Fatalities		0.01		1.09

Table 4-279 includes nonradiological impacts of construction and operation of the rail line under the Proposed Action including construction of the rail line, construction and operation of the construction work camps, construction and operation of quarries to produce ballast for construction activities, construction and operation of wells to produce water for construction activities, operation of construction trains, and construction and operation of batch plants to produce concrete for construction activities. Operations impacts include impacts to train crews and escort and security personnel. Table 4-281 summarizes the nonradiological impacts of construction and operation of rail line facilities under the Proposed Action, including the Rail Equipment Maintenance Yard, Staging Yard, Nevada Railroad Control Center and National Transportation Operations Center, Maintenance-of-Way Facilities, and Cask Maintenance Facility.

Table 4-281. Estimated impacts to workers from nonradiological industrial hazards during rail line and facility construction and operations under the Proposed Action.

Group and industrial hazard category	Construction		Operations	
	Labor hours worked	Incidents	Labor hours worked	Incidents
	15.7 million		17.9 million	
Total recordable cases		400		398
Lost workday cases		221		248
Fatalities		0.65		1.35

4.3.10.4.1.1 Workers. Nonradiological occupational health and safety impacts from railroad construction and operations under the Proposed Action involve approximately 800 recordable incidents, approximately 470 lost workday accidents, and approximately two fatalities. Rail line construction and operations nonradiological occupational health and safety impacts for the Shared-Use Option would be approximately the same as for the Proposed Action, based on the construction and operation of the proposed rail line. It is assumed that construction of the proposed rail line for the Shared-Use Option would require approximately the same number of workers and labor hours, and approximately the same amount of construction materials and equipment as would construction of the proposed rail line for the Proposed Action.

Construction and operations workers under the Proposed Action and Shared-Use Option could potentially be exposed to nonradiological hazardous chemicals related to operation and maintenance of construction equipment and rail line facility equipment, including maintenance-of-way and maintenance of casks. Such activities are anticipated to include welding, metal degreasing, painting, and related activities. Occupational health and safety impacts could also result from worker exposure to fuels, lubricants, and other materials used in construction, operation, and maintenance of the proposed rail line and associated facilities. The recorded incident rates of these exposure hazards during construction work at the Yucca Mountain Site has been small and is anticipated to be small for construction and operation of the rail alignment and facilities under the Proposed Action.

Dust and soils hazards include potential occupational exposure to hazardous inhalable dust, including the minerals crystalline silica, cristobalite, and erionite, and potential occupational encounters with unexploded ordnance. It is unlikely that any fugitive particulate generated in the construction areas would contain a concentration of crystalline silica, erionite, or cristobalite that would result in exceedance of occupational exposure limits for these materials. Therefore, impacts associated with occupational exposure to these materials are not anticipated from construction and operation of the railroad and facilities under the Proposed Action.

Impacts to construction or operations workers from unexploded ordnance would be small due to implementation of inspection procedures and mitigation measures if necessary.

Workers may also be exposed to biological hazards including infectious diseases (such as Hantavirus, West Nile virus) and other biological hazards (such as venomous animals). The recorded incidence rates of these biological hazards in the region of influence in Nevada are small, according to statistics published by state and federal agencies including the U.S. Centers for Disease Control and the Nevada State Health Division, and the recorded incident rates of these biological hazards during construction work at the Yucca Mountain Site has also been small. Therefore, DOE would expect small impacts to construction or operations workers from these biological hazards.

4.3.10.4.1.2 Public. Nonradiological impacts to the public from the construction and operation of the rail line and facilities (other than impacts from transportation accidents) are presented in the air quality section and noise section of this Rail Alignment EIS and are therefore not further discussed in Section 4.3.10. Impacts to the public from transportation accidents (those transportation accidents not involving release of radiation) are discussed in Section 4.3.10.4.3.

4.3.10.4.2 Radiological Impacts

Occupational and public radiological impacts and accident risk of rail line and associated facility operations for the Proposed Action and Shared-Use Option are summarized in Table 4-282. For the radiological impacts analyses, the four specific alignments described in Table 3-146 were evaluated. Table 4-282 summarizes the radiation doses and impacts along these four classes of alignments.

4.3.10.4.2.1 Workers. For workers, the radiological impacts of the Proposed Action and Shared-Use Option are estimated to result in less than one latent cancer fatality.

4.3.10.4.2.2 Public. Radiological impacts of the Proposed Action and Shared-Use Option are estimated to result in less than one latent cancer fatality.

Table 4-282. Summary of occupational and public estimated radiological impacts for the Proposed Action (expressed as latent cancer fatality units).[a]

Case	Staging Yard	Workers	Public	Accident Risk	Total
Highest population	Hawthorne	0.34	8.5×10^{-4}	7.7×10^{-6}	0.34
Shortest distance	Hawthorne	0.33	8.2×10^{-4}	7.4×10^{-6}	0.33
Longest distance	Hawthorne	0.35	8.3×10^{-4}	7.6×10^{-6}	0.35
Lowest population	Hawthorne	0.35	8.1×10^{-4}	7.4×10^{-6}	0.35

a. Radiation doses modeled from the point where the proposed railroad would meet the existing Union Pacific rail line at Hazen.

Radiological occupational and public health and safety impacts to workers and the public for the Shared-Use Option would be approximately the same as those for the Proposed Action, as the additional trains that would be operated for the Shared-Use Option would not involve transportation of radioactive materials that would result in additional occupational or public exposure to radiation.

4.3.10.4.2.3 Accidents. Radiological impacts of the Proposed Action and Shared-Use Option are estimated to result in less than one latent cancer fatality.

4.3.10.4.3 Nonradiological Transportation Impacts

Table 4-283 summarizes impacts from nonradiological transportation accidents, including vehicular-related accidents and rail-related accidents, from construction and operation of the Proposed Action and Shared-Use Option. Impacts for the Shared-Use Option are considered to be the same as those identified for the Proposed Action for the construction phase.

Table 4-283. Summary of estimated transportation accident impacts.

	Construction	Operations	
	Proposed Action and Shared-Use Option	Proposed Action	Shared-Use Option
Vehicular-related fatalities	6	7	7
Rail-related fatalities	0.4	0.7	7
Rail-related accidents	2	14	36
Rail-related accidents involving cask trains	Not applicable	3	3

4.3.11 UTILITIES, ENERGY, AND MATERIALS

This section describes potential impacts to utilities, energy, and materials from constructing and operating the proposed railroad along the Mina rail alignment. Section 4.3.11.1 describes the methodology DOE used to assess potential impacts to utilities, energy, and materials; Section 4.3.11.2 describes potential impacts; Section 4.3.11.3 describes the potential impacts under the Shared-Use Option; and Section 4.3.11.4 summarizes potential impacts.

Section 3.3.11.1 describes the regions of influence for utilities, energy, and materials. To aid reader understanding, the regions of influence are repeated throughout Section 4.3.11 where appropriate.

4.3.11.1 Impact Assessment Methodology

The utilities, energy, and materials impacts analysis considered whether construction and operation of the proposed railroad along the Mina rail alignment would:

- Cause utility service outages as a result of construction activities
- Affect the capacity of ***public water systems***, directly or indirectly
- Require extension of water mains involving off-site construction for connection to a public water source
- Impact water-supply capacity needed for fire suppression
- Affect the capacities of public wastewater-treatment facilities, directly or indirectly
- Require extension of sewer mains involving off-site construction for connection with a public wastewater-treatment system
- Require extensive expansion of telecommunications systems involving off-site construction for connections with the network (including construction of communications towers)
- Affect the capacity and distribution capabilities of local and regional suppliers of fossil fuel
- Cause new sources of construction materials and operations supplies to be built, such as new mining areas, processing plants, or fabrication plants
- Affect the capacity of existing materials suppliers and industries in the region

4.3.11.2 Construction and Operations Impacts

This section describes potential impacts to utilities, energy, and materials resources from constructing and operating the proposed railroad along the Mina rail alignment. The analysis of impacts to existing utilities considers:

- Potential impacts of constructing the rail line in or near existing utility lines or rights-of-way
- Potential impacts on the capacities of public utilities
- Potential impacts on the availability of fossil fuels (the focus of the energy analysis)
- Potential impacts on the availability of construction materials

4.3.11.2.1 Construction Impacts

4.3.11.2.1.1 Potential Interfaces with Public Utility Corridors and Rights-of-Way. Potential utility conflicts would arise if construction activities could interfere with a public utility's ability to continue service or could prevent future expansion of that utility or its use of a right-of-way. Conflicts could arise in areas where the rail line and its construction and operations support facilities would either cross or overlap an existing utility corridor or right-of-way.

Utility crossings are common to linear projects such as roads, railroads, and pipelines, and they can be accomplished with minimal impact using standard engineering procedures and appropriate design specifications (see Chapter 2).

Utilities that would require the construction of crossings either above or beneath the rail line (new grade crossings) might be subject to temporary interruption as the switch is made from the existing infrastructure to the new routing. Service interruptions for electrical and telephone service, if necessary, could be limited to the time required to throw a transfer switch or to disconnect and reconnect. Service interruptions to pipelines might be longer, but to the greatest extent practicable, would be limited to a few hours.

4.3.11.2.1.2 Public Utility Systems. Potential impacts to public utility systems during the construction phase would be related to the demands on these systems to support construction activity and sustain construction workers. DOE would establish 10 temporary construction camps along the rail alignment within the construction right-of-way to house construction workers, and would fully operate a maximum of six camps at any one time (DIRS 180874-Nevada Rail Partners 2007, Section 2.3). DOE estimates that 2,160 construction personnel would be employed full-time. Each construction camp would have the capacity to house 360 people (254 construction workers and 106 support staff) for such functions as construction administration, utilities, emergency services, and other support. The personnel at each camp would comprise 40 professional staff, 20 clerical staff, and 300 craftsmen (DIRS 180874-Nevada Rail Partners 2007, Table D-1). The utilities sector of each construction camp would include areas dedicated to power, wastewater treatment, water treatment, and trash disposal. DOE expects that most construction workers would live in and spend most of their time in these camps, thereby reducing the impacts that these individuals would have on public water and wastewater systems and the use of fuel for travel.

As described in Section 4.3.9, Socioeconomics, population changes are related to changes in employment. DOE expects that most of the full-time construction workers would live in the construction camps, but the Department estimates 40 construction workers might live in Mineral County, five in Esmeralda County, and 15 in Nye County (DIRS 180874-Nevada Rail Partners 2007, Table D-1). There would be some population increases in nearby towns attributable to construction workers and indirect support workers. Because increases in population affect future demand on public utilities in a community, the utilities impacts analysis uses the basic assumptions and expectations regarding population change during the construction phase, as described below.

For purposes of this analysis, and consistent with the methodology described in Section 4.3.9 of this Rail Alignment EIS, DOE assumes that most construction workers would come from outside the region of influence rather than the sparsely populated Lyon, Mineral, Esmeralda, and Nye Counties. Any changes in the populations of Lyon, Mineral, Esmeralda, Nye, and Clark Counties and towns within those counties would be small (see Section 4.3.9). Therefore, associated infrastructure impacts at the county and local levels during the construction phase would be small.

Public Water Systems The region of influence for public water systems is Lyon, Mineral, Esmeralda, and Nye Counties, and communities within those counties, and the Walker River Paiute Reservation, the bulk of which lies within Mineral County with smaller portions in Lyon and Churchill Counties. However, water requirements for the project during the construction phase would be met by new wells.

Because DOE does not plan to rely on public water systems as primary sources of water during the construction phase, direct impacts to public water systems would be those related to permanent population increases within the region of influence attributable to the construction phase.

Because, as previously discussed in Section 4.3.9, permanent population increases would be expected to be minor for most areas during the construction phase, DOE expects that existing public water systems in the region of influence could accommodate the increased demand within existing system capacities without adverse impacts.

As discussed in Section 3.3.11, Lyon and Mineral Counties can adequately meet current and future demands for water. Given the level of demand and limited capacity of groundwater in Nye County, further demands could strain the water-supply system. However, future population growth that might occur in Nye County during the railroad construction phase would be less than 1 percent. Goldfield, in Esmeralda County, has the water and infrastructure to triple the number of users served by its water-supply system, and can meet increased demands for water. Section 4.3.6, Groundwater Resources, discusses water requirements by hydrologic basin and indirect impacts associated with groundwater withdrawals.

Wastewater-Treatment Systems The region of influence for wastewater transported offsite for treatment and disposal is the existing permitted treatment facilities in Lyon, Mineral, Esmeralda, and Nye Counties and communities within those counties, and the Walker River Paiute Reservation, the bulk of which lies within Mineral County with smaller portions in Lyon and Churchill Counties.

DOE estimated that up to 609,000 liters (161,000 gallons) per day of sanitary wastewater could be generated during the construction phase, as summarized in Table 4-284. However, because construction activities would be phased, actual daily maximums would be less. The Department estimates that the amount of sanitary wastewater that would be generated at each construction camp would peak at 95,000 liters (25,000 gallons) per day. Most of this wastewater would be generated from flush toilets and showers. Sanitary sewage generated at the construction camps would be treated onsite using portable wastewater-treatment facilities, and treated wastewater would be recycled and used for construction purposes (such as soil compaction and dust suppression). DOE would recycle about 90 percent of all construction-generated wastewater. Therefore, there would be no impacts to existing wastewater-treatment capacity in the region of influence.

Table 4-284. Wastewater generation during the construction phase – Mina rail alignment.

Facility	Number of personnel (maximum)	Wastewater generation (gallons per day per person)[a,b]	Total wastewater (gallons per day)[c]
Construction camps[d]	2,160[e]	70	151,000
Staging Yard at Hawthorne	110[e]	20	2,200
Maintenance-of-Way Facility (Silver Peak or Klondike)	60[e]	20	1,200
Rail Equipment Maintenance Yard	150[e]	20	3,000
Cask Maintenance Facility	150[f]	20	3,000
Concrete batch plant	10[e]	20	200
Total			161,000

a. Sources: Daily wastewater-generation rates from DIRS 182825-Nevada Rail Partners 2007, Section 4.4.2; Nevada Administrative Code 444.8312 as an estimated per person wastewater flow from an office (for other facilities).
b. To convert gallons to liters, multiply by 3.78533.
c. Numbers in column are rounded to three significant figures.
d. Six construction camps of a total of 10 would be in operation at one time.
e. Source: DIRS 180874-Nevada Rail Partners 2007, Table D-1.
f. Source: DIRS 181425-MTS 2007, p. 5.

Commercial vendors would provide portable restroom facilities where needed and would transport wastewater offsite for treatment, which could include the use of permitted wastewater-treatment facilities in the region of influence. As shown in Table 3-152, permitted wastewater-treatment facilities in the region of influence have adequate capacity. Therefore, any impacts to those wastewater-treatment facilities during the construction phase would be small.

DOE expects permanent population increases would be small for most areas during the construction phase (see Section 4.3.9); therefore, existing publicly owned wastewater-treatment works in the region of influence could accommodate the increased wastewater within existing system capacities without adverse impacts.

Telecommunications Systems The region of influence for telephone and fiber-optic telecommunications systems is the southern Nevada region serviced by Nevada Bell Telephone Company (AT&T Nevada), Citizens Telecommunications Company of Nevada, and Verizon. For wireless communications, the region of influence is that area of Nevada served by Verizon One along the U.S. Highway 95 corridor north from the Las Vegas area.

During preliminary grading, construction communications would be provided via short-wave radio and satellite telephone (DIRS 180875-Nevada Rail Partners 2007, Section 2.5). Communications systems during construction would be designed to not interfere with other licensed services operating in the same geographic areas and would remain in place until the communications systems for railroad operations were in place and commissioned. Little or no landline or wireless telecommunications service would be required during the construction phase. The installation and use of telecommunications systems would have a small impact on local telecommunications utilities.

Electricity The region of influence for electric power includes areas serviced by the southern Nevada electrical grid operated by Nevada Power Company, Sierra Pacific Power Company, and Valley Electric Association, Inc. Electric energy demand for initial construction activities would be satisfied with portable generators until electrical connections were established. This section discusses energy needs that would be satisfied through the use of existing electrical utilities.

During the construction phase, DOE proposes to lay an underground 25-kilovolt distribution line under the rail roadbed (DIRS 180875-Nevada Rail Partners 2007, Section 4.1.2). The primary purpose of the distribution line would be to provide electric power to facilities and equipment needed for routine railroad operations (such as signals, switches, and radio communication towers), and to be able to provide the capacity to meet expected power needs for support facilities; a secondary purpose would be to provide an alternative to diesel-powered generators or local power sources.

Although power might be required during construction or operations only in specific areas along the rail alignment (such as at sidings, radio communication towers, construction camps, and quarries), for purposes of analysis DOE assumed that an underground 25-kilovolt distribution line would be laid in a trench in an uninterrupted length of approximately 452 kilometers (281 miles), which would include the nominal 409 kilometers (254 miles) of new rail construction and the approximately 43 kilometers (27 miles) of Department of Defense Branchline between the southern end of the Schurz bypass and Hawthorne (Department of Defense Branchline South). Chapter 2 fully describes these rail segments and explains that different combinations of alternative segments and common segments would produce a rail line of different lengths. At the same time the Department was laying the power distribution line, it would also lay the fiber-optic cable to be used as part of a telecommunications system (encased in a polyvinyl-chloride [commonly referred to as PVC] duct), and would place it in the same trench as the 25-kilovolt distribution line. Once the cables were placed, the trench would be backfilled to grade.

Based on initial planning studies, power to the distribution system would be fed from locations where the rail line would intersect existing high-voltage transmission lines (DIRS 180875-Nevada Rail Partners 2007, Section 4.1.2). At this stage of the design process, DOE has not identified specific locations. DOE would construct substations within the nominal width of the construction right-of-way to feed the 25-kilovolt distribution line from the higher-voltage transmission lines at such intersections. At locations along the rail line where lower-voltage power was required for railroad systems, DOE would place step-down transformers from the 25-kilovolt distribution line on the trackside.

Construction camps would be powered one of three ways: (1) from existing transmission or distribution lines where they run alongside the camp sites, (2) from the 25-kilovolt distribution line, or (3) from diesel-powered generators. Option (1) would require access to pre-existing nearby transmission or distribution lines at construction-camp sites and their contracted use. Option (2) would depend on the availability of an energized 25-kilovolt distribution line during the period in which a construction camp would be operated. For options (1) and (2), DOE would place a substation at the construction camp. If neither option (1) nor (2) was available, DOE would select option (3). In addition, for options (1) and (2), the Department would use backup diesel-powered generators at each camp during unexpected power outages. Energy use at each camp during the peak output year would approach 54,000 kilowatt-hours per day, or 20 million kilovolt-hours per year.

Quarry sites would require electric power for conveyor belts, machinery, lighting, and support services. That need would be met by either of three options: (1) from nearby transmission or distribution lines if available, (2) from diesel-powered generators, or (3) from the 25-kilovolt distribution line. DOE would build a substation at each quarry site. Temporary power lines would distribute power at the quarry facility. If DOE selected option (1) or (3), diesel-powered backup generators would always be available at each quarry site for emergencies. Each quarry would be expected to use 27,600 kilowatt-hours of power per day. Energy use at each quarry site during the peak output years would approach 10 million kilowatt-hours per year (DIRS 180875-Nevada Rail Partners 2007, Section 3.1.3).

DOE plans to have 24-meter (80-foot)-long rails delivered by rail from manufacturing plants to Hawthorne. DOE would set up a portable welding plant at Hawthorne and would later relocate the plant along the rail alignment at 80- to 160-kilometer (50- to 100-mile) increments to weld 24-meter-long rail into 438-meter (1,440-foot)-long strings to be distributed along the rail alignment by dedicated welding trains (DIRS 180875-Nevada Rail Partners 2007, Section 3.3). Typically, such welding units are powered by diesel generators generating 375 kilowatts of electrical power. DOE might build a substation connected to existing transmission lines to supply this need at Hawthorne, but this is conceptual at this stage of design. Yard and siding areas would be likely candidate relocation sites. At these sites, the Department would use portable diesel-powered generators, or conceptually, the 25-kilovolt distribution line if available and energized. (Alternatively, off-line welding of the rail would be possible, but would require dedicated welding trains to support track construction activities.)

The major electrical providers in the project region, including Nevada Power Company, Sierra Pacific Power Company, and Valley Electric Association, Inc., would have adequate generating capacity or power-purchase capabilities (see Section 3.3.11) to supply the project during peak demand without disrupting service to the providers' respective coverage areas. As discussed in Section 3.3.11, demand is expected to remain relatively stable in the serviced areas, increasing at about 2 percent annually, and is not expected to impact the capacity of service providers. In cooperation with the affected utilities, DOE would perform electrical-capacity analyses to ensure adequate capacity exists, including evaluation of the conditions of existing electric facilities and determination of appropriate interface equipment to meet the needs of both parties, prior to any connection to a transmission or distribution line; therefore, any impact on electric services would be small.

For purposes of analysis, DOE assumed that electricity requirements for construction of the railroad operations support facilities would be met with portable generating equipment, but could later be met through substations connected to the 25-kilovolt distribution line when it was completed. As described in Chapter 2, these facilities would include the Staging Yard at Hawthorne, which would incorporate a Satellite Maintenance-of-Way Facility and possibly the Nevada Railroad Control Center and National Transportation Operations Center, and where designated tracks would serve as interchange tracks for Union Pacific Railroad trains; the Maintenance-of-Way Facility located either in the vicinity of Silver Peak or Klondike; and the Rail Equipment Maintenance Yard, which would incorporate a Satellite Maintenance-of-Way Facility, the Cask Maintenance Facility, and possibly the Nevada Railroad Control Center and National Transportation Operations Center.

4.3.11.2.1.3 Fossil Fuels. At this point in project planning, DOE has not identified specific providers of fossil fuels. However, for purposes of analysis, DOE expects that regional supply systems and suppliers could economically supply the project.

Fossil-fuel consumption during the construction phase would primarily consist of diesel fuel for construction equipment and vehicles. Heavy construction equipment would be diesel-powered, as would electric generators. Fuel would be transported by truck and stored at the hazardous materials storage areas at the construction camps. These materials would be stored in accordance with applicable state and federal regulations (DIRS 180875-Nevada Rail Partners 2007, Section 6.2). DOE estimated that annual consumption of diesel fuel would be 109 million liters (28.8 million gallons) (DIRS 180874-Nevada Rail Partners 2007, Appendix D, Table 5b). The annual consumption of diesel fuel for the region of influence, as represented by the State of Nevada, is approximately 1.8 billion liters (480 million gallons) (DIRS 176397-EIA 2005, Table 4, 2004 data). Construction fuel consumption would represent 6 percent of diesel fuel used annually in Nevada, and could be met by existing regional supply systems and suppliers.

Construction of the proposed railroad would have a small impact on the capacity of regional suppliers or the availability of fuel resources. The fuel supply system is such that it can flexibly respond to changes in demand. Fuel consumption for construction of the railroad operations support facilities would be lower; therefore, fuel consumption during construction of those facilities would have a small impact on the capacity of regional suppliers or the availability of fuel resources.

4.3.11.2.1.4 Materials. As described in Section 3.3.11, the region of influence for necessary raw materials is limited to the distribution networks and suppliers that can economically service the general project area. For cast-in-place concrete, ballast, and subballast, the region of influence is limited to the State of Nevada. DOE would need a ***free-use permit*** from the BLM to use common varieties of sand, stone, and gravel from BLM-administered public lands during the construction phase, pursuant to the regulations implementing the Materials Act of 1947 (30 U.S.C. 601 through 603) as codified in 43 CFR Part 3600. As described in Chapter 2, the Department could obtain ballast materials from two of the five potential quarry sites within Nevada that would be close to the Mina rail alignment construction right-of-way. Therefore, the region of influence for obtaining ballast would be limited to the immediate area in Nevada. Other materials, including steel, steel rail, concrete ties, and other precast concrete could be procured and shipped on a national level. Therefore, the region of influence for these materials is considered to be national.

Material needs for construction of the proposed rail line along the Mina rail alignment would vary among the alternative segments roughly in proportion to their lengths. The primary materials that would be consumed during rail line construction include steel; concrete, principally for rail ties, bridges, and drainage structures; and rock for ballast and subballast. Table 4-285 lists the rail line construction material requirements and current production rates within the respective regions of influence.

Table 4-285. Rail line construction material requirements – Mina rail alignment.

Material	Total requirement	Annual requirements over a 4- to 10- year construction period	Region of influence	Region of influence annual production	Percent of region of influence production
Steel rail	69,000 tons[a]	17,300 to 6,900 tons	U.S. (all steel) U.S. (steel rail)	95,000,000 tons 571,000 tons	0.018 to 0.007 3 to 1.2
Concrete, cast-in-place	127,000 tons	31,800 to 12,700 tons	Nevada	18,000,000 tons[b]	0.19 to 0.08
Concrete, precast (including concrete ties)	411,000 tons	103,000 to 41,100 tons	U.S.	17,000,000 tons[b]	0.6 to 0.024
Concrete ties	776,000 ties	194,000 to 77,600 ties	U.S.	1,000,000 ties	19 to 7.8
Ballast	2.8 million tons	700,000 to 280,000 tons	Nevada	11,500,000 tons[b]	6.1 to 2.4
Subballast	2.4 million tons	600,000 to 240,000 tons	Nevada	10,200,000 tons[b]	5.9 to 2.4

a. To convert tons to metric tons, multiply by 0.90718.
b. Crushed stone for all users, 2000 data (DIRS 173393-Tepordei 2003, Table 6).

Steel DOE has calculated that construction of the proposed rail line along the nominal 409 kilometers (254 miles) of the Mina rail alignment, including sidings and yard tracks, would require 2,176 strings of ***136 RE*** welded rail, each string being 439 meters (1,440 feet) long (DIRS 180875-Nevada Rail Partners 2007, Section 3.3). This would correspond to a requirement for 63,000 metric tons (69,000 tons) of steel over an estimated construction period of 4 to 10 years. DOE would acquire the sections of rail from national commercial sources.

Because DOE would purchase steel rail from national suppliers in staggered preordered phases over a 2- to 3-year period, the impact on availability of steel rail would be small.

DOE would need additional steel for rail hardware, bridges, and facility structures. Existing commercial fabricators would supply the steel required for the bridges. The designs of bridges and rail facilities are not sufficiently advanced to tabulate materials needs; however, the quantities required would be much less than required for rail line construction.

Concrete DOE has estimated that 50,000 cubic meters (65,000 cubic yards) of cast-in-place concrete would be required for Mina rail alignment structures (DIRS 180874-Nevada Rail Partners 2007, p. B-19). Concrete weighs approximately 2.4 metric tons per cubic meter (145 pounds per square foot) and 50,000 cubic meters would translate to an approximate requirement of 115,000 metric tons (127,000 tons) over the 4- to 10-year construction phase. Cast-in-place concrete for the Mina rail alignment would be required primarily for bridge abutments. As described in Chapter 2, DOE would obtain concrete for site placement activities at proposed bridges and other structures from a portable batch plant set up near the construction sites. DOE would truck all aggregate and cement from the portable batch plant to the construction sites. Annual production of cast-in-place concrete in Nevada equals approximately 16 million metric tons (18 million tons) per year (DIRS 173400-NRMCA 2004, p. 2).

The primary use of precast concrete would be for concrete ties. Concrete ties would be placed at 0.61-meter (2-foot) intervals along the constructed rail line (DIRS 180875-Nevada Rail Partners 2007, Section 3.2). DOE estimates that approximately 776,000 concrete ties would be required for the nominal 409 kilometers (254 miles) of new rail line construction, and an additional 64 kilometers (40 miles) of track at sidings, the Staging Yard at Hawthorne, and the Rail Equipment Maintenance Yard. Using 318-

kilogram (700-pound) ties would require 247,000 metric tons (272,000 tons) of concrete to produce the ties. Precast concrete ties would either be supplied through national manufacturers or potentially through a dedicated tie production facility a commercial manufacturer would establish in Hawthorne or another area. Additional precast concrete requirements would include manufactured elements such as culverts, bridge beams, and overpass components. These precast concrete elements would be obtained from commercial sources nationally. At this stage of the design process, DOE has extrapolated that these additional precast concrete requirements would be broadly similar to an estimate documented in the Yucca Mountain FEIS (DIRS 155970-DOE 2002, Section 6.3.2.1.10) of approximately 126,000 metric tons (139,000 tons) for the rail line along the Caliente corridor. DOE has estimated that total precast concrete requirements (that include concrete ties) for the Mina rail alignment would be approximately 373,000 metric tons (411,000 tons) over a 4-year construction period.

Annual national production of concrete railway ties has been increasing from about 620,000 ties in 2000 (DIRS 173572-RTA 2000, p. 22) to about 720,000 ties in 2004, and is projected to grow to about 1.2 million ties in 2007 (DIRS 173573-Gauntt 2004, p. 17). The 247,000 metric tons (272,000 tons) of concrete ties that would be required to construct the rail line along the Mina rail alignment represent 19 percent of the annual national production of concrete ties. Although this might seem like a significant requirement, the national production volume for concrete ties does not reflect manufacturing capacity. Concrete tie production is a very scaleable industry, and recent data suggests that, if needed, the industry has the capacity to increase concrete tie production rapidly (DIRS 173573-Gauntt 2004, p. 17). For example, the current national production of concrete ties represents only approximately 0.3 percent of all manufactured (precast) concrete production, which is 15 million metric tons (17 million tons) per year (DIRS 173392-van Oss 2003, Table 15). Because DOE would purchase precast concrete components from national suppliers in staggered preordered phases, and because construction would involve a small amount of cast-in-place concrete via the use of an onsite batch plant, the impact on availability of concrete would be small.

Ballast and Subballast Ballast and subballast are essentially crushed rock such as that required for the development of the rail roadbed. DOE has estimated that a total of approximately 2.5 million metric tons (2.8 million tons) of rail roadbed ballast would be required for track construction along the Mina rail alignment (DIRS 180875-Nevada Rail Partners 2007, Section 3.1.2). As discussed in Chapter 2, the Department has identified five potential quarry sites along the Mina rail alignment and would develop only two on an as-needed basis. Each of the potential quarries could produce approximately 3,100 metric tons (3,400 tons) of useable ballast per day. Therefore, the impact to availability of ballast from constructing the rail line along the Mina rail alignment would be small.

> **Ballast:** Gravel or broken stone laid in a rail roadbed to distribute train weight uniformly across the bed.
>
> **Subballast:** Gravel or broken stone that does not have to meet the ballast specifications, layered beneath the ballast as a transition between the ballast and the compacted subgrade.
>
> Source: DIRS 180922-Nevada Rail Partners 2007, p. 3-1.

DOE has estimated that a total of approximately 2.2 million metric tons (2.4 million tons) of subballast would be required for track construction along the Mina rail alignment (DIRS 180875-Nevada Rail Partners 2007, Section 3.1.2). Some of the remaining material from each ballast quarry might be suitable for subballast. Remaining subballast requirements would be obtained either from cuts made for constructing the roadbed or from existing borrow sites and quarries along the alignment. The Mina rail alignment would not incorporate enough cut sections to generate the required 2.2 million metric tons of subballast; therefore, DOE would develop sources approximately 16 kilometers (10 miles) apart along the alignment during construction. Approximately 55 surplus borrow-site locations are available adjacent to

Nevada Department of Transportation materials sources and additional nearby sites could be developed (DIRS 180875-Nevada Rail Partners 2007, Section 3.1.2). Impacts on the availability of subballast materials would be small.

DOE would construct 7.3-meter (24-foot)-wide gravel access roads parallel to the rail line and within the construction right-of-way. The rail line and the alignment access roads would be accessed via existing public roads where the rail line would cross an existing roadway. DOE would construct additional access roads to reach features like wells and quarries that are not immediately accessible to the rail alignment. The quarry sites identified would be within 3 kilometers (2 miles) of the alignment, thereby minimizing access-road construction requirements.

Materials for access-road construction or improvement would be obtained primarily from locally available materials such as stone, and gravel resulting from cuts and fills along the alignment and overburden at quarries. Access roads would likely have gravel surfaces. The native material would be supplemented by crushed rock screenings as necessary to provide a serviceable roadway surface.

Sand and Gravel There is a high likelihood DOE would find sand and gravel on the alluvial fans along cuts for the rail line that would be suitable for construction purposes and road making. Sand and gravel also would be generated from overburden at quarry and borrow sites. Approximately 55 surplus pit locations are available adjacent to Nevada Department of Transportation materials sources and additional nearby sites could be developed. DOE would use some natural sand and gravel excavated from cuts and crushed rock from the quarries to make concrete aggregate (DIRS 183636-Shannon & Wilson 2007, pp. 20, 21, 25, 26, 30, 31, 36, 41, and 42). The Department would determine the prime sand and gravel deposits needed before beginning construction. Using locally available sand and gravel would result in the consumption of a nonrenewable resource that could be used as a supply of construction materials for other construction projects in the area. However, alluvial deposits of sand and gravel are commonplace in the Mina rail alignment region of influence, and their use to construct the rail line would not substantially reduce the area’s resources. Therefore, impacts would be small.

Other Materials Requirements In addition to the aforementioned materials needed for the rail line, DOE would also need construction materials for railroad operations support facilities. An estimated total of approximately 9,300 square meters (100,000 square feet) of building space would be required for operations support facilities (DIRS 180873-Nevada Rail Partners 2007, Sections 3, 4, and 5; DIRS 181425-MTS 2007, p. 1). By comparison, the Las Vegas market alone had over 186,000 square meters (2 million square feet) of industrial space under construction in 2004 (DIRS 173390-Colliers International Partnership 2004, p. 1) and 160,000 square meters (1.7 million square feet) of office space completed in the 12-month period ending in March 2004 (DIRS 173391-Colliers International Partnership 2004, p. 1). Materials for the construction of rail yards at the operations support facilities are included in the rail line material estimates described in this section. Materials requirements for buildings would not be substantial in comparison to regional demand and would have a small impact on the regional supply system.

4.3.11.2.2 Operations Impacts

4.3.11.2.2.1 Utility Systems. None of the potential utility interfaces identified in Section 4.3.11.2.1.1 would prevent the future expansion of a utility service area. Impacts on infrastructure at the county level associated with railroad operations would be small because regional population projections anticipate modest growth (see Section 4.3.9.3.2). However, there could be some impacts on infrastructure in towns near the proposed railroad operations support facilities. Areas that would be likely to experience the greatest impacts include:

- Hawthorne (Mineral County), where the Staging Yard, the Maintenance-of-Way Satellite Facility, train crew quarters, and possibly the Nevada Railroad Control Center and National Transportation Operations Center would be located
- Tonopah (Nye County) and Goldfield (Esmeralda County), the towns that would be closest to the Maintenance-of-Way Facility located either at Silver Peak or Klondike
- Southern Nye County, the location of the Rail Equipment Maintenance Yard, Cask Maintenance Facility, train crew quarters, and possibly the Nevada Railroad Control Center and National Transportation Operations Center

Public Water Systems DOE would need water for railroad operations, particularly at operations support facilities. Because they would be reclaimed after the construction phase was completed, there would be no water demands associated with the quarries.

DOE estimates water consumption at the Rail Equipment Maintenance Yard would be about 23,000 liters (6,000 gallons) per day for personnel and an additional 11,000 liters (3,000 gallons) per day for building and rail yard uses, including irrigation and vehicle washing. At the Rail Equipment Maintenance Yard, water needs would be met by using the repository's well system, which would eliminate the need for service by any local public water system. DOE estimates water consumption at the Maintenance-of-Way Facility that would be located either in the vicinity of Silver Peak or Klondike would be about 11,000 liters (3,000 gallons) per day, and 21,000 liters (5,500 gallons) per day at the Staging Yard at Hawthorne, where water would be obtained from locally drilled wells (DIRS 180873-Nevada Rail Partners 2007, Table 2-2, Section 3.6, and Section 4.6).

Public water systems in Lyon, Mineral, Esmeralda, and Nye Counties could be affected by incremental changes in population attributable to railroad operations. As discussed in Section 3.3.11, Lyon and Mineral Counties are able to meet current and future demands for water. Goldfield, in Esmeralda County, has the groundwater resources and infrastructure available to triple the number of users served by its public water system and thus has the potential to meet increased demand for water by additional residential and commercial users.

In Nye County, given the level of demand and the limited capacity of groundwater resources (particularly in the Pahrump Valley hydrographic area), water needs could strain supply. Although the Cask Maintenance Facility would be collocated with the Rail Equipment Maintenance Yard and the geologic repository operations area interface in Nye County, the estimates for population increase attributable to the employees at the Yucca Mountain Site (see Section 4.3.9.3.2) would represent a small incremental increase. Therefore, impacts to the public water systems in Nye County from the demands associated with these potential new residents would be small.

Wastewater-Treatment Facilities DOE would dispose of sanitary wastewater in accordance with State of Nevada regulations. Under the Statutory Authority of Nevada Revised Statutes (NRS) 445A.300 through 445A.730, and pursuant to the Nevada Administrative Codes (NAC) 445A.810 through 445A.925, and NAC 444.750 through 444.828, the Nevada Division of Environmental Protection, Bureau of Water Pollution Control, issues wastewater-discharge permits, administers loans to publicly owned treatment works, and oversees the certification program for sewer-treatment plant employees. In most cases, DOE would construct on-site sanitary wastewater-treatment systems within the railroad operations right-of-way and they would be permitted by the State of Nevada. These would likely be ***package plants***, as described in Section 3.3.11.2.3. If access to nearby existing permitted wastewater-treatment facility capacity was available to any on-site facilities, DOE would discharge sanitary waste to those existing facilities. Impacts to existing wastewater-treatment capacities of jurisdictions in the region of influence during the operations phase would be small.

Table 4-286 lists the rates of wastewater generation that would be associated with railroad facilities during the operations phase.

Table 4-286. Wastewater generation during the operations phase – Mina rail alignment.

Facility	Number of personnel (maximum)	Total wastewater generation (gallons per day)[a]
Staging Yard at Hawthorne	40[b]	800
Maintenance-of-Way Facility	40[b]	800
Rail Equipment Maintenance Yard, including the Nevada Railroad Control Center and National Transportation Operations Center-	40[b,c]	800
Cask Maintenance Facility	30	600
Totals	150	3,000

a. Twenty gallons per person per day wastewater generation rate, Nevada Administrative Code 444.8312 for offices; to convert gallons to liters, multiply by 3.78533.
b. Source: DIRS 180873-Nevada Rail Partners 2007, Section 2.1.3.
c. Source: DIRS 181425-MTS 2007, p. 1.

Wastewater from the Staging Yard at Hawthorne would be disposed of at the permitted wastewater-treatment facility in Hawthorne, the capacity of which is approximately 1.5 million liters (0.6 million gallons per day) (see Table 3-152) (DIRS 180873-Nevada Rail Partners 2007, Section 4.6). The Rail Equipment Maintenance Yard would provide a staging area for delivery of loaded cask cars to the repository, construction materials, and fuel. The facility would include office space, and train crew and escort personnel quarters, all of which would generate sanitary wastewater. Sanitary wastewater disposal at this facility would consist of septic systems or wastewater-treatment facilities at the Yucca Mountain Site (DIRS 180919-Nevada Rail Partners 2007, p. 3-5).

The numbers of employees projected to reside in the communities near railroad operations support facilities would represent small fractions of the existing populations (see Section 4.3.9). Also, as shown in Table 3-152, most of the existing wastewater-treatment facilities are operating well below their capacities, and these facilities would be capable of accommodating any increases in wastewater attributable to railroad facility employees. Goldfield has recently been awarded a Water Resource Development Act grant of approximately $3 million for renovations and upgrades. Therefore, the impact to public wastewater systems from operating railroad support facilities would be small.

Telecommunications Systems The communication system required to support railroad operations would utilize four distinct communication technologies: synchronous optical network fiber-optic backbone, very high frequency (VHF) land mobile radio, geosynchronous satellite dispatch radio, and possibly satellite telephone service (DIRS 180876-Nevada Rail Partners 2007, Section 6). The fiber-optic cable laid along the length of the nominal 409 kilometers (254 miles) of DOE-constructed rail line and the approximately 43 kilometers (27 miles) of Department of Defense Branchline South (between the southern end of the Schurz bypass and Hawthorne) would allow the installation of a VHF land mobile radio system consisting of a series of base stations located at points approximately 16 to 32 kilometers (10 to 20 miles) apart along the rail alignment to provide full radio coverage communications with locomotive and maintenance crews. Base stations would consist of an equipment room that would house the radio and fiber-optic electronics and a monopole radio tower to mount an elevated VHF antenna. The Nevada Railroad Control Center would also have a private branch exchange telephone system. In the event of a failure of all or part of the primary VHF radio system, operations would continue via a geosynchronous satellite dispatch radio system. As a backup, DOE could utilize satellite telephone hand sets. At the Nevada Railroad Control Center, the system would be configured to allow the dispatcher easy access to all of the various communication modes available, including the ability to patch communication modes together if required. However, for external communications, the Staging Yard at Hawthorne, the Nevada Railroad Control Center and National Transportation Operations Center, the Maintenance-of-Way Facility, the Cask Maintenance Facility, and the Rail Equipment Maintenance Yard would each require digital subscriber line and telephone service. The Rail Equipment Maintenance Yard would require the greatest telecommunications capacity, with approximately 75 conventional telephone lines, 50 broadband internet connections, five secure telephone lines, a fiber-optic line for closed-circuit television and data communication, and radio communications for railroad operations in conjunction with the centralized traffic control rail signal system (DIRS 180919-Nevada Rail Partners 2007, Section 6.6). The radio communication systems would be designed not to interfere with other licensed systems operating in the same area. The radio communication systems would be designed not to interfere with other licensed systems operating in the same area. The levels of commercially provided service would be small, and would not adversely affect the capacities of commercial telecommunications providers.

Electricity Impacts associated with the underground 25-kilovolt distribution line would be related to utility interfaces, as discussed in Section 4.3.11.2.1.1, and in Section 4.3.2, Land Use and Ownership.

Operation of the proposed railroad would require electricity for buildings, signaling, communications, and control. Twelve-kilovolt electrical service would be required for each facility. Depending on the distance from available power sources, larger distribution lines and intermediate substations might be needed. In addition to commercial sources, electric power could be supplied from the installed power distribution system. Each facility site would require a 12-kilovolt/480-volt transformer with a 480-volt distribution system to power industrial equipment and feed each building where a 480-volt/120-volt transformer would supply the building power (DIRS 180873-Nevada Rail Partners 2007, Section 2.1.5). Additional transformers could be required for other site requirements such as site lighting, power to yard switches and signals, or power for communications equipment. Each site would require a diesel-powered emergency generator to supply electrical power in case of an outage.

DOE estimates that the Staging Yard at Hawthorne would have a normal power demand of 386 kilowatts with the Nevada Railroad Control Center and National Transportation Operations Center (or 290 kilowatts without) (DIRS 180873-Nevada Rail Partners 2007, Section 3.6). DOE would build a substation connected to existing transmission lines to service this power need or make use of the 25-kilovolt distribution line. Diesel-powered generators would provide backup power.

DOE estimates that the Maintenance-of-Way Facility would have a normal power demand of 484 kilowatts (DIRS 180873-Nevada Rail Partners 2007, Section 4.6). DOE has made separate estimates of power demand at the Rail Equipment Maintenance Yard that range between 722 and 815 kilowatts (DIRS 180919-Nevada Rail Partners 2007, p. 6-20). The Department has established an 8-megawatt power requirement (which includes a 30-percent reserve) for the Rail Equipment Maintenance Yard and Cask Maintenance Facility (DIRS 181033-Hamilton-Ray, 2007, all). DOE could obtain power from a newly constructed substation connected to the existing transmission line providing power to the Yucca Mountain Site, or from a new 138-kilovolt transmission line DOE plans to build to the geologic repository operations area.

The 2007 peak load for the Nevada Power Company was expected to be 6,300 megawatts (DIRS 185100-Nevada State Office of Energy 2007, pp. 33 to 34), whereas there would be approximately a 3-megawatt demand to operate the proposed railroad. The Department would perform an electrical capacity analysis before connecting into local transmission or distribution lines, and consistent with the demonstration of available capacity. Therefore, impacts to other regional needs for electric power during the railroad operations phase would be small.

4.3.11.2.2.2 Fossil Fuels. DOE has estimated that 119 million liters (31.5 million gallons) of diesel fuel would be consumed over an anticipated 50-year operations phase, and that the annual consumption rate would peak at 4.3 million liters (1.1 million gallons) (DIRS 180874-Nevada Rail Partners 2007, Appendix D, Table 5a), a rate that would be less than 0.25 percent of the current annual vehicular diesel fuel usage in Nevada. Therefore, potential impacts to capacities of national and regional fuel producers and distributors during the operations phase would be small.

4.3.11.2.2.3 Materials. Materials use during the operations phase would be limited to materials for repair and maintenance of the railroad, including the locomotives, railcars, casks, and operations support facilities. The annual rate of material use over the 50-year operations phase would be substantially less than during the construction phase, and materials requirements would be expected to remain well below available capacity.

DOE would reclaim the quarries developed during the construction phase and would not use them during operations. Therefore, the relatively minor amounts of ballast required for repairs and replacements during the operations phase would be met through existing commercial sources that at this stage of the design process have been identified as quarries in Milford, Utah, and Oroville, California, as described in Section 3.3.11.4. The impacts to available supplies of ballast at these quarries would be small.

4.3.11.3 Impacts under the Shared-Use Option

Railroad construction under the Shared-Use Option would include all of the features described in Section 4.3.11.2, but would include the construction of commercial sidings and support facilities. All such construction would occur on lands immediately adjacent to the rail alignment within the rail line construction right-of-way and would have impacts related to interfaces with utility corridors and rights-of-way similar to those under the Proposed Action without shared use.

The incremental demands on public water systems, wastewater systems, telecommunications systems, electric power systems, fossil fuels, and materials for construction of commercial sidings and support facilities would be sufficiently small that the anticipated impacts on these resources would be effectively the same as for the Proposed Action without shared use. Therefore, potential impacts to local, regional, or national suppliers of such resources under the Shared-Use Option would be small.

Railroad operations under the Shared-Use Option would be the same as described in Section 4.3.11.2 for the Proposed Action without shared use, but commercial shippers would add to traffic on the rail line.

The incremental demands on public water systems, wastewater systems, telecommunications systems, electric power systems, and materials for the operation and maintenance of commercial sidings and support facilities would be sufficiently small that the anticipated impacts on these resources would be effectively the same as those for the Proposed Action without shared use. Therefore, potential impacts to local, regional, or national suppliers of such resources under the Shared-Use Option would be small.

Fossil-fuel requirements for transporting general freight under the Shared-Use Option would depend on the volume and distance of shared-use traffic. DOE estimated that the incremental annual diesel consumption for commercial shared-use traffic would be 4.6 million liters (1.2 million gallons), a rate that is less than 0.3 percent of current annual diesel fuel usage in Nevada (DIRS 180874-Nevada Rail Partners 2007, Appendix D, Table D-5a). Most, if not all, of this fuel consumption would be offset by diesel fuel that would otherwise be used if the goods or materials were shipped by truck. Therefore, impacts to the capacities of national and regional fuel producers and distributors with shared used would be small.

4.3.11.4 Summary

Table 4-287 summarizes potential impacts to utilities, energy, and materials from constructing and operating the proposed railroad along the Mina rail alignment. DOE determined that those impacts would be small.

Table 4-287. Summary of potential impacts to utilities, energy, and material resources – Mina rail alignment.[a]

Resource	Construction impacts	Operations impacts
Utility interfaces	Potential for short-term interruption of service. No permanent or long-term loss of service or prevention of future service-area expansions.	None.
Public water systems	Most water would be supplied by new wells; small effect on public water systems from population increase attributable to construction employees.	Most water for operations would be supplied by new wells; small effect on public water systems from population increase attributable to operations employees.
Wastewater-treatment systems	Dedicated treatment systems would be provided at construction camps; small impact on public systems from population increase attributable to construction employees.	Dedicated treatment systems would be provided at operations facilities; small impact on public systems from population increase attributable to operations employees.
Telecommunications systems	Dedicated systems; minimal reliance on communications providers.	Dedicated system along rail line; minimal reliance on communications providers.
Electricity	Peak demand would be within capacity of regional providers.	Peak demand would be within capacity of regional providers.
Fossil fuels	Demand would be approximately 6 percent of statewide use and can be met by existing regional supply systems and suppliers. Under the Shared-Use Option, demand would be less than 0.3 percent of statewide use during operations. Demand would be met by existing regional supply.	Demand would be less than 0.25 percent of statewide use.
Materials	Requirements generally would be very small in relation to supply capacity.	Requirements would be very small in relation to supply capacity.

a. Impacts under the Shared-Use Option would be similar to those under the Proposed Action without shared use, except as noted for fossil fuels.

4.3.12 HAZARDOUS MATERIALS AND WASTES

This section describes potential impacts of the use of hazardous materials and the management of nonhazardous wastes, ***hazardous wastes***, and ***low-level radioactive wastes*** that would be generated during construction and operation of the proposed railroad along the Mina rail alignment. The section identifies the types of hazardous materials DOE would use and the hazardous, nonhazardous, and low-level radioactive wastes that would be generated during the construction and operations phases. The applicable guidelines, regulations, and available methods for treatment or ***disposal*** are identified for each waste. DOE evaluated the potential impacts of hazardous materials, hazardous wastes, nonhazardous wastes, and low-level radioactive wastes based on this information.

Section 4.3.12.1 describes the methodology DOE used to assess potential impacts; Section 4.3.12.2 describes potential construction impacts; Section 4.3.12.3 describes potential operations impacts; Section 4.3.12.4 describes potential impacts under the Shared-Use Option; and Section 4.3.12.5 summarizes potential impacts related to the use of hazardous materials and the generation of wastes.

DOE could purchase hazardous materials necessary for railroad construction and operations, such as engine coolant and solvents, through the federal supply chain or through local vendors. The Department anticipates local distributors in Nevada would supply propane and natural gas. The required hazardous materials would consist primarily of products consumers could purchase at most hardware, building-supply, or home-improvement stores. Therefore, DOE does not expect the supply of such products to be limited. As a consequence of using hazardous materials, associated hazardous wastes would be generated.

Section 3.3.12.1 describes the region of influence for hazardous materials and wastes.

4.3.12.1 Impact Assessment Methodology

DOE developed a list of anticipated types of hazardous materials and wastes to evaluate potential impacts from the use of hazardous materials or generation of wastes (see Table 4-288). To avoid or limit adverse impacts, DOE emphasizes adhering to applicable laws, regulations, policies, standards, and directives. The ***storage*** and disposal of hazardous and nonhazardous wastes is largely governed by the Resource Conservation and Recovery Act of 1976 (42 U.S.C. 6901 *et seq.*) and State of Nevada waste regulations (see Chapter 6, Statutory, Regulatory, and Other Applicable Requirements).

Table 4-288. General considerations for assessing potential impacts from the use of hazardous materials and the generation of hazardous and nonhazardous wastes.

Material	Basis for assessing adverse impacts
Hazardous materials	Determine if the use of hazardous materials would create reasonably foreseeable conditions that would significantly increase the risk of a release of hazardous materials resulting from not adhering to storage and use standards set in applicable guidelines and regulations
Hazardous waste	Determine if the quantity of hazardous wastes generated would adversely affect the capacity of hazardous-waste collection and disposal services
Nonhazardous waste	Determine if the volume of solid and industrial and special wastes generated would adversely affect the capacity of solid-waste collection service and landfills
Low-level radioactive waste	Determine if the quantity of low-level radioactive wastes generated would adversely affect the capacity of available disposal facilities

4.3.12.2 Construction Impacts

This section summarizes the types of hazardous materials DOE would use and the wastes that would be generated during construction of the proposed railroad. DOE would handle all wastes in accordance with applicable federal, state, and local environmental, occupational safety, and public health and safety requirements to minimize the possibility of adverse impacts to plants, animals, soils, and water resources inside or outside the region of influence. Because DOE would manage the use of hazardous materials and the disposal of wastes in accordance with applicable regulations and would implement best management practices (see Chapter 7), adverse impacts to environmental resources would be small.

4.3.12.2.1 Nonhazardous Waste

A total of approximately 2,300 metric tons (2,500 tons) per year of ***solid waste*** (such as general trash from kitchens and dormitories) would be generated during the construction phase, for a daily rate of approximately 6.3 metric tons (6.9 tons). Most of the solid waste would be generated at construction camps. DOE would dispose of all solid waste in permitted landfills. Table 4-289 summarizes the solid waste generation rate during the construction phase.

Table 4-289. Solid waste generation during the construction phase – Mina rail alignment.

	Number of personnel (maximum)	Solid-waste generation (pounds per day per person)[a,b]	Total solid waste (tons per day)[c,d]	Total solid waste (tons per year)[d]
Workforce	2,160[e]	6.4	6.9	2,500

a. Source: DIRS 174041-State of Nevada 2004, p. 13.
b. To convert pounds to kilograms, multiply by 0.45359.
c. To convert tons to metric tons, multiply by 0.90718.
d. Numbers are not exact due to rounding.
e. Source: DIRS 180874-Nevada Rail Partners 2007, Appendix D.

Construction activities would generate approximately 12,000 metric tons (13,100 tons) of ***industrial and special wastes*** (such as construction debris, used tires, and other materials with specific management requirements) per year, for an approximate daily rate of 33 metric tons (36 tons) (DIRS 180875-Nevada Rail Partners 2007, p. 6-3). (This estimate includes rail, ballast, and rail tie materials from the dismantling of the Department of Defense Branchline through Schurz, which would either be reused for the new rail line or recycled.) DOE would minimize the amount of these wastes as much as possible by ordering construction materials in correct sizes and amounts, reusing leftover materials, and recycling appropriate types of materials (DIRS 152540-Hoganson 2000, all).

Almost 1.8 million metric tons (2 million tons) of industrial and special wastes were disposed of in Nevada in 2002, which was 90 percent of the total solid waste (all categories) generated state-wide (DIRS 174663-State of Nevada 2005, slide 8). Nevada has 20 operating municipal landfills that combined accept more than 17,000 metric tons (19,000 tons) of waste per day (DIRS 184969-Nevada Division of Environmental Protection 2007, Appendix 3). However, most of this capacity is available through the Apex Landfill, which serves the Las Vegas Valley, and receives an average of 10,000 metric tons (11,000 tons) per day (DIRS 184969-Nevada Division of Environmental Protection 2007, pp. 6 and 7). Some of the landfills in Mineral, Esmeralda, and Nye Counties are quite small by comparison, and receive about 2.7 metric tons (3 tons) of waste per day (DIRS 184969-Nevada Division of Environmental Protection 2007, pp. 6 and 7).

It is likely that while some of the larger landfills would not see an appreciable change in the amount of waste received if they were utilized, some of the smaller landfills might see a substantial, although manageable, change in daily receipt of solid and industrial and special wastes if utilized during the construction phase.

As shown in Table 3-154, landfills in Mineral, Nye, Esmeralda, and Clark Counties accept more than 11,700 metric tons (13,000 tons) of waste per day combined. The addition of about 6.3 metric tons (6.9 tons) per day of solid waste anticipated during the construction phase (see Table 4-289) would raise the total amount disposed of in the four-county area by approximately 0.054 percent. DOE anticipates that about 33 metric tons (36 tons) per day of industrial and special wastes would need to be disposed of due to construction activities, which would result in an increase of approximately 0.28 percent in waste receipt to local landfills (DIRS 180875-Nevada Rail Partners 2007, p. 6-3). Therefore, impacts to local landfills from the disposal of solid and industrial and special wastes would be small (for the relatively large Apex Landfill) to moderate (for the smaller landfills).The geotechnical exploration program would include drilling approximately 2,100 boreholes at depths of 15 to 60 meters (50 to 200 feet). These borings would generate more than 1,000 cubic meters (1,300 cubic yards) of drill cuttings (DIRS 181867-Holder 2007, all). DOE would not dispose of these drill cuttings in landfills, but would dispose of them through land application, which would involve spreading the drill cuttings on the land surface. All drilling fluids would meet the requirements for standard land disposal. Therefore, there would be no impacts to waste treatment or disposal facilities as a result of the generation of drill cuttings.

Construction activities would include dismantling the existing Department of Defense Branchline through Schurz, which would involve the removal of 44 kilometers (27 miles) of rail, ballast, and rail ties (DIRS 180875-Nevada Rail Partners 2007, p. 2-3). Culverts, bridges, and the roadbed would be left in place. The rail, ballast, and rail tie materials from the Department of Defense Branchline through Schurz would either be reused for the proposed new rail line or recycled to the extent practicable.

Construction activities would include some clearing of land. Wastes generated from this activity, including soil and plant material, would be used to construct fill slopes and contours within the rail line construction right-of-way; therefore, no waste would need to be disposed of and there would be no impacts to local waste disposal facilities from clearing of land (DIRS 180875-Nevada Rail Partners 2007, p. 6-1).

Earthwork fill requirements for rail line construction would be expected to outweigh cut requirements (DIRS 180872-Nevada Rail Partners 2007, Appendix D). In the event that more cut material was generated than would be needed as fill, DOE would use the excess to strengthen access roads and rail embankments. Therefore, no excess cut material would need to be disposed of and there would be no impacts to disposal facilities from the generation of excess cut material.

4.3.12.2.2 Hazardous-Materials Use and Hazardous-Waste Generation

DOE would store and use hazardous materials such as oil, gasoline, diesel fuel, and solvents during the construction phase primarily for the operation and maintenance of equipment and cleaning of equipment and facilities. The Department would implement an Environmental Management System and a Pollution Prevention/Waste Minimization Program during the construction and operations phases, which would include an evaluation of alternatives to eliminate, reduce, or minimize the amounts of hazardous materials used and hazardous wastes generated. As part of the Environmental Management System, DOE would regularly perform assessments to identify opportunities to reduce the generation of waste (DIRS 182385-Burns 2007, all). The Department would formulate and implement Spill Prevention Control and Countermeasures plans, including the use of secondary containment, to prevent releases of hazardous materials, such as diesel fuel, to the environment.

Table 4-290 lists the anticipated hazardous materials and the waste types that could be generated. The Department expects some materials (such as diesel fuel, lubricants, and hydrocarbons) would be used at

Table 4-290. Summary of anticipated types of hazardous materials that would be used and wastes that would be generated during railroad construction and operations – Mina rail alignment.[a,b]

	Railroad construction	Construction camps	Concrete batch plants	Asphalt plants	Railroad operations[c]
Materials					
Fuel	X	X	X	X	X
Lubricants	X	X	X	X	X
Hydrocarbons (oils, greases)	X	X	X	X	X
Solvents	X	X		X	X
Compressed gas (flammable and nonflammable)	X	X	X	-	X
Batteries (such as lead, acid, nickel-cadmium)	X	X	X	-	X
Battery acid	X	X	-	-	X
Reactive (magnesium welding/fusing)	X	X	-	-	X
Explosives	X	X	-	-	-
Flammables (such as paints, coatings)	X	X	X	X	X
Herbicides/pesticides	X	X	-	-	X
Cleaning supplies (such as bleach ammonia)	X	X	X	-	X
Lithium lubricants	X	-	-	-	X
Wastes					
Refuse	X	X	X	X	X
Industrial/construction waste	X	X	X	-	X
Hazardous waste	X	X	-	X	X
Recyclable/biodegradable	X	X	-	X	X
Universal waste (such as fluorescent lighting)	X	X	X	X	X
Tires	X	X	X	X	X
Asphalt	X	-	-	X	-
Antifreeze	X	X	X	X	X
Hydrocarbon-contaminated soils	X	X	X	X	X
Sewage	X	X	X	X	X
Gray water	-	X	-	-	X
Low-level radioactive waste	-	-	-	-	X

a. Source: DIRS 176750-Bishop 2006, all.
b. An X indicates that the listed material would be used or the listed waste would be generated during that specific activity or at that specific facility; a dash indicates that the listed material would not be used or the listed waste would not be generated during that specific activity or at that specific facility.
c. Includes only the proposed railroad activities; does not include DOE facilities at the Yucca Mountain Repository.

each of the construction support facilities. However, most materials used and wastes generated would be specific to certain activities and facilities. It is estimated that each year during the course of construction, approximately 18 metric tons (approximately 20 tons) of hazardous waste will be generated (a total of 74 metric tons [82 tons] over the entire construction phase), much of which can be recycled through existing Nevada municipal waste programs. The nonrecyclable hazardous wastes generated during both the construction and operations phases of the railroad will be stored and disposed of in accordance with applicable federal and state regulations.

Hazardous wastes, such as used lubricants and solvents, would be accumulated, shipped, and disposed of in accordance with Resource Conservation and Recovery Act regulations. Hazardous wastes would be shipped in accordance with 49 CFR Parts 171 and 172 and U.S. Department of Transportation Hazardous Materials 215D regulations. The disposal capacity for hazardous wastes in western states has been estimated at 50 times the demand for landfills and 7 times the demand for incineration until at least 2013 (DIRS 103245-EPA 1996, pp. 32, 33, 36, 46, 47, and 50); thus, there would be ample capacity available to dispose of any hazardous wastes. Through compliance with applicable state and federal regulations, adverse impacts from the use of hazardous materials, generation of hazardous waste, and the disposal of hazardous waste would be small.

DOE could use explosives during quarry, access-road, and rail line construction, and would develop a safety program specifically for the storage, transportation, and handling of these materials. The Department would adhere to the requirements of DOE Order 440.1A, *Worker Protection Management for DOE Federal and Contractor Employees* (as described in Chapter 6), which specifies that explosives operations must comply with the DOE Explosives Safety Manual (DOE M 440.1-1A). The manual provides guidance on the storage and transportation of explosives and refers to Occupational Safety and Health Administration safety requirements for routine construction and tunnel-blasting operations.

There could be impacts if hazardous materials, such as fuels, lubricants, and antifreeze, were released and spread. DOE would store such materials at construction camps, and supply trucks would routinely bring new materials and remove used lubricants and coolants from the construction sites. These activities could result in local spills and releases of contaminants. DOE would immediately remediate any areas affected by such spills in accordance with applicable regulations (see Chapter 6).

4.3.12.2.3 Low-Level Radioactive Waste

No low-level radioactive waste would be generated during the construction phase.

4.3.12.3 Operations Impacts

DOE would purchase hazardous and nonhazardous products and materials during the operations phase. The use of hazardous materials and products would lead to the generation of hazardous wastes. Table 4-290 lists the anticipated hazardous materials and the waste types that could be generated during the railroad operations phase.

4.3.12.3.1 Nonhazardous Waste

Railroad operations would generate solid wastes, which DOE would dispose of at facilities along the rail line. Amounts of such wastes would be very small and would not impact disposal capacity in Clark, Esmeralda, Nye, and Mineral Counties.

Amounts of industrial and special wastes generated during maintenance of fixed equipment such as signals and rail crossings would be very small and would be disposed of in accordance with applicable federal and state regulations. Where possible such wastes would be recycled (DIRS 180919-Nevada Rail

Partners 2007, p. 3-6). DOE anticipates that crossties, ballast, rails, and bridges would be likely to require replacement in approximately 25 years of operations. However, if and when these materials do require maintenance or replacement, they would be recycled if their reuse was not an option. Therefore, no impacts to local landfills would be anticipated from the disposal of industrial and special wastes during the operations phase.

The anticipated quantity of solid waste generated at all railroad operations support facilities is 170 metric tons (190 tons) per year or 0.45 metric ton (0.5 ton) per day (Table 4-291). DOE would transport solid waste to permitted solid-waste landfills. As shown in Table 3-154, landfills in Mineral, Nye, Esmeralda, and Clark Counties accept more than 11,700 metric tons (13,000 tons) of waste per day combined. The addition of about 0.45 metric ton (0.5 ton) of solid waste anticipated during the operations phase (Table 4-291) would raise the total amount disposed of in the four-county area by less than 0.01 percent. Nevada has enough landfill capacity to accommodate this additional solid waste; therefore impacts to landfill capacities would be small.

Table 4-291. Solid waste generation at proposed railroad operations support facilities – Mina rail alignment.

Facility	Number of personnel (maximum)	Solid waste generation (pounds per day per person)[a,b]	Total solid waste (tons per day)[c]	Total solid waste (tons per year)
Cask Maintenance Facility	30[d]	6.4	0.1	36
Staging Yard at Hawthorne	40[d,e]	6.4	0.13	47
Rail Equipment Maintenance Yard (including the Nevada Railroad Control Center and National Transportation Operations Center)[f]	40[d,e]	6.4	0.13	47
Maintenance-of-Way Facility	40[e]	6.4	0.13	47
Totals[g]	150		0.49	177

a. To convert pounds to kilograms, multiply by 0.45359.
b. Source: Per person solid waste generation rate is from DIRS 174041-State of Nevada 2004, p. 13.
c. To convert tons to metric tons, multiply by 0.90718.
d. Includes four rail-crew members.
e. Source: DIRS 180874-Nevada Rail Partners 2007, Appendix D.
f. The Nevada Railroad Control Center could be at either the Rail Equipment Maintenance Yard or the Staging Yard at Hawthorne and the National Transportation Operations Center could be anywhere in the continental United States; for purposes of analysis, DOE assumed these centers would be at the Rail Equipment Maintenance Yard.
g. Totals might not equal sums of values due to rounding.

4.3.12.3.2 Hazardous-Materials Use and Hazardous-Waste Generation

Maintenance of rolling and stationary railroad equipment and track would generate some hazardous wastes, including: lubricants from equipment and machinery, solvents, paint, and other hazardous materials typical of railroad operations.

The Staging Yard at Hawthorne, including the collocated Interchange Yard, would use limited quantities of hazardous materials, such as oils, solvents, and lubricants, and associated wastes would be generated. An off-site contractor would perform diesel fueling at the Staging Yard using a tank truck to service the yard switcher locomotive. DOE would also store propane and natural gas at the Staging Yard in tanks (DIRS 180873-Nevada Rail Partners 2007, pp. 3-1 and 3-2).

The Maintenance-of-Way Facility would include maintenance work areas, office space, and a material-storage area. Limited quantities of hazardous materials such as lubricants, solvents, and possibly pesticides (for example, herbicides and rodenticides), would be stored and used there, and associated wastes would be generated. DOE would also store propane or natural gas onsite in tanks (DIRS 180873-Nevada Rail Partners 2007, pp. 4-1, 4-4, and 4-7).

DOE would store and use hazardous materials, including diesel fuel, gasoline, propane, oils, paints, and solvents, at the Cask Maintenance Facility and associated hazardous wastes (such as oily rags and solvent wastes) would be generated (DIRS 174083-WPI 2003, pp. 30, 39, and 52). Compressed flammable gas and oxygen would also be stored at the Cask Maintenance Facility.

The Nevada Railroad Control Center could be at either the Rail Equipment Maintenance Yard or the Staging Yard and the National Transportation Operations Center could be anywhere in the continental United States, although for purposes of analysis, DOE assumed these Centers would be at the Rail Equipment Maintenance Yard. The Centers would consist primarily of office space (DIRS 180873-Nevada Rail Partners 2007, p. 5-1). DOE would store general cleaning supplies at these facilities.

There would be a diesel fuel storage tank with a 190,000-liter (50,000-gallon) capacity and a diesel fueling depot at the Rail Equipment Maintenance Yard (DIRS 181033-Hamilton-Ray 2007, all). There would also be a staging area where fuel oil and construction materials could be delivered to the repository. DOE would store and use hazardous materials, including lubricating oil, diesel fuel, natural gas or propane, and solvents, at the Rail Equipment Maintenance Yard and associated hazardous wastes would be generated (DIRS 180873-Nevada Rail Partners 2007, p. 5-1). Locomotive maintenance activities would generate approximately 420 liters (110 gallons) of used oil for each locomotive maintained (DIRS 155970-DOE 2002, p. 6-89). During peak operations, a maximum of 442 locomotives would travel on the rail line each year (DIRS 175036-BSC 2005, Table 4.2), which would generate approximately 190,000 liters (50,000 gallons) per year of used oil from locomotive maintenance. The used oil would be reclaimed rather than disposed of (DIRS 155970-DOE 2002, p. 6-89). During the operations phase of the railroad, approximately 17,010 metric tons (approximately 18,750 tons) of hazardous waste could be produced during the shipping campaign. It is anticipated that much of this material will also be recyclable through existing waste programs.

There could be small spills of hazardous materials such as oils and fuel along the rail line during the operations phase. DOE would immediately remediate any areas affected by such spills in accordance with applicable regulations (See Chapter 6).

DOE would manage the use of hazardous materials and would follow all federal, state, and local regulations, and would transport hazardous wastes to appropriately permitted disposal facilities that have ample capacities to receive such wastes, as discussed in Section 4.3.12.2.2. Therefore, impacts from the use of hazardous materials and the disposal of hazardous waste during the operations phase would be small.

4.3.12.3.3 Low-Level Radioactive Waste

Activities at the Cask Maintenance Facility would generate from 3,200 to 7,900 cubic meters (113,000 to 280,000 cubic feet) of low-level radioactive waste throughout the operations phase (DIRS 181425-MTS 2007, p. 6). Site-generated, low-level radioactive waste would be controlled and disposed of in a DOE low-level radioactive waste disposal site, in an ***Agreement State*** site, or in a U.S. Nuclear Regulatory Commission-licensed site subject to the completion of the appropriate review pursuant to the National Environmental Policy Act. Disposal in an Agreement State site or in a U.S. Nuclear Regulatory Commission-licensed site would be in accordance with applicable portions of 10 CFR Part 20.

Impacts to licensed disposal facilities from low-level radioactive waste would be small because the amount of such waste would be small. For comparison, the total amount of waste estimated to be generated throughout the operations phase accounts for only about 6 percent of the low-level waste disposed of in 2005 at commercial low-level waste facilities nationwide (DIRS 182320-NRC 2007, all).

4.3.12.4 Impacts under the Shared-Use Option

Impacts under the Shared-Use Option would be similar to those described for the Proposed Action without shared use. The only difference would be the construction and operation of additional sidings and a slight increase in overall rail traffic. Waste characteristics, generation rates, and disposal requirements would vary only slightly. Therefore, any additional adverse impacts associated with the Shared-Use Option would be small.

4.3.12.5 Summary

Table 4-292 summarizes potential impacts related to the use of hazardous materials and the generation of waste from constructing and operating the proposed railroad along the Mina rail alignment. Chapter 7 describes mitigation measures DOE could employ to reduce impacts.

Table 4-292. Summary of potential impacts related to the use of hazardous materials and the generation of waste from constructing and operating the proposed railroad – Mina rail alignment[a] (page 1 of 2).

Rail line segment/facilities (county)	Construction impacts	Operations impacts
Common to all alternative segments and common segments (Mineral, Nye, and Esmeralda Counties)	Small (Apex Landfill) to moderate (smaller landfills) impacts from nonhazardous-waste (solid and industrial and special waste) disposal. Small impacts from use of hazardous materials. Small impacts from hazardous-waste disposal.	Small impacts from nonhazardous-waste (solid and industrial and special waste) disposal. Small impacts from use of hazardous materials. Small impacts from hazardous-waste disposal.
Staging Yard at Hawthorne (Mineral County)	Small (Apex Landfill) to moderate (smaller landfills) impacts from nonhazardous-waste (solid and industrial and special waste) disposal. Small impacts from use of hazardous materials. Small impacts from hazardous-waste disposal.	Small impacts from nonhazardous-waste (solid and industrial and special waste) disposal. Small impacts from use of hazardous materials. Small impacts from hazardous-waste disposal.
Maintenance-of-Way Facility; Rail Equipment Maintenance Yard; Cask Maintenance Facility; and Nevada Railroad Control Center and National Transportation Operations Center at the Rail Equipment Maintenance Yard (Mineral, Nye, and Esmeralda Counties)	Small (Apex Landfill) to moderate (smaller landfills) impacts from nonhazardous waste (solid and industrial and special waste) disposal. Small impacts from use of hazardous materials. Small impacts from hazardous-waste disposal.	Small impacts from nonhazardous-waste (solid and industrial and special waste) disposal. Small impacts from use of hazardous materials. Small impacts from hazardous-waste disposal. Small impacts from low-level radioactive waste disposal for wastes that would be generated at the Cask Maintenance Facility.

Table 4-292. Summary of potential impacts related to the use of hazardous materials and the generation of waste from constructing and operating the proposed railroad – Mina rail alignment[a] (page 2 of 2).

Rail line segment/facilities (county)	Construction impacts	Operations impacts
Construction camps (Mineral, Nye, and Esmeralda Counties)	Small (Apex Landfill) to moderate (smaller landfills) impacts from nonhazardous waste (solid and industrial and special waste) disposal. Small impacts from use of hazardous materials. Small impacts from hazardous-waste disposal.	No impact. There would be no construction camps during railroad operations.
Access roads (including alignment service road) (Mineral, Nye, and Esmeralda Counties)	Small (Apex Landfill) to moderate (smaller landfills) impacts from nonhazardous waste (solid and industrial and special waste) disposal. Small impacts from use of hazardous materials. Small impacts from hazardous-waste disposal.	No impact. Use of access roads during railroad operations would not involve the use of hazardous materials or the generation of wastes.
Quarries (common to all potential quarry locations)	Small (Apex Landfill) to moderate (smaller landfills) impacts from nonhazardous waste (solid and industrial and special waste) disposal. Small impacts from use of hazardous materials. Small impacts from hazardous-waste disposal.	No impact. DOE would not operate quarries after the end of the construction phase.

a. Impacts under the Shared-Use Option would be similar to those under the Proposed Action without shared use.

Impacts from nonhazardous waste (solid and industrial and special waste) disposal listed in Table 4-292 represent the degree to which potentially affected landfills could be affected by increased waste receipt rates as a result of railroad construction and operations along the Mina rail alignment. Construction of the proposed railroad along the Mina rail alignment would raise the disposal rate of nonhazardous waste to landfills in the region of influence by about 0.34 percent. Overall, impacts during the construction phase would be small, for the relatively large Apex Landfill, to moderate for smaller landfills. During the operations phase, impacts to landfills would be small.

Impacts from the use of hazardous materials listed in Table 4-292 represent the likelihood that railroad construction and operations along the Mina rail alignment would create reasonably foreseeable conditions that would significantly increase the risk of a release of hazardous material. Overall, impacts during the construction and operations phases would be small, considering that DOE would implement proper planning measures in relation to the storage and handling of hazardous materials and would adhere to all applicable regulations.

Impacts from hazardous-waste disposal listed in Table 4-292 represent the degree to which potentially affected hazardous-waste disposal facilities could be affected by increased waste receipt rates as a result of railroad construction and operations along the Mina rail alignment. Overall, impacts during the construction and operations phases would be small because the amount of waste generated would be small.

Impacts from the disposal of low-level radioactive waste disposal listed in Table 4-292 represent the degree to which potentially affected low-level radioactive waste disposal facilities could be affected by increased waste receipt rates as a result of railroad construction and operations along the Mina rail alignment. No low-level radioactive waste would be generated during the construction phase. During the operations phase, low-level radioactive wastes would be generated during cask maintenance activities at the Cask Maintenance Facility. Impacts to low-level radioactive waste disposal facilities during the operations phase would be small because adequate disposal capacity would be available.

4.3.13 CULTURAL RESOURCES

This section describes potential impacts to cultural resources from constructing and operating the proposed railroad along the Mina rail alignment. Section 4.3.13.1 describes the methods DOE used to assess potential impacts; Section 4.3.13.2 describes potential construction and operations impacts; Section 4.3.13.3 describes potential impacts under the Shared-Use Option; and Section 4.3.13.4 summarizes potential impacts to cultural resources. This section also incorporates American Indian perspectives to assess the potential direct and indirect impacts to important American Indian prehistoric and historic resources.

Section 3.3.13.1 describes the region of influence for cultural resources. Unless specified otherwise, this section describes impacts within the 3.2-kilometer (2-mile)-wide area centered on the rail alignment.

4.3.13.1 Impact Assessment Methodology

Because of the length of the proposed rail line along the Mina rail alignment, DOE is using a phased cultural resource identification and evaluation approach, as described in 36 CFR 800.4(b) 2, to identify specific cultural resources along the alignment. Under this approach, DOE would defer final field surveys (an intensive BLM ***Class III inventory***) of the actual construction right-of-way, as provided in the programmatic agreement between DOE, the BLM, the STB, and the Nevada State Historic Preservation Office (see Appendix M).

A **Class II inventory** is a sample-oriented field inventory designed to locate and record, from surface and exposed profile indications, all cultural resource sites within a portion of a defined area to make possible an objective estimate of the nature and distribution of cultural resources in the entire defined area.

A **Class III inventory** is an intensive field survey designed to locate and record all cultural resource sites within a specified area. Upon completion of such an inventory, no further cultural resource inventory work is normally needed in the area.

The programmatic agreement states that an appropriate level of field investigation – including on-the-ground intensive surveys; evaluations of all recorded resources listed on the *National Register of Historic Places*; assessments of adverse effects; and applicable mitigation of identified impacts – be completed before any ground-disturbing construction activities could begin. This programmatic agreement also stipulates that there be tribal consultation activities, and treatment (mitigation) guidelines and measures designed to cover unanticipated discoveries and impacts during the construction and operations phases. Tribal consultation is addressed in detail in the programmatic agreement and specifies the use of written communication, telephone communication, personal meetings, procedures for resolving identified issues, participation of tribal monitors during field studies, and notifications of tribes within 2 days in the event that any unanticipated archaeological materials (including American Indian human remains and sensitive cultural items as covered by the Native American Graves Protection and Repatriation Act) are encountered. Under the Native American Graves Protection and Repatriation Act, tribes must be notified if American Indian human remains or sensitive cultural items are discovered during excavation, and activity in that area must immediately stop. These requirements are included in Section II.D. of the programmatic agreement. Mitigation of impacts would be guided by an appropriate treatment or data recovery plan and would be designed to lessen or mitigate project-related effects to historic properties through avoidance, data recovery, or measures other than data recovery (including Historic American Buildings Survey/Historic American Engineering recordation, oral history, historic markers or exhibits, or interpretive publications).

The BLM administers most of the potentially affected land along the Mina rail alignment. Relevant provisions of another programmatic agreement between the BLM, the State of Nevada, and the Nevada

State Historic Preservation Office (DIRS 174690-Abbey & Baldrica 2005, all) would apply, along with cultural resources procedures outlined in the BLM *Cultural Resource Inventory Guidelines* (DIRS 174691-BLM 1990, all).

The region of influence for the Class III inventory would include all potential direct and indirect effects to cultural resources and all properties of traditional religious and cultural importance from any construction activities associated with the proposed railroad. Before beginning any ground-disturbing activities, DOE would conduct a Class III inventory and an ethnographic study for the following specific region of influence for project activities (DIRS 176912-Wenker et al. 2006, p. 2):

> The APE [Area of Potential Effect, referred to in this Rail Alignment EIS as the region of influence] for the rail line will be 200 feet [61 meters] from the centerline of the alignment or the actual ROW [right-of-way] application submitted to BLM, whichever is greater. The APE for access roads outside of the alignment will be a minimum of 100 feet [30.5 meters] wide with at least 50 feet [15 meters] on either side of centerline. The minimum APE for any construction areas or other temporary use areas, outside of the alignment, will be the footprint of the area plus 100 feet outward in all directions from the perimeter of each area. The APE for assessing indirect effects on historic properties outside of the rail line alignment will extend at least one mile in all directions from the perimeter of the direct effects APE.

Cultural resource requirements for the portion of Mina rail alignment within the Yucca Mountain Site boundary and at the Rail Equipment Maintenance Yard would be covered by a separate programmatic agreement prepared to address development of a geologic repository at Yucca Mountain, Nevada, underway between the DOE Office of Civilian Radioactive Waste Management, the Advisory Council on Historic Preservation, and the Nevada State Historic Preservation Office.

The present evaluation of impacts depends on a comprehensive review of existing literature and site-file databases, sample archaeological inventory, and discussions with responsible federal agencies, State of Nevada agencies, and American Indian groups, which have identified many known and potential archaeological, historical, and American Indian sites and features along the Mina rail alignment. Section 3.3.13.3 provides pertinent baseline information. DOE acquired additional information for potential cultural resources during ***Class II*** (sample-oriented) field surveys of the Mina rail alignment. American Indian viewpoints for potential impacts to sites and resources important to regional tribes and organizations in the southern portion of the Mina rail alignment are expressed in *American Indian Perspectives on the Proposed Rail Alignment Environmental Impact Statement for the U.S. Department of Energy's Yucca Mountain Project* (the American Indian Resource Document) (DIRS 174205-Kane et al. 2005, all). However, the American Indian Writers Subgroup prepared that document to address the Caliente rail alignment; therefore, it does not necessarily fully capture the views of the Walker River Paiute Tribe and other Northern Paiute groups.

DOE would commission an ethnographic study of the rail alignment to gain understanding of American Indian use of the area and the meaning of features and natural resources to Indian people. Plans for ethnographic studies are also described in Chapter 7.

4.3.13.2 Railroad Construction and Operations Impacts

Nearly all potential direct physical impacts to cultural resources, including those that would physically damage, alter, or disturb a historic property, would occur during the construction phase, specifically within the designated rail line construction right-of-way. There could be additional construction-related ground disturbances at quarry sites, road crossings, temporary access roads, borrow sites, ***spoils areas*** or piles, and temporary construction camps. Each camp would have a construction footprint of about 0.1 square kilometer (25 acres). There would be other ground disturbances at the locations of the railroad operations support facilities, including the Staging Yard at Hawthorne (0.2 square kilometer [50 acres]); the Maintenance-of-Way Facility (0.06 square kilometer [15 acres]), which would be near Goldfield; the Rail Equipment Maintenance Yard (about 0.41 square kilometer [101 acres]), which would be within the Yucca Mountain Site boundary; and the Cask Maintenance Facility, which would be collocated with the Rail Equipment Maintenance Yard.

There could be various forms of indirect impacts during both the construction and operations phases, such as visual intrusions or increased access and visitation. During construction, large numbers of workers in the vicinity of the construction camps could increase the potential for both intentional and unintentional impacts to nearby cultural resources. Excavation and other construction-related ground-disturbing activities could unearth additional cultural materials that, based on previous archaeological surveys, were either thought to occur only at the surface or were previously undetected because they were completely buried. Improved access to remote areas could also increase the likelihood of looting or other damage to archaeological properties during the construction and operations phases.

Another indirect impact that would be unavoidable from construction in remote areas would be visual intrusion effects to a variety of resources designated as potential cultural resource landscapes. These resources include potential ***ethnographic landscapes***, rural historic landscapes, and historic mining landscapes, and incorporate geographic areas, including both cultural and natural resources associated with historic events or activities. In some instances, the literature reviews, known-site file searches, and the Class II inventory conducted for this Rail Alignment EIS have identified potential areas of specific impacts for some of the alternative segments and common segments. In addition, the American Indian Resource Document (DIRS 174205-Kane et al. 2005, all) provides other relevant information.

4.3.13.2.1 Construction Impacts along Mina Rail Alignment Alternative Segments and Common Segments

The following sections outline both the direct and indirect construction-related impacts within each of the Mina rail alignment alternative segments and common segments. Each section begins with a discussion of the direct impacts to cultural resources, which is followed by a discussion of the indirect impacts. These sites include those listed on the *National Register of Historic Places*, those eligible for listing on the National Register, and those known to have cultural significance but are not listed on the National Register.

4.3.13.2.1.1 Union Pacific Railroad Hazen Branchline. The Class I site-file search identified 21 previously recorded cultural resources within the Level I region of influence of the existing Union Pacific Railroad Hazen Branchline. These resources include seven prehistoric sites, 10 historic sites, one site with both prehistoric and historic components, and three unknown site types. Six of the cultural properties are considered eligible or probably eligible for the National Register of Historic Places, including several that are part of the National Register-listed Lahontan Dam historic district (DIRS 182290-Desert Research Institute 2007, all). Eligible or potentially eligible resources include a large prehistoric residential base camp, a portion of the Overland Stage Road, the Newlands Waterworks at Lahontan City, a Lahontan City construction townsite and railroad station, a railroad berm and debris scatter, and a multi-component site with eligible historic elements including a telephone line and debris scatter. In addition, the existing rail line passes through Fort Churchill State Historic Park, site of an important 1860-1869 U.S. Army post. No direct or indirect impacts to these resources are anticipated due to the lack of planned construction activities.

The presence of 21 archaeological sites indicates a known site frequency of 0.5 site per mile within the Level I region of influence for this segment.

4.3.13.2.1.2 Department of Defense Branchline North. The Class I site-file search did not identify any cultural resources recorded within the Level I region of influence. No Class II survey has been conducted. No direct or indirect impacts to these resources are anticipated due to the lack of planned construction activities.

Previous archaeological studies do not indicate the presence of any archaeological sites within the Level I region of influence for this segment.

4.3.13.2.1.3 Schurz Alternative Segments. The Class I site-file search revealed that five cultural resources are recorded along Schurz alternative segment 1, including two within the Level I region of influence and three within the Level II region of influence. Previously recorded sites include one prehistoric site, three historic sites, and one multi-component prehistoric and historic site. None of the five resources has been evaluated for eligibility to the *National Register of Historic Places*.

DOE surveyed 15 sample units during the Class II effort, totaling 12 kilometers (7.5 miles) or 23 percent of the segment. Eight resources were recorded, including five prehistoric sites, all characterized by ***lithic scatters***, and three historic sites, including two railroads and one trash deposit. One prehistoric lithic scatter and one historic railroad are potentially eligible for listing on the *National Register of Historic Places*. The other six resources appear ineligible for listing. Construction activities along this segment could result in direct and indirect impacts to these eligible or potentially eligible prehistoric and historic resources. Sample inventory indicates that approximately 34 resources could be present within the Level I region of influence.

The Class I site-file search revealed that one historic cultural resource, the Rawhide Western Railroad grade, has been recorded along Schurz alternative segment 4, within the Level I region of influence. National Register-eligibility of this resource has not been determined. Construction activities along this segment could result in direct and indirect impacts to this grade.

DOE surveyed four sample units during the Class II effort along Schurz alternative segment 4, totaling 3.2 kilometers (2 miles) or 5 percent of the segment. Eight prehistoric resources were recorded, including lithic and groundstone scatters, and a quarry. Three of the sites are considered potentially eligible for listing on the *National Register of Historic Places*, two are considered not eligible, and three of the sites have not been evaluated. Construction activities along this segment could result in direct and indirect impacts to these eligible or potentially eligible prehistoric and historic resources. Sample inventory indicates that approximately 160 resources could be present within the Level I region of influence.

The Class I site-file search revealed that four cultural resources are recorded along Schurz alternative segment 5, including two within the Level I region of influence and two within the Level II region of influence. These include three historic sites and one multi-component prehistoric and historic site. The multi-component site, Double Spring, is considered eligible for listing on the *National Register of Historic Places* and is in the Level II region of influence; the historic sites have not been evaluated.

DOE surveyed 10 sample units during the Class II effort along Schurz alternative segment 5, totaling 8 kilometers (5 miles) or 11 percent of the segment. Four resources were recorded, including three prehistoric lithic scatters, all unevaluated for eligibility, and one historic site, a trash deposit that is recommended not eligible for listing on the *National Register of Historic Places*. Construction activities along this segment could result in direct and indirect impacts to these eligible or potentially eligible prehistoric and historic resources. The National Register-eligible Double Spring, located outside of the Level I region of influence, would not be directly impacted. Sample inventory indicates that approximately 35 resources could be present within the Level I region of influence.

The Class I site-file search revealed that nine cultural resources are recorded along Schurz alternative segment 6, including five within the Level I region of influence and four within the Level II region of influence. Of these nine, seven are prehistoric or have a prehistoric component, and two are historic resources. Prehistoric resources include one isolate, two lithic scatters, one rock alignment with possible burials, one ***petroglyph*** site, and one site considered eligible for listing on the *National Register of Historic Places* that has a medicine rock, cairns, hunting blinds, and petroglyphs. The isolate and one of the lithic scatters are considered not eligible; eligibility status of the remaining prehistoric sites has not been determined. The sites within the Level I region of influence include a lithic scatter, the isolate, and the rock alignment. The two historic sites that would fall along Schurz alternative segment 6 are found within the Level I region of influence and include the Rawhide Western Railroad grade and the Reese River Road stage route. Eligibility status of these resources has not been determined.

DOE surveyed two sample units during the Class II effort, totaling 1.6 kilometers (1 mile) or 2 percent of the segment. One resource, a prehistoric lithic scatter, was recorded. This site has not been evaluated for listing on the *National Register of Historic Places*. Construction activities along this segment could result in direct and indirect impacts to the eligible or potentially eligible prehistoric and historic resources. Sample inventory indicates that approximately 45 resources could be present within the Level I region of influence.

4.3.13.2.1.4 Department of Defense Branchline South. The Class I site-file search revealed that three cultural resources are recorded within 152 meters (500 feet) of the existing rail line, including an historic pier piling, the historic Nolan Station rail siding, and a boulder containing cupule-style rock art (DIRS 182290-Desert Research Institute 2007, all). The historic pier piling is considered not eligible, and the other two sites have not been evaluated for eligibility. No direct or indirect impacts to these resources are anticipated due to the lack of planned construction activities.

4.3.13.2.1.5 Mina Common Segment 1 (Soda Spring Valley Area). The Class I site-file search revealed that 56 cultural resources are recorded along Mina common segment 1, including 18 within the Level I region of influence and 38 within the Level II region of influence. Within the Level I region of influence, previously recorded resources include two prehistoric lithic scatters (one site is considered not eligible, one site has not been evaluated), 14 historic sites (five sites are considered eligible, two sites are considered not eligible, and seven sites have not been evaluated), and two multi-component sites (one site is not eligible, one site has not been evaluated). Types of eligible resources falling within the Level I region of influence include the Sodaville to Tonopah Freight Road, railroad workers’ camps, and a railroad grade. Within the Level II region of influence, there are 24 prehistoric sites (15 sites are considered not eligible, and nine have not been evaluated), and 14 historic sites (four are considered eligible, six are considered not eligible, and four have not been evaluated). The prehistoric sites consist of a rockshelter, lithic scatters, and isolates. Most of the historic sites are associated with railroad construction and operations, including camps, stations, and grades. Mining sites and the townsites of Redlich and Mina also fall within the region of influence of Mina common segment 1.

DOE surveyed 29 sample units during the Class II effort, totaling 23 kilometers (15 miles) or 20 percent of the segment. A total of 19 resources were recorded, including 14 prehistoric sites (13 lithic scatters and one quarry), three historic trash deposits, and two historic railroads. One historic railroad and the prehistoric quarry site are both considered eligible for listing on the *National Register of Historic Places*. Seven of the prehistoric lithic scatters are considered not eligible, and six have not been evaluated for eligibility. The three historic trash deposits and the additional historic railroad are considered not eligible. Given the high density of resources along this segment, construction activities could result in direct and indirect impacts to the eligible or potentially eligible prehistoric and historic resources.

Sample inventory indicates that approximately 94 resources could be present within the Level I region of influence.

4.3.13.2.1.6 Montezuma Alternative Segments.

Montezuma Alternative Segment 1 The Class I site-file search revealed that 43 cultural resources are recorded along Montezuma alternative segment 1, including five within the Level I region of influence and 38 within the Level II region of influence. Within the Level I region of influence, two prehistoric sites, including a quarry site of unknown eligibility status and a small lithic scatter that is considered not eligible, and three historic sites (two sites, a railroad grade and telephone line, are considered eligible and one site, a trash dump, has not been evaluated) are present.

Within the Level II region of influence, previously recorded resources include 27 prehistoric sites (one site is considered eligible, 17 sites are considered not eligible, and nine have not been evaluated), 10 historic sites (three are considered eligible, four are considered not eligible, and three have not been evaluated), and one multi-component site that is considered not eligible. The majority of the prehistoric sites consist of lithic scatters and isolates, though cave and quarry sites are also present; historic sites include railroad grades, a dump, a wagon road, mining sites, and the townsite of Blair.

DOE surveyed 25 sample units during the Class II effort, totaling 20 kilometers (13 miles) or 17 percent of the segment. Twenty resources were recorded, including 17 prehistoric lithic scatters, two historic trash deposits, and one historic mining site. One lithic scatter is considered eligible for listing on the *National Register of Historic Places*; three scatters are considered not eligible, and the remaining 13 prehistoric sites have not been evaluated for eligibility. Of the historic sites, one trash deposit and the mining site are considered not eligible; the other trash deposit has not been evaluated. Construction activities along this segment could result in direct and indirect impacts to the eligible or potentially eligible prehistoric and historic resources.

Sample inventory indicates that approximately 117 resources could be present within the Level I region of influence.

Montezuma Alternative Segment 2 The Class I site-file search revealed that 226 cultural resources are recorded along Montezuma alternative segment 2, including 39 within the Level I region of influence and 187 within the Level II region of influence. Within the Level I region of influence, previously recorded resources include 11 prehistoric sites (10 are considered not eligible, one has not been evaluated), 17 historic sites (one site, the townsite of Goldfield, is listed on the *National Register of Historic Places*, nine sites are considered eligible, and seven are considered not eligible), and 11 multi-component sites (one site is considered eligible, nine are considered not eligible, and one has not been evaluated). Eligible site types include railroad grades, Millers townsite, a mining camp and miner’s cabin, the Goldfield Junction Station and Goldfield Dump, a feed lot with corrals, and a multi-component site having mining structures and rock art. An unrecorded American Indian settlement is also reported along Montezuma alternative segment 2.

Within the Level II region of influence, recorded resources include 112 prehistoric sites (four sites are considered eligible, 73 are considered not eligible, and 35 have not been evaluated), 58 historic sites (14 sites are considered eligible, 42 are considered not eligible, and two have not been evaluated), and 17 multi-component sites (14 are considered not eligible, and three have not been evaluated). The majority of the prehistoric sites consist of small lithic scatters and isolates; a variety of historic sites is found, primarily associated with mining and railroad activities. Historic sites also include the townsite of Millers, cemeteries, historic dumps, and military encampments, as well as sites and features potentially contributing to the *National Register of Historic Places*-listed Goldfield townsite.

DOE surveyed 24 sample units during the Class II effort, totaling 19 kilometers (12 miles) or 16 percent of the segment. A total of 39 resources were recorded, including 28 prehistoric lithic scatters and one quarry, four historic trash deposits, three historic railroad sites, one historic homestead site, one historic mining site, and one multi-component site.

Two of the lithic scatters are considered eligible for listing on the *National Register of Historic Places*, and seven are considered not eligible; 19 lithic scatters and the quarry have not been evaluated for eligibility. The four historic trash deposits, two of the railroads, and the mining site are considered not eligible; one railroad, the homestead, and the multi-component site have not been evaluated. Given the high density of resources along this segment, construction activities could result in direct and indirect impacts to the eligible or potentially eligible prehistoric and historic resources.

Sample inventory indicates that approximately 241 resources could be present within the Level I region of influence.

Montezuma Alternative Segment 3 The Class I site-file search revealed that 84 cultural resources are recorded along Montezuma alternative segment 3, including eight within the Level I region of influence and 76 within the Level II region of influence. Within the Level I region of influence, there is one prehistoric site (considered not eligible) and seven historic sites (six are considered eligible, and one is considered not eligible). The eligible resources include two railroad grades, Millers townsite, the Goldfield Junction Station, a mining camp, and a feed lot with corrals.

Within the Level II region of influence, previously recorded resources include 55 prehistoric sites (35 sites are considered not eligible, and 20 have not been evaluated), 18 historic sites (four sites are considered eligible, 12 are considered not eligible, and two have not been evaluated), and three multi-component sites that are considered not eligible. The majority of the prehistoric sites consist of small lithic scatters and isolates; a rockshelter is also present. Historic sites are primarily associated with mining and railroad activities, and include camps, dumps, mining features, and railroad grades and stations.

DOE surveyed 30 sample units during the Class II effort, totaling 24 kilometers (15 miles) or 17 percent of the segment. A total of 46 resources were recorded, including 36 prehistoric lithic scatters and one quarry, three historic trash deposits, three historic railroad sites, one historic homestead site, one historic mining site, and one multi-component site.

Two of the lithic scatters are considered eligible for listing on the *National Register of Historic Places*, and eight are considered not eligible; 26 lithic scatters and the quarry have not been evaluated for eligibility. The three historic trash deposits, two of the railroads, and the mining site are considered not eligible; one railroad, the homestead, and the multi-component site have not been evaluated. Given the high density of resources along this segment, construction activities could result in direct and indirect impacts to the eligible or potentially eligible prehistoric and historic resources.

Sample inventory indicates that approximately 270 resources could be present within the Level I region of influence.

4.3.13.2.1.7 Mina Common Segment 2 (Lida Junction Area). The Class I site-file search revealed that one prehistoric cultural resource, the Twin Buttes Rockshelters, is recorded along Mina common segment 2 within the Level II region of influence. This site has not been formally evaluated for eligibility, but is likely to be considered eligible. No cultural resources are previously identified within the Level I region of influence.

No Class II effort has been conducted along this short segment, which is between regular sample intervals; archaeological site distribution can be anticipated to reflect that noted along adjoining segments. The Twin Buttes Rockshelters would not be affected by construction of this segment.

4.3.13.2.1.8 Bonnie Claire Alternative Segments.

Bonnie Claire Alternative Segment 2 The Class I site-file search identified one cultural resource in the Level I region of influence. The site includes both prehistoric and historic components (a lithic scatter and mining prospects and debris). The prehistoric component was evaluated as being eligible for listing on the *National Register of Historic Places*.

The Class II sample survey examined five sample units, a total of 4 kilometers (2.5 miles) or 19 percent of the segment. Two sites and five isolates were recorded. The sites include a prehistoric campsite with a lithic and ground stone scatter, evaluated as being eligible for listing on the *National Register of Historic Places*, and a lithic scatter for which eligibility is under review.

Potential direct and indirect impacts along this alternative segment include the National Register-eligible prehistoric lithic and ground stone scatter identified during the Class II survey. This area also reveals the potential for the existence of prehistoric lithic scatters, obsidian nodule source areas, and rockshelters that, if present, would be directly affected by the construction of this alternative segment. The American Indian Resource Document (DIRS 174205-Kane et al. 2005, all) does not identify any known areas of importance to American Indians along this alternative segment.

The sample inventory indicates that approximately 10 resources could be present within the Level I region of influence.

Bonnie Claire Alternative Segment 3 The Class I site-file search identified four cultural resources within the Level I region of influence. These resources include four previously recorded but unevaluated prehistoric sites. One of these is a rockshelter, and the other three are extractive sites located in areas of obsidian cobble occurrences.

The Class II survey inspected four sample units along this segment, a total of 3.2 kilometers (2 miles) or 17 percent of the segment. One site and 24 isolates were recorded. The site is an historic rail line construction camp along the abandoned combined Bullfrog and Goldfield/Las Vegas and Tonopah rail bed, recommended as eligible for listing on the *National Register of Historic Places*. The American Indian Resource Document (DIRS 174205-Kane et al. 2005, all) does not identify specific resources for this alternative segment.

Construction along this alternative segment could result in direct and indirect impacts to the historic railroad camp along the abandoned Bullfrog and Goldfield/Las Vegas and Tonopah Railroad.

Sample inventory indicates that approximately six resources could be present within the Level I region of influence.

4.3.13.2.1.9 Common Segment 5 (Sarcobatus Flat Area). The Class I site-file search identified 33 cultural resources along common segment 5, including seven within the Level I region of influence and 26 within the Level II region of influence. These resources include 20 prehistoric sites (14 lithic scatters and six quarry extractive sites), four historic sites (a Tolicha mining district campsite, two debris scatters, and a railroad segment), seven isolates, and two unknown sites. Of these sites, one lithic scatter has been recommended as eligible for listing on the *National Register of Historic Places*, 11 are not eligible, and 14 remain unevaluated.

DOE surveyed 10 sample units along this segment for the Class II effort, a total of 8 kilometers (5 miles) or 20 percent of the segment. Four prehistoric sites (three lithic scatters and one campsite) and 33 isolates were recorded. Of these sites, the campsite was recommended as eligible for listing on the *National Register of Historic Places,* and the tree lithic scatters are not eligible.

Common segment 5 would pass about 2.4 kilometers (1.5 miles) east of the Timbisha Shoshone Trust Lands at Scottys Junction. However, no specific cultural resource properties are identified on those lands that would be indirectly affected by construction of the proposed railroad. There is a high probability for direct and indirect impacts along common segment 5. Previous cultural resources inventories in the Sarcobatus Flat area indicate a relatively high potential for lithic scatters and extractive quarries (obsidian nodules).

The sample inventory indicates that approximately 15 resources could be present within the Level I region of influence.

4.3.13.2.1.10 Oasis Valley Alternative Segments. The Class I site-file search identified three cultural resources along Oasis Valley alternative segments 1 and 3, within the Level II region of influence. These resources include one prehistoric campsite (recommended as eligible for nomination to the *National Register of Historic Places*) and two sites with both prehistoric and historic components (unevaluated ethnographic village sites).

Oasis Valley Alternative Segment 1 The Class II survey looked at three sample units along Oasis Valley 1, a total of 2.4 kilometers (1.5 miles) or 25 percent of the segment. Two prehistoric sites (lithic scatters) and one historic mine site were recorded, all recommended not eligible for nomination to the *National Register of Historic Places*.

This alternative segment would cross the culturally sensitive Oasis Valley, where potential ethnographic and historic ranching cultural landscapes are present. There could be direct and indirect impacts to sites in the Oasis Valley, particularly the unrecorded historic Beatty Cattle Company Ranch and an unevaluated Western Shoshone winter camp.

The American Indian Resource Document notes the presence of the early Western Shoshone camp and also states that, because of its abundant water supply and large variety of culturally important plants and animals, American Indian people extensively used the entire valley (DIRS 174205-Kane et al. 2005, Section 2.3). Recent ethnographic studies on the nearby Nevada Test and Training Range revealed cultural links to Oasis Valley. The Oasis Valley area is both a potential ethnographic and historic ranching cultural landscape. In later historic times, these landscapes overlapped, as American Indian people collocated and supplied labor for the ranches.

Rail line construction could directly and indirectly affect sites in the Oasis Valley, particularly the historic Beatty Cattle Company Ranch and a known Western Shoshone winter camp.

The sample inventory indicates that approximately 20 resources could be present within the Level I region of influence.

Oasis Valley Alternative Segment 3 The Class II sample survey inspected four sample units, a total of 3.2 kilometers (2 miles) or 22 percent of the segment; five sites and 28 isolated artifacts were recorded. These resources include five prehistoric sites (four lithic scatters and one campsite with a lithic scatter and cleared rock rings). The campsite has been determined eligible for listing on the *National Register of Historic Places.*

Oasis Valley 3 also would cross the culturally sensitive Oasis Valley. It would pass just east of another historic ranch, the Colson or Indian Camp Ranch, which also has an early Western Shoshone winter camp adjacent to the ranch buildings. While both the ranch and Western Shoshone camp are unevaluated, rock lines (geoglyphs) were observed at the Indian camp area during field reconnaissance. These resources would be additional components of the potential Oasis Valley ethnographic and historic ranching cultural landscapes. Construction of the alternative segment could result in a visual intrusion to these cultural landscapes.

The sample inventory indicates that approximately 23 resources could be present within the Level I region of influence.

4.3.13.2.1.11 Common Segment 6 (Yucca Mountain Approach). The Yucca Mountain area has been heavily analyzed in conjunction with repository ***site characterization*** studies. Intensive cultural resource studies related to the development of the repository site have been completed. Consequently, a large number of archaeological sites have been found along common segment 6. This is due more to the intensive nature of past studies than actual site density characteristics.

A Class I site-file search identified 204 cultural resources along common segment 6. These resources include 152 prehistoric sites, three historic sites, one site with both prehistoric and historic components, and 49 isolates. Prehistoric sites include eight rockshelters (four eligible), two eligible rock-art sites, 13 campsites (five eligible), six quarry sites (two eligible), four rock features and two rock rings, and 117 lithic scatters (one eligible). Historic sites include two debris scatters and one rail segment.

The Class II survey for common segment 6 did not extend inside the Yucca Mountain Site boundary. DOE inspected 13 sample units, a total of 11 kilometers (7 miles) or 22 percent of the segment. Seven sites (two prehistoric lithic scatters, four eligible sites with both prehistoric and historic components, and one historic debris scatter) and 52 isolates were recorded.

To provide additional information on cultural resources along common segment 6 within the Yucca Mountain Site boundary, Desert Research Institute conducted a Class III supplementary field survey along the section of proposed rail alignment inside the Yucca Mountain Site boundary. This survey investigated a 150-meter (500-foot)-wide corridor centered on the rail alignment for an approximate length of 5.9 kilometers (3.7 miles). This land comprised acreage that was previously surveyed during repository site characterization activities. Desert Research Institute identified eight cultural resources (two prehistoric sites, five isolates, and one historic site) during the Class III survey. All were evaluated as ineligible for National Register listing.

Given the large number of resources in the area, construction of common segment 6 could result in direct and indirect impacts to prehistoric and historic sites. Three National Register-eligible prehistoric quarry sites are in this area within the Level I region of influence. The Beatty Wash Petroglyphs Site, listed on the National Register, is in the vicinity of a proposed bridge over Beatty Wash. Direct and indirect impacts from construction activities would include vibration of the rock matrix exhibiting the rock-art panels, and a potential for inadvertent or deliberate adverse impacts due to increased access and worker presence. The site holds important cultural value for American Indians. Over the long term, American Indians would likely view the bridge and operating trains as a visual and noise impact to the rock-art cultural landscape site.

After common segment 6 crossed onto the Yucca Mountain Site, it would cross an area that has undergone earlier intensive archaeological inventory and has been the subject of previous American Indian studies during repository characterization. As discussed in Section 4.3.13.1, DOE would consider identification, evaluation, and mitigation of potential impacts to these resources under a separate programmatic agreement with those along the proposed rail alignment.

Based primarily on previous ethnographic studies, the American Indian Resource Document (DIRS 174205-Kane et al. 2005, Section 2.3) identifies several areas of cultural significance for American Indians along this common segment. Several of these fall inside the Yucca Mountain Site boundary, including the Busted Butte rock-art site, Fortymile Wash, and Alice Hill. The American Indian Writers Subgroup also notes the cultural importance of the Beatty area rock-art site and Crater Flat, specifically the Black Cone geological feature in Crater Flat, which would be within 0.8 kilometer (0.5 mile) of common segment 6.

The sample inventory of the segment outside the Yucca Mountain Site boundary indicates that approximately 32 sites could be present within the Level I region of influence.

4.3.13.2.2 Railroad Operations Impacts

After the construction phase, there would be no additional direct or indirect impacts at cultural resource sites, other than the potential visual intrusion of operating trains on the character of potential cultural landscapes. American Indians would continue to view operation of the rail line as an intrusion on their holy lands.

4.3.13.3 Impacts under the Shared-Use Option

Impacts under the Shared-Use Option would be the same as those under the Proposed Action without shared use. Although under the Shared-Use Option there would be a slight increase in train traffic from the addition of commercial users, construction and operation of the proposed railroad would not differ and the slight increase in train traffic under the Shared-Use Option would not result in additional impacts. Construction of any additional commercial-use sidings would have the potential to impact cultural resources.

4.3.13.4 Summary

DOE would complete intensive cultural resource inventories of the Mina rail alignment alternative segments and common segments. Because of the length of the rail alignment and the complexity associated with engineering a feasible alignment, DOE is using a phased cultural resource identification and evaluation approach, described in 36 CFR 800.4(b)2, to identify specific cultural resources. Under this approach, DOE would complete an inventory of the construction right-of-way, evaluate all recorded resources in accordance with criteria established for listing on the *National Register of Historic Places*, assess adverse impacts, and apply mitigation measures for identified impacts before it started any ground-disturbing construction activities. Identification, evaluation, mitigation, and tribal consultation efforts would be guided by the programmatic agreement developed between DOE, the BLM, the STB, and the Nevada State Historic Preservation Office (DIRS 176912-Wenker et al. 2006, all).

Table 4-293 summarizes the potential for impacts to cultural resources within the region of influence for each Mina rail alignment alternative segment and common segment. At present, DOE cannot fully characterize potential effects on cultural resources and the magnitude of those impacts. The potential for impacts is based primarily on the relationship between the density of cultural resource sites associated with each alternative segment and common segment (that is, the greater the likely density of sites along a particular alternative segment or common segment, the higher the potential of affecting one or more of these sites). Sample inventory indicates that approximately 527 archaeological sites could be present within the Mina rail alignment Level I region of influence. Based on this sample, DOE expects that most of these sites would be characterized as prehistoric sites (77 percent), primarily lithic scatters, followed by historic sites (20 percent) and sites with both prehistoric and historic components (3 percent). Data currently available indicate that many of these sites (43 percent or more) will not meet eligibility criteria for listing on the *National Register of Historic Places*.

Based on current information and sample surveys conducted to date, the magnitude of these impacts would likely range from small to moderate due to the extensive effort to avoid or mitigate impacts in accordance with the regulatory framework and with the terms of the cultural resources programmatic agreement (see Appendix M). To the extent feasible, DOE would avoid cultural resources identified within the construction areas. Where appropriate, temporary barriers would be used to isolate resources during construction. Monitoring and data recovery through excavation would also be used where necessary to mitigate impacts to archaeological sites. If the additional future inventory work described above indicated the presence of National Register-eligible sites, the magnitude of impacts could be greater. Additionally, if the future inventory work described above indicated the discovery of traditional cultural properties or other resources important to American Indians that cannot be avoided, the magnitude of impacts might be greater.

Table 4-293. Summary of impacts to cultural resources – Mina rail alignment (page 1 of 3).

Location	Construction impacts[a]	Operations impacts[b]
Rail line segment		
Union Pacific Railroad Hazen Branchline	No potential for impacts.	No additional direct or indirect impacts.
Department of Defense Branchline North	No potential for impacts.	No additional direct or indirect impacts.
Schurz segment 1	Potential direct and indirect inputs at two potential National Register-eligible sites identified along segments subjected to sample inventory and at other sites that might be identified during the complete survey.	No additional direct or indirect impacts
Schurz alternative segment 4	Potential direct and indirect inputs at three potential National Register-eligible sites identified along segments subjected to sample inventory and at other sites that might be identified during the complete survey.	No additional direct or indirect impacts
Schurz alternative segment 5	Potential direct and indirect impacts at archaeological sites identified along segments of alignments subject to sample inventory, and at other sites that might be identified during the complete survey.	No additional direct or indirect impacts.
Schurz alternative segment 6	Potential direct and indirect inputs at two potential National Register-eligible sites identified along segments subjected to sample inventory and at other sites that might be identified during the complete survey.	No additional direct or indirect impacts.
Department of Defense Branchline South	No potential for impacts.	No additional direct or indirect impacts.
Mina common segment 1	Potential direct and indirect impacts at multiple National Register-eligible sites, at archaeological sites identified along segments of alignments subject to sample inventory, and at other sites that might be identified during the complete survey.	No additional direct or indirect impacts.

Table 4-293. Summary of impacts to cultural resources – Mina rail alignment (page 2 of 3).

Location	Construction impacts[a]	Operations impacts[b]
Rail line segment (continued)		
Montezuma alternative segments	Potential direct and indirect impacts at archaeological sites identified along segments of alignments subject to sample inventory, and at other sites that might be identified during the complete survey.	No additional direct or indirect impacts.
Mina common segment 2	Potential direct and indirect impacts at archaeological sites identified along segments of alignments subject to sample inventory, and at other sites that might be identified during the complete survey.	No additional direct or indirect impacts.
Bonnie Claire alternative segments 2 and 3 (Nye County)	Potential direct and indirect impacts at one National Register-eligible archaeological sites and at other sites that might be identified during the complete survey.	No additional direct or indirect impacts.
Common segment 5 (Nye County)	Potential direct and indirect impacts at two National Register-eligible archaeological sites and 20 additional resources recorded within the region of influence.	No additional direct or indirect impacts.
Oasis Valley alternative segments 1 and 3 (Nye County)	Potential direct and indirect impacts at a historic cattle ranch, a campsite, archaeological sites identified along segments subjected to sample inventory, and at other sites that might be identified during the complete survey.	No additional direct or indirect impacts.
Common segment 6 (Nye County)	Potential direct and indirect impacts at archaeological sites recorded in the region of influence, including three National Register-eligible resources.	No additional direct or indirect impacts.
Proposed facilities		
Access roads (including alignment access roads)	Potential direct and indirect impacts at sites that might be identified during the complete survey. Significant resources likely avoidable.	No additional direct or indirect impacts.
Staging Yard at Hawthorne	Potential direct and indirect impacts at sites that might be identified during the complete survey. Significant resources likely avoidable.	No additional direct or indirect impacts.
Maintenance-of-Way Facility; Rail Equipment Maintenance Facility; Cask Maintenance Facility; and Nevada Railroad Control Center and National Transportation Operations Center	Potential direct and indirect impacts at sites that might be identified during the complete survey. Significant resources likely avoidable.	No additional direct or indirect impacts.
Construction camps	Potential direct and indirect impacts at sites that might be identified during the complete survey. Significant resources likely avoidable.	No additional direct or indirect impacts.
Wells	Potential direct and indirect impacts at sites that might be identified during the complete survey. Significant resources likely avoidable.	No additional direct or indirect impacts.

Table 4-293. Summary of impacts to cultural resources – Mina rail alignment (page 3 of 3).

Location	Construction impacts[a]	Operations impacts[b]
Potential quarries		
Malpais Mesa	Potential direct and indirect impacts at sites that might be identified during the complete survey. Significant resources likely avoidable.	No additional direct or indirect impacts.
North Clayton Valley	Potential direct and indirect impacts at sites that might be identified during the complete survey. Significant resources likely avoidable.	No additional direct or indirect impacts.
Gabbs Valley	Small potential for impacts; significant resources likely avoidable.	No additional direct or indirect impacts.
Garfield Hills	Possible obsidian source; impacts would require mitigation.	No additional direct or indirect impacts.

a. Impact assessment based on sample inventory only; actual impacts cannot be identified until completion of field studies.

b. After the proposed rail line was constructed, no additional direct or indirect impacts would be anticipated at archaeological, historical, and cultural sites, other than the potential visual intrusion of operating trains on the character of potential cultural landscapes.

4.3.14 PALEONTOLOGICAL RESOURCES

This section describes potential impacts to paleontological resources (***fossils***) from constructing and operating the proposed railroad along the Mina rail alignment. Section 4.3.14.1 describes the methodology DOE used to assess impacts to such resources; Section 4.3.14.2 describes potential impacts during the construction phase; Section 4.3.14.3 describes potential impacts during the operations phase; Section 4.3.14.4 describes impacts under the Shared-Use Option; and Section 4.3.14.5 summarizes potential impacts.

Section 3.3.14.1 describes the region of influence for paleontological resources along the Mina rail alignment.

4.3.14.1 Impact Assessment Methodology

Any project activity involving land disturbance could have an adverse impact on the physical environment that could contain paleontological resources. Paleontological resources could be disturbed or destroyed by ground excavation, cuts and fills, surface-disturbing activities such as road building and blasting, or vandalism or theft of the resources.

DOE used the BLM system (DIRS 176084-BLM 1998, all; DIRS 176085-BLM 1998, all) to identify and classify paleontological resource areas along the Mina rail alignment according to their potential for containing vertebrate (animals with backbones) fossils or noteworthy occurrences of invertebrate or plant fossils. The BLM uses these paleontological resource classifications (***Condition 1***, ***Condition 2***, and ***Condition 3***; see the text box in Section 3.3.14) to identify areas that might warrant special management or special designation for paleontological resources.

The BLM steps to evaluate the potential for impacts to fossil resources are outlined in *General Procedural Guidance for Paleontological Resource Management* (DIRS 176084-BLM 1998, Chapter III), and include identification by a qualified paleontologist and protection of any paleontological area uncovered during field surveys. Educating the public about the value of paleontological resources is also an important part of BLM resource management.

To assess potential impacts to paleontological resources along the Mina rail alignment, DOE considered whether unique or scientifically important vertebrate, invertebrate, or plant fossils could be damaged, destroyed, or removed during construction and operation of the proposed railroad, quarries, water wells, and access roads.

4.3.14.2 Construction Impacts

Neither the rail line nor its construction and operations support facilities would be constructed at or near known or likely fossil beds. There is a known vertebrate bed between Hawthorne and Luning in the Garfield Hills area, just south of existing rail line along Mina common segment 1, but there would be no new construction in this area. Therefore, DOE would expect no impacts to paleontological resources during the construction phase.

However, the Department could encounter currently unknown paleontological resources during the construction phase. The BLM would continue to manage all identified paleontological resources in accordance with its management plans, and if DOE discovered new paleontological resources during the construction phase, the BLM would take appropriate action (DIRS 179560-BLM 2001, p. CUL-5).

4.3.14.3 Operations Impacts

The most likely source of potential impacts to paleontological resources would be from land disturbance during the construction phase, as discussed in Section 4.3.14.2. DOE expects there would be no impacts to paleontological resources resulting from railroad operations.

4.3.14.4 Construction and Operations Impacts under the Shared-Use Option

As for the Proposed Action without shared use (see Sections 4.3.14.2 and 4.3.14.3), DOE expects there would be no impacts to paleontological resources along the Mina rail alignment under the Shared-Use Option.

4.3.14.5 Summary

Although DOE could discover currently unknown paleontological resources along the Mina rail alignment during the construction phase, at present there are no known resources. The Department would expect impacts to paleontological resources during construction and operation of the proposed railroad to be small. Though there could be a potential to uncover previously unknown fossils during the construction phase, if paleontological resources were uncovered, DOE would consult with the BLM to develop appropriate measures to minimize damage to these resources.

Chapter 7, Best Management Practices and Mitigation, describes the best management practices DOE would implement as part of the Proposed Action and the mitigation measures the Department would consider to reduce or eliminate the potential for impacts to paleontological resources.

4.3.15 ENVIRONMENTAL JUSTICE

This section describes the DOE analysis of ***environmental justice*** (whether impacts are ***disproportionately high and adverse*** to ***minority*** or ***low-income populations***) under the Proposed Action along the Mina rail alignment. Section 4.3.15.1 describes the DOE methodology for analyzing environmental justice; Section 4.3.15.2 describes the assessment of impacts to environmental resources; Section 4.3.15.3 describes the potential for disproportionately high and adverse impacts; and Section 4.3.15.4 summarizes any environmental justice impacts.

Section 3.3.15.1 describes the region of influence for environmental justice.

4.3.15.1 Impact Assessment Methodology

For this analysis, DOE uses the terms minority and low income in the context of environmental justice (DIRS 155970-DOE 2002, Section 3.1.13.1; DIRS 174625-Bureau of Census 2005, all).

DOE performed the analysis of environmental justice impacts in accordance with Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, and Council on Environmental Quality guidance (DIRS 177702-CEQ 1997, all). Using information from Sections 4.3.1 through 4.3.14, this section assesses whether any high and adverse impacts could fall disproportionately on minority or low-income populations.

As a starting point, as described in Section 3.3.15.2, DOE determined whether there would be minority or low-income populations in the Mina rail alignment region of influence for environmental justice. Next, DOE determined whether there would be any potential for high and adverse impacts to environmental resources as evaluated in Sections 4.3.1 through 4.3.14. Finally, DOE determined whether any high and adverse impacts would fall disproportionately on minority or low-income populations.

For the Yucca Mountain FEIS, DOE followed the Council on Environmental Quality guidance (DIRS 177702-CEQ 1997, all) and the then-existing methodology of the U.S. Nuclear Regulatory Commission to identify low-income and minority communities (also called low-income and minority populations). However, since that time, the U.S. Nuclear Regulatory Commission methodology used in the Yucca Mountain FEIS has been revised, and for this Rail Alignment EIS, DOE used the revised methodology to identify low-income and minority communities (69 *FR* 52048). The revised methodology is, in part:

> Under current NRC [Nuclear Regulatory Commission] staff guidance, a minority or low-income community is identified by comparing the percentage of the minority or low-income population in the impacted area to the percentage of the minority or low-income population in the County (or Parish) and the State. If the percentage in the impacted area significantly exceeds that of the State or the County percentage for either the minority or low-income population then EJ [environmental justice] will be considered in greater detail. 'Significantly' is defined by staff guidance to be 20 percentage points. Alternatively, if either the minority or low-income population percentage in the impacted area exceeds 50 percent, EJ matters are considered in greater detail.

The details for consideration of environmental justice impacts for these identified communities are discussed in Section 4.3.15.3.

DOE also considered whether minority or low-income populations would be affected by an alternative in different ways than the general population, such as through unique ***exposure pathways*** or rates of exposure, special sensitivities, or different uses of natural resources.

If there would be no high and adverse impacts to environmental resource areas, or if any identified high and adverse impacts would not fall disproportionately on minority or low-income populations, then there would be no environmental justice impacts.

4.3.15.2 Assessment of Impacts to Environmental Resources

Results of the impacts analyses described in Sections 4.3.1 through 4.3.14 indicate that there would be moderate to large impacts in the following environmental resource areas:

- Land use. Construction and operation of the proposed railroad along the Mina rail alignment would result in impacts to land use and ownership along the entire alignment. There would be changes in land uses on public lands within the operations right-of-way and impacts to patented mining claims.
- Aesthetic resources. During the construction phase, there would be small to large impacts with weak to strong contrasts in the short term from visible construction equipment, either operating or in storage, and from scars on soil and vegetated landscape from cuts, fills, and well pads along all segments of the Mina rail alignment. There would be small to large, but temporary, impacts from moderate to strong contrast in the short term for rail-over-road crossing of U.S. Highway 95 by Schurz alternative segment 6, which would not meet BLM Class III management objectives, and weak to moderate contrast in the short term for other rail line sections and structures, which would meet Class III objectives. There would also be moderate impacts from moderate contrast due to proximity to viewers on State Route 265 and in some parts of the town of Silver Peak that would meet BLM Class III and IV management objectives, and impacts from moderate contrast in the short term from quarrying, ballast production facilities, and a conveyor close to viewers that would be compatible with BLM Class III management objectives.

  During the operations phase, there would be small to moderate impacts as a result of no to moderate contrast in the long term from the installation of linear track, signals, communications towers, power poles connecting to the grid, and access roads along the entire Mina rail alignment. There would also be small to moderate impacts from weak to moderate contrast as rail line and crossing structures would, in places, attract the attention of viewers, but would meet BLM Class III management objectives. There would be moderate impacts from moderate contrast from a new linear feature adjacent to State Route 265 and in Clayton Valley that would meet BLM Class III and IV management objectives.
- Air quality. Air pollutant concentrations would not exceed the National Ambient Air Quality Standards for construction or operation of the railroad or any associated facilities, with the exception of the 24-hour standards for both PM_{10} and $PM_{2.5}$ that could be exceeded near the construction right-of-way at Mina and Schurz during the relatively short construction period, and at the Staging Yard at Hawthorne and the potential Garfield Hills quarry. The highest increase in emissions would be for NO_x emissions in Esmeralda County during the construction phase, where emissions could be as high as 25 times greater than 2002 county-wide NO_x emissions. The Shared-Use Option impact would result in a slightly higher increase in air pollutant emissions and air pollutant concentrations than would the Proposed Action without shared use.
- Noise and vibration. Eight receptors (individuals who could be affected) would be included in the 65 day-night average noise level contours in Silver Springs and one receptor would be included in Wabuska. These nine receptors would experience an adverse noise impact because they would be exposed to 65 DNL and a 3 dBA increase.
- Biological resources. There would be potential adverse impacts related to noxious and invasive species, which would include increased risk of these species becoming established in disturbed areas and encroaching on adjacent undisturbed habitat. There would be the potential for impacts to

threatened or endangered species during the construction phase. Habitat for several special status species would be disturbed and individuals of several of the species could be disturbed, injured, or killed from construction and operation of the proposed railroad. Direct impacts to wildlife and wild horses and burros from railroad operations would consist of potential collisions of wildlife with trains and temporary disruption of activities (such as foraging, nesting, and resting) due to the disturbance from noise caused by passing trains and from noise and presence of humans at facilities and potential contamination of forage, prey species, nesting, and spawning habitat, and sources of drinking water in the rare event of train derailment and associated spill of diesel fuel. Indirect impacts could include possible changes to predator/prey interactions due to the construction of towers and other structures that would provide new perch habitat for raptors and other predatory birds.

Although there are many historic and archaeological sites along the Mina rail alignment (see Section 3.3.13), and construction and operation of the proposed railroad could directly and indirectly affect those resources (see Section 4.3.13), that analysis did not determine that impacts to cultural resources would be high and adverse.

4.3.15.3 Potential for Disproportionately High and Adverse Impacts

To determine whether environmental impacts identified in Sections 4.3.1 through 4.3.14 could be disproportionately high and adverse to minority or low-income populations, DOE considered the following factors:

- Whether there would be an impact on the natural or physical environment that would adversely affect a minority population, low-income population, or American Indian tribe (such effects could include ecological, cultural, human-health, economic, or social impacts on minority communities, low-income communities, or an American Indian tribe when those impacts are interrelated with impacts on the natural or physical environment)
- Whether environmental effects could have an adverse impact on minority populations, low-income populations, or an American Indian tribe that would be meaningfully greater than or be likely to be meaningfully greater than the impact on the general population or other appropriate comparison group
- Whether minority or low-income populations would be affected by an alternative in different ways than the general population, such as through unique exposure pathways or rates of exposure, special sensitivities, or different uses of natural resources
- Whether the environmental effects could occur in a minority population, low-income population, or American Indian tribe affected by cumulative or multiple adverse exposures from environmental hazards

Based on these factors, DOE identified for further analysis the following impacts to land use, aesthetic resources, air quality, biological resources from noise and vibration, and unique or special pathways:

- Land use. To implement the Proposed Action along the Mina rail alignment, DOE would need to gain access to some private land, the amount of which would be very small (about 0.2 percent) compared to the total land required for the project. The Schurz alternative segments would cross the Walker River Paiute Reservation, utilizing between 0.3 and 0.5 percent of the Reservation's land, depending on the segment. The Tribe's concurrence would be necessary to secure a right-of-way for the rail line. However, the Tribe's current position (as stated in an April 29, 2007 [DIRS 181604-Williams 2007, all] letter from the Tribal Council) is that the Tribe will not allow nuclear waste to be transported across their Reservation. Under the Mina Implementing Alternative, DOE would remove the existing Department of Defense rail line through Schurz, providing a perceived benefit to the town's residential land uses; the Tribe could use the existing roadbed as a recreational trail. Most of the local mining activity is outside the rail line construction right-of-way. However, Montezuma alternative segment 2 would intersect some patented mining claims and DOE would need to acquire access to this land. Mina common segment 1, all the Montezuma alternative segments, the Oasis Valley alternative segments, and common segment 6 would cross several Township and Range Sections that contain many unpatented mining claims. The actual number of claims that would intersect the construction right-of-way would need to be determined through additional record searches and field verification. Nevertheless, there would be moderate impacts to patented and unpatented mining claims along these segments where they would fall within the construction right-of-way. There is also the possibility that the rail line could be affected by or affect underground mining tunnels or shafts. During the final engineering design phase, DOE would need to survey these underground features to avoid adverse impacts.

Although the Schurz population center and the Walker River ***Census County Division*** exceed the minority population threshold of 50 percent and the Walker River Census County Division exceeds the low-income threshold of 31 percent (20 percent over the state average of 11 percent) the impacts to land use that would be felt on the Walker River Paiute Reservation are not high or adverse. The moderate impacts to patented and unpatented mining claims would be felt all along the Mina rail alignment and not just in the areas where the minority population threshold of 50 percent or the low-income threshold of 20 percent over the state average of 11 percent is exceeded. DOE has concluded that low-income and minority populations in these areas would not be disproportionately affected.

- Aesthetic resources. During the construction phase, there would be small to large impacts with weak to strong contrast in the short term from visible construction equipment either operating or in storage, and from scars on soil and vegetated landscape from cuts, fills, and well pads. There would be small to large impacts with weak to strong contrast in the long term from scars on rock from cuts, and from access roads along the entire Mina rail alignment. Also, there would be small to large, but temporary, impacts with a moderate to strong contrast in the short term for the Schurz alternative segment 6 rail-over-road crossing of U.S. Highway 95, which would not meet BLM Class III management objectives. There would be weak to moderate contrasts in the short term for other rail line sections and structures, which would meet Class III objectives.

  Along the Mina rail alignment, the Schurz population center and the Walker River Census County Division, both in Mineral County, have the widest percentage difference, 89-percent and 80-percent minority populations, respectively, compared to a 30-percent minority population for Mineral County as a whole. These two areas exceed the 50-percent threshold described in section 3.3.15.2. Also, there is one Census County Division with a poverty rate of more than 20 percent above the state average of 11 percent – the Walker River Census County Division, with a 32-percent poverty rate.

  Although the Schurz population center and the Walker River Census County Division exceed the minority population threshold of 50 percent and the Walker River Census County Division exceeds the low-income threshold of 31 percent (20 percent over the state average of 11 percent), the large, permanent impacts to aesthetic resources would be felt all along the Mina rail alignment and not just in these areas. DOE has concluded that low-income and minority populations in these areas would not be disproportionately affected.

- Air quality. Annualized emissions for all air pollutants projected to be released during the construction phase would be greater than during the operations phase. Projected ambient concentrations of all air pollutants would be below the National Ambient Air Quality Standards, except for particulate matter during the construction phase, which could exceed the 24-hour standard under some conditions. Therefore, the projected impacts throughout the region of influence, during both construction and operations, would be small, except immediately adjacent to the potential Garfield Hills quarry and the Staging Yard at Hawthorne, and segments of the rail line during construction. Under the Shared-Use Option, there would be in an increase in emissions over those of the Proposed Action without shared use, but impacts to air quality would still be small.

Along the Mina rail alignment, the Schurz population center and the Walker River Census County Division, both in Mineral County, have the widest percentage difference, 89-percent and 80-percent minority populations, respectively, compared to a 30-percent minority population for Mineral County as a whole. These two areas exceed the 50-percent threshold described in Section 3.3.15.2. Also, there is one Census County Division with a poverty rate of more than 20 percent above the state average of 11 percent – the Walker River Census County Division, with a 32-percent poverty rate.

Although the Schurz population center and the Walker River Census County Division exceed the minority population threshold of 50 percent and the Walker River Census County Division exceeds the low-income threshold of 31 percent (20 percent over the state average of 11 percent), the impacts to air quality would be felt all along the Mina rail alignment and not just in these areas. DOE has concluded that low-income and minority populations in these areas would not be disproportionately affected.

- Biological resources. Potential adverse impacts related to noxious and invasive species would include increased risk of these species becoming established in disturbed areas and encroaching on adjacent undisturbed habitat. DOE would implement best management practices (see Chapter 7) and BLM-prescribed and -approved methods to prevent the establishment of noxious weeds or invasive plant species. There would be the potential for impacts to threatened or endangered species during rail line construction. Habitat for several special status species would be disturbed and individuals of several of the species could be disturbed, injured, or killed from the construction and operation of the proposed railroad and associated facilities. Potential impacts to federally listed species would likely require consultation with the U.S. Fish and Wildlife Service in accordance with Section 7 of the Endangered Species Act. Direct impacts to wildlife and wild horses and burros during the operations phase would consist of potential collisions of wildlife with trains; temporary disruption of activities (foraging, nesting, resting, etc.) due to the disturbance from noise caused by passing trains and from noise and presence of humans at railroad facilities; and potential contamination of forage, prey species, nesting, and spawning habitat, and sources of drinking water in the rare event of train derailment and associated spill of diesel fuel. Indirect impacts could include possible changes to predator/prey interactions due to the construction of towers and other structures that would provide new perch habitat for raptors and other predatory birds.

  Along the Mina rail alignment, the Schurz population center and the Walker River Census County Division, both in Mineral County, have the widest percentage difference, 89-percent and 80-percent minority populations, respectively, compared to a 30-percent minority population for Mineral County as a whole. These two areas exceed the 50-percent threshold described in Section 3.3.15.2. Also, there is one Census County Division with a poverty rate of more than 20 percent above the state average of 11 percent – the Walker River Census County Division, with a 32-percent poverty rate.

  Although the Schurz population center and the Walker River Census County Division exceed the minority population threshold of 50 percent and the Walker River Census County Division exceeds the low-income threshold of 31 percent (20 percent over the state average of 11 percent), the impacts to biological resources would be felt all along the Mina rail alignment and not just in these areas. DOE has concluded that low-income and minority populations in these areas would not be disproportionately affected.

- Noise and Vibration. There would be eight receptors included in the 65 DNL contours in Silver Springs and one receptor in Wabuska. There would be no receptors included in the 65 DNL contours for Mina, Silver Peak, or Goldfield. These nine receptors would experience an adverse noise impact because they would be exposed to 65 DNL and a 3 dBA increase. These impacts would not occur within the Schurz population center or the Walker River Census County Division. The Schurz population center and the Walker River Census County Division are the only locations along the Mina rail alignment where the minority populations exceed the threshold of 50 percent, and the Walker River Census County Division is the only location along the Mina rail alignment where the low-income population exceeds the threshold of 31 percent (20 percent over the state average of 11). DOE has concluded that low-income and minority populations in these areas would not be disproportionately affected.

- Unique or special pathways: DOE has not identified any special pathways that could cause high and adverse impacts to these populations; therefore, there would be no environmental justice impacts associated with the Mina rail alignment through special or unique pathways.

Seventeen tribes and organizations have formed the Consolidated Group of Tribes and Organizations, which is a forum consisting of tribally approved representatives who are responsible for presenting their respective tribal concerns and perspectives to DOE. The Consolidated Group of Tribes and Organizations has provided DOE with valuable insights into American Indian cultural and religious values and beliefs.

Section 3.4 summarizes the interests and concerns expressed by various American Indian tribes and organizations within or near the Mina rail alignment region of influence. Sections 3.2.13 and 3.3.13, Cultural Resources, provide additional information on American Indian cultural resources. Perceptions about the types and magnitudes of potential impacts to American Indian interests along the Mina rail alignment vary among the various stakeholders with interests in the proposed railroad because of different beliefs, goals, responsibilities, and values. American Indians are concerned that the proposed railroad could cause substantial and high adverse effects to a number of American Indian interests within and adjacent to the Mina rail alignment region of influence. American Indian views on environmental justice are presented in Section 3.4.2.4. DOE acknowledges the concerns of the American Indians and has consulted with the tribes. The Department would continue to consult with the Consolidated Group of Tribes and Organizations throughout the life of the project. Under the Mina Implementing Alternative, DOE would work closely with the American Indians to develop a mitigation action plan and ensure compliance with Section 106 of the National Historic Preservation Act (16 U.S.C. 470).

The environmental justice analysis for the Shared-Use Option is the same as that described for the Proposed Action without shared use.

4.3.15.4 Conclusion

The Schurz population center and the Walker River Census County Division are the only locations along the Mina rail alignment where the minority populations exceed the threshold of 50 percent, and the Walker River Census County Division is the only location along the Mina rail alignment where the low-income population exceeds the threshold for a low-income community of 31 percent, which is 20 percent above the state average of 11 percent. Based on current information, DOE has concluded that constructing and operating the proposed railroad along the Mina rail alignment would not result in any high and adverse impacts to minority or low-income populations. No special pathways were identified; therefore, DOE has concluded that there would be no disproportionately high and adverse impacts to minority or low-income populations. If, during the development of the inventory described in Section 4.3.13.4, additional cultural resources related primarily to American Indian interests were discovered that could not be avoided, then the magnitude of environmental justice impacts might also be larger and disproportionately high and adverse. Similarly, if during development of ethnographic studies described in Section 3.4.5, special pathways were identified, then the magnitude of environmental justice impacts might be larger. Should larger environmental justice impacts be identified, such as for cultural resources or special pathways, DOE would institute mitigation through the process described in Chapter 7.