1.0 INTRODUCTION

The U.S. Department of Energy (DOE) is proposing an action (the Proposed Action) consisting of the construction and operation of the following five site development projects at the National Renewable Energy Laboratory's (NREL) South Table Mountain (STM) site at Golden, Colorado:

- The Energy Systems Integration Facility (ESIF), a new research facility;
- Phase 2 of planned site infrastructure improvements (Phase 2 of Full Site Development);
- A new second full service access road (hereafter referred as the "second access road");
- Expansion of the Waste Handling Facility (WHF); and
- Expansion of the Visitors Center.

In accordance with DOE and National Environmental Policy Act (NEPA) implementing regulations, DOE is required to evaluate the potential environmental impacts of DOE facilities, operations, and related funding decisions. The decision to use federal funds for this Proposed Action requires that DOE address NEPA requirements and related environmental documentation and permitting requirements.

In July 2003, DOE issued the *Final Site-Wide Environmental Assessment of the National Renewable Energy Laboratory's South Table Mountain Complex* (the SWEA) and a Finding of No Significant Impact (FONSI) for proposed site development activities (DOE/EA-1440) (DOE 2003). The SWEA evaluated the impacts that would be associated with long-term buildout of the STM site and the areas suitable for future development. It also identified areas to be set aside and preserved as a conservation easement not subject to future development. As project-specific funding has become available to implement the STM site buildout vision, additional project-specific NEPA analyses have been generated.

In July 2007, DOE issued the *Final Environmental Assessment of Three Site Development Projects at the National Renewable Energy Laboratory South Table Mountain Site* (DOE/EA-1573) (DOE 2007). That environmental assessment (EA) tiered off the SWEA and, for some resource areas, provided updated descriptions of the existing environment at the STM site and impacts expected from the three proposed projects. The July 2007 EA and its associated FONSI are incorporated by reference in their entirety into this NEPA document.

In May 2008, DOE issued its first supplement to the SWEA (SWEA/S-I): *Final Supplement to Final Site-wide Environmental Assessment of the National Renewable Energy Laboratory's South Table Mountain Complex, Proposed Construction and Operation of: Research Support Facilities, Infrastructure Improvements (Phase I), Upgrades to the Thermochemical User Facility and Addition of the Thermochemical BioRefinery Pilot Plant* (DOE/EA-1440-S-1) (DOE 2008).

The SWEA and SWEA/S-I provide a detailed framework and an analytical structure under which the potential environmental impacts of the Proposed Action assessed in this second supplement to the SWEA (hereafter referred to as SWEA/S-II) will be evaluated. In compliance with the NEPA (42 U.S.C. 4321) and with DOE's NEPA implementing regulations (10 CFR section 1021.314) and procedures, DOE is examining the potential environmental impacts of the Proposed Action described above. The Proposed Action would be implemented in areas that were analyzed in the SWEA and SWEA/S-I. This supplement tiers off the descriptions of the affected environment and the potential environmental impact assessments presented in the SWEA and the SWEA/S-I.

The SWEA and the SWEA/S-I evaluated the existing and proposed STM site facilities as well as the operation of the site. Implementation of the full site buildout contemplated in the SWEA on 55 hectares (136 acres) of buildable site land would be based on the availability of funds. This SWEA/S-II evaluates

the proposed activities for which funding is currently available or for which the likelihood of securing funding in the near future is high. Additional site development activities identified in the SWEA would be evaluated in future SWEA supplements or other NEPA analyses as funding for them is obtained and as project designs and schedules are further developed. Although this SWEA/S-II does not address all potential future site development projects, they have been included under the analyses of cumulative impacts (to the extent that they can be addressed at this time) in accordance with the Council on Environmental Quality (CEQ) and DOE regulations.

The July 2003 SWEA, the July 2007 EA, and the May 2008 SWEA/S-I and their associated FONSIs are available at the NREL Visitors Center and at the DOE Golden Field Office Public Reading Room website at http://www.eere.energy.gov/golden/reading_room.aspx.

This SWEA/S-II has been prepared under DOE's regulations and guidelines for compliance with NEPA. It was distributed to interested members of the public and to federal, state, and local agencies for review and comment prior to DOE's final decision on the Proposed Action.

1.1 The National Environmental Policy Act and Related Procedures

CEQ regulations for implementing the procedural provisions of NEPA (40 CFR Parts 1500-1508) and DOE's implementing procedures for compliance with NEPA (10 CFR Part 1021) require that DOE, as a federal agency:

- assess the environmental impacts of its proposed actions;
- identify any adverse environmental effects that cannot be avoided should a proposed action be implemented;
- evaluate alternatives to the proposed action, including a "no action alternative";
- describe the relationship between local short-term uses of the environment and the maintenance and enhancement of long-term productivity; and
- characterize any irreversible and irretrievable commitments of resources that would be involved should the proposed action be implemented.

These requirements must be met before a final decision is made to proceed with any proposed federal action that could cause significant impacts to human health or the environment. This SWEA/S-II is intended to meet DOE's regulatory requirements under NEPA.

1.2 Background

NREL History and Research Mission

In July 1977, DOE opened the Solar Energy Research Institute as a federal facility dedicated to harnessing solar power. In 1991, it achieved national laboratory status and was renamed the National Renewable Energy Laboratory (NREL). Today, NREL is one of 10 DOE national laboratories and is the nation's primary laboratory for renewable energy and energy efficiency research and development. NREL's mission is focused on advancing national energy policy and efficiency goals, particularly in the areas of renewable, wind, and solar energy research, development, demonstration, and deployment. NREL conducts research activities at the STM site in support of the following DOE research programs:

- Solar energy technologies
- Geothermal technologies
- Distributed energy, electrical infrastructure, and reliability
- Biomass
- Industrial technologies
- Freedom car and vehicle technology
- Hydrogen, fuel cell, and infrastructure technologies
- Buildings technologies
- Weatherization and intergovernmental grants
- Federal energy management
- Other DOE-sponsored programs
- Work for others supporting the DOE mission

As of October 1, 2008, NREL is operated for DOE by the Alliance for Sustainable Energy, LLC. The laboratory includes three main sites: STM; the adjacent Denver West Office Park (DWOP) in Golden; and the National Wind Technology Center located just south of Boulder, Colorado. The STM and DWOP sites are collectively referred to as the STM complex. The five site development projects that make up the Proposed Action and are the subject of this SWEA/S-II would be implemented at the STM site. Figures 1-1 and 1-2 illustrate the regional location and local setting of the STM site and the Proposed Action.

1.3 Purpose and Need

The Proposed Action

The Proposed Action supports and advances DOE's research and development mission in the area of energy efficiency and renewable energy technologies. The goal of this mission is to improve the nation's overall economic strength and competitiveness, energy security, and environmental stewardship through the development, demonstration, and deployment of clean, competitive, and reliable power technologies. The Proposed Action would contribute to achieving this mission. Specifically, the purpose and need of the Proposed Action are to (1) provide additional research and development capabilities at NREL, (2) upgrade and expand portions of the existing infrastructure, including the handling of site-generated wastes, (3) provide additional research and support space for the expanding employee population, (4) alleviate projected traffic congestion associated with future growth, and (5) expand the site's ability to accommodate visitors to NREL.

The additional research and development capabilities that the ESIF would provide would address several specific technical needs that are critical to the NREL and DOE missions. The federal system currently lacks a facility for and testing engineering-optimized systems, testing integrated energy technologies, and simulating and or emulating new infrastructure scenarios under the control of DOE and available to all of DOE industry partners. The lack of such a facility represents a key barrier in the effort to meet DOE's solar, wind, and hydrogen goals. The proposed ESIF would allow DOE to optimize these technologies as part of a total energy system. Collecting both technical and economic data for business analysis would encourage their integration into energy production and delivery systems at minimum cost and high system reliability. The ESIF would also enable DOE and its industrial partners to assess the potential of solar, wind, and hydrogen technology options for buildings, transportation, communities, and utilities and to develop a validated engineering-scale collection and analysis of performance data for the most promising technologies and integrated energy systems. The ESIF would allow U.S. industry members to insert their

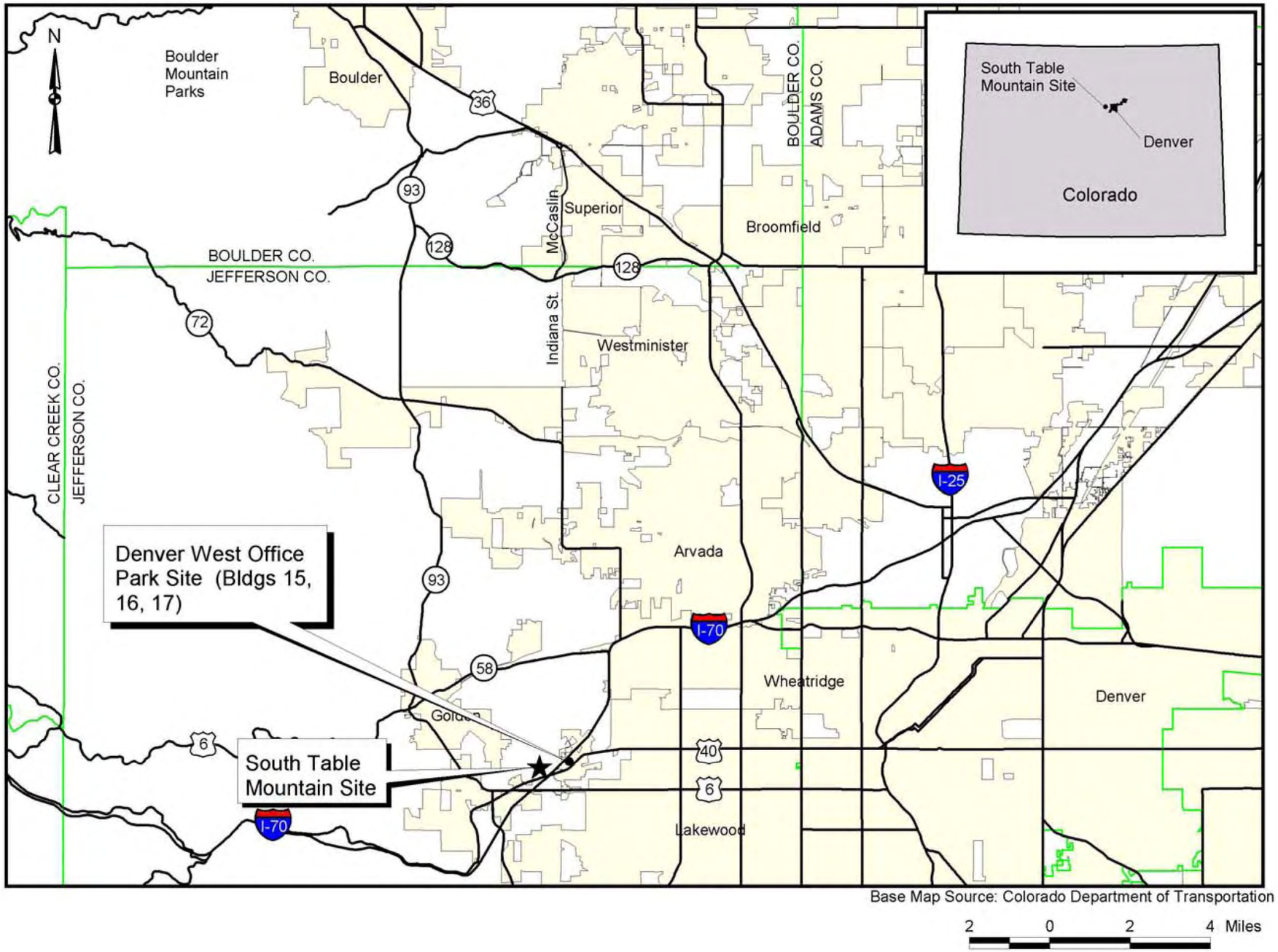

Figure 1-1. Regional Location of the STM Site

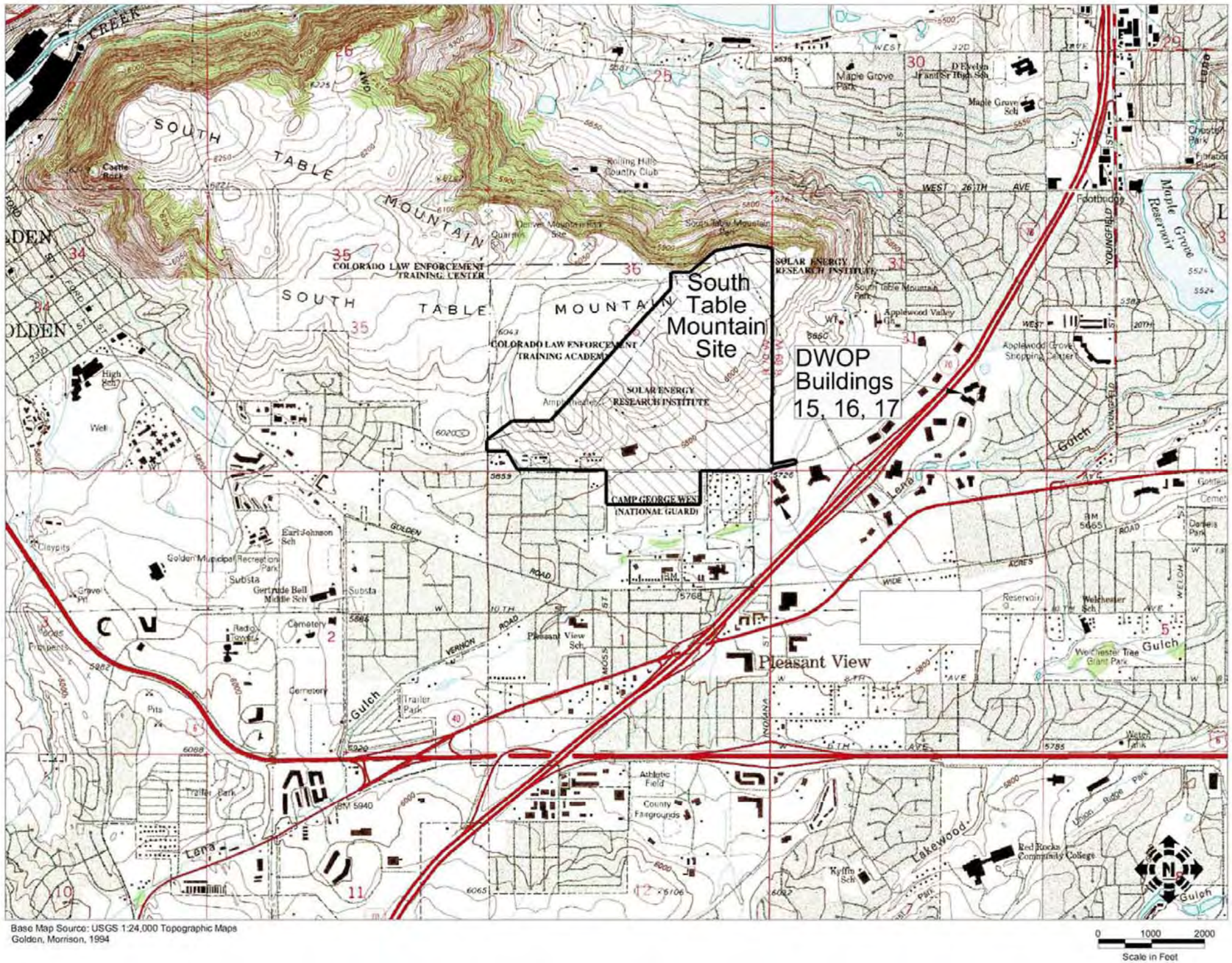

Figure 1-2. Local Setting of the STM Site

individual technologies into a controlled integrated energy system platform to test and optimize the technologies for earlier market penetration. It would also contribute to the ability of the Hydrogen, Fuel Cell & Infrastructure Technologies Program within DOE's Office of Energy Efficiency and Renewable Energy (EERE) to meet its technology readiness milestones.

Supplement Environmental Assessment-II

The purpose of this NEPA document is to assess the individual and cumulative potential effects of the five projects that make up the Proposed Action in order to determine if they would pose a significant impact to the human and physical environment. The SWEA (DOE 2003) addressed future site developments, improvements, and on-site activities at the STM complex and future changes associated within the STM site boundaries. It acknowledged that final designs and locations of some proposed or conceptual projects or facilities at the complex were uncertain and that various configurations were possible. The SWEA was prepared as a "bounding" analysis that would allow for future flexibility in implementing a range of potential activities. The bounding approach was used to evaluate potential environmental impacts resulting from an array of potential development options within a conceptually defined "buildout" scenario. The assessment considered a range of future site use and development options. In the FONSI, DOE determined that the proposed or contemplated improvements assessed in the SWEA did not, either individually or collectively, constitute a major federal action significantly affecting the human or physical environment within the meaning of NEPA.

The SWEA (DOE 2003) analyzed impacts that would occur if site development took place in areas that DOE believed would minimize the overall environmental impacts associated with sustainable site development. Moreover, it identified areas that should be set aside and preserved in a natural or existing state. The SWEA assessed specific activities or improvements proposed for implementation at specific site locations or areas. With the exception of the second access road, the proposed projects that are the topic of this SWEA/S-II are specific improvements of the type that were analyzed in the SWEA and would occur in areas that were analyzed in the SWEA. DOE concluded in the SWEA that development in these areas would not constitute a major federal action significantly affecting the quality of the human environment.

1.4 Scoping

The provisions of NEPA provide the public an opportunity to participate in the environmental review process. In addition, NREL has taken extra measures to maximize public consultation and input during the preparation of this EA. This section describes the steps taken to document that all matters of public interest are considered in this SWEA/S-II.

On September 4, 2008, DOE initiated the scoping process by sending a letter to agencies and the public requesting comments on a suite of proposed activities. Due to program changes and funding availability, DOE's proposed actions have evolved since September 2008; as a result, DOE issued a revised invitation for agency and public comment and held a public meeting on August 6, 2009, to discuss the status of the proposed actions, the characteristics of the five projects, and the nature of environmental issues to be addressed in this SWEA/S- II. It also provided an opportunity for public input regarding environmental concerns in the project area. The meeting was intended to encourage public input into the planning process. Notice letters for the scoping meetings and their distribution lists are found in Appendix A. The comments expressed during the two scoping periods are summarized below in italics; where appropriate, responses to the comment summaries note specific section(s) or chapters within this SWEA/S-II that address the issues raised in the comments.

1. *Commentor requested that consideration be given to establishing a wildlife corridor between Lena Gulch and the top of the mesa to allow deer and other wildlife access to water.* Section 3.1.6 discusses impacts to wildlife.

2. *Commentor requested that the EA evaluate air emissions, specifically particulates, as he suffers from asthma.* Section 3.1.8 describes construction and operational impacts to air quality.

3. *Commentor requested that the EA address safety precautions for the waste handling facility, and expressed concern for the consequences of a fire or terrorist act.* Sections 3.1.10 and 3.1.14 discuss potential impacts associated with waste management and intentional destructive acts under the Proposed Action.

4. *Commentor and nearby neighbor noted that their well water has developed an odor and cloudiness since the recent construction began, and asked that impacts to groundwater be addressed.* Section 3.1.5 discusses impacts to surface water and groundwater.

5. *Commentor asked that other alternatives to a new access road such as bikes, light rail, car pools, telecommuting, etc., be examined first before committing to a new road*. This SWEA/S-II (Section 3.1.2) and the previously prepared EAs for the STM site discuss traffic demand management (TDM) measures that would be implemented to reduce traffic and circulation impacts and explains the need for the new second access road.

6. *Commentor noted that current traffic on South Golden Road is extremely heavy, and dangerous to pedestrians and bicyclists, and therefore DOE should consider upgrades to that route since all new access corridors would put NREL traffic onto South Golden Road.* The traffic analyses generated to support this SWEA/S-II would aid DOE and other agencies in future decision-making regarding needed upgrades to South Golden Road.

7. *Commentor noted that in the past DOE had promised that the West Gate and Quaker Street would only be used in emergencies and other special needs, and not for routine STM traffic.* NEPA requires that all reasonable alternatives be evaluated. Quaker Street is a viable alternative for meeting the needs of a second access road and, therefore, Section 3.1.2 assesses the impacts of utilizing Quaker Street as a potential alternative.

8. *Commentor noted that the developers of Colorado Mills were required to upgrade the roads servicing that facility and that DOE should consider such for the new access road and roads affected by such action.* The project description in Chapter 2 identifies needed roadway upgrades associated with new access corridors.

9. *Commentor was concerned about the Moss Street corridor and the effect on her neighborhood, the wildlife, Lena Gulch, and the gas pipeline*. Potential impacts associated with using Corridor B/C (Moss Street) are assessed throughout Chapter 3. DOE prepared an EA (DOE/EA-1254) that addressed the impacts of constructing and operating the existing gas pipeline prior to its installation (DOE 1998). The second access road corridor selection process would include consideration of the gas pipeline along with numerous other criteria.

10. *Commentor wanted to be sure that the new access corridors did not extend to the mesa top*. *Be assured that the conservation easement prevents development in those areas.* The proposed access corridors described in Chapter 2 do not propose access to the mesa top.

11. *Commentor noted the proximity of homes to several of the corridors.* The relationship of residences to the proposed alternatives for a second access road is assessed in Chapter 3.

12. *Commentor thought the Isabell Street corridor was a good option*. Comment noted. Corridor E (Isabell) is evaluated throughout Chapter 3 of this SWEA/S-II.

13. *Commentor supported the expansion of the waste handling facility.* Comment noted.

14. *Commentor noted that he can hear, and is disturbed by, exhaust fans at night from the Alternative Fuels User Facility, and requested that noise impacts be included in the EA.* Potential impacts from noise emissions are described in Section 3.1.11.

15. *Commentor noted that there is periodic surface water runoff coming into his neighborhood from the ditch near the Alternative Fuels User Facility during periods when there has been no rain, and noted that there should be no surface discharges from any NREL facility.* Annual hydrostatic testing of fire suppression systems occurs at the various on-site buildings. Approximately 3,800 to 11,400 liters (1,000 to 3,000 gallons) of potable water are used during testing. All test waters are discharged to Lena Gulch via NREL's existing stormwater conveyance systems, which exit the site at the western, middle, and eastern portions of the site. Additionally, twice a year, Consolidated Mutual's 2-million-gallon tank on top of STM is flushed when the tank's contents are low, releasing about 30,000 to 50,000 gallons of water; that water is discharged into the stormwater system.

16. *Commentor noted that the area is very pedestrian and bicyclist unfriendly and asked that a pathway allowing pedestrian and bicycle access across the STM site be provided.* The second full service site access design considers pedestrian and bicycle access.

17. *Commentor noted that DOE had promised in past meetings that new buildings would not exceed 2 stories and that the new construction was exceeding that height.* Section 3.1.4 assesses potential impacts to sensitive visual receptors. DOE acknowledges that site development activities have the potential to impact views of the foothills and surrounding communities and strives to minimize these impacts.

18. *Commentor thought that a diagram displayed at the scoping meeting was in error locating the natural gas pipeline and that the parking garages as plotted were actually over the gas pipeline.* Parking garages are not proposed to be built over the subject gas pipeline.

19. *Commentor was concerned about all of the pollution that would be brought to the site by the new staff vehicles.* Section 3.1.8 describes construction and operational impacts to air quality.

20. *Commentor noted that several of the proposed new structures are too close to the neighborhood*. The analyses in Chapter 3 of this SWEA/S-II consider the proximity of the neighborhoods in assessing impacts.

21. *Commentor noted that Quaker Street had speed bumps which are successful in keeping speeds to 25 mph, and that the speed bumps should not be removed*. Chapter 3 of this SWEA/S-II assesses the impacts of utilizing Quaker Street a potential alternative.

22. *Commentor was concerned that there are many individuals and organizations with involvement in several of the corridors (e.g., private land owners, USFWS, USACE, County) and that it would*

be difficult consulting with all of those people. DOE and NREL are actively involved in discussions with all potentially affected parties and agencies with regulatory authority relative to decision-making on the alternative corridors.

23. *Commentor noted that Old Golden Road and many of the other roads in the area are already overloaded.* This SWEA/S-II (Section 3.1.2) and the previously prepared EAs for the STM site discuss potential traffic impacts and circulation effects from the STM site.

24. *Commentor asked how DOE had considered previous comments.* DOE maintains records of all comments received during the NEPA process and takes those comments into consideration in its decision-making.

25. *Commentor asked that moving to another site be considered for NREL's buildout.* The alternative of relocating NREL is considered infeasible and has not been considered as a viable alternative.

26. *Commentor noted that there are rumors that DOE is planning to annex the Richards Heights neighborhood.* There are no plans being considered by NREL or DOE to annex the Richards Heights subdivision.

27. *Commentor was concerned about the impacts of lighting the parking lots.* Refer to Section 3.1.4 for an assessment on light and glare.

28. *Commentor was concerned about the impacts, such as noise and traffic, from employees working late hours.* Noise and traffic impacts associated with the Proposed Action are described in Sections 3.1.11 and 3.1.2, respectively.

29. *Commentor was concerned about the effect the expansion of the STM site might have on property values.* The positive or negative effects that site development might have on property values are beyond the scope of this SWEA/S-II.

30. *One commentor asked for the location of the proposed second entrance road.* The alternative corridors that are evaluated by DOE are detailed on Figure 2-4 of this SWEA/S-II.

31. *Jefferson County Open Space (JCOS), which has ownership and easement rights adjacent to the NREL STM site at the Pleasant View Community Park and the STM open space park, requested that DOE consider granting JCOS administrative access through a new south entrance, and that the expansion of the Visitors Center and any new parking capacity consider the public's access to the trail system to STM and utilization of the Pleasant View Community Park.* In this SWEA/S II, DOE evaluates the environmental impacts of constructing and operating a new second access road within one of five alternative corridors and assesses the consequences of additional parking developed to meet anticipated growth at the STM site. In addition to the information provided by this SWEA/S-II, DOE would consider a range of options for administrative and public use of a new access road and parking in its final decision-making and anticipates further discussions with JCOS on these subjects before making its decision.

1.5 Organization of this SWEA/S-II

The five projects that make up the Proposed Action assessed in this SWEA/S-II are described in detail in Chapter 2. The affected environment within which these actions would occur, and the impacts that would result if implemented, are characterized in Chapter 3. The cumulative impacts of these actions and others

are assessed in Chapter 4, and the commitment of resources is discussed in Chapter 5. Chapter 6 lists references cited.

In addition, five appendices provide information pertaining either to the NEPA process or to the analyses in this SWEA/S-II. Appendix A contains notice letters and distribution lists for the scoping periods. Appendix B provides correspondence relating to agency consultations. A detailed bounding events analysis for the proposed ESIF is contained in Appendix C, and Appendix D describes the Camp George West Historic District, a Colorado Army National Guard installation with historic resources that could potentially be affected under the Proposed Action. Appendix E contains comments on the draft version of this SWEA/S-II and provides DOE's responses to those comments.

2.0 PROPOSED ACTION AND ALTERNATIVES

The Proposed Action assessed in this SWEA/S-II consists of the construction and operation of the following five site development projects at NREL's STM site at Golden, Colorado:

- The ESIF, a new research facility;
- Phase 2 of planned site infrastructure improvements (Phase 2 of Full Site Development);
- A new second access road;
- Expansion of the WHF; and
- Expansion of the Visitors Center.

Figure 2-1 illustrates the current STM site layout, and Figure 2-2 illustrates the seven development zones DOE has established on the STM site for the management of ongoing and future site land use and development. The development zones are also illustrated and described in Section 2 of the SWEA (DOE 2003). Figure 2-3 illustrates the approximate proposed locations on the STM site for the projects that would be implemented under the Proposed Action.

NREL's internal planning process for site buildout is a coordinated effort between NREL and DOE. As mission needs and research focus areas are identified, NREL's Laboratory Development Office facilitates annual and long-term planning efforts across the laboratory to make sure that all planning efforts are integrated with program goals. Campus planning and buildout activities are aligned with the annual budget planning process and are incorporated into NREL's One Year Plan and Ten Year Site Plan. Development of the Ten Year Site Plan is an ongoing iterative process that is coordinated with NREL's Infrastructure and Campus Development Office.

2.1 Energy Systems Integration Facility

Descriptive Overview

The ESIF would serve as a model for sustainable high-performance design. It would demonstrate the integration of high-performance building design and practices, showcase technology advances, and demonstrate to industry the applications of renewable and energy-efficient technologies for this type of facility. The ESIF would incorporate energy efficiency, environmental performance, and advanced controls using a "whole building" integrated design approach and would be required to comply with Energy Star standards. In support of DOE's goal to demonstrate energy-efficient buildings with a lower impact on the environment, the facility would be designed to merit at least a Leadership in Energy and Environmental Design (LEED) "Gold" rating from the U.S. Green Building Council, which would be the highest-certified facility of its type with a high-performance computing data center as a major part of the building.

At the ESIF, technical staff would research, engineer, design, test, and analyze components and systems for a broad range of renewable energy generation capabilities. The ESIF would house a state-of-the-art, high-performance computing and data center. It would also support improved and expanded capabilities in the modeling and simulation of renewable energy and energy-efficient technologies and their integration into the existing energy infrastructure.

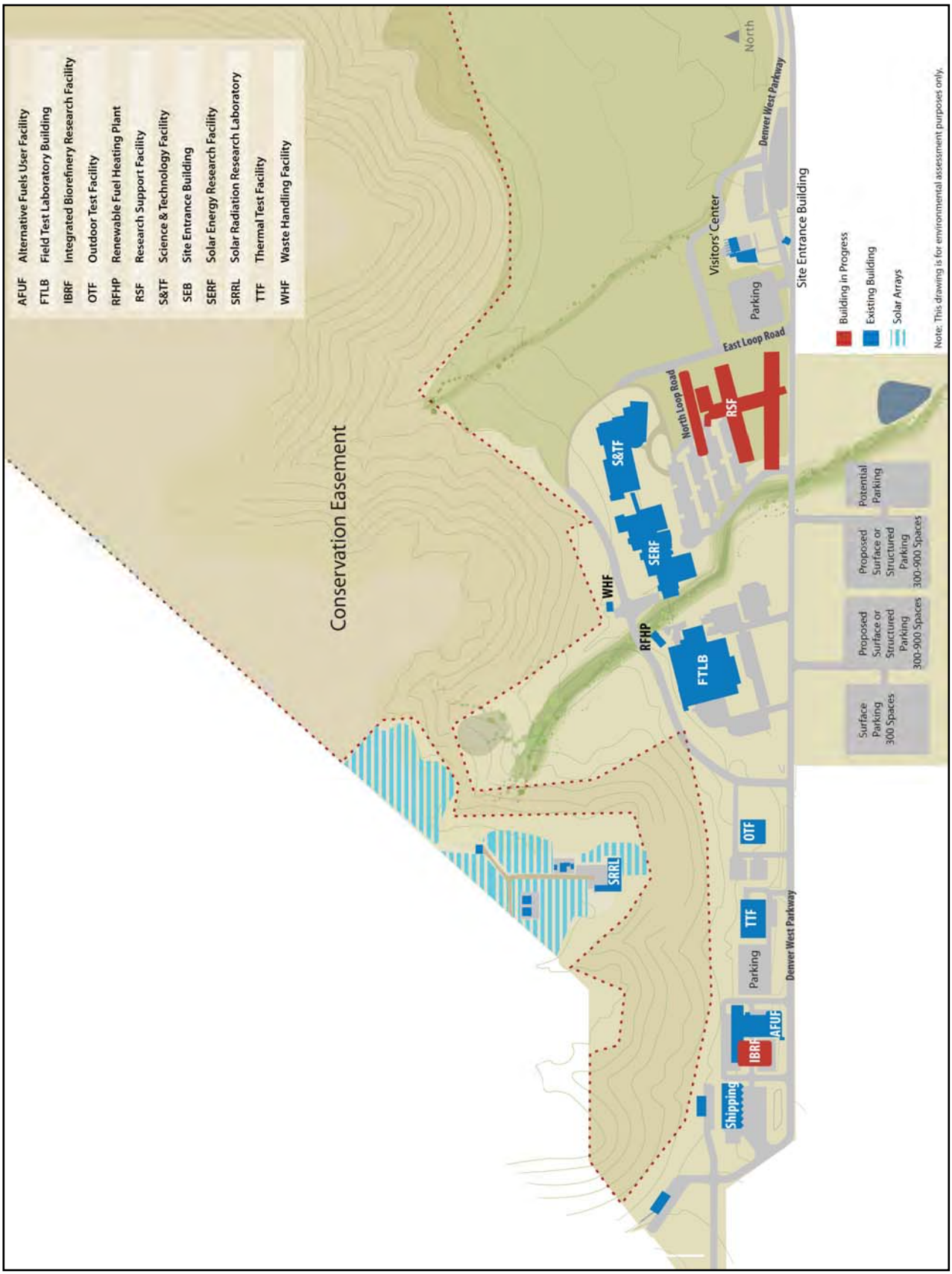

Figure 2-1. Current Site Layout

Figure 2-2. Site Development Zones

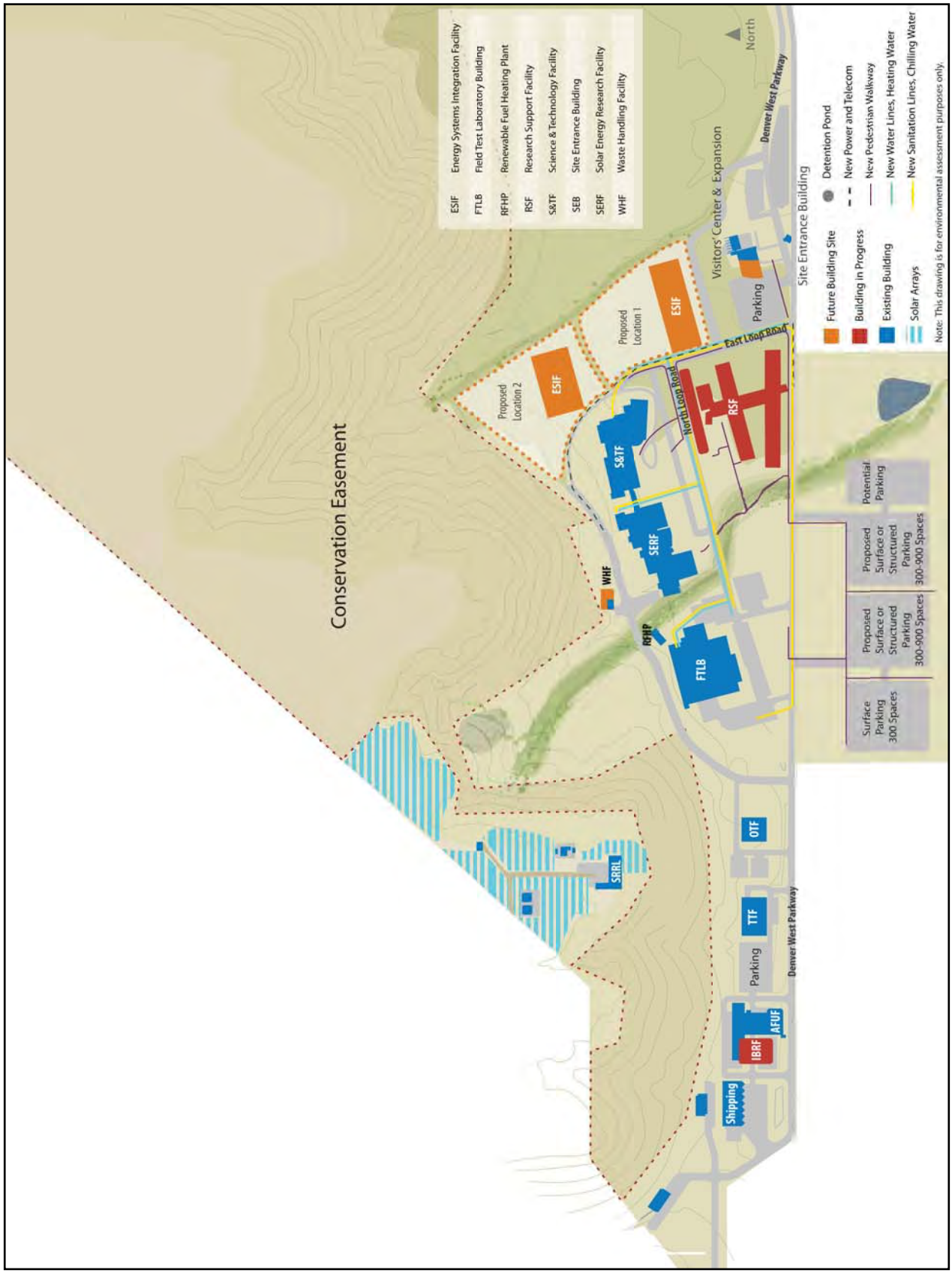

Figure 2-3. On-site Locations of Proposed Buildings and Upgrades

The ESIF would provide laboratory and research capabilities for:

- Solar technologies—interconnection, power electronics, building integration, and system optimization
- Buildings—sensors and controls, photovoltaic (PV) and other systems integration, modeling, and simulation
- Hydrogen—electrical interfaces, electrolyzers, storage, standards, fueling systems, fuel cell integration
- Wind—models, wind generation and grid interaction, grid analysis
- Vehicle technologies—hybrids and vehicle-to-grid integration, battery thermal management, power electronics
- Biofuels—gensets[1] and engines
- Energy storage—electrical and thermal

To support its research, the ESIF would house offices and shared areas to support a constant staff of approximately 250 personnel and would include special spaces such as conferencing capabilities, guest offices, and other "institutional" spaces that facilitate collaboration between NREL/DOE's private, academic, and public sector partners. In addition, outdoor pads would provide for testing larger equipment and systems up to a megawatt (MW) scale.

DOE anticipates the ESIF would have the following features:

- Approximately 20 to 30 laboratories and research areas of various sizes, each with different missions, construction requirements, and operational hazards.
- A high-performance computing and data center with sufficient room to support a minimum 100-Teraflop computer, all peripheral equipment, and enough space to allow for a future, redundant 1,000-Teraflop computer or even larger if appropriate.
- Approximately five outdoor and rooftop test pads that would be integrated with the building for testing and monitoring purposes.
- Research equipment and supporting infrastructure, including:
  - Electrical distribution test circuits
  - Electrical and grid simulators (wind turbine, PV, utility grid)
  - Hydrogen research equipment (fuel cell, dispenser, compressors, electrolyzers, storage)
  - Test pads and test cells (roof-mounted and ground-based PV, vehicle chamber)
  - Load banks and test busses (alternating current [AC], direct current [DC], motor load)
  - Other equipment (surge tester, electrical sources, dynamometer, metrology equipment, etc.)

[1] An engine-generator is the combination of an electrical generator and an engine mounted together to form a single piece of equipment. This combination is also called an engine-generator set or a gen-set. In many contexts, the engine is taken for granted and the combined unit is simply called a generator.

Physical Characteristics

The ESIF would be a one- to five-story building with a maximum footprint of approximately 23,230 square meters (250,000 square feet), plus an additional 1,850 to 2,800 square meters (20,000 to 30,000 square feet) of outdoor research test pads and associated infrastructure requirements (access road, services drives, etc.). A final decision on the number of stories that would be built would be based on the analyses provided in this document and ultimately on the input of a design-build contractor. The design may include Renewable Energy/Energy Efficiency technology such as roof-top PV. The approximate location of the proposed facility (to be located in STM Development Zone 4) is shown in Figure 2-3. Two alternative pad locations for the ESIF are proposed; a final decision on the building location would be based on the analysis provided in this document and ultimately on the input of a design-build contractor. Computer-generated simulations of the proposed new building are shown in Section 3.1.4 (Visual Quality/Aesthetics). Depending upon the outcome of this NEPA document and funding, construction could begin in 2010 and take approximately 18 to 24 months to complete. The maximum construction workforce is estimated to be approximately 100 to 150 workers.

ESIF construction would require a temporary laydown area of approximately 1.6 to 2 hectares (4 to 5 acres) and would be located east of the ESIF construction site on the east side of the east drainage. This area would be used to unload building materials, stage equipment, and park construction vehicles during the construction period. Access to the laydown area from the construction site would be provided by constructing a crossing over the east drainage. The crossing would consist of a culvert large enough to contain a 100-year flood, with fill and road base material placed over the culvert. Once construction is completed and the laydown area is no longer needed, the laydown area would be reclaimed and reseeded with an approved seed mix. The crossing over the east drainage may remain in place for further use in site buildout plans; however, when it is determined that the crossing is no longer needed, the road base, fill, and culvert would be removed and the topography of the area would be graded to preconstruction contours and reseeded using approved seed mix.

Major ESIF Programs

A Distributed Energy Resource Testing Program would be conducted that would use any energy source (such as a genset, hydrogen generator, natural gas microturbine, fuel cell, etc.) to model and test the switches that interconnect the energy source to the grid. The components of the Distributed Energy Resource Testing Program (Table 2-1) would mostly operate on outdoor test pads near the ESIF.

The Hydrogen Systems Laboratory (HSL) at the ESIF would be a comprehensive, flexible laboratory for testing equipment that produces and uses hydrogen. This laboratory would support the EERE's Hydrogen, Fuel Cells & Infrastructure Technologies Program, Wind & Hydropower Technologies Program, and Solar Energy Technologies Program, as well as supporting activities and research for other organizations. The HSL would be capable of evaluating and testing the hydrogen equipment, systems, and technologies of the future. It would provide space and resources for comprehensive testing and demonstration of hydrogen systems. The HSL would also include a nearby hydrogen systems outdoor test area for hydrogen storage, vehicle fueling stations, and large hydrogen systems equipment. The major testing activities of the HSL would include:

- Electrolysis of water to produce hydrogen using various electrolysis technologies
- Consumption of hydrogen in fuel cells to produce electricity
- Combustion of hydrogen in internal hydrogen combustion generators to produce electricity or to do mechanical work

Table 2-1. Distributed Energy Resource Testing Equipment

Generator Gensets	Capacity	Location	Operations	Fuel
Permanent Gensets				
Diesel genset 1	1 MW	Outside	24 hr/day, 2 wk continuous every 2 months (approx 12 wk/yr total)	Diesel biodiesel, hydrogen
Diesel genset 2	120 kW	Outside	24 hr/day, 2 wk continuous every 2 months (approx 12 wk/yr total)	Diesel biodiesel, hydrogen
Diesel genset 3	80 kW	Outside	24 hr/day, 2 wk continuous every 2 months (approx 12 wk/yr total)	Diesel biodiesel, hydrogen
Intermittent Gensets				
Diesel genset A	1 MW	Inside or outside	2 wk of continuous or intermittent operations per year	Diesel biodiesel, hydrogen
Diesel genset B	1 MW	Inside or outside	2 wk of continuous or intermittent operations per year	Diesel biodiesel, hydrogen
Diesel genset C	1 MW	Inside or outside	2 wk of continuous or intermittent operations per year	Diesel biodiesel, hydrogen
Facility Backup Power				
Diesel Genset	~500 kW, 3 MMBtu/hr	Outside	Expected at 12 hr/yr (monthly operational test)	Diesel

Note: hr = hour
kW = kilowatt
MMBtu = 1 million (1 thousand thousand) British thermal units
MW = megawatt
wk = week
yr = year

- Compression of hydrogen to high pressures (250 – 800 bar [3,500 – 12,000 pounds per square inch]) for storage or transport
- Delivery of vehicle fuel cell-grade hydrogen via hydrogen fuel dispensers for fuel cell vehicles
- Storage of hydrogen
- Investigation and development of hydrogen system design and sizing for hydrogen economy infrastructure

Hydrogen research program components that would be used for integrated renewable electrolysis system testing are listed in Table 2-2.

Summary of Principal Operational Hazards

Operations at the ESIF would present a variety of potential hazards that would be mitigated through a variety of controls. For example, testing and validation of methods and processes for the production, storage, processing, and distribution of hydrogen would be conducted. This work would include generating and compressing hydrogen on-site, fueling hydrogen vehicles, and testing equipment and fuel cells that use hydrogen as a fuel. The scale of this work would range from bench-top experimentation to end-use distribution systems, including 250-kilogram (kg) high-pressure storage tanks. Working with hydrogen presents risks associated with fire, explosion, or bursting of high-pressure vessels.

In addition, high-voltage surge testing of equipment would be conducted. This work would incorporate methods to create high-voltage arcs. This type of arcing can vaporize metal, ignite combustible materials, and result in serious injuries, fatalities, and property damage.

Testing and evaluation of several types of gensets and engine test chambers could also be performed in the ESIF. These engines would operate on a variety of fuel types, including biofuels and hydrogen. High-voltage load banks would be associated with this equipment. Potential hazards would include moving or rotating mechanical equipment, high temperatures, fire, and electrocution.

A detailed bounding events analysis for the ESIF is provided in Appendix C and is discussed in Section 3.1.3.

2.2 Site Infrastructure Improvements (Phase 2 Buildout)

The proposed Site Infrastructure Improvements (Phase 2 Buildout) would entail infrastructure improvements (roadways, parking structures, gathering areas, pedestrian/bicycle paths) and utility improvements in Zones 4, 5, and 6 that would service and support the proposed ESIF and other projected developments contemplated in the SWEA. Figure 2-3 illustrates the types and approximate locations of the proposed improvements. A new east-west roadway (referred to as the North Loop Road), connecting the East Loop Road and Denver West Parkway, and utility extensions would be part of this phase. Denver West Parkway through the campus would remain. As buildings are completed, the interconnectivity of pedestrian walkways, bicycle paths, and open space landscaping and gathering areas would also be completed. Site stormwater features and detention basins would also be improved as part of the Phase 2 Buildout. These improvements could consist of minor grading and recontouring, installation of drop structures, resizing of current detention basins, and installation of additional detention basins.

Table 2-2. Integrated Renewable Electrolysis System Components

Equipment	Size	Operating time	Operating pressure	Location	Noise	Fuel	Next step
Electrolyzer	One 1 MW or two 500 kW	24hr/wk (three working days)	200 psi	Indoors	Very quiet	1-MW cell will produce 200 kg hydrogen in about 12 hr	Compressors
Hydrogen Compressors (3)	6 ft wide x 4 ft long x 4 ft high	8 hr/day, 52 wk/yr, only while electrolyzer operating	3,500 psi 6,000 psi 12,000 psi	One indoors, two outdoors	Very quiet	Hydrogen sent to pressure tank storage	Storage tanks
Hydrogen Storage Tanks (12)	2.5 ft diameter by 20 ft long	8 hr/day, 52 wk/yr	5 tanks @3,500psi 1 tank @6,000psi 6 tanks @12,000psi	Outdoors	Silent	Approximately 200 kg of hydrogen weekly throughput from the electrolyzer via compressors	Combustion engine, fuel cells, turbine generator, fuel stations
Hydrogen Filling Station 1	Pump size approx 3-ft x 3-ft footprint	2 to 5 fill activities per day	5,000 psi output	Outdoors	Very quiet	Hydrogen from the 6,000 psi storage tank	Fleet of 5 to 10 cars, two buses, 2 to 5 fill activities per day
Hydrogen Filling Station 2	Pump size approx 3-ft x 3-ft footprint	2 to 5 fill activities per day	10,000 psi output	Outdoors	Very quiet	Hydrogen from the 12,0000 psi storage tank	Fleet of 5 to 10 cars, two buses, 2 to 5 fill activities per day

Table 2-2. Integrated Renewable Electrolysis System Components (continued)

Equipment	Size	Operating time	Operating pressure	Location	Noise	Fuel	Next step
Hydrogen-Fueled Internal Combustion Engine Generator	60 kW (200 kW possible)	4 hr/day, 5 day/wk, 52 wk/yr	100 psi	Outdoors	Similar to a large diesel truck	Consumes 20 kg H_2/hr	Electricity sent to the grid
Hydrogen-Fueled Turbine Generator	250 kW	4 hr/day, 5 day/wk, 52 wk/yr	100 psi	Outdoors	Noise: Approx 65 dBA at 33 ft	Consumes 5 kg H_2/hr	Electricity sent to the grid
Fuel Cell 1	1 MW	4 hr/day, 5 day/wk	100 psi	Outdoors	Silent	Consumes 70 kg H_2/hr	Electricity sent to the grid
Fuel Cell 2 & 3	Two 50 kW	4 hr/day, 5 day/wk	100 psi	Indoors	Silent	Consumes 3 kg H_2/hr	Electricity sent to the grid
Equipment Cooling (propylene glycol closed-loop system)	Fan 5 ft x 5 ft	Continuous operation during equipment operation	Not Applicable	Outdoors	Approx 95 dBA at 6 ft	None	Not Applicable

Note: dBA = A-weighted decibel
ft = feet
H_2 = hydrogen
hr = hour
kg = kilogram
kW = kilowatt
MW = megawatt
psi = pounds per square inch
wk = week
yr = year

North Loop Road

Approximately 370 meters (1,200 feet) of two-lane, 6-meter (20-foot) wide paved road would be constructed. It would run from the East Loop Road to the Denver West Parkway (see Figure 2-3). The total footprint of the proposed roads, including shoulders, would be approximately 0.2 hectare (0.6 acre).

New Parking Areas

The total permanent footprint of the new parking areas, including access roads, would be approximately 4 hectares (10 acres). This new parking may be added to areas adjacent to the Visitors Center and/or to the new parking lots identified in SWEA/S-I south of Denver West Parkway (Figure 2-3). Multi-level parking up to five stories above grade could be constructed over those parking lots to provide the additional parking space. The lower level of the multi-story parking could be partially below grade.

Utility Improvements

Approximately 1,200 meters (4,000 feet) of trenching would be needed for new underground water, hot and chill water distribution, sewer, power, and telecommunication lines. The new lines would support the ESIF and future site development (see Figure 2-3). Because most of the improvements would be underground, they would not result in permanent footprints.

Drainage and Stormwater Improvements

The final size, number, and location of drainage and stormwater improvements would be determined during design of the proposed ESIF, the proposed expansions of the Visitors Center and WHF, and the new parking areas.

Landscaping, Walkways, and Bike Paths

Open-space landscaping, pedestrian walkways, gathering spaces, bike paths, and other campus amenities would be constructed. The location and design of these features would be determined based on the final location of the proposed projects.

2.3 Second Access Road

Consistent with the needs identified in traffic surveys conducted in 2007 and 2008 (FHU 2008) and most recently in 2009 (Baseline 2009), a new second access road providing access to and from the STM site would be built to accommodate additional traffic associated with the Proposed Action. DOE and NREL are considering five corridors for the second access road (Figure 2-4). Either a single corridor (Corridor A or Corridor E) or a combination of corridors (Corridor B/C, B/D, or B/D/E) are evaluated for the final roadway alignment. The routes, access points, and lengths of the corridors are described below, assuming a driver is leaving the site:

- Corridor A would connect with the existing western entrance gate on the STM site and extend south on Quaker Street, connecting to South Golden Road, a distance of approximately 0.69 kilometer (0.43 mile).
- Corridor B/C would begin at the proposed on-site parking lots and extend south to connect with South Golden Road, a distance of approximately 0.49 kilometer (0.31 mile).

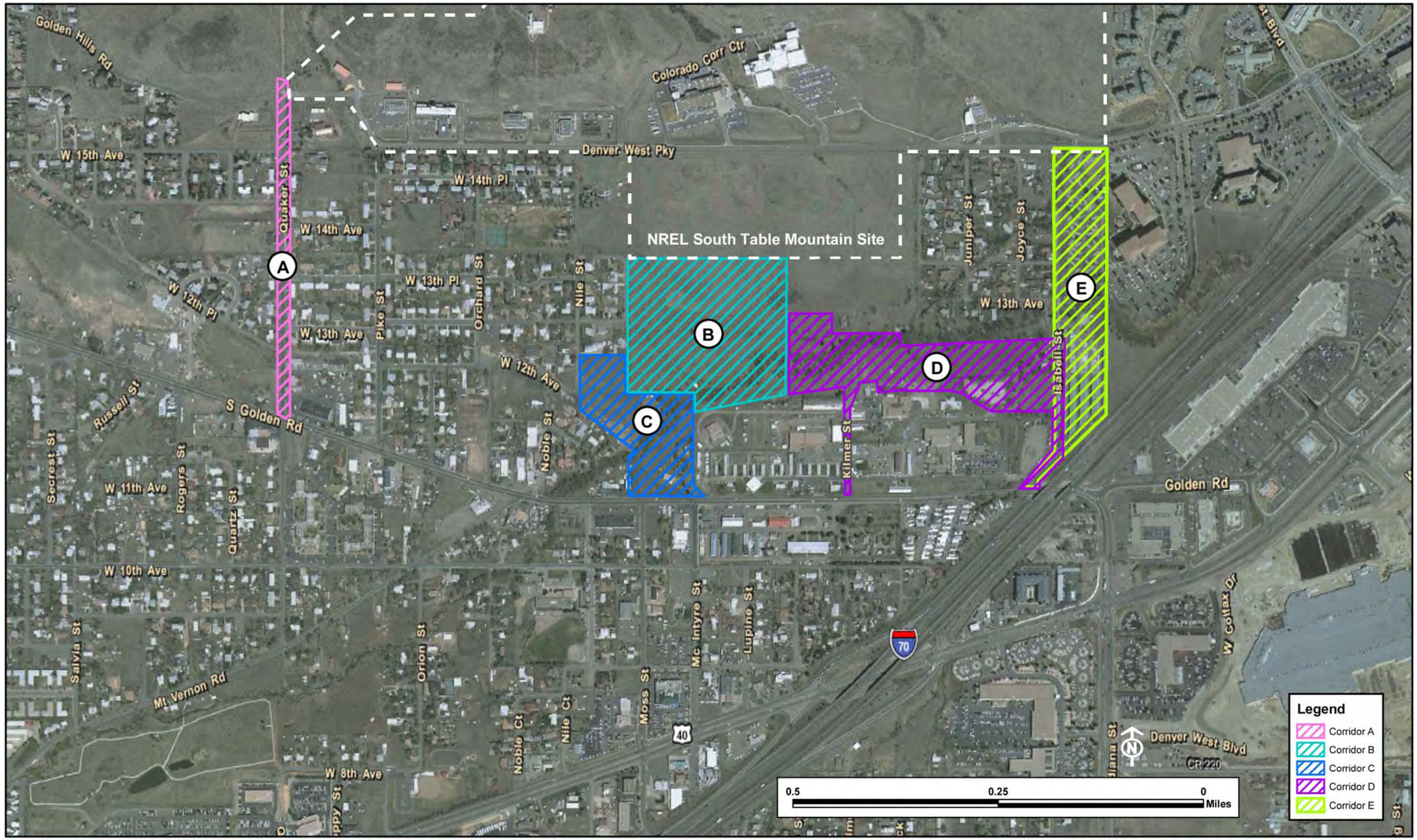

Figure 2-4. Proposed Five Corridors for the Second Access Road

- Corridor B/D would begin in the same area as Corridor B/C. From there, it would either utilize the existing access road (with upgrades) to the current parking lot for the Pleasant View Community Park or require new construction in an area nearby to cross Lena Gulch. It would then travel south on Kilmer Street to connect to South Golden Road. The total distance of this corridor would be approximately 0.88 kilometer (0.55 mile).
- Corridor B/D/E would be the same as the Corridor B/D option with the exception of using Isabell Street to gain access to South Golden Road. The total distance of this corridor would be approximately 1.13 kilometers (0.70 mile).
- Corridor E would begin at the Denver West Parkway near the current Visitors Center and travel south along Isabell Street to connect with South Golden Road, a distance of approximately 0.72 kilometer (0.45 mile).

For all of the proposed corridors, construction of either a new access road or widening and upgrades of existing roads would require a roadway right-of-way (ROW) width of 18.3 meters (60 feet). Additionally, a roadway on Corridors B, C, or D would require new bridging or a culvert over Lena Gulch, and Corridor E could require expansion of the existing bridge. Corridors A and E would require widening to sections of Quaker Street and Isabell Street, respectively, and Corridor D would require widening of Kilmer Street. The intersections of all corridors with South Golden Road would require either upgrades to existing intersection signals or new signals, and could require additional turn lanes and/or roundabouts. As a result, ROW expansions at these intersections could be required.

Preferred Corridor Alternative

Table 2-3 summarizes the impacts that would result from constructing and operating a second access road to the STM site within each of the alternative corridors. These impacts are discussed in more detail in Section 3.1. Based on this understanding of impacts, DOE has selected Corridor B/C (Figure 2-5) as the preferred corridor for a second access road to the STM site. This corridor would provide the best traffic flow for employees to access the major arteries and freeways; minimize the number of residential properties that might be affected; avoid large increases in traffic down existing residential streets; and avoid numerous historic resources and conflicts with other activities along Kilmer Street. Local, county and state traffic agencies support this corridor as the preferred corridor, as does the U.S. Army Corps of Engineers (USACE), which has jurisdiction over the wetlands and floodplains associated with crossing Lena Gulch, and JeffCo Open Space, which owns the land leased to the Pleasant View Park and Recreation District. The Colorado State Patrol and Colorado Department of Public Safety also concur that Corridor B/C would be the least disruptive to the state tenants of Camp George West.

Before a route could be sited within this corridor, DOE and NREL would negotiate a ROW with the current private and public landowners; mitigate potential impacts to the Camp George West Historic District and historic resources to the satisfaction of the State Historic Preservation Officer (SHPO); work through the Clean Water Act Section 404 permitting process with the USACE, which regulates the impacts to wetlands and floodplains and discharges to Lena Gulch that could result from a new crossing over Lena Gulch; and resolve the approach to intersection improvements at the South Golden Road/Moss Street intersection with Jefferson County. DOE would consider granting public access to the Pleasantview Park via any new routing but at this time would not consider linking a new access road to any of the existing residential streets to the west or east of Corridor B/C. DOE would also avoid construction over the existing natural gas pipeline.

Table 2-3. Second Access Road Comparison Matrix

Attribute	Corridor				
	A	B/C	B/D/Kilmer	B/D/E	E
New road required	N	Y	Y	Y	N
Upgrades and ROW expansion to existing off-site roads required	Y	N	Y	Y	Y
Private residences directly affected by ROW expansion	~15	0-3	0	0-2	10-12
Residential yards converted to ROW (acres)	1-2	1-2	0	0-1	1-2
Private residences experiencing new commuter traffic noise	~15	0-9	0-6	0-8	10-12
Conflicts with existing off-site businesses or uses	N	Y	Y	Y	Y
Camp George West Historic District affected by ROW expansion	N	Y	Y	Y	N
Historic resources potentially affected by ROW	0	0-4	11-15	0-4	0
Affected land ownership (percent)					
Private	100	50	-	25	100
County	-	50	75	50	-
State	-	-	25	25	-
Natural vegetation converted to ROW (acres)	0	2	3	3	0
Wetlands potentially affected (acres)	0	0.1-1	0.1-1	0.1-1	0.1
Floodplains potentially affected (acres)	0	0.1-2	0.1-3	0.1-3	0.1
Lena Gulch crossing (new or modified)	N	Y	Y	Y	Y
LOS AM at South Golden Road[a]	A	B	A	A	A
LOS PM at South Golden Road[a]	C	C	C	B	B
Percent increase in AM traffic[b]	235	NA[c]	514	412	412
Percent increase in PM traffic[b]	166	NA[c]	860	374	374
South Golden Road intersection improvement required	Y	Y	Y	Y	Y
Favorable traffic flow per DOT	N	Y	N	N	N

a. LOS – level of service.
b. Traffic increases estimated along the affected roadway (e.g., Corridor A – Quaker Street, Corridor E – Isabell Street)
c. NA - not applicable, because there is no existing street within this corridor.

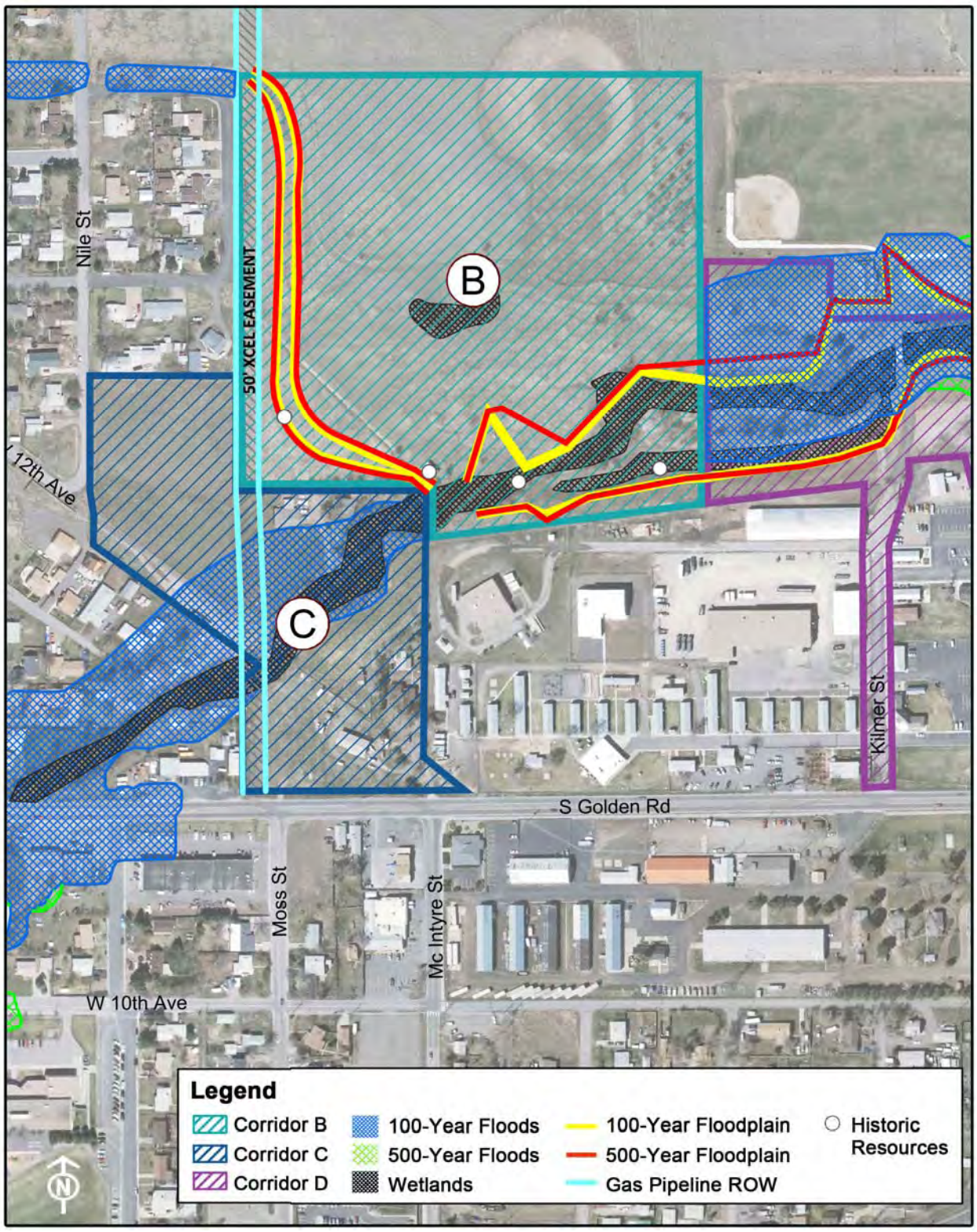

Figure 2-5. Close-up of Corridor B/C

2.4 Expansion of the Waste Handling Facility

The current WHF would be expanded from 99 square meters (1,065 square feet) to approximately 370 square meters (4,000 square feet). This expansion would accommodate anticipated future needs. The expanded facility would be used for packaging and short-term storage of NREL's increasing volume of hazardous wastes before the wastes are shipped off-site for disposal. No on-site waste treatment or disposal is proposed. The building would most likely be constructed of cinder block and concrete to match the existing architecture.

2.5 Expansion of the Visitors Center

The Visitors Center is currently about 600 square meters (6,500 square feet). DOE is proposing to approximately double the size of the center, to 1,200 square meters (13,000 square feet). The added space would include a large conference room and additional office and exhibit space. It could also include a café for visitor and employee use. The existing parking area may also be expanded to accommodate additional visitors.

2.6 No Action Alternative

The No Action Alternative would leave the site in its current configuration. The proposed ESIF construction, WHF and Visitors Center expansions, and new infrastructure projects, including a new second access road, would not be undertaken. However, the No Action Alternative would not preclude future projects addressed or contemplated in the SWEA from being proposed at which time DOE would make a NEPA determination.

2.7 Alternatives Considered But Not Analyzed

The Proposed Action and the No Action Alternative are the only alternatives specifically addressed in this SWEA/S-II. The Proposed Action alternative is to implement the five site development projects described in Sections 2.1 through 2.5. However, alternatives to the Proposed Action were raised and considered prior to the scoping period for the SWEA. The SWEA resulted in a finding that development in the central and south-central portions of the site, rather than other locations, was the most appropriate, technically feasible, and environmentally benign alternative. Other alternatives considered were eliminated from further analysis. The rationales for having eliminated these alternatives remain applicable to the current Proposed Action and are summarized below:

- New Site and Off-Site Improvements Alternative: not considered feasible because of the technical and cost implications associated with decentralized operations and site/infrastructure complications.
- Other Site Development Configuration Alternatives: not considered feasible because of the interrelated nature of the proposed facilities, site development constraints, and the inherent flexibility of the Proposed Action with respect to future facility footprints.
- Reduced Development Intensity Alternative: not considered feasible because it is inconsistent with the Proposed Action's purpose and need and the intent of preparing the SWEA and its supplements, which is to facilitate NREL in carrying out its mission.

3.0 EXISTING ENVIRONMENT AND ENVIRONMENTAL IMPACTS

GENERAL SITE DESCRIPTION

The 132-hectare (327-acre) STM site is located on the southeast side of STM, north of Interstate 70 (I-70) and west of the I-70 and Denver West Boulevard interchange in unincorporated Jefferson County near Golden, Colorado. The areas surrounding the STM site are within portions of unincorporated Jefferson County, as well as the cities of Golden and Lakewood in Jefferson County. The Pleasant View Metropolitan District, within unincorporated Jefferson County, overlies portions of each of these jurisdictions. These jurisdictions are described and illustrated in detail in the SWEA (DOE 2003).

Of the 132 hectares (327 acres) at the STM site, 55 hectares (136 acres) are available for development. A total of 71.6 hectares (177 acres) is protected by a conservation easement, and development on 5.7 hectares (14 acres) is restricted by utility easements. There are currently seven laboratory facilities, a few small test facilities, and several support buildings on the site. The site includes acreage on the STM mesa top, slope, and toe, and approximately 10 hectares (25 acres) that were formerly part of the Colorado National Guard facility, established between 1903 and 1924, at Camp George West. Figure 2-1 shows the STM site layout, and Figure 2-3 shows the locations of the five proposed improvement projects that are the subject of this SWEA/S-II.

For aspects of the existing environment that remain essentially unchanged since the SWEA (DOE 2003) and subsequent STM EAs (DOE 2007, 2008) were issued, this SWEA/S-II reiterates or summarizes the descriptions found in those EAs. Otherwise, this SWEA/S-II describes relevant environmental changes since those EAs were issued.

The impacts expected from the Proposed Action are generally bounded by the impacts reported in the SWEA (DOE 2003) and subsequent STM EAs (DOE 2007, 2008). In cases where impacts from the Proposed Action may not be adequately bounded by or fully discussed in those EAs, more detailed discussions are provided. Unless otherwise noted or updated, the summary descriptions of the existing environment for specific resources areas provided in Section 3.1 are consistent with the descriptions provided in those EAs.

3.1 Environmental Impacts of the Proposed Action

3.1.1 Land Use

3.1.1.1 Existing Environment

Current land use at the site includes research and development facilities, office space, support buildings, and testing areas. The STM complex provides approximately 56,900 square meters (612,000 square feet) of facilities and workspace for approximately 1,600 staff, including federal employees, contractors, and temporary personnel, of which approximately 1,300 are NREL employees.

The proposed ESIF, WHF expansion, and most of the Phase 2 Site Infrastructure Improvements would be located in Zone 4, the center of the STM complex. The 22-hectare (55-acre) Zone 4 includes major DOE facilities such as the Solar Energy Research Facility (SERF), Field Test Laboratory Building (FTLB), and Science and Technology Facility (S&TF). It also includes wet laboratories and space for research such as experiments with hydrogen (H_2), toxic gases, PV, biofuels, and industrial technology.

The proposed new second access road and associated new connecting roads would be located in or immediately east or west of Zone 6 or south of Zone 5. Parts of Corridors B, C, and D traverse the Camp George West Historic District, which housed the Colorado National Guard beginning in 1903. Currently, the Colorado Department of Corrections, the Colorado Department of Transportation (CDOT), and the Colorado State Highway Patrol maintain a presence within the district's boundaries. The Pleasant View Community Park is also inside the boundaries. There are also private residences within Corridors A, C, D and E. However, the majority of land within Corridors C and D is grassland and riparian vegetation along Lena Gulch. Corridors A and E are generally made up of residential housing or are adjacent to residential land uses. Other existing land uses associated with Corridor E include an abandoned mobile home park bordering Isabell Street and a storage facility. The Richards Heights subdivision is located adjacent to Corridor E. Quaker Street generally runs north and south within Corridor A. Table 3-1 shows the ownership of lands within each corridor alternative.

Table 3-1. Land Ownership within Corridor Alternatives for Proposed Second Access Road

Corridor	Land Ownership		
	Private	County	State
A	100%	--	--
B	--	100%	--
C	100%	--	--
D	50%	25%	25%
E	100	--	--

Note: Shown in general percentages traversed by each corridor alternative

The 10-hectare (25-acre) Zone 5 includes the Visitors Center and East Entrance; otherwise, this zone is undeveloped. The zone is designated for general research and development with dry laboratories and minimal use of hazardous materials

3.1.1.2 Impacts of the Proposed Action

The land use and planning impacts of the proposed site development projects on the STM site are bounded by the discussion of impacts presented in the SWEA (DOE 2003) and subsequent STM EAs (DOE 2007, 2008); these impacts are summarized in the following sections.

Energy Systems Integration Facility

Land use for the proposed ESIF would be consistent with the designated uses of NREL Planning Zone 4. If the ESIF were built as a single-story building, the building footprint would cause approximately 23,230 square meters (250,000 square feet) of undeveloped site land to be converted to facility use, and another 1,860 to 2,800 square meters (20,000 to 30,000 square feet) of land to be converted to outdoor research test pads. If the ESIF were built as a multi-story building, the footprint would be smaller. The single-story or multi-story options are viable on either alternative pad location proposed for the ESIF.

Site Infrastructure Improvements

The proposed site infrastructure improvements would convert approximately 40,500 square meters (436,500 square feet) of undeveloped site land into parking, new paved roads, and infrastructure.

Second Access Road

Each proposed corridor would convert differing amounts of natural vegetation, affect private residences, and require upgrades to existing roadways to construct a proposed second access road into the STM site. Assuming a finished roadway of 11 meters (36 feet) wide and an 18-meter (60-foot) wide ROW containing gutters, curbs, and sidewalks, the impacted area for each proposed corridor would be as follows:

- Corridor A – would require expansion of the Quaker Street existing ROW, which would include a wider road to meet applicable requirements. Although not affecting any physical structures, this corridor could require the conversion of approximately 0.4 hectare (1.0 acre) of residential yards to ROW. The yards of up to 15 private residences could be directly affected.
- Corridor B – would convert approximately 0.4 hectare (1.0 acre) of natural vegetation into a roadway, require either a new crossing or modification of the existing crossing over Lena Gulch, and directly affect no private residences.
- Corridor C – would convert approximately 0.4 hectare (1.0 acre) of residential uses and natural vegetation into a roadway, require a new crossing over Lena Gulch, and directly affect up to two private residences, depending upon route selection.
- Corridor D – would convert approximately 0.8 hectare (2.00 acres) of natural vegetation into a roadway; require a new crossing or modification of the existing crossing over Lena Gulch; possibly require an upgrade of 0.16 kilometer (0.1 mile) of Kilmer Street affecting the ROW in which there are currently numerous historic structures, or directly affect one or two private residences if extended to Isabell Street, which may require upgrades to the existing crossing over Lena Gulch; and could affect operations at the state corrections facility or National Guard facilities, and workers utilizing buildings along Kilmer Street and adjacent buildings.
- Corridor E – would require expansion of the existing Isabell Street ROW, which would include a wider road to meet applicable requirements. Although not affecting any physical structures, this corridor could require the conversion of approximately 0.5 hectare (1.3 acres) of residential yards to ROW. The yards of up to 10 to 12 private residences could be directly affected. This corridor also may require upgrades to the existing crossing over Lena Gulch.

Expansion of the Waste Handling Facility

The proposed expansion of the WHF would be confined to Zone 4. The expansion would require the conversion of approximately 370 square meters (4,000 square feet) of undeveloped land to facility use.

Expansion of the Visitors Center

The proposed expansion of the Visitors Center would be confined to Zone 5. The expansion would require the conversion of approximately 600 square meters (6,500 square feet) of undeveloped land to facility use.

3.1.2 Traffic

3.1.2.1 Existing Environment

Section 3.1.2.1 of the May 2008 SWEA/S-I (DOE 2008) provides a detailed description of the existing traffic environment at the STM site, including discussions of transportation facilities and circulation,

existing roadways and traffic volumes, existing operating conditions, and future baseline traffic volumes and operating conditions. The SWEA/S-I (DOE 2008) assumed that a second, right-turn lane would be constructed by 2012 at the Denver West Parkway/Denver West Marriott Boulevard (DWP/DWMB) intersection, as required by the approved traffic mitigation plan prescribed in the EA. Also included in SWEA/S-I are data and figures suggesting that without a new access road, unacceptable levels of service (LOS) would occur on the roadway system associated with staffing increases at the STM site. That description of the existing traffic environment (existing roadway network and existing traffic volumes and conditions), which was based on recent traffic studies at the STM site (FHU 2008), remains current and is incorporated into this section by reference.

Traffic operational conditions are described with a LOS, a qualitative measure of traffic flow based on the average delay per vehicle at a controlled intersection. LOS are described with a letter designation of A, B, C, D, E or F. A LOS "A" represents conditions resulting in minimal delay, while a LOS "F" represents conditions resulting in much longer delays. Typically, a LOS "D" or better is considered to be acceptable operational conditions. A second traffic impact analysis report titled *National Renewable Energy Laboratory South Table Mountain Facility Traffic Impact Study Revision* was prepared in September 2009 (Baseline 2009) to update the previously completed 2008 traffic impact study (FHU 2008) and to assess potential traffic volumes and operating conditions associated with the new access road proposed as part of this action.

Additionally, SWEA/S-I and its accompanying FONSI make commitments to undertake mitigating actions such as TDM measures; those commitments were made to prevent unacceptable traffic impacts. Those mitigating efforts would continue under the Proposed Action in this SWEA/S-II and are incorporated by reference. The alternative corridors that are being considered as part of the Proposed Action are described and shown in Chapter 2 of this SWEA/S-II.

3.1.2.2 Impacts of the Proposed Action

Near-term (2012) Traffic Conditions

Due to increasing funding levels at NREL for site buildout, the staffing projection of 1,430 employees used in the 2007 and 2008 traffic modeling underestimated the staffing levels that would occur at the STM site in the near term (2012). Under the Proposed Action, an estimated 2,228 employees would be on the STM site by 2012. Therefore, multiple traffic analyses were conducted to determine critical expansion-level thresholds associated with alternative access corridors and to identify key mitigation measures. Specifically, this "sensitivity evaluation" was conducted to determine the impact that increased employment levels would have on peak-hour traffic operations and delays. These analyses determined that, even with the planned improvements to the DWP/DWMB intersection, staffing levels beyond approximately 1,500 employees would begin to degrade the LOS at this intersection to unacceptable levels without a second access road (FHU 2008). Current staffing plans predict that this threshold would be crossed sometime during the summer of 2010. The most recent traffic study (Baseline 2009) examined the effects of optimizing the timing of traffic signals in the DWP/DWMB/I-70 intersections and determined that although conditions at the DWP/DWMB intersection could be temporarily improved, even under optimized conditions, the west bound exit ramp of I-70 would degrade to unacceptable levels (LOS "E") by 2012 during the morning rush hour without a second access road.

Based on the updated staffing levels, operations at the STM site are projected to generate approximately 8,622 average daily trips (ADT) in 2012 (Baseline 2009). The 2012 traffic volumes are based on previously conducted analysis and traffic data prepared in 2008, as well as trip generation rates associated with the Institute of Transportation Engineers *Trip Generation* manual. It should also be noted that for

traffic impact analysis purposes, area growth and consequent traffic were projected to grow at an average rate of approximately 1.0 percent per year. This slight growth rate is not associated with the Proposed Action but instead is attributable to the project area (Baseline 2009).

Based on the need and recommendation of a second access road to the STM site, the traffic impact study in this SWEA/S-II assessed the potential effects that the Proposed Action would have on the existing roadway system and operating conditions as a result of adding a new access road. The traffic impact study assessed the five different access alternatives (Figure 2-4) described in Chapter 2.

Long-term Traffic Conditions

Also considered under the Proposed Action are staffing projections once buildout occurs. An estimated 1,668 additional employees beyond 2012 levels, are expected on the STM site by 2030, resulting in an estimated total of 3,896 employees. Similar to the near-term analysis (2012) described above, due to the increasing funding levels at NREL for the site buildout, the staffing projection of 2,675 employees used in the 2007 and 2008 traffic modeling underestimated the staffing levels that would occur at the STM site in the long term (2030).

Using the revised staffing level projections, the results of the new analysis show that the DWP/DWMB intersection and the intersection of Denver West Marriott Boulevard and the I-70 westbound off-ramp would be beyond capacity (LOS "F") in 2030 if no additional access to the STM site is constructed. Further analyses show that the DWMB/I-70 intersection would operate at LOS "F" in the morning and "E" in the evening by 2015, and the DWP/DWMB intersection would be operating at and unacceptable level (LOS "E") by 2020 if no additional access to the STM site is constructed (Baseline 2009). Operations at the STM site are projected to generate approximately 15,078 ADT in 2030 (Baseline 2009).

Project Traffic Conditions

Table 3-2 provides the expected traffic conditions associated with each of the proposed access road corridors in both the near term (2012) and the long term (2030). Table 3-2 also provides the expected LOS for the nearest intersection affected by each corridor alternative.

As shown in Table 3-2, all intersections affected by construction and operation of the proposed second access road would operate at acceptable LOS for all of the alternative corridors in 2012. In comparison, as discussed earlier, the west bound ramp of I-70 would be at an unacceptable LOS by 2012, without a second access road.

Corridor Impacts

Corridor A – If Quaker Street were used as a second access road, the existing roadway would be expanded to a width of 36 feet. This alternative would require a ROW expansion into the front yards of current residences but would avoid any structures. The existing speed bumps would be removed because they would impede commuter traffic. The intersection of Quaker Street and South Golden Road would require additional turn lanes to accommodate the increase in traffic volume. As shown on Table 3-2, in 2012 the peak rush-hour traffic volume would increase by 235 percent during the morning rush and by 166 percent during the evening rush. Currently, the residents of Quaker Street experience approximately 2 to 3 cars passing by every minute during morning and evening rush hours. If Quaker Street were used as a second access road, residents would observe approximately 8.6 to 9 cars every minute of the morning and evening rush hours, or approximately 6 to 7 more cars per minute than they experience under current conditions.

Table 3-2. Comparison of Traffic Impacts among Corridor Alternatives

Corridor[a]	Conditions	2012				2030			
		Peak Rush-Hour Traffic Volumes[c]		LOS[a]		Peak Rush-Hour Traffic Volumes		LOS	
		AM	PM	AM	PM	AM	PM	AM	PM
DWP/DWMB	No Second Access Road[b]	952	1,155	B	C	1,610	1,828	E	F
	With Second Access Road	579	810	B	B	957	1,223	B	C
	Percent Decrease (%)	39	30	--	--	41	33	--	--
A	Used as Second Access Road	520	537	A	C	838	847	C	D
	Baseline - No Action	155	202	B	B	200	254	A	B
	Percent Increase (%)	235	166	--	--	319	233	--	--
B/C	Used as Second Access Road	375	345	B	C	653	602	B	D
	Baseline - No Action	0	0	A	C	0	0	A	D
	Percent Increase (%)	NA[d]	NA	--	--	NA	NA	--	--
B/D (using Kilmer Street)	Used as Second Access Road	448	384	A	C	742	652	B	F
	Baseline - No Action	73	40	A	B	89	49	A	D
	Percent Increase (%)	514	860	--	--	734	1,231	--	--
B/D/E (using Isabell Street)	Used as Second Access Road	466	436	A	B	765	716	B	D
	Baseline - No Action	91	92	A	A	112	113	A	C
	Percent Increase (%)	412	374	--	--	583	534	--	--
E	Used as Second Access Road	466	436	A	B	765	716	B	D
	Baseline - No Action	91	92	A	A	112	113	A	C
	Percent Increase (%)	412	374	--	--	583	534	--	--

a. Traffic numbers and LOS apply to the intersection of each corridor with South Golden Road, except Denver West Parkway.
b. No Second Access Road: Denver West Marriott Boulevard provides the major access to the STM site; no second access road built.
c. Peak rush hour traffic volume means the amount of traffic occurring during any single hour during morning or evening rush hours which is typically between 7:00 to 9:00 AM and 4:00 to 6:00 PM
d. NA = not applicable.

Corridor B/C – Because there is no existing road within this corridor, any route within this corridor would require new construction, including a new bridge over Lena Gulch. Intersection improvements such as traffic signals would be required at either the Moss Street or McIntyre Street intersection on South Golden Road. The proposed roadway would cross both public and private land. No roadway currently exists along this corridor, so there would be no relevant percentage increase in traffic experienced by residents. The two residences within this corridor would experience the entire traffic volume projected in Table 3-2 if this corridor were used; under current conditions, they experience no traffic.

Corridor B/D (using Kilmer) – Except for Kilmer Street, there is no existing road within this corridor; therefore, any proposed route within this corridor would require new road construction, including a new bridge or reconstruction of the existing bridge over Lena Gulch. Intersection improvements such as traffic signals would be required at the Kilmer Street/South Golden Road intersection. This proposed roadway would cross public land.

To meet applicable regulations, if Corridor B/D were used as a second access road, Kilmer Street would have to be expanded to a width of 36 feet. This would require the expansion of the ROW and could require the relocation of structures, many of which either are listed on the National Register of Historic Places (NRHP) or contribute to the listed Camp George West Historic District.

As shown on Table 3-2, in 2012 the peak rush-hour traffic volume would increase by 514 percent during the morning rush and by 860 percent during the evening rush. Currently, occupants of the buildings along Kilmer Street experience approximately 0.5 to 1 car passing by every minute during morning and evening rush hours. If Corridor B/D were used as a second access road, building occupants along Kilmer Street would observe approximately 6 to 7.5 cars every minute of the morning and evening rush hour, or approximately 6 to 7 more cars per minute than they experience under current conditions.

Corridor B/D/E (using Isabell) – Except for a short stretch of Isabell Street along the southern half of Corridor E, there is no existing road within this proposed corridor; therefore, any route within this corridor would require new road construction, including a new bridge or reconstruction of the existing bridge over Lena Gulch. Intersection improvements such as traffic signals would be required at the Isabell Street/South Golden Road intersection. This proposed corridor would cross public and private land.

Depending upon route selection, some historic structures could be affected. As shown on Table 3-2, in 2012 the peak rush-hour traffic volume on Isabell Street would increase by 412 percent during the morning rush and by 374 percent during the evening rush. Currently, the one or two residences along the stretch of Isabell Street within Corridor E experience approximately 1.5 cars passing by every minute during morning and evening rush hours. If Corridor B/D/E were used as a second access road, residents on Isabell Street would observe approximately 6 to 7 cars every minute of the morning and evening rush hours, or approximately 5 to 6 more cars per minute than they experience under current conditions.

Corridor E - If Isabell Street were used as a second access road, the existing roadway would have to be expanded to a width of 36 feet. This would result in a ROW expansion into the front yards of current residences but would not require relocation of any structures. Intersection improvements such as traffic signals would be required at the Isabell Street/South Golden Road intersection.

As shown on Table 3-2, in 2012 the peak rush-hour traffic volume on Isabell Street would increase by 412 percent during the morning rush and by 374 percent during the evening rush. Currently, the residences of Isabell Street experience approximately 1.5 cars passing by every minute during morning and evening rush hours. If Corridor E were used as a second access road, Isabell Street residents would

observe approximately 6 to 7 cars every minute of the morning and evening rush hours, or approximately 5 to 6 more cars per minute than they experience under current conditions.

3.1.3 Safety and Accidents

3.1.3.1 Existing Environment

NREL implements DOE's Integrated Safety Management process to ensure that NREL operations are "low risk." Risk is formally defined as a quantitative or qualitative expression of possible loss that considers (1) the probability that a hazard-driven event will occur, and (2) the consequences of that event. An activity can be "low risk," even if the consequences of an accident might be catastrophic (may cause death or system loss), so long as the likelihood or probability of such an accident occurring is extremely remote (annual probability of 0.000001 to 0.0001).

A bounding events analysis for the proposed ESIF (Appendix C) has been conducted as part of the NEPA process to identify potential adverse conditions that may be associated with the Proposed Action. The ESIF is in the early stages of the design/build process. While some design safety features have been identified, the structured hazards analysis that would relate the design features to the accident sequences (and demonstrate that the design features are effective in preventing or mitigating the accidents) has not yet been performed. As the design/build process progresses, facility performance specifications would be identified, and their effectiveness to prevent or mitigate severe accidents would be determined. Once safety assessments are completed, it would be possible to determine whether adequate safety measures are in place to protect against all forseeable accidents, particularly low-probability accidents with the potential for off-site consequences. Integrating safety features into the design requirements allows the designer/builder to incorporate the necessary engineering controls into the ESIF design to manage risks in a manner that would protect the off-site population, non-facility workers at NREL, and facility workers. Furthermore, as the facility design evolves, additional hazards/safety assessments would be performed. Using actual equipment selections and configurations, these assessments may identify additional engineering and administrative controls to be incorporated in the design specifications. Before operations began, each activity would undergo a readiness verification to confirm that all required controls are in place and functioning.

Although it is not possible to identify all possible events early in the design phase, the goal of the bounding events analysis (Appendix C) is to consider many classes of events—for example, equipment failures, process upsets, and procedural errors—as they are understood in the early stages of a design process. The objective of this exercise is to identify the representative and bounding events for the ESIF and the control sets that would be necessary to operate the facility within an acceptable level of risk so that DOE and NREL can consider this information as part of their decision-making on the actions in this SWEA/S-II. As design and construction proceed, more detailed hazards analyses would be performed consistent with NREL's Hazard Identification and Control Procedure so that changes in the facility hazards and design are adequately captured and analyzed. This would confirm that facility workers, site workers, and the general public would be adequately protected from any events that may occur after the ESIF becomes operational. As the design process proceeds, it is anticipated that some of the assumptions upon which the analysis is based would change. As a result, new risks could be identified, other events might be shown to be impossible, and still others might fall into a different risk category.

3.1.3.2 Impacts of the Proposed Action

Based on the evaluation of between 60 and 70 event scenarios with and without safety controls (see Addendum 1 in Appendix C), four scenarios were selected for more detailed analyses to provide a

representative range of accidents in this SWEA/S-II as required by DOE's NEPA guidance.[1] These scenarios, which apply to either alternative location for the ESIF, are briefly summarized here and are discussed in detail in Appendix C:

- **Compressor failure.** The energy of the pressure pulse from this event could cause damage for a few tens of meters. The biggest threat would be from the potential shrapnel produced.
- **Rupture of a H_2 storage vessel.** An explosion from this event could shatter non-reinforced cinderblock wall, glass would be broken, and personnel exposed to the flying glass could be injured. Individuals within 30 meters (100 feet) might experience eardrum rupture; however, the overpressure would not be sufficient to cause lung damage or produce fatal injuries. Shrapnel striking a person could produce fatal injuries.
- **Shearing off of a valve on a pressure cylinder.** The analysis shows that although the results may vary, gas storage cylinders have the potential to attain high velocities. If a worker were struck with a cylinder weighing almost 140 pounds at 100 miles per hour, serious injuries could occur. Smaller lecture-sized bottles would not be capable of doing as much damage, but they could nevertheless strike a person at a significant velocity and cause injury.
- **Leakage of H_2 into a confined space, resulting in deflagration**. If a high-pressure line ruptured, a room could rapidly attain the flammability limit. If an ignition source were present, the H_2 gas would ignite, and the resulting deflagration would destroy the laboratory from the overpressure and seriously injure any persons present.

In summary, the bounding events analysis in Appendix C identifies many possible events that could occur at the ESIF and analyzes in detail several of the more severe event sequences. The analysis concludes that several events have the potential for significant impacts to site workers and possibly the general public and emphasizes the importance of incorporating effective safety features into the design. As stated previously, NREL will use formal hazards analyses, as specified in the NREL Hazard Identification and Control Procedure, to guide the design process. The facility would not operate until it could be shown that the general public, on-site NREL workers, and ESIF workers would be adequately protected from potential accidents.

3.1.4 Visual Quality/Aesthetics

3.1.4.1 Existing Environment

The text and figures describing the visual and aesthetic environment of the STM presented in the SWEA remain current and are summarized below. Figures 3-1 through 3-3 illustrate the current overall visual environment at the STM site as viewed from off-site locations south and east of the site. The location of the ESIF in these simulations is approximate and representative of the ESIF on either of the two alternative pad locations under consideration.

The dominant visual characteristics of the existing STM site include the prominent slope and mesa top associated with STM; the DOE facilities located on top of STM; and the SERF, FTLB, S&TF, and Visitors Center located at the toe of the slope. The STM site buildings are prominent against the landscape of STM. Other less-prominent buildings occupy the western end of the site.

[1] A fifth scenario, a spill of nanomaterials, is discussed in Appendix C, but because of uncertainties in estimating the consequences of such a spill, that event is analyzed in less detail.

Figure 3-1. Current View from a Location South of the STM Site

Figure 3-2. Current View from a Location East of the STM Site

Figure 3-3. Current View from a Neighborhood Located East of the STM Site

The STM site facilities are designed to reflect the laboratory activities related to modern energy concepts. Three of the larger buildings—the SERF, FTLB, and S&TF—are terraced and set against the south slope of STM. In addition to the buildings at the STM central campus, DOE has constructed a variety of solar testing and measurement structures such as the High Flux Solar Furnace, Solar Radiation Research Laboratory, Alternative Fuels User Facility, Outdoor Test Facility, Thermal Test Facility, support facilities (e.g., shipping/receiving, facilities maintenance), and numerous PV panels situated throughout the site.

3.1.4.2 Impacts of the Proposed Action

Of the elements making up the Proposed Action in this SWEA/S-II, the construction of a new ESIF, the addition of multi-story parking structures to the STM site, and the development of a second access road have the greatest potential to affect the visual environment; therefore, these elements of the Proposed Action have been analyzed in more detail.

Energy Systems Integration Facility

As discussed previously, due to the nature of design-build contracting, a final decision on the dimensions of the ESIF would not be made until a decision is reached, based on this SWEA/S-II, to build the ESIF and a design-build contract is awarded. To support this future decision-making, a representative range of building heights has been simulated in this SWEA/S-II. Specifically, based on two options defined in Table 3-3, one-story and five-story views from the south and the east are provided with a simulation of the Research Support Facilities (RSF) currently under construction (Figures 3-4 through 3-7). These figures show the extent to which views beyond the ESIF would be obstructed. Although the final site location of the two proposed areas would be predicated on the analyses in this document and other design criteria, it is expected that the potential visual impacts noted in the following figures would be similar for either building site location.

Table 3-3. ESIF Height and Location Options

Option	Simulation Viewed From	Figure Number	Height in feet (number of stories)[a]
A	South	3-4	75 (5)
	East	3-6	75 (5)
B	South	3-5	15 (1)
	East	3-7	15 (1)

a. One story equals approximately 15 feet.

Figure 3-4. ESIF Option A – View From South
(including the Research Support Facility currently under construction)

Figure 3-5. ESIF Option B – View From South
(including the Research Support Facility currently under construction)

Figure 3-6. ESIF Option A – View From East

Figure 3-7. ESIF Option B – View From East

At either location proposed for the ESIF, there would be no potential to obstruct neighborhood views of the foothills to the west with either a one-story or five-story building. This same conclusion applies to the Visitors Center expansion and the WHF expansion.

Multi-Story Parking

Figure 3-8 shows a simulated view of the proposed multi-story parking structure. Similar to the ESIF, the dimensions of the parking structure would not be determined until the design-build contract has been awarded and preliminary design drawings have been completed. As part of the design-build process, the structure would be designed to reduce or preclude adverse visual impacts to nearby neighborhoods. As depicted in Figure 3-8, a multi-story parking structure would partially obstruct views of the foothills to the west from the neighborhood to the east of the STM site. The lower level of the multi-story parking could be partially below grade, and this design will be considered to minimize visual impacts.

A potential incompatibility could result from outdoor lighting and associated glare. The STM site is adjacent to residential uses and would be visible from off-site locations. Lighting for parking, the new second access road (described below), and for other areas could cause glare to nearby residents if not properly shielded. Design measures would be implemented in the design-build process which would require all outdoor lighting to be directed toward the ground and to be shielded so as minimize glare for sensitive receptors. Moreover, systems could be put into place to activate the on-site lighting only when the system sensed movement from a vehicle or a pedestrian in the lighting area. These systems would be evaluated during the design-build process. Based on these design measures, minimal lighting impacts are expected under the Proposed Action.

Figure 3-8. Multi-Level Parking Option

Second Access Road

Three of the corridors proposed for the second access road (Corridors B, C, and D [see Figure 2-4]) would change from undeveloped land into a roadway use. Adding landscaping associated with roadway construction would provide screening and improve visual compatibility for the proposed second access. Viewers near Corridors A and E would not experience an appreciable change from the current visual conditions.

3.1.5 Water Resources

3.1.5.1 Existing Environment

The description of water resources found in the SWEA remains current and is summarized below.

Surface Water

There are no perennial creeks, streams, ponds, jurisdictional wetlands, waters of the United States, or floodplains on the STM site. There may be seasonal seeps on the STM site after small amounts of surface water percolate through the soil or the fractured basalt that caps STM. Intermittent storms and other seasonal precipitation events may cause water to temporarily collect in topographic lows and drainages.

In addition to surface water in the form of seasonal seeps and stormwater runoff from the STM site, there are occasional releases of potable water from the STM site. NREL annually tests the fire suppression systems in the STM buildings, resulting in the release of up to 3,000 gallons of water per test. The fire hydrants are also tested annually, releasing about 10,000 gallons in the process. Finally, Consolidated Mutual Water District, which owns and maintains a drinking water storage tank on top of South Table

Mountain, occasionally flushes the tank, releasing as much as 30,000 gallons. These volumes may be seen flowing from the STM site.

To the south of the STM site between NREL's property boundary and South Golden Road runs Lena Gulch, a perennial stream that originates in the foothills 3 to 5 kilometers (2 to 3 miles) to the west at the mouth of Apex Gulch near Heritage Square, a retail and recreational complex on West Colfax Road. After passing through numerous commercial developments, residential areas, and several impoundments, Lena Gulch empties several miles east into Clear Creek.

The 100- and 500-year floodplains associated with Lena Gulch, as modified by mitigation measures implemented by the Pleasant View Recreation District, are shown in Figure 3-9. Figure 3-10 shows the area that could be affected by a 100- or 500-year flood event prior to the channel modifications within the Pleasant View Recreation District's boundaries. These flows could spread across portions of the STM site and across four corridors identified for the proposed second access road (Corridors B, C, D, and E). According to the *Major Drainageway Planning-Upper Lena Gulch-Phase B Report* (Boyle Engineering 1994), for the subject area adjacent to Lena Gulch, 100-year peak flows are estimated to be 2,150 to 2,700 cubic feet per second (cfs), and 500-year peak flows are estimated to be 5,700 to 6,400 cfs. Corridor A would not be affected by such flood events.

Groundwater

NREL is situated over the very western fringe of a large groundwater feature known as the Denver Basin. The Denver Basin comprises of five distinct geological formations or aquifers; NREL lies above the Denver Aquifer, which is overlain by the Dawson Formation in the southern areas of the basin. No regulatory agencies require groundwater monitoring by NREL; however, over time as many as 15 groundwater monitoring wells have been installed at the STM site. Many of the monitoring wells have since been plugged and abandoned in accordance with state regulations. Five wells remain on the STM site: one near a decades-old, abandoned amphitheater, one north of the S&TF, and three in the vicinity of the Alternative Fuels User Facility and shipping and receiving. These wells are very shallow; the deepest was completed to a depth of 25 feet. The NREL monitoring wells do not reach the deeper region of the water table beneath the STM site; they were designed to collect subsurface water as it moves downgradient to verify that there were no areas of potential contamination. The shallow wells did not show significant seasonal variation in the elevation of the water table surface. Levels measured in September 1998 were about 0.3 meter (1 foot) higher than that recorded in March 1999; levels measured in September 1999 were nearly the same as the level in March. The 1998 levels may be attributable to wetter conditions in the late summer before the September levels were measured.

During the active period of groundwater monitoring at NREL, it was estimated that the groundwater moved through the subsurface stratum at a rate of about 0.02 meter (0.05 feet) per day. The most recent analysis of groundwater quality was in 1997, when samples were collected and analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides, and herbicides. None of these parameters were detected. Analysis for inorganic constituents showed that groundwater at the STM site is similar in quality to groundwater elsewhere in the Denver Basin. There is no evidence that activities at the STM site have had adverse impacts on groundwater quality, and there have been no releases or discharges that could lead to groundwater contamination since the time of this sampling.

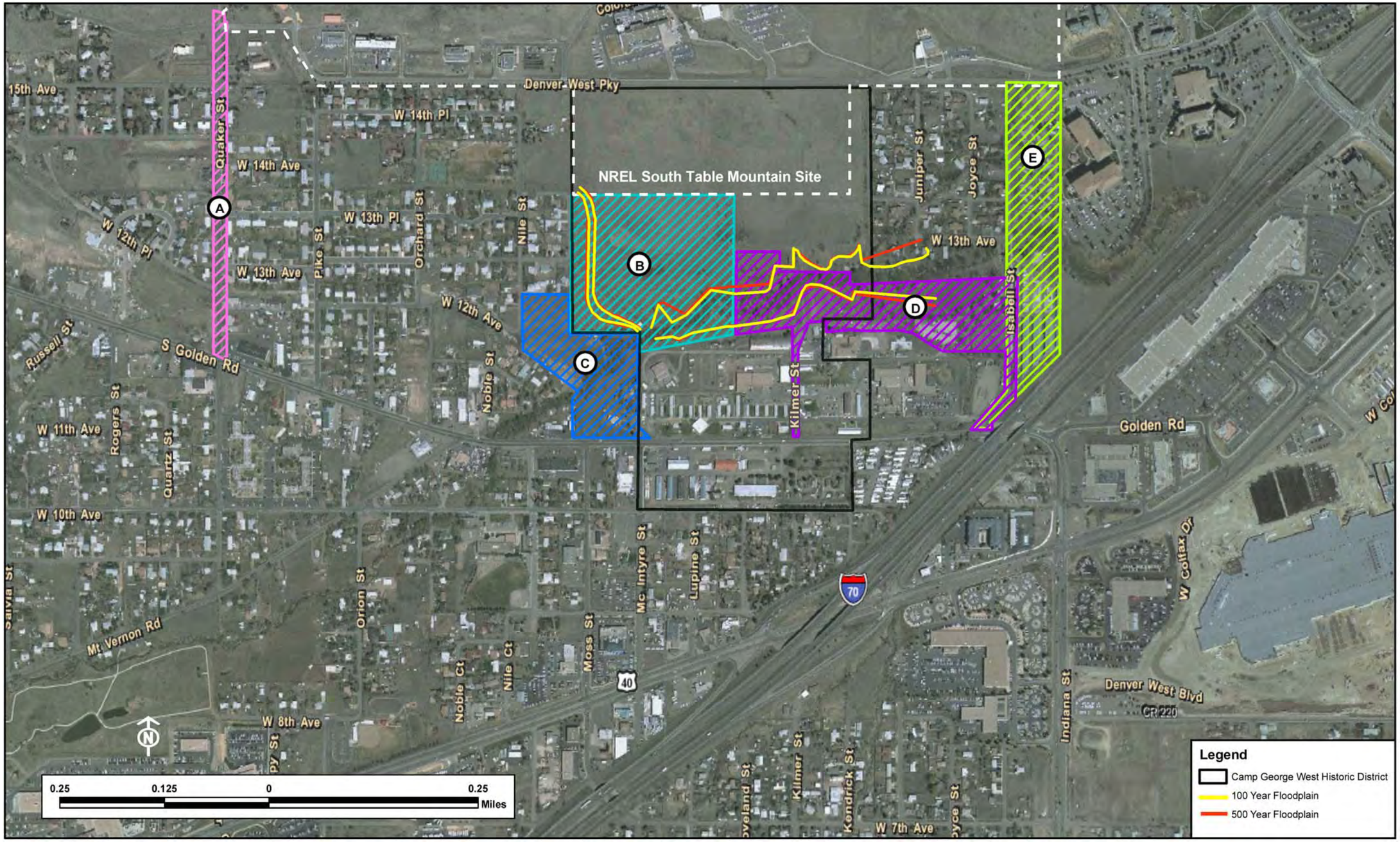

Figure 3-9. 100- and 500-Year Floodplains within Proposed Corridors for a Second Full Service Access Road to the NREL's STM Site

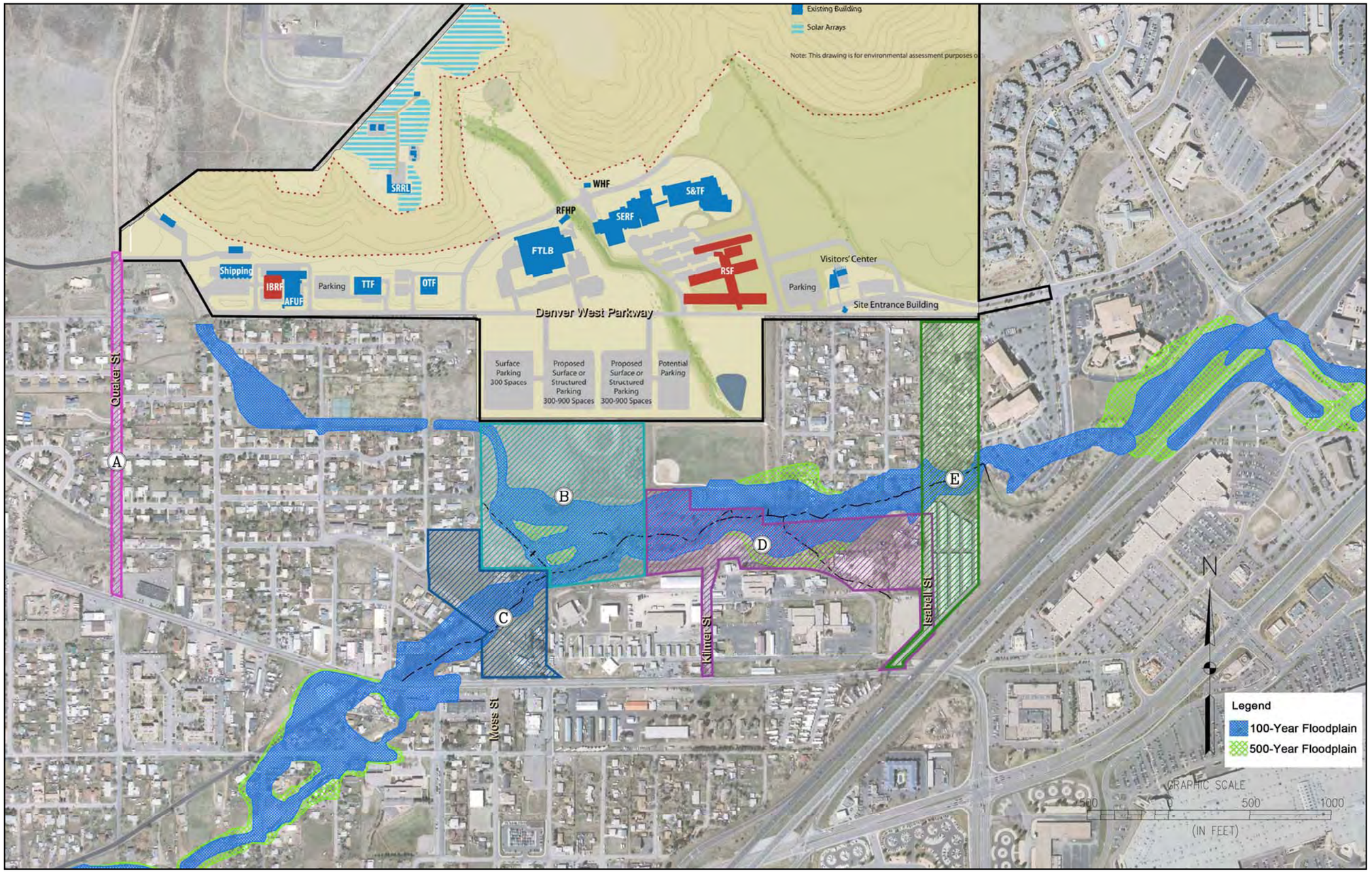

Figure 3-10. Areas that Could Potentially Be Inundated by Peak Flows Associated with 100- and 500-Year Floods

3.1.5.2 Impacts of the Proposed Action

Neither the proposed facilities nor the proposed site infrastructure improvements would result in untreated operational discharges of pollutants to surface water or groundwater. New drains, stormwater detention basins, and conveyance structures would be connected to the site's existing stormwater and sewage lines or to other existing publicly owned water discharge and treatment works.

All discharges to publicly owned treatment works would meet the requirements of the Metropolitan Wastewater Reclamation District and the Pleasant View Water and Sanitation District.

Absent mitigation measures, facility construction, new parking lots and structures, and new paved roads would increase quantities of runoff conveyed off-site and consequently could incrementally degrade down-slope surface water quality. Increased turbidity (e.g., increased water flow/runoff would suspend additional particulates) and quantities of various chemicals associated with incidental leaks from additional vehicles and construction equipment would occur. Increased runoff could increase localized on-site flooding. Absent mitigation measures, the estimated volume of increased runoff over current runoff would be approximately 19.8 acre-feet per year, most of which would be additional runoff from the proposed buildings, parking lots and roads. This estimate of increased runoff in the absence of mitigation measures is based on the following assumptions, using standard runoff coefficients from impermeable surfaces:

- Approximately 23,230 square meters (250,000 square feet) for the ESIF footprint, with an additional 1,860 to 2,800 square meters (20,000 to 30,000 square feet) of outdoor research test pads and associated infrastructure requirements (access road, services drives, etc.)
- Approximately 40,500 square meters (436,500 square feet) of proposed roads, infrastructure, and parking lots and structures
- Between 0.4 hectare (1.0 acre) and 1.00 hectare (2.7 acres) for the proposed second access road, depending on the corridor selected for construction.
- Approximately 370 square meters (4,000 square feet) for the WHF expansion
- Approximately 560 square meters (6,000 square feet) for the Visitors Center expansion

The estimate assumes one event based on Denver's historical average precipitation of 40.1 centimeters (15.8 inches) per year. The estimate does not address natural factors that could reduce runoff and mitigate the impacts of increased runoff, including the fact that precipitation occurs as multiple events throughout the year rather than a one-time event, the duration and intensity of events, land slope, soil infiltration rates, and local evaporation rates.

To address impacts from increased runoff, DOE would install a new detention basin or a series of basins in or around the central and/or eastern drainage dry stream channel and/or implement other stormwater management techniques to minimize and manage off-site runoff from the Proposed Action. In addition, DOE would regrade the surrounding terrain and/or install engineered drainage systems to direct runoff from the proposed parking lots and structures into the new detention basins, or other stormwater management systems as appropriate through NREL's stormwater program. This would be a "committed" measure. Stormwater impacts would be further minimized by complying with the provisions of NREL's U.S. Environmental Protection Agency (EPA)-issued National Pollutant Discharge Elimination System (NPDES) General Permit for construction activities.

ESIF construction crews would utilize an existing access road leading to the RSF, a new on-site structure currently under construction. The access road crosses two or more dry stream channels using culverts to permit the unimpeded flow of runoff during storm events.

If groundwater were encountered during excavations, it would be pumped from the excavation to a vegetated area rather than directly into a natural drainage. The vegetated areas would act as filters to trap sediment and reduce impacts to surface water.

As described in Section 3.1.5.1, Corridor A is not expected to be affected by 100- or 500-year storm events, and use of this corridor would not require construction within a floodplain. Corridors B, C, D, and E may be subjected to flood events based on their locations relative to Lena Gulch, and use of any of these corridors would require some construction within the floodplain of Lena Gulch. Potential adverse impacts associated with flooding events are not expected at the STM site. The volume of surface water flowing downstream through the gulch and associated tributaries is progressively diminished by diversions upstream of the STM site. While occasional intense storms may generate enough precipitation to result in surface flow that reaches the local base level, such storms commonly trigger flash flooding in the channelized gulch. Moreover, the areas that may be subject to 100- and 500-year floods are not considered sensitive areas for property damage or human safety.

3.1.6 Biological Resources and Wetlands

3.1.6.1 Existing Environment

The descriptions of biological resources and wetlands found in the SWEA remain current and are summarized below. Additional biological resource information is available in the following reports:

- Wildlife Survey (Including Migratory Birds and Raptors) at the National Renewable Energy Laboratory, South Table Mountain Site, Golden, Colorado (NREL 2005)
- Vegetation Survey, NREL South Table Mountain Site (NREL 2002)
- South Table Mountain Site Conservation Easement Baseline Inventory (NREL 1999)

Located at the base of the foothills to the Rocky Mountains, the STM site occurs at elevations ranging from 1,760 meters (5,780 feet) to 1,840 meters (6,030 feet) above mean sea level. This coincides with the interface between two ecological provinces: the Great Plains-Palouse Dry Steppe Province to the east, and the Southern Rocky Mountain Steppe – Open Woodland – Coniferous Forest – Alpine Meadow Province to the west (Bailey 1995).

Vegetation

With the exception of the second access road, the Proposed Action that is the subject of this SWEA/S-II would occur on NREL land with one predominant vegetation type. The construction that would occur as part of the Proposed Action would occur in Development Zones 4, 5, and 6 (see Figures 2-2 and 2-3), where the vegetation is mixed grass. Mixed grass vegetation makes up approximately 30 percent of the vegetation at the STM site.

Grassland and shrubland vegetation within proposed Corridors B, C and D is typical of the plains and foothill zones of the Front Range; however, these corridors are also bisected by riparian and wetland habitats associated with Lena Gulch and adjoining tributaries. Original vegetation primarily consisted of shrub-dominated (scrub) communities, grasslands (e.g., mid-grass prairie), and grasslands mixed with

shrubs. However, the project area corridors have been altered due to impacts from conversions, weed introductions, and irrigation activities. Additionally, alterations have occurred from the introduction of non-native grasses, such as crested wheatgrass and smooth brome, which have been seeded in disturbed areas to prevent erosion and provide forage. Lena Gulch is dominated by peach-leaved willow (*Salix amygdaloides*), crack willow (*Salix fragilis*), and cottonwood (*Populus deltoides*) trees along with scattered areas of wetland species, including Palustrine emergent, a wetland type that would typically support hydrophytic vegetation such as cattails (*Typha latifolia*), Nebraska sedge (*Carex nebrascensis*), slender sedge (*Carex praegracilis*), and Canada thistle (*Breea arvense*). An ecological assessment of areas including these corridors at Camp George West (Anderson & Company 1999a) provides additional details about the vegetation and ecology of Lena Gulch and surrounding areas.

Vegetation types associated with Corridor A (along Quaker Street) is limited to scattered trees, shrubs, and grasses typical of a suburban setting. Many single-family residences and multi-unit residences support gardens and lawns as well. Corridor E along Isabell Street is vegetated with scattered trees and grass varieties introduced when the area was populated with a mobile home park.

Wetlands

Wetlands exist along Lena Gulch within an area starting at South Golden Road and extending to Isabell Street. Figure 3-11 illustrates the results of a recent wetland delineation of the Lena Gulch area, including the proposed second access road corridors. On August 17, 2009, DOE sent a letter to the U.S. Army Corps of Engineers (USACE) requesting concurrence with the wetland boundaries shown on the map. The USACE concurred with the wetland mapping shown on Figure 3-11 on August 28, 2009. Previously (December 2008), DOE sent a letter to the USACE requesting a determination on whether existing nationwide permits apply to construction involving wetlands in Lena Gulch, and the USACE responded that, depending upon final route selection, nationwide permits could apply. These letters and the USACE responses are included in Appendix B. The Pleasant View Metropolitan District has previously re-contoured areas within Pleasant View Community Park in order to change the floodplain along Lena Gulch in preparation for park build-out plans. These activities are independent of NREL's plans proposed in this document. However, many of the newly constructed wetlands shown on Figure 3-11 are designed specifically for a water drainage system, and some locations serve as mitigation areas. Therefore, it is prudent to avoid these wetlands whenever possible.

Wildlife

Wildlife habitat at the STM site is almost exclusively grassland and shrubland. The Colorado Division of Wildlife (CDOW) has estimated that these habitats may support up to 14 reptile species, 36 mammal species, 82 bird species, and 4 amphibian species. A wildlife study of the STM was conducted in 1987.

The demographics of the area surrounding the STM site have changed since that study, and additional development of the STM site has since occurred. At the request of NREL, Science Applications International Corporation began a four-season wildlife survey of the STM site in the spring of 2004 to update the 1987 data. The 2005 wildlife survey (NREL 2005) is incorporated into this SWEA/S-II by reference. The wildlife survey also includes recommendations for consideration during normal site operations and future construction projects to minimize adverse impacts to wildlife. These recommendations would be reviewed and implemented to the fullest extent possible before and during implementation of the Proposed Action.

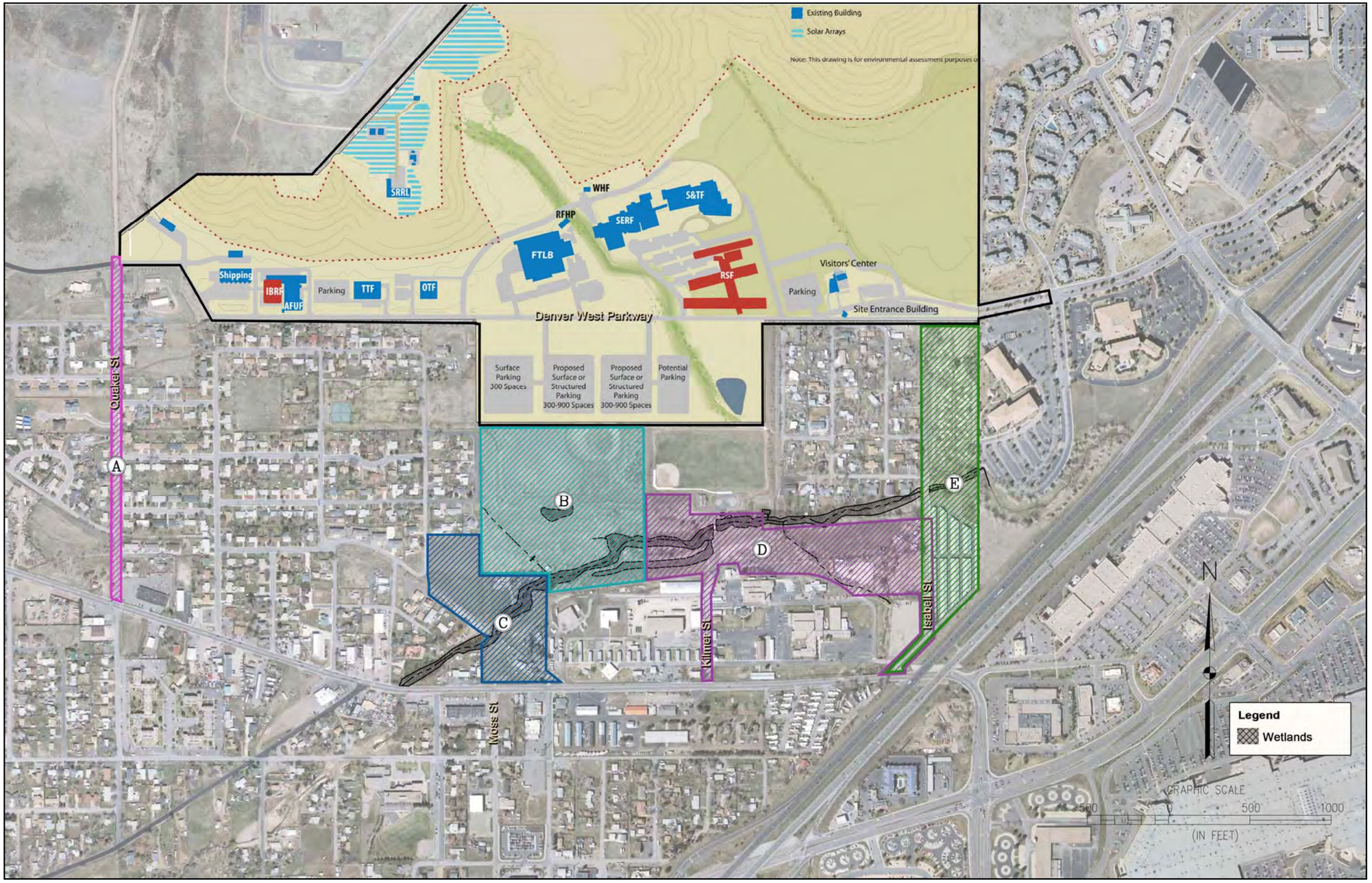

Figure 3-11. Wetlands Map of the Lena Gulch Area

Given its location within the landscape, Lena Gulch does not function as a high-quality wildlife corridor due to urban encroachment upstream of the proposed Corridors B, C, and D. In other words, Lena Gulch does not provide a quality connection for wildlife movement from the foothills given the urban encroachment and associated management of the drainage west of Pleasant View Community Park. However, Lena Gulch does serve as an important watering area and as shelter, especially for mule deer does with fawns. Mule deer regularly travel from South Table Mountain to Lena Gulch as observed by local residents.

Species of Concern

For this SWEA/S-II, a species of concern is defined as those species protected under federal statute, including the Endangered Species Act of 1973, as amended; the Bald Eagle Protection Act of 1940, as amended; and the CDOW list of endangered, threatened, and wildlife species of concern. Federal agencies are also required to abide by the Migratory Bird Treaty Act of 1918, as amended.

The 2005 survey included a review of the U.S. Fish and Wildlife Service (USFWS) list of proposed, endangered, threatened, experimental, and candidate species and habitat and the CDOW list of endangered, threatened and wildlife species of special concern for species observed on the STM site. No species observed on the STM site during the 1987 or the 2004-2005 wildlife surveys were present on either agency's list. However, golden eagles were incidentally observed on the STM site (outside of raptor surveys) and are protected under the Bald Eagle Protection Act. Golden eagles were observed flying over the site and may use the site for hunting. No golden eagle nests or nesting activities were observed on the STM site. During the 2009 nesting season, a red-tailed hawk was observed along Lena Gulch, and a raptor nest was also observed. Although the hawk was not observed at the nest, the nesting season was ending (CDOW 2008); it is assumed that the nest was associated with the hawk.

The USFWS lists two threatened plant species—the Ute ladies' tresses orchid (*Spiranthes diluvialis*) and the Colorado butterfly plant (*Gaura neomexicana* ssp. *coloradensis*)—and the threatened Preble's meadow jumping mouse (*Zapus hudsonius preblei*) as protected species that may potentially occur in the Lena Gulch area. However, field surveys completed in 2009 (see letters to USFWS in Appendix B) did not observe the Ute ladies' tresses or Colorado butterfly plant on the project site or in the proposed access road corridors. Although suitable hydrologic conditions exist at Lena Gulch and in the lower reaches of various upslope drainageways, only two species commonly associated with Ute ladies' tresses occurred. In addition, a field survey completed in 1999 did not observe the Ute ladies' tresses on the project site or in the proposed access road corridors, and soils identified during the survey generally did not appear conducive to the establishment of the species (Anderson & Company 1999b). Ecological conditions for the Colorado butterfly plant were marginal along Lena Gulch, and this plant species has very limited populations. It was not expected to be found, but the 2009 survey was conducted to be thorough. As stated earlier, no Colorado butterfly plants were found.

A habitat assessment for the Preble's mouse was conducted according to USFWS guidelines (USFWS 2004). Any project within 300 feet of the 100-year floodplain within associated Front Range counties in Colorado must consider impacts to Preble's mouse habitat. A few locations have been cleared in blocks so that projects within the clearance zones do not need to consider impacts to this mouse. The Denver Urban Drainage Block Exclusion Zone does not extend to Lena Gulch until it passes under I-70. Therefore, a habitat assessment for Lena Gulch was required. A trapping survey completed in 1999 (Kane 1999) did not capture any Preble's mice. After conducting the assessment and reviewing past trapping efforts, biologists recommend that the area along Lena Gulch be disqualified as habitat for the Preble's mouse. The USFWS concurred with the assessment findings (Appendix B). Although the USFWS typically requires multiple trapping surveys before removing a site from consideration, the low-

quality habitat and the unsuccessful trapping effort supported the recommendation that Lena Gulch be disqualified as habitat for this mouse. No populations exist nearby or at Lena Gulch.

Regulatory Background and Agency Consultations

The Proposed Action falls under the jurisdiction of the USFWS. The Clean Water Act, Section 404, falls under the jurisdiction of the USACE. The USACE provided concurrence on the wetland delineations and associated mapping of the Lena Gulch area on August 28, 2009 (Appendix B). Based on previous discussions, USACE indicated that impacts to wetlands associated with a final design of a road crossing would likely be covered under a Nationwide Permit #14.

Reports documenting the Preble's mouse habitat assessment and the rare plants survey (i.e., the Ute ladies' tresses orchid and the Colorado butterfly plant) were sent to the USFWS (Appendix B). On August 20, 2009, DOE received a letter from the USFWS concurring with the findings of the habitat assessment. DOE received concurrence on the findings of the plants survey on September 24, 2009.

3.1.6.2 Impacts of the Proposed Action

The proposed projects on the STM site would be located largely on undeveloped land. Land clearing, excavation, construction, and paving would clear approximately 6 hectares (15 acres) of land suitable as habitat for wildlife or for any vegetation other than noxious weeds. The construction access road developed for the RSF, will become a permanent part of the site infrastructure, and access for the ESIF construction activities for up to two years. There would be no difference in the impacts to native vegetation between the two proposed ESIF locations.

A proposed second access road would permanently convert native grassland and riparian vegetation, including some wetlands into a roadway.

- Corridor A – approximately 0.4 hectare (1.0 acre) of mostly non-native, residential vegetation would be converted into a ROW.
- Corridor B – approximately. 0.4 hectare (1.0 acre) of natural vegetation would be converted into a ROW, and either a new crossing or modification of the existing crossing over Lena Gulch would be required.
- Corridor C – approximately 0.4 hectare (1.0 acre) of natural vegetation would be converted into a ROW, and either a new crossing or modification of the existing crossing over Lena Gulch would be required.
- Corridor D – approximately 0.8 hectare (2.0 acres) of natural vegetation would be converted into a ROW, and either a new crossing or modification of the existing crossing over Lena Gulch would be required.
- Corridor E – approximately 0.5 hectare (1.3 acres) of mostly non-native, residential vegetation would be converted into a ROW.

For Corridors B, C, D and E, less than 0.07 hectare (0.1 acre) of wetland habitat could be affected while crossing Lena Gulch. However, it should be noted that wetland vegetation occurs primarily within Corridors B, C, and D. Depending upon the final route location, considerably more wetland area could be disturbed if Corridor D were selected than if Corridor B or C were selected. Corridor A is devoid of wetlands, and Corridor E encompasses a comparatively small amount. Pending approval through a FONSI, DOE would use this document to select among the corridor alternatives but would not select a

specific route within a corridor without further analyses and consultations with CDOW regarding minimizing or mitigating wildlife impacts.

Land clearing would destroy or disturb existing native vegetation, making the areas more susceptible to noxious weeds. Noxious weeds such as Canada thistle, diffuse knapweed, musk thistle, houndstongue, field bindweed, common teasel, jointed goatgrass, and dalmatian toadflax occur on the site and are found on either the list of the 10 most widespread noxious weeds in the State of Colorado or on Jefferson County's list of noxious weeds of concern. The potential spread of these species, as well as cheatgrass and 12 other noxious weed species found at the STM site, into disturbed areas represents secondary impacts as a result of the Proposed Action. NREL has made efforts to combat noxious weed invasion. These efforts include implementation of a noxious weed management plan which, among other strategies, calls for a native grassland seed mix to be used in restoration areas after construction and application of herbicides or mowing to control weeds in areas identified as having noxious weed infestations.

Build out of the facilities and infrastructure under the proposed action would not create an impassible barrier to the movements of wildlife from the mesa top to Lena Gulch.

3.1.7 Cultural Resources

3.1.7.1 Existing Environment

There are no known significant prehistoric archeological resources within or adjacent to the NREL STM property. There are no known significant traditional cultural resources within or adjacent to the STM site. Should any evidence of archeological or cultural resources be discovered during any ground-disturbing activities at the STM site or within the Camp George West Historic District, all work would stop in the vicinity until a qualified archeologist evaluated the significance of the find according to NRHP criteria.

Development of a second access road along Corridors B, C, and D would occur within the boundaries of the Camp George West Historic District. This district was deemed eligible for NRHP listing by the SHPO as part of the determination of eligibility for the larger Camp George West complex. The complex, in its entirety, is defined by the boundaries of all lands historically utilized by the Colorado Army National Guard for its activities at the Camp George West installation. The registered district is listed based on historical significance and association with the military development of the area during a portion of World War I and the duration of World War II. The district, also known as the "State Rifle Range," includes portions of the former Colorado Army National Guard complex located south of Denver West Parkway. The range was used during World War I and World War II for intense training, target practice, marching, tank operation, and tactical exercises.

The boundaries of the historic district relative to the STM site and the locations of several historic structures in the area are shown in Appendix D, Figure D-1. Historic resources that could be affected by a second access road are shown on Figure D-2. DOE has reviewed the information available from the NRHP on the Camp George West Historic District and has determined that 13 listed structures that contributed to the district's designation (called contributing resources) and two noncontributing resources occur in or near Corridors B and D. Table 3-4 lists these resources and the corridor in which each occurs. Corridors A, C and E are devoid of any known historic resources. A more detailed characterization of the potentially affected historic resources and current photographs of each resource are provided in Appendix D.

Table 3-4. Historic Resources in or near Corridors B and D

Resource Number	Description	Corridor	
		B	D
Contributing Resources			
12	Mess Hall	No	Yes
28	Mess Hall	No	Yes
29	Mess Hall	No	Yes
33	Small Arms/Ammunition Storage	No	Yes
45	Headquarters	No	Yes
48	Recreation Hall	No	Yes
49	Swimming Pool[a]	No	Yes
50	Pedestrian Underpass	No	Yes
83	Guardhouse	No	Yes
84	Pump House[a]	Yes	No
92	Bridge	Yes	No
113	Bridge	No	Yes
FR12	Firing Lines	Yes	No
Noncontributing Resources			
104	Golden Gun Club Clubhouse[b]	Yes	No
111	Motor Vehicle Warehouse	No	Yes
Total Number of Resources		4	11

a. No evidence of this resource could be found during field surveys in October 2008.
b. Structure was destroyed by fire in July 2009.

3.1.7.2 Regulatory Background and SHPO Consultations

SWEA/S-I addressed the impacts to the northern-most firing lines and the low rock walls within the STM site that would occur from the establishment of new parking lots in this area and also summarized the mitigation measures that were agreed to between DOE and the SHPO.

SHPO consultations are ongoing relative to the new Proposed Action and are documented in Appendix B. A search of the state's databases identified the resources noted in this text and in Appendix B.

3.1.7.3 Impacts of the Proposed Action

The proposed facilities and infrastructure improvements in Zones 4, 5, and 6 would occur in areas that have been surveyed and where no cultural or historic resources are known or believed to exist. No impact to cultural or historical resources is anticipated. However, if, during the course of construction, any cultural or historic resources were discovered, work in that area would be immediately halted pending consultations with a qualified state or tribal archeologist or historian and, if necessary, the SHPO.

Construction of a second access road within Corridors B and D could result in adverse impacts to some historical resources within the Camp George West Historic District, depending upon the location of the final route. However, most resources could be avoided by careful route location. Road construction in Corridors A, C, and E would not affect any historic resources.

If a FONSI results from this SWEA/S-II, DOE would use this document to select among the corridor alternatives but would not select a specific route within a corridor without further analyses and

consultations with the SHPO. Therefore, no formal determination of effect under Section 106 of the National Historic Preservation Act (NHPA), as amended (16 U.S.C. 470f), and implementing regulations codified at 36 CFR Part 800, has been made, nor has Historic American Building Survey/Historic American Engineering Record (HABS/HAER) documentation been prepared. If DOE's corridor selection and subsequent route evaluation suggested that historic resources would be impacted, DOE anticipates that a Memorandum of Agreement (MOA) would be established with the SHPO (similar to the MOA established previously) that would stipulate the process for assessing and mitigating impacts to historic resources.

3.1.8 Air Quality

National Ambient Air Quality Standards (NAAQS) set upper concentration limits for six air pollutants in order to protect human health. These six pollutants, called criteria air pollutants, are carbon monoxide (CO), nitrogen oxides (NO_X), ozone (O_3), particulate matter (PM), sulfur dioxide (SO_2), and lead (Pb). Geographic areas that currently exceed or have recently exceeded the limit for one or more of the criteria air pollutants (or for O_3 precursors) are called nonattainment areas or maintenance areas. The two O_3 precursors are VOCs and NO_X.

3.1.8.1 Existing Environment

Detailed descriptions of the existing air quality at the STM are provided in the SWEA. Those descriptions address climate (Section 3.3.1), air quality regulatory authorities (Section 3.3.2), emissions sources (Section 3.3.3), and STM site permit status (Section 3.3.4). They remain generally current and are summarized or updated below.

The STM site has numerous stationary sources of air emissions, including boilers, water heaters, back-up generators, and building heaters. Table 3-5 shows the STM site's potential to emit four criteria air pollutants—PM, SO_2, NO_X, and CO—and provides estimated annual emissions of those pollutants. In addition, with respect to hazardous air pollutants, the STM site emits extremely small quantities of materials from laboratory hoods. Examples of these hazardous air pollutants include aliphatic and aromatic hydrocarbons, chlorinated and non-chlorinated compounds, inorganic acids, alcohols, and noble gases. The emission quantities are below notification and permit thresholds. Fugitive emissions also can occur from the STM site as unplanned emissions from miscellaneous routes other than stacks, chimneys, or vents. These emissions are minor. Construction activities at the STM site have the potential to increase fugitive dust levels by disturbing soil.

Table 3-5. STM Site Estimated Annual Air Pollutant Emissions

Type of Air Emission	Particulates	SO_2	NO_x	CO
	Tons per Year (TPY)			
Potential	7.96	5.76	51.61	24.61
Estimated[a]	4.41	0.59	9.35	4.97

a. Includes projected emissions from Renewable Fuel Heating Plant, which was assessed in DOE 2007 and began intermittent operations in late 2008.
Sources: NREL 2001, as updated for 2007.
DOE 2007.

3.1.8.2 Impacts of the Proposed Action

This section discusses general construction- and operations-related impacts to air quality that would occur under the Proposed Action. Section 3.1.8.3 (Conformity Review) discusses criteria air pollutant emissions attributable to the Proposed Action in further detail.

Construction activities associated with the proposed projects would cause a temporary increase in emissions of criteria air pollutants from construction equipment exhaust emissions. Construction of the proposed second access road, new parking lots, and service roads and installation of underground utilities would involve scraping and grading, which would result in intermittent fugitive dust emissions during construction. Dust would be managed in accordance with NREL's existing Particulate Emissions Permit for Construction Activities issued by the Colorado Department of Public Health and Environment (CDPHE).

Air emissions from the proposed ESIF operations and from the Visitors Center and WHF expansions would be limited to those characteristic of heating, ventilation, and air conditioning (HVAC) equipment, similar to the operating emissions from other NREL research buildings and would be well below current permit limits. The WHF is short-term (less than 90 days) storage facility, and containers are maintained in a closed condition. However, during packaging activities, small quantities of organic solvents containing VOCs are consolidated into larger packages. During this process, containers are opened for brief periods and would emit extremely small quantities of air pollutants. Because construction-related emissions would be short-term, and operational emissions would be small, no adverse health impacts to on-site workers or the public or adverse visual impacts to the local or regional viewshed would result from air emissions due to the proposed construction, building expansions, and site infrastructure improvements.

3.1.8.3 Conformity Review

Section 176(c)(1) of the Clean Air Act requires that federal actions conform to applicable state implementation plans (SIPs) for achieving and maintaining the NAAQS for the criteria air pollutants. In 1993, the EPA promulgated a rule titled "Determining Conformity of General Federal Actions to State or Federal Implementation Plans" (58 Fed. Reg. 63214 (1993), codified at 40 CFR Parts 6, 51, and 93. The "conformity rule" is intended to ensure that emissions of criteria air pollutants and their precursors are specifically identified and accounted for in the attainment or maintenance demonstration contained in SIPs. For there to be conformity, a federal action must not contribute to new violations of air quality standards, increase the frequency or severity of existing violations, or delay timely attainment of standards in areas of concern.

The conformity rule applies to non-exempt, federal actions that would cause emissions of criteria air pollutants (or their precursors) above EPA's established threshold levels (de minimis levels) in designated nonattainment or maintenance areas. Under the rule, an agency must engage in a *conformity review* and, depending on the outcome of that review, conduct a *conformity determination*. In a conformity review, the federal agency must (1) determine whether a proposed action would cause emissions of criteria pollutants or their precursors, (2) determine whether the emissions would occur in a nonattainment or maintenance area for any of the criteria air pollutants, (3) determine whether the proposed action is exempt from the conformity rule requirements, (4) estimate the emission rates of criteria air pollutants impacting a nonattainment or maintenance area, and (5) compare the estimate to the applicable threshold emission rates. If the estimated emission rates are below the threshold, the proposed action is assumed to

conform and no further action is required. If they exceed the threshold, a more detailed conformity determination is required. [2]

DOE conducted a conformity review for the Proposed Action and determined that (1) the Proposed Action would result in emissions of criteria air pollutants, and (2) these emissions would occur in an area (Jefferson County, Colorado) that the EPA has designated as a moderate nonattainment area for O_3 and a maintenance area for CO and PM. Consequently, DOE conducted a further review of estimated emissions of these criteria air pollutants to determine the applicability of the general conformity rule and to determine if the estimated rate of these emissions would be less than or greater than the allowed thresholds.

The threshold emission rates for a moderate O_3 nonattainment area is 100 tons per year (TPY) of NO_X or VOC; the threshold emission rates for CO and PM in a CO or PM maintenance area are also 100 TPY (40 CFR 93.153).

Operational Emissions

Operation of the proposed ESIF facility would likely result in increased emissions of VOCs (e.g., acetone, cyclohexane, toluene, xylene, and similar volatile organics) and criteria pollutants (CO, O_3, PM, NO_X, and SO_2). At either alternative location for the ESIF, emission sources associated with the proposed operations of ESIF research equipment would include: four diesel fired gensets and one diesel-fired backup generator. Worst-case criteria air emission calculations (i.e., potential to emit) prepared for these new air emission generators are expected to be: CO: 16.81 TPY; NO_X: 65.19 TPY; PM: 2.43 TPY; and SO_2: 18.03 TPY.

These emission totals are lower than the 100-TPY potential-to-emit threshold for Major Source designation; therefore, they would be expected to be below thresholds for notification of conformity review and permitting and, as such, would not require modeling. As specific information became available regarding equipment size, fuel type, and runtime, a notification and permitting determination would be made considering activity-specific and cumulative emissions.

As discussed previously, the buildout of the STM site would result in an increased number of employees and, therefore, increased emissions from more vehicles entering and leaving the STM site. At the STM site these mobile sources individually would operate only briefly during the morning and evening commutes, and collectively, because of the planned traffic management measures, would be spread over 2.5 hours each morning and evening allowing dispersion of vehicle emissions. Emissions from commuting workers are exempted from the conformity review requirements under several provisions of 40 CFR 93.153(c)(2), however, the proposed action of adding a second access road to the STM site would reduce the idling time at the STM site, as thus the emissions, from that which would occur if the Denver West Parkway were the only entrance and egress from the site.

In the Denver area, there are about 52,736,000 miles of vehicle travel daily (DOT 2008). Vehicles traveling to and from the STM site, including commuting workers, would travel about 75,600 miles daily. This represents about a 0.14 percent increase in the regional traffic, or less than 1 percent. Due to nearby

[2] Previously, a conformity review would also entail comparing estimated emissions in a nonattainment or maintenance area to regional inventories to ensure that estimated emissions were not "regionally significant". However, in its proposed revision to the general conformity rule (73 FR 1402; January 8, 2008), EPA proposes to delete the requirement in 40 C.F.R. 93.153(i) relating to regionally significant actions in part because in more than 12 years since promulgation of the existing regulations, no action has been determined to be regionally significant.

development such as the Colorado Mills shopping center, traffic in the area has increased 3 to 4 percent in recent years and is expected to increase by about 1 percent per year in the future (FHU 2008).

Studies have found that chronic exposure to traffic-related air pollution may contribute to premature mortality (Jerrett et al. 2009). However, these studies usually examine relatively large increases in exposure to traffic-related air pollution (about 20 percent), so it is unlikely that a 0.14 percent increase in traffic would result in an increase in observable adverse health effects.

Construction Emissions

Construction associated with the Proposed Action would result in localized, short-term increases in ambient concentrations of CO, NO_X, and PM. These emissions would result from operation of construction equipment engines and from fugitive dust suspended during earth moving and grading, material handling and storage, and construction equipment and vehicles traveling over temporary dirt and gravel access roads. Given the small area of the proposed construction sites, the proximity to paved roads, and the anticipated short duration of the construction, potential impacts to the local air quality environment would be local and temporary. Construction impacts would be minimized through the use of best management practices (BMPs), such as wetting the soil surfaces, covering trucks and stored materials with tarps to reduce windborne dust, limiting freeboard on material haul vehicles, and using relatively late-model, properly maintained construction equipment.

Emissions of construction-generated fugitive dust would be permitted under NREL's CDPHE Air Permit #08JE0889L, which authorizes emissions of fugitive dust at the STM site associated with overlot grading and associated construction activities. The general conformity rule (40 CFR 93.153(d)) provides an exemption for portions of an action that require an air emissions permit because state-permitted emissions are presumed to conform to the applicable SIP. DOE has determined that because PM emissions from construction-generated fugitive dust would be permitted under CDPHE Permit # #08JE0889L, they are exempt from the need for further conformity determination.

The Proposed Action also includes construction activities that would result in emissions of CO, NO_X, and PM primarily from diesel engines. EPA has published exhaust and crankcase emission factors for steady-state emission of CO, NO_X, and PM from off-road diesel engines (EPA 2004). Table 3-6 shows these emission factors for Tier 1 engines of various power ranges. Tier 1 standards were adopted in 1994 for engines over 50 horsepower (hp) and were phased in from 1996 to 2000.

Table 3-6. Tier 1 Steady-State Emission Factors for Nonroad Diesel Engines

Engine Power (hp)	Tier 1 Technology-Type Emission Factors (g/hp-hr)		
	CO	NO_x	PM
>50-75	2.3655	5.5988	0.4730
>75-100	2.3655	5.5988	0.4730
>100-175	0.8667	5.6523	0.2799
>175-300	0.7475	5.5772	0.2521
>300-600	1.3060	6.0153	0.2008

Note: hp = horsepower; g/hp-hr = grams per horsepower-hour.
Source: EPA 2004.

The exact types and numbers of engines that would be used for the Proposed Action and their total hours of operation are not yet known. However, based on a review of recent, similar construction projects at the STM site and at other DOE sites, DOE developed a list of the types and sizes (horsepower ranges) of equipment (Table 3-7). This equipment is believed to be representative of the equipment that would be used for the Proposed Action. Table 3-7 also shows DOE's estimate of the hours that each type of equipment would operate during the Proposed Action. The emission factors shown in Table 3-6 were applied to develop the estimates of the annual emissions of NO_X, CO, and PM shown in Table 3-7.

The estimated annual emissions of each of these criteria air pollutants are well below the 100-TPY thresholds. Moreover, DOE believes these estimates are conservative for the following reasons: (1) the calculations assume the highest engine horsepower shown in a given engine size range, (2) the calculations assume Tier 1 technology, and at least some of the equipment used would probably employ more stringent (lower-emitting) Tier 2 through 3 technology, and (3) the estimates of operating hours are conservatively high.

Because the estimated emissions of CO, NO_X, and PM from construction activities would be below the de minimis thresholds, DOE has determined that further conformity determination is not required. DOE acknowledges that there would likely be additional miscellaneous sources of CO, NO_X, and PM directly or indirectly attributable to the Proposed Action (for example, commuting construction workers and the use of equipment types not specifically identified in Table 3-7). While recognizing and acknowledging these potential additional incremental sources, DOE believes they would not result in the Proposed Action exceeding allowed threshold levels because they would be either short-term (commuting workers) or limited in their potential to emit.

3.1.9 Geology and Soils

3.1.9.1 Existing Environment

The detailed descriptions of the site geology and soils found in the SWEA remain current and are summarized below.

The STM is located on the gently sloping terrain of the Foothills Province of the Rocky Mountain Front Range between the Southern Rocky Mountain Province to the west and Great Plains Province to the east. Denver clay loam and Denver cobbly clay loam dominate the soils at STM site where the proposed new facilities would be constructed. The STM site is classified as being in Seismic Zone 1, an area of low seismic risk. Structures to be built on the STM site would meet the most current Uniform Building Code standards appropriate for its designated seismic zone.

3.1.9.2 Impacts of the Proposed Action

Potential geological impacts would closely resemble the geological impacts presented in the SWEA, which specifically considered construction of the S&TF and other comparable site developments. Prior to construction, the new construction areas would be excavated and graded as needed. Materials such as concrete aggregate and crushed rock would be required during construction. These materials would be obtained from off-site commercial sources or may involve use of material from on-site excavations. Excavation may occur below the alluvial surface. Excavation could conceivably go below the alluvium if reaching bedrock for stability were necessary. It is unlikely that any construction associated with the Proposed Action would increase landslide potential anywhere on the STM site because there is no evidence of recent landslides on the south side of STM, and no on-site or off-site construction in the immediate vicinity of the STM site has caused slope instability.

Table 3-7. Estimated CO, NO_X, and PM Emissions from Diesel Construction Equipment

Major Construction Source	No. of Units	Engine Size Range (hp)	Total Operating Hours/Yr	Estimated Annual Emissions (TPY)		
				CO	NO_x	PM
Portable Lighting Units	3	50-100	254	0.07	0.16	0.01
Portable Generator	1	50-100	170	0.04	0.10	0.01
Backhoe/Loader	3	50-100	1,661	0.43	1.03	0.09
Forklift	3	50-100	2,563	0.67	1.58	0.13
Asphalt Paver	1	100-175	213	0.04	0.23	0.012
Asphalt Roller	1	100-175	213	0.04	0.23	0.012
Vibratory Compactor	2	100-175	427	0.07	0.47	0.02
Concrete Pumper	3	100-175	256	0.04	0.28	0.01
Water Tanker	1	100-175	384	0.06	0.42	0.02
Excavator	2	100-175	768	0.13	0.84	0.04
Bulldozer	2	100-176	768	0.19	1.42	0.06
Motor Grader	2	175-300	768	0.19	1.42	0.06
Wheel Loader	3	175-300	1,152	0.28	2.12	0.10
Crane – 35-ton	2	175-300	555	0.14	1.02	0.05
Concrete Truck	2	175-300	339	0.08	0.63	0.02
Scraper	2	300-600	768	0.66	3.06	0.10
Dump Truck	4	300-600	1,537	1.32	6.11	0.20
Crane – 50-ton	2	300-600	171	0.15	0.68	0.02
		Total Estimated Emissions (TPY)		**4.60**	**21.79**	**0.99**
		De Minimis Threshold (TPY)		**100**	**100**	**100**

Note: hp = horsepower
TPY = tons per year
yr = year

3.1.10 Waste Management

3.1.10.1 Existing Environment

The descriptions of the existing waste management environment found in the SWEA remain generally current and are summarized or updated below.

The STM generates a variety of hazardous and nonhazardous wastes from laboratory and mission support activities (Table 3-8). All waste-handling and disposal activities comply with the requirements and regulations of the Occupational Safety and Health Act (OSHA), the Resource Conservation and Recovery Act, DOE, and the CDPHE. All hazardous wastes are packaged and disposed of through contracted off-site commercial treatment, disposal, and recycling firms. Many of the hazardous wastes generated on-site are recycled in accordance with CDPHE regulations, including such items as batteries, fluorescent bulbs, and computer monitors. As a BMP, many of the nonhazardous waste materials (nonregulated waste) generated at the sites are treated in the same manner as the hazardous wastes. These materials, although not classified as hazardous, are also recycled or disposed of at off-site commercial treatment, storage, disposal, and recycling facilities.

Table 3-8. Hazardous Waste Generation, 2003-2009

	Amount Generated (gross weight in pounds)						
	CY03	**CY04**	**CY05**	**CY06**	**CY07**	**CY08**	**CY09**
STM Site	18,627	18,124	41,948	17,187	22,280	15,700	15,008

Note: To convert pounds to kilograms, multiply by 0.45.

The WHF serves as a central consolidation point for hazardous, non-hazardous, radioactive and universal waste items that are generated throughout the STM site. The building is secured with controlled, limited access and is engineered to segregate individual waste items in order to prevent the comingling of incompatible materials. Additionally, the building houses its own ventilation and fire suppression systems inspected annually by West Metro Fire Department in conjunction with their issuance of site-specific hazardous materials storage permits. NREL security staff routinely and randomly patrols all facilities on the site to monitor for abnormal and off-normal conditions. The site maintenance program requires mowing of areas adjacent to buildings and equipment to provide a fire break zone in the event of a wildfire.

Recent volumes of hazardous wastes that have been handled at the WHF (by calendar year) are summarized below. During the period January 2009 through August 2009, eight waste shipments have occurred at the STM facility.

Historically, NREL has been a small-quantity waste generator, which means that the facility has generated more than 100 kilograms (220.5 pounds) but less than 1,000 kilograms (2,205 pounds) of hazardous waste per month. However NREL anticipates that it will become a large-quantity generator as early as 2010. Large-quantity generators generate more than 1,000 kilograms (2,205 pounds) of hazardous waste, or more than 1 kilogram (2.2 pounds) of acutely hazardous waste, per month.

The STM site does not maintain an on-site waste disposal facility. Waste is shipped to licensed off-site disposal facilities.

3.1.10.2 Impacts of the Proposed Action

ESIF Construction, Visitors Center and WHF Expansions, and Site Infrastructure Improvements including a Second Access Road

Construction would be short-term (less than 24 months) and would not substantially increase the amounts or types of waste generated or temporarily stored at the site. In the case of a spill or release of chemicals or hydrocarbons during construction activities, existing BMPs and procedures associated with spill response and materials handling would minimize impacts to surface water and soils. These procedures are defined in the NREL *Spill Prevention Control and Countermeasures (SPCC) Plan* for the STM (Procedure 6.2-10) and the NREL *Stormwater Pollution Prevention for Construction Activities: STM* (Procedure 6-2.15) (NREL 2006). Any construction debris that could not be recycled would temporarily increase the weight and volume of nonregulated waste generated at the site.

In support of DOE's goal to demonstrate energy-efficient buildings with a lower impact on the environment, the facility would be designed to merit at least a LEED "Gold" rating from the U.S. Green Building Council, which would be the highest-certified facility of its type. At least 10 percent of the total value of materials used in construction projects is to contain recycled content. At least 10 percent of the total value of the materials and products used in the project is required to be manufactured regionally within an 800-kilometer (500-mile) radius of NREL. At least 50 percent of construction debris is to be recycled.

ESIF operations could generate small quantities of hazardous waste and nonregulated waste, which would be disposed of off-site at existing commercial facilities. Even though waste volumes would grow, neither construction nor operational wastes from the Proposed Action would result in any new impacts to off-site waste treatment, storage, or disposal facilities that currently handle NREL wastes.

3.1.11 Noise

3.1.11.1 Existing Environment

Detailed descriptions of the existing noise environments at the STM are provided in the SWEA. These descriptions address sensitive noise receptors (Section 3.4.1), existing noise levels (Section 3.4.2) and noise regulations and guidelines (Section 3.4.3). They remain current and are summarized below.

Noise receptors located in the immediate vicinity of the STM site include STM personnel; inhabitants of residences east, west, and south of the site boundary; and wildlife. With respect to NREL personnel, DOE has accepted the OSHA noise regulations and guidelines for worker exposure and manages compliance with them. These regulations and guidelines focus on noise from machinery, equipment, and tools. DOE maintains compliance with all regulations related to worker health and safety.

Receptors in the vicinity of the site include inhabitants of multi-family residences located approximately 15 meters (50 feet) east of the site boundary. Two subdivisions consisting of single-family residences are located south and west of the STM site. The nearest residence to the site's southwestern boundary is located approximately 15 meters (50 feet) away. The nearest residence to the site's southeastern boundary is located approximately 30 meters (100 feet) away. The nearest school, church, or day-care center is about one-half mile from the site, near 20th and Denver West Parkway. The partially completed regional park, Pleasant View Community Park, is being established in the open area south of Zone 6.

Within the corridor alternatives for the proposed second access road, noise receptors vary in number and proximity to any potential route. All receptors are currently affected by the ambient traffic noise generated by South Golden Road and I-70.

Although noise measurements were not taken for the SWEA and noise modeling was not performed, site observations indicate that the acoustic environment within the boundaries of the southeastern portion of the site can be considered similar to that of an urban location. I-70 is a significant noise source throughout the day and during sensitive late-night and early-morning periods. It is estimated that 24-hour day-night average sound levels on the site typically range from 40 to 60 A-weighted decibels (dBA). Most activity and mechanical operations at the STM site are conducted within buildings.

3.1.11.2 Impacts of the Proposed Action

The State of Colorado Noise Statute (Code of Colorado Regulations [CCR] 25-12-101 through CCR 25-12-109) has established state-wide standards for noise level limits for various time periods and areas. These standards can be used as guidelines for evaluating impacts. The most stringent permissible noise levels apply to residential zones, where the maximum permissible daytime (7 AM. to 7 PM) noise level is 55 dBA measured at a distance of 8 meters (25 feet) from the property line. In addition, construction projects are limited to permit conditions or 80 dBA for the period within which the construction is to be completed or a reasonable amount of time.

Facility Construction

Construction would normally occur Monday through Friday during daylight hours. An exception would be in cases where construction activity required interruption of site utility services; in that case, weekend work may occur. There would be a short-term (approximately 24 months) increase in ambient noise due to construction of the project facilities. Heavy equipment such as bulldozers, graders, backhoes, excavators, dump trucks, and cement trucks would generate noise that would impact on-site workers and nearby residents, especially residents living immediately east and west of the project site. Construction equipment typically emits noise in the 86- to 94-dB range. Construction workers would use hearing protection and would follow OSHA standards and procedures. Direct exposure of NREL staff to construction noise would be generally limited to times when personnel were outdoors walking to or from parked vehicles or between buildings.

Construction activities near the east or west boundary of the project site would occur close to residences, and noise could be a nuisance for some residents during construction. Construction-related noise impacts would vary with the phase of construction and would occur intermittently.

Second Access Road Construction

Roadway construction along any of the proposed corridors would take 2 to 3 months and would utilize heavy equipment similar to that needed for building construction on the STM site.

Corridor A

Construction noise would affect ambient noise levels of as many as 15 adjacent residences (sensitive receptors) adjacent to Corridor A. Noise emissions are expected to occur over a 2- to 3-month period. Noise generated by roadway construction equipment, including material handlers, pavement machines, and equipment to construct curb and gutter portions of the roadway, can reach levels exceeding 65 dBA (EPA 1971). Typical operating cycles may involve 2 minutes of full power, followed by 3 or 4 minutes at

lower settings. Although noise ranges were found to be similar for all construction phases, in general, noise levels would vary from 79 dBA to 88 dBA at 15 meters (50 feet) during construction. Based on these estimates, and assuming noise from construction activities would attenuate rapidly from source to receptor, construction noise would not be considered adverse. Moreover, these noise emissions would be experienced for a relatively short duration and would comply with all applicable noise ordinances.

Corridor B

Construction noise associated with Corridor B would affect ambient noise levels for as many as six residences to the west of the site along Moss Street and for a number of nearby receptors in proximity to this corridor. Similar to the discussion for Corridor A, noises from source to receptor are expected to attenuate rapidly.

Corridor C

Construction noise associated with Corridor C would affect ambient noise levels for two residences in proximity to this corridor. Similar to the discussions above for Corridors A and B, noises from source to receptor are expected to attenuate rapidly.

Corridor D

Construction noise associated with Corridor D would affect sensitive receptors residing or working within the State of Colorado property. Depending upon the need to modify Kilmer Street, the inmates of the nearby correctional institution and workers in the CDOT and State Highway Patrol buildings would be affected by construction noise.

Corridor E

Construction noise associated with Corridor E would be audible from nine residences to the west of the corridor along Isabell Street.

Facility Operations

The proposed ESIF would be an office building and a research and development facility, not a manufacturing facility. Noise sources associated with the ESIF would include the intermittent operation of four to seven hydrogen or diesel-fired gensets and a backup generator.

Final selection of specific gensets and a generator has not been made; however, based on available manufacturer information, noise levels associated with this equipment are expected to be approximately 80 dBA at a distance of 6 meters (20 feet).

Levels of ambient or intrusive outdoor noise vary extensively at distances greater than about 90 meters (300 feet) from the source. This variation is caused by changes in weather and by topographical features, structures, and other obstacles between the noise source and the sensitive noise receptor. To assess potential off-site noise levels associated with the proposed equipment, it was assumed that a sound level drops 6 dBA for every doubling of the distance from the source (AEUB 2007).

The off-site noise receptors nearest to the proposed ESIF would be homes just south of the Visitors Center. As shown on Figures 3-12 and 3-13, these off-site receptor areas are approximately 150 meters (500 feet) from the proposed ESIF location 1 (Figure 3-12) and 300 meters (1,000 feet) from location 2 (Figure 3-13). There are structures located between the noise source (the ESIF) and the receptors (the homes), which makes it difficult to quantify the noise impact from the proposed ESIF at these locations. However, applying the assumption that the loudest source of noise at the ESIF could generate 80 dBA at a distance of 6 meters (20 feet), the noise level at the nearest off-site receptors would be approximately 68 dBA for location 1 and 62 dBA for location 2. For comparison, 45 dBA is approximately the ambient noise level in quiet agricultural areas, while 62 dBA and 68 dBA are similar to urban residential areas affected by roadways (EPA 1978). The noise from the ESIF, which would be intermittent, would likely not be noticeable over ambient residential neighborhood, street, and highway noise. Operational noise from the Visitors Center upgrades would be very similar to operational noise from the center's current operations. Because proposed operations would be inside, there would be only a minor increment to the existing ambient noise in the project area. With the exception of the new parking lots, operation of the proposed site infrastructure improvements (power, water, and telecommunications devices, etc.) would result in little, if any, additional ambient on-site noise. Operation of the parking lots would result in elevated ambient noise twice each working day during rush hour. Implementation and enforcement of on-site speed limits would mitigate a portion of the rush-hour traffic noise.

Typical A-Weighted Range of Common Sounds

Common Sounds	***dBA***
Chain Saw	102-114
Diesel Locomotive at 50 ft	87-102
Snowmobile including wind effects	86-109
Motorcycle	80-110
Power Lawnmower	80-95
Heavy Truck at 50 ft	77-89
Food Disposer	67-93
Home Shop Tools	65-110
Food Blender	63-87
Automobile at 50 ft	60-90
Vacuum Cleaner	60-85
Air Conditioner (window units)	60-72
Clothes Dryer	50-72
Washing Machine	47-78
Refrigerator	46-68

Source: EPA 1978

Second Access Road Operations

The expected peak-hour traffic associated with operation of any of the second access road corridors would be approximately 300 additional vehicles per hour during the morning and evening rush hours.

Corridor A

Traffic within Corridor A would have potential noise effects on the residences along Quaker Street as a result of noise emanating from employee and visitor vehicles and delivery trucks entering and exiting the project area. Potential average noise level increases would likely be limited to moderate changes in the ambient noise environment due to the morning and evening rush hours as well as the distance between the new roadway (centerline) and potential sensitive receptors. The traffic mitigation plan, which features a flextime provision that would expand the duration of the morning and evening rush hours to about 2.5 hours, would further reduce potential traffic noise generated as a result of the Proposed Action.

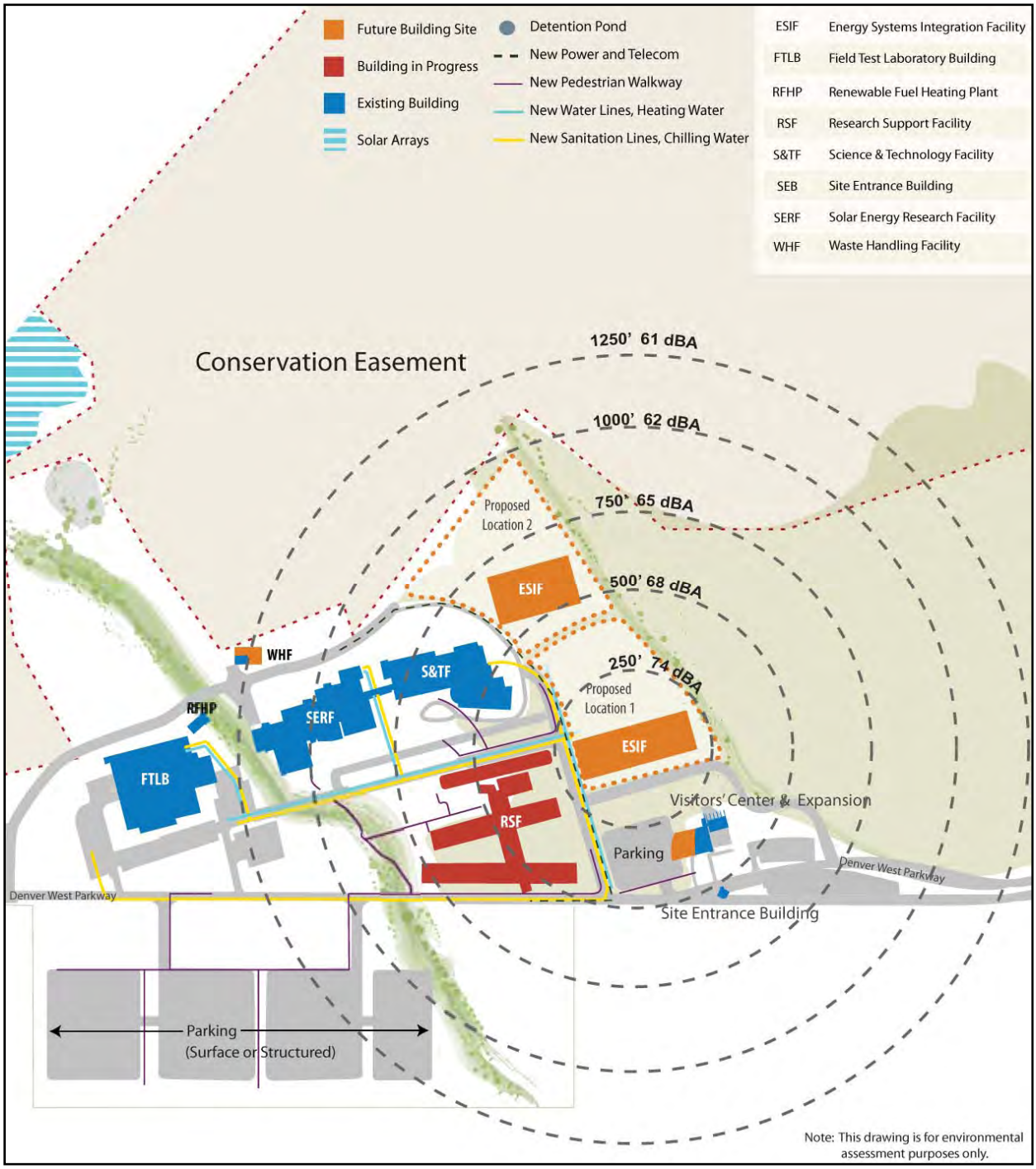

Figure 3-12. Expected Noise Levels from ESIF Operations – Proposed Location 1

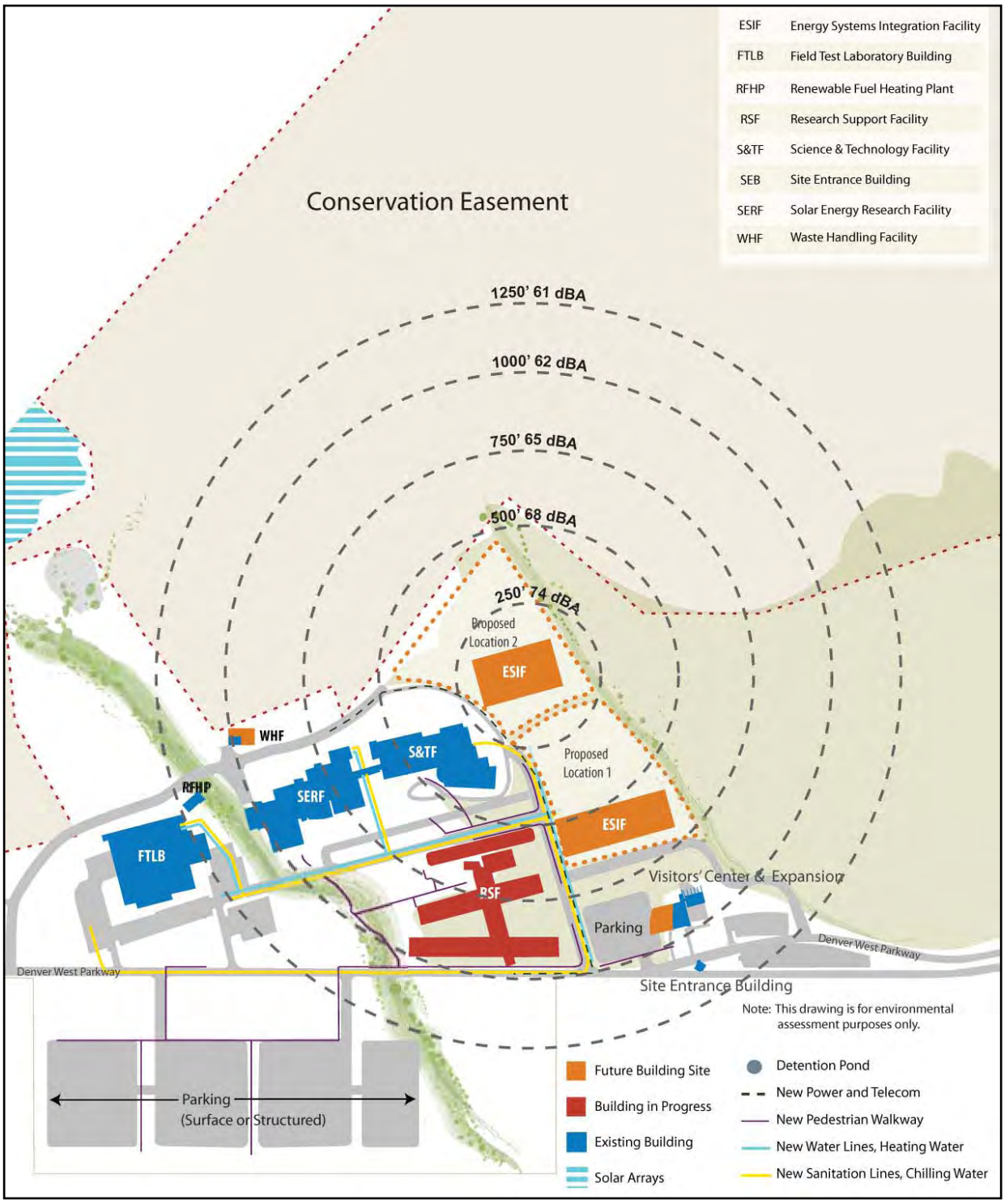

Figure 3-13. Expected Noise Levels from ESIF Operations – Proposed Location 2

Corridor B/C

Residents located to the west of the STM site could experience an increase in average noise levels as a result of noise emanating from employee and visitor vehicles and delivery trucks entering and exiting the project area. Potential average noise level increases would likely be limited to small changes in the ambient noise environment since the majority of the traffic noise would be limited to normal morning and evening work hours (6:30 to 8:30 AM and 4:30 to 6:30 PM). Moreover, based on the distance between the proposed roadway (centerline) and potential sensitive receptors adjacent to Corridors B and C, the average noise equivalency levels are not expected to increase to levels where adverse noise levels would be experienced. Moreover, NREL's traffic mitigation plan includes a flextime provision that would expand the duration of the morning and evening rush hours to about 2.5 hours, thereby further reducing the amount of traffic noise potentially generated as a result of the Proposed Action.

Corridor B/D

Residents located on to the west and south of the STM site and receptors adjacent to Isabell Street (Corridor D) could experience an increase in average noise levels as a result of noise emanating from employee and visitor vehicles and delivery trucks entering and exiting the project area. Inmates at the state correctional facility and CDOT and State Highway Patrol workers along Kilmer Street could be affected. Potential average noise level increases would likely be limited to small changes in the ambient noise environment due to the morning and evening rush hours as well as the distance between the proposed roadway (centerline) and potential sensitive receptors. The traffic mitigation plan, which features a flextime provision that would expand the duration of the morning and evening rush hours to about 2.5 hours, would further reduce potential traffic noise generated as a result of the Proposed Action.

Corridor E

Residents located on Isabell Street adjacent to Corridor E could experience an increase in average noise levels as a result of noise emanating from employee and visitor vehicles and delivery trucks entering and exiting the project area. Potential average noise level increases would likely be limited to moderate changes in the ambient noise environment due to the morning and evening rush hours as well as the distance between the proposed roadway (centerline) and potential sensitive receptors. The traffic mitigation plan, which features a flextime provision that would expand the duration of the morning and evening rush hours to about 2.5 hours, would further reduce potential traffic noise generated as a result of the Proposed Action.

3.1.12 Public Services and Utilities

3.1.12.1 Existing Environment

The discussion of the existing public services and utilities environment (electricity and gas, telecommunications, water, sewage service, emergency response and fire protection) provided in the SWEA remains current.

3.1.12.2 Impacts of the Proposed Action

In the SWEA, DOE found that planned and contemplated expansions would not significantly affect the local and regional public service and utility infrastructure. In summary, the SWEA found the following:

- The increased demand for electricity and gas by the proposed facilities at the STM site is not expected to be substantial with respect to Xcel Energy's overall capacity or local infrastructure. The new demand would not contribute substantially to peak-period power demand and associated power generation capacities.
- The Proposed Action would improve and extend the on-site telecommunications infrastructure to support new research and development activities, facilities, and an increasing number of employees on the site. No off-site infrastructure requirements would be needed, and the capacity of local service would not be adversely affected by the proposed improvements.
- The Proposed Action would incrementally increase the demand for domestic water and would require modifications and upgrades to the on-site domestic water infrastructure. The capacity of on-site infrastructure would be adequate with contemplated improvements. The current water system would accommodate additional buildings and associated office areas and restroom facilities with the addition of an underground pipe that would be installed from new buildings to the nearest domestic water loop. The long-term water system infrastructure and supplies are considered adequate to serve the site for the foreseeable future.
- The Proposed Action would increase demand on existing sewer infrastructure and treatment facilities associated with the Pleasant View Water and Sanitation District. The existing on-site system is considered adequate for current and anticipated future sewage needs. The capacity of the Metro Wastewater Reclamation District's downstream treatment plant in Denver is adequate to accommodate regional sewage needs for the foreseeable future.
- The proposed facilities and additional staff associated with the Proposed Action would incrementally increase demand for police, fire, and ambulance services, but the increases would be considered minor given site use, on-site security, and anticipated needs for emergency service providers. Moreover, NREL must contract for fire and ambulance services at the STM site and would pay for any increased LOS that is needed.

The impact of the Proposed Action that is the subject of this SWEA/S-II on the local and regional public service and utility infrastructure is bounded by the impacts discussed in the SWEA (DOE 2003).

3.1.13 Environmental Justice

3.1.13.1 Existing Environment

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (59 FR 7629), directs federal agencies to identify and address, as appropriate, any activities that may affect minority and low-income populations. Minorities have been defined as individuals who are members of the following population groups: American Indian or Alaska Native; Asian or Pacific Islander; Black, not of Hispanic origin; or Hispanic. A minority population has been identified where the minority population of the affected area exceeds 50 percent of the population. Low-income populations are groups with an annual income below the poverty threshold.

In SWEA/S-I (DOE 2008), DOE provided a detailed characterization of low-income and minority populations in the area surrounding the STM site; those analyses are incorporated by reference. Based on the detail analyses, it was determined that there are no census block groups of low-income households adjacent to or within a few miles of the STM site, and that the nearest census block with a minority population of more than 50 percent occurs about 400 meters (1,300 feet, or about one-quarter mile) south of the STM site. There are no census blocks with minority populations of more than 50 percent adjacent to the STM site.

3.1.13.2 Impacts of the Proposed Action

The proposed projects would not disproportionately affect members of a low-income or minority population because no low-income households are adjacent to or within a few miles of the STM site, and no minority populations of more than 50 percent are adjacent to the STM site. Additionally, the nearest minority population of more than 50 percent which occurs about 400 meters (1,300 feet, or about one-quarter mile) south of the STM site, would not be affected by development within any of the second access road alternatives.

3.1.14 Intentional Destructive Acts

The DOE Office of General Counsel has issued interim guidance stipulating that each DOE environmental impact statement (EIS) and EA should explicitly consider intentional destructive acts (i.e., acts of sabotage or terrorism). DOE applied a sliding scale in considering the potential impacts of intentional destructive acts within the context of the Proposed Action.

None of the proposed projects that are the subject of this SWEA/S-II would involve the transportation, storage, or use of large quantities of radioactive, reactive, or explosive materials. Consequently, it is highly unlikely that any element of the Proposed Action would be viewed as a potential target by saboteurs or terrorists. The Proposed Action would not offer any credible targets of opportunity for terrorists or saboteurs to inflict significant adverse impacts to human life, health, or safety, nor would the Proposed Action render the STM site as a whole any more susceptible to such acts. However, the consequences of an operational accident as defined in Section 3.1.3 could occur if initiated by an act of terrorism or sabotage.

3.1.15 Energy Efficiency and Sustainability

Sections 3.12 and 4.12 of the SWEA addressed energy efficiency, renewable energy, and sustainability at NREL. That EA emphasized that NREL takes energy conservation seriously and has implemented a comprehensive energy program as part of the “Sustainable NREL” initiative. NREL has a standing goal to reduce conventional energy use and views itself as a “model for the nation” in terms of sustainable technologies and designs. The proposed action addressed in the SWEA had a complex impact on energy efficiency and sustainability because it would increase on-site energy demand, would generate small amounts of electricity for use on-site, and was expected to contribute substantially to nationwide and possibly global use of energy efficiency and renewable energy technology. However, overall, the proposed action addressed in the SWEA had a beneficial impact on energy efficiency and renewable energy. These conclusions bound the impact of the Proposed Action that is the subject of this SWEA/S-II.

The construction and operation of the proposed ESIF, the installation of Phase 2 of planned site infrastructure improvements, and the proposed expansions of the Visitors Center and the WHF would increase on-site energy demand. However, the expanded research capacity realized from these actions would contribute directly or indirectly to national (and possibly global) energy efficiency and renewable energy technology development. The ESIF would incorporate energy efficiency, environmental performance, and advanced controls using a “whole building” integrated design approach and would be required to comply with Energy Star standards. In support of DOE’s goal to demonstrate energy-efficient buildings with a lower impact on the environment, the proposed ESIF and the Visitors Center expansion would be designed to merit at least a LEED “Gold” rating from the U.S. Green Building Council.

3.2 Environmental Consequences of the No Action Alternative

The No Action Alternative assumes that operations of the existing facilities at the STM site would continue, but that the five site development activities that make up the Proposed Action described in this SWEA/S-II would not occur. As such, the No Action Alternative is not tantamount to stating that no change or growth would occur at the site. Regardless of whether or not the Proposed Action is implemented, in the foreseeable future NREL would experience normal minor fluctuations, including growth, in staff levels, resource use, and environmental impacts due to currently authorized and planned programmatic growth and research activities that are not associated with the Proposed Action, but which would not cross the significance threshold under NEPA that would require separate evaluation under an EA or EIS. No major or significant proposed actions, as defined by CEQ (40 CFR 1508.27), would be taken under the No Action Alternative.

The environmental consequences of the No Action Alternative would be very similar, and in some instances identical, to the environmental consequences of the no action alternative presented in the SWEA. These are summarized or updated below.

Under the No Action Alternative, the proposed ESIF, Visitors Center and WHF expansions, second access road, and associated site improvements would not be undertaken. The impacts under the No Action Alternative would be as follows:

- Existing on-site land uses, site development density, and operations would continue to experience normal growth but would not be impacted or accelerated by the proposed ESIF, Visitors Center and WHF expansions, second access road, or associated site improvements. Fewer local beneficial economic impacts would result because construction would not occur, and related job growth and NREL development would be more limited.
- The incremental impacts to traffic and parking from site construction and from development of a new second access road would be avoided. Changes to on-site and off-site traffic patterns due to adding a second access road and staffing the proposed ESIF, expanded WHF, and expanded Visitors Center would be avoided.
- Emissions of criteria air pollutants and toxic air pollutants from the ESIF would not occur. In the short term, air emissions from site operations would remain at approximately current levels; in the longer term, increases in emissions would occur due to normal site growth and development.
- Noise associated with the construction and operation of the proposed ESIF, WHF and Visitors Center expansions, second access road, and associated improvements would not occur because these projects would not be developed. Current levels of ambient noise levels at the site would remain the same. Off-site noise levels in the area would continue to be dominated by vehicle traffic on I-70.
- There would be no increased runoff or impacts to surface water, stormwater, or groundwater resources from the paving over of land for the proposed new parking lots, roads, ESIF, and WHF and Visitors Center expansions.
- The loss of grassland habitat due to paving and building construction would not occur.
- In the short term, the quantities and types of hazardous materials and hazardous wastes generated at the site would remain at approximately current levels; in the longer term, increases in waste generation would occur due to normal site growth and development.

- Any incremental capacity impacts on existing service providers resulting from the Proposed Action and the impacts of associated infrastructure improvements would be avoided.
- In the short term, the site's energy consumption would remain at approximately current levels; in the longer term, increases in energy consumption would occur due to normal growth and development.

4.0 CUMULATIVE AND SECONDARY IMPACTS

Cumulative impacts result from the incremental impact of a proposed action when added to other past, present, and reasonably foreseeable future actions. Secondary impacts are those that are caused by a proposed action, but that may occur later in time or farther removed in distance, relative to the primary impacts of the proposed action (40 CFR Section 1508.7).

The 2003 SWEA considered cumulative and secondary impacts of various pending and conceptual site development projects and concluded that the incremental contribution to these cumulative and secondary impact areas would be insignificant. It also concluded that the No Action Alternative would not contribute to these impacts. The most important examples of cumulative and secondary impacts associated with the SWEA Proposed Action were as follows:

- traffic congestion at the intersections along Denver West Marriott Boulevard,
- regional and local air pollutant emissions,
- noise impacts on Pleasant View neighborhoods,
- development intensification,
- increases in Lena Gulch stormwater flows,
- habitat losses from development of natural areas,
- demand for energy, and
- beneficial impacts from improved alternative energy sources.

The Proposed Action that is the subject of this SWEA/S-II was not sufficiently far along in its conceptualization to be explicitly discussed in the SWEA. However, the preceding list of cumulative and secondary impacts bounds those associated with this Proposed Action. In general, the impacts discussed below are considered cumulative and secondary impacts in light of DOE and NREL's planned future buildout at the STM site and the ongoing private development in the area. Figure 4-1 illustrates one conceptual site plan upon full buildout; however, the figure does not illustrate mesa-top facilities or those at the far western end of the site.

Traffic Congestion

As indicated in Figure 4-1, subject to Congressional appropriation, DOE and NREL have long-term plans for additional buildings and staffing increases at the STM site. A detailed evaluation of traffic conditions in the area was included in SWEA/S-I and is incorporated by reference into this SWEA/S-II.

At this time, only the near-term staffing levels assessed in detail in this SWEA/S-II are realistic, as they are supported by Congressional funding actions. For the foreseeable future, the addition of a new second access road would adequately meet staffing levels on the STM site and prevent degradation of traffic conditions at local intersections to unacceptable levels.

Future projections are highly speculative; therefore, DOE and NREL propose no specific mitigation actions at this time for future speculative cumulative impacts. However, as future site buildout plans develop over the coming years, DOE and NREL would work with regional traffic authorities and determine the suite of mitigations that will best fit foreseeable staff increases so that traffic impacts from DOE's and NREL's actions can be adequately mitigated. Any future proposals would undergo a supplemental NEPA process listing mitigation measures if any.

Figure 4-1. Conceptual Schematic of Site after Full Buildout

Visual Impacts

Implementation of the Proposed Action would slightly modify the overall visual impression of the STM site by adding facilities on undeveloped land. Off-site commercial development continues to occur adjacent to the STM site, further altering the visual landscape from open space to offices and residential buildings. Also, DOE anticipates further development (office or laboratories) in the northern half of Zone 6 between the proposed new parking lots and Denver West Parkway. This ongoing and planned DOE and commercial development, when added to the visual impacts described in Chapter 3, would constitute cumulative visual impacts, especially if construction occurred on Building Pad 1 in Zone 6.

Increase in Lena Gulch Stormwater

Stormwater flooding in Lena Gulch is the result of an off-site channel constriction in Camp George West Park. The Proposed Action would increase the impervious surface area on the STM site by up to 7 hectares (17 acres). Moreover, the planned further development of the STM site would further increase the impervious surface area. Similarly, projected and ongoing off-site commercial development would further increase the impervious surface area and increase stormwater runoff flows into Lena Gulch. Collectively, the Proposed Action and future developments constitute a cumulative water quality and stormwater management impact. However, the new stormwater detention basins that are part of the Proposed Action would substantially mitigate the cumulative impacts of increases in Lena Gulch stormwater flows.

Demand for Energy

Implementation of the Proposed Action would increase the STM site's overall electric power use and the demand on regional power supplies, and would challenge the adequacy of the local power distribution infrastructure. The Proposed Action itself would not require upgrades to the existing power infrastructure. However, the Proposed Action, in combination with other planned future site developments and the projected continuing local development, would eventually require Xcel Energy, the regional power utility, to upgrade the local electrical infrastructure as noted in the following excerpt from an email received from Xcel Energy in May 2007.

> *The circuit this customer (NREL) is currently on has 16.3 megawatts of load and a normal rating of 18.7 megawatts. It will be good for the 2009 projected increase. After that we will need to do something. This would likely be switching some of this circuit's other load on to another circuit for 2010. Ultimately with this customer's added load and the projected added load from others in the area, a new circuit will be needed in the area. We already have additional substation capacity in the area to do this from. We have added this projected load increase into our forecasts and will continue to monitor the area's load requirements. At this point I (Xcel) do not foresee any additional costs to the customer for Xcel to serve this added load.*

Habitat Loss

The Proposed Action would not have direct impacts on protected species or habitats. However, it would result in the loss of 6 to 8 hectares (15 to 20 acres) of wildlife habitat and could impact migratory bird species. The Proposed Action, combined with DOE's long-term buildout vision for the STM site, ultimately would entail complete or near-complete elimination of existing wildlife habitat in Zone 6 and most, if not all, of Zone 4. However, the cumulative impact of habitat loss due to on-site development would be mitigated by the preservation of 72 hectares (177 acres) of undisturbed on-site habitat in the conservation easement and by the fact that of the total area of the STM site (132 hectares [327 acres]), full

buildout of the site (the construction of buildings, parking, experimental pads, and roads) would impact approximately 19 hectares (48 acres), leaving 85 percent of the original site area available for wildlife.

5.0 COMMITMENT OF RESOURCES AND SHORT-TERM USES

The discussions in Sections 5.1 and 5.2 were presented in the SWEA and are directly applicable to the Proposed Action that is the subject of this SWEA/S-II.

5.1 Irreversible/Irretrievable Commitment of Resources

An irreversible commitment of resources is defined as the loss of future options. The term applies primarily to the effects of using nonrenewable resources such as minerals or cultural resources, or to those factors such as soil productivity that are renewable only over long periods. It could also apply to the loss of an experience as an indirect effect of a "permanent" change in the nature or character of the land. An irretrievable commitment of resources is defined as the loss of production, harvest, or use of natural resources. The amount of production forgone is irretrievable, but the action is not irreversible. If the use changes, it is possible to resume production.

The Proposed Action would have no irreversible impacts on the STM site because future options for using the site would remain open. A future decommissioning process could restore the site for alternative uses, ranging from natural open space to urban development. No loss of future options would occur.

The primary irretrievable impacts of the Proposed Action would involve the use of energy, labor, materials, and funds, and the conversion of some lands from a natural condition through the construction of buildings and infrastructure. The direct losses of biological productivity and the use of natural resources from these impacts would be inconsequential.

5.2 The Relationship between Local Short-Term Uses of the Human Environment and the Maintenance and Enhancement of Long-Term Productivity

This section addresses the commitment of resources associated with the Proposed Action relative to the loss of long-term productivity associated with these commitments.

The Proposed Action would commit resources in the form of energy, labor, materials, funds, and land over 20 years or more. The justification for these commitments is described in Section 1.3, Purpose and Need. Long-term productivity associated with the site relates to biological value as habitat and open-space values associated with aesthetic quality and recreation. The Proposed Action would be implemented at a site where substantial portions of the land are specifically reserved and preserved for these purposes. For these reasons, the incremental loss of biological and open-space values is balanced by the protections afforded to the long-term productivity of the site. Improved efficiency and increased use of renewable energy sources could substantially reduce the use of and reliance on imported fossil fuels.

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6.0 REFERENCES

Anderson & Company, 1999a. *Ecological Assessment at Camp George West park site*. Prepared by Anderson & Company, Longmont, CO, for Pleasantview Metropolitan District and The Norris Dullea Company. July. 10 pp+ tables.

Anderson & Company, 1999b. *Spiranthes diluvialis Survey, Camp George West park site*. Prepared by Anderson & Company, Longmont, CO, for Pleasantview Metropolitan District and The Norris Dullea Company. October. 10 pp+ photos and appendix.

AEUB (Alberta Energy and Utilities Board), 2007. *Noise Control*. Directive 038, pg 41. February. Available at http://www.eub.gov.ab.ca/bbs/documents/directives/Directive038.pdf.

Bailey, R.G., 1995. *Description of the ecoregions of the United States* (2nd ed.). 1995. Misc. Pub. No. 1391, Map scale 1:7,500,000. U.S. Department of Agriculture (USDA), Forest Service.

Baseline (Baseline Engineering), 2009. *National Renewable Energy Laboratory South Table Mountain Facility Traffic Impact Study Revision.* Golden, CO. September.

Boyle Engineering, 1994. *Major Drainageway Planning-Upper Lena Gulch-Phase B Report.* Prepared for the Urban Drainage and Flood Control District. March. Available at http://www.udfcd.org/downloads/down_pub_mdp.htm.

CDOW (Colorado Division of Wildlife), 2008. *Recommended Buffer Zones and Seasonal Restrictions for Colorado Raptors.* Colorado Division of Wildlife internal report.

DOE (U.S. Department of Energy), 2008. *Final Supplement to Final Site-wide Environmental Assessment of the National Renewable Energy Laboratory's South Table Mountain Complex, Proposed Construction and Operation of: Research Support Facilities, Infrastructure Improvements (Phase I), Upgrades to the Thermochemical User Facility and Addition of the Thermochemical BioRefinery Pilot Plant.* DOE/EA-1440-S-1. May.

DOE (U.S. Department of Energy), 2007. *Final Environmental Assessment of Three Site Development Projects at the National Renewable Energy Laboratory South Table Mountain Site*. DOE/EA-1573. July.

DOE (U.S. Department of Energy), 2003. *Final Site-Wide EA of the National Renewable Energy Laboratory's South Table Mountain Complex*. DOE/EA-1440. July.

DOE (U.S. Department of Energy), 1998. *Right-of-Way Easement for Public Service Company of Colorado at the South Table Mountain Site, Golden, CO*. DOE/EA-1254. April.

DOT (U.S. Department of Transportation), 2008. "Urbanized Areas – 2007: Selected Characteristics." Table HM-72. Prepared by the Federal Highway Administration. October. Available online at http://www.fhwa.dot.gov/policyinformation/statistics/2007/hm72.cfm.

EPA (U.S. Environmental Protection Agency), 2004. *Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling—Compression-Ignition*. *NR-009c*. EPA 420-P-04-009. Revised April 2004.

EPA (U.S. Environmental Protection Agency), 1978. "Protective Noise Levels: Condensed Version of EPA Levels Document." EPA 550/9-79-100. Available online at http://www.nonoise.org/library/levels/levels.htm.

EPA (U.S. Environmental Protection Agency), 1971. *Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances*. NTID 300.1. December.

FHU (Felsburg Holt & Ullevig), 2008. *National Renewable Energy Laboratory South Table Mountain Facility, Traffic Impact Study*.

Jerrett et al. (M. Jerrett, M.M. Finkelstein, J.R. Brook, M. Altaf Arain, P. Kanaroglou, D.M. Stieb, N.L. Gilbert, D. Verma, N. Finkelstein, K.R. Chapman, and M.R. Sears), 2009. "A Cohort Study of Traffic-Related Air Pollution and Mortality in Toronto, Ontario, Canada," in *Environmental Health Perspectives*, volume 117, number 5, May 2009.

Kane, David P., 1999. *Preble's Meadow Jumping Mouse Survey Report*. Prepared for Pleasantview Metropolitan District and The Norris Dullea Company. September. 11 pp+ photos and appendix.

NREL (National Renewable Energy Laboratory), 2009. *National Renewable Energy Laboratory Ten-Year Site Plan FY2009-FY2020.*

NREL (National Renewable Energy Laboratory), 2007. *Project Report for the South Table Mountain Grand Buildout Infrastructure Plan.*

NREL (National Renewable Energy Laboratory), 2006. *Spill Prevention Control and Countermeasures (SPCC) Plan for the STM.* Procedure 6.2-10.

NREL (National Renewable Energy Laboratory), 2005. *Wildlife Survey (Including Migratory Birds and Raptors) at the National Renewable Energy Laboratory South Table Mountain Site, Golden, Colorado*.

NREL (National Renewable Energy Laboratory), 2002. *Vegetation Survey, NREL South Table Mountain Site*.

NREL (National Renewable Energy Laboratory), 2001. *South Table Mountain Emissions Inventory*. July, updated for 2007.

NREL (National Renewable Energy Laboratory), 1999. *Site Conservation Easement Baseline Inventory*.

USFWS (U.S. Fish and Wildlife Service), 2004. *Preble's meadow jumping mouse (*Zapus hudsonius preblei*) survey guidelines*. Revised April 2004. Available online at http://www.fws.gov/mountain-prairie/endspp/protocols/PMJM2004.pdf.

APPENDIX A SCOPING LETTER AND DISTRIBUTION LISTS

The U.S. Department of Energy (DOE) mailed the scoping letter shown below to the businesses, agencies, and organizations shown in the mailing list that follows the letter. In addition, DOE mailed the scoping letter to all known Pleasant View residential addresses.

SCOPING LETTER

Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3305

September 4, 2008

DISTRIBUTION LIST

SUBJECT: Notice of Public Scoping for the Preparation of an Environmental Assessment Supplement for Proposed Site Development Projects at the National Renewable Energy Laboratory South Table Mountain Site:

- Energy Systems Integration Facility,
- Site Infrastructure Improvements,
- Southern Site Entrance from South Golden Road,
- Expansion of the Waste Handling Facility, and
- Expansion of the Visitors Center

The U.S. Department of Energy (DOE), in compliance with the National Environmental Policy Act of 1969 (NEPA) will be preparing a second Supplement to its Site-wide Environmental Assessment (EA) of the NREL South Table Mountain Complex (DOE/EA 1440, July 2003). This EA Supplement II will analyze the proposed Energy Systems Integration Facility, site infrastructure improvements, a southern site entrance from South Golden Road, and the expansion of the Waste Handling Facility and Visitors Center. DOE is seeking public input on this environmental assessment supplement. A description of the site and the proposed site development projects is included in an attachment to this letter. Specifically, DOE is seeking public comment on the proposed actions and alternatives, and the environmental issues to be addressed in the EA Supplement II.

Pursuant to the requirements of NEPA, the Council on Environmental Quality regulations for implementing the procedural provisions of NEPA (40 CFR Parts 1500-1508), and DOE's implementing procedures for compliance with NEPA (10 CFR Part 1021), DOE is preparing a draft EA Supplement II to:

- Identify any adverse environmental effects that cannot be avoided should this proposed action be implemented.
- Evaluate viable alternatives to the proposed action, including a no action alternative.
- Describe the relationship between local short-term uses of the environment and the maintenance and enhancement of long-term productivity.
- Characterize any irreversible and irretrievable commitments of resources that would be involved should this proposed action be implemented.

The DOE Golden Field Office welcomes your input throughout the NEPA Process. DOE plans to complete the draft EA for public review by December 2008. Public scoping comments on the EA Supplement II will be accepted for a period of 30 days. Please submit your comments regarding this scoping document by **October 10, 2008**, to:

NREL NEPA Comments
National Renewable Energy Laboratory
1617 Cole Boulevard – MS 730,
Golden, CO 80401-3393,
(303) 275-4002 (fax),
Email: NREL.NEPA.comments@nrel.gov

Sincerely,

Steve Blazek
NEPA Compliance Officer

Enclosure

cc: Maureen Jordan
Senior Environmental Scientist
NREL

2

ATTACHMENT

NOTICE OF PUBLIC SCOPING FOR THE PREPARATION OF AN ENVIRONMENTAL ASSESSMENT SUPPLEMENT FOR PROPOSED SITE DEVELOPMENT PROJECTS AT THE NATIONAL RENEWABLE ENERGY LABORATORY SOUTH TABLE MOUNTAIN SITE:

- **ENERGY SYSTEMS INTEGRATION FACILITY,**
- **SITE INFRASTRUCTURE IMPROVEMENTS,**
- **SOUTHERN SITE ENTRANCE FROM SOUTH GOLDEN ROAD,**
- **EXPANSION OF THE WASTE HANDLING FACILITY, AND**
- **EXPANSION OF THE VISITORS CENTER**

SITE BACKGROUND AND DESCRIPTION

The National Renewable Energy Laboratory (NREL) is one of twelve Department of Energy (DOE) national laboratories and is dedicated to the research, development, and deployment of renewable energy and energy efficiency technologies. The laboratory is comprised of three main sites: 1) South Table Mountain (STM); 2) Denver West Office Park (DWOP), and 3) the National Wind Technology Center (NWTC).

NREL conducts research activities at the STM site in support of the following DOE research programs:

- Solar Energy Technologies
- Geothermal Technologies
- Distributed Energy, Electrical Infrastructure and Reliability . Biomass
- Industrial Technologies
- Freedom Car and Vehicle Technology
- Hydrogen, Fuel Cells and Infrastructure Technologies
- Buildings Technologies
- Weatherization and Intergovernmental Grants
- Federal Energy Management
- Other DOE Sponsored Programs
- Work for Others Supporting the DOE Mission

Additional detail regarding NREL's mission and research programs is available on the website at: www.nrel.gov.

The 327-acre STM site is located on the southeast side of South Table Mountain, north of Interstate 70 and west of the Interstate 70 and Denver West Boulevard interchange in unincorporated Jefferson County, near Golden, Colorado (Legal description: Township 3 S, Range 70 W, Section 36, and Township 4 S, Range 70 W, Section 1) (See Figure 1). Only a portion of the site, 136 acres, is available for development. A total of 177 acres is protected by a conservation easement, and development on the remaining 14 acres is restricted by utility easements. The community of Pleasant View is adjacent to the southern border of the STM site. The STM site includes acreage on the South Table

Mountain mesa top, slope, and toe, and was formerly part of the Colorado National Guard facility at Camp George West. There are currently seven laboratory buildings, a few small test facilities, and several support buildings on the site.

PURPOSE AND NEED

A Site-Wide Environmental Assessment (EA) for the STM and the DWOP was prepared in 2003 that evaluated the existing and proposed facilities as well as the operation of the site. A supplement to the Site-Wide EA was completed in May 2008 (Supplement I, DOE-EA-144-S-I). The 2003 Site-Wide EA provides a detailed framework under which the potential environmental impacts of the Proposed Action will be evaluated. As was the case for Supplement I, activities evaluated in this EA Supplement II are those for which there is either current funding or there is a high likelihood of receiving funding in the near term. Further site development activities will be evaluated in future EA Supplements as funding for future projects is obtained and project designs and schedules are identified.

The subjects of this EA Supplement II include an Energy Systems Integration Facility (ESIF), site infrastructure improvements, a southern site entrance from South Golden Road, and expansion of both the Waste Handling Facility and Visitors Center at the National Renewable Energy Laboratory South Table Mountain Site.
This EA Supplement II will provide an opportunity to review the potential effects of constructing and operating these proposed actions. The purpose and need for the Proposed Actions is to: 1) provide additional research and development capabilities, 2) upgrade and expand portions of the existing infrastructure, including the handling of site generated wastes 3) prepare the site for future development, and alleviate projected traffic impacts associated with future growth, and 4) expand the site's ability to provide visitor access to NREL activities.

PROPOSED ACTION AND ALTERNATIVES

The following presents a summary of the Proposed Action and the No Action alternative descriptions.

Proposed Action

Energy Systems Integration Facility (ESIF). NREL is proposing to design, construct and operate a 'first of its kind' integrated test and validation facility for distributed renewable energy generation technologies being developed by EERE programs in partnership with industry. The federal government currently lacks a facility for designing and testing engineering optimized systems, testing integrated energy technologies, and simulating and or emulating new infrastructure scenarios. The lack of such a facility represents a key barrier to being able to meet national renewable energy goals. The proposed ESIF would allow DOE to optimize these technologies as part of a total energy system. Collecting both technical and economic data for business analysis would encourage integration of renewable energy technologies into energy production and

delivery systems at minimum cost and high system reliability. The ESIF would also allow U.S. industry members to insert their individual technologies into a controlled integrated energy system platform to test and optimize the technologies for earlier market penetration.

The ESIF is envisioned as a new 130,000 – 170,000 gross-square-foot facility with an additional 20,000 – 30,000 square feet for outdoor research test pads and associated infrastructure requirements (access road, service drives, etc.). The facility would provide research support space for up to 200 researchers. The facility would be designed to merit at least a "Gold" rating from the U.S. Green Building Council, in support of EERE's goal to demonstrate energy efficient buildings with a lower impact on the environment.

The ESIF project would be a multi-year project with the design phase expected to start in 2009 and construction completion scheduled for December 2011. The actual location of the building would be selected during the design phase. The facility would most likely be placed on the North East quadrant of the existing STM campus, east of the existing Science and Technology Facility.

Infrastructure. Site infrastructure improvements would be designed to accommodate the ESIF and some of the additional future development envisioned at the STM site. Proposed infrastructure improvements include a North Loop Road, which would be approximately 1200 feet in length, approximately 4,000 feet of trenching for underground utility extensions, and up to 170,000 square feet of additional surface parking at the south end of the site. Denver West Boulevard, which currently runs through the campus, would remain. Additional onsite pedestrian walkways and bicycle paths, as well as a Commons Quad and an East Quad, would be developed. Additional improvements to the central arroyo and storm water detention are being considered as well.

Southern site entrance from South Golden Rd. In the traffic surveys completed by NREL in 2007 and 2008, the need for a third STM site entrance from the south was identified. This Supplement EA II will analyze the impacts of the options for an entrance connecting the site to South Golden Road.

Visitors Center Expansion. DOE is proposing to expand the existing NREL Visitors Center. The Visitors Center is currently about 6,500 square feet, and the expansion is anticipated to at least double the size of the facility. The added space could include a large conference room, additional office and indoor or outdoor exhibit space, and additional parking.

Waste Handling Facility Expansion. The current Waste Handling Facility is 1,065 square feet. This proposed expansion would provide a total of approximately 4,000 square feet for storage, packaging, and other hazardous waste activities to accommodate NREL's increasing waste volumes that accompany overall Laboratory growth. Waste handling activities at NREL currently involve storage, preparation and packaging for transportation of waste to off-site disposal sites. No on-site waste treatment or disposal is proposed.

No Action

The No Action Alternative would add facilities and improve the infrastructure as proposed and assessed in EA Supplement I, but leave the remainder of the site in its current configuration. Specifically, the ESIF, infrastructure improvements would not be built, a new site entrance would not be created, and the Waste Handling Facility and Visitors Center would not be expanded.

ENVIRONMENTAL TOPICS TO BE ADDRESSED

The Draft EA Supplement II will address direct, indirect, and cumulative impacts of the Proposed Action and alternatives. Beneficial and adverse, on-site and off-site, construction, demolition, and operation and maintenance impacts will be discussed, as appropriate. The preliminary list of environmental topics to be addressed in the EA include:

- Land Use, Planning, Socioeconomics and Public Policy
- Traffic and Circulation
- Air Quality and Noise
- Visual Quality/Aesthetics
- Water Resources
- Soils and Geology
- Biological Resources
- Cultural Resources
- Waste Management
- Public Facilities, Services and Utilities
- Energy
- Sustainability
- Risk Assessment
- Intentional Destructive Acts

SCHEDULE

DOE anticipates public distribution of the Draft EA Supplement II for comments by December 2008. Comments on the scoping letter and proposed action are requested by October 10, 2008. No formal public scoping meeting is currently planned for this project. The Draft EA Supplement II, when available, will be posted in the Department of Energy's Golden Field Office electronic reading room:

http://www.eere.energy.gov/golden/reading room.aspx

Please direct your comments to:

NREL NEPA Comments

Attachment – Notice of Public Scoping 4

National Renewable Energy Laboratory
1617 Cole Boulevard – MS 730
Golden, CO 80401-3393
(303) 275- 4002 (fax)
Email: NREL.NEPA.Comments@nrel.gov

FIGURES:
Figure 1 Regional Location Map, South Table Mountain Site

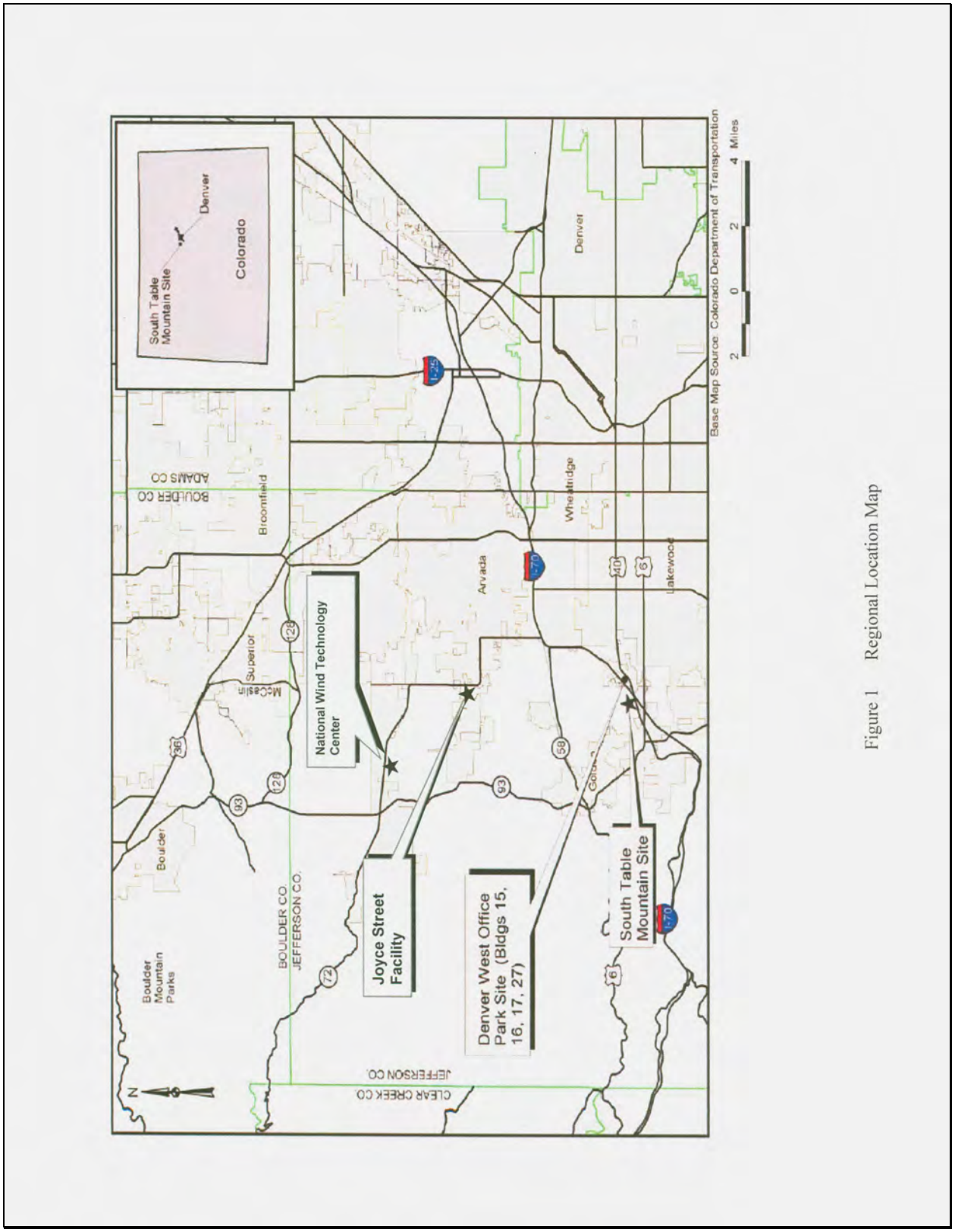

Figure 1 Regional Location Map

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City of Lakewood Planning Dept.
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Jefferson County Sheriff's Office
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Northern Ute Indian Tribe
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Lakewood, CO 80215

Senator Mark Udall
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North Tower, Suite 1525
Denver, CO 80202

Office of Senator Tim Bennet
2300 15th Street, Suite 450
Denver, CO 80202

Office of Representative Coffman
9220 Kimmer Dr. Suite #220
Lone Tree, CO 80124

Mr. Robert Pille, Director
Oglala Sioux Tribe
Environmental Protection
PO Box 2008
Pine Ridge, SD 57770

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Pleasant View Fire Department
955 Moss Street
Golden, CO 80401

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Pleasant View Metro District
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Golden, CO 80401

Mr. David Councilman
Pleasant View Water & Sanitation Dist.
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Golden, CO 80401

Mr. Wally Pulliam
Regional Transportation District
District L
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Arvada, CO 80007

Ms. Andrea Taylor, Director
Southern Ute Tribe
Tribal Information Services
PO Box 737
Ingacio, CO 81137

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Ingacio, CO 81137

Mr. Neil Cloud
Southern Ute Tribe
NAGPRA Coordinator
PO Box 737
Igacio, CO 81137

State Historic Preservation Office
1300 Broadway-OAHP
Denver, CO 80203

Governor Bill Ritter
State of Colorado
136 State Capital
Denver, CO 80203-1792

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Fish & Wildlife Service
PO Box 25486-DFC (65412)
Denver, CO 80225

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National Resource Conservation Ser.
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Lakewood, CO 80215-5517

Ms. Betsy Chapoose
Uinta and Ouray Ute Indian Tribe
Cultural Rights and Protection
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Ft. Duchesene, UT 84026

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Corps of Engineers, Omaha District
9307 S. Wadsworth Blvd.
Littleton, CO 80128-6901

Mr. Gregory Davis
US EPA - Region 8
Stormwater Coordinator; EPR-EP
1595 Wynkoop St.
Denver, CO 80202-1129

Mr. Bert Garcia, Director
US EPA - Region 8
Ecosystem Protection
1595 Wynkoop St.
Denver, CO 80202-2405

Mr. Larry Svoboda
US EPA - Region 8
NEPA Compliance, 8EPR-N
1595 Wynkoop St.
Denver, CO 80202-1129

Mr. Manuel Heart, Chairman
Ute Mountain Ute Tribal Council
PO Box JJ
Towaoc, CO 81334

MAILING LIST - BUSINESSES

Business and residences were notified via postal route mailing. The following postal route codes were notified:

- 80401 C07
- 80401 C08
- 80401 C09
- 80401 C18
- 80401 C24
- 80401 C25
- 80401 C27
- 80401 C29
- 80401 C30
- 80401 C33
- 80401 C37
- 80401 C41
- 80401 C42
- 80401 C46
- 80401 C47

APPENDIX B AGENCY CONSULTATION

2008-2996

6

Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3393

November 24, 2008

U.S. Department of Army
Corps of Engineers, Omaha District
9307 S. Wadsworth Blvd
Littleton, Colorado 80128-6901

NE Sec 1 4S 70W

Attention: Mr. Terry McKee

Subject: Department of Energy's New Southern Access to the National Renewable Energy Laboratory South Table Mountain Site

Pursuant to your recent discussions with Dan Lowery of Battelle Memorial Institute, the purpose of this letter is to provide your agency with additional information regarding the subject project, current vegetation conditions of the Lena Gulch, and proposed design measures that would be incorporated into a roadway as it crosses Lena Gulch. Please accept this letter as a formal request to provide our agency with the proper permit requirements and guidance pursuant to compliance with Section 404 of the Clean Water Act.

Background

As you may be aware, the Department of Energy (DOE) is involved in a multiyear buildout of the National Renewable Energy Laboratory's (NREL) South Table Mountain (STM) Site located in Golden, CO. Traffic studies recently commissioned by DOE to assess the consequences of staff growth at NREL resulting from the buildout have indicated that future traffic congestion at the intersections of Denver West Parkway/Denver West Marriott Boulevard could reach unacceptable levels without an additional entrance. As a result, DOE is considering options for a new southern entrance that would connect the STM site to South Golden Road. Several of the available alternatives for this new access would cross Lena Gulch, a perennial stream beginning in the foothills to the west of the STM site and culminating several miles to the east into Clear Creek.

This proposed action along with other site infrastructure upgrades, a new laboratory building, and an expansion to the Visitor's Center are being evaluated under DOE's NEPA regulations in a Supplemental Environmental Assessment (EA). A more detailed description of the other proposed actions being assessed can be found in the attached Notice of Public Scoping for the Preparation of an Environmental Assessment Supplement for Proposed Site Development Projects at NREL. At this time DOE is evaluating its alternatives for a southern entrance road and does not yet have a preferred alternative. Through this EA process, DOE plans to select a corridor within in which

more detailed route selection and design work would be performed before any construction would begin.

Proposed Action Summary

As shown in the attached Figure, four Corridors (A, B, C and D) are being considered at this time. As part of the roadway entrance design, all alternatives would require crossing Lena Gulch and, therefore, may be the subject of potential permit requirements under the Nationwide Permit Program. Alternative A would require a new bridge. Alternatives B and D could use an existing bridge on Kilmer Street, possibly with some upgrades, or a new bridge may be needed. Alternative C would utilize the existing bridge on Isabell Street.

Existing Conditions

Based on recent field visits conducted in early-November 2008 at proposed roadway crossings of Lena Gulch, a number of riparian areas were identified within or adjacent to onsite drainages. These areas exhibited a number of wetland criteria based on U.S. Fish and Wildlife Service guidelines for delineation of wetlands. These areas could be considered as jurisdictional wetlands based on onsite vegetation and soil conditions and could fall under the jurisdiction of the U.S. Army Corps of Engineers Section 404 regulations.

Proposed Design Measures

As envisioned, the bridge would be designed to eliminate any need of permanent components (e.g. abutments, truss, supporting materials and decking) within Lena Gulch, thereby reducing any potential impacts to biological or hydrologic resources. Moreover, the construction of the bridge would not require the need to be in the active portion or riparian portions of the gulch.

Based on the low-profile design of the bridge, as well as the use of low-intensity equipment to construct the bridge, disturbance to the Lena Gulch is not expected. The following main activities would be conducted prior to construction activities:

- Survey project site for bridge length and placement
- Test on-site soils for structural compatibility
- Design final bridge shop drawings for agency approval
- Delineate sensitive habitat for avoidance
- Fabricate bridge components off-site
- Establish staging area(s) for approval by agency

The following main activities would be conducted during construction:

- Excavate, by hand, abutments and ready site with pea-gravel
- Place abutments and set on pea-grave for leveling

- Place bridge trusses and ancillary components to project site for placement
- Construct bridge deck in-place
- Construct bridge rail in-place

The following main activities would be conducted after construction:

- Consult with agency once bridge has been set in place
- Restore and re-vegetate disturbed areas including abutments, slab foundations and pilings

Construction Schedule

The total construction time for the entire bridge design and fabrication and installation is expected to occur within 30 to 45 days.

▪ Transport activities	7 days
▪ Excavation activities to ready site for bridge	7 days
▪ Bridge construction activities	10 days
▪ Project restoration activities	5 days

To summarize, by way of this letter DOE is requesting that the Corps provide our agency with the proper permit requirements and guidance pursuant to compliance with Section 404 of the Clean Water Act. Thank you for your time and cooperation in this matter and feel free to contact Steve Blazek at 303-275-4723 should you have any questions or should you require additional information.

Sincerely,

Gregory D. Collette
Acting Assistant Manager
Laboratory Operations

Enclosures

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, OMAHA DISTRICT
DENVER REGULATORY OFFICE, 9307 S. Wadsworth Boulevard
LITTLETON, COLORADO 80128-6901

December 2, 2008

Mr. Gregory Collette
Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, CO 80401-3393

RE: Department of Energy's New Southern Access to the National Renewable Energy Laboratory South Table Mountain Site, Lena Gulch
Corps File No. NWO-2008-2996-DEN

Dear Mr. Collette:

Reference is made to the above-referenced project located in the NE ¼ of Section 1, T4S, R70W, Jefferson County, Colorado. This project has been reviewed by Mr. Terry McKee of my office in accordance with Section 404 of the Clean Water Act under which the U.S. Army Corps of Engineers regulates the discharge of dredged and fill material, and any excavation activity associated with a dredge and fill project in waters of the United States.

Based on the information provided, a Department of the Army (DA) Permit will not be required for work at this site. Although a DA Permit will not be required for the project, this does not eliminate the requirement that other applicable federal, state, and local permits be obtained as needed. If, however, any work associated with this project requires the placement of dredged or fill material, and any excavation associated with a dredged or fill project, either temporary or permanent, in an aquatic site, which may include ephemeral and perennial streams, wetlands, lakes, ponds, drainage ditches and irrigation ditches, this office should be notified by a **proponent** of the project for Department of the Army permits, changes in permit requirements or jurisdictional determinations pursuant to Section 404 of the Clean Water Act.

Work in an aquatic site should be identified by the **proponent of the project** and be shown on a map identifying the Quarter Section, Township, Range and County and Latitude and Longitude, Decimal Degrees (datum NAD 83) and the dimensions of work in each aquatic site. Any loss of an aquatic site may require mitigation. Mitigation requirements will be determined during the Department of the Army permitting review.

If there are any questions call **Mr. Terry McKee** of my office at **(303) 979-4120** and reference **Corps File No. NWO-2008-2996-DEN**.

Sincerely,

Timothy T. Carey
Chief, Denver Regulatory Office

tm

57787
STM

Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3393

November 24, 2008

Mr. Edward Nichols
State Historic Preservation Officer
Colorado Historical Society
1300 Broadway
Denver, Co 80203
(303) 866-3355

RECEIVED
DEC 2 2008
CHS/OAHP

Dear Mr. Nichols:

SUBJECT: U.S. DEPARTMENT OF ENERGY NEW SOUTHERN ENETRANCE TO THE NATIONAL RENEWABLE ENERGY LABORATORY'S SOUTH TABLE MOUNTAIN SITE (DOE/EA1440S-II)

The purpose of this letter is to notify your agency that the U.S. Department of Energy (DOE) is evaluating alternative corridors to provide a new southern access road into the South Table Mountain Site (STM) site. Further, DOE solicits your review and comments on this proposed action as well as concurrence on the historic resources which might be affected by roadway construction of these proposed corridors. Three of the four corridors (A, B, and D) (Figure Attached) would traverse the Camp George West Historic District located in Jefferson County, Section 36, Township 3 South, Range 70 West, and Section 1, Township 4 South, Range 70 West. Corridor C would connect the STM site with the current Isabell Street and thus have no potential to affect historic resources within the District.

DOE will use your information and consider any other factors in its evaluation of corridor options before selecting a single corridor for more detail roadway route selection, design, and impact mitigation if needed. DOE intends to work closely with your office during and after our corridor selection process in the determination of affects, if any, which may result from this action. As you can see from our figure, the corridors as defined are sufficiently wide to avoid historic resources, with the exception of corridor D which follows Kilmer Street with numerous resources adjacent to the street. The other resources that might prove difficult to avoid for all alternatives could be the six-hundred and five-hundred-yard firing lines (FR12) due to their length and locations, but a determination of effect will have to wait for more detailed route selection. Please also note that, at this time, we believe the use of Kilmer Street under corridor D would not require any widening of the current roadway and thus the resources along this route would not be disturbed. We are working with the appropriate roadway agencies to confirm the adequacy of the existing roadway.

Background

As you may be aware, the Department of Energy (DOE) is involved in a multiyear buildout of the National Renewable Energy Laboratory's (NREL) South Table Mountain Site located in Golden, CO. Traffic studies recently commissioned by DOE to assess the consequences of staff growth at NREL resulting from the buildout have indicated that future traffic congestion at the intersections of Denver West Parkway/Denver West Marriott Boulevard could reach unacceptable levels if an additional entrance to the site was not added. As a result, DOE is considering its options for a new southern entrance that would connect the STM site to South Golden Road.

This proposed action along with other site infrastructure upgrades, a new laboratory building, and an expansion to the Visitor's Center are being evaluated under DOE's NEPA regulations in a Supplemental Environmental Assessment (EA). A more detailed description of the other proposed actions being assessed can be found in the attached Notice of Public Scoping for the Preparation of an Environmental Assessment Supplement for Proposed Site Development Projects at NREL. At this time DOE is evaluating alternatives for a southern entrance road and does not yet have a preferred alternative. Through this EA process, DOE plans to select a corridor within in which more detailed route selection and design work would be performed, and concurrence on a determination of effect (if applicable) would be solicited before any construction would begin.

Resources Potentially Affected

DOE has reviewed the information available from the National Register of Historic Places on the Camp George West Historic District and has determined that there are thirteen listed structures that contributed to the District's designation and two non-listed, noncontributing resources occur in or near the access corridors currently under review by DOE. Resources and the corridor(s) in which they occur are identified in the table below.

Resource Number	Name	Present within Southern Access Corridor			
		A	B	C	D
Contributing Resources					
12	Mess Hall	No	No	No	Yes
26	Mess Hall	No	No	No	Yes
29	Mess Hall	No	No	No	Yes
33	Small Arms/Ammunition Storage	No	No	No	Yes
45	Headquarters	No	No	No	Yes
48	Recreational Hall	No	Yes	No	Yes

49	Swimming Pool	No	Yes	No	Yes
50	Pedestrian Underpass	No	No	No	Yes
83	Guard House	No	No	No	Yes
84	Pump House	No	Yes	No	Yes
92	Bridge	No	Yes	No	Yes
113	Bridge	No	Yes	No	Yes
FR 12	Firing Lines	Yes	Yes	No	Yes
Non-Contributing Resources					
(A)	Warehouse	No	No	No	Yes
104	Golden Clubhouse	Yes	Yes	No	Yes

(A) The number designation on this warehouse cannot be determined from the copies of the designation report in our files. This metal roofed and sided warehouse lies on Kilmer Street just west of the gateway arch to the Pleasantview Community Park.

If your records indicate additional resources within these corridors that are not listed above please include the identification of any such resources in your response to this letter.

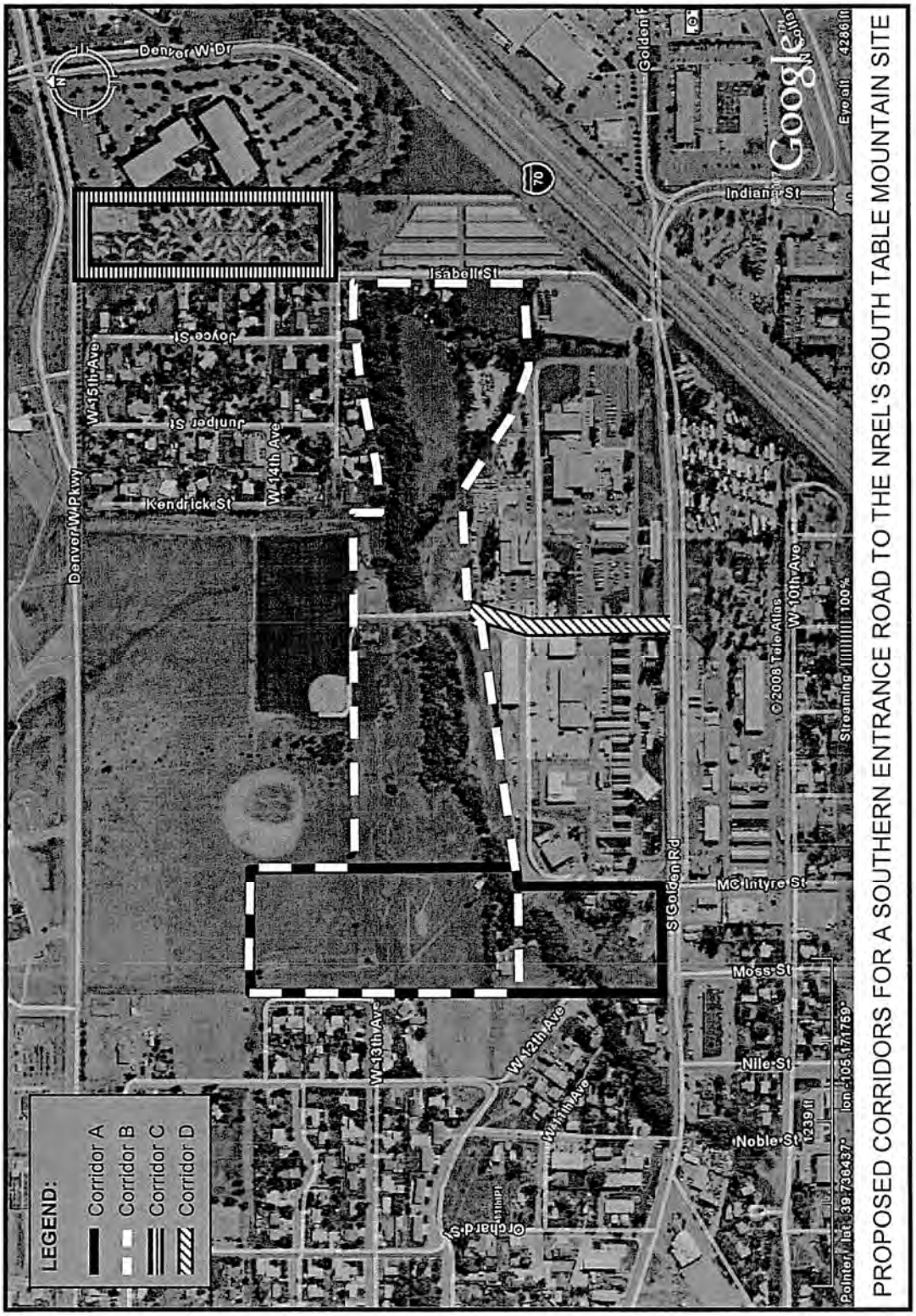
DOE appreciates your participation in this process of resource identification and will work closely with you and your staff as we comply with Section 106 of the National Historic Preservation Act and with the Advisory Council on Historic Preservation regulations.

We look forward to further consultations on this project. Please contact Steve Blazek at (303) 275-4723 for additional information.

Sincerely,

Gregory D. Collette
Acting Assistant Manager
Laboratory Operations

Enclosures


LEGEND:
Corridor A
Corridor B
Corridor C
Corridor D
Denver W Dr
Denver W Pkwy
W 15th Ave
W 14th Ave
W 13th Ave
W 12th Ave
W 11th Ave
Joyce St
Juniper St
Kendrick St
Isabel St
Indiana St
Golden Rd
MC Intyre St
Moss St
Nile St
Noble St
Orchard St
W 10th Ave
70
Google
© 2008 Tele Atlas
Streaming 100%
Eye alt 4286 ft
Pointer lat: 39.738437° lon: -105.171769
PROPOSED CORRIDORS FOR A SOUTHERN ENTRANCE ROAD TO THE NREL'S SOUTH TABLE MOUNTAIN SITE

OFFICE *of* ARCHAEOLOGY *and* HISTORIC PRESERVATION

December 8, 2008

Gregory D. Collette
Acting Assistant Manager
Laboratory Operations
Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, CO 80401-3393

Re: New Southern Entrance to the National Renewable Energy Laboratory South Table Mountain Site (DOE/EA 14402-II) (CHS #53787)

Dear Mr. Collette:

Thank you for your correspondence dated November 24, 2008 and received by our office on December 2, 2008 regarding the consultation of the above-mentioned project under Section 106 of the National Historic Preservation Act (Section 106).

After review of the provided information, we are not able to complete our review of your project under Section 106. In order to review this project under Section 106, we need to consult with your office regarding the Area of Potential Effects (APE) and identification of other consulting parties, as stipulated in 36 CFR 800.4(a). Once we have an appropriate APE boundary and consulting parties notified of the project, we can consult on the identification of historic properties and assessment of adverse effect. We recommend contacting our office regarding the APE and identification of other consulting parties.

Please note that our compliance letter does not end the 30-day review period provided to other consulting parties. If we may be of further assistance, please contact Amy Pallante, our Section 106 Compliance Manager, at (303) 866-4678.

Sincerely,

Edward C. Nichols
State Historic Preservation Officer

cc: Steve Blazek/Department of Energy

COLORADO HISTORICAL SOCIETY
1300 BROADWAY DENVER COLORADO 80203 TEL 303/866-3395 FAX 303/866-2711 www.coloradohistory-oahp.org

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, OMAHA DISTRICT
DENVER REGULATORY OFFICE, 9307 SOUTH WADSWORTH BOULEVARD
LITTLETON, COLORADO 80128-6901

April 27, 2009

Ms. Genny Braus
Senior Environmental Specialist
NREL - Environmental Health and Safety
1617 Cole Boulevard, Mail Stop 730
Golden, CO 80401

RE: National Renewable Energy Laboratory, Drainage Review
Corps File No. NWO-2009-1014-DEN

Dear Ms. Braus:

Reference is made to your April 24, 2009 site visit with Mr. Terry McKee of my office concerning the above-mentioned project located in the S ½ of Section 36, T3S, R70W, Jefferson County, Colorado. During the site visit the below drainages were examined and identified as upland swales vegetated with upland vegetation:

1. JeffCo Easement Drainage
2. East Drainage
3. Middle Drainage
4. Middle West Drainage
5. West Drainage
6. Road Side Drainages and Trickle Channel Drainages

An approved jurisdictional determination (JD) has been completed for the above mentioned upland swales. The JD's for these swales are attached to this letter. If you are not in agreement with the JD decision, you may request an administrative appeal under regulation 33 CFR 331, by using the attached Appeal Form and Administrative Appeal Process form. The request for appeal must be received within 60 days from the date of this letter. If you would like more information on the jurisdictional appeal process, contact this office. It is not necessary to submit a Request for Appeal if you do not object to the JD.

The above upland swales have been reviewed in accordance with Section 404 of the Clean Water Act under which the U.S. Army Corps of Engineers regulates the discharge of dredged and fill material, and any excavation activity associated with a dredge and fill project in waters of the United States. A Department of the Army (DA) Permit will not be required for work at in these upland swales. Although a DA Permit will not be required for work in these swales, this does not eliminate the requirement that other applicable federal, state, and local permits be obtained as needed.

This JD is valid for a period of five years from the date of this letter, unless new information warrants revisions of the JDs before the expiration date, or unless the Corps has identified, after a possible public notice and comment, that specific geographic areas with rapidly changing environmental conditions merit re-verification on a more frequent basis.

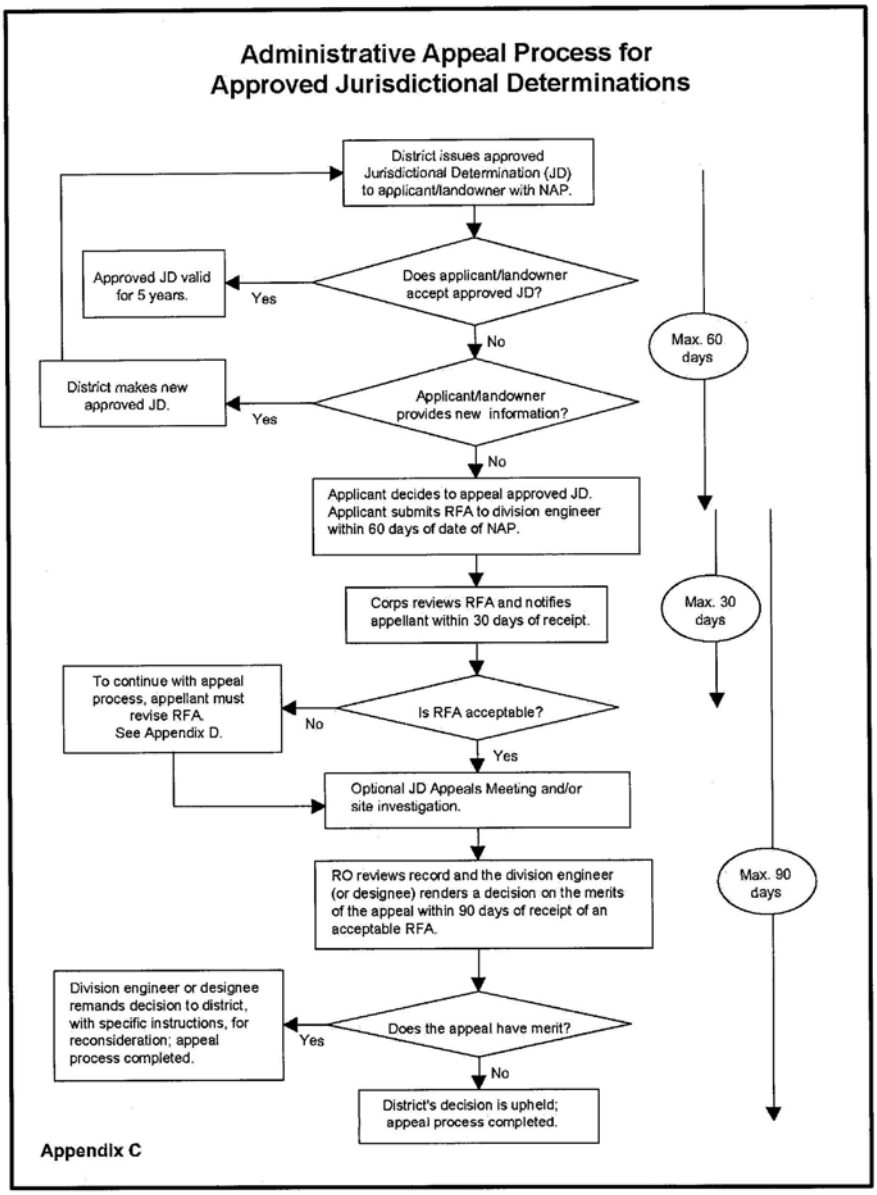
The Omaha District, Regulatory Branch is committed to providing quality and timely service to our customers. In an effort to improve customer service, please take a moment to complete our Customer Service Survey found on our website at http://per2.nwp.usace.army.mil/survey.html. If you do not have Internet access, you may call and request a paper copy of the survey that you can complete and return to us by mail or fax. (Completing the survey is a voluntary action)

If there are any questions call **Mr. Terry McKee** at **(303) 979-4120** and **reference Corps No. NWO-2009-1014-DEN**.

Sincerely,

Timothy T. Carey
Chief, Denver Regulatory Office

tm


Administrative Appeal Process for
Approved Jurisdictional Determinations
District issues approved Jurisdictional Determination (JD) to applicant/landowner with NAP.
Does applicant/landowner accept approved JD?
Yes
Approved JD valid for 5 years.
No
Applicant/landowner provides new information?
Yes
District makes new approved JD.
No
Applicant decides to appeal approved JD. Applicant submits RFA to division engineer within 60 days of date of NAP.
Corps reviews RFA and notifies appellant within 30 days of receipt.
Is RFA acceptable?
No
To continue with appeal process, appellant must revise RFA. See Appendix D.
Yes
Optional JD Appeals Meeting and/or site investigation.
RO reviews record and the division engineer (or designee) renders a decision on the merits of the appeal within 90 days of receipt of an acceptable RFA.
Does the appeal have merit?
Yes
Division engineer or designee remands decision to district, with specific instructions, for reconsideration; appeal process completed.
No
District's decision is upheld; appeal process completed.
Max. 60 days
Max. 30 days
Max. 90 days
Appendix C

NOTIFICATION OF ADMINISTRATIVE APPEAL OPTIONS AND PROCESS AND REQUEST FOR APPEAL		
Applicant:	File Number:	Date:
Attached is:		See Section below
INITIAL PROFFERED PERMIT (Standard Permit or Letter of permission)		A
PROFFERED PERMIT (Standard Permit or Letter of permission)		B
PERMIT DENIAL		C
APPROVED JURISDICTIONAL DETERMINATION		D
PRELIMINARY JURISDICTIONAL DETERMINATION		E

SECTION I - The following identifies your rights and options regarding an administrative appeal of the above decision. Additional information may be found at http://usace.army.mil/inet/functions/cw/cecwo/reg or Corps regulations at 33 CFR Part 331.

A: INITIAL PROFFERED PERMIT: You may accept or object to the permit.

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- OBJECT: If you object to the permit (Standard or LOP) because of certain terms and conditions therein, you may request that the permit be modified accordingly. You must complete Section II of this form and return the form to the district engineer. Your objections must be received by the district engineer within 60 days of the date of this notice, or you will forfeit your right to appeal the permit in the future. Upon receipt of your letter, the district engineer will evaluate your objections and may: (a) modify the permit to address all of your concerns, (b) modify the permit to address some of your objections, or (c) not modify the permit having determined that the permit should be issued as previously written. After evaluating your objections, the district engineer will send you a proffered permit for your reconsideration, as indicated in Section B below.

B: PROFFERED PERMIT: You may accept or appeal the permit

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- APPEAL: If you choose to decline the proffered permit (Standard or LOP) because of certain terms and conditions therein, you may appeal the declined permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

C: PERMIT DENIAL: You may appeal the denial of a permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

D: APPROVED JURISDICTIONAL DETERMINATION: You may accept or appeal the approved JD or provide new information.

- ACCEPT: You do not need to notify the Corps to accept an approved JD. Failure to notify the Corps within 60 days of the date of this notice, means that you accept the approved JD in its entirety, and waive all rights to appeal the approved JD.
- APPEAL: If you disagree with the approved JD, you may appeal the approved JD under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

E: PRELIMINARY JURISDICTIONAL DETERMINATION: You do not need to respond to the Corps regarding the preliminary JD. The Preliminary JD is not appealable. If you wish, you may request an approved JD (which may be appealed), by contacting the Corps district for further instruction. Also you may provide new information for further consideration by the Corps to reevaluate the JD.

SECTION II - REQUEST FOR APPEAL or OBJECTIONS TO AN INITIAL PROFFERED PERMIT

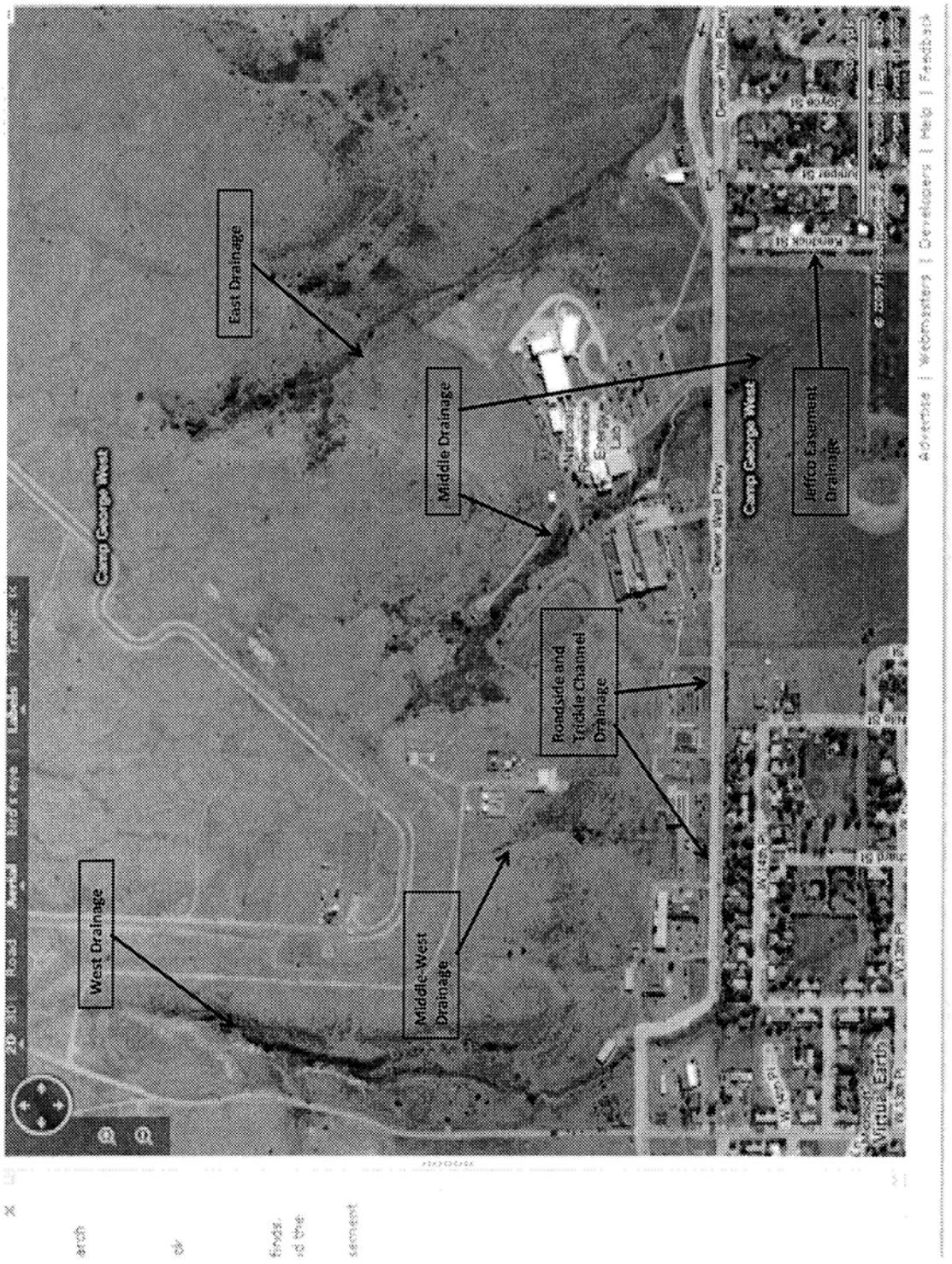
REASONS FOR APPEAL OR OBJECTIONS: (Describe your reasons for appealing the decision or your objections to an initial proffered permit in clear concise statements. You may attach additional information to this form to clarify where your reasons or objections are addressed in the administrative record.)

ADDITIONAL INFORMATION: The appeal is limited to a review of the administrative record, the Corps memorandum for the record of the appeal conference or meeting, and any supplemental information that the review officer has determined is needed to clarify the administrative record. Neither the appellant nor the Corps may add new information or analyses to the record. However, you may provide additional information to clarify the location of information that is already in the administrative record.

POINT OF CONTACT FOR QUESTIONS OR INFORMATION:

If you have questions regarding this decision and/or the appeal process you may contact:	If you only have questions regarding the appeal process you may also contact:
Timothy T. Carey Chief, Denver Regulatory Office 9307 South Wadsworth Boulevard Littleton, CO 80128 (303) 979-4120	US Army Corps of Engineers, Northwestern Division Attn: David Gesl, Appeal Review Officer 1125 NW Couch St. Portland, OR 97209-4141 Telephone (503) 808-3825

RIGHT OF ENTRY: Your signature below grants the right of entry to Corps of Engineers personnel, and any government consultants, to conduct investigations of the project site during the course of the appeal process. You will be provided a 15 day notice of any site investigation, and will have the opportunity to participate in all site investigations.


East Drainage
Middle Drainage
Roadside and Trickle Channel Drainage
Jeffco Easement Drainage
West Drainage
Middle-West Drainage
Camp George West
Denver West Pkwy

APPROVED JURISDICTIONAL DETERMINATION FORM
U.S. Army Corps of Engineers

This form should be completed by following the instructions provided in Section IV of the JD Form Instructional Guidebook.

SECTION I: BACKGROUND INFORMATION

A. REPORT COMPLETION DATE FOR APPROVED JURISDICTIONAL DETERMINATION (JD): April 27, 2009

B. DISTRICT OFFICE, FILE NAME, AND NUMBER:
Denver Regulatory Office, National Renewable Energy Laboratory, NWO-2009-1014-DEN

C. PROJECT LOCATION AND BACKGROUND INFORMATION: West Drainage
State: CO County/parish/borough: Jefferson City: Golden
Center coordinates of site (lat/long in degree decimal format): Lat. 39.74131 N; Long. -104.17376 W
Universal Transverse Mercator:
Name of nearest waterbody: Lena Gulch
Name of nearest Traditional Navigable Water (TNW) into which the aquatic resource flows: NA
Name of watershed or Hydrologic Unit Code (HUC): 10190002
☒ Check if map/diagram of review area and/or potential jurisdictional areas is/are available upon request.
☒ Check if other sites (e.g., offsite mitigation sites, disposal sites, etc…) are associated with this action and are recorded on a different JD form.

D. REVIEW PERFORMED FOR SITE EVALUATION (CHECK ALL THAT APPLY):
☒ Office (Desk) Determination. Date: April 24, 2009
☒ Field Determination. Date(s): April 24, 2009

SECTION II: SUMMARY OF FINDINGS

A. RHA SECTION 10 DETERMINATION OF JURISDICTION.

There Are no *"navigable waters of the U.S."* within Rivers and Harbors Act (RHA) jurisdiction (as defined by 33 CFR part 329) in the review area. [*Required*]
☐ Waters subject to the ebb and flow of the tide.
☐ Waters are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce.
Explain: .

B. CWA SECTION 404 DETERMINATION OF JURISDICTION.

There Are no *"waters of the U.S."* within Clean Water Act (CWA) jurisdiction (as defined by 33 CFR part 328) in the review area. [*Required*]

1. Waters of the U.S.

a. Indicate presence of waters of U.S. in review area (check all that apply): [1]
☐ TNWs, including territorial seas
☐ Wetlands adjacent to TNWs
☐ Relatively permanent waters[2] (RPWs) that flow directly or indirectly into TNWs
☐ Non-RPWs that flow directly or indirectly into TNWs
☐ Wetlands directly abutting RPWs that flow directly or indirectly into TNWs
☐ Wetlands adjacent to but not directly abutting RPWs that flow directly or indirectly into TNWs
☐ Wetlands adjacent to non-RPWs that flow directly or indirectly into TNWs
☐ Impoundments of jurisdictional waters
☐ Isolated (interstate or intrastate) waters, including isolated wetlands

b. Identify (estimate) size of waters of the U.S. in the review area:
Non-wetland waters: linear feet: width (ft) and/or acres.
Wetlands: acres.

c. Limits (boundaries) of jurisdiction based on: Established by OHWM.
Elevation of established OHWM (if known): .

2. Non-regulated waters/wetlands (check if applicable):[3]
☒ Potentially jurisdictional waters and/or wetlands were assessed within the review area and determined to be not jurisdictional.
Explain: Upland swale vegetated with upland vegetation

[1] Boxes checked below shall be supported by completing the appropriate sections in Section III below.
[2] For purposes of this form, an RPW is defined as a tributary that is not a TNW and that typically flows year-round or has continuous flow at least "seasonally" (e.g., typically 3 months).
[3] Supporting documentation is presented in Section III.F.

SECTION III: CWA ANALYSIS

F. NON-JURISDICTIONAL WATERS, INCLUDING WETLANDS (CHECK ALL THAT APPLY):

- ☒ If potential wetlands were assessed within the review area, these areas did not meet the criteria in the 1987 Corps of Engineers Wetland Delineation Manual and/or appropriate Regional Supplements.
- ☐ Review area included isolated waters with no substantial nexus to interstate (or foreign) commerce.
  - ☐ Prior to the Jan 2001 Supreme Court decision in "*SWANCC*," the review area would have been regulated based solely on the "Migratory Bird Rule" (MBR).
- ☐ Waters do not meet the "Significant Nexus" standard, where such a finding is required for jurisdiction. Explain: .
- ☒ Other: (explain, if not covered above): No OHWM physical indicators

Provide acreage estimates for non-jurisdictional waters in the review area, where the sole potential basis of jurisdiction is the MBR factors (i.e., presence of migratory birds, presence of endangered species, use of water for irrigated agriculture), using best professional judgment (check all that apply):

- ☐ Non-wetland waters (i.e., rivers, streams): linear feet width (ft).
- ☐ Lakes/ponds: acres.
- ☐ Other non-wetland waters: acres. List type of aquatic resource: .
- ☐ Wetlands: acres.

Provide acreage estimates for non-jurisdictional waters in the review area that do not meet the "Significant Nexus" standard, where such a finding is required for jurisdiction (check all that apply):

- ☐ Non-wetland waters (i.e., rivers, streams): linear feet, width (ft).
- ☐ Lakes/ponds: acres.
- ☐ Other non-wetland waters: acres. List type of aquatic resource: .
- ☐ Wetlands: acres.

SECTION IV: DATA SOURCES.

A. SUPPORTING DATA. Data reviewed for JD (check all that apply - checked items shall be included in case file and, where checked and requested, appropriately reference sources below):

- ☒ Maps, plans, plots or plat submitted by or on behalf of the applicant/consultant: NREL – Environmental and Safety
- ☐ Data sheets prepared/submitted by or on behalf of the applicant/consultant.
  - ☐ Office concurs with data sheets/delineation report.
  - ☐ Office does not concur with data sheets/delineation report.
- ☐ Data sheets prepared by the Corps: .
- ☐ Corps navigable waters' study: .
- ☒ U.S. Geological Survey Hydrologic Atlas: .
  - ☐ USGS NHD data.
  - ☒ USGS 8 and 12 digit HUC maps.
- ☒ U.S. Geological Survey map(s). Cite scale & quad name: 1:24000. Morrison
- ☐ USDA Natural Resources Conservation Service Soil Survey. Citation: .
- ☐ National wetlands inventory map(s). Cite name: .
- ☐ State/Local wetland inventory map(s): .
- ☐ FEMA/FIRM maps: .
- ☐ 100-year Floodplain Elevation is: (National Geodectic Vertical Datum of 1929)
- ☐ Photographs: ☐ Aerial (Name & Date):
  or ☐ Other (Name & Date):
- ☐ Previous determination(s). File no. and date of response letter: .
- ☒ Applicable/supporting case law: Rapanos and Carabell cases.
- ☐ Applicable/supporting scientific literature: .
- ☐ Other information (please specify): .

B. ADDITIONAL COMMENTS TO SUPPORT JD:

2

APPROVED JURISDICTIONAL DETERMINATION FORM
U.S. Army Corps of Engineers

This form should be completed by following the instructions provided in Section IV of the JD Form Instructional Guidebook.

SECTION I: BACKGROUND INFORMATION

A. REPORT COMPLETION DATE FOR APPROVED JURISDICTIONAL DETERMINATION (JD): April 27, 2009

B. DISTRICT OFFICE, FILE NAME, AND NUMBER:
Denver Regulatory Office, National Renewable Energy Laboratory, NWO-2009-1014-DEN

C. PROJECT LOCATION AND BACKGROUND INFORMATION: JeffCo Easement Drainage
State: CO County/parish/borough: Jefferson City: Golden
Center coordinates of site (lat/long in degree decimal format): Lat. 39.74131 N; Long. -104.17376 W
Universal Transverse Mercator:
Name of nearest waterbody: Lena Gulch
Name of nearest Traditional Navigable Water (TNW) into which the aquatic resource flows: NA
Name of watershed or Hydrologic Unit Code (HUC): 10190002
☒ Check if map/diagram of review area and/or potential jurisdictional areas is/are available upon request.
☒ Check if other sites (e.g., offsite mitigation sites, disposal sites, etc…) are associated with this action and are recorded on a different JD form.

D. REVIEW PERFORMED FOR SITE EVALUATION (CHECK ALL THAT APPLY):
☒ Office (Desk) Determination. Date: April 24, 2009
☒ Field Determination. Date(s): April 24, 2009

SECTION II: SUMMARY OF FINDINGS

A. RHA SECTION 10 DETERMINATION OF JURISDICTION.

There Are no "*navigable waters of the U.S.*" within Rivers and Harbors Act (RHA) jurisdiction (as defined by 33 CFR part 329) in the review area. [*Required*]
☐ Waters subject to the ebb and flow of the tide.
☐ Waters are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce.
Explain: .

B. CWA SECTION 404 DETERMINATION OF JURISDICTION.

There Are no "*waters of the U.S.*" within Clean Water Act (CWA) jurisdiction (as defined by 33 CFR part 328) in the review area. [*Required*]

1. **Waters of the U.S.**
   a. **Indicate presence of waters of U.S. in review area (check all that apply):** [1]
      ☐ TNWs, including territorial seas
      ☐ Wetlands adjacent to TNWs
      ☐ Relatively permanent waters[2] (RPWs) that flow directly or indirectly into TNWs
      ☐ Non-RPWs that flow directly or indirectly into TNWs
      ☐ Wetlands directly abutting RPWs that flow directly or indirectly into TNWs
      ☐ Wetlands adjacent to but not directly abutting RPWs that flow directly or indirectly into TNWs
      ☐ Wetlands adjacent to non-RPWs that flow directly or indirectly into TNWs
      ☐ Impoundments of jurisdictional waters
      ☐ Isolated (interstate or intrastate) waters, including isolated wetlands

   b. **Identify (estimate) size of waters of the U.S. in the review area:**
      Non-wetland waters: linear feet: width (ft) and/or acres.
      Wetlands: acres.

   c. **Limits (boundaries) of jurisdiction** based on: Established by OHWM.
      Elevation of established OHWM (if known): .

2. **Non-regulated waters/wetlands (check if applicable):**[3]
   ☒ Potentially jurisdictional waters and/or wetlands were assessed within the review area and determined to be not jurisdictional.
   Explain: Upland swale vegetated with upland vegetation

[1] Boxes checked below shall be supported by completing the appropriate sections in Section III below.
[2] For purposes of this form, an RPW is defined as a tributary that is not a TNW and that typically flows year-round or has continuous flow at least "seasonally" (e.g., typically 3 months).
[3] Supporting documentation is presented in Section III.F.

SECTION III: CWA ANALYSIS

F. NON-JURISDICTIONAL WATERS, INCLUDING WETLANDS (CHECK ALL THAT APPLY):

- ☒ If potential wetlands were assessed within the review area, these areas did not meet the criteria in the 1987 Corps of Engineers Wetland Delineation Manual and/or appropriate Regional Supplements.
- ☐ Review area included isolated waters with no substantial nexus to interstate (or foreign) commerce.
  - ☐ Prior to the Jan 2001 Supreme Court decision in "*SWANCC*," the review area would have been regulated based solely on the "Migratory Bird Rule" (MBR).
- ☐ Waters do not meet the "Significant Nexus" standard, where such a finding is required for jurisdiction. Explain: .
- ☒ Other: (explain, if not covered above): No OHWM physical indicators

Provide acreage estimates for non-jurisdictional waters in the review area, where the sole potential basis of jurisdiction is the MBR factors (i.e., presence of migratory birds, presence of endangered species, use of water for irrigated agriculture), using best professional judgment (check all that apply):

- ☐ Non-wetland waters (i.e., rivers, streams): linear feet width (ft).
- ☐ Lakes/ponds: acres.
- ☐ Other non-wetland waters: acres. List type of aquatic resource: .
- ☐ Wetlands: acres.

Provide acreage estimates for non-jurisdictional waters in the review area that do not meet the "Significant Nexus" standard, where such a finding is required for jurisdiction (check all that apply):

- ☐ Non-wetland waters (i.e., rivers, streams): linear feet, width (ft).
- ☐ Lakes/ponds: acres.
- ☐ Other non-wetland waters: acres. List type of aquatic resource: .
- ☐ Wetlands: acres.

SECTION IV: DATA SOURCES.

A. SUPPORTING DATA. Data reviewed for JD (check all that apply - checked items shall be included in case file and, where checked and requested, appropriately reference sources below):

- ☒ Maps, plans, plots or plat submitted by or on behalf of the applicant/consultant: NREL – Environmental and Safety
- ☐ Data sheets prepared/submitted by or on behalf of the applicant/consultant.
  - ☐ Office concurs with data sheets/delineation report.
  - ☐ Office does not concur with data sheets/delineation report.
- ☐ Data sheets prepared by the Corps: .
- ☐ Corps navigable waters' study: .
- ☒ U.S. Geological Survey Hydrologic Atlas: .
  - ☐ USGS NHD data.
  - ☒ USGS 8 and 12 digit HUC maps.
- ☒ U.S. Geological Survey map(s). Cite scale & quad name: 1:24000. Morrison
- ☐ USDA Natural Resources Conservation Service Soil Survey. Citation: .
- ☐ National wetlands inventory map(s). Cite name: .
- ☐ State/Local wetland inventory map(s): .
- ☐ FEMA/FIRM maps: .
- ☐ 100-year Floodplain Elevation is: (National Geodectic Vertical Datum of 1929)
- ☐ Photographs: ☐ Aerial (Name & Date):
  or ☐ Other (Name & Date):
- ☐ Previous determination(s). File no. and date of response letter: .
- ☒ Applicable/supporting case law: Rapanos and Carabell cases.
- ☐ Applicable/supporting scientific literature: .
- ☐ Other information (please specify): .

B. ADDITIONAL COMMENTS TO SUPPORT JD:

2

APPROVED JURISDICTIONAL DETERMINATION FORM
U.S. Army Corps of Engineers

This form should be completed by following the instructions provided in Section IV of the JD Form Instructional Guidebook.

SECTION I: BACKGROUND INFORMATION

A. REPORT COMPLETION DATE FOR APPROVED JURISDICTIONAL DETERMINATION (JD): April 27, 2009

B. DISTRICT OFFICE, FILE NAME, AND NUMBER:
Denver Regulatory Office, National Renewable Energy Laboratory, NWO-2009-1014-DEN

C. PROJECT LOCATION AND BACKGROUND INFORMATION: East Drainage
State: CO County/parish/borough: Jefferson City: Golden
Center coordinates of site (lat/long in degree decimal format): Lat. 39.74131 N; Long. -104.17376 W
Universal Transverse Mercator:
Name of nearest waterbody: Lena Gulch
Name of nearest Traditional Navigable Water (TNW) into which the aquatic resource flows: NA
Name of watershed or Hydrologic Unit Code (HUC): 10190002
☒ Check if map/diagram of review area and/or potential jurisdictional areas is/are available upon request.
☒ Check if other sites (e.g., offsite mitigation sites, disposal sites, etc…) are associated with this action and are recorded on a different JD form.

D. REVIEW PERFORMED FOR SITE EVALUATION (CHECK ALL THAT APPLY):
☒ Office (Desk) Determination. Date: April 24, 2009
☒ Field Determination. Date(s): April 24, 2009

SECTION II: SUMMARY OF FINDINGS

A. RHA SECTION 10 DETERMINATION OF JURISDICTION.

There Are no "*navigable waters of the U.S.*" within Rivers and Harbors Act (RHA) jurisdiction (as defined by 33 CFR part 329) in the review area. [*Required*]
☐ Waters subject to the ebb and flow of the tide.
☐ Waters are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce.
Explain: .

B. CWA SECTION 404 DETERMINATION OF JURISDICTION.

There Are no "*waters of the U.S.*" within Clean Water Act (CWA) jurisdiction (as defined by 33 CFR part 328) in the review area. [*Required*]

1. Waters of the U.S.

a. Indicate presence of waters of U.S. in review area (check all that apply): [1]
☐ TNWs, including territorial seas
☐ Wetlands adjacent to TNWs
☐ Relatively permanent waters[2] (RPWs) that flow directly or indirectly into TNWs
☐ Non-RPWs that flow directly or indirectly into TNWs
☐ Wetlands directly abutting RPWs that flow directly or indirectly into TNWs
☐ Wetlands adjacent to but not directly abutting RPWs that flow directly or indirectly into TNWs
☐ Wetlands adjacent to non-RPWs that flow directly or indirectly into TNWs
☐ Impoundments of jurisdictional waters
☐ Isolated (interstate or intrastate) waters, including isolated wetlands

b. Identify (estimate) size of waters of the U.S. in the review area:
Non-wetland waters: linear feet: width (ft) and/or acres.
Wetlands: acres.

c. Limits (boundaries) of jurisdiction based on: Established by OHWM
Elevation of established OHWM (if known): .

2. Non-regulated waters/wetlands (check if applicable):[3]
☒ Potentially jurisdictional waters and/or wetlands were assessed within the review area and determined to be not jurisdictional.
Explain: Upland swale vegetated with upland vegetation

[1] Boxes checked below shall be supported by completing the appropriate sections in Section III below.
[2] For purposes of this form, an RPW is defined as a tributary that is not a TNW and that typically flows year-round or has continuous flow at least "seasonally" (e.g., typically 3 months).
[3] Supporting documentation is presented in Section III.F.

SECTION III: CWA ANALYSIS

F. NON-JURISDICTIONAL WATERS, INCLUDING WETLANDS (CHECK ALL THAT APPLY):

- ☒ If potential wetlands were assessed within the review area, these areas did not meet the criteria in the 1987 Corps of Engineers Wetland Delineation Manual and/or appropriate Regional Supplements.
- ☐ Review area included isolated waters with no substantial nexus to interstate (or foreign) commerce.
  - ☐ Prior to the Jan 2001 Supreme Court decision in "*SWANCC*," the review area would have been regulated based solely on the "Migratory Bird Rule" (MBR).
- ☐ Waters do not meet the "Significant Nexus" standard, where such a finding is required for jurisdiction. Explain: .
- ☒ Other: (explain, if not covered above): No OHWM physical indicators.

Provide acreage estimates for non-jurisdictional waters in the review area, where the sole potential basis of jurisdiction is the MBR factors (i.e., presence of migratory birds, presence of endangered species, use of water for irrigated agriculture), using best professional judgment (check all that apply):

- ☐ Non-wetland waters (i.e., rivers, streams): linear feet width (ft).
- ☐ Lakes/ponds: acres.
- ☐ Other non-wetland waters: acres. List type of aquatic resource: .
- ☐ Wetlands: acres.

Provide acreage estimates for non-jurisdictional waters in the review area that do not meet the "Significant Nexus" standard, where such a finding is required for jurisdiction (check all that apply):

- ☐ Non-wetland waters (i.e., rivers, streams): linear feet, width (ft).
- ☐ Lakes/ponds: acres.
- ☐ Other non-wetland waters: acres. List type of aquatic resource: .
- ☐ Wetlands: acres.

SECTION IV: DATA SOURCES.

A. SUPPORTING DATA. Data reviewed for JD (check all that apply - checked items shall be included in case file and, where checked and requested, appropriately reference sources below):

- ☒ Maps, plans, plots or plat submitted by or on behalf of the applicant/consultant: NREL – Environmental and Safety
- ☐ Data sheets prepared/submitted by or on behalf of the applicant/consultant.
  - ☐ Office concurs with data sheets/delineation report.
  - ☐ Office does not concur with data sheets/delineation report.
- ☐ Data sheets prepared by the Corps: .
- ☐ Corps navigable waters' study: .
- ☒ U.S. Geological Survey Hydrologic Atlas: .
  - ☐ USGS NHD data.
  - ☒ USGS 8 and 12 digit HUC maps.
- ☒ U.S. Geological Survey map(s). Cite scale & quad name: 1:24000. Morrison
- ☐ USDA Natural Resources Conservation Service Soil Survey. Citation: .
- ☐ National wetlands inventory map(s). Cite name: .
- ☐ State/Local wetland inventory map(s): .
- ☐ FEMA/FIRM maps: .
- ☐ 100-year Floodplain Elevation is: (National Geodectic Vertical Datum of 1929)
- ☐ Photographs: ☐ Aerial (Name & Date):
  or ☐ Other (Name & Date):
- ☐ Previous determination(s). File no. and date of response letter: .
- ☒ Applicable/supporting case law: Rapanos and Carabell cases.
- ☐ Applicable/supporting scientific literature: .
- ☐ Other information (please specify): .

B. ADDITIONAL COMMENTS TO SUPPORT JD:

2

APPROVED JURISDICTIONAL DETERMINATION FORM
U.S. Army Corps of Engineers

This form should be completed by following the instructions provided in Section IV of the JD Form Instructional Guidebook.

SECTION I: BACKGROUND INFORMATION

A. REPORT COMPLETION DATE FOR APPROVED JURISDICTIONAL DETERMINATION (JD): April 27, 2009

B. DISTRICT OFFICE, FILE NAME, AND NUMBER:
Denver Regulatory Office, National Renewable Energy Laboratory, NWO-2009-1014-DEN

C. PROJECT LOCATION AND BACKGROUND INFORMATION: Middle Drainage
State: CO County/parish/borough: Jefferson City: Golden
Center coordinates of site (lat/long in degree decimal format): Lat. 39.74131 N; Long. -104.17376 W
Universal Transverse Mercator:
Name of nearest waterbody: Lena Gulch
Name of nearest Traditional Navigable Water (TNW) into which the aquatic resource flows: NA
Name of watershed or Hydrologic Unit Code (HUC): 10190002
☒ Check if map/diagram of review area and/or potential jurisdictional areas is/are available upon request.
☒ Check if other sites (e.g., offsite mitigation sites, disposal sites, etc…) are associated with this action and are recorded on a different JD form.

D. REVIEW PERFORMED FOR SITE EVALUATION (CHECK ALL THAT APPLY):
☒ Office (Desk) Determination. Date: April 24, 2009
☒ Field Determination. Date(s): April 24, 2009

SECTION II: SUMMARY OF FINDINGS

A. RHA SECTION 10 DETERMINATION OF JURISDICTION.

There Are no "*navigable waters of the U.S.*" within Rivers and Harbors Act (RHA) jurisdiction (as defined by 33 CFR part 329) in the review area. [*Required*]
☐ Waters subject to the ebb and flow of the tide.
☐ Waters are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce.
Explain:

B. CWA SECTION 404 DETERMINATION OF JURISDICTION.

There Are no "*waters of the U.S.*" within Clean Water Act (CWA) jurisdiction (as defined by 33 CFR part 328) in the review area. [*Required*]

1. **Waters of the U.S.**
   a. **Indicate presence of waters of U.S. in review area (check all that apply):** [1]
      ☐ TNWs, including territorial seas
      ☐ Wetlands adjacent to TNWs
      ☐ Relatively permanent waters[2] (RPWs) that flow directly or indirectly into TNWs
      ☐ Non-RPWs that flow directly or indirectly into TNWs
      ☐ Wetlands directly abutting RPWs that flow directly or indirectly into TNWs
      ☐ Wetlands adjacent to but not directly abutting RPWs that flow directly or indirectly into TNWs
      ☐ Wetlands adjacent to non-RPWs that flow directly or indirectly into TNWs
      ☐ Impoundments of jurisdictional waters
      ☐ Isolated (interstate or intrastate) waters, including isolated wetlands

   b. **Identify (estimate) size of waters of the U.S. in the review area:**
      Non-wetland waters: linear feet: width (ft) and/or acres.
      Wetlands: acres.

   c. **Limits (boundaries) of jurisdiction** based on: Established by OHWM.
      Elevation of established OHWM (if known):

2. **Non-regulated waters/wetlands (check if applicable):**[3]
   ☒ Potentially jurisdictional waters and/or wetlands were assessed within the review area and determined to be not jurisdictional.
   Explain: Upland swale vegetated with upland vegetation

[1] Boxes checked below shall be supported by completing the appropriate sections in Section III below.
[2] For purposes of this form, an RPW is defined as a tributary that is not a TNW and that typically flows year-round or has continuous flow at least "seasonally" (e.g., typically 3 months).
[3] Supporting documentation is presented in Section III.F.

SECTION III: CWA ANALYSIS

F. NON-JURISDICTIONAL WATERS, INCLUDING WETLANDS (CHECK ALL THAT APPLY):

- ☒ If potential wetlands were assessed within the review area, these areas did not meet the criteria in the 1987 Corps of Engineers Wetland Delineation Manual and/or appropriate Regional Supplements.
- ☐ Review area included isolated waters with no substantial nexus to interstate (or foreign) commerce.
  - ☐ Prior to the Jan 2001 Supreme Court decision in "*SWANCC*," the review area would have been regulated based solely on the "Migratory Bird Rule" (MBR).
- ☐ Waters do not meet the "Significant Nexus" standard, where such a finding is required for jurisdiction. Explain: .
- ☒ Other: (explain, if not covered above): No OHWM physical indicators

Provide acreage estimates for non-jurisdictional waters in the review area, where the sole potential basis of jurisdiction is the MBR factors (i.e., presence of migratory birds, presence of endangered species, use of water for irrigated agriculture), using best professional judgment (check all that apply):

- ☐ Non-wetland waters (i.e., rivers, streams): linear feet width (ft).
- ☐ Lakes/ponds: acres.
- ☐ Other non-wetland waters: acres. List type of aquatic resource: .
- ☐ Wetlands: acres.

Provide acreage estimates for non-jurisdictional waters in the review area that do not meet the "Significant Nexus" standard, where such a finding is required for jurisdiction (check all that apply):

- ☐ Non-wetland waters (i.e., rivers, streams): linear feet, width (ft).
- ☐ Lakes/ponds: acres.
- ☐ Other non-wetland waters: acres. List type of aquatic resource: .
- ☐ Wetlands: acres.

SECTION IV: DATA SOURCES.

A. SUPPORTING DATA. Data reviewed for JD (check all that apply - checked items shall be included in case file and, where checked and requested, appropriately reference sources below):

- ☒ Maps, plans, plots or plat submitted by or on behalf of the applicant/consultant: NREL – Environmental and Safety
- ☐ Data sheets prepared/submitted by or on behalf of the applicant/consultant.
  - ☐ Office concurs with data sheets/delineation report.
  - ☐ Office does not concur with data sheets/delineation report.
- ☐ Data sheets prepared by the Corps: .
- ☐ Corps navigable waters' study: .
- ☒ U.S. Geological Survey Hydrologic Atlas: .
  - ☐ USGS NHD data.
  - ☒ USGS 8 and 12 digit HUC maps.
- ☒ U.S. Geological Survey map(s). Cite scale & quad name: 1:24000. Morrison
- ☐ USDA Natural Resources Conservation Service Soil Survey. Citation: .
- ☐ National wetlands inventory map(s). Cite name: .
- ☐ State/Local wetland inventory map(s): .
- ☐ FEMA/FIRM maps: .
- ☐ 100-year Floodplain Elevation is: (National Geodectic Vertical Datum of 1929)
- ☐ Photographs: ☐ Aerial (Name & Date):
  or ☐ Other (Name & Date):
- ☐ Previous determination(s). File no. and date of response letter: .
- ☒ Applicable/supporting case law: Rapanos and Carabell cases.
- ☐ Applicable/supporting scientific literature: .
- ☐ Other information (please specify): .

B. ADDITIONAL COMMENTS TO SUPPORT JD:

2

APPROVED JURISDICTIONAL DETERMINATION FORM
U.S. Army Corps of Engineers

This form should be completed by following the instructions provided in Section IV of the JD Form Instructional Guidebook.

SECTION I: BACKGROUND INFORMATION

A. REPORT COMPLETION DATE FOR APPROVED JURISDICTIONAL DETERMINATION (JD): April 27, 2009

B. DISTRICT OFFICE, FILE NAME, AND NUMBER:
Denver Regulatory Office, National Renewable Energy Laboratory, NWO-2009-1014-DEN

C. PROJECT LOCATION AND BACKGROUND INFORMATION: Middle West Drainage
State: CO County/parish/borough: Jefferson City: Golden
Center coordinates of site (lat/long in degree decimal format): Lat. 39.74131 N; Long. -104.17376 W
Universal Transverse Mercator:
Name of nearest waterbody: Lena Gulch
Name of nearest Traditional Navigable Water (TNW) into which the aquatic resource flows: NA
Name of watershed or Hydrologic Unit Code (HUC): 10190002
☒ Check if map/diagram of review area and/or potential jurisdictional areas is/are available upon request.
☒ Check if other sites (e.g., offsite mitigation sites, disposal sites, etc…) are associated with this action and are recorded on a different JD form.

D. REVIEW PERFORMED FOR SITE EVALUATION (CHECK ALL THAT APPLY):
☒ Office (Desk) Determination. Date: April 24, 2009
☒ Field Determination. Date(s): April 24, 2009

SECTION II: SUMMARY OF FINDINGS

A. RHA SECTION 10 DETERMINATION OF JURISDICTION.

There Are no "*navigable waters of the U.S.*" within Rivers and Harbors Act (RHA) jurisdiction (as defined by 33 CFR part 329) in the review area. [*Required*]
☐ Waters subject to the ebb and flow of the tide.
☐ Waters are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce.
Explain: .

B. CWA SECTION 404 DETERMINATION OF JURISDICTION.

There Are no "*waters of the U.S.*" within Clean Water Act (CWA) jurisdiction (as defined by 33 CFR part 328) in the review area. [*Required*]

1. Waters of the U.S.

a. Indicate presence of waters of U.S. in review area (check all that apply): [1]
☐ TNWs, including territorial seas
☐ Wetlands adjacent to TNWs
☐ Relatively permanent waters[2] (RPWs) that flow directly or indirectly into TNWs
☐ Non-RPWs that flow directly or indirectly into TNWs
☐ Wetlands directly abutting RPWs that flow directly or indirectly into TNWs
☐ Wetlands adjacent to but not directly abutting RPWs that flow directly or indirectly into TNWs
☐ Wetlands adjacent to non-RPWs that flow directly or indirectly into TNWs
☐ Impoundments of jurisdictional waters
☐ Isolated (interstate or intrastate) waters, including isolated wetlands

b. Identify (estimate) size of waters of the U.S. in the review area:
Non-wetland waters: linear feet: width (ft) and/or acres.
Wetlands: acres.

c. Limits (boundaries) of jurisdiction based on: Established by OHWM.
Elevation of established OHWM (if known): .

2. Non-regulated waters/wetlands (check if applicable):[3]
☒ Potentially jurisdictional waters and/or wetlands were assessed within the review area and determined to be not jurisdictional.
Explain: Upland swale vegetated with upland vegetation

[1] Boxes checked below shall be supported by completing the appropriate sections in Section III below.
[2] For purposes of this form, an RPW is defined as a tributary that is not a TNW and that typically flows year-round or has continuous flow at least "seasonally" (e.g., typically 3 months).
[3] Supporting documentation is presented in Section III.F.

SECTION III: CWA ANALYSIS

F. NON-JURISDICTIONAL WATERS, INCLUDING WETLANDS (CHECK ALL THAT APPLY):

- ☒ If potential wetlands were assessed within the review area, these areas did not meet the criteria in the 1987 Corps of Engineers Wetland Delineation Manual and/or appropriate Regional Supplements.
- ☐ Review area included isolated waters with no substantial nexus to interstate (or foreign) commerce.
  - ☐ Prior to the Jan 2001 Supreme Court decision in "*SWANCC*," the review area would have been regulated based solely on the "Migratory Bird Rule" (MBR).
- ☐ Waters do not meet the "Significant Nexus" standard, where such a finding is required for jurisdiction. Explain: .
- ☒ Other: (explain, if not covered above): No OHWM physical indicators

Provide acreage estimates for non-jurisdictional waters in the review area, where the sole potential basis of jurisdiction is the MBR factors (i.e., presence of migratory birds, presence of endangered species, use of water for irrigated agriculture), using best professional judgment (check all that apply):

- ☐ Non-wetland waters (i.e., rivers, streams): linear feet width (ft).
- ☐ Lakes/ponds: acres.
- ☐ Other non-wetland waters: acres. List type of aquatic resource: .
- ☐ Wetlands: acres.

Provide acreage estimates for non-jurisdictional waters in the review area that do not meet the "Significant Nexus" standard, where such a finding is required for jurisdiction (check all that apply):

- ☐ Non-wetland waters (i.e., rivers, streams): linear feet, width (ft).
- ☐ Lakes/ponds: acres.
- ☐ Other non-wetland waters: acres. List type of aquatic resource: .
- ☐ Wetlands: acres.

SECTION IV: DATA SOURCES.

A. SUPPORTING DATA. Data reviewed for JD (check all that apply - checked items shall be included in case file and, where checked and requested, appropriately reference sources below):

- ☒ Maps, plans, plots or plat submitted by or on behalf of the applicant/consultant: NREL – Environmental and Safety
- ☐ Data sheets prepared/submitted by or on behalf of the applicant/consultant.
  - ☐ Office concurs with data sheets/delineation report.
  - ☐ Office does not concur with data sheets/delineation report.
- ☐ Data sheets prepared by the Corps: .
- ☐ Corps navigable waters' study: .
- ☒ U.S. Geological Survey Hydrologic Atlas: .
  - ☐ USGS NHD data.
  - ☒ USGS 8 and 12 digit HUC maps.
- ☒ U.S. Geological Survey map(s). Cite scale & quad name: 1:24000, Morrison
- ☐ USDA Natural Resources Conservation Service Soil Survey. Citation: .
- ☐ National wetlands inventory map(s). Cite name: .
- ☐ State/Local wetland inventory map(s): .
- ☐ FEMA/FIRM maps: .
- ☐ 100-year Floodplain Elevation is: (National Geodectic Vertical Datum of 1929)
- ☐ Photographs: ☐ Aerial (Name & Date):
  or ☐ Other (Name & Date):
- ☐ Previous determination(s). File no. and date of response letter: .
- ☒ Applicable/supporting case law: Rapanos and Carabell cases.
- ☐ Applicable/supporting scientific literature: .
- ☐ Other information (please specify): .

B. ADDITIONAL COMMENTS TO SUPPORT JD:

2

APPROVED JURISDICTIONAL DETERMINATION FORM
U.S. Army Corps of Engineers

This form should be completed by following the instructions provided in Section IV of the JD Form Instructional Guidebook.

SECTION I: BACKGROUND INFORMATION

A. REPORT COMPLETION DATE FOR APPROVED JURISDICTIONAL DETERMINATION (JD): April 27, 2009

B. DISTRICT OFFICE, FILE NAME, AND NUMBER:
Denver Regulatory Office, National Renewable Energy Laboratory, NWO-2009-1014-DEN

C. PROJECT LOCATION AND BACKGROUND INFORMATION: Road Side Drainages and Trickle Channel Drainages
State: CO County/parish/borough: Jefferson City: Golden
Center coordinates of site (lat/long in degree decimal format): Lat. 39.74131 N; Long. -104.17376 W
Universal Transverse Mercator:
Name of nearest waterbody: Lena Gulch
Name of nearest Traditional Navigable Water (TNW) into which the aquatic resource flows: NA
Name of watershed or Hydrologic Unit Code (HUC): 10190002
☒ Check if map/diagram of review area and/or potential jurisdictional areas is/are available upon request.
☒ Check if other sites (e.g., offsite mitigation sites, disposal sites, etc…) are associated with this action and are recorded on a different JD form.

D. REVIEW PERFORMED FOR SITE EVALUATION (CHECK ALL THAT APPLY):
☒ Office (Desk) Determination. Date: April 24, 2009
☒ Field Determination. Date(s): April 24, 2009

SECTION II: SUMMARY OF FINDINGS

A. RHA SECTION 10 DETERMINATION OF JURISDICTION.

There Are no "*navigable waters of the U.S.*" within Rivers and Harbors Act (RHA) jurisdiction (as defined by 33 CFR part 329) in the review area. [*Required*]
☐ Waters subject to the ebb and flow of the tide.
☐ Waters are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce.
Explain: .

B. CWA SECTION 404 DETERMINATION OF JURISDICTION.

There Are no "*waters of the U.S.*" within Clean Water Act (CWA) jurisdiction (as defined by 33 CFR part 328) in the review area. [*Required*]

1. Waters of the U.S.

a. Indicate presence of waters of U.S. in review area (check all that apply): [1]
☐ TNWs, including territorial seas
☐ Wetlands adjacent to TNWs
☐ Relatively permanent waters[2] (RPWs) that flow directly or indirectly into TNWs
☐ Non-RPWs that flow directly or indirectly into TNWs
☐ Wetlands directly abutting RPWs that flow directly or indirectly into TNWs
☐ Wetlands adjacent to but not directly abutting RPWs that flow directly or indirectly into TNWs
☐ Wetlands adjacent to non-RPWs that flow directly or indirectly into TNWs
☐ Impoundments of jurisdictional waters
☐ Isolated (interstate or intrastate) waters, including isolated wetlands

b. Identify (estimate) size of waters of the U.S. in the review area:
Non-wetland waters: linear feet: width (ft) and/or acres.
Wetlands: acres.

c. Limits (boundaries) of jurisdiction based on: Established by OHWM.
Elevation of established OHWM (if known): .

2. Non-regulated waters/wetlands (check if applicable):[3]
☒ Potentially jurisdictional waters and/or wetlands were assessed within the review area and determined to be not jurisdictional.
Explain: Upland swale vegetated with upland vegetation

[1] Boxes checked below shall be supported by completing the appropriate sections in Section III below.
[2] For purposes of this form, an RPW is defined as a tributary that is not a TNW and that typically flows year-round or has continuous flow at least "seasonally" (e.g., typically 3 months).
[3] Supporting documentation is presented in Section III.F.

SECTION III: CWA ANALYSIS

F. NON-JURISDICTIONAL WATERS, INCLUDING WETLANDS (CHECK ALL THAT APPLY):

- ☒ If potential wetlands were assessed within the review area, these areas did not meet the criteria in the 1987 Corps of Engineers Wetland Delineation Manual and/or appropriate Regional Supplements.
- ☐ Review area included isolated waters with no substantial nexus to interstate (or foreign) commerce.
  - ☐ Prior to the Jan 2001 Supreme Court decision in "*SWANCC*," the review area would have been regulated based solely on the "Migratory Bird Rule" (MBR).
- ☐ Waters do not meet the "Significant Nexus" standard, where such a finding is required for jurisdiction. Explain: .
- ☒ Other: (explain, if not covered above): No OHWM physical indicators

Provide acreage estimates for non-jurisdictional waters in the review area, where the sole potential basis of jurisdiction is the MBR factors (i.e., presence of migratory birds, presence of endangered species, use of water for irrigated agriculture), using best professional judgment (check all that apply):

- ☐ Non-wetland waters (i.e., rivers, streams): linear feet width (ft).
- ☐ Lakes/ponds: acres.
- ☐ Other non-wetland waters: acres. List type of aquatic resource: .
- ☐ Wetlands: acres.

Provide acreage estimates for non-jurisdictional waters in the review area that do not meet the "Significant Nexus" standard, where such a finding is required for jurisdiction (check all that apply):

- ☐ Non-wetland waters (i.e., rivers, streams): linear feet, width (ft).
- ☐ Lakes/ponds: acres.
- ☐ Other non-wetland waters: acres. List type of aquatic resource: .
- ☐ Wetlands: acres.

SECTION IV: DATA SOURCES.

A. SUPPORTING DATA. Data reviewed for JD (check all that apply - checked items shall be included in case file and, where checked and requested, appropriately reference sources below):

- ☒ Maps, plans, plots or plat submitted by or on behalf of the applicant/consultant: NREL – Environmental and Safety
- ☐ Data sheets prepared/submitted by or on behalf of the applicant/consultant.
  - ☐ Office concurs with data sheets/delineation report.
  - ☐ Office does not concur with data sheets/delineation report.
- ☐ Data sheets prepared by the Corps: .
- ☐ Corps navigable waters' study: .
- ☒ U.S. Geological Survey Hydrologic Atlas: .
  - ☐ USGS NHD data.
  - ☒ USGS 8 and 12 digit HUC maps.
- ☒ U.S. Geological Survey map(s). Cite scale & quad name: 1:24000. Morrison
- ☐ USDA Natural Resources Conservation Service Soil Survey. Citation: .
- ☐ National wetlands inventory map(s). Cite name: .
- ☐ State/Local wetland inventory map(s): .
- ☐ FEMA/FIRM maps: .
- ☐ 100-year Floodplain Elevation is: (National Geodectic Vertical Datum of 1929)
- ☐ Photographs: ☐ Aerial (Name & Date):
  or ☐ Other (Name & Date):
- ☐ Previous determination(s). File no. and date of response letter: .
- ☒ Applicable/supporting case law: Rapanos and Carabell cases.
- ☐ Applicable/supporting scientific literature: .
- ☐ Other information (please specify): .

B. ADDITIONAL COMMENTS TO SUPPORT JD:

2

Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3305

07 August 2009

Ms. Susan Linner
U.S. Fish and Wildlife Service
Ecological Services
Colorado Field Office
P.O. Box 25486, DFC (MS 65412)
Denver, Colorado 80225-0486

SUBJECT: PREBLES MEADOW JUMPING MOUSE HABITAT ASSESSMENT AT LENA GULCH

In compliance with the U.S. Fish and Wildlife Service Preble's Meadow Jumping Mouse Survey Guidelines, Revised April 2004, we have conducted a habitat assessment along Lena Gulch in documenting baseline conditions for conducting a supplemental environmental assessment for NREL's South Table Mountain (STM) Campus.

The US Department of Energy (DOE) is currently preparing an Environmental Assessment (EA) Supplement for five proposed Site Development Projects at the National Renewable Energy Laboratory's STM site: 1) Energy Systems Integration Facility (ESIF), 2) expansion of campus infrastructure, 3) Waste Handling Facility (WHF) expansion, 4) Visitor's Center expansion, and 5) the addition of a second full service access road (secondary access) to STM. The attached habitat assessment for the Preble's mouse is needed to determine baseline conditions for the secondary access portion of the EA and represents an effort by DOE to afford the U.S. Fish and Wildlife Service an opportunity to be involved early in project planning. This habitat assessment determines the potential for affecting the Preble's mouse, a federally protected species in Colorado.

Please review the attached report, prepared by Thomas Ryon (Federal Permit No. TE081867-0) of our NREL staff and provide a response at your earliest convenience. We understand that the U.S. Fish and Wildlife Service has 30 days to respond to such reports and are planning our EA schedule accordingly.

DOE plans to complete a draft EA for Public Review by September 2009. Beyond your response to this report, we welcome your input throughout the NEPA process.

Sincerely,

Kristin Kerwin

for Steve Blazek, NEPA Compliance Officer

National Renewable Energy Laboratory
Innovation for Our Energy Future

August 3, 2009

Ms. Susan Linner
U.S. Fish and Wildlife Service
Ecological Services
Colorado Field Office
P.O. Box 25486, DFC (MS 65412)
Denver, Colorado 80225-0486

RE: LENA GULCH ROAD CROSSING – GOLDEN, COLOROADO

Dear Ms. Linner,

On July 20. 2009, I conducted a site visit of the proposed **Lena Gulch Road Crossing** study area to assess the potential for the development of a road crossing over Lena Gulch to affect Preble's meadow jumping mouse (Preble's mouse) habitat. The National Renewable Energy Lab is considering a second full service access road from South Golden Road to the South Table Mountain (STM) Complex to accommodate future growth at the facility. The road would likely cross Lena Gulch to create a southern route for STM access. Figure 1 presents the project area.

The US Department of Energy (DOE) is currently preparing an Environmental Assessment (EA) Supplement for five proposed Site Development Projects at the National Renewable Energy Laboratory's STM site: 1) Energy Systems Integration Facility (ESIF), 2) expansion of campus infrastructure, 3) Waste Handling Facility (WHF) expansion, 4) Visitor's Center expansion, and 5) the addition of a second full service access road (secondary access) to STM. This habitat assessment for the Preble's mouse is needed to determine baseline conditions for the secondary access portion of the EA and represents an effort by DOE to afford the U.S. Fish and Wildlife Service an opportunity to be involved early in project planning. This habitat assessment determines the potential for affecting the Preble's mouse, a federally protected species in Colorado.

Project Location

The project location is north of I-70 and west of Denver West Parkway on a portion of the former Camp George West National Guard facility in Jefferson County. The land within the project area includes private land and land currently owned by Jefferson County Open Space and leased by the Pleasant View Metropolitan District (T04S, R70W, SEC 01, NE1/4 – Morrison Quadrangle-Figure 1). The UTM coordinates (NAD83) representing the upstream and downstream extents of the project area under consideration are upstream: Zone 13, 4398241mN, 484740mE; downstream: Zone 13, 4398582mN and 485724mE. Adjacent properties include the Pleasant View Subdivision to the west, NREL to the north, the Colorado State Patrol Academy and correctional facility to the south, and the Richards Heights subdivision and a larger private parcel to the east. Access to the site is from South Golden Road and Kilmer Street.

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Vegetation and Habitat

Lena Gulch originates in the foothills in the Apex Park Open Space west of the Heritage Square Amusement Park. The gulch continues east and is often conveyed in concrete canals through the Golden area. Lena Gulch becomes forested as it crosses South Golden Road with typical tree species of riparian areas in eastern Colorado. After crossing two private parcels, Lena Gulch crosses into the Pleasant View Community Park and this reach extends through the park for approximately ½ mile. Once the drainageway crosses back into private land, it again becomes channelized and adjacent land use encroaches as Lena Gulch crosses through urban and suburban landscapes until it reaches its confluence with Clear Creek near the intersection of 44th Avenue and Kipling Street.

Common trees along this reach within Pleasant View Community Park include plains cottonwood (*Populus deltoides*), peachleaf willow (*Salix amygdaloides*), Russian olive (*Elaeagnus angustifolia*), green ash (*Fraxinus pennsylvanica*), and Siberian elm (*Ulmus pumila*) (Photo 1). Shrubs are localized along the riparian zone and include chokecherry (*Prunus virginiana*), wild plum (*Prunus americana*), and red hawthorn (*Crataegus erythropoda*). Only one small area along Lena Gulch, supports sandbar willow (*Salix exigua*). Understory vegetation consists mostly of grasses including smooth brome (*Bromus inermis*), reed canarygrass (*Phalaris arundinacea*), and tall fescue (*Schedonorus phoenix*) (Photo 2).

Upland vegetation includes grasses and a dominance of weedy herbs. Dominant plants include western wheat grass (*Pascopyrum smithii*), crested wheat grass (*Agropyron cristatum*), smooth brome, cheatgrass (*Bromus tectorum*), and fringe sage (Artemisia ludoviciana).

Remnant drainageways remain, north of Lena Gulch and a patch (about ¼ acre) of sandbar willow remains along one of the larger drainageways (Photo 3). These drainageways were more evident before Pleasant View Metro District began re-engineering of the drainage patterns across the site. Also, the entire site was likely disturbed and reworked during operations of Camp Georg West and during decommissioning.

Lena Gulch has an incised channel (Photo 4) throughout this reach and overbank flooding appears limited to a few locations. Recently, the Pleasant View Metro District has created a side channel to the south of the natural drainage for wetland mitigation and flood storage (Photo 5). This area was excavated and lined with rip-rap and is now supporting robust cattail (*Typha latifolia*) stands and diverse wetland vegetation upgradient from the cattails.

History of Trapping and Habitat Assessments in the General Area

Lena Gulch at the Camp George West site was trapped previously (Kane 1999). No Preble's mice were captured during this trapping effort. An interesting observation from this report and an ecological report (Anderson 1999) was the reporting of willows and other shrubs in the understory of the riparian zone. Currently, the riparian area supports only one small patch of sandbar willow and a larger patch off-channel. These past reports seem to indicate that shrubs was much more widespread 10 years ago.

Once Lena Gulch passes under Interstate 70 near Denver West Parkway, it enters the Denver Urban Drainage Block Clearance Area. Considering past trapping and the Lena Gulch drainageway, the riparian area found within this study area is isolated and does not support Preble's mouse habitat given the history of the area and the continued human presence and disturbance the site has experienced. Additionally, succession or stream processes (i.e., increased channel down-cutting) have eliminated riparian shrub communities once present at the site.

Recommendations

Given the past trapping results, the history of the site, and the relative isolation of this site in a surrounding urban/suburban landscape, it seems very unlikely that Lena Gulch supports a population of Preble's mice. Any impacts from the development of a road and associated creek crossing would not impact the Preble's mouse. Therefore, I recommend that this area be disqualified as habitat for the Preble's mouse. It may also be appropriate to incorporate this area of Lena Gulch into the Denver Urban Drainage Block Clearance Area.

I ask that you provide written concurrence to this habitat assessment if you agree with the disqualification. If you have further questions or concerns regarding this assessment, please contact me.

Sincerely,

Thomas Ryon

Thomas Ryon, Wildlife Biologist

Cc: Tom Anderson – Battelle
Steve Blazek – DOE, Golden Field Office
John Eickhoff – EHS, NREL

References

Anderson & Company. 1999. Preble's mouse trapping at Camp George West park site. Prepared for Pleasantview Metropolitan District and The Norris Dullea Company. July. 10+ photos and appendix.

Kane, D. 1999. Preble's mouse trapping at Camp George West park site. Prepared for Pleasantview Metropolitan District and The Norris Dullea Company. September. 11 pp+ photos and appendix.

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Photo 1. Riparian forest gallery line Lena Gulch.

Photo 2. Understory along Lena Gulch is primarily grasses.

Photo 3. An isolated patch of willow shrubs found north of Lena Gulch. Lena Gulch is in the background of this photo with the willow patch in the mid-ground.

Photo 4. Lena Gulch is incised for most of its length through the Pleasant View Park.

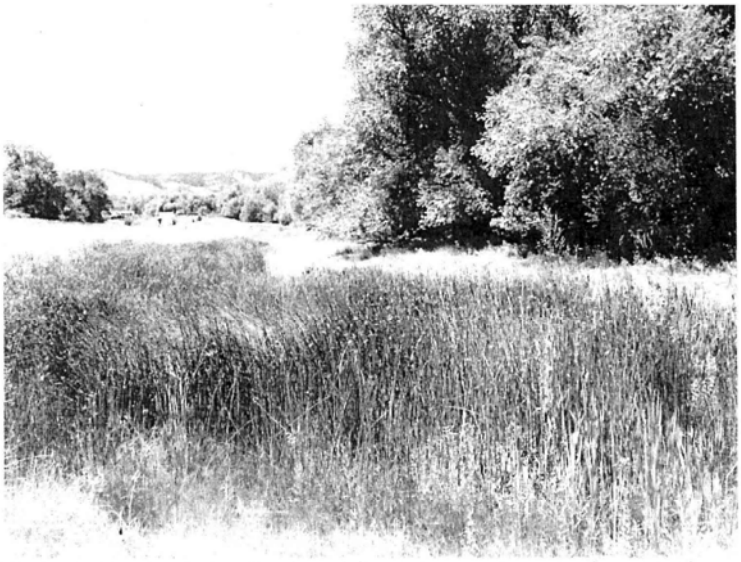


Photo 5. Constructed wetlands and flood storage channel adjacent to the south bank of Lena Gulch.

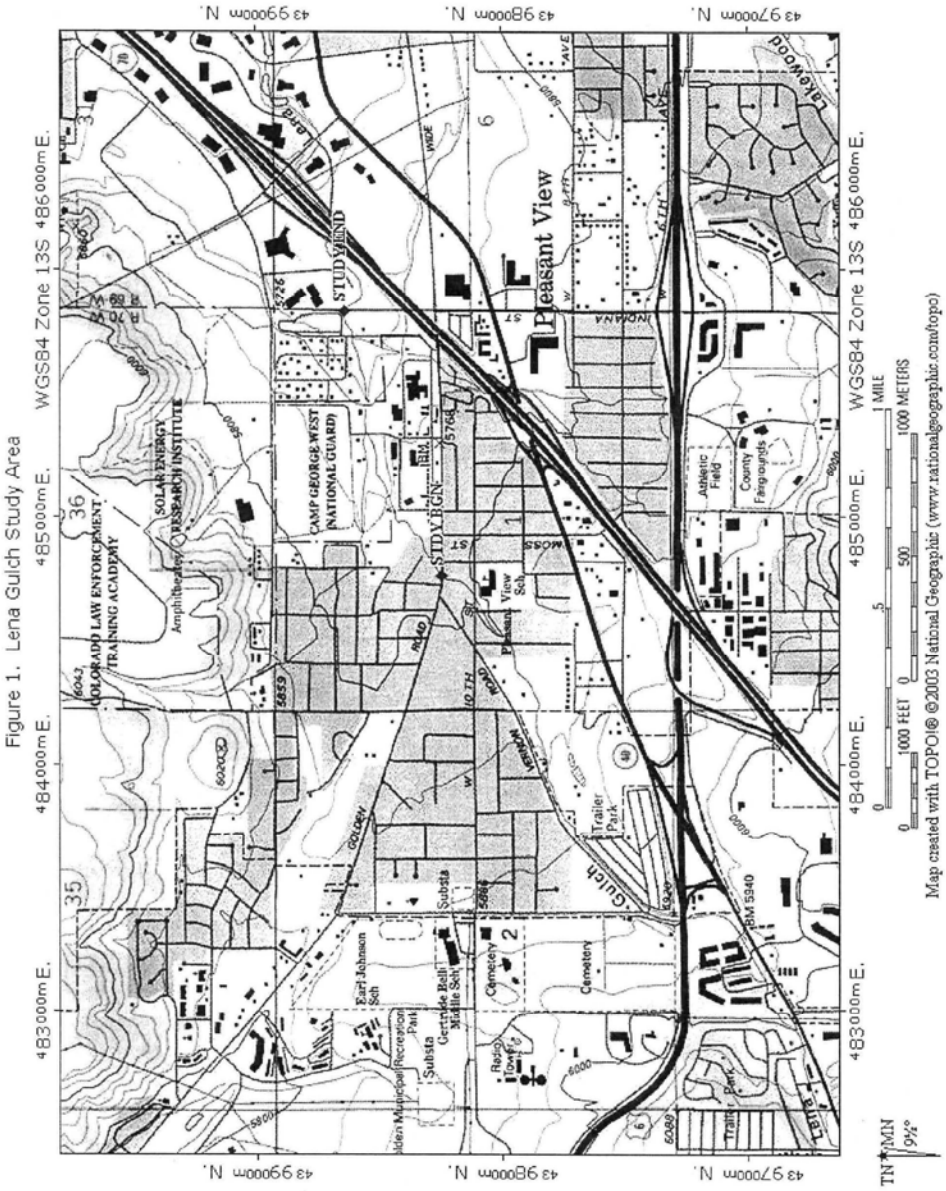


Figure 1. Lena Gulch Study Area

U.S. Fish & Wildlife Service

Colorado Field Office

Preble's Meadow Jumping Mouse

Survey Field Data Compilation Form

Preble's Meadow Jumping Mouse, *Zapus hudsonius preblei*

2005 Survey Field Data Compilation Form

☐ TRAPPING SURVEY ☒ EVALUATED, NOT TRAPPED

Fill out both sections 1 and 2 if trapping survey, fill out section 1 only if habitat evaluation (ie. not trapped). Compilation forms needed for updated habitat evaluations and site disqualification requests.

SECTION 1

Surveyor:

Date of Site/Habitat Assessment 20 July 2009

Organization/Company National Renewable Energy Laboratory

Full Name(s) Tom Ryon

Location:

Project Name (if applicable) Environmental Assessment of the Southern Access Route from the NREL South Table Mesa Campus.

Project Description (nearby road intersection, type of impact, etc.) South Golden Road and considering several potential intersections but only one will be chosen. Included are Quaker Street, Moss Street, McIntyre Street, Kilmer Street, and Isabella Street. Project will likely be a road crossing of Lena Gulch.

U.S.G.S. Quad Name Morrison County Jefferson Elevation 5,810 to 5730 feet

Township(s) 4S Range(s) 70W Section(s) 1

¼¼ Section(s) NE

UTM Coordinates, Zone 13 Northing 484740 to 485724m Easting 4398241 to 4398582m

UTM Coordinate Datum NAD27 ☐ NAD83 ☒

Directions to Location I-70 to West Colfax Blvd. South on Colfax to South Golden Road. North on South Golden Road to Isabell to bridge crossing over Lena Gulch. Travel upstream on foot to where Lena Gulch goes under South Golden Road.

Land Ownership Jefferson County Open Space – Leased by Pleasant View Metro District

Habitat:

General Habitat Description : Riparian mixed gallery forest including Plains Cottonwood and Peachleaf Willow surrounded by grasslands and upland swales

Dominant Overstory Plant Community: mixed riparian forest of cottonwood and non native tree species including plains cottonwood, peachleaf willow, Russian olive, green ash, and Siberian elm.

Dominant Understory Plant: Community grass and minor herb component. Nearly completely lacking a shrub component.

Current Land Use open space

Drainage Name: Lena Gulch Type: Perennial Stream XXXXX

Ephemeral Stream _____ Pond/Lake _____ Ditch _____ Other _____

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
Colorado Field Office
P.O. Box 25486, DFC (65412)
Denver, Colorado 80225-0486

IN REPLY REFER TO:
ES/CO: T&E/PMJM/other
65412-2009-I-0553

AUG 2 0 2009

Steve Blazek
Department of Energy, Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3305

Dear Mr. Blazek:

We are responding to your letter of August 07, 2009, requesting site disqualification under the authority conferred to the U.S. Fish and Wildlife Service (Service) by the Endangered Species Act of 1973 (ESA), as amended (16 U.S.C. 1531 *et seq.*). The Service has reviewed the Preble's meadow jumping mouse, *Zapus hudsonius preblei* (Preble's), habitat assessment report for proposed Department of Energy's proposed **Lena Gulch Road Crossing** in Jefferson County, Colorado (Section 1, Township 4 South, Range 70 West).

Based on the information provided, the Service finds the report acceptable and agrees that a population of Preble's is not likely to be present within the subject area. The Service concludes that the proposed crossing should not have direct adverse effects on Preble's or Preble's habitat. Thus, this site is disqualified for consideration under provisions of the ESA.

Please note that this clearance is valid for one year from the date of this letter. Should additional information regarding listed or proposed species become available, this determination may be reconsidered under the ESA. If the proposed project has not commenced within one year, please contact the Colorado Field Office to request a clearance extension.

If we can be of further assistance, please contact Peter Plage of my staff at (303) 236-4750.

Sincerely,

Susan C. Linner
Colorado Field Supervisor

pc: Plage

PPlage:PMJMSurvey\2009.11:0822 09

Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3305

August 11, 2009

Mr. Edward Nichols
State Historic Preservation Officer
Colorado Historical Society
1300 Broadway
Denver, Co 80203
(303) 866-3355

Dear Mr. Nichols:

SUBJECT: CURRENT STATUS OF U.S. DEPARTMENT OF ENERGY NEW SECOND FULL ACCESS ROAD TO THE NATIONAL RENEWABLE ENERGY LABORATORY'S SOUTH TABLE MOUNTAIN SITE (DOE/EA1440S-II)

The purpose of this letter is to provide you with updated information regarding the U.S. Department of Energy's (DOE) plan to evaluate alternative corridors for a potential new access road into the National Renewable Energy Laboratory (NREL) South Table Mountain Site (STM) site. Since our last correspondence, in the winter of 2008, DOE has worked with other Federal (US Fish & Wildlife, Army Corps of Engineers), State (Colorado Department of Transportation, Colorado Natural Heritage Office), and local agencies (Jefferson County, Lakewood, Golden, Pleasant View Metro) and private land owners to characterize the alternative corridors available to DOE for a new site entrance. Through this process we have modified the corridors under consideration and added Quaker Street to the range of alternatives under consideration, which are shown on Figures A-1 and A-2 in Appendix A.

We met recently with Ms. Amy Pallante and Ms. Sarah Rothwell from your office and obtained new information about historic resources in the vicinity of our corridors. For your information, we have included summary information and photographs regarding the resources within Camp George West that could be affected (Appendix A), and have provided the information made available from the data base search provided by Ms. Rothwell for the other resources shown on Figures A-1 and A-2 (Appendix B). Additionally, we must advise that the Golden Gun Club Clubhouse, a non contributing resource #104 in the National Register Forms prepared by the Simmons of Front Range Associates in September 1992, was destroyed in an arson fire the weekend of July 25-26, 2009.

Since our last correspondence, our traffic engineers have further reviewed Kilmer Street under corridor D and reversed our previous determination that this alternative could be implemented without widening the current roadway. Thus, resources along this route could be disturbed if this alternative is selected, and analysis of this impact will be included in the EA.

As we discussed in our meeting with Ms. Pallante, if a Finding of No Significant Impact (FONSI) results from the Environmental Assessment (EA), we plan to select a corridor from the alternatives based on the analyses provided in the EA. Subsequent to the selection of a corridor, DOE and NREL would evaluate specific routes within the selected corridor. At that time we anticipate further consultations with your office and other parties regarding the Area of Potential Effects (APE) and the potential for adverse effects on historic properties under Section 106 of the National Historic Preservation Act (Section 106) before finalizing a route. At this stage of decision-making, the EA will consider the areas shaded on Figures A-1 and A-2 for each corridor our APE.

If your records indicate that there may be additional resources within these corridors that are not shown on the figures or included in the Appendices, please include the identification of any such resources in your response to this letter. Additionally, if you have specific concerns at this time over the use of any of the alternative corridors please advise, so that we may take your input into consideration in our analyses in the EA.

DOE appreciates your participation in this process and will work closely with you and your staff as we comply with Section 106 of the National Historic Preservation Act and with the Advisory Council on Historic Preservation regulations.

We look forward to further consultations on this project.
Please contact me at (303) 275-4723 for additional information.

Sincerely,

Kristin Kerwin

for Steve Blazek
NEPA Compliance Officer

Enclosure:
Appendix A - Resources Summary for the Camp George West Historic District
Appendix B - Inventory of Cultural Resources

APPENDIX A
RESOURCES SUMMARY FOR THE CAMP GEORGE WEST HISTORIC DISTRICT

Camp George West is a Colorado Army National Guard installation located in central Jefferson County, Colorado, approximately 3 miles east of the City of Golden and 10 miles west of downtown Denver. The facility is situated in an unincorporated area known as Pleasant View, with the City of Golden to the west and the City of Lakewood to the east.

Camp George West Historic District was listed on the National Register of Historic Places (NRHP) in 1993 (NRHP 2008). This appendix discusses the district's location and setting, background, and historic significance, then describes the resources within the district boundaries that could be affected if a South Entrance were built.[1]

Glossary of NRHP terms used in this appendix

Site: the location of a significant event, a prehistoric or historic occupation or activity, or a building or structure, whether standing, ruined, or vanished, where the location itself possesses historic, cultural, or archeological value regardless of the value of any existing structure

District: a significant concentration, linkage, or continuity of sites, buildings, structures, or objects united historically or aesthetically by plan or physical development

Building: a resource created principally to shelter any form of human activity, such as a house

Structure: a functional construction made for purposes other than creating shelter, such as a bridge

Object: a construction primarily artistic in nature or relatively small in scale and simply constructed, such as a statue or milepost

Source: National Park Service: http://www.nps.gov/history/nr/publications/bulletins/nrb16a/nrb16a_appendix_IV.htm

Location and Setting

The geographic setting and location of the Camp George West site has strongly influenced its development and architecture. The site is located at the edge of the foothills of the Rocky Mountains and encompasses part of South Table Mountain. Lena Gulch and unnamed tributaries flow from west to east through the camp, and dry washes extend down the sides of South Table Mountain and join Lena Gulch. The steep sides of South Table Mountain provided a natural backdrop for target practice, and the top of the mountain was quarried for stone used in street surfacing, construction of many Camp George West buildings, and other projects. The relatively flat part of the camp lying south of the plateau was used for training and as a parade ground, while the southernmost portion along both sides of South Golden Road was the setting for most of the facility's buildings.

The Pleasant View area, which lies mainly to the west and south of Camp George West, is an older residential area. More recent suburban residential and office development lies to the north and east. A profusion of intersecting roadways pass near or through the installation. Interstate 70 passes close to the southwest corner of the camp on a southwest-northeast axis. West Colfax Avenue (U.S. 40) and West 6th Avenue (U.S. 6) follow alignments south of the facility. South Golden Road cuts through the southern section of the camp on an east-west route.

[1] The information in this appendix was obtained from two NRHP forms: (1) the Multiple Property Documentation Form, and (2) the Registration Form, prepared by Front Range Research Associates, Inc. (1992a, 1992b).

Contributing vs. Noncontributing Resources

Some historic districts, including Camp George West, contain a mix of contributing and noncontributing resources. A contributing resource is a site, building, structure, or object that adds to the historical associations, historic architectural qualities, or archeological values for which a property is significant. A contributing resource has the following characteristics:

- It was present during the period of time that the property achieved its significance;
- It relates to the documented significance of the property;
- It possesses historical integrity or is capable of yielding important information relevant to the significance of the property.

Any resource within a district that lacks such associations, qualities, or values is called a noncontributing resource.

Source: http://www.nps.gov/history/nr/publications/bulletins/arch/pt5.htm

Background

The district is an architecturally cohesive collection of buildings and structures associated with a Colorado Army National Guard installation. Camp George West, established in 1903, was the Colorado National Guard's only permanent training facility and was an integral part of the National Guard's activities in Colorado, serving as the principal storage and supply center and the site of summer encampments. The district encompasses historic resources along both sides of South Golden Road, including the highest concentration of historic resources associated with the post. Included are the major historic administrative, residential, storage, utility, and training facilities of the camp, constructed during the period 1903 to 1945.

The resources reflect a variety of masonry techniques utilizing stone obtained on post lands and quarried from the camp quarry. One of the largest collections of Works Progress Administration (WPA)-sponsored buildings in Colorado is located on the grounds of Camp George West, reflecting the installation's significant role in providing employment during the 1930s.

The district incorporates 82 resources, including 64 (78 percent) contributing historic resources and 18 (22 percent) noncontributing resources. Of the 64 contributing historic resources, 51 are buildings, 11 are structures, and 2 are objects. The initial parcel of land acquired for the post in 1903 was cut on its southern end by South Golden Road and the track of the Denver and Inter-Mountain Railroad. This division was to influence the subsequent development of the installation. While the size of the post increased and contracted over the years, most of the buildings constructed at Camp George West were located in the southern section close to transportation facilities.

During the 1927-1941 period, a long east-west row of mess halls was built just north of South Golden Road. Two more mess halls were built farther to the north. Concrete tent pads were built in rows in an encampment area behind the mess halls and provided bases on which tents were pitched during summer encampments. Bathhouses/latrines were located on the east and west sides of the camp, and four magazine structures were in the northeast area. An administrative quadrangle also was built north of South Golden Road. The headquarters building and guardhouse are located here.

The area north of Lena Gulch contained a number of uses. The extreme western portion was developed as a rifle firing range in the mid-1920s. Four concrete firing lines are located here. The central area was used as a training area and parade ground for summer encampments and as a grass landing field for small

aircraft. A plane hangar and quonset hut installed during 1949 were later removed and the landing field abandoned in the late 1950s. The eastern portion of this area was developed as a recreation area during the 1930s, containing a recreation hall, outdoor swimming pool (no longer in existence), and tennis courts (no longer in existence).

The buildings and structures of the Camp George West Historic District have been categorized according to the following NRHP categories:

- administrative and general support buildings
- equipment and supply storage facilities
- residences, cantonment structures, and troop support buildings
- recreational facilities
- firing range
- water storage and distribution structures
- transportation-related facilities
- fence and gate structures

Historic Significance

The Camp George West Historic District is a concentrated and architecturally cohesive group of historic resources representing the historic growth and development of the Colorado National Guard's only permanent historic storage and training installation. The district is historically significant for the following reasons:

- In the field of military history, the district is associated with the historic activities of the Colorado National Guard and with the 757th Military Police Battalion of the World War II era.
- In the field of social history, the district is associated with numerous 1930s New Deal era public works relief projects.
- The district's architecture represents a large group of native stone and frame buildings designed to reflect an overall architectural theme and to perform a variety of functions required for National Guard activities. The architecture of the installation reflects the expanding role of the Colorado National Guard, the influence of popular architectural styles, evolution of military technology, and changes in construction methods and building materials.

Within the district, 68 of the 82 resources are associated with the development of the post prior to 1945. Only 14 of the properties within the district are of post-1945 construction. The period of significance extends from the creation of the post in 1903 to 1945, coinciding with the end of activities associated with World War II and the construction of temporary buildings during that era. Sixty-four (78 percent) of the resources within the district are more than 50 years old. Within the district is the oldest building still in existence on the post, the officers' clubhouse/caretaker's residence, reflecting the earliest period of development of the site. In addition, the district includes the majority of buildings erected during later historic periods of development in the 1920s and 1930s, with a few examples from the World War II era.

A substantial number of the buildings and structures erected during the 1930s as a result of New Deal public works relief programs are included in the district and form one of the largest collections of WPA-sponsored building in the state. Programs such as the WPA provided funding for construction of buildings and structures at the post during the Depression era. A camp for transient workers was established at the camp during the mid-1930s; over half of the historic resources at the post were built during this period. The various projects employed hundreds of men and helped relieve area unemployment in Colorado. The

buildings within the district are also associated with National Guard activities such as strike and r natural disaster assistance, mobilization for Mexican border service and for war, and military trair addition, the post was a training site during World War II for military police.

A significant number of buildings within the district are constructed of native fieldstone and stone obtained from the post's quarry on South Table Mountain, which give the post a unique architectur identity. The early stone buildings constructed at Camp George West embody style elements such a gabled roofs, battered piers, and multi-pane windows and were built of unquarried stone found on tl post. The Depression-era buildings and structures reflect design elements such as multiple narrow windows, complex roofs, and a variety of wall projections that were included to increase the amount labor necessary for their construction. Residences built during the 1930s feature multiple gables and multi-pane windows. The Depression-era buildings were largely composed of stone quarried on the installation. The small group of World War II temporary buildings erected at Camp George West represent standard plans and the conservation of labor and materials.

The majority of buildings within the district possess the physical characteristics required to be evaluat as contributing elements. In general, the storage buildings and the mess halls have undergone more alterations than other resources due to their adaptation to new uses. However, the original scale, construction techniques, workmanship, location, setting, and much of the original materials are still apparent in these resources. The most common alterations within the district are the remodeling of door and windows, and less frequently, the addition of nonhistoric siding. A few buildings have been enlarge with enclosed entrance bays or small wings, but none of the additions is large or intrusive enough to diminish the integrity of the buildings. In general, the buildings within the district maintain a high integrity of design, scale, location, craftsmanship, setting, and materials, and as a group convey the historic associations which resulted in their creation.

Physical Characteristics of Historic Resources at Camp George West

The physical characteristics of the buildings erected at Camp George West were determined by the themes set by the early architecture of the post and the materials and manpower available at the time the buildings were erected. The first permanent building erected on the post was an officers' clubhouse/caretaker's residence, designed by architect Albert Bryan. Built in 1911-1912 south of South Golden Road, the officers' clubhouse/caretaker's residence utilized native stone construction with design elements such as a gabled roof, overhanging eaves with exposed rafters, and multi-pane windows. These elements influenced subsequent buildings and resulted in the creation of a unique architectural environment. Buildings erected during the 1910s and 1920s repeated elements of Bryan's work.

During the 1930s, a quarry that operated under the auspices of various public works programs supplied materials, and public relief agencies supplied manpower for buildings. George H. Merchant, architect for the buildings constructed during this period, used native stone for the post's buildings. The buildings of this era were designed with numerous narrow windows, wall buttresses, and complex rooflines in order to utilize as much labor as possible, thereby giving work to unemployed men. The built environment of the post grew substantially during the 1930s as a result of these public works projects.

During World War II, a small number of temporary buildings were erected following standard plans provided by the Quartermaster Corps. To conserve materials and time, these temporary buildings were simple frame structures similar to thousands of others built on military installations across the country.

Descriptions of the Potentially Affected Resources

Table A-1 lists the potentially affected resources at Camp George West, their year of construction, their historic status (contributing or noncontributing), and the nearest corridor(s) along which each resource lies. Of the 15 potentially affected buildings and structures, 13 are contributing resources and 2 are noncontributing resources. All of the potentially affected resources lie north of South Golden Road.

Table A-1. Camp George West Resources Potentially Affected under the Proposed Action

Resource	Resource Number	Year of Construction	Historic Status	Nearest Proposed Corridor(s)
Administrative and General Support Buildings				
Headquarters	45	1937	Contributing	D
Guardhouse	83	1940	Contributing	D
Equipment and Supply Storage Facilities				
Small Arms/ Ammunition Storage	33	1925	Contributing	D
Motor Vehicle Storage	111	1953	Noncontributing	B, D
Residences, Cantonment Structures, and Troop Support Buildings				
Mess Hall	12	1936	Contributing	D
Mess Hall	28	1941	Contributing	D
Mess Hall	29	1941	Contributing	D
Recreational Facilities				
Recreation Hall	48	1937	Contributing	D
Outdoor Swimming Pool[a]	49	1936	Contributing	D
Firing Range				
Rifle Firing Range	FR12	1924	Contributing	B, C
Water Storage and Distribution Structures				
Pump House[a]	84	1927	Contributing	B
Transportation-Related Facilities				
Pedestrian Underpass	50	1934	Contributing	D
Bridge	92	1940	Contributing	B
Bridge	113	1938	Contributing	D
Other Buildings/Structures				
Golden Gun Club Clubhouse (lost to fire July 2009)	104	1941	Noncontributing	B

a. The Outdoor Swimming Pool and the Pump House are no longer in existence.

The following sections describe the buildings and structures that could be affected if one of the five proposed corridors were built. The locations of these resources are shown on Figures A-1 and A-2.

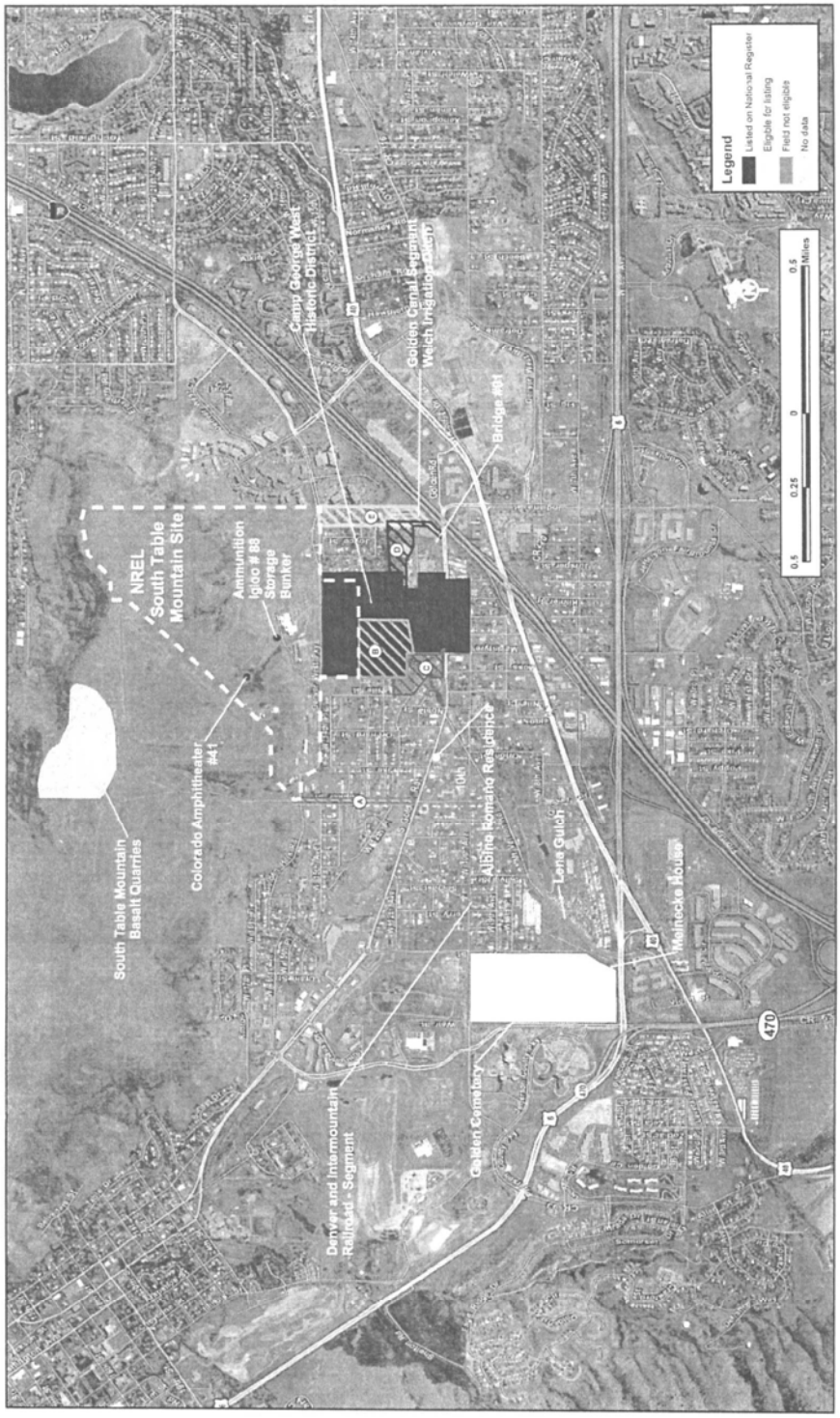


Figure A-1. Historic Resources within the Proposed Corridors for a Second Full Service Access Road to the NREL's South Table Mountain Site

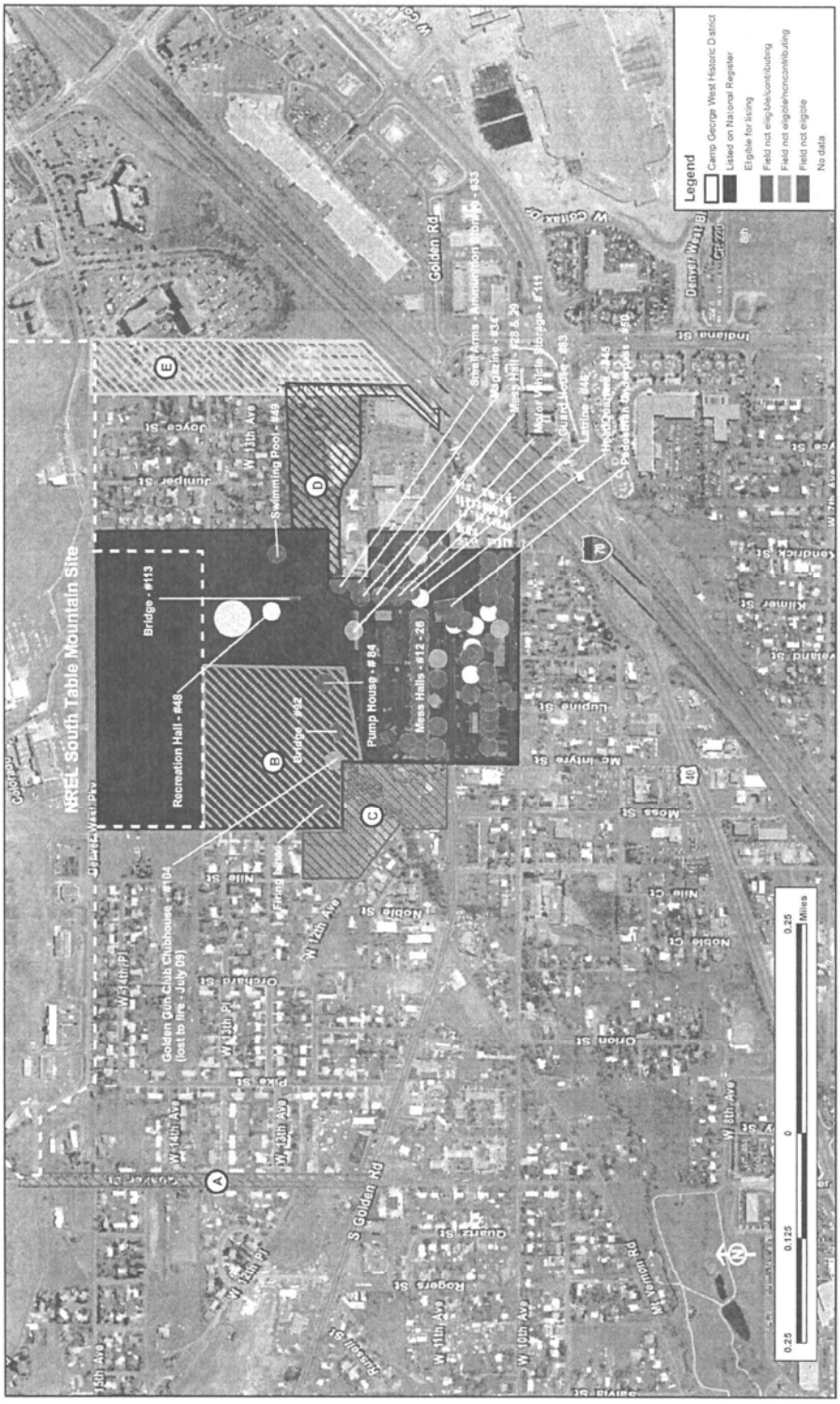


Figure A-2. Camp George West Historic Resources within the Proposed Corridors for a Second Full Service Access Road to the NREL's South Table Mountain Site

A-7

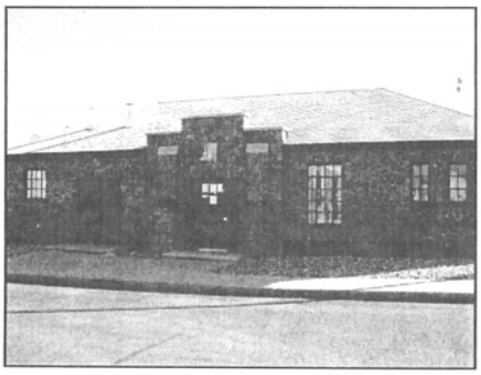
Administrative and General Support Buildings

Building 45—Headquarters (1937)

Headquarters (Building 45)

A focal point of the post is the headquarters building erected in 1937 with funding from the WPA. The building was designed by George H. Merchant to employ as many hours of labor as possible in its construction, thereby providing employment for public relief workers. Included in the design were a complex roofline, many windows, and several wall projections. The one-story split fieldstone building has a central bay with a steeply pitched roof intersected on each end by roof wings. The central bay has a low, shed-roofed projecting façade presenting the building's central entrance. Above the entrance is a pediment arch that is stuccoed and decorated with the state seal. The entrance is flanked by a pair of casement windows with concrete sills. Flanking these are large 16-pane windows.

At the corners of the main bay are engaged stone pilasters. In 1956, a frame addition was added to the eastern wing of the building. The main entrance has been remodeled, as have entrances on the east and west wings.



Guardhouse (Building 83)

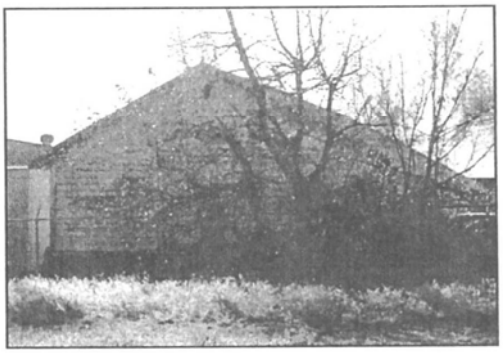
Building 83—Guardhouse (1940)

The guardhouse was one of the WPA-funded projects which erected major administrative and support buildings around the central quadrangle of the post. George H. Merchant designed the building to employ a maximum amount of labor through the inclusion of numerous windows and wall projections. The one-story, randomly coursed, split stone building has a pitched roof. A central, slightly projecting entrance features a stepped parapet with cast cement coping. Flanking the entrance are engaged stone pilasters with cast cement trim. Stonework above the entrance opening forms a slight arch. Windows are multi-pane casements with cast sills. The building has a raised concrete foundation, which has been painted. The original main entrance has been enclosed and has a window. The east elevation has an enclosed entrance bay with nonhistoric siding.

Equipment and Supply Storage Facilities

Building 33—Small Arms/Ammunition Storage (1925)

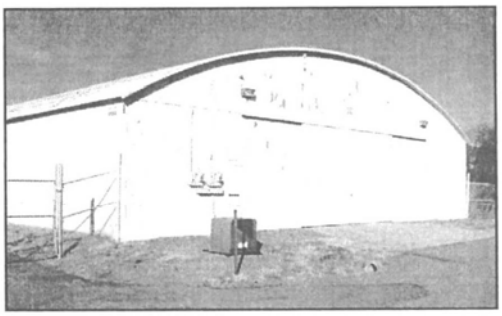
This one-story rectangular frame building has tongue-and-groove siding and a gabled roof with overhanging eaves and exposed rafters. The northern elevation has a central sliding wooden door that opens onto a small loading dock and is flanked by small multi-pane windows. A second sliding door is on the west. Windows are mostly six-pane with wood trim. One window on the east elevation has been replaced with a metal vent.



Small Arms/Ammunition Storage (Building 33)

Building 111—Motor Vehicle Storage (1953)

Built in 1953, after the period of significance (1903 to 1945), Building 111 was constructed north and west of the Headquarters and Guardhouse. This quonset-hut-style building has been designated a noncontributing resource, meaning it lacks any associations, qualities, or values that would contribute to the significance of the Camp George West Historic District.



Motor Vehicle Storage (Building 111)

Residences, Cantonment Structures, and Troop Support Buildings

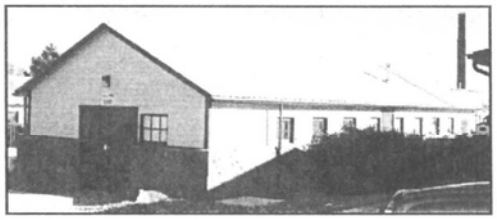
Building 12—Mess Hall (1936)

This building is one of 11 remaining of 17 mess halls built during the period 1936-1941 on the post. It is representative of the current appearance of the buildings. This mess hall is a one-story front gable building with overhanging eaves. The lower portion of the building to sill height is composed of quarried basaltic stone rubblework; the upper walls are frame, now covered with nonhistoric siding over the original horizontal tongue-and-groove siding. The building has central entrances on gable end walls. The south entrance originally had double doors but now has a single door. Side elevations had central doors that are now covered up. Original six-pane windows have been replaced with sliding windows. Original corrugated iron roofing has been replaced with shingle roofing.

Mess Hall (Building 12)

Buildings 28 and 29—Mess Halls (1941)

The basic design of these mess halls, built approximately 5 years after Building 12, was essentially the same as the design for Building 12. However, the stone masonry on the lower portion of these buildings is more polygonal, with the stones quarried to a flatter surface.



Mess Hall (Building 28)

Mess Hall (Building 29)

Recreational Facilities

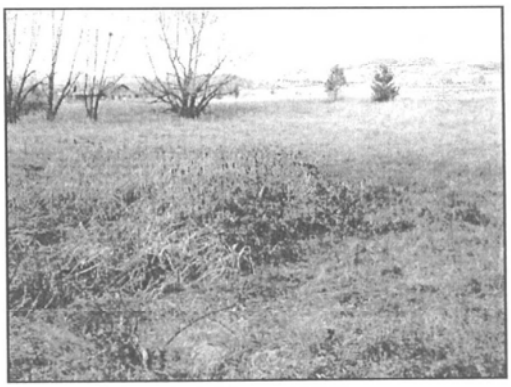
Building 48—Recreation Hall (1937)

Recreation Hall (Building 48)

This one-story building was designed to accommodate leisure-time activities of Guardsmen as a WPA public works relief project. The walls of the building are composed of fieldstone set with wide mortar seams. The cross-gabled roof has widely overhanging eaves, decorative beams, and exposed rafters. A projecting, gabled, central entrance bay is flanked by wraparound porches with stone pillar supports and walls. Over the entrance is a flat stone lintel. All windows have multiple panes (six or eight) and cast cement sills. The interior features a large fieldstone fireplace. The building has nonhistoric doors, the windows have metal grills, and a portion of the porch has been enclosed.

Structure 49—Outdoor Swimming Pool (1936)

The concrete outdoor swimming pool is no longer in existence; in its place is a wetland. The pool, built as a public works relief project, was a 50- by 90-foot rectangle that varied in depth from 3 feet on the western shallow end to 8 feet on the eastern end. The edge of the pool was surrounded by a narrow wall approximately 18 inches high, which was topped by a flat concrete top. An L-shaped concrete bench was located northwest of the pool. The pool originally had a diving board in the center of the east end and metal access ladders adjacent to the diving board and at the northeast and southeast corners. The pool was enclosed by a chain link fence.



Wetland occupying the original location of the outdoor swimming pool (Structure 49)

Firing Range

Structure FR12—Rifle Firing Range (1924)

Located northwest of the principal concentration of buildings at Camp George West, on the western edge of the installation, the lines of the firing range are oriented east-west and consist of a 600-yard line (farthest to the south), a 500-yard line, a 300-yard line, and a 200-yard line (farthest to the north). The lines are constructed of concrete, approximately 340 feet long and 1 foot wide, flush with the ground on the side of the shooter and about a foot above the ground on the side of the target. The 600-yard line is intact; the remaining three are missing segments where a dirt road and/or channelized drainage cuts through the lines. The rifle range was utilized during summer encampments of the Colorado National Guard during the 1920s and 1930s. During World War II, the 757th Military Police Battalion used the range.

Rifle Firing Range (FR12)

Water Storage and Distribution Structures

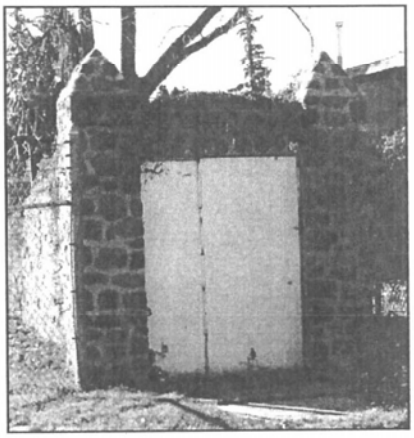
Structure 84—Pump House (1927)

The pump house is no longer in existence. The pump house was a small, wedge-shaped, one-story frame structure with drop siding and a shed roof that extended to the ground. It had a stone foundation and a central door constructed of vertical boards. By the 1980s, the structure was in an advanced state of deterioration (Front Range Research Associates, 1992b).

Transportation-Related Facilities

Structure 50—Pedestrian Underpass (1934)

A Civil Works Administration project completed this pedestrian tunnel under South Golden Road and the Denver and Inter-Mountain railroad tracks to connect the northern and southern portions of the camp. The concrete-lined passageway consists of steps and a tunnel with sloping floors toward a level midsection. Entrances on either end are wedge-shaped and composed of split fieldstone. Stone posts with pyramidal tops stand at the corners of the entry and extend beyond the roofline. The roof is slightly curved and covered with a thin layer of concrete. The entrance on the southern end is open, while the one on the north is covered with a metal door and siding.



Pedestrian Underpass (Structure 50)

Bridge (Structure 92)

Bridge (Structure 113)

Structure 92—Bridge (1940)

This bridge over Lena Gulch was built as part of the WPA project to improve the post and provided easier access to the northwest quadrant of the camp and firing range. The one-lane bridge has a reinforced flat concrete deck and a 10-foot roadway with a 3-foot sidewalk on the east. The span of the bridge is 14 feet. The bridge abutments are composed of roughly split basaltic stone laid in courses. The side walls of the bridge are flared, rounded, and tapered and have a top layer of concrete.

Structure 113—Bridge (1938)

This two-lane bridge in the north-central section of Camp George West was constructed in 1938 as a WPA project. The bridge separately spans Lena Gulch and an unnamed tributary to that stream. It has a reinforced concrete slab deck and split fieldstone abutments with thick mortar. The roadway is 20 feet wide with stone walls higher toward the center of the bridge, where the land drops off beneath. A layer of projecting fieldstones is cemented to the top of the bridge walls, and metal railings flank the bridge deck. The total length of the bridge and its approaches is approximately 140 feet.

Golden Gun Club Clubhouse (Building 104)

Golden Gun Club Clubhouse - lost to fire (July 2009)

Other Buildings/Structures

Building 104—Golden Gun Club Clubhouse (1941)

This small one-story gabled building is composed of hand-made concrete blocks with decorative rocks embedded in them in decorative patterns. The building was not built by the military, and the National

Guard did not take possession of the building until 1948; therefore, it does not meet the requirements for a contributing resource within the district. This building was destroyed by fire the weekend of July 25-26, 2009

References

NRHP (National Register of Historic Place), 2008. COLORADO – Jefferson County – Historic Districts, online at http://www.historicdistricts.com/co/Jefferson/districts.html.

Front Range Research Associates, 1992a. National Register of Historic Places, Multiple Property Documentation Form, September 1, 1992, online at http://www.nr.nps.gov/multiples/64500062.pdf.

Front Range Research Associates, 1992b. National Register of Historic Places, Registration Form, September 1, 1992.

APPENDIX B
RESULTS OF THE OFFICE OF ARCHAEOLOGY AND HISTORIC PRESERVATION SEARCH OF THE COLORADO INVENTORY OF CULTURAL RESOURCES FOR AN AREA IN THE FOLLOWING SECTIONS:

PM	TOWNSHIP	RANGE	SECTION
6th	4S	70W	1, 2
6th	3S	70W	36

Development of a new access road to the STM site may have the potential for direct or indirect impacts in these sections.

Table B-1. Results of the Office of Archaeology and Historic Preservation Search of the Colorado Inventory of Cultural Resources within the Camp George West Historic District

Resource ID	Resource Name	Resource Type	Resource Address	Eligibility Status
5JF.1032	Meinecke House	Historic	605 Ulysses St., Golden	Field not eligible
5JF.1033.1	Lena Gulch	Historic Historical Archaeology	Mt. Vernon Rd. N & S of U.S. 6, Golden	Field not eligible
5JF.145	Camp George West Historic District	Historic District	15000 S. Golden Rd., Golden Vicinity	Listed on National Register 106 - Officially eligible Field not eligible
5JF.145.1	Mess Hall Building Number 11	Historic	15000 S. Golden Rd., Golden	Field not eligible Contributes to NR district
5JF.145.10	Mess Hall Building Number 20	Historic	15000 S. Golden Rd., Golden	Field not eligible Contributes to NR district
5JF.145.11	Mess Hall Building Number 21	Historic	15000 S. Golden Rd., Golden	Field not eligible Contributes to NR district
5JF.145.12	Mess Hall Building Number 22	Historic	15000 S. Golden Rd., Golden	Field not eligible Contributes to NR district
5JF.145.13	Mess Hall Building Number 23	Historic	15000 S. Golden Rd., Golden	Field not eligible Contributes to NR district
5JF.145.14	Mess Hall Building Number 24	Historic	15000 S. Golden Rd., Golden	Field not eligible Contributes to NR district
5JF.145.15	Mess Hall Building Number 25	Historic	15000 S. Golden Rd., Golden	Field not eligible Contributes to NR district
5JF.145.16	Mess Hall Building Number 26	Historic	15000 S. Golden Rd., Golden	Field not eligible Contributes to NR district
5JF.145.17	Mess Hall Building Number 28	Historic	15000 S. Golden Rd., Golden	Field not eligible Contributes to NR district
5JF.145.18	Mess Hall Building Number 29	Historic	15000 S. Golden Rd., Golden	Field not eligible Contributes to NR district

Table B-1. Results of the Office of Archaeology and Historic Preservation Search of the Colorado Inventory of Cultural Resources within the Camp George West Historic District

Resource ID	Resource Name	Resource Type	Resource Address	Eligibility Status
5JF.145.19	Quartermaster Supply Building Building Number 30	Historic	15000 S. Golden Rd., Golden	Contributes to NR district Field not eligible
5JF.145.2	Mess Hall Building Number 12	Historic	15000 S. Golden Rd., Golden	Field not eligible Contributes to NR district
5JF.145.20	Small Arms Ammunition Storage Building Number 33	Historic	15000 S. Golden Rd., Golden	Field not eligible Contributes to NR district
5JF.145.21	Magazine Building Number 34	Historic	15000 S. Golden Rd., Golden	Field not eligible Contributes to NR district
5JF.145.22	Storage Fire Station Building Number 35	Historic	15000 S. Golden Rd., Golden	Field not eligible Contributes to NR district
5JF.145.23	Officers Mess Hall Building Number 43	Historic	15000 S. Golden Rd., Golden	Field not eligible Contributes to NR district
5JF.145.24	Headquarters Building Number 45	Historic	15000 S. Golden Rd., Golden	Field eligible Contributes to NR district
5JF.145.25	Latrine Building Number 46	Historic	15000 S. Golden Rd., Golden	Field not eligible Contributes to NR district
5JF.145.26	Infirmary Building Number 47	Historic	15000 S. Golden Rd., Golden	Field not eligible Contributes to NR district
5JF.145.27	Recreation Hall Building Number 48	Historic	15000 S. Golden Rd., Golden	Field eligible Contributes to NR district
5JF.145.28	Swimming Pool-Outdoor Structure Number 49	Historic	15000 S. Golden Rd., Golden	Field not eligible Contributes to NR district
5JF.145.29	Pedestrian Underpass Structure Number 50	Historical Archaeology Historic	15000 S. Golden Rd., Golden	Field not eligible Contributes to NR district
5JF.145.3	Mess Hall Building Number 13	Historic	15000 S. Golden Rd., Golden	Field not eligible Contributes to NR district

Table B-1. Results of the Office of Archaeology and Historic Preservation Search of the Colorado Inventory of Cultural Resources within the Camp George West Historic District

Resource ID	Resource Name	Resource Type	Resource Address	Eligibility Status
5JF.145.30	Filling Station Building Number 51	Historic	15000 S. Golden Rd., Golden	Field eligible Contributes to NR district
5JF.145.31	Warehouse Building Number 52	Historic	15000 S. Golden Rd., Golden	Field eligible Contributes to NR district
5JF.145.32	Laundry Building Building Number 53	Historic	15000 S. Golden Rd., Golden	Field not eligible Contributes to NR district
5JF.145.33	Latrine Building Number 54	Historic	15000 S. Golden Rd., Golden	Field not eligible Contributes to NR district
5JF.145.34	Warehouse Building Number 55	Historic	15000 S. Golden Rd., Golden	Field eligible Contributes to NR district
5JF.145.35	Wagon Shed Building Number 58	Historic	15000 S. Golden Rd., Golden	Field not eligible Contributes to NR district
5JF.145.36	Wagon Shed Building Number 59	Historic	15000 S. Golden Rd., Golden	Field not eligible Contributes to NR district
5JF.145.37	Wagon Shed Building Number 60	Historic	15000 S. Golden Rd., Golden	Field not eligible Contributes to NR district
5JF.145.38	Wagon Shed Building Number 61	Historic	15000 S. Golden Rd., Golden	Field not eligible Contributes to NR district
5JF.145.39	Wagon Shed Building Number 62	Historic	15000 S. Golden Rd., Golden	Field not eligible Contributes to NR district
5JF.145.4	Mess Hall Building Number 14	Historic	15000 S. Golden Rd., Golden	Field not eligible Contributes to NR district
5JF.145.40	Water Tower-South Building Number 63	Historic	15000 S. Golden Rd., Golden	Field not eligible Contributes to NR district
5JF.145.41	Gas And Oil Station Building Number 66	Historic	15000 S. Golden Rd., Golden	Field not eligible Contributes to NR district
5JF.145.42	Officers' Clubhouse Building Number 67	Historic	15000 Golden Rd., Golden	Field eligible Contributes to NR district
5JF.145.43	Quarters Building Number 68	Historic	15000 S. Golden Rd., Golden	Field not eligible Contributes to NR district

Table B-1. Results of the Office of Archaeology and Historic Preservation Search of the Colorado Inventory of Cultural Resources within the Camp George West Historic District

Resource ID	Resource Name	Resource Type	Resource Address	Eligibility Status
5JF.145.44	Quarters Building Number 69	Historic	15000 S. Golden Rd., Golden	Field not eligible Contributes to NR district
5JF.145.45	Quarters Building Number 70	Historic	15000 S. Golden Rd., Golden	Field not eligible Contributes to NR district
5JF.145.46	Quarters Building Number 71	Historic	15000 S. Golden Rd., Golden	Field not eligible Contributes to NR district
5JF.145.47	Garage Building Number 73	Historic	15000 S. Golden Rd., Golden	Field not eligible Contributes to NR district
5JF.145.48	Garage Building Number 74	Historic	15000 S. Golden Rd., Golden	Field not eligible Contributes to NR district
5JF.145.49	Garage Building Number 76	Historic	15000 S. Golden Rd., Golden	Field not eligible Contributes to NR district
5JF.145.5	Mess Hall Building Number 15	Historic	15000 S. Golden Rd., Golden	Field not eligible Contributes to NR district
5JF.145.50	Garage Building Number 77	Historic	15000 S. Golden Rd., Golden	Field not eligible Contributes to NR district
5JF.145.51	Garage Building Number 81	Historic	15000 S. Golden Rd., Golden	Field not eligible Contributes to NR district
5JF.145.52	Motor Vehicle Storage Building Number 82	Historic	15000 S. Golden Rd., Golden	Field not eligible Contributes to NR district
5JF.145.53	Guard House Building Number 83	Historic	15000 S. Golden Rd., Golden	Field not eligible Contributes to NR district
5JF.145.54	Pump House Building Number 84	Historic	15000 S. Golden Rd., Golden	Field not eligible Contributes to NR district
5JF.145.55	Underground Reservoir Structure Number 90	Historic	15000 S. Golden Rd., Golden	Field not eligible Contributes to NR district
5JF.145.56	Bridge Structure Number 92	Historic	15000 S. Golden Rd., Golden	Field not eligible Contributes to NR district

Table B-1. Results of the Office of Archaeology and Historic Preservation Search of the Colorado Inventory of Cultural Resources within the Camp George West Historic District

Resource ID	Resource Name	Resource Type	Resource Address	Eligibility Status
5JF.145.57	Orderly Room Building Number 96	Historic	15000 S. Golden Rd., Golden	Field not eligible Contributes to NR district
5JF.145.58	Orderly Room Building Number 97	Historic	15000 S. Golden Rd., Golden	Field not eligible Noncontributing to NR district
5JF.145.59	Theater/Chapel Building Number 100	Historic	15000 S. Golden Rd., Golden	Field not eligible Noncontributing to NR district
5JF.145.6	Mess Hall Building Number 16	Historic	15000 S. Golden Rd., Golden	Field not eligible Contributes to NR district
5JF.145.60	Gate House Building Number 102	Historic	15000 S. Golden Rd., Golden	Field not eligible Noncontributing to NR district
5JF.145.61	Golden Gun Club Clubhouse Building Number 104	Historic	15000 S. Golden Rd., Golden	Field not eligible Noncontributing to NR district
5JF.145.62	Bridge Structure Number 113	Historic	15000 S. Golden Rd., Golden	Field not eligible Contributes to NR district
5JF.145.63	Inter-Mountain Railroad Station Building Number 116	Historic	15000 S. Golden Rd., Golden	Field eligible Contributes to NR district
5JF.145.64	Gates Stone Gates	Historic	15000 S. Golden Rd., Golden	Field not eligible Contributes to NR district
5JF.145.65	Gate And Wall Stone Gate And Wall	Historic	15000 S. Golden Rd., Golden	Field not eligible Contributes to NR district
5JF.145.66	Firing Lines Firing Pits Firing Range	Historic	15000 S. Golden Rd., Golden	Field not eligible Contributes to NR district
5JF.145.67	Tent Pads Tent Encampment	Historical Archaeology	15000 S. Golden Rd., Golden	Field not eligible Contributes to NR district
5JF.145.68	Tent Pads Tent Encampment	Historical Archaeology		Field not eligible Contributes to NR district

Table B-1. Results of the Office of Archaeology and Historic Preservation Search of the Colorado Inventory of Cultural Resources within the Camp George West Historic District

Resource ID	Resource Name	Resource Type	Resource Address	Eligibility Status
5JF.145.69	Tent Pads Tent Encampment	Historical Archaeology		Field not eligible Contributes to NR district
5JF.145.70	Tent City North (Camp George West)	Historical Archaeology		Field needs data
5JF.145.71		Historical Archaeology		No assessment given on form
5JF.145.7	Mess Hall Building Number 17	Historic	15000 S. Golden Rd., Golden	Field not eligible Contributes to NR district
5JF.145.8	Mess Hall Building Number 18	Historic	15000 S. Golden Rd., Golden	Field not eligible Contributes to NR district
5JF.145.9	Mess Hall Building Number 19	Historic	15000 S. Golden Rd., Golden	Field not eligible Contributes to NR district
5JF.165		Archaeological		Field not eligible
5JF.166		Archaeological		Field not eligible
5JF.167		Archaeological		Field not eligible
5JF.2410		Historical Archaeology		Field not eligible
5JF.2784	Albino Romano Residence	Historic	16300 S Golden Rd., Golden	Field eligible
5JF.2840		Historic	600 Kilmer St., Golden	Officially not eligible Field not eligible
5JF.2841		Historic	609 Lupine St., Golden	Officially not eligible Field not eligible
5JF.2842		Historic	615 Kendrick St., Golden	Officially not eligible Field not eligible
5JF.2843		Historic	620 Kendrick St., Golden	Officially not eligible Field not eligible
5JF.2844		Historic	625 Juniper St., Golden	Officially not eligible Field not eligible

Table B-1. Results of the Office of Archaeology and Historic Preservation Search of the Colorado Inventory of Cultural Resources within the Camp George West Historic District

Resource ID	Resource Name	Resource Type	Resource Address	Eligibility Status
5JF.2845		Historic	612 Juniper St., Golden	Officially not eligible
5JF.2846		Historic	635 Joyce St., Golden	106 - Officially eligible Field eligible
5JF.2847		Historic	640 Joyce St., Golden	Officially not eligible Field not eligible
5JF.2848		Historic	645 Isabell St., Golden	Officially not eligible Field not eligible
5JF.401	Golden Cemetery	Historic Historical Archaeology	Golden	106 - Officially eligible Field eligible
5JF.817.6	Denver And Intermountain Railroad - Segment	Historical Archaeology Historic		Officially not eligible Noncontributing to NR district Field not eligible
5JF.839	South Table Mountain Basalt Quarries	Historical Archaeology		Field needs data
5JF.842	Colorado Amphitheater Structure #41	Historic	15001 Denver West Pkwy., Golden	Listed on National Register Multiple Resource Component Within NR district Contrib. to Officially elig. dist.
5JF.843	Ammunition Igloo Building 88 Storage Bunker	Historic	15001 Denver West Pkwy., Golden	Listed on National Register Within NR district Multiple Resource Component Field eligible
5JF.846	Bridge Structure Number 91	Historical Archaeology Historic	15000 S. Golden Rd., Golden	Field not eligible

Table B-1. Results of the Office of Archaeology and Historic Preservation Search of the Colorado Inventory of Cultural Resources within the Camp George West Historic District

Resource ID	Resource Name	Resource Type	Resource Address	Eligibility Status
5JF.848.1	Golden Canal Segment Welch Irrigation Ditch	Historical Archaeology Historic	15000 S. Golden Rd., Golden	Officially not eligible Noncontrib. to Officially elig. Dist Field not eligible Field eligible

Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3393

August 17, 2009

Mr. Terry McKee
U.S. Army Corps of Engineers
Denver Regulatory Office
9307 South Wadsworth Blvd.
Littleton, CO 80128-6901

Dear Mr. McKee,

SUBJECT: Lena Gulch wetland delineation review request relevant to the National Renewable Energy Laboratory Supplemental Environmental Assessment for the South Table Mountain Facility

With this letter, the Department of Energy (DOE) requests that the U.S. Army Corps of Engineers (USACE) review the wetland delineation shown on the attached figure in the vicinity of Lena Gulch and determine that it is accurate and acceptable to your office.

The delineated wetlands fall within possible areas of impact associated with potential alignments of proposed access to DOE's National Renewable Energy Laboratory (NREL) South Table Mountain (STM) facility. The capacity of Denver West Parkway is a limiting factor to site development. Consequently, second full-service site access is being investigated and an Environmental Assessment (EA) is underway per the requirements of the National Environmental Policy Act (NEPA). As the various alignments being considered in the EA have the potential to impact wetlands and waters of the U.S., approval of the delineated extent of wetlands and waters of the U.S. under the jurisdiction of the USACE is needed.

The potential road alignments being considered in the EA are located in the NE1/4 of Section 1, Township 4S, Range 70W, within Jefferson County. The nearest major intersection is I-70 and Highway U.S. 40. (Please see Figure 1). Driving directions from the USACE offices in Littleton are as follows:

Take C-470 West to I-70E
Take W. Colfax Ave/US40 Exit 262
Follow W. Colfax Avenue to turn (at light) for South Golden Road
Follow South Golden Road (veers to west/left) to Kilmer Street
Turn north/right on Kilmer Street
Follow Kilmer into Pleasant View Community Park parking lot

The delineated wetland boundaries as well as channels and ditches within the area being evaluated for the EA are shown in the attached exhibit. The completed data sheets from Great Plains Region Supplement are also attached. At this time, it is not possible to provide a quantification of the area of impact or of the volume of dredge or fill materials to be placed in wetlands or below the ordinary high mark of waters of the U.S. as a final road alignment has not been determined.

We appreciate your review of the attached wetland delineation and assessment of possible jurisdictional waters and look forward to your response. Please contact Tom Ryon at 303-275-3252 or Genny Braus at 303-275-3251 with NREL Environment, Health and Safety with any questions you might have.

Sincerely,

Steve Blazek
NEPA Compliance Officer

Attachments

cc: Chris Carusona, DOE GO
John Eickhoff – NREL, EHS
Genevieve Braus NREL, EHS
Tom Ryon – NREL, EHS
Tom Anderson PNL
Christine Ross PNL
Daniel Lowery – PNL

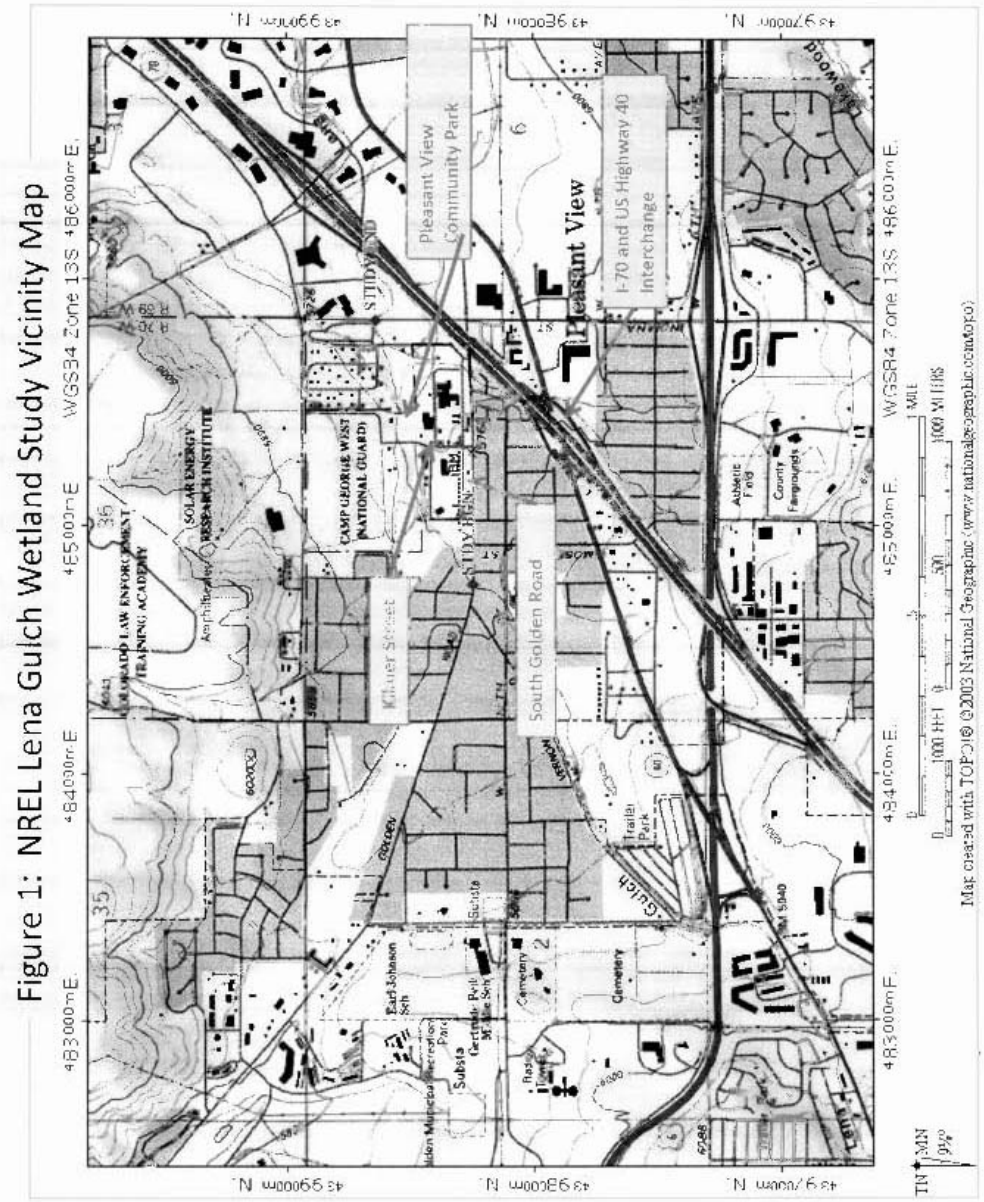
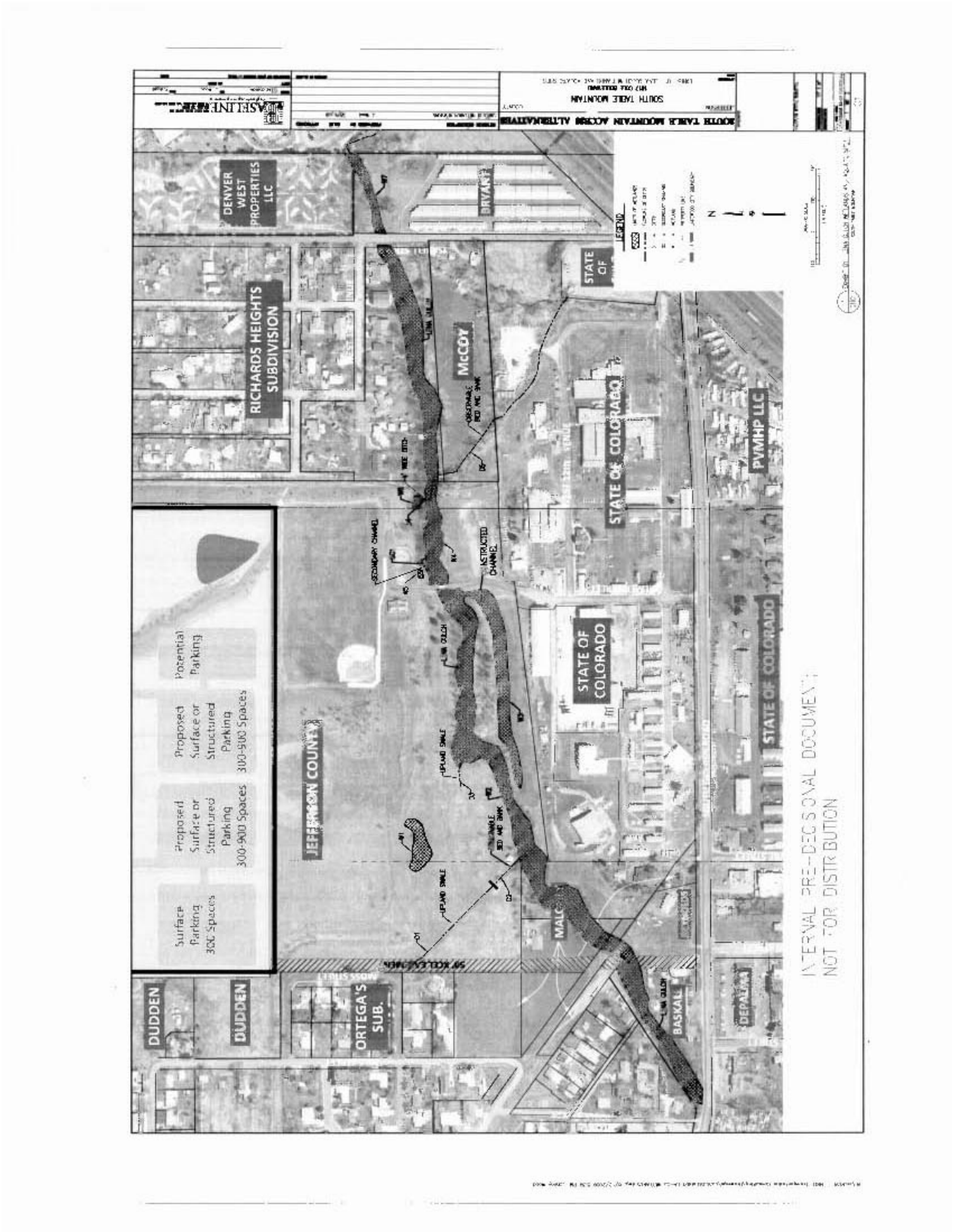
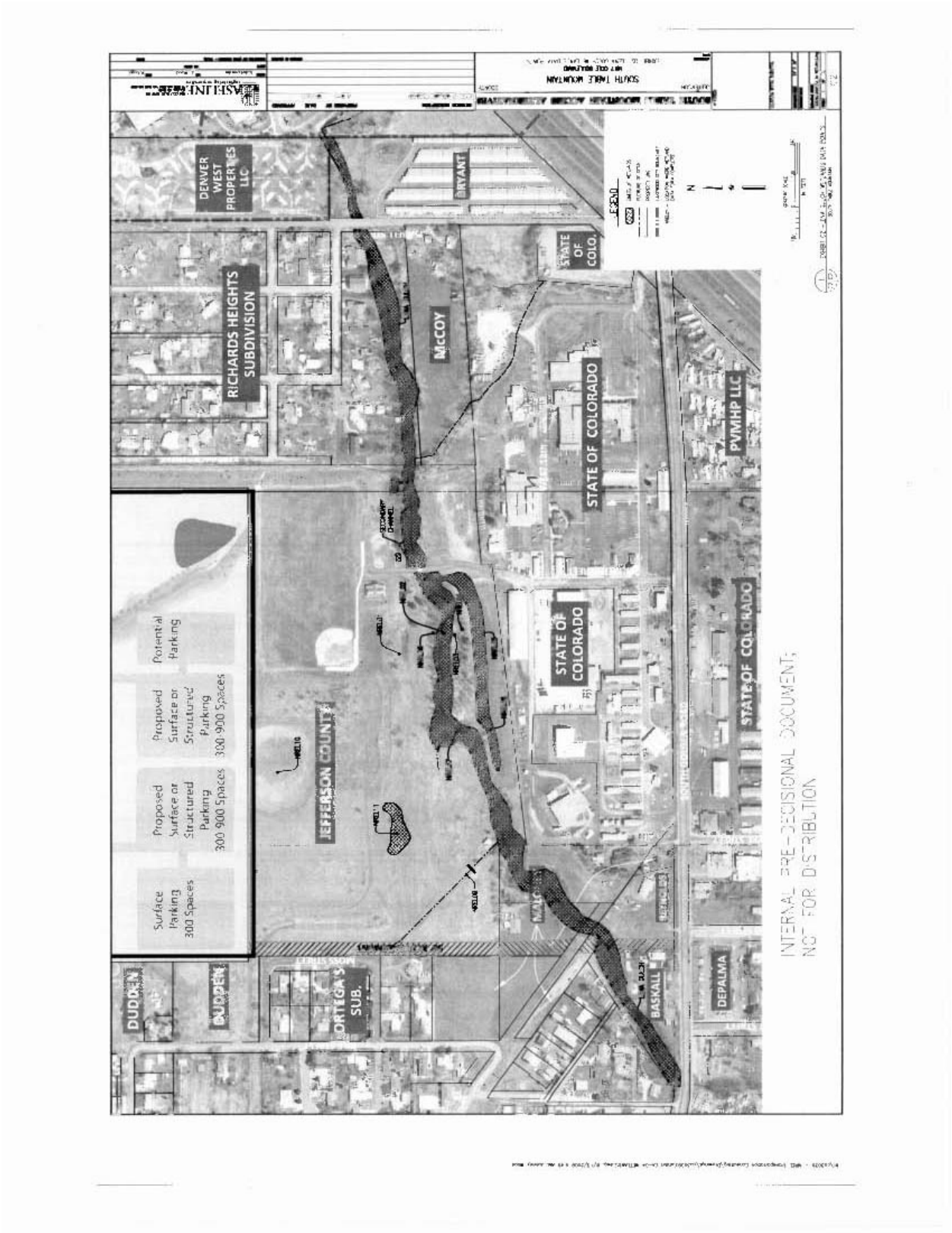


Figure 1: NREL Lena Gulch Wetland Study Vicinity Map


DENVER WEST PROPERTIES LLC
BRYANT
RICHARDS HEIGHTS SUBDIVISION
McCOY
STATE OF COLORADO
PVMHP LLC
JEFFERSON COUNTY
DUDDEN
DUDDEN
ORTEGA'S SUB.
BASKAL
Surface Parking 300 Spaces
Proposed Surface or Structured Parking 300-900 Spaces
Proposed Surface or Structured Parking 300-900 Spaces
Potential Parking
INTERNAL PRE-DECISIONAL DOCUMENT
NOT FOR DISTRIBUTION


SOUTH TABLE MOUNTAIN
DENVER WEST PROPERTIES LLC
BRYANT
STATE OF COLO.
RICHARDS HEIGHTS SUBDIVISION
McCOY
STATE OF COLORADO
PVMHP LLC
JEFFERSON COUNTY
STATE OF COLORADO
STATE OF COLORADO
Surface Parking 300 Spaces
Proposed Surface or Structured Parking 300-900 Spaces
Proposed Surface or Structured Parking 300-900 Spaces
Potential Parking
DUDDEN
DUDDEN
ORTEGA SUB.
BASKALL
DEPALMA
INTERNAL PRE-DECISIONAL DOCUMENT;
NOT FOR DISTRIBUTION

WETLAND DETERMINATION DATA FORM – Great Plains Region

Project/Site: Lena Gulch/SEA II STM City/County: Golden, Jefferson Sampling Date: 7/28/09
Applicant/Owner: National Renewable Energy Lab State: CO Sampling Point: NREL-01
Investigator(s): Ryan, Braus, Beatty, Wood Section, Township, Range: Sec 01 NE, T04S, R70W
Landform (hillslope, terrace, etc.): Swale Local relief (concave, convex, none): Concave Slope (%): _____
Subregion (LRR): G (Western Great Plains) Lat: 39.7368°N Long: 105.1725°W Datum: NAD83
Soil Map Unit Name: Englewood Urban land Complex NWI classification: _____
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)
Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No _____
Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes _____ No X
Hydric Soil Present? Yes _____ No X
Wetland Hydrology Present? Yes _____ No X
Is the Sampled Area within a Wetland? Yes _____ No X

Remarks: High Precip Year

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 15')			
1.			
2.			
3.			
4.			
	0 = Total Cover		
Sapling/Shrub Stratum (Plot size: 15')			
1. Rosa arkansana	5	Y	NI (FAC)
2. Prunus virginiana	3	Y	FACU
3.			
4.			
5.			
	8 = Total Cover		
Herb Stratum (Plot size: 5')			
1. Agropyron cristatum	60	Y	NL
2. Tragopogon dubius	T	N	NL
3. Ambrosia psilostachya	T	N	FAC
4. Solidago altissima	T	N	FACU
5. Aster ericoides	20	Y	FACU
6. Lobularia maritima	T	N	NL
7. Poa pratensis	3	N	FACU
8. Agropyron smithii	10	N	FACU
9. Agropyron repens	T	N	FAC
10. Elymus canadensis	T	N	FACU
11th Herb	T		
	93 = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	0 = Total Cover		

% Bare Ground in Herb Stratum: 3

Remarks:

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC (excluding FAC-): 0 (A)
Total Number of Dominant Species Across All Strata: 4 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species _____	x 1 = _____
FACW species _____	x 2 = _____
FAC species _____	x 3 = _____
FACU species _____	x 4 = _____
UPL species _____	x 5 = _____
Column Totals: _____ (A)	_____ (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:
N Dominance Test is >50%
N Prevalence Index is ≤3.0[1]
N Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
N Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes _____ No X

US Army Corps of Engineers — Great Plains – Interim Version

SOIL

Sampling Point: NREL-01

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-8	10YR 3/1	100					Loam	
8-13	10YR 3/3	100					LS	Loamy Sand
13-20	10YR 3/3	100					C-L	Clay Loam

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- N Histosol (A1)
- Histic Epipedon (A2)
- Black Histic (A3)
- Hydrogen Sulfide (A4)
- Stratified Layers (A5) (LRR F)
- 1 cm Muck (A9) (LRR F, G, H)
- Depleted Below Dark Surface (A11)
- Thick Dark Surface (A12)
- Sandy Mucky Mineral (S1)
- 2.5 cm Mucky Peat or Peat (S2) (LRR G, H)
- 5 cm Mucky Peat or Peat (S3) (LRR F)
- Y Sandy Gleyed Matrix (S4)
- Sandy Redox (S5)
- Stripped Matrix (S6)
- Loamy Mucky Mineral (F1)
- Loamy Gleyed Matrix (F2)
- Depleted Matrix (F3)
- Redox Dark Surface (F6)
- Depleted Dark Surface (F7)
- Redox Depressions (F8)
- High Plains Depressions (F16) (MLRA 72 & 73 of LRR H)

Indicators for Problematic Hydric Soils[3]:

- N 1 cm Muck (A9) (LRR I, J)
- Coast Prairie Redox (A16) (LRR F, G, H)
- Dark Surface (S7) (LRR G)
- High Plains Depressions (F16) (LRR H outside of MLRA 72 & 73)
- Reduced Vertic (F18)
- Red Parent Material (TF2)
- Y Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: NA

Depth (inches):

Hydric Soil Present? Yes ____ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- N Surface Water (A1)
- High Water Table (A2)
- Saturation (A3)
- Water Marks (B1)
- Sediment Deposits (B2)
- Drift Deposits (B3)
- Algal Mat or Crust (B4)
- Iron Deposits (B5)
- Inundation Visible on Aerial Imagery (B7)
- Y Water-Stained Leaves (B9)
- N Salt Crust (B11)
- Aquatic Invertebrates (B13)
- Hydrogen Sulfide Odor (C1)
- Dry-Season Water Table (C2)
- Oxidized Rhizospheres on Living Roots (C3) (where not tilled)
- Presence of Reduced Iron (C4)
- Thin Muck Surface (C7)
- Y Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- N Surface Soil Cracks (B6)
- Sparsely Vegetated Concave Surface (B8)
- Drainage Patterns (B10)
- Oxidized Rhizospheres on Living Roots (C3) (where tilled)
- Crayfish Burrows (C8)
- Saturation Visible on Aerial Imagery (C9)
- Geomorphic Position (D2)
- FAC-Neutral Test (D5)
- Y Frost-Heave Hummocks (D7) (LRR F)

Field Observations:

Surface Water Present? Yes ____ No N Depth (inches): —

Water Table Present? Yes ____ No N Depth (inches): —

Saturation Present? (includes capillary fringe) Yes ____ No N Depth (inches): —

Wetland Hydrology Present? Yes ____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

NA

Remarks:

WETLAND DETERMINATION DATA FORM – Great Plains Region

Project/Site: Lena Gulch/SEA # STM City/County: Golden, Jefferson Sampling Date: 7/28/09
Applicant/Owner: National Renewable Energy Lab State: CO Sampling Point: NREL-02
Investigator(s): Ryan, Braus, Beatty, Wolf Section, Township, Range: Sec 01NE, T04S, R70W
Landform (hillslope, terrace, etc.): terrace Local relief (concave, convex, none): concave Slope (%): 3
Subregion (LRR): G (Western Great Plains) Lat: 39.7364°N Long: -105.1725°W Datum: NAD83
Soil Map Unit Name: Eaglewood Urban land Complex NWI classification:
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)
Are Vegetation N Soil N or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No
Are Vegetation N Soil N or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No
Hydric Soil Present? Yes X No
Wetland Hydrology Present? Yes X No
Is the Sampled Area within a Wetland? Yes X No

Remarks:
High Precip Year
test pit near stream bed

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 15')			
1. Fraxinus americana	10	N	FACW
2. Elaeagnus angustifolia	2	N	FAC
3. Populus deltoides	10	N	FAC
4. Salix amygdaloides	60	Y	FACW
	82	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15')			
1. Fraxinus americana	3	Y	FACW
2.			
3.			
4.			
5.			
	3	= Total Cover	
Herb Stratum (Plot size: 5')			
1. Agropyron repens	20	Y	FAC
2. Poa pratensis	5	N	FACW
3. Phalaris arundinacea	5	N	FACW
4. Agrostis gigas	5	N	FACW
5. Cirsium arvense	3	N	FACU
6. Cynoglossum officinale	3	N	NO
7. Rumex crispus	1	N	FACW
8. Nepeta cataria	1	N	FACU
9. Bromus inermis	40	Y	NL
10. Dactylis glomerata	10	N	FACU
	91	= Total Cover	
Woody Vine Stratum (Plot size:)			
1. Parthenocissus quinquefolia	3	Y	FAC
2.			
	3	= Total Cover	

% Bare Ground in Herb Stratum: 10

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC (excluding FAC-): 4 (A)
Total Number of Dominant Species Across All Strata: 5 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 80 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:
Y Dominance Test is >50%
Prevalence Index is ≤3.0[1]
N Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
N Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No

Remarks:

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SOIL Sampling Point: NREL-02

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type	Loc	Texture	Remarks
0-10	10YR 3/3	100					SLS	
10-22	10YR 3/2	95	2.5YR 4/8	15	C	M	CSi, +G	Coarse Sand/gravel
22-27	N 2.5/	100					S, H	Gley Layer

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- N Histosol (A1)
- Histic Epipedon (A2)
- Black Histic (A3)
- Hydrogen Sulfide (A4)
- Stratified Layers (A5) (LRR F)
- 1 cm Muck (A9) (LRR F, G, H)
- Depleted Below Dark Surface (A11)
- Thick Dark Surface (A12)
- Sandy Mucky Mineral (S1)
- 2.5 cm Mucky Peat or Peat (S2) (LRR G, H)
- 5 cm Mucky Peat or Peat (S3) (LRR F)
- N Sandy Gleyed Matrix (S4)
- Y Sandy Redox (S5)
- N Stripped Matrix (S6)
- Loamy Mucky Mineral (F1)
- Loamy Gleyed Matrix (F2)
- Depleted Matrix (F3)
- Redox Dark Surface (F6)
- Depleted Dark Surface (F7)
- Redox Depressions (F8)
- High Plains Depressions (F16) (MLRA 72 & 73 of LRR H)

Indicators for Problematic Hydric Soils[3]:

- N 1 cm Muck (A9) (LRR I, J)
- Coast Prairie Redox (A16) (LRR F, G, H)
- Dark Surface (S7) (LRR G)
- High Plains Depressions (F16) (LRR H outside of MLRA 72 & 73)
- Reduced Vertic (F18)
- Red Parent Material (TF2)
- Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: N A

Depth (inches): ____

Hydric Soil Present? Yes X No ____

Remarks: Low chroma Soil with mottles with 12" & reduced gley muck at bottom (24").

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- N Surface Water (A1)
- N High Water Table (A2)
- N Saturation (A3)
- N Water Marks (B1)
- N Sediment Deposits (B2)
- Y Drift Deposits (B3)
- N Algal Mat or Crust (B4)
- N Iron Deposits (B5)
- N Inundation Visible on Aerial Imagery (B7)
- N Water Stained Leaves (B9)
- N Salt Crust (B11)
- N Aquatic Invertebrates (B13)
- N Hydrogen Sulfide Odor (C1)
- N Dry-Season Water Table (C2)
- N Oxidized Rhizospheres on Living Roots (C3) (where not tilled)
- N Presence of Reduced Iron (C4)
- N Thin Muck Surface (C7)
- N Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- N Surface Soil Cracks (B6)
- N Sparsely Vegetated Concave Surface (B8)
- Y Drainage Patterns (B10)
- N Oxidized Rhizospheres on Living Roots (C3) (where tilled)
- N Crayfish Burrows (C8)
- N Saturation Visible on Aerial Imagery (C9)
- Y Geomorphic Position (D2)
- Y FAC-Neutral Test (D5)
- N Frost Heave Hummocks (D7) (LRR F)

Field Observations:

Surface Water Present? Yes ____ No X Depth (inches): ____

Water Table Present? Yes X No ____ Depth (inches): 25"

Saturation Present? (includes capillary fringe) Yes X No ____ Depth (inches): 24"

Wetland Hydrology Present? Yes X No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Near Stream Bed

US Army Corps of Engineers — Great Plains – Interim Version

WETLAND DETERMINATION DATA FORM – Great Plains Region

Project/Site: Lena Gulch/SEA # STM City/County: Golden, Jefferson Sampling Date: 7/28/09
Applicant/Owner: National Renewable Energy Lab State: CO Sampling Point: NREL-03
Investigator(s): Ryan, Braus, Beatty, Wood Section, Township, Range: Sec 01NE, T04S, R70W
Landform (hillslope, terrace, etc.): Terrace Local relief (concave, convex, none): Convex Slope (%): 1
Subregion (LRR): G (Western Great Plains) Lat: 39.7363°N Long: -105.1724°W Datum: NAD 83
Soil Map Unit Name: Eaglewood-Urban Land Complex NWI classification:
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)
Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No
Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No
Hydric Soil Present? Yes No X
Wetland Hydrology Present? Yes No X
Is the Sampled Area within a Wetland? Yes No X

Remarks: High Precip Year

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 20')	Absolute % Cover	Dominant Species?	Indicator Status
1. Populus deltoides	20	Y	FAC
2. Fraxinus pennsylvanica	25	Y	FACW
3. Elaeagnus angustifolia	5	N	FAC
4.			
5.			
	50	= Total Cover	

Sapling/Shrub Stratum (Plot size 15')			
1. Fraxinus pennsylvanica	3	Y	FACW
2.			
3.			
4.			
5.			
	3	= Total Cover	

Herb Stratum (Plot size 5')			
1. Bromus inermis	80	Y	NL
2. Elymus repens	5	N	FAC
3. Dactylis glomerata	8	N	FACU
4. Xanthium strumarium	5	N	FAC
5.			
6.			
7.			
8.			
9.			
10.			
	98	= Total Cover	

Woody Vine Stratum (Plot size 5')		
1.		
2.		
	0	= Total Cover

% Bare Ground in Herb Stratum 2

Remarks:

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC (excluding FAC-): 3 (A)
Total Number of Dominant Species Across All Strata: 4 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 75 (A/B)

Prevalence Index worksheet:

Total % Cover of	Multiply by
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:
Y Dominance Test is >50%
– Prevalence Index is ≤3.0
N Morphological Adaptations (Provide supporting data in Remarks or on a separate sheet)
N Problematic Hydrophytic Vegetation (Explain)

Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No

US Army Corps of Engineers Great Plains – Interim Version

SOIL

Sampling Point: NREL-03

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type	Loc	Texture	Remarks
0-20	10YR 3/3						Sa fL	~~Sandy~~ Sandy Loam

Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- Histosol (A1)
- Histic Epipedon (A2)
- Black Histic (A3)
- Hydrogen Sulfide (A4)
- Stratified Layers (A5) (LRR F)
- 1 cm Muck (A9) (LRR F, G, H)
- Depleted Below Dark Surface (A11)
- Thick Dark Surface (A12)
- Sandy Mucky Mineral (S1)
- 2.5 cm Mucky Peat or Peat (S2) (LRR G, H)
- 5 cm Mucky Peat or Peat (S3) (LRR F)
- Sandy Gleyed Matrix (S4)
- Sandy Redox (S5)
- Stripped Matrix (S6)
- Loamy Mucky Mineral (F1)
- Loamy Gleyed Matrix (F2)
- Depleted Matrix (F3)
- Redox Dark Surface (F6)
- Depleted Dark Surface (F7)
- Redox Depressions (F8)
- High Plains Depressions (F16) (MLRA 72 & 73 of LRR H)

Indicators for Problematic Hydric Soils[3]:

- 1 cm Muck (A9) (LRR I, J)
- Coast Prairie Redox (A16) (LRR F, G, H)
- Dark Surface (S7) (LRR G)
- High Plains Depressions (F16) (LRR H outside of MLRA 72 & 73)
- Reduced Vertic (F18)
- Red Parent Material (TF2)
- Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: N/A

Depth (inches):

Hydric Soil Present? Yes ____ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- Surface Water (A1)
- High Water Table (A2)
- Saturation (A3)
- Water Marks (B1)
- Sediment Deposits (B2)
- Drift Deposits (B3)
- Algal Mat or Crust (B4)
- Iron Deposits (B5)
- Inundation Visible on Aerial Imagery (B7)
- Water-Stained Leaves (B9)
- Salt Crust (B11)
- Aquatic Invertebrates (B13)
- Hydrogen Sulfide Odor (C1)
- Dry-Season Water Table (C2)
- Oxidized Rhizospheres on Living Roots (C3) (where not tilled)
- Presence of Reduced Iron (C4)
- Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- Surface Soil Cracks (B6)
- Sparsely Vegetated Concave Surface (B8)
- Drainage Patterns (B10)
- Oxidized Rhizospheres on Living Roots (C3) (where tilled)
- Crayfish Burrows (C8)
- Saturation Visible on Aerial Imagery (C9)
- Geomorphic Position (D2)
- FAC-Neutral Test (D5)
- Frost-Heave Hummocks (D7) (LRR F)

Field Observations:

Surface Water Present? Yes ____ No X Depth (inches): ____

Water Table Present? Yes ____ No X Depth (inches): ____

Saturation Present? (includes capillary fringe) Yes ____ No X Depth (inches): ____

Wetland Hydrology Present? Yes ____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

US Army Corps of Engineers — Great Plains – Interim Version

WETLAND DETERMINATION DATA FORM – Great Plains Region

Project/Site: Lena Gulch/SEA II-STM City/County: Golden, Jefferson Sampling Date: 7/28/09
Applicant/Owner: National Renewable Energy Lab State: CO Sampling Point: NREL-C4
Investigator(s): Ryan, Braus, Beatty, Woal Section, Township, Range: Sec 8 NE, T 4 S, R 70 W
Landform (hillslope, terrace, etc.): old floodplain Local relief (concave, convex, none): concave Slope (%): 1
Subregion (LRR): G (Western Great Plains) Lat: 39.736 3°N Long: -105.172 5°W Datum: NAD 83
Soil Map Unit Name: Englewood - Urban Land Complex NWI classification:
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)
Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No
Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No
Hydric Soil Present? Yes No X
Wetland Hydrology Present? Yes No X
Is the Sampled Area within a Wetland? Yes No X

Remarks: High Precip Year

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 20')	Absolute % Cover	Dominant Species?	Indicator Status
1. Fraxinus pennsylvanica	95	Y	FAC
2.			
3.			
4.			
	95	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15')			
1. Fraxinus pennsylvanica	3	Y	FAC
2.			
3.			
4.			
5.			
	3	= Total Cover	
Herb Stratum (Plot size: 5')			
1. Bromus inermis	3	Y	NL
2. unk herb	T	—	—
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	3	= Total Cover	
Woody Vine Stratum (Plot size: 5')			
1.			
2.			
	0	= Total Cover	

% Bare Ground in Herb Stratum: 94

Remarks: Bare ground includes leaf litter

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC (excluding FAC–): 2 (A)
Total Number of Dominant Species Across All Strata: 3 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 66.7 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:
Y Dominance Test is >50%
N Prevalence Index is ≤3.0
N Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
N Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No

US Army Corps of Engineers Great Plains – Interim Version

SOIL Sampling Point NREL-04

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-8	10YR 4/3	100					S & L	Sandy Loam
8-20	10YR 3/2	90	10YR 2/1	10	C	M	S.Cl.L	Sandy Clay Loam

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- N Histosol (A1)
- Histic Epipedon (A2)
- Black Histic (A3)
- Hydrogen Sulfide (A4)
- Stratified Layers (A5) (LRR F)
- 1 cm Muck (A9) (LRR F, G, H)
- Depleted Below Dark Surface (A11)
- Thick Dark Surface (A12)
- Sandy Mucky Mineral (S1)
- 2.5 cm Mucky Peat or Peat (S2) (LRR G, H)
- 5 cm Mucky Peat or Peat (S3) (LRR F)
- N Sandy Gleyed Matrix (S4)
- Sandy Redox (S5)
- Stripped Matrix (S6)
- Loamy Mucky Mineral (F1)
- Loamy Gleyed Matrix (F2)
- Depleted Matrix (F3)
- Redox Dark Surface (F6)
- Depleted Dark Surface (F7)
- Redox Depressions (F8)
- High Plains Depressions (F16) (MLRA 72 & 73 of LRR H)

Indicators for Problematic Hydric Soils[3]:

- N 1 cm Muck (A9) (LRR I, J)
- Coast Prairie Redox (A16) (LRR F, G, H)
- Dark Surface (S7) (LRR G)
- High Plains Depressions (F16) (LRR H outside of MLRA 72 & 73)
- Reduced Vertic (F18)
- Red Parent Material (TF2)
- Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: NA
Depth (inches):

Hydric Soil Present? Yes ____ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- N Surface Water (A1)
- High Water Table (A2)
- Saturation (A3)
- Water Marks (B1)
- Sediment Deposits (B2)
- Drift Deposits (B3)
- Algal Mat or Crust (B4)
- Iron Deposits (B5)
- Inundation Visible on Aerial Imagery (B7)
- Water-Stained Leaves (B9)
- N Soil Crust (B11)
- Aquatic Invertebrates (B13)
- Hydrogen Sulfide Odor (C1)
- Dry-Season Water Table (C2)
- Oxidized Rhizospheres on Living Roots (C3) (where not tilled)
- Presence of Reduced Iron (C4)
- Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- N Surface Soil Cracks (B6)
- Sparsely Vegetated Concave Surface (B8)
- Drainage Patterns (B10)
- Oxidized Rhizospheres on Living Roots (C3) (where tilled)
- Crayfish Burrows (C8)
- Saturation Visible on Aerial Imagery (C9)
- Geomorphic Position (D2)
- FAC-Neutral Test (D5)
- Frost-Heave Hummocks (D7) (LRR F)

Field Observations:

Surface Water Present? Yes ____ No X Depth (inches): ____

Water Table Present? Yes ____ No X Depth (inches): ____

Saturation Present? (includes capillary fringe) Yes ____ No X Depth (inches): ____

Wetland Hydrology Present? Yes ____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

US Army Corps of Engineers — Great Plains – Interim Version

WETLAND DETERMINATION DATA FORM – Great Plains Region

Project/Site: Lena Gulch/SEA II STM City/County: Golden, Jefferson Sampling Date: 7/28/09
Applicant/Owner: National Renewable Energy Lab State: CO Sampling Point: NREL-05
Investigator(s): Ryan, Brous, Beatty, West Section, Township, Range: Sec 01NE, T04S, R70W
Landform (hillslope, terrace, etc.): Constructed flood channel Local relief (concave, convex, none): Concave Slope (%): 1
Subregion (LRR): G (Western Great Plains) Lat: 39.7361°N Long: -105.1715°W Datum: NAD83
Soil Map Unit Name: Harvester Loam NWI classification:
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)
Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes No X
Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No
Hydric Soil Present? Yes X No
Wetland Hydrology Present? Yes X No
Is the Sampled Area within a Wetland? Yes X No

Remarks: High Precip Year, Constructed wetlands - well established wetland vegetation, planted in coarse riprap. Soil not well developed, water ponds in this area

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	Ø = Total Cover		
Sapling/Shrub Stratum (Plot size: 15')			
1. Salix exigua	3	Y	OBL
2.			
3.			
4.			
5.			
	3 = Total Cover		
Herb Stratum (Plot size: 5')			
1. Typha latifolia	60	Y	OBL
2. Schoenoplectus acutus	30	Y	OBL
3. Cirsium arvense	1	N	FACU
4. Cenium maculatum	T	N	FACW
5. Polygonum aviculare ssp.	3	N	OBL
6. Carex spp.	5	N	FAC
7. Juncus spp.	5	N	FAC
8.			
9.			
10.			
	103 Total Cover		
Woody Vine Stratum (Plot size: 5')			
1.			
2.			
	Ø = Total Cover		
% Bare Ground in Herb Stratum: 5			

Remarks:

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC (excluding FAC-): 3 (A)
Total Number of Dominant Species Across All Strata: 3 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:
Y Dominance Test is >50%
— Prevalence Index is ≤3.0[1]
N Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
N Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No

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SOIL Sampling Point: NREL-05

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-8	10YR 3/2	80	7.5YR 5/8	20	C	M	SaC	Sandy Clay
8-20	10YR 3/2	100					SaCl	Sandy Clay, Lens

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- N Histosol (A1)
- Histic Epipedon (A2)
- Black Histic (A3)
- Hydrogen Sulfide (A4)
- Stratified Layers (A5) (LRR F)
- 1 cm Muck (A9) (LRR F, G, H)
- Depleted Below Dark Surface (A11)
- Thick Dark Surface (A12)
- Sandy Mucky Mineral (S1)
- 2.5 cm Mucky Peat or Peat (S2) (LRR G, H)
- 5 cm Mucky Peat or Peat (S3) (LRR F)
- N Sandy Gleyed Matrix (S4)
- Sandy Redox (S5)
- Stripped Matrix (S6)
- Loamy Mucky Mineral (F1)
- Loamy Gleyed Matrix (F2)
- Depleted Matrix (F3)
- Y Redox Dark Surface (F6)
- N Depleted Dark Surface (F7)
- Redox Depressions (F8)
- High Plains Depressions (F16) (MLRA 72 & 73 of LRR H)

Indicators for Problematic Hydric Soils[3]:

- N 1 cm Muck (A9) (LRR I, J)
- Coast Prairie Redox (A16) (LRR F, G, H)
- Dark Surface (S7) (LRR G)
- High Plains Depressions (F16) (LRR H outside of MLRA 72 & 73)
- Reduced Vertic (F18)
- Red Parent Material (TF2)
- Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: NA
Depth (inches):

Hydric Soil Present? Yes X No

Remarks: Constructed wetland - soil has not had time to develop + riprap makes sampling difficult

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- X Surface Water (A1)
- N High Water Table (A2)
- Y Saturation (A3)
- N Water Marks (B1)
- N Sediment Deposits (B2)
- N Drift Deposits (B3)
- N Algal Mat or Crust (B4)
- N Iron Deposits (B5)
- N Inundation Visible on Aerial Imagery (B7)
- N Water-Stained Leaves (B9)
- N Salt Crust (B11)
- N Aquatic Invertebrates (B13)
- N Hydrogen Sulfide Odor (C1)
- N Dry-Season Water Table (C2)
- N Oxidized Rhizospheres on Living Roots (C3) (where not tilled)
- Y Presence of Reduced Iron (C4)
- N Thin Muck Surface (C7)
- N Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- N Surface Soil Cracks (B6)
- N Sparsely Vegetated Concave Surface (B8)
- N Drainage Patterns (B10)
- N Oxidized Rhizospheres on Living Roots (C3) (where tilled)
- N Crayfish Burrows (C8)
- N Saturation Visible on Aerial Imagery (C9)
- N Geomorphic Position (D2)
- Y FAC-Neutral Test (D5)
- N Frost-Heave Hummocks (D7) (LRR F)

Field Observations:

Surface Water Present? Yes X No ___ Depth (inches): 1"
Water Table Present? Yes X No ___ Depth (inches): 0"
Saturation Present? (includes capillary fringe) Yes X No ___ Depth (inches): 0"

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Constructed channel

US Army Corps of Engineers — Great Plains – Interim Version

WETLAND DETERMINATION DATA FORM - Great Plains Region

Project/Site: Lena Gulch/SEA II STM City/County: Golden, Jefferson Sampling Date: 7/29/09
Applicant/Owner: National Renewable Energy Lab State: CO Sampling Point: NREL-06
Investigator(s): Ryan, Braus, Beatty, Wood Section, Township, Range: Sec 01NE, T04S, R70W
Landform (hillslope, terrace, etc.): terrace Local relief (concave, convex, none): Convex Slope (%): 1
Subregion (LRR): G (Western Great Plains) Lat: 39.7364°N Long: 105.1726°W Datum: NAD83
Soil Map Unit Name: Englewood - Urban land complex NWI classification:
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)
Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ____
Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____
Hydric Soil Present? Yes ____ No X
Wetland Hydrology Present? Yes ____ No X
Is the Sampled Area within a Wetland? Yes ____ No X

Remarks: High Precip Year

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 20')			
1. Salix amygdaloides	40	Y	FACW
2. Populus deltoides	20	Y	FAC
3. Fraxinus pennsylvanica	10	N	FACW
4. ~~Elaeagnus~~ Ulmus pumila	5	N	NL
	75 = Total Cover		
Sapling/Shrub Stratum (Plot size: 15')			
1. Fraxinus pennsylvanica	5	Y	FACW
2. Rosa woodsii	3	Y	FACU
3. Prunus virginiana	T	N	FACU
4.			
5.			
	= Total Cover		
Herb Stratum (Plot size: 5')			
1. Bromus inermis	70	Y	NL
2. Dactylis glomerata	10	N	FACU
3. Cirsium arvense	10	N	FACU
4. Agropyron repens	5	N	FAC
5.			
6.			
7.			
8.			
9.			
10.			
	95 = Total Cover		
Woody Vine Stratum (Plot size: 5')			
1.			
2.			
	0 = Total Cover		

% Bare Ground in Herb Stratum 5

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC (excluding FAC-): 3 (A)
Total Number of Dominant Species Across All Strata: 5 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 60 (A/B)

Prevalence Index worksheet:

Total % Cover of	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:
Y Dominance Test is >50%
= Prevalence Index ≤3.0[1]
N Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
N Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ____

Remarks:

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SOIL

Sampling Point: NREL-06

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type	Loc	Texture	Remarks
0-19	10YR 6/3	100					FSa	Fine Sand
19-24	10YR 5/4	100					FSa	

Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ✓ Histosol (A1)
- Histic Epipedon (A2)
- Black Histic (A3)
- Hydrogen Sulfide (A4)
- Stratified Layers (A5) (LRR F)
- 1 cm Muck (A9) (LRR F, G, H)
- Depleted Below Dark Surface (A11)
- Thick Dark Surface (A12)
- Sandy Mucky Mineral (S1)
- 2 cm Mucky Peat or Peat (S2) (LRR G, H)
- 5 cm Mucky Peat or Peat (S3) (LRR F)
- ✓ Sandy Gleyed Matrix (S4)
- Sandy Redox (S5)
- Stripped Matrix (S6)
- Loamy Mucky Mineral (F1)
- Loamy Gleyed Matrix (F2)
- Depleted Matrix (F3)
- Redox Dark Surface (F6)
- Depleted Dark Surface (F7)
- Redox Depressions (F8)
- High Plains Depressions (F16) (MLRA 72 & 73 of LRR H)
- ✓ 1 cm Muck (A9) (LRR I, J)
- Coast Prairie Redox (A16) (LRR F, G, H)
- Dark Surface (S7) (LRR G)
- High Plains Depressions (F16) (LRR H outside of MLRA 72 & 73)
- Reduced Vertic (F18)
- Red Parent Material (TF2)
- Other (Explain in Remarks)

Indicators for Problematic Hydric Soils[3]:

Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: NA
Depth (inches):

Hydric Soil Present? Yes ____ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ✓ Surface Water (A1)
- High Water Table (A2)
- Saturation (A3)
- Water Marks (B1)
- Sediment Deposits (B2)
- Drift Deposits (B3)
- Algal Mat or Crust (B4)
- Iron Deposits (B5)
- Inundation Visible on Aerial Imagery (B7)
- Water Stained Leaves (B9)
- ✓ Salt Crust (B11)
- Aquatic Invertebrates (B13)
- Hydrogen Sulfide Odor (C1)
- Dry-Season Water Table (C2)
- Oxidized Rhizospheres on Living Roots (C3) (where not tilled)
- Presence of Reduced Iron (C4)
- Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ✓ Surface Soil Cracks (B6)
- Sparsely Vegetated Concave Surface (B8)
- Drainage Patterns (B10)
- Oxidized Rhizospheres on Living Roots (C3) (where tilled)
- Crayfish Burrows (C8)
- Saturation Visible on Aerial Imagery (C9)
- Geomorphic Position (D2)
- FAC-Neutral Test (D5)
- Frost-Heave Hummocks (D7) (LRR F)

Field Observations:

Surface Water Present? Yes ____ No X Depth (inches): ____

Water Table Present? Yes ____ No X Depth (inches): ____

Saturation Present? (includes capillary fringe) Yes ____ No X Depth (inches): ____

Wetland Hydrology Present? Yes ____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

High Bank = 6' from Creek

US Army Corps of Engineers

Great Plains – Interim Version

WETLAND DETERMINATION DATA FORM Great Plains Region

Project/Site: Lena Gulch/SEA II-STM City/County: Golden, Jefferson Sampling Date: 7/29/07
Applicant/Owner: National Renewable Energy Lab State: CO Sampling Point: NREL-07
Investigator(s): Ryan, Braus, Beatty, Wood Section, Township, Range: Sec 01 NE, T04S, R70W
Landform (hillslope, terrace, etc.): Terrace Local relief (concave, convex, none): Concave Slope (%): 2
Subregion (LRR): G (Western Great Plains) Lat: 39.7364°N Long: 105.1734°W Datum: NAD83
Soil Map Unit Name: Englewood-Urban Land Complex NWI classification:
Are climatic / hydrologic conditions on the site typical for this time of year? Yes Y No (If no, explain in Remarks.)
Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No
Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No
Hydric Soil Present? Yes X No
Wetland Hydrology Present? Yes X No
Is the Sampled Area within a Wetland? Yes X No

Remarks: High Precip Year

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 20)	Absolute % Cover	Dominant Species?	Indicator Status
1. Salix amygdaloides	40	Y	FACW
2. Elaeagnus angustifolia	5	N	FAC
3. Populus deltoides	15	Y	FAC
4.			
	60	= Total Cover	

Sapling/Shrub Stratum (Plot size: 15)			
1.			
2.			
3.			
4.			
5.			
	0	= Total Cover	

Herb Stratum (Plot size: 5)			
1. Dactylis glomerata	5	N	FACU
2. Juncus torreyi	3	N	FACW
3. Cirsium arvense	20	Y	FACU
4. (Redtop) Agrostis stolonifera	5	N	FAC
5. Juncus balticus	T	N	OBL
6. Bromus inermis	5	N	NL
7. Typha latifolia	20	Y	OBL
8. Cynoglossum officinale	T	N	NO
9. Aegopodium podagraria	20	Y	FAC
10. Phalaris arundinacea	20	Y	FACW
	98	= Total Cover	

Woody Vine Stratum (Plot size: 5)			
1.			
2. Parthenocissus quinquefolia	3	Y	FAC
	3	= Total Cover	

% Bare Ground in Herb Stratum

Remarks:

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC (excluding FAC-): 5 (A)
Total Number of Dominant Species Across All Strata: 6 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 83.3 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:
Y Dominance Test is >50%
Prevalence Index is ≤3.0
N Morphological Adaptations (Provide supporting data in Remarks or on a separate sheet)
N Problematic Hydrophytic Vegetation (Explain)

Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No

US Army Corps of Engineers Great Plains – Interim Version

SOIL Sampling Point: NREL-07

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-8	10YR 3/2	100					CSA	many rocks
8-14	10YR 2/1	100					CSA	Coarse Sand

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (LRR F)
- ___ 1 cm Muck (A9) (LRR F, G, H)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) (LRR G, H)
- ___ 5 cm Mucky Peat or Peat (S3) (LRR F)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) (MLRA 72 & 73 of LRR H)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (LRR I, J)
- ___ Coast Prairie Redox (A16) (LRR F, G, H)
- ___ Dark Surface (S7) (LRR G)
- ___ High Plains Depressions (F16) (LRR H outside of MLRA 72 & 73)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: rock/asphalt
Depth (inches): 14"

Hydric Soil Present? Yes X No ___

Remarks:
Buried asphalt Soil shows reducing conditions with a low chroma.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- (Y) Surface Water (A1)
- (N) High Water Table (A2)
- (Y) Saturation (A3)
- N Water Marks (B1)
- N Sediment Deposits (B2)
- (Y) Drift Deposits (B3)
- N Algal Mat or Crust (B4)
- N Iron Deposits (B5)
- N Inundation Visible on Aerial Imagery (B7)
- N Water-Stained Leaves (B9)
- N Salt Crust (B11)
- (Y) Aquatic Invertebrates (B13)
- N Hydrogen Sulfide Odor (C1)
- N Dry-Season Water Table (C2)
- N Oxidized Rhizospheres on Living Roots (C3) (where tilled)
- (Y) Presence of Reduced Iron (C4)
- N Thin Muck Surface (C7)
- N Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- N Surface Soil Cracks (B6)
- N Sparsely Vegetated Concave Surface (B8)
- (Y) Drainage Patterns (B10)
- N Oxidized Rhizospheres on Living Roots (C3) (where tilled)
- N Crayfish Burrows (C8)
- N Saturation Visible on Aerial Imagery (C9)
- N Geomorphic Position (D2)
- (Y) FAC-Neutral Test (D5)
- N Frost-Heave Hummocks (D7) (LRR F)

Field Observations:

Surface Water Present? Yes X No ___ Depth (inches): 5"
Water Table Present? Yes X No ___ Depth (inches): 10"
Saturation Present? (includes capillary fringe) Yes X No ___ Depth (inches): 3"

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

US Army Corps of Engineers — Great Plains – Interim Version

WETLAND DETERMINATION DATA FORM – Great Plains Region

Project/Site: Lena Gulch/SEA # STM City/County: Golden, Jefferson Sampling Date: 7/29/09
Applicant/Owner: National Renewable Energy Lab State: CO Sampling Point: NREL-08
Investigator(s): Ryan, Brans, Beatty, Weal Section, Township, Range: Sec. 01 NE, T04S, R70W
Landform (hillslope, terrace, etc.): Floodwater channel Local relief (concave, convex, none): concave Slope (%): 2.
Subregion (LRR): G (Western Great Plains) Lat: 39.7359°N Long: -105.1735°W Datum: NAD83
Soil Map Unit Name: Havenson Loam NWI classification:
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)
Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes Y No
Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No	Is the Sampled Area within a Wetland? Yes X No
Hydric Soil Present?	Yes X	No	
Wetland Hydrology Present?	Yes X	No	

Remarks:
High Precip Year
Constructed wetland

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size 20')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot size 15')			
1.			
2.			
3.			
4.			
5.			
	0	= Total Cover	
Herb Stratum (Plot size 5')			
1. Festuca arundinacea	30	Y	FACU
2. wk grass #2	5	N	—
3. Scirpus Pungens	10	Y	OBL
4. Polygonum monspeliensis	10	Y	OBL
5. Bare Ground	3	N	NI
6. Glycyrrhiza lepidota	3	N	FACW
7. Equisetum arvense	T	N	FAC
8. Alopecurus geniculatus	T	N	OBL
9. Melilotus officinalis	T	N	FACU
10. Conyza canadensis	T	N	FACU
	61	Total Cover	
Woody Vine Stratum (Plot size 5')			
1.			
2.			
	0	= Total Cover	

% Bare Ground in Herb Stratum 55

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC (excluding FAC-): 2 (A)
Total Number of Dominant Species Across All Strata: 3 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 66.7 (A/B)

Prevalence Index worksheet:

Total % Cover of	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

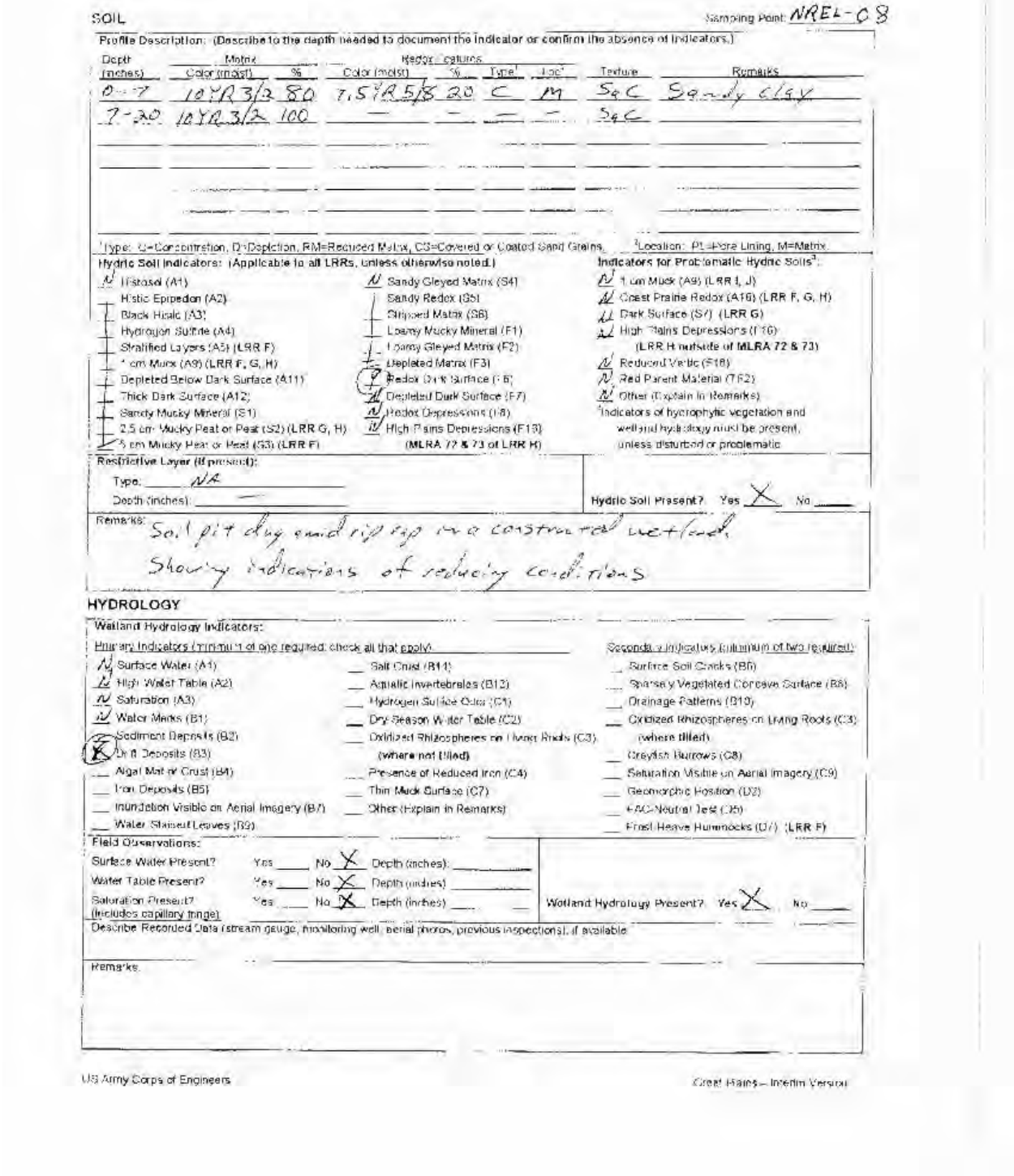
Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:
Y Dominance Test is >50%
– Prevalence Index is ≤3.0¹
N Morphological Adaptations¹ (Provide supporting data in Remarks or on a separate sheet)
N Problematic Hydrophytic Vegetation (Explain)

¹Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No

Remarks:



SOIL

Sampling Point: NREL-08

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-7	10YR 3/3	80	7.5YR 5/8	20	C	M	SaC	Sandy clay
7-20	10YR 3/2	100	—	—	—	—	SaC	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- N Histosol (A1)
- Histic Epipedon (A2)
- Black Histic (A3)
- Hydrogen Sulfide (A4)
- Stratified Layers (A5) (LRR F)
- 1 cm Muck (A9) (LRR F, G, H)
- Depleted Below Dark Surface (A11)
- Thick Dark Surface (A12)
- Sandy Mucky Mineral (S1)
- 2.5 cm Mucky Peat or Peat (S2) (LRR G, H)
- 5 cm Mucky Peat or Peat (S3) (LRR F)
- N Sandy Gleyed Matrix (S4)
- Sandy Redox (S5)
- Stripped Matrix (S6)
- Loamy Mucky Mineral (F1)
- Loamy Gleyed Matrix (F2)
- Depleted Matrix (F3)
- Redox Dark Surface (F6)
- Depleted Dark Surface (F7)
- N Redox Depressions (F8)
- N High Plains Depressions (F16) (MLRA 72 & 73 of LRR H)

Indicators for Problematic Hydric Soils[3]:

- N 1 cm Muck (A9) (LRR I, J)
- N Coast Prairie Redox (A16) (LRR F, G, H)
- N Dark Surface (S7) (LRR G)
- N High Plains Depressions (F16) (LRR H outside of MLRA 72 & 73)
- N Reduced Vertic (F18)
- N Red Parent Material (TF2)
- N Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: NA

Depth (inches): —

Hydric Soil Present? Yes X No ____

Remarks: Soil pit dug and ripped in a constructed wetland, showing indications of reducing conditions

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply):

- N Surface Water (A1)
- N High Water Table (A2)
- N Saturation (A3)
- N Water Marks (B1)
- Sediment Deposits (B2)
- X Drift Deposits (B3)
- Algal Mat or Crust (B4)
- Iron Deposits (B5)
- Inundation Visible on Aerial Imagery (B7)
- Water-Stained Leaves (B9)
- Salt Crust (B11)
- Aquatic Invertebrates (B13)
- Hydrogen Sulfide Odor (C1)
- Dry-Season Water Table (C2)
- Oxidized Rhizospheres on Living Roots (C3) (where not tilled)
- Presence of Reduced Iron (C4)
- Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (minimum of two required):

- Surface Soil Cracks (B6)
- Sparsely Vegetated Concave Surface (B8)
- Drainage Patterns (B10)
- Oxidized Rhizospheres on Living Roots (C3) (where tilled)
- Crayfish Burrows (C8)
- Saturation Visible on Aerial Imagery (C9)
- Geomorphic Position (D2)
- FAC-Neutral Test (D5)
- Frost-Heave Hummocks (D7) (LRR F)

Field Observations:

Surface Water Present? Yes ____ No X Depth (inches): ____

Water Table Present? Yes ____ No X Depth (inches): ____

Saturation Present? (includes capillary fringe) Yes ____ No X Depth (inches): ____

Wetland Hydrology Present? Yes X No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

US Army Corps of Engineers — Great Plains – Interim Version

WETLAND DETERMINATION DATA FORM – Great Plains Region

Project/Site: Lena Gulch/Supp. II EA STM City/County: Golden, Jefferson Sampling Date: 7/29/08
Applicant/Owner: National Renewable Energy Lab State: CO Sampling Point: NREL-09
Investigator(s): Ryan, Bross, Beatty, Wood Section, Township, Range: Sec 1 NE, T3S, R70W
Landform (hillslope, terrace, etc.): Ditch Local relief (concave, convex, none): Concave Slope (%): 2
Subregion (LRR): G (Western Great Plains) Lat: 39.7362°N Long: -105.1254°W Datum: NAD83
Soil Map Unit Name: Denver Urban Land Complex NWI classification:
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)
Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No
Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes No X
Hydric Soil Present? Yes No X
Wetland Hydrology Present? Yes X No
Is the Sampled Area within a Wetland? Yes No X

Remarks: High Precip Year

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 10)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot size: 10)			
1. Robinia pseudoacacia (10')	5	Y	FAC
2. Rosa woodsii	1	N	FACU
3.			
4.			
5.			
	6	= Total Cover	
Herb Stratum (Plot size: 5')			
1. Agropyron trachycaulum	65	Y	FACW
2. Allium vineale	20	Y	FACU
3. Conyza canadensis	5	N	FACU
4. Cirsium vulgare	<1	N	UPL
5. Ambrosia artemisiifolia	<1	N	FACU
6.			
7.			
8.			
9.			
10.			
	90	Total Cover	
Woody Vine Stratum (Plot size: 5')			
1.			
2.			
	0	= Total Cover	

% Bare Ground in Herb Stratum 5

Remarks:

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC (excluding FAC-): 1 (A)
Total Number of Dominant Species Across All Strata: 3 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 33 (A/B)

Prevalence Index worksheet:

Total % Cover of	Multiply by
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:
N Dominance Test is >50%
— Prevalence Index is ≤3.0*
N Morphological Adaptations* (Provide supporting data in Remarks or on a separate sheet)
N Problematic Hydrophytic Vegetation* (Explain)

*Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes No X

US Army Corps of Engineers Great Plains – Interim Version

SOIL

Sampling Point: ___

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-22	10YR 3/2	100	—	—	—	—	Sandy & Loamy Sand	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ✓ Histosol (A1)
- Histic Epipedon (A2)
- Black Histic (A3)
- Hydrogen Sulfide (A4)
- Stratified Layers (A5) (LRR F)
- 1 cm Muck (A9) (LRR F, G, H)
- Depleted Below Dark Surface (A11)
- Thick Dark Surface (A12)
- Sandy Mucky Mineral (S1)
- 2.5 cm Mucky Peat or Peat (S2) (LRR G, H)
- 5 cm Mucky Peat or Peat (S3) (LRR F)
- ✓ Sandy Gleyed Matrix (S4)
- Sandy Redox (S5)
- Stripped Matrix (S6)
- Loamy Mucky Mineral (F1)
- Loamy Gleyed Matrix (F2)
- Depleted Matrix (F3)
- Redox Dark Surface (F6)
- Depleted Dark Surface (F7)
- Redox Depressions (F8)
- High Plains Depressions (F16) (MLRA 72 & 73 of LRR H)

Indicators for Problematic Hydric Soils[3]:

- ✓ 1 cm Muck (A9) (LRR I, J)
- Coast Prairie Redox (A16) (LRR F, G, H)
- Dark Surface (S7) (LRR G)
- High Plains Depressions (F16) (LRR H outside of MLRA 72 & 73)
- Reduced Vertic (F18)
- Red Parent Material (TF2)
- Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: N/A

Depth (inches): ___

Hydric Soil Present? Yes ___ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ✓ Surface Water (A1)
- High Water Table (A2)
- Saturation (A3)
- Water Marks (B1)
- Sediment Deposits (B2)
- X Drift Deposits (B3)
- ✓ Algal Mat or Crust (B4)
- Iron Deposits (B5)
- Inundation Visible on Aerial Imagery (B7)
- Water-Stained Leaves (B9)
- ✓ Soil Crust (B11)
- Aquatic Invertebrates (B13)
- Hydrogen Sulfide Odor (C1)
- Dry-Season Water Table (C2)
- Oxidized Rhizospheres on Living Roots (C3) (where not tilled)
- Presence of Reduced Iron (C4)
- Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ✓ Surface Soil Cracks (B6)
- Sparsely Vegetated Concave Surface (B8)
- Drainage Patterns (B10)
- Oxidized Rhizospheres on Living Roots (C3) (where tilled)
- Crayfish Burrows (C8)
- Saturation Visible on Aerial Imagery (C9)
- Geomorphic Position (D2)
- FAC-Neutral Test (D5)
- Frost-Heave Hummocks (D7) (LRR F)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

US Army Corps of Engineers — Great Plains – Interim Version

WETLAND DETERMINATION DATA FORM – Great Plains Region

Project/Site: Long Gulch / SEA # STM City/County: Golden, Jefferson Sampling Date: 7/29/09
Applicant/Owner: National Renewable Energy Lab State: CO Sampling Point: NREL-10
Investigator(s): Ryan, Brooks, Beatty, Wood Section, Township, Range: Sec. 8 NE, T 04 S, R 70 W
Landform (hillslope, terrace, etc.): Depression Local relief (concave, convex, none): concave Slope (%): 0
Subregion (LRR): G (Western Great Plains) Lat: 39.7380° N Long: -105.1737° W Datum: NAD83
Soil Map Unit Name: Denver Urban Land Complex NWI classification:
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)
Are Vegetation N, Soil Y, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No
Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes No X
Hydric Soil Present? Yes No
Wetland Hydrology Present? Yes No
Is the Sampled Area within a Wetland? Yes No X

Remarks:
High Precip Year
man-made depression / feature - no inlet or outlet

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
	0 = Total Cover		
Sapling/Shrub Stratum (Plot size: 15')			
1. Rosa woodsii	T	Y	FACU
2.			
3.			
4.			
5.			
	1 = Total Cover		
Herb Stratum (Plot size: 5')			
1. Agropyron smithii	50	Y	FACU
2. Melilotus officinalis	10	N	FACU
3. Cirsium arvense	10	N	FACU
4. Festuca arundinacea	5	N	FACU
5. Lactuca serriola	5	N	FAC
6. Bromus japonicus	3	N	FACU
7. Grindelia squarrosa	T	N	FACU
8.			
9.			
10.			
	83 = Total Cover		
Woody Vine Stratum (Plot size: 5')			
1.			
2.			
	0 = Total Cover		

% Bare Ground in Herb Stratum: 15

Remarks:

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC (excluding FAC-): 0 (A)
Total Number of Dominant Species Across All Strata: 2 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:
N Dominance Test is >50%
N Prevalence Index is ≤3.0[1]
N Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
N Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes No X

US Army Corps of Engineers Great Plains – Interim Version

SOIL

Sampling Point: NREL-10

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-17	10YR 4/2	100					CL	
17-20	10YR 5/4	60					SCL	Silty clay loam
	10YR 4/6	40					SCL	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- X Histosol (A1)
- Histic Epipedon (A2)
- Black Histic (A3)
- Hydrogen Sulfide (A4)
- Stratified Layers (A5) (LRR F)
- 1 cm Muck (A9) (LRR F, G, H)
- Depleted Below Dark Surface (A11)
- Thick Dark Surface (A12)
- Sandy Mucky Mineral (S1)
- 2.5 cm Mucky Peat or Peat (S2) (LRR G, H)
- 5 cm Mucky Peat or Peat (S3) (LRR F)
- N Sandy Gleyed Matrix (S4)
- Sandy Redox (S5)
- Stripped Matrix (S6)
- Loamy Mucky Mineral (F1)
- Loamy Gleyed Matrix (F2)
- Depleted Matrix (F3)
- Redox Dark Surface (F6)
- Depleted Dark Surface (F7)
- Redox Depressions (F8)
- High Plains Depressions (F16) (MLRA 72 & 73 of LRR H)

Indicators for Problematic Hydric Soils[3]:

- N 1 cm Muck (A9) (LRR I, J)
- Coast Prairie Redox (A16) (LRR F, G, H)
- Dark Surface (S7) (LRR G)
- High Plains Depressions (F16) (LRR H outside of MLRA 72 & 73)
- Reduced Vertic (F18)
- Red Parent Material (TF2)
- Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: NA

Depth (inches):

Hydric Soil Present? Yes ____ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- N Surface Water (A1)
- High Water Table (A2)
- Saturation (A3)
- Water Marks (B1)
- Sediment Deposits (B2)
- Drift Deposits (B3)
- Algal Mat or Crust (B4)
- Iron Deposits (B5)
- Inundation Visible on Aerial Imagery (B7)
- Water-Stained Leaves (B9)
- N Salt Crust (B11)
- Aquatic Invertebrates (B13)
- Hydrogen Sulfide Odor (C1)
- Dry-Season Water Table (C2)
- Oxidized Rhizospheres on Living Roots (C3) (where not tilled)
- Presence of Reduced Iron (C4)
- Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- N Surface Soil Cracks (B6)
- Sparsely Vegetated Concave Surface (B8)
- Drainage Patterns (B10)
- Oxidized Rhizospheres on Living Roots (C3) (where tilled)
- Crayfish Burrows (C8)
- Saturation Visible on Aerial Imagery (C9)
- Geomorphic Position (D2)
- FAC-Neutral Test (D5)
- Frost-Heave Hummocks (D7) (LRR F)

Field Observations:

Surface Water Present? Yes ____ No X Depth (inches): ____

Water Table Present? Yes ____ No X Depth (inches): ____

Saturation Present? (includes capillary fringe) Yes ____ No X Depth (inches): ____

Wetland Hydrology Present? Yes ____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Large (3/4 acre) depression that is man-made

WETLAND DETERMINATION DATA FORM – Great Plains Region

Project/Site: Lena Gulch/SEA II STM City/County: Golden, Jefferson Sampling Date: 7/29/09
Applicant/Owner: National Renewable Energy Lab State: CO Sampling Point: NREL-11
Investigator(s): Ryan, Braus, Beatty, Wood Section, Township, Range: Sec 01 NE, T3S, R70W
Landform (hillslope, terrace, etc.): Drainage Swale Local relief (concave, convex, none): Concave Slope (%): 2
Subregion (LRR): G (Western Great Plains) Lat: 39.7369° Long: -105.1747° Datum: NAD83
Soil Map Unit Name: Denver-Kirkland Complex NWI classification:
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)
Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No
Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No
Hydric Soil Present? Yes X No
Wetland Hydrology Present? Yes X No
Is the Sampled Area within a Wetland? Yes X No

Remarks:
High Precip Year
Originally, this swale was created by placing RIP-RAP

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 20)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15)			
1. Salix exigua	60	Y	OBL
2. Salix amygdaloides	10	N	FACW
3.			
4.			
5.			
	70	= Total Cover	
Herb Stratum (Plot size: 5)			
1. Cirsium arvense	30	Y	FACU
2. Mentha arvensis	10	Y	FACW
3. Conium maculatum	10	Y	FACW
4. Glyceria striata	T	N	OBL
5. Rumex crispus	T	N	FACW
6.			
7.			
8.			
9.			
10.			
	50	= Total Cover	
Woody Vine Stratum (Plot size: 5)			
1.			
2.			
	0	= Total Cover	

% Bare Ground in Herb Stratum 15

Remarks:

Dominance Test Worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC (excluding FAC-): 2 (A)
Total Number of Dominant Species Across All Strata: 3 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 66.7 (A/B)

Prevalence Index worksheet:
Total % Cover of — Multiply by —
OBL species — x 1 =
FACW species — x 2 =
FAC species — x 3 =
FACU species — x 4 =
UPL species — x 5 =
Column Totals — (A) — (B)
Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:
Y Dominance Test is >50%
— Prevalence Index is ≤3.0[1]
N Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
N Problematic Hydrophytic Vegetation[1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No

US Army Corps of Engineers Great Plains – Interim Version

SOIL

Sampling Point: NREL-11

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type	Loc	Texture	Remarks
0-8	10YR 3/2	80	7.5YR 5/8	20	C	M	SaC	Sandy Clay
8-21	10YR 3/3	100					SaC	

Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- Histosol (A1)
- Histic Epipedon (A2)
- Black Histic (A3)
- Hydrogen Sulfide (A4)
- Stratified Layers (A5) (LRR F)
- 1 cm Muck (A9) (LRR F, G, H)
- Depleted Below Dark Surface (A11)
- Thick Dark Surface (A12)
- Sandy Mucky Mineral (S1)
- 2.5 cm Mucky Peat or Peat (S2) (LRR G, H)
- 5 cm Mucky Peat or Peat (S3) (LRR F)
- Sandy Gleyed Matrix (S4)
- Sandy Redox (S5)
- Stripped Matrix (S6)
- Loamy Mucky Mineral (F1)
- Loamy Gleyed Matrix (F2)
- Depleted Matrix (F3)
- Redox Dark Surface (F6)
- Depleted Dark Surface (F7)
- Redox Depressions (F8)
- High Plains Depressions (F16) (MLRA 72 & 73 of LRR H)

Indicators for Problematic Hydric Soils[3]:

- 1 cm Muck (A9) (LRR I, J)
- Coast Prairie Redox (A16) (LRR F, G, H)
- Dark Surface (S7) (LRR G)
- High Plains Depressions (F16) (LRR H outside of MLRA 72 & 73)
- Reduced Vertic (F18)
- Red Parent Material (TF2)
- Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: NA

Depth (inches):

Hydric Soil Present? Yes X No

Remarks:

Rip rap in sample.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- Surface Water (A1)
- High Water Table (A2)
- Saturation (A3)
- Water Marks (B1)
- Sediment Deposits (B2)
- Drift Deposits (B3)
- Algal Mat or Crust (B4)
- Iron Deposits (B5)
- Inundation Visible on Aerial Imagery (B7)
- Water-Stained Leaves (B9)
- Salt Crust (B11)
- Aquatic Invertebrates (B13)
- Hydrogen Sulfide Odor (C1)
- Dry-Season Water Table (C2)
- Oxidized Rhizospheres on Living Roots (C3) (where not tilled)
- Presence of Reduced Iron (C4)
- Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- Surface Soil Cracks (B6)
- Sparsely Vegetated Concave Surface (B8)
- Drainage Patterns (B10)
- Oxidized Rhizospheres on Living Roots (C3) (where tilled)
- Crayfish Burrows (C8)
- Saturation Visible on Aerial Imagery (C9)
- Geomorphic Position (D2)
- FAC-Neutral Test (D5)
- Frost-Heave Hummocks (D7) (LRR F)

Field Observations:

Surface Water Present? Yes No X Depth (inches):

Water Table Present? Yes No X Depth (inches):

Saturation Present? (includes capillary fringe) Yes No X Depth (inches):

Wetland Hydrology Present? Yes X No

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

US Army Corps of Engineers

Great Plains – Interim Version

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, OMAHA DISTRICT
DENVER REGULATORY OFFICE, 9307 SOUTH WADSWORTH BOULEVARD
LITTLETON, COLORADO 80128-6901

August 28, 2009

Mr. Steve Blazek
Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, CO 80401-3393

RE: Lena Gulch Wetland Delineation Review Relevant to the National Renewable Energy Laboratory Supplemental Environmental Assessment for the South Table Mountain Facility
Corps File No. NWO-2009-2120-DEN

Dear Mr. Blazek:

Mr. Terry McKee of my office has reviewed your August 17, 2009 correspondence containing the wetland delineation report and map for this project located in the NE ¼ of Section 1, T4S, R70W, Jefferson County, Colorado. Mr. McKee considers your wetland report and map for this project accurate and acceptable.

If any work associated with this project requires the placement of dredged or fill material, and any excavation associated with a dredged or fill project in Lena Gulch Stream bed or wetlands, this office should be notified by a proponent of the project for Department of the Army permits or changes in permit requirements pursuant to Section 404 of the Clean Water Act.

Work in Lena Gulch Stream bed or wetlands should be identified and be shown on a map identifying the Quarter Section, Township, Range and County and Latitude and Longitude, Decimal Degrees (datum NAD 83) and the dimensions of work in a stream bed or wetland. Any loss of an aquatic site may require mitigation. Mitigation requirements will be determined during the Department of the Army permitting review.

The Omaha District, Regulatory Branch is committed to providing quality and timely service to our customers. In an effort to improve customer service, please take a moment to complete our Customer Service Survey found on our website at http://per2.nwp.usace.army.mil/survey.html. If you do not have Internet access, you may call and request a paper copy of the survey that you can complete and return to us by mail or fax. (Completing the survey is a voluntary action)

If there are any questions call **Mr. Terry McKee** of my office at **303-979-4120** and reference **Corps File No. NWO-2009-2120-DEN**.

Sincerely,

Timothy T. Carey
Chief, Denver Regulatory Office

tm

Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3305

September 1, 2009

Ms. Ellen Mayo
U.S. Fish and Wildlife Service
Ecological Services
Western Colorado Field Office
764 Horizon Drive, Building B
Grand Junction, Colorado 81506-3946

Dear Ms. Mayo,

RE: LENA GULCH ROAD CROSSING – GOLDEN, COLORADO

The U.S. Department of Energy (DOE) is proposing to establish a second full service access road to its South Table Mountain (STM) Complex to accommodate future growth at the facility. Four of DOE's proposed access corridors would cross Lena Gulch to create a southern route for STM access. Figure 1 presents the project area and the proposed corridors.

DOE is currently preparing an Environmental Assessment (EA) Supplement for five proposed Site Development Projects at the National Renewable Energy Laboratory's STM site:

1) Energy Systems Integration Facility (ESIF)
2) Expansion of campus infrastructure
3) Waste Handling Facility (WHF) expansion
4) Visitor's Center expansion
5) The addition of a second full service access road (secondary access) to STM

A rare plant survey is needed to determine baseline conditions for the secondary access portion of the EA and represents an effort by DOE to afford the U.S. Fish and Wildlife Service an opportunity to be involved early in project planning.

Project Location

The project location is north of I-70 and west of Denver West Parkway on a portion of the former Camp George West National Guard facility in Jefferson County. The land within the project area includes private land as well as land currently owned by Jefferson County Open Space and leased by the Pleasant View Metropolitan District (T04S, R70W, SEC 01, NE1/4 Morrison Quadrangle- Figure 1). The UTM coordinates (NAD83) representing the upstream and downstream extents of the project area under consideration are upstream: Zone 13, 4398241mN, 484740mE; downstream: Zone 13, 4398582mN and 485724mE. Adjacent properties include the Pleasant View Subdivision to the west, NREL to the north, the Colorado State Patrol Academy and correctional facility to the south, and the Richards Heights subdivision and a larger private parcel to the east.

Access to the project location is from South Golden Road and Kilmer Street (Figure 1). The majority of the project area is contained within Pleasant View Community Park with adjoining private parcels up- and down-stream of the park.

Vegetation and Habitat

Lena Gulch originates in the foothills in the Apex Park Open Space west of the Heritage Square Amusement Park. The gulch continues east and is often conveyed in concrete canals through the Golden area. Lena Gulch becomes forested as it crosses South Golden Road (into the project area) with typical tree species of riparian areas in eastern Colorado. After crossing two private parcels, Lena Gulch crosses into the Pleasant View Community Park and extends through the park for approximately ½ mile. Once the drainageway crosses back into private land, it again becomes channelized and adjacent land use encroaches as Lena Gulch continues through urban and suburban landscapes to its confluence with Clear Creek near the intersection of 44th Avenue and Kipling Street.

Common trees along this reach within Pleasant View Community Park include plains Cottonwood (*Populus deltoides*), Peachleaf Willow (*Salix amygdaloides*), Russian olive (*Elaeagnus angustifolia*), Green Ash (*Fraxinus pennsylvanica*), and Siberian Elm (*Ulmus pumila*) (Photo 1). Shrubs are localized along the riparian zone and include Chokecherry (*Prunus virginiana*), Wild Plum (*Prunus americana*), and Red Hawthorn (*Crataegus erythropoda*). Understory vegetation consists mostly of grasses including Smooth Brome (*Bromus inermis*), Reed Canarygrass (*Phalaris arundinacea*), and Tall Fescue (*Schedonorus phoenix*) (Photo 2).

Only a few locations supported plant species commonly associated with orchids. These include Field Horsetail (*Equisetum arvense*) and Goldenrod (*Solidago* spp.).

Upland vegetation includes grasses and a dominance of weedy herbs. Dominant plants include Western Wheat Grass (*Pascopyrum smithii*), Crested Wheat Grass (*Agropyron cristatum*), Smooth Brome, Cheatgrass (*Bromus tectorum*), and Fringe Sage (*Artemisia ludoviciana*).

Hydrology and Landscape

Lena Gulch is identified as an intermittent stream on the USGS Morrison Quadrangle map. However, given the level of urbanization upstream of the project area, the stream likely flows most of the year if not all year round. Lena Gulch has likely been channelized. Channelization often creates instability and active erosion and deposition that are extensive (Anderson 1999b). Consequently, Lena Gulch has an incised channel (Photo 3) throughout most of this reach and overbank flooding appears limited to a few locations. The Pleasant View Metro District has created a side channel to the south of the natural drainage for wetland mitigation and flood storage (Photo 4). This area was excavated and lined with rip-rap and is now supporting robust Cattail (*Typha latifolia*) stands and diverse wetland vegetation among and upgradient from the cattails.

The project area was recently delineated for wetlands and a map was created and submitted to the U.S. Army Corps of Engineers for approval. This effort helped with site familiarity and an understanding of hydric soils in the area. This information is available upon request but soil characteristics match closely with an earlier rare plant survey (Anderson 1999a).

Site History and Management

The project area was formerly the Camp George West National Guard facility. The management of the site was for military training, administrative, and storage purposes. Remnant drainageways north of Lena Gulch support a patch (about ¼ acre) of Sandbar Willow (*Salix exigua*). These drainage ways were more evident before recent park development that reworked drainage across the site.

Land formerly part of Camp George West has been following decommissioning since the late 1950's, but was likely disturbed and reworked during operations of Camp Georg West and during decommissioning. Over the last 10 years, Pleasant View Metro District has begun re-engineering the drainage patterns across the site and constructing ball fields and a parking lot. A constructed wetland was built south of Lena Gulch to reorient the floodplain to the south.

Survey Methods

In accordance with the Endangered Species Act, we conducted a survey for the federally listed Ute ladies' tresses Orchid (*Spiranthes diluvialis*- Orchid) and the Colorado Butterfly Plant (*Gaura neomexicana coloradensis*- CBP). This survey was conducted over two site visits, on August 5th and again on August 19th, 2009 when local populations of orchids (Wheat Ridge and Boulder, Colorado) were known to be blooming.

All potential wetland and wetland fringe areas within the limits of the EA secondary access study area (project area) were surveyed for the presence of orchids in accordance with the current interim guidelines published by the U.S. Fish and Wildlife Service (USFWS 1992). The project area was also surveyed for CBP. Tom Ryon, a prequalified *Spiranthes diluvialis* surveyor, led a team of 3 biologists conducting the surveys. Mr. Ryon's qualifications are available upon request.

Potential habitat areas at Lena Gulch, as identified by areas with common associated plant species for the orchid and a general knowledge of wetlands within the project area, were walked in a 5 to 10-foot grid pattern and the understory was carefully observed. Small drainages were walked along the length of both banks in potential habitat areas.

Survey Results and Conclusion

This is the second time the Lena Gulch area has been surveyed for these two federally protected plants. Anderson (1999a) conducted a survey of the Camp George West site for a park development project for the Pleasant View Metropolitan District. This report is available from NREL upon request.

The results of the survey revealed no orchids or CBP within the project area along Lena Gulch and adjoining tributaries. All potential habitat areas exhibiting vegetative or hydrologic potential were surveyed. Although suitable hydrologic conditions exist along Lena Gulch and in the lower reaches of various tributaries, only two species commonly associated with the orchid occurred, Field Horsetail (*Equisetum arvense*) and Goldenrod (*Solidago* spp.). Soils on this site generally do not appear to be conducive to the establishment of the orchid or CBP (Anderson 1999a). Recent soil observations during wetland delineations support Anderson's (1999a) findings.

After two surveys, confirming only marginal habitat conditions at the site, and considering the site history that *Spiranthes diluvialis* and *Gaura neomexicana coloradensis* do not exist within this project area, DOE concludes that these species are not present in or adjacent to Lena Gulch in the identified project area.

DOE requests that USFWS provide written concurrence to this habitat assessment. If USFWS agrees with the disqualification. For further questions or concerns regarding this assessment, please contact Tom Ryon (303-275-3252) or myself at 303-275-4723.

Sincerely,

Steve Blazek, NEPA Compliance Officer

Cc: Adam Mizstal – U.S. Fish and Wildlife Service
Pete Plage – U.S. Fish and Wildlife Service
Tom Anderson – Pacific Northwest Labs
Chris Carasona – DOE, Golden Field Office
John Eickhoff – EHS, NREL
Tom Ryon – EHS, NREL

References

Anderson & Company. 1999. Ecological Assessment at Camp George West park site. Prepared for Pleasantview Metropolitan District and The Norris Dullea Company. July. 10+ tables.

Anderson & Company. 1999. *Spiranthes diluvialis* Survey of the Camp George West Park Site. Prepared for Pleasant View Metropolitan District and The Norris Dullea Company. July. 10+ photos and appendix.

Colorado Native Plant Society. 1997. Rare Plants of Colorado, Second Edition.

United States Department of the Interior, Fish and Wildlife Service. 1992. FFW/CO:ES Plants – *Spiranthes diluvialis* (Ute ladies'-tresses orchid). Interim. Survey requirements for *Spiranthes diluvialis*.

United States Department of Agriculture, Soil Conservation Service. 1980. Soil survey of the Golden Area, Colorado. Online: < http://soils.usda.gov/survey/online_surveys/> and < http://websoilsurvey.nrcs.usda.gov/>

Weber, W.A. 1990. Colorado Flora: Eastern Slope. University Press of Colorado, Niwot, Colorado.

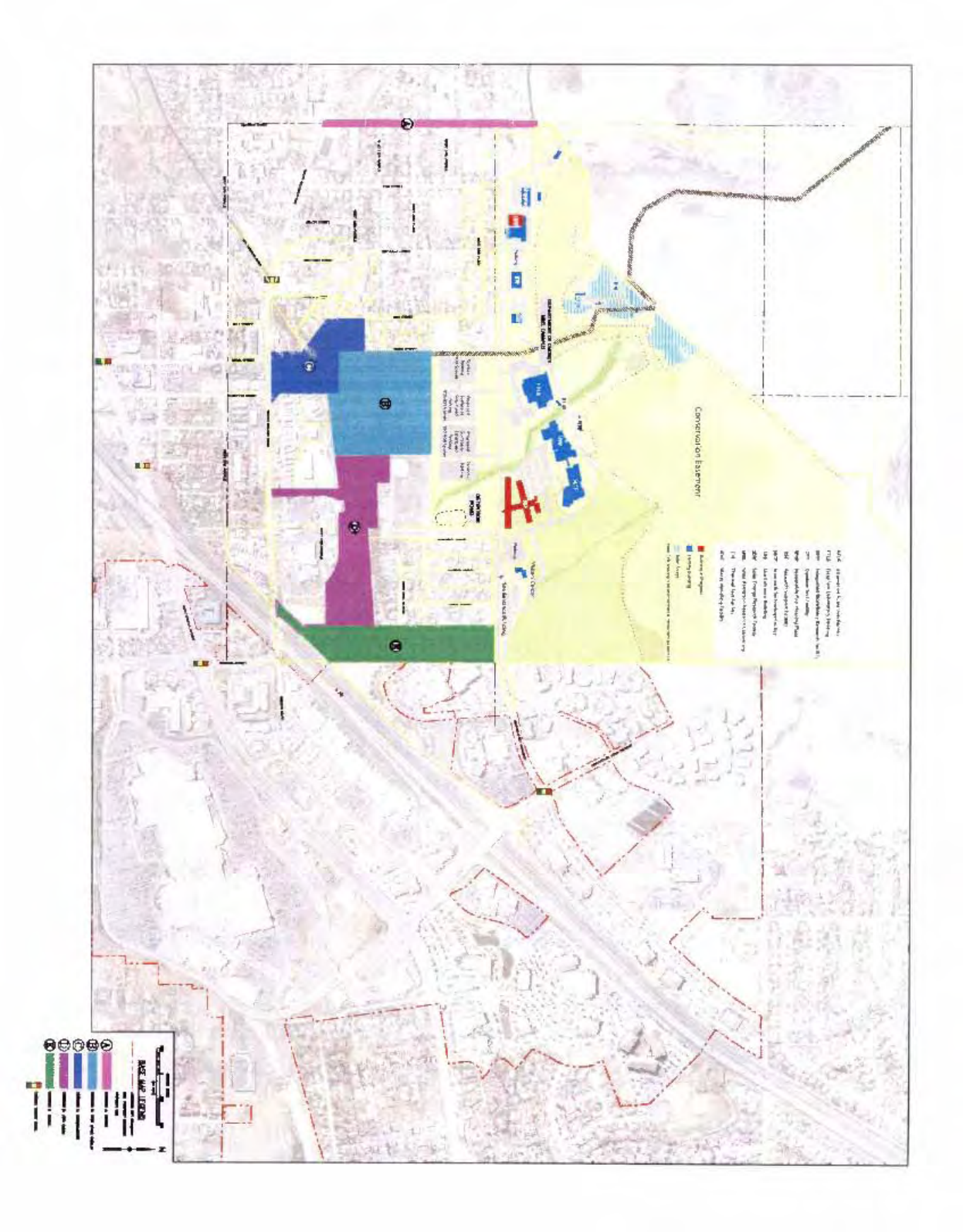

Conservation Easement

Photo 1. Riparian forest gallery line Lena Gulch.

Photo 2. Understory along Lena Gulch is primarily grasses.

Photo 3. Lena Gulch is incised for most of its length through the Pleasant View Park.

Photo 4. Constructed wetlands and flood storage channel adjacent to the south bank of Lena Gulch.

Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3305

September 1, 2009

U.S. FISH AND WILDLIFE SERVICE
X CONCUR NO EFFECT
☐ CONCUR NOT LIKELY TO ADVERSELY AFFECT
☐ NO COMMENT
SEP 2 4 2009
COLORADO FIELD SUPERVISOR (ES/ES)
Susan C. Linner

Ms. Ellen Mayo
U.S. Fish and Wildlife Service
Ecological Services
Western Colorado Field Office
764 Horizon Drive, Building B
Grand Junction, Colorado 81506-3946

Dear Ms. Mayo,

RE: LENA GULCH ROAD CROSSING – GOLDEN, COLOROADO

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APPENDIX C BOUNDING EVENTS ANALYSIS

This preliminary bounding events analysis for the proposed Energy Systems Integration Facility (ESIF) at the National Renewable Energy Laboratory (NREL) has been developed using information available as of June 2008 (Manno 2008), supplemented by the draft ESIF Request for Proposal (RFP) (NREL 2009). The goal of this analysis is to identify the bounding events relating to life safety and property protection that could be used in the environmental assessment (EA) of the ESIF. Once established, these bounding events would represent the upper boundary of risk that would be presented by activities proposed for the facility. All other proposed and future work must have a level of risk below the bounding events, or a new assessment would be required to determine the significance of impact to the site. It is important to note that the ESIF bounding events analysis is necessarily an iterative process in the design/build delivery model; hence, the risk scenarios, hazards, controls, mitigations, and the risks themselves may change, evolve or be refined as the design progresses.

ESIF operations would require a number of materials, including nanomaterials, to be stored and processed at the facility. Some of these materials are hazardous. Data on the hazardous materials that would be present in the ESIF are based on the types of activities that would be performed in the various laboratories. Because the facility design process is in early stages, quantitative estimates of the amount of hazardous material present, as well as their physical state, are based on bounding estimates from design/build documents or based on experience operating similar processes in currently existing facilities. The majority of hazardous materials to be stored and processed at the ESIF are well understood. In addition, many facilities within NREL and throughout the world have used these hazardous materials safely.

Nanomaterials: Nanoscale materials; materials with structural features (particle size or grain size, for example) of at least one dimension in the range 1 to 100 nanometers.

Nanometer: One-billionth of a meter (10^{-9} meter).

The hazards posed by nanomaterials are less understood than more common hazardous materials, but for now NREL treats these materials as toxic and extremely hazardous, and uses controls commensurate with this assumed hazard. NREL would continue implementing this conservative approach until empirical-based evidence demonstrates that alternative precautions are effective. Although specific guidance on evaluation and control of the risks posed by nanomaterials is limited, preliminary research suggests that some of the controls used in conventional laboratory settings are effective and NREL has practical experience in the handling and control of these materials. In the case of the ESIF, the actual quantities of nanomaterials would be extremely limited because their use is not integral to most of the activities that would be conducted in the ESIF at this time; however, with the potential growth in this research area, NREL should consider laboratory designs for the ESIF that include engineering controls that are sufficient to protect workers, the public and the environment from nanomaterials.

The safety staff at NREL would apply their Hazard Identification and Control Procedure (NREL 2006) throughout the design/build process to ensure that the safety features incorporated into the facility would provide adequate protection to workers and the general public during facility construction and operations. In accordance with the Hazard Identification and Control Procedure, if, during the design process, the proposed safety features were shown to be inadequate, design changes or new safety features would be specified and shown to provide adequate protection. Before a laboratory would be used, the systems would be evaluated and readiness to operate them verified, in accordance with this procedure. Moreover, the Department of Energy, Golden Field Office, would provide independent oversight and verification reviews to ensure that NREL has met its commitments to identify, mitigate, and manage risk to an acceptable level.

The basis for the preliminary bounding events analysis is the risk matrix contained in Appendix A of the NREL Hazard Identification and Control Procedure (NREL 2006). The risk matrix is shown in Figure C-1.

Failure	Failure Frequency (per year)	Failure Consequence Severity			
		Catastrophic	Critical	Marginal	Negligible
Frequent	>1	High Risk	High Risk	Moderate Risk	Routine Risk
Reasonably Probable	1 to 0.1	High Risk	High Risk	Moderate Risk	Routine Risk
Occasional	$0.1 – 10^{-2}$	High Risk	Moderate Risk	Low Risk	Routine Risk
Remote	$10^{-2} – 10^{-4}$	Moderate Risk	Low Risk	Low Risk	Routine Risk
Extremely Remote	$10^{-4} – 10^{-6}$	Low Risk	Low Risk	Routine Risk	Routine Risk
Impossible	$< 10^{-6}$	Routine Risk	Routine Risk	Routine Risk	Routine Risk

Source: Appendix A of National Renewable Energy Laboratory Procedure No. 6-6.2, Hazard Identification and Control, 06/30/2006.

Figure C-1. Risk Assessment Matrix

In the Hazard Identification and Control Procedure, an event resulting in more than $1 million in equipment loss, death, or system loss is defined as Catastrophic. An event resulting in $100,000 to $1 million in equipment damage, severe injury or occupational illness, or minor system damage is defined as Critical. An event resulting in $10,000 to $100,000 in equipment damage, minor occupational injury or illness, or minor system damage is defined as Marginal. An event resulting in less than $10,000 in equipment damage, no injury or illness, or no system damage is classified as Negligible. Based on the Hazard Identification and Control Procedure, activities having Low Risk and Routine Risk are acceptable, and activities having High Risk or Moderate Risk levels must be approved by executive management on a case-by-case basis.

The NREL Hazard Identification and Control Procedure defines the scope of future hazards analysis reviews to be performed during facility design. The analysis contained herein relies on information available in the June version of the preliminary hazards assessment for the ESIF facility (Manno 2008), then supplements that assessment with information from the ESIF RFP (NREL 2009), to identify a series of events that could occur at the ESIF. Each event scenario is placed into a cell in the risk matrix based on the probability that the event would occur and the severity of the event. This process is performed twice for each event: once assuming that no protective features are in place, and a second time assuming that commonly used or already identified protective features are in place to prevent, protect, or mitigate that specific event.

Even though it is not possible to identify all possible events early in the design phase, the goal of this analysis is to consider many classes of events—for example, equipment failures, process upsets, and procedural errors as they are understood at this early stage of the design process. The objective of this exercise is to identify the representative and bounding events for the facility and the control sets that would be necessary to operate the facility within an acceptable level of risk. As design and construction proceed, consistent with the Hazard Identification and Control Procedure, more detailed hazards analyses would be performed so that changes in the facility hazards and design are adequately captured and analyzed. This would ensure that facility that workers, site workers, and the general public are adequately protected from any events that may occur after the ESIF becomes operational. As the design process proceeds, it is anticipated that some of the assumptions upon which this analysis is based would change. This may result in the identification of some new bounding events, others might be shown to be

impossible, and still others might fall into a lower cell in the risk matrix. The identification of a new bounding event of higher significance would trigger a review of the impact of that event on the site.

This analysis is divided into four major sections. Section C.1 discusses major hazards and potential events based on the long history of hydrogen production and use around the world. The experiences presented in this section consider neither the likelihood nor the consequences of their occurrence at the ESIF. Section C.2 summarizes the risk tables developed as part of this bounding events analysis. Section C.3 quantifies some of the representative event scenarios identified in Section C.2. Section C.4 lists sources cited.

C.1 Hazards and Potential Events

Hydrogen

The generation, storage, and use of significant quantities of hydrogen at high pressures represents the major hazard at the proposed ESIF. The following discussion is a review of the more significant events associated with handling hydrogen at high pressures, and of their consequences, without considering the probability of their occurrence.[1]

The current design includes enough storage capacity for 250 kilograms of hydrogen. Storage pressures vary from 3,500 to 15,000 pounds per square inch (psi). The ESIF hazards analyses can build off the extensive National Aeronautics and Space Administration (NASA) experience handling large quantities of gaseous hydrogen at high pressures. Metals fabrication facilities also use large quantities of hydrogen, as does the petroleum refining industry. Overall, there have been many years of safe operation, as well as some spectacular failures. Clearly, the hazards of handling hydrogen are well-known, and there is every likelihood that it would be handled safely at the ESIF.

The hazards of handling hydrogen stem from its large flammability range—4 percent to 75 percent (Lees 2006, Table 16.4)—and its very low spark ignition energy—0.019 millijoules (mJ) (Lees 2006, Table 16.6). The Fire Protection Handbook (Cote 1986, p5-52) states: “Although its wide flammability range and high burning rate accentuate these hazards, its low ignition energy, low heat of combustion on a volume basis and its nonluminous (low thermal radiation level) flame exert counteracting influences in many instances.” The handbook (p 5-52) further states:

> Because of its low ignition energy, when gaseous hydrogen is released at high pressure, normally small heat producing sources, e.g. friction and static generation, often result in prompt ignitions. Accordingly, hydrogen is often thought of as self-igniting under these circumstances. A record of releases at high pressure reveals that fires rather than combustion explosions occur. When hydrogen is released at low pressure, self-ignition is unlikely and combustion explosions occur which are often characterized by very rapid pressure rises which are extremely difficult to vent effectively. Open air or space explosions have occurred from large releases of gaseous hydrogen.

The combustion explosions are often referred to as deflagrations. While some damage can result from the flame front, such as secondary ignition of combustible materials, most of the damage from a deflagration occurs from rapid pressure buildup from the heating of the reactants (hydrogen and oxygen), the combustion product water vapor, and the air. The pressure rise is limited by the extent to which the gases are confined. The pressure buildup is never greater than about 10 times the absolute pressure before

[1] The purpose of this document is to perform sufficient analyses to identify bounding accidents. Because hydrogen presents a significant hazard in the ESIF, much of the focus of the analysis has been on hydrogen accident scenarios. Consequently, this document should not be considered to be a comprehensive safety guide for the ESIF design.

ignition. While the peak pressure might be quite high, its duration is normally quite limited because of venting and the heat transfer between the hot gases and cold surfaces in the area where the fire occurred.

Because of its broad flammable range, if there is a leak of hydrogen in any area where hydrogen can accumulate, from a safety perspective it should be assumed that there would be a location where the hydrogen concentration is within the flammability range and that a spark source of sufficient energy to ignite the hydrogen would also be present. Given that it would be difficult to totally prevent leaks from occurring (the ESIF is, after all, a developmental facility), designs must take advantage of the rapid dissipation of released hydrogen. Specifically, the design must ensure that (1) released hydrogen cannot rise into an enclosed area, and (2) vent pipes designed to remove any hydrogen are not venting a flammable mixture of hydrogen and air. The metal fabrication industry places large holes in the roofs of its facilities, and the petroleum industry places much of its equipment outdoors to take advantage of the rapid diffusion and resultant dispersion of hydrogen gas to the atmosphere. Both of these design approaches avoid the difficult issue of ensuring adequate venting should a deflagration occur in a confined area.

It has been shown experimentally and theoretically that the flame front produced in an unconfined three-dimensional flammable gas cloud would not accelerate and produce a much more damaging explosive shock wave. That is not the case if the plume is confined in one or two of the three dimensions. Numerous detailed accident investigations have concluded that the damage resulting from partially confined plumes is much greater than would be expected for an unconfined vapor cloud deflagration. Similarly, if the flammable mixture is in a pipe of sufficient diameter (typically 1 inch or greater) and ignition occurs, the flame front rapidly accelerates; after about 10 pipe diameters, the flame front would reach sonic velocity and the resultant shock wave would split the pipe open.

Regarding the storage of hydrogen at high pressures, the failure of a vessel is judged to be in the Impossible range using the NREL risk matrix. A NASA-authored report discussing catastrophic storage vessel failure states: “Although there is a very low probability for catastrophic occurrence, selecting a site that would minimize the effects of such an event is prudent” (NASA 2004). The analysis then assumes a catastrophic failure of the pressure vessel and establishes a safe distance to the nearest building from the storage location. The basis for the distance comes from a modeling of the release plume. The objective is to place the storage location far enough away from any adjacent structure such that the release plume would be unconfined should it be ignited. National Fire Protection Association (NFPA) standards for hydrogen handling incorporate these distances.

High-pressure hydrogen would be stored in tube racks consisting of a number of cylinders, four to six, each about 20 feet long and 1 foot in diameter. Each cylinder is protected by a rupture disk, and all the cylinders in the tube rack are likely to be on a common manifold. The tube configuration is not unlike the tube trailers used to deliver high-pressure gases to facilities like NREL. Failure of a hydrogen storage cylinder is not anticipated. If a cylinder did fail, it would not be expected to cause an adjacent pressure cylinder to fail because such vessels are often made of ductile metals.

Under this failure scenario, one of the pressure cylinders fails and generates a large gas cloud. While such failures are rare, those that have occurred are often the result of hydrogen embrittlement in an area sensitized following welding. Accumulation of combustibles, trash, or a fuel spill around the pressure cylinders could also result in cylinder failures if a fire occurred. The 20-foot-long storage vessels are long enough to make it possible for a fire to overheat one end of a vessel; if the rupture disk is at the other end, the vessel could fail catastrophically before it vented to the atmosphere. Even in this case, although several vessels might be close to failing, it is not expected that they would fail simultaneously. Based on

information supplemental to the bid package provided by NREL, the maximum quantity in one vessel, 25 kilograms, limits the energy that would be released should one or more of the storage vessels fail.

Another hydrogen hazard that must be considered is the quantity of hydrogen that could be released should a high-pressure hydrogen pipe be damaged and fail. The system would be provided with a quick-acting isolation valve that would isolate the hydrogen in the line from the storage vessels when the pressure in the piping drops rapidly. Often, the volume of hydrogen that exits the system before shutdown is initiated and the volume that exits after shutdown is great enough to cause all or a large portion of the atmosphere in a laboratory room to exceed the lower flammability limit for hydrogen in just a few seconds. An ignition source, if present, would ignite the gas cloud, and because the cloud is confined, the pressure in the room would rapidly rise. If the whole room were in the flammable range at the time of ignition, the pressure would breach the walls and potentially damage adjacent laboratories. As previously discussed, if the vented hydrogen accumulates in a pipe and the flammable mixture ignites, an even more damaging detonation could occur.

There are other properties of hydrogen that present some hazards. Explosions have occurred within a pressure cylinder if air is not purged from the cylinder before hydrogen is added. Static electricity could ignite the hydrogen concentration if within the flammability range. The flame front formed would accelerate down the cylinder and detonate. Such a detonation would be violent enough to cause the remaining cylinders to fail. This risk is documented.[2]

Another hazard of hydrogen is associated with its interaction with the pressure cylinder. If the hydrogen is extremely pure, which might be the case with hydrogen generated on-site, the pressure vessel would be more susceptible to hydrogen embrittlement.

General Controls used for Hydrogen. Hazard controls for hydrogen use and other safety precepts applied to hydrogen systems generally include the following:

- Providing adequate ventilation, as well as designing and operating hydrogen systems to prevent leakage, and eliminating potential ignition sources.

- Installing barriers or safeguards to minimize risks and control failures.

- Installing safety systems to detect and counteract or control the possible effects of such hazards as vessel failures, leaks and spills, embrittlement, collisions during transportation, ignitions, fires and explosions, cloud dispersions, and the exposure of personnel to flame temperatures.

- Maintaining a safe interface under normal and emergency conditions so at least two failures occur before hazardous events could lead to personal injury, loss of life, or equipment or property damage.

- Installing warning systems to detect abnormal conditions, measure malfunctions, and indicate incipient failures. Providing warning system data transmissions with visible and audible signals that have sufficient redundancy to prevent any single-point failure from disabling the warning system.

[2] See: "Assessment of detonation hazards in high-pressure hydrogen storage from chemical sensitivity analysis," online at http://cat.inist.fr/?aModele=afficheN&cpsidt=18471100.

- Installing safety valving and flow regulation that would adequately respond and protect personnel and equipment during hydrogen storage, handling, and use.

- Using automated control systems with caution and warning feedback inputs. Also, constraining manual controls within the systems by using automatic limiting devices to prevent over-ranging.

- Applying a system of verifications of equipment, power, and other system services for safe performance in the design and normal operational regimes.

- Applying "fail-safe" system design, meaning that any single point failure from which potentially hazardous conditions are a risk must cause the system to revert to conditions that would be safest for personnel and with the lowest property damage potential.

- Applying redundant safety features to prevent a hazardous condition when a component fails.

- Subjecting all plans, designs, and operations associated with hydrogen use to an independent, safety review. Safety reviews should be conducted on effects of fluid properties, training, escape and rescue, fire detection, and fire fighting.

- Establishing operating procedures for normal and emergency conditions and reviewing these procedures as appropriate.

- Performing hazards analyses to identify conditions that may cause injury, death, or property damage.

- Assuring continuous improvement of systems through reporting, investigating, and documenting the occurrences, causes, and corrective actions required for mishaps, incidents, test failures, and mission failures in accordance with standardized procedures.

All of these safety controls and precepts are currently used at NREL and NREL's Integrated Safety Management System provides a rigorous administrative structure and requires resources to ensure that these safety precepts are successfully applied to the ESIF.

Natural Gas

In addition to the hazards of handling hydrogen gas in the ESIF, other hazardous materials would also be used in the facility. Natural gas presents some of the same flammability and explosive hazards as hydrogen; however, the flammability range of natural gas in air is narrower, mainly at the high end—the lower flammability limit is 5 percent and the upper limit is 15 percent. The confined-space deflagrations associated with natural gas are just as severe when they occur. For this analysis, the assessments are bounded by the hydrogen scenarios being considered.

Toxic Gases

The facility would contain limited quantities of toxic gases, such as hydrogen sulfide, whose release could pose a risk to workers' health should it occur. Based on discussions with safety personnel at NREL, any hydrogen sulfide contained in high-pressure gas cylinders would be diluted with a carrier gas such as argon or nitrogen, such that any accidental discharge is unlikely to exceed any exposure limits. It was stated that the concentration of the hydrogen sulfide in the gas cylinders would not exceed 40 parts per million (ppm) and the Emergency Response Planning Guideline (ERPG)-2 limit of 30 ppm. The turbulent

jet caused by a release would be expected to induce enough mixing with the surrounding air to limit the volume above 30 ppm to a very small volume. These releases are not considered to be bounding accidents.

Nanomaterials

Limited quantities of nanoparticles may be used in the ESIF. It is expected that fewer than 10 grams of nanomaterials would be present at any location; these materials are, in most cases, immobilized on a solid substrate.[3] Because the hazards of these materials are not completely understood, NREL would follow its Chemical Safety Procedure, which incorporates DOE and National Institute of Health and Human Services (NIOSH) guidelines on nanomaterials. Based on these guidelines, the naonparticles would be handled in inerted gloveboxes or ventilated enclosures with HEPA filtration and would be transported, if necessary, in properly sealed containers within secondary containment.

In general, if a material presents a hazard as a particulate, it is commonly assumed that the hazard would also be realized and perhaps enhanced if present as nanoparticles. For example, fine carbon particles dispersed in air present a dust explosion hazard. The same hazard is likely present for carbon nanoparticles dispersed in air. The risk could be higher for nanoparticles because if they became charged with static electricity, nanoparticles would readily disperse and, being lighter, would presumably be easier to entrain in the air. Both phenomena would make the nanoparticles more likely to generate a dust cloud explosion, which would be limited in effect because of the small quantities in use. Alternatively, if nanoparticles are immobilized on a solid substrate or in a form that tends to clump together (often observed), the hazard would be no different than that posed by larger particulates. Following the NIOSH guidelines, this material would be handled in inerted gloveboxes and, if present in dispersible form, would be transported, if necessary, in closed cans with taped lids.

Spills and Other Hazards

Spills of diesel and gasoline pose a lesser threat but are sufficiently different from a gas release to be considered separately.

There is a small risk from spills of acids and caustic materials that mainly present a risk to workers; such risks could be largely controlled by having workers don protective equipment (such as gloves and face shields) and performing the work in a hood or other type of enclosure. Furthermore, whenever multiple chemicals are present in a facility, there is a risk of incompatible reactions; however, based on the list of chemicals that could be present in the ESIF, the risk of incompatible chemicals mixing and causing a violent reaction appears to be low.

Because the ESIF would deal with full-sized equipment that would be prototypic of equipment to be used on an industrial scale, the risk of over-pressurization and subsequent failure would be present. Such failures are largely a risk to workers; however, they can also cause damage to adjacent equipment when they occur.

Finally, there are risks associated with stored energy sources, which includes electrical energy and compressed gas. The ESIF would develop systems to manage high-voltage and high-amperage electrical circuits. More common industrial hazards, such as high-pressure gas cylinders, present a significant source of stored energy should a valve be sheared off during handling.

[3] Information based on NREL e-mail transmittal.

Natural Phenomena

The natural phenomena risk was not addressed in this bounding events analysis. It is assumed that any accidents resulting from natural phenomena, should they occur, would be bounded by the accidents considered in this appendix. For example, a pipe break that might occur as a result of a faulty weld could occur in an earthquake from equipment movement.

Summary

Overall, the vast majority of the potential ESIF hazards are known and are well-understood. Section C.2 presents a more detailed analysis for several accidents that are believed to be the bounding events for the ESIF. Some effort was made to identify a location where these bounding events might occur. In general, any location mentioned is considered to be representative of analogous areas. In any future detailed safety assessment, the adequacy of safety features for every process that could result in the accidents described in Section C.2 would have to be assessed.

Even though many of the laboratory operations proposed for the ESIF are currently being performed at NREL, the scale of these activities would increase in some cases, and the integration and potential co-location of these operations in one facility pose challenges for the design-build team. Given the nature of design-build projects and the design challenges of this facility, it is important that the design-build team perform rigorous process hazard analyses.

C.2 Bounding Events Analysis

Section C.1 discussed many of the hazards that could be present in the ESIF. This section attempts to list some accident scenarios where these hazards might be realized during ESIF operations. The goal of the bounding events analysis is to identify a sufficient number of plausible event scenarios from the many classes of events, external accidents, equipment failures, procedural errors, etc., to identify the bounding events for the ESIF.

Section 5 of the RFP, which provides an inventory of equipment and energy sources for the proposed ESIF, was used as a starting point to determine plausible events for each of the listed laboratories. Most of the safety features specified were identified in the June 2008 preliminary hazards assessment (Manno 2008). For the new laboratories not addressed in the June 2008 assessment, the safety features were applied based either on the safety features listed for similar laboratories or on known standards discussed in Section C.1. Additional hazards analyses must be performed as the design progresses and safety features that are judged to be more effective would replace or supplement the features listed in this report.

The risk matrix is used to select a few bounding events for more detailed analysis in Section C.3; however, one other criterion has also been applied. When discussing hydrogen storage, NASA analyzes the catastrophic failure of a storage vessel even though such an event falls in the “Impossible” probability range on the NREL risk matrix. NASA states that such assessments are prudent given the potentially severe consequences.

C.2.1 Methodology

In performing this preliminary bounding events analysis for the ESIF, each event determined to be plausible is placed in one of the NREL risk matrix bins (see Figure C-1). This process is performed twice: once assuming no safety features are in place, and a second time imposing safety features identified in pertinent standards (Section C.1) or listed in the June 2008 preliminary hazards assessment (Manno 2008). By performing the analysis twice, both the importance and effectiveness of the safety features can

be shown. Those events judged to bound the event sequences with the safety features present are candidates for more detailed analysis. The analysis lists the key assumptions, followed by a summary of the representative scenarios listed in Addendum 1 of this appendix.

It is possible to estimate the likelihood of initiating events by applying some general estimating techniques that are frequently used when initiating a hazards assessment of a proposed facility. Such estimates consider three classes of events: the failure of static systems, the failure of active systems, and failures initiated by human error. The failure rate of static components is often in the range of 10^{-3} to 10^{-6} per year. Well-maintained active systems frequently fail at a rate of between 10^{-2} to 10^{-4} per year, and human-caused initiating events are often in the 10^{-1} to 10^{-3} range. The latter depends on the number of times the procedure has to be repeated per year. If it is anticipated that an activity would be performed hundreds of times each year, an estimate at the high end of the range is used. If the activity would be performed only occasionally, a number at the lower end of the range is used. This technique is used in this bounding events analysis to bin the event sequences with no safety features present.

The next step is to expand the analysis by binning the same events with the safety features present and applying roughly the same failure probability ranges for the ineffectiveness of static and active safety systems and administrative controls designed to reduce human error. The use of multiple safety features does not necessarily increase the effectiveness of the systems significantly because of common-cause failures. Because the design for the ESIF has yet to be specified in detail, the frequency of initiating events is typically assigned a value toward the high end of the failure range given above. For hydrogen systems, since the safety systems are well-developed, values closer to the lower end of the failure range are used for the ineffectiveness of the safety systems incorporated. After the second binning of the event sequences, the bounding events are identified.

This analysis technique may seem coarse, but it is appropriate for an initial assessment when little or no design information is available. It is often possible to identify those major events that are catastrophic and frequent in the absence of safety features and remain high in the risk matrix after the safety features have been taken into account. A catastrophic and frequent event scenario without safety features often remains high on the risk matrix after the safety features have been applied when it is necessary to rely heavily on administrative controls instead of on the more effective active or passive safety features. These event scenarios typically become the bounding events.

C.2.2 Key Assumptions

1. This preliminary bounding events analysis is based on the inventory of equipment and energy sources as shown in Section 5 of the draft RFP for the design and construction of the ESIF (NREL 2009). If additional operations, equipment, and chemicals are incorporated into the design, the analysis must be updated to meaningfully reflect the facility risk level and the related safety envelope.

2. The intent of this analysis it to provide a reasonable upper bound on the risk levels associated with ESIF operations. This analysis does not meet the requirements identified for a preliminary hazards analysis review specified in NREL's Hazard Identification and Control Procedure (NREL 2006) because of its limited focus. When identifying bounding events, it is necessary to identify all the classes of events that might occur and, from those events, select the bounding events.

3. As additional design details become available, it would not be necessary to modify documents that use this analysis as long as a documented risk assessment is conducted showing that the event

scenarios that define the facility risk level and the related safety envelope as defined in this appendix remain bounding.

4. This preliminary bounding events analysis shows two risk levels: one without operational safety features and one with operational safety features. The second would be used when estimating facility impacts. The first, although it is stated to be evaluated without safety features present, was evaluated with common industrial safety systems incorporated in the design and operation. For example, it was assumed that a hydrogen storage vessel is designed to withstand its normal operating pressure and to use proper construction materials. Otherwise, the frequency of a vessel explosion and all the other events identified would be Frequent. The likelihood of an explosion without the safety features operational was estimated by removing the listed safety features.

5. Without knowledge of the design of each safety system, only ranges of effectiveness can be estimated. In general, safety systems that rely on procedural controls—for example, a trained operator monitoring gauges—would reduce the probability of an event by factors of 10 to 100. Active safety systems would reduce the probability of an event by factors of 100 to 1,000, and passive safety systems by factors of 100 to 10,000. For this analysis, it was assumed that little reliance would be placed solely on procedural controls, while recognizing that even active and passive safety systems rely on effective inspection and maintenance procedures.

6. The goal of this analysis is not to provide a worst-case analysis; rather, it is to identify the bounding events. Expected values have been used when evaluating scenarios.

7. To identify bounding events, it is not necessary to generate a probabilistic risk assessment. Performing a probabilistic risk assessment requires a complete design; all written operating, inspection, and maintenance procedures; and ideally some facility operational experience. This preliminary analysis uses ranges of values for event rates and consequence levels to screen events and, from the screening process, identify those scenarios that are most limiting. The frequency of their occurrence and the magnitude of the potential consequences have been estimated using historical failure data and safety system reliability data. In the second part of this analysis, an effort is made for each bounding event to quantify the magnitude of its potential impacts. Because the design has yet to specify the safety equipment (including specific types of safety equipment), conservative estimates have been used.

C.3 Representative Event Scenarios

The first step in identifying a set of representative event scenarios is to plot the risk level for the scenarios shown in Addendum 1.[4] Figure C-2 places each event sequence listed in Addendum 1 in a bin on the risk matrix assuming that no safety features have been installed to protect against the hazardous materials present in the laboratories. Figure C-3 places each event sequence in a bin in the risk matrix assuming that safety features have been installed in the laboratories. A comparison of the two tables shows that safety features are critical and that effective safety features can ensure the safety of workers and the general public.

[4] Because the information associated with each event scenario in Addendum 1 is sometimes incomplete, the notation "AI" is used in the addendum to identify action items. These items, when addressed, would enable the scenario to be better defined, with the result that the risk level could be assigned with greater accuracy.

Annual Frequency	Severity Level			
	Catastrophic	Critical	Marginal	Negligible
Frequent	ESL-1, HPTF-4	OTP-7		
Reasonably Probable	HBML-8, HVHC-1, PEL-2, HPL-1, HPL-2, HPL-6, HPL-7, OTP-1, OTP-4, OTP-5, FQL-7	HVHC-3, SGC-1, HPL-3, OTP-2, ESL-2, TP-2, TP-3, AM-4, AM-5, FCL-3, FQL-2, FQL-3	HBML-1, HBML-3, ESL-3, ML-1, AM-1, AM-3, FQL-5	
Occasional	HBML-5, OTP-6, SL-1, FCL-1, FQL-4, FQL-8	AB-1, HBML-2, HBML-4, HBML-6, HBML-7, HVHC-2, AM-6, FCL-2, FQL-1, FQL-6	AM-2	
Remote	HBTC-3, OTP-8, OTP-9, MS-2, OTB-1	AB-2, HBTC-1, HBTC-2, HBTC-4, SHOT-1, HPL-4, HPL-5, OTP-3, HPTF-1, HPTF-2	ML-2	
Extremely Remote				
Impossible				

Note: White cells = high risk
Tan cells = moderate risk
Turquoise cells = low risk
Yellow cells = routine risk

Figure C-2. Risk Profile for Events without Safety Features

Annual Frequency	Severity Level			
	Catastrophic	Critical	Marginal	Negligible
Frequent				HPTF-4
Reasonably Probable				HVHC-1
Occasional			HBML-5	
Remote		OTP-9	HBML-3, HVHC-2, SGC-1, HPL-5, HPL-7, OTP-7, AM-4, AM-5, FQL-5	AB-1, HBML-1, HVHC-3, HPL-3, OTP-4, OTP-5, TP-2, TP-3, ML-1, AM-1, AM-3
Extremely Remote	OTP-8, FQL-7	HPL-4, OTP-2, SL-1, SL-2, HPTF-2, AM-6, FQL-3, FQL-8	HBML-2, HBTC-3, HPL-2, OTP-1, OTP-3, OTP-6, MS-2, TS-1, TP-1, OTP-1, FQL-1	AB-2, HBML-7, HBTC-2, HBTC-4, HPL-1, HPL-6, ESL-1, ESL-2, ESL-3, ML-2, FCL-1, FCL-2, FCL-3, FQL-2, FQL-4, PEL-2
Impossible			HBTC-1, SHOT-1	HBML-4, HBML-6, HBML-8, AM-2, FQL-6

Note: White cells = high risk
Tan cells = moderate risk
Turquoise cells = low risk
Yellow cells = routine risk

Figure C-3. Risk Profile for Events with Safety Features

In comparing Figures C-2 and C-3, it is evident that preventive, protective, and mitigative safety features significantly lower the risk profile for the ESIF. Figure C-2 shows that in the absence of safety features, many event scenarios are high-risk (high frequencies with severe consequences). With safety features in place (Figure C-3), none of the scenarios are high-risk. The most frequent events with the highest severity consequences, and the events that lie along the spectrum between the two, define the facility's safety envelope.

The following events provide some definition on the safety envelope for the ESIF (see Figure C-3). As the programming and design become more complete, the safety envelope would be revised and refined.

- One extremely remote probability event with catastrophic consequences: the rupture of a hydrogen supply line within a laboratory as mentioned in FQL-7 (this scenario is judged to be extremely remote and catastrophic). HBML-5 is a similar event, estimated to have an occasional probability and marginal consequences.
- One extremely remote probability event with catastrophic consequences: the detonation of a hydrogen storage vessel as it is being filled (OTP-8).
- One remote probability event with critical consequences: the failure of a research component on an outside test pad (OTP-9).

Numerous additional event sequences are less limiting because they have a lower frequency of occurrence or a lower severity level (or both). There are also some events, such as the catastrophic failure of a pressure storage tube, that are prudent to analyze even though they did not rise to the level of a bounding event. Given the uncertainty in the design, nonbounding events should not be totally dismissed because their probability of occurrence, the effectiveness of safety systems, or the consequences of the event might have been over- or underestimated. For this reason, Section C.3.1, where several events are quantified, considers several classes of events.

Figure C-3 shows two similar event scenarios all associated with the deflagration of an enclosure following a breach of a hydrogen line: FQL-7 and HBML-5. These two scenarios point out one of the difficult design issues the ESIF faces. There would be thousands of feet of high-pressure hydrogen tubing in the facility; some equipment (such as a 1-MW generator set) would be quite large, which means that the tubing must be able to provide many grams per second of hydrogen to the test device. This would require large flows at relatively small pressure drops, making a leak that does not trigger the isolation valves a possible limiting design consideration.

The detonation of a hydrogen storage cylinder as it is being filled is a limiting accident. It was noted in Section C.1 that individuals often think of high-pressure hydrogen as being spontaneously combustible when it is discharged; in fact, if the air were not evacuated from a storage cylinder and high-pressure hydrogen were used to fill it, this exact circumstance is produced. Such a detonation has the potential to fail other storage cylinders, which, if they were filled with hydrogen, would add to the consequences. The accident is prevented not by design but by following procedures. Such transient scenarios point out the importance of looking at the off-normal, not the normal, conditions at a facility.

Another event, the failure of a storage vessel containing hydrogen at several thousand pounds per square inch, has a low probability of occurrence and as a result is not categorized as a bounding event but nevertheless should be analyzed as such. NFPA Standard 55 (NFPA 2005) specifies an exclusion zone of 50 feet. Within this zone, the following restrictions apply:

- There should be no other buildings.
- There should be no flammable storage tanks or combustible materials.
- The hydrogen tanks should not be in a trench.
- If liquid combustible storage is located in the vicinity, the hydrogen tanks must be above the level of the combustible storage tanks. This configuration ensures that there is no possibility that a discharge of the combustible material would collect under the hydrogen storage cylinders.

It is assumed that these safety requirements would be met for the hydrogen storage units for the ESIF.

A number of Extremely Remote event scenarios are estimated to have Critical consequences (see Figure C-3). These include failures of outside hydrogen compressors, leaks that result in the buildup of explosive gas concentrations in confined spaces, and drops of pressurized gas cylinders. The frequency of the latter class of events (drops of pressurized gas cylinders) is driven by human error; therefore, it is premature to lower to Impossible at this time. One additional event from these lower risk bins would also be analyzed: the shearing off of the valve on a pressurized gas cylinder.

In an effort to identify various classes of events, it is clear from Figure C-3 that workers could be exposed to toxic gases; that flammable gas clouds could form and, if ignited, could result in catastrophic damage to the laboratory and to adjacent laboratories; that high-pressure equipment could rupture; and that workers could be exposed to the unknown risks from nanomaterials. Thus, to complete the list of representative events to be analyzed in greater detail, one of each of the above classes of events is analyzed in greater detail in Section C.3.1.

C.3.1 Analyses of Representative Event Scenarios

Based on the above discussions, four event scenarios have been selected for detailed analysis: a compressor failure, the rupture of a hydrogen storage vessel, the shearing off of a valve on a pressure cylinder, and the leakage of hydrogen into a confined space resulting in deflagration. A fifth scenario, a spill of nanomaterials, is also included, but because of uncertainties in estimating the consequences of such a spill, this event is discussed in less detail.

1. Compressor Failure

It is assumed that the compressor has a volume of 1 liter and is operating at a pressure of 15,000 psi. The energy generated by the failure can be estimated using the equation (Lees 2006, Equation 17.4.28, page 17/26):

$$E = \frac{pV}{\gamma - 1} \qquad \textbf{Eq. 1}$$

where E is the energy generated
P is the pressure (units of Pa)
V is the volume (units of m^3),
γ is the heat capacity ratio (C_p/C_v), which equals 1.4 for a diatomic gas such as hydrogen or for dry air.

The key assumption is the free volume inside the compressor. The energy released from the compressor failure is 0.26 megajoules (MJ), or the equivalent of 55 grams of trinitrotoluene (TNT). The energy of the pressure pulse from this event would be equivalent to about 22 grams of TNT and would cause damage for a few tens of meters. The biggest threat would be from the potential shrapnel produced. More details regarding the mass and internal volume of the compressor are needed to quantify the extent of the impact.

The arrangement of the compressor relative to other equipment and the presence of any barriers could also significantly affect the extent of impacts. Overall, if the volumes are correct, this is a relatively small explosion which could be effectively limited. The greater concern would be the shrapnel generated from the explosion. Note that if the internal volume in the compressor is significantly greater than 1 liter, an estimated value, then the failure would cause proportionately greater impacts.

2. Hydrogen Storage Vessel Rupture

The same equation used for the compressor failure analysis is valid for the storage vessel rupture. The volume of the vessel needed to store 25 kilograms of hydrogen at 15,000 psi is approximately 0.3 cubic meters. Using Eq. 1, the energy released is equivalent to about 15 kilograms of TNT. The energy of the pressure pulse from this event would be equivalent to about 6 kilograms of TNT. A diagram of the proposed tube trailer shows five storage cylinders; if one catastrophically failed, the others are strong enough to withstand the failure. As previously mentioned, the presence of safety features reduces the probability that this event would occur from Extremely Remote to Impossible, using the NREL risk matrix. The estimated severity remains Catastrophic. Based on Figure 17.98 in Lees (2006, page 17/205), shrapnel from this explosion could be ejected up to a quarter of a mile from the facility. The Lees scenario assumes a cased explosive, which is typically very thin-walled. No shrapnel from a pressure vessel failure at the ESIF would be expected to travel that far. Thus, the real danger is to people close to the tube trailers, which is one reason for excluding all but essential personnel from the vicinity of the tube trailers.

If one of the tubes in a tube trailer filled and if all were piped together, all the hydrogen would be released. NFPA 52 specifies a minimum separation distance of 20 feet for gas storage (NFPA 2006). A release from a hydrogen tube trailer occurred in Stockholm, Sweden, in 1983 on a city street lined with buildings several stories high, and the consequences were devastating. Clearly, the deflagration was confined (Venetsanos 2003). More analysis is needed to ensure that no off-site impacts would result from such a catastrophic event. NREL is committed to requiring the design-build team to perform such analyses selecting final sites for all the hydrogen storage vessels that are being proposed to support ESIF activities.

For an explosion equivalent to 6 kilograms of TNT, the overpressure at 30 meters is estimated to be slightly over 2 psi. At this overpressure, a nonreinforced cinderblock wall could be shattered (Lees 2006, Table 17.42). Glass would be broken, and personnel exposed to the flying glass could be injured. At 30 meters, using the most conservative model for eardrum injury, 1 percent of the exposed individuals might experience eardrum rupture (Lees 2006, p. 17/237). The overpressure is not sufficient to cause lung damage or produce fatal injuries. Shrapnel striking a person could produce fatal injuries.

3. Shearing off a Valve on a Pressure Cylinder

Based on information from Linde (2004), a #1 steel cylinder has a tare weight of 136 pounds and a capacity of 1.72 cubic feet and is commonly filled to a pressure of 2,400 pounds per square inch gauge (psig); this is considered a representative gas cylinder. If it were filled to a higher pressure or contained a higher molecular weight gas, the cylinder would be accelerated to a higher velocity before its contents were spent. A lighter gas bottle would also be accelerated to a higher velocity if it contained the same

quantity of gas. At the same molecular weight, a monoatomic gas would also accelerate the cylinder to a higher velocity, in proportion to the square root of the heat capacity ratio.

Given the above parameter values, and assuming the sheared-off pipe section is ¾-inch schedule 80 pipe, the final velocity of the pressure cylinder is 50 meters per second, or approximately 110 miles per hour.

The analysis shows that although the results may vary, gas storage cylinders have the potential to attain high velocities. If a worker were struck with a cylinder weighing almost 140 pounds at 100 miles per hour, serious injuries could occur. Smaller lecture-sized bottles would not be capable of doing as much damage, but they could nevertheless strike a person at a significant velocity and cause injury.

At NREL, high-pressure gas cylinders are used in many laboratories, and the procedures for safe handling are well-developed. Furthermore, training ensures compliance with the procedures. Thus, while the consequences of such an event could be catastrophic in terms of equipment damage or worker injury, the safe handling practices employed at NREL reduce the frequency of this event to the Impossible probability range in the NREL risk matrix. The analysis shows the importance of complying with NREL procedures for the safe handling of gas cylinders.

4. Leakage of Hydrogen into a Confined Space

For purposes of this analysis, it is assumed that a 0.25-inch outside diameter high-pressure hydrogen tube containing 150 psig hydrogen is breached. Assuming that the tubing is rated for 20,000 psi, the inside diameter is 0.109 inch. Again, for purposes of this analysis, the supply pressure is 150 psig, the length of tubing from the reduction valve to the point of the leak is 100 feet, and the pressure drop caused by the leak is 50 psig. This pressure drop was assumed to not cause the quick-acting excess-flow valve to shut, so the system would continue to operate. Because the hydrogen flow through the tubing is compressible, a computational fluid dynamics code was run to estimate the discharge rate from the tubing; the result was 0.213 grams of hydrogen per second. Once that lower explosive limit is reached, a deflagration of the chamber is possible.

Many other similar calculations could have been performed using different laboratories. Some have much larger pressures and some have much greater flow requirements, probably indicating that for some facilities, a 3/8-inch outside-diameter tube with an inside diameter of 0.206 inch might be required just to supply the required hydrogen. For that outside diameter, 100 feet of tubing at 50-psig pressure drop can discharge 1.14 grams per second of hydrogen—still not enough for a 1-megawatt electrical (MWe) generator requiring tens of grams of hydrogen per second.

The design of the ESIF has not been specified to this level of detail, so these calculations are all hypothetical. They show that the potential exists for hydrogen to build up in chambers to concentrations above the lower flammability limit quite quickly. Thus, this type of accident is expected to continue to be a bounding accident that must be addressed throughout the design and operations.

5. Spill of Nanomaterials

The U.S. Department of Health and Human Services has developed a report titled *Approaches to Safe Nanotechnology* (NIOSH 2009). This document points out the great uncertainty in estimating the consequences should a person be exposed to nanomaterials. Given the lack of good impact estimates, it must be assumed that a spill of nanomaterials during transfer could result in serious long-term health effects to any individual who came in contact with or inhaled the particles.

The NIOSH report states that the properties of nanomaterials are often different from those of other materials having the same composition; as a result, nanomaterials could present an increased handling risk. For example, nanomaterials could pose a major static electricity hazard. If a dust cloud of nanomaterials formed and were ignited, the explosion could breach any enclosure. The resulting debris from the failure of the enclosure would pose a risk to workers. Safety features might include inerting the gloveboxes until it can be shown that the nanomaterials pose no risk from static electricity initiation or from the ignition of a dust cloud of nanomaterials.

C.3.2 Summary and Conclusions

This bounding events analysis has identified many possible events that could occur at the ESIF and has analyzed in detail several of the more severe event sequences. The analysis concludes that several events have the potential for significant impacts to site workers and possibly the general public and emphasizes the importance of incorporating effective safety features into the design. This analysis shows there is ample justification for using formal hazards analyses, as specified in the NREL Hazard Identification and Control Procedure, to guide the design process as it proceeds.

The calculations in this analysis are preliminary and limited. The ESIF would be a complex facility with thousands of feet of piping and numerous safety devices of varying types that must function with high reliability to ensure safety. All results depend on material quantities and the conditions under which ESIF materials would be handled. As the design is derived and refined, these bounding events would become more refined and more precise calculations can be performed.

Despite the limitations of the analyses as stated above, it can also be said that except for nanomaterials, decades of experience safely handling these materials have resulted in the development of a highly reliable suite of adequate preventive, protective, and mitigative safety features to ensure that a well-designed ESIF can be operated safely. Any finding of no significant impact must be based on the assurance that comprehensive safety assessments would be successfully completed during the design phase of the ESIF. The design-build team would need to perform rigorous process hazard analyses to define the hazards and operability envelope for the ESIF.

Regarding the handling of nanomaterials, given the lack of NIOSH exposure limits, DOE and NIOSH guidance for the safe handling of these materials must be incorporated into the design and ESIF operating procedures.

C.4 References

Cote, Arthur E. 1986. *Fire Protection Handbook. Sixteenth edition,* National Fire Protection Association, Quincy, Massachusetts.

Lees, Frank P. 2006. *Loss Prevention in the Process Industry.* Third edition, Butterworth Heinemann, Oxford, England.

Linde Corporation. 2004. “Pure Gas: Cylinder Information.” Information compiled by Spectra Gases Inc. division, available online at http://www.spectragases.com/content/upload/AssetMgmt/PDFs/puregases/PG_CylinderInformation_011207.pdf. Accessed March 25, 2009.

Manno, D. 2008. *Preliminary Hazards Assessment for the Energy Systems Integration Facility*, June 8.

NASA (National Aeronautics and Space Administration). 2004. *Safety and Security Analysis: Investigative Report by NASA on Proposed EPA Hydrogen-Powered Vehicle Fueling Station*. EPA420-R-04-016, October 2004.

NFPA (National Fire Protection Association). 2006. *Vehicular Fuel Systems Code*. NFPA Standard 52.

NFPA (National Fire Protection Association). 2005. *Standard for the Storage, Use, and Handling of Compressed Gases and Cryogenic Fluids in Portable and Stationary Containers, Cylinders, and Tanks*. NFPA Standard 55.

NIOSH (National Institute of Health and Human Services). 2009. *Approaches to Safe Nanotechnology: Managing the Health and Safety Concerns Associated with Engineered Nanomaterials*. Publication No. 2009-125. Department of Health and Human Services, Washington, D.C.

NREL (National Renewable Energy Laboratory). 2009. *Draft Energy Systems Integration Facility Request for Proposal*. March 9.

NREL (National Renewable Energy Laboratory). 2006. *Hazard Identification and Control*, Procedure 6.6-2, June 30.

Venetsanos, A.G., et al. 2003. "Source, dispersion and combustion modeling of an accidental release of hydrogen in and urban environment." *Journal of Hazardous Materials*, Vol. A105, pp 1-25.

Addendum 1
Event Scenarios[a]

Scenario Number	Laboratory/ Energy Source	Hazard(s)	Quantity	Likelihood of Occurrence (Without Safety Features)	Severity (Without Safety Features)	Possible Preventive/ Protective/ Mitigative Measures	Likelihood of Occurrence (With Safety Features)	Severity (With Safety Features)	Risk Level (Without Safety Features/ With Safety Features) Comments
Energy Analysis GIS Laboratory									
GISL-1	Electricity	Standard industrial hazard							
Materials and Computational Sciences Center (MCSC) High Performance Computer Data Center									
HPC-1	Fire from electrical short in cable tray	Standard industrial hazard							
Applied Battery and Electronics Laboratory	House nitrogen, 6 – gas cylinders, (oxygen, argon, forming gas (hydrogen-nitrogen mix), powdered lithium								
AB-1	Oxygen gas	Fire accelerant	Oxygen leak	Occasional	Critical: Oxygen-enhanced fire consumes equipment and materials such as lithium in gloveboxes	Standard operating procedures, noncombustible materials of construction, ventilation	Remote	Negligible: Materials of construction would limit spread of fire, ventilation the concentration buildup	Moderate Risk / Routine Risk

Event Scenarios[a]

Scenario Number	Laboratory/ Energy Source	Hazard(s)	Quantity	Likelihood of Occurrence (Without Safety Features)	Severity (Without Safety Features)	Possible Preventive/ Protective/ Mitigative Measures	Likelihood of Occurrence (With Safety Features)	Severity (With Safety Features)	Risk Level (Without Safety Features/ With Safety Features) Comments
AB-2	Lithium powder	Alkali metal fire	Lithium fire	Remote	Critical: Metal fire could damage equipment and produce toxic smoke	Inerted glovebox to contain lithium in a finely divided state. metal fire extinguishers close to where lithium is being used or stored	Extremely Remote	Negligible: Inerting of glovebox eliminates risk of a metal fire, Class D fire extinguishers	Low Risk / Routine Risk
Center for Electricity, Resources and Building Systems (CERBS) **High Bay - Main Laboratory 1-MW Grid Simulator (High-Voltage High-Current), Research Fuel Lines (diesel, biodiesel, natural gas, and hydrogen lines), corrosives and flammables**									
HBML-1	Solvents	Small local fire in work area	Assume liter- to gallon-sized, non-breakable containers	Reasonably Probable	Marginal: Injury to a worker (burns); possible loss of equipment	Low combustible loading, solvents used in fume hood	Remote	Negligible: Minimal equipment damage, minor worker injury	Moderate Risk / Routine Risk
HBML-2	Solvents	Room fire	Assume many liter- to gallon-sized bottles in storage cabinets	Occasional	Critical: Room fire that damages equipment and life-threatening worker injury from burns and toxic smoke exposure (from involvement of corrosives)	Nonflammable storage cabinets, flammable-gas monitors, fire suppression equipment, activities with flammables performed in fume hoods	Extremely Remote	Marginal: Fire that is confined to a small portion of the room and is extinguished before much damage to equipment occurs	Moderate Risk / Routine Risk

Event Scenarios[a]

Scenario Number	Laboratory/ Energy Source	Hazard(s)	Quantity	Without Safety Features: Likelihood of Occurrence	Without Safety Features: Severity	Possible Preventive/ Protective/ Mitigative Measures	With Safety Features: Likelihood of Occurrence	With Safety Features: Severity	Risk Level (Without Safety Features/ With Safety Features) Comments
HBML-3	Corrosives	Small spill of corrosives in work area	Assume liter- to gallon-sized, non-breakable containers	Reasonably Probable	Marginal: Injury to a worker (burns)	Chemical-resistant flooring, activities in fume hood	Remote	Marginal; Injury to a worker (burns)	Moderate Risk / Low Risk
HBML-4	Hydrogen	Release of hydrogen followed by ignition	100 feet of 1/8-inch ID tubing at 150 psig	Occasional	Critical: Potential for flash fire, injury to workers	Flammable-gas detectors, laboratory ventilation, emergency shutoff valves	Impossible	Negligible: Release with no fire, very small flammable volume in vicinity of break	Moderate Risk / Routine Risk AI: Size of supply line and pressure, before and after pressure reduction
HBML-5	Hydrogen	Release of hydrogen into an enclosure followed by deflagration	Buildup to flammable concentration in enclosure within room	Occasional	Catastrophic: Deflagration inside enclosure would produce shrapnel, which could seriously injure an individual and damage adjacent equipment	Flammable-gas detectors, rapid shutoffs on hydrogen supply line, design limits on quantity of hydrogen that could be released before shutoff	Occasional	Marginal: Might still be a small fire that would have the potential for some minor injuries and equipment damage	High Risk / Low Risk AI: Need design commitment that limits the amount of hydrogen release if a pipe breached, and the design does not have enclosures where the hydrogen can accumulate

Event Scenarios[a]

Scenario Number	Laboratory/ Energy Source	Hazard(s)	Quantity	Likelihood of Occurrence (Without Safety Features)	Severity (Without Safety Features)	Possible Preventive/ Protective/ Mitigative Measures	Likelihood of Occurrence (With Safety Features)	Severity (With Safety Features)	Risk Level (Without Safety Features/ With Safety Features) Comments
HBML-6	Natural gas	Release of natural gas followed by ignition	Size of supply line and pressure not specified, assume 1: OD and low pressure, < 15 psig	Occasional	Critical: Potential for flash fire, injury to workers	Flammable-gas detectors, laboratory ventilation, emergency shutoff valves	Impossible	Negligible: Release with no fire	Bounded by HBML-4 AI: Size of Supply line and supply pressure
HBML-7	Flammable liquid	Spill or discharge of flammable liquid	Size of supply line and pressure not specified, assume 1-inch OD and <15 psig pressure	Occasional	Critical: Potential for fire and injury to workers	Spill prevention program, emergency shutoff valves	Extremely Remote	Negligible: Release with no fire	Bounded by HBML-4 AI: Size of storage vessels
HBML-8	High voltage and current	Energy discharge cuts through hydrogen gas line	100 feet of 0.109-inch ID hydrogen at 150 psig ignites	Reasonably Probable	Catastrophic: Room fire involving hydrogen – potential loss of laboratory	Emergency shutoff valves on hydrogen lines on loss of pressure, separation of electrical equipment from flammable gas lines, isolation valves	Impossible	Negligible: Limited quantify of hydrogen - line not in vicinity of electrical discharge	High Risk / Routine Risk

Event Scenarios[a]

Scenario Number	Laboratory/ Energy Source	Hazard(s)	Quantity	Likelihood of Occurrence (Without Safety Features)	Severity (Without Safety Features)	Possible Preventive/ Protective/ Mitigative Measures	Likelihood of Occurrence (With Safety Features)	Severity (With Safety Features)	Risk Level (Without Safety Features/ With Safety Features) Comments
High Bay Lab Environmental Test Chambers									
HBTC-1	Vehicle exhaust	Exposure to toxic gas	Typical rate of CO from vehicle exhaust (assume 200-hp engine)	Remote	Critical: Personnel could be overcome by toxic gases (CO), resulting in a fatality	Vented exhaust, toxic gas monitoring equipment interlocked to shut down engine if toxic gas detected	Impossible	Marginal: If overcome, co-worker would rescue	Low Risk / Routine Risk
HBTC-2	Biodiesel fuel	Diesel spill and fire when it comes in contact with hot surface	250-gallon supply	Remote	Critical: Loss of test vehicle, damage to environmental chamber	Secondary containment, fire suppression	Remote	Negligible: Some damage to test vehicle	Low Risk / Routine Risk
HBTC-3	Hydrogen and natural gas	Flammable gas buildup from leak in hydrogen or natural gas supply line	Vehicle-sized enclosure	Remote	Catastrophic: Explosion of test chamber from flammable gas buildup, possible worker fatality	Exhaust ventilation, toxic gas analysis, IR/UV detection, automatic shutoff valves, welded or metal-gasketed fittings	Extremely Remote	Marginal: Hydrogen leak could cause fire within test chamber that is quickly brought under control without major equipment damage	Moderate Risk / Routine Risk AI: The quantity of H_2 in the piping between the shutoff valve and the motor must not be sufficient to generate a flammable atmosphere in the vehicle enclosure

Event Scenarios[a]

Scenario Number	Laboratory/ Energy Source	Hazard(s)	Quantity	Likelihood of Occurrence (Without Safety Features)	Severity (Without Safety Features)	Possible Preventive/ Protective/ Mitigative Measures	Likelihood of Occurrence (With Safety Features)	Severity (With Safety Features)	Risk Level (Without Safety Features/ With Safety Features) Comments
HBTC-4	Overhead gantry crane	Equipment or tool drop from crane cable break	10 to 20 tons	Remote	Critical: Personnel injury (possibly a fatality) from a cable break, equipment damage	Periodic weight testing and replacement when signs of cable wear appear, standard industrial safety procedures	Extremely Remote	Negligible: No injury to personnel or equipment damage	Low Risk / Routine Risk
Commercial Building High Bay Laboratory									
		Hazards similar to those addressed under the High Bay - Main Laboratory							
Environmental Test Chamber in High Bay									
High Bay Laboratory – VSHOT									
SHOT-1	Overhead gantry crane	Equipment or tool drop from crane cable break	10 tons	Remote	Critical: Personnel injury (possibly a fatality) from a cable break	Periodic weight testing and replacement when signs of cable wear appear, standard industrial safety procedures	Impossible	Marginal: No injury to personnel or equipment damage	Low Risk / Routine Risk
High Bay Control Room									
HBCR-1	Electricity	Standard industrial hazard							

Event Scenarios[a]

Scenario Number	Laboratory/ Energy Source	Hazard(s)	Quantity	Likelihood of Occurrence (Without Safety Features)	Severity (Without Safety Features)	Possible Preventive/ Protective/ Mitigative Measures	Likelihood of Occurrence (With Safety Features)	Severity (With Safety Features)	Risk Level (Without Safety Features/ With Safety Features) Comments
High Voltage / High Current Laboratory; High Voltage / High Current Research Fuel Lines (hydrogen, natural gas, diesel and biodiesel)									
HVHC-1	Electricity	Explosive destruction of test device from high current or voltage	Shrapnel from test device destruction	Reasonably Probable	Catastrophic: Shrapnel could severely injure workers, gas expansion from destruction of equipment could destroy room	Explosive-proof construction, remote testing in specially designed and isolated room, no ancillary personnel or equipment in test room	Reasonably Probable	Negligible	High Risk / Routine Risk
HVHC-2	Room Fire	Failure of test device could damage fuel supply line, initiating a room fire	Flammable gas and liquid supply lines (Research Fuel Lines) provide fuel source for fire	Occasional	Critical: Fire could damage equipment in laboratory	Placement of test device in a containment chamber or vented chamber?	Remote	Marginal: Could still damage equipment in room from test piece destruction	Moderate Risk / Low Risk AI: Do not understand need for fuel supply lines in High Voltage / High Current Lab
HVHC-3	Electricity	An electrical short	Arc Flash from an electrical short	Reasonably Probable	Critical Flash could burn or cause eye damage to workers	Placement of barriers between workers and high voltage high current equipment	Remote	Negligible Separation of workers from high voltage high current equipment prevents injury	High Risk / Routine Risk
Power Electronics Laboratory Research Fuel Lines (hydrogen, natural gas, diesel and biodiesel), High Voltage and High Current									
PEL-1	Electricity	Standard industrial hazard							

Event Scenarios[a]

Scenario Number	Laboratory/ Energy Source	Hazard(s)	Quantity	Likelihood of Occurrence (Without Safety Features)	Severity (Without Safety Features)	Possible Preventive/ Protective/ Mitigative Measures	Likelihood of Occurrence (With Safety Features)	Severity (With Safety Features)	Risk Level (Without Safety Features/ With Safety Features) Comments
PEL-2	Hydrogen gas	Room deflagration from hydrogen gas buildup		Reasonably Probable	Catastrophic: Damage to laboratory equipment and serious injury to workers	Room ventilation, flammable gas detectors with alarm	Extremely Remote	Negligible: No damage to personnel or equipment	High Risk / Routine Risk AI: Need data on hydrogen gas supply line
PEL-3	Natural gas	Room deflagration from natural gas buildup		Reasonably Probable	Bounded by PEL-2				AI: Need information on natural gas line
Smart Grid Components Laboratory									
SGC-1	Electricity	Arcing from equipment failure (electrical short)	480-V, 30-amp three-phase equipment	Reasonably Probable	Critical: Could injure workers exposed to the flash (burns) and damage equipment	Safe operating procedures, protective barriers for operating personnel, equipment design to minimize likelihood of shorting, trained and qualified personnel, blowout panels to prevent room over-pressurization from heating	Remote	Marginal: Still could be loss of equipment from event	High Risk / Low Risk

Event Scenarios[a]

Scenario Number	Laboratory/ Energy Source	Hazard(s)	Quantity	Likelihood of Occurrence (Without Safety Features)	Severity (Without Safety Features)	Possible Preventive/ Protective/ Mitigative Measures	Likelihood of Occurrence (With Safety Features)	Severity (With Safety Features)	Risk Level (Without Safety Features/ With Safety Features) Comments
Instruments Developments Laboratory									
IDL-1	Electricity and small quantities of chemicals	Standard laboratory hazards				Standard laboratory ventilation to prevent accumulation of chemical vapors			
Electrical Shop									
ES-1	Electricity	Standard industrial hazard							
Hydrogen Production Laboratory Research Fuel Lines									
HPL-1	Hydrogen gas	Hydrogen release from break in electrolyzer piping	Hydrogen generated at a rate of 3,000 standard liters/minute based on a 1-MW electrolyzer	Reasonably Probable	Catastrophic: Personnel injury (burns) from deflagration of hydrogen gas cloud	Periodic inspection and maintenance, gas detectors with alarms, electrolyzer shutoff, ventilation system to prevent buildup of flammable gases	Extremely Remote	Negligible: With an open pipe, it takes almost 20 minutes to build up to a flammable gas concentration in room, ample time to detect and take corrective actions	High Risk / Routine Risk

Event Scenarios[a]

Scenario Number	Laboratory/ Energy Source	Hazard(s)	Quantity	Likelihood of Occurrence (Without Safety Features)	Severity (Without Safety Features)	Possible Preventive/ Protective/ Mitigative Measures	Likelihood of Occurrence (With Safety Features)	Severity (With Safety Features)	Risk Level (Without Safety Features/ With Safety Features) Comments
HPL-2	Electrolyzer explosion because of overpressure (system failure isolates electrolyzer or compressor back flow)	Release of oxygen, hydrogen, and caustic spray	Electrolyzers operate at 200 psia (temperature not specified)	Reasonably Probable	Catastrophic: Personnel injury from shrapnel, damage to adjacent equipment, explosive gas cloud	Design of electrolyzer, overpressure cutoff, pressure relief valve, over-temperature cutoff	Extremely Remote	Marginal: Could still be the possibility of an injury and a small amount of damage from the initiating event	High Risk / Routine Risk
HPL-3	Electrolyzer explosion because of overpressure	Caustic spray when electrolyzer overpressure disk ruptures	Not specified	Reasonably Probable	Critical: Personnel injury from caustic spray	Design of electrolyzer, overpressure cutoff, pressure relief valve, over-temperature cutoff	Remote	Negligible: Worker shielded from spray	High Risk / Routine Risk AI: Need quantity and temperature of caustic to better quantify consequences
HPL-4	Electrolyzer temperature excursion because of membrane rupture	Reaction of hydrogen and oxygen produces heat and pressure, rupturing the electrolyzer	Electrolyzers operates at 200 psi	Remote	Critical: Personnel injury (caustic spray) and shrapnel, damage to adjacent equipment, explosive gas cloud	Electrolyzer design, pressure-relief valve?, temperature interlock, pressure interlock.	Extremely Remote	Critical: Personnel injury (caustic spray) and shrapnel, damage to adjacent equipment, explosive gas cloud	Low Risk / Low Risk: Small pinholes would lead to over-temperature shutdown

Event Scenarios[a]

Scenario Number	Laboratory/ Energy Source	Hazard(s)	Quantity	Likelihood of Occurrence (Without Safety Features)	Severity (Without Safety Features)	Possible Preventive/ Protective/ Mitigative Measures	Likelihood of Occurrence (With Safety Features)	Severity (With Safety Features)	Risk Level (Without Safety Features/ With Safety Features) Comments
HPL-5	Compressor failure	Flying shrapnel	Shrapnel from explosion of 1-liter vessel at 3,500 psi	Remote	Critical: Personnel injury, equipment damage	Compressor design, compressor outside work area, shielded from hydrogen fueling station where personnel are present	Remote	Marginal Personnel injury, damage to equipment	Low Risk / Low Risk: Specifically stated indoor and no enclosure
HPL-6	High-pressure hydrogen	Backflow of 3,500 (in HPL) to 15,000 psi hydrogen gas (outside building) overpressures equipment or piping	Nominally 200 kg at various pressures	Reasonably Probable	Catastrophic: Rapid buildup of hydrogen in High Pressure Laboratory, probable room deflagration	Compressor design to prevent backflow, inside tubing rated at 20,000 psi	Extremely Remote	Negligible: No damage to equipment or release of hydrogen gas to High Pressure Laboratory	High Risk / Routine Risk
HPL-7	Flammable liquids	Fire involving flammable materials – possible failure of high-pressure hydrogen line in fire	Not specified	Reasonably Probable	Catastrophic: Potential for severe injury to personnel, loss of High Pressure Laboratory	Layout of equipment to prevent exposure of high-pressure lines to fire, low combustible loading	Remote	Marginal: Small fire could damage some equipment	High Risk / Low Risk AI: Need quantity of flammable liquids present in HPL

Event Scenarios[a]

Scenario Number	Laboratory/ Energy Source	Hazard(s)	Quantity	Likelihood of Occurrence (Without Safety Features)	Severity (Without Safety Features)	Possible Preventive/ Protective/ Mitigative Measures	Likelihood of Occurrence (With Safety Features)	Severity (With Safety Features)	Risk Level (Without Safety Features/ With Safety Features) Comments
Hydrogen Systems Laboratory and Hydrogen Systems Outdoor Test Area Research Fuel Lines (hydrogen, natural gas, diesel, and biodiesel)									
OTP-1	Hydrogen gas	Catastrophic rupture of high-pressure hydrogen storage vessel	25 kg of hydrogen at 3,500 to 15,000 psi	Reasonably Probable	Catastrophic: Damage to adjacent equipment and buildings, serious injury (perhaps a fatality) to nearby personnel	ICC, NFPA, ASME pressure vessel codes, pressure relief devices on storage vessels, separation distance from buildings and other equipment, restricted access to storage vessels (e.g., NFPA 55)	Extremely Remote	Marginal: Some equipment damage	High Risk / Routine Risk AI: Need to provide adequate separation distance from building to prevent shrapnel damage and protect nearby personnel
OTP-2	Hydrogen gas	Compressor failure	Compressor raising the pressure to as high as 15,000 psi	Reasonably Probable	Critical: Personnel injury (including possible fatality), damage to facility and equipment from shrapnel, deflagration of flammable gas cloud from hydrogen release when compressor fails	ASME design standards, required periodic inspection and maintenance, establishing a safe distance from any structures	Extremely Remote	Critical: Personnel injury (including possible fatality), damage to facility and equipment from shrapnel, deflagration of flammable gas cloud from hydrogen release when compressor fails	High Risk / Low Risk: Bounded by event scenario for compressor failure under High Pressure Test Facility

Event Scenarios[a]

Scenario Number	Laboratory/ Energy Source	Hazard(s)	Quantity	Likelihood of Occurrence (Without Safety Features)	Severity (Without Safety Features)	Possible Preventive/ Protective/ Mitigative Measures	Likelihood of Occurrence (With Safety Features)	Severity (With Safety Features)	Risk Level (Without Safety Features/ With Safety Features) Comments
OTP-3	Hydrogen gas	Flammable gas cloud from hydrogen leak	200 kg of hydrogen at 3,500 to 15,000 psi	Remote	Critical: Personnel injury (burns) from deflagration of hydrogen gas cloud	Welded or metal pipe joints, leak testing, selection of materials that are compatible with high-pressure hydrogen without embrittlement, periodic inspection and maintenance	Extremely Remote	Marginal: Personnel injury (burns) from deflagration of hydrogen gas cloud	Low Risk / Routine Risk: Hydrogen gas rapidly diffusing upward limits the size of the flammable cloud, confined spaces for accumulation should be avoided
OTP-4	Grass fire	Grass fire heats hydrogen storage vessels, causing pressure relief valve to vent H_2 gas	Approximately 200 kg of hydrogen stored	Reasonably Probable	Catastrophic: Some vessels may fail destructively if fire impacts end of vessels opposite relief valves	Good housekeeping that keeps combustible debris away from vessel storage areas, vent pipes on relief valves to discharge hydrogen gas at an elevated point (where it would not add to the fire energy)	Remote	Negligible: No fire and no damage from a fire	High Risk / Routine Risk AI: Need to direct venting hydrogen away from equipment and buildings and need to confine rupture disk so no personnel injuries occur

Event Scenarios[a]

Scenario Number	Laboratory/ Energy Source	Hazard(s)	Quantity	Likelihood of Occurrence (Without Safety Features)	Severity (Without Safety Features)	Possible Preventive/ Protective/ Mitigative Measures	Likelihood of Occurrence (With Safety Features)	Severity (With Safety Features)	Risk Level (Without Safety Features/ With Safety Features) Comments
OTP-5	Hydrogen gas	Hydrogen buildup on enclosure followed by deflagration when ignition source introduced	Sufficient hydrogen to reach the 4-percent flammable limit in the enclosure	Reasonably Probable	Catastrophic: Potential for serious injury to workers and major damage to the ESIF	Welded piping, flammable-gas detectors with shutoff interlock on hydrogen supply line	Remote	Negligible: No buildup of hydrogen gas in the test enclosure	High Risk / Routine Risk
OTP-6	Electrical energy release	Short in electrical equipment burns hole in high-pressure hydrogen line	600 V ac and 600 V dc plus hydrogen at pressures from 3,500 to 12,000 psi	Occasional	Catastrophic: Potential for serious injury and loss of facility from hydrogen fire	Separation of electrical power systems from hydrogen supply piping and hydrogen storage systems	Extremely Remote	Marginal: Some equipment damage could still occur from electrical short	High Risk / Routine Risk
OTP-7	Hydrogen gas	Hydrogen fire during vehicle filling because connection is not leak-tight	Release of 10,000 psi hydrogen from filling station	Frequent	Critical: Burns to individual filling vehicle, fire spreads to vehicle and occupants	EPA / NFPA collaboration to develop first safety standard for hydrogen refilling stations	Remote	Marginal: A few small fires could still occur, dispenser system designed to be resistant to hydrogen fires	High Risk / Low Risk
OTP-8	Hydrogen gas	Hydrogen air mixture detonates within the storage vessel during filling	A flammable mixture of air and hydrogen present in the storage vessel	Remote	Catastrophic: Rupture of adjacent storage vessels, generation of shrapnel extending the damage radius for personnel and equipment	Evacuation of the air before starting to fill the pressure vessels with hydrogen	Extremely Remote	Catastrophic: Rupture of adjacent storage vessels, generation of shrapnel extending the damage radius for personnel and equipment	Moderate Risk / Low Risk

Event Scenarios[a]

Scenario Number	Laboratory/ Energy Source	Hazard(s)	Quantity	Likelihood of Occurrence (Without Safety Features)	Severity (Without Safety Features)	Possible Preventive/ Protective/ Mitigative Measures	Likelihood of Occurrence (With Safety Features)	Severity (With Safety Features)	Risk Level (Without Safety Features/ With Safety Features) Comments
OTP-9	Hydrogen gas	Failure of a research component generates shrapnel and hydrogen fire	Several hundred kilograms of hydrogen and many pieces of equipment operating at high pressure	Remote	Catastrophic: Damage from the failure of one piece of equipment could result in the failure of other pieces of equipment	Safe separation distances (verify that distances in NFPA 55 are applicable), limit occupancy to protect visitors and workers from flying debris	Remote	Critical: Damage limited to failed piece of equipment	Moderate Risk / Low Risk
Roof Test Area									
RTA-1	Propylene glycol	Leak of propylene glycol	Leak rate unspecified - release to environment expected to be minimal						Routine Risk: Bounded by other events
Machine Shop	Acetylene and oxygen, argon from gas bottles								
MS-1	Rotating equipment	Standard industrial hazard							

Event Scenarios[a]

Scenario Number	Laboratory/ Energy Source	Hazard(s)	Quantity	Likelihood of Occurrence (Without Safety Features)	Severity (Without Safety Features)	Possible Preventive/ Protective/ Mitigative Measures	Likelihood of Occurrence (With Safety Features)	Severity (With Safety Features)	Risk Level (Without Safety Features/ With Safety Features) Comments
MS-2	Acetylene deflagration	Acetylene released from storage cylinder	Standard welding tank (acetylene dissolved in acetone)	Remote	Catastrophic: Acetylene shares many of the same properties as hydrogen but would not readily disperse, so would deflagrate or, when confined, detonate, damaging equipment or injuring workers	Dangers of acetylene well understood, concern arises during maintenance when equipment is moved into an area with other hazards such as high-pressure hydrogen storage tanks	Extremely Remote	Marginal	Moderate Risk / Routine Risk
Energy Storage Laboratory Research Fuel Lines (hydrogen, natural gas, diesel, and biodiesel)									
ESL-1	Hydrogen	Hydrogen buildup from outgassing of batteries	Unspecified rate of generation - expected to be low	Frequent	Catastrophic: Deflagration of hydrogen could fail walls of storage area and cause fires in adjacent laboratories, also serious injuries to personnel	Flammable-gas detectors, laboratory ventilation	Extremely Remote	Negligible: Discharge rate is expected to very slow, so room ventilation would keep hydrogen gas concentration well below detection limits	High Risk / Routine Risk AI: Laboratory design should ensure that hydrogen cannot build up in a battery room

Event Scenarios[a]

Scenario Number	Laboratory/ Energy Source	Hazard(s)	Quantity	Likelihood of Occurrence (Without Safety Features)	Severity (Without Safety Features)	Possible Preventive/ Protective/ Mitigative Measures	Likelihood of Occurrence (With Safety Features)	Severity (With Safety Features)	Risk Level (Without Safety Features/ With Safety Features) Comments
ESL-2	H_2S gas release from overcharging batteries	Toxic gas release	H_2S formed at rate based on charging current	Reasonably Probable	Critical: Personnel could be overcome by H_2S gas	Batteries protected from overcharging, room ventilation, alarm when ventilation stops	Extremely Remote	Negligible: No damage from overcharging, no release of H_2S gas	High Risk / Routine Risk AI: Need charge rate of batteries
ESL-3	Sulfuric acid	Sulfuric acid release from pressure buildup in battery	Small spray of concentrated sulfuric acid	Reasonably Probable	Marginal: Sulfuric acid has a low vapor pressure, so injury to personnel expected to be minor	Acid-resistant floors and paint, sturdy racks that are resistant to sulfuric acid, safe handling practices for acids and bases	Extremely Remote	Negligible: No damage if spills are prevented	Moderate Risk / Routine Risk AI: Need estimated quantity of sulfuric acid in batteries
Electrical Visualization									
EV-1	Standard electrical hazards								
ZEB Simulation Laboratory									
ZS-1	Standard electrical hazards								

Event Scenarios[a]

Scenario Number	Laboratory/ Energy Source	Hazard(s)	Quantity	Likelihood of Occurrence (Without Safety Features)	Severity (Without Safety Features)	Possible Preventive/ Protective/ Mitigative Measures	Likelihood of Occurrence (With Safety Features)	Severity (With Safety Features)	Risk Level (Without Safety Features/ With Safety Features) Comments
Thermal Storage Materials Laboratory									
TS-1	Nanomaterials	Release of nanomaterials to room	Less than 10 grams, probably on a solid substrate		Unknown	DOE / NIOSH guidelines for safe handling of nanomaterials, inerted glovebox or transport in closed container with taped lid	Extremely Remote	Marginal because of uncertainty, could be unknown hazards	Routine Risk
Thermal Storage Processes and Components Laboratory									
TP-1	Nanomaterials	Release of nanomaterials to room	Less than 10 grams, probably carbon-based and probably on a solid substrate		Unknown	DOE / NIOSH guidelines for safe handling of nanomaterials, inerted glovebox or transport in closed container with taped lid	Extremely Remote	Marginal because of uncertainty, could be unknown hazards	Routine Risk
TP-2	Hot heat transfer fluids	Burns from exposure to release of heat transfer	Quantity and temperature not mentioned	Reasonably Probable	Critical: Exposure to high temperature	Noncorrosive construction materials, periodic inspection and maintenance	Remote	Negligible: Minimal loss of heat transfer fluid	High Risk / Routine Risk

Event Scenarios[a]

Scenario Number	Laboratory/ Energy Source	Hazard(s)	Quantity	Likelihood of Occurrence (Without Safety Features)	Severity (Without Safety Features)	Possible Preventive/ Protective/ Mitigative Measures	Likelihood of Occurrence (With Safety Features)	Severity (With Safety Features)	Risk Level (Without Safety Features/ With Safety Features) Comments
TP-3	High electrical loads	Potential for shorts causing electrical discharges	480 V ac, 100 kW of power	Reasonably Probable	Critical: Personnel exposure to burns from arc discharge	Equipment built to electrical standards	Remote	Negligible: Standards protect individuals from injury when short occurs	High Risk / Routine Risk
Outdoor Test Beds – partially covered under Hydrogen Systems Laboratory and Hydrogen Systems Outdoor Test Area									
OTB-1	Diesel fuel	Spill and fire while filling diesel fuel	1,000-gallon diesel storage tank	Remote	Catastrophic: Boiling liquid expanding vapor explosion (BLEVE) involving diesel storage tank	Design of tank vents and leg supports, dike designed to prevent pooling under tank	Extremely Remote	Marginal: Fire involving diesel fuel during filling of tank	Moderate Risk / Routine Risk
Metrology Laboratory									
Electrical Calibration Laboratory									
ECL-1	Standard laboratory hazards								
Shielded Room									
SR-1	Standard laboratory hazards, including a N_2 gas bottle								
Optical Calibration Laboratory									
OCL-1	Standard laboratory hazards								

Event Scenarios[a]

Scenario Number	Laboratory/ Energy Source	Hazard(s)	Quantity	Likelihood of Occurrence (Without Safety Features)	Severity (Without Safety Features)	Possible Preventive/ Protective/ Mitigative Measures	Likelihood of Occurrence (With Safety Features)	Severity (With Safety Features)	Risk Level (Without Safety Features/ With Safety Features) Comments
Equipment Staging Area and Heat Sink (airlock)									
ESL-1	Standard laboratory hazards								
Hydrogen Technologies and Systems Center									
Manufacturing Laboratory									
ML-1	Solvents	Small local fire in work area	Assume liter- to gallon-sized, nonbreakable containers	Reasonably Probable	Marginal: Injury to a worker (burns), possible loss of equipment	Low combustible loading, solvents used in fume hood	Remote	Negligible: Minimal equipment damage, minor worker injury	Moderate Risk / Routine Risk
ML-2	X-ray equipment	Accidental X-ray exposure	Unspecified energy level, but below the level that would be capable of life-threatening exposures in minutes	Remote	Marginal: X-ray exposure may exceed annual limit of 3 rem	Personnel shielding, barriers, alarms (audible and/or lights) when X-ray tube active	Extremely Remote	Negligible: Minor exposure far below regulatory limits	Low Risk / Routine Risk
MEA Laboratory									
MEA-1	Standard laboratory hazards								

Event Scenarios[a]

Scenario Number	Laboratory/ Energy Source	Hazard(s)	Quantity	Likelihood of Occurrence (Without Safety Features)	Severity (Without Safety Features)	Possible Preventive/ Protective/ Mitigative Measures	Likelihood of Occurrence (With Safety Features)	Severity (With Safety Features)	Risk Level (Without Safety Features/ With Safety Features) Comments
Sensor Laboratory High-pressure hydrogen up to 1,000 psi in equipment – may be 2,500 psi in gas cylinders)									
SL-1	Hydrogen gas	Breach of high-pressure hydrogen gas piping operating at 1,000 psi	Choke flow through 0.25-inch OD high-pressure tubing w/ 0.109-inch ID	Occasional	Catastrophic: Rapid release of hydrogen into laboratory would rapidly raise concentration to above flammable limit, causing deflagration in room	High flow detectors to isolate hydrogen storage vessels, welded piping, routine maintenance and inspection, room ventilation	Extremely Remote	Critical: Assume a 50-psig drop across 100 feet of tubing would not trigger automatic shutoff, and flow would still allow hydrogen concentration in room to build up quickly	High Risk / Low Risk. AI: Is the hydrogen piping connected to hydrogen storage system or just a gas bottle of hydrogen. How much hydrogen could be released?
High Pressure Test Facility 10,000 psi nitrogen, 15,000 psig hydrogen									
HPTF-1	Hydrogen gas	Compressor failure	Compressor raising the pressure to as high as 15,000 psi	Remote	Critical: Personnel injury (including possible fatality), damage to facility and equipment from shrapnel, deflagration of flammable gas cloud from hydrogen release when compressor fails	ASME design standards, required periodic inspection and maintenance	Extremely Remote	Critical: Personnel injury (including possible fatality), damage to facility and equipment from shrapnel, deflagration of flammable gas cloud from hydrogen release when compressor fails	Moderate Risk / Low Risk

Event Scenarios[a]

Scenario Number	Laboratory/ Energy Source	Hazard(s)	Quantity	Likelihood of Occurrence (Without Safety Features)	Severity (Without Safety Features)	Possible Preventive/ Protective/ Mitigative Measures	Likelihood of Occurrence (With Safety Features)	Severity (With Safety Features)	Risk Level (Without Safety Features/ With Safety Features) Comments
HPTF-2	Hydrogen gas	Hydrogen gas leak	Hydrogen gas at 15,000 psi in piping and equipment	Remote	Critical: Personnel injury (including possible fatality), deflagration of flammable gas cloud from hydrogen release	ASME design standards, required periodic inspection and maintenance, flammable-gas detectors	Extremely Remote	Critical: Personnel injury (including possible fatality), deflagration of flammable gas cloud from hydrogen release	Low Risk / Low Risk
HPTF-3	Hydrogen gas	Rupture of surge tank on compressor	Hydrogen gas at 15,000 psi in vessel	Remote	Bounded by compressor failure	ASME design standards, required periodic inspection and maintenance			
HPTF-4	Helium or Nitrogen gas	Rupture of hydrogen pressure vessel in High Pressure Test Cell – equivalent energy release 2.5 kg TNT	Helium or Nitrogen gas at 10,000 psi in 163-liter vessel	Frequent	Catastrophic: Tank failure produces shrapnel that damages laboratory and fatally injures personnel	High Pressure Test Cell designed to contain pressure increase from helium or nitrogen release and debris from vessel failure	Frequent	Negligible: Chamber designed to confine the nitrogen and debris from vessel explosion	High Risk / Routine Risk

Event Scenarios[a]

Scenario Number	Laboratory/ Energy Source	Hazard(s)	Quantity	Likelihood of Occurrence (Without Safety Features)	Severity (Without Safety Features)	Possible Preventive/ Protective/ Mitigative Measures	Likelihood of Occurrence (With Safety Features)	Severity (With Safety Features)	Risk Level (Without Safety Features/ With Safety Features) Comments
PEC Advanced Materials Laboratory									
AM-1	Solvents	Small local fire in work area	Assume liter- to gallon-sized, nonbreakable containers	Reasonably Probable	Marginal: Injury to a worker (burns), possible loss of equipment	Low combustible loading, solvents used in fume hood	Remote	Negligible: Minimal equipment damage, minor worker injury	Moderate Risk / Routine Risk
AM-2	Solvents	Room fire	Assume many liter- to gallon-sized bottles in storage cabinets	Occasional	Marginal: Equipment damage, life-threatening worker injury from burns and toxic smoke exposure (from corrosives in fire)	Nonflammable storage cabinets, flammable-gas monitors	Impossible	Negligible: Exposed flammable materials would be insufficient to engulf the entire room, minimal equipment damage, minor worker injury	Low Risk / Routine Risk
AM-3	Corrosives	Small spill of corrosives in work area	Assume liter- to gallon-sized, nonbreakable containers	Reasonably Probable	Marginal: Injury to a worker (burns)	Berm and chemical-resistant flooring, activities in fume hood	Remote	Negligible: Minor worker injury	Moderate Risk / Routine Risk

Event Scenarios[a]

Scenario Number	Laboratory/ Energy Source	Hazard(s)	Quantity	Likelihood of Occurrence (Without Safety Features)	Severity (Without Safety Features)	Possible Preventive/ Protective/ Mitigative Measures	Likelihood of Occurrence (With Safety Features)	Severity (With Safety Features)	Risk Level (Without Safety Features/ With Safety Features) Comments
AM-4	Incompatible reactions of solvents with acids	Heat of reaction, pressure buildup and container rupture, toxic gas release	Assume liter- to gallon-sized, nonbreakable containers	Reasonably Probable	Critical: Chemical burns and toxic gas exposure could result in permanent health effects to exposed workers	Personnel training, laboratory safety procedures such as face shields, fume hoods, gloves, materials handled would not have runaway interactions	Remote	Marginal: Chemical reactions limited to heat generation, a small amount of toxic gas generation handled by fume hood, perhaps small spills resulting in minor injuries	High Risk / Low Risk
AM-5	Drop and spill of container with nanomaterials	Nanomaterials can be absorbed through the skin or be inhaled and enter the blood stream in the lungs	Quantity less than 10 grams, carbon-based, typically immobilized on a solid substrate	Reasonably Probable	Critical: Potential exposure to hazards that are not totally known	Handled in gloveboxes or in closed and taped containers during transfer, HEPA filtration of room exhaust, follow NIOSH guide	Remote	Marginal: NIOSH protection guide should minimize hazards, even though hazards not totally understood	High Risk / Low Risk
AM-6	Drop of nanomaterials generates a flammable gas cloud that ignites	Glovebox failure from internal deflagration	Quantity less than 10 grams, typically immobilized on a solid substrate	Occasional	Critical: Potential worker injury from flying debris	Inert glovebox, HEPA filtration of exhaust from laboratory and gloveboxes, where nanomaterials are generated or handled	Extremely Remote	Critical: Potential worker injury from flying debris	High Risk / Low Risk

Event Scenarios[a]

Scenario Number	Laboratory/ Energy Source	Hazard(s)	Quantity	Likelihood of Occurrence (Without Safety Features)	Severity (Without Safety Features)	Possible Preventive/ Protective/ Mitigative Measures	Likelihood of Occurrence (With Safety Features)	Severity (With Safety Features)	Risk Level (Without Safety Features/ With Safety Features) Comments
Fuel Cell Laboratory	Research Fuel Lines (hydrogen, natural gas, diesel, and biodiesel)								
FCL-1	Hydrogen	Pipe or vessel leak followed by room deflagration	50 standard liters per minute	Occasional	Catastrophic: Injury to personnel from flash burns, equipment damage from subsequent room fire	Volume of room, room ventilation, flammable-gas detectors, excess-flow valve	Extremely Remote	Negligible: Given the maximum rate of leakage and the room ventilation rate, it should be possible to design laboratory to prevent a flammable gas buildup	High Risk / Routine Risk AI Need to ensure that the hydrogen cannot build up in an enclosed space
FCL-2	Hydrogen - oxygen	Fuel cell membrane rupture and resultant oxygen - hydrogen explosion	Volume in cell limited to 10 milliliters (ml)	Occasional	Critical: Rupture of fuel cell and injury to personnel from hot flying debris	Cell casing design to contain explosion	Extremely Remote	Negligible: Fuel cell casing can be designed to contain such an explosion	Moderate Risk / Routine Risk Could calculate the TNT equivalent for a 10-ml vessel failing at 150 psi, the maximum pressure generated by the explosive reaction

Event Scenarios[a]

Scenario Number	Laboratory/ Energy Source	Hazard(s)	Quantity	Likelihood of Occurrence (Without Safety Features)	Severity (Without Safety Features)	Possible Preventive/ Protective/ Mitigative Measures	Likelihood of Occurrence (With Safety Features)	Severity (With Safety Features)	Risk Level (Without Safety Features/ With Safety Features) Comments
FCL-3	Toxic gases	Pipe or vessel leak	Volume of standard gas cylinder (CO concentration > 1 percent) or a small lecture bottle of 100 percent CO	Reasonably Probable	Critical: Possible accumulation of CO, leading to irreversible health effects	Gas detectors, laboratory ventilation	Extremely Remote	Negligible: With warning and dilution from air exchanges, the concentration of CO is probably below level for continuous occupancy	High Risk / Routine Risk AI: Need to verify that for worst-case leaks, the ventilation system maintains the CO concentration at safe levels
Fuel Quality Laboratory									
FQL-1	Hydrogen sulfide lecture-sized gas bottle	Drop and shearing off of valve stem	Gas release from 2,000 psi bottle	Occasional	Critical: Possible injury to personnel from rocketing bottle, exposure to toxic gas cloud	Design of gas storage bottles, safe laboratory handling procedures, use of bottle small enough to limit impacts	Extremely Remote	Marginal: Smaller rocketing bottles could still injure personnel, although impact and velocity would be less	Moderate Risk / Routine Risk
FQL-2	Carbon monoxide release	Toxic gas leak	Gas leak in piping	Reasonably Probable	Critical: Personnel exposed to CO could experience life-threatening health effects, even death	Design and inspection of piping integrity, gas monitors, laboratory ventilation	Extremely Remote	Negligible: Ventilation of laboratory should minimize CO concentration, gas monitors should warn laboratory occupants to leave a toxic environment.	High Risk / Routine Risk AI: Design of laboratory should ensure that CO cannot collect in confined spaces

Event Scenarios[a]

Scenario Number	Laboratory/ Energy Source	Hazard(s)	Quantity	Likelihood of Occurrence (Without Safety Features)	Severity (Without Safety Features)	Possible Preventive/ Protective/ Mitigative Measures	Likelihood of Occurrence (With Safety Features)	Severity (With Safety Features)	Risk Level (Without Safety Features/ With Safety Features) Comments
FQL-3	Gases in standard gas storage bottles	Drop and shearing off of valve stem	Gas bottle rockets around the laboratory, can reach velocities of greater than 100 mph	Occasional	Critical: Possible injury to personnel (including possible fatality), extensive damage to laboratory equipment	Design of gas storage bottles, safe laboratory handling procedures	Extremely Remote	Critical: Possible injury to personnel (including possible fatality), extensive damage to laboratory equipment	High Risk / Low Risk
FQL-4	Gases in standard gas storage bottles	Drop and shearing off of valve stem	Flammable gas cloud formed from sudden release	Occasional	Catastrophic: Possible deflagration, injury to personnel from flash burns, extensive damage to laboratory from overpressure	Design of gas storage bottles safe laboratory handling procedures	Extremely Remote	Negligible: Size of laboratory should limit concentration to below the flammable limit for all cases	High Risk / Routine Risk Need to analyze the final concentration assuming complete mixing when the contents of a standard gas cylinder is rapidly emptied into the laboratory.
FQL-5	Solvents	Small local fire in work area	Assume liter- to gallon-sized, nonbreakable containers	Reasonably Probable	Marginal: Injury to a worker (burns), possible loss of equipment	Low combustible loading, solvents used in fume hood	Remote	Marginal: Minimal equipment damage, minor worker injury	Moderate Risk / Routine Risk

Event Scenarios[a]

Scenario Number	Laboratory/ Energy Source	Hazard(s)	Quantity	Without Safety Features: Likelihood of Occurrence	Without Safety Features: Severity	Possible Preventive/ Protective/ Mitigative Measures	With Safety Features: Likelihood of Occurrence	With Safety Features: Severity	Risk Level (Without Safety Features/ With Safety Features) Comments
FQL-6	Solvents	Room fire	Assume many liter- to gallon-sized bottles in storage cabinets	Occasional	Critical: Room fire that damages equipment, life-threatening worker injury from burns and toxic smoke exposure (from corrosives in fire)	Nonflammable storage cabinets, flammable-gas monitors	Impossible	Negligible: Exposed flammable materials would be insufficient to engulf the entire room, minimal equipment damage, minor worker injury	High Risk / Routine Risk
FQL-7	Hydrogen gas leak	Hydrogen gas could accumulate in a confined area, build up to a flammable gas concentration, and deflagrate	The quantity of hydrogen that can be discharged from a 0.25-inch-OD, 0.109-inch-ID pipe at choke flow	Reasonably Probable	Catastrophic: The hydrogen could accumulate in an enclosed space and deflagrate, with debris injuring nearby workers	A minimum of six air exchanges per hour in all areas where hydrogen accumulates, interlocked flammable-gas detectors, IR/UV detectors, excess-flow valves	Extremely Remote	Catastrophic: The hydrogen could accumulate in an enclosed space and deflagrate, with debris injuring nearby workers	High Risk / Low Risk Comment: when design details are finalized, it may be possible to show that this event is not Reasonably Probable and lower consequences

Event Scenarios[a]

Scenario Number	Laboratory/ Energy Source	Hazard(s)	Quantity	Likelihood of Occurrence (Without Safety Features)	Severity (Without Safety Features)	Possible Preventive/ Protective/ Mitigative Measures	Likelihood of Occurrence (With Safety Features)	Severity (With Safety Features)	Risk Level (Without Safety Features/ With Safety Features) Comments
FGL-8	Hydrogen pipe deflagration	If a hydrogen air mixture were present in a pipe having a diameter of greater than 1 inch, flame fronts accelerate in pipe and detonate at an L/D of about 10	Explosive gas concentration of hydrogen in a pipe	Occasional	Catastrophic: Near the point of the deflagration, serious worker injuries could occur	Quick-acting flow shutoff valves when rapid discharge is detected	Extremely Remote	Critical: Near the point of the deflagration, serious worker injuries could occur	High Risk / Low Risk
Secure Data Center									
SDC-1	Standard laboratory hazards								

a. The information associated with each event scenario is sometimes incomplete. In those cases, the notation “AI” is used to identify action items. These items, when addressed, would enable the scenario to be better defined, with the result that the risk level could be assigned with greater accuracy.

APPENDIX D CAMP GEORGE WEST HISTORIC DISTRICT

Camp George West is a Colorado Army National Guard installation located in central Jefferson County, Colorado, approximately 3 miles east of the City of Golden and 10 miles west of downtown Denver. The facility is situated in an unincorporated area known as Pleasant View, with the City of Golden to the west and the City of Lakewood to the east.

Camp George West Historic District was listed on the National Register of Historic Places (NRHP) in 1993 (NRHP 2008). This appendix discusses the district's location and setting, background, and historic significance, then describes the resources within the district boundaries that could be affected under the Proposed Action.[1]

Location and Setting

The geographic setting and location of the Camp George West site has strongly influenced its development and architecture. The site is located at the edge of the foothills of the Rocky Mountains and encompasses part of South Table Mountain. Lena Gulch and unnamed tributaries flow from west to east through the camp, and dry washes extend down the sides of South Table Mountain and join Lena Gulch. The steep sides of South Table Mountain provided a natural backdrop for target practice, and the top of the mountain was quarried for stone used in street surfacing, construction of many Camp George West buildings, and other projects. The relatively flat part of the camp lying south of the plateau was used for training and as a parade ground, while the southernmost portion north and south of South Golden Road was the setting for most of the facility's buildings.

NRHP terms used in this appendix

Site*:* the location of a significant event, a prehistoric or historic occupation or activity, or a building or structure, whether standing, ruined, or vanished, where the location itself possesses historic, cultural, or archeological value regardless of the value of any existing structure

District: a significant concentration, linkage, or continuity of sites, buildings, structures, or objects united historically or aesthetically by plan or physical development

Building: a resource created principally to shelter any form of human activity, such as a house

Structure: a functional construction made for purposes other than creating shelter, such as a bridge

Object: a construction primarily artistic in nature or relatively small in scale and simply constructed, such as a statue or milepost

Source: National Park Service: http://www.nps.gov/history/nr/publications/bulletins/nrb16a/nrb16a_appendix_IV.htm

The Pleasant View area, which lies mainly to the west and south of Camp George West, is an older residential area. More recent suburban residential and office development lies to the north and east. A profusion of intersecting roadways pass near or through the installation. Interstate 70 passes close to the southwest corner of the camp on a southwest-northeast axis. West Colfax Avenue (U.S. 40) and West 6th Avenue (U.S. 6) follow alignments south of the facility. South Golden Road cuts through the southern section of the camp on an east-west route.

[1] The information in this appendix was obtained from two NRHP forms: (1) the Multiple Property Documentation Form, and (2) the Registration Form, prepared by Front Range Research Associates, Inc. (1992a, 1992b).

Contributing vs. Noncontributing Resources

Some historic districts, including Camp George West, contain a mix of contributing and noncontributing resources. A contributing resource is a site, building, structure, or object that adds to the historical associations, historic architectural qualities, or archeological values for which a property is significant. A contributing resource has the following characteristics:

- It was present during the period of time that the property achieved its significance;
- It relates to the documented significance of the property;
- It possesses historical integrity or is capable of yielding important information relevant to the significance of the property.

Any resource within a district that lacks such associations, qualities, or values is called a noncontributing resource.

Source: http://www.nps.gov/history/nr/publications/bulletins/arch/pt5.htm

Background

The district is an architecturally cohesive collection of buildings and structures associated with a Colorado Army National Guard installation. Camp George West, established in 1903, was the Colorado National Guard's only permanent training facility and was an integral part of the National Guard's activities in Colorado, serving as the principal storage and supply center and the site of summer encampments. The district encompasses historic resources along both sides of South Golden Road, including the highest concentration of historic resources associated with the post. Included are the major historic administrative, residential, storage, utility, and training facilities of the camp, constructed during the period 1903 to 1945.

The resources reflect a variety of masonry techniques utilizing stone obtained on post lands and quarried from the camp quarry. One of the largest collections of Works Progress Administration (WPA)-sponsored buildings in Colorado is located on the grounds of Camp George West, reflecting the installation's significant role in providing employment during the 1930s.

The district incorporates 82 resources, including 64 (78 percent) contributing historic resources and 18 (22 percent) noncontributing resources. Of the 64 contributing historic resources, 51 are buildings, 11 are structures, and 2 are objects. The initial parcel of land acquired for the post in 1903 was cut on its southern end by South Golden Road and the track of the Denver and Inter-Mountain Railroad. This division was to influence the subsequent development of the installation. While the size of the post increased and contracted over the years, most of the buildings constructed at Camp George West are located in the southern section close to transportation facilities.

During the 1927-1941 period, a long east-west row of mess halls was built just north of South Golden Road. Two more mess halls were built farther to the north. Concrete tent pads were built in rows in an encampment area behind the mess halls and provided bases on which tents were pitched during summer encampments. Bathhouses/latrines were located on the east and west sides of the camp, and four magazine structures were in the northeast area. An administrative quadrangle also was built north of South Golden Road. The headquarters building and guardhouse are located here.

The area north of Lena Gulch contained a number of uses. The extreme western portion was developed as a rifle firing range in the mid-1920s. Four concrete firing lines are located here. The central area was used as a training area and parade ground for summer encampments and as a grass landing field for small

aircraft. A plane hangar and quonset hut installed during 1949 were later removed and the landing field abandoned in the late 1950s. The eastern portion of this area was developed as a recreation area during the 1930s, containing a recreation hall, outdoor swimming pool (no longer in existence), and tennis courts (no longer in existence).

The buildings and structures of the Camp George West Historic District have been categorized according to the following NRHP categories:

- administrative and general support buildings
- equipment and supply storage facilities
- residences, cantonment structures, and troop support buildings
- recreational facilities
- firing range
- water storage and distribution structures
- transportation-related facilities
- fence and gate structures

Historic Significance

The Camp George West Historic District is a concentrated and architecturally cohesive group of historic resources representing the historic growth and development of the Colorado National Guard's only permanent historic storage and training installation. The district is historically significant for the following reasons:

- In the field of military history, the district is associated with the historic activities of the Colorado National Guard and with the 757th Military Police Battalion of the World War II era.
- In the field of social history, the district is associated with numerous 1930s New Deal era public works relief projects.
- The district's architecture represents a large group of native stone and frame buildings designed to reflect an overall architectural theme and to perform a variety of functions required for National Guard activities. The architecture of the installation reflects the expanding role of the Colorado National Guard, the influence of popular architectural styles, evolution of military technology, and changes in construction methods and building materials.

Within the district, 68 of the 82 resources are associated with the development of the post prior to 1945. Only 14 of the properties within the district are of post-1945 construction. The period of significance extends from the creation of the post in 1903 to 1945, coinciding with the end of activities associated with World War II and the construction of temporary buildings during that era. Sixty-four (78 percent) of the resources within the district are more than 50 years old. Within the district is the oldest building still in existence on the post, the officers' clubhouse/caretaker's residence, reflecting the earliest period of development of the site. In addition, the district includes the majority of buildings erected during later historic periods of development in the 1920s and 1930s, with a few examples from the World War II era.

A substantial number of the buildings and structures erected during the 1930s as a result of New Deal public works relief programs are included in the district and form one of the largest collections of WPA-sponsored building in the state. Programs such as the WPA provided funding for construction of buildings and structures at the post during the Depression era. A camp for transient workers was established at the camp during the mid-1930s; over half of the historic resources at the post were built during this period.

The various projects employed hundreds of men and helped relieve area unemployment in Colorado. The buildings within the district are also associated with National Guard activities such as strike and riot duty, natural disaster assistance, mobilization for Mexican border service and for war, and military training. In addition, the post was a training site during World War II for military police.

A significant number of buildings within the district are constructed of native fieldstone and stone obtained from the post's quarry on South Table Mountain, which give the post a unique architectural identity. The early stone buildings constructed at Camp George West embody style elements such as gabled roofs, battered piers, and multi-pane windows and unquarried stone found on the post. The Depression-era buildings and structures reflect design elements such as multiple narrow windows, complex roofs, and a variety of wall projections increased the amount of labor necessary for their construction. Residences built during the 1930s feature multiple gables and multi-pane windows. The Depression-era buildings are largely composed of stone quarried on the installation. The small group of World War II temporary buildings erected at Camp George West represent standard plans and the conservation of labor and materials.

The majority of buildings within the district possess the physical characteristics required to be evaluated as contributing elements. In general, the storage buildings and the mess halls have undergone more alterations than other resources due to their adaptation to new uses. However, the original scale, construction techniques, workmanship, location, setting, and much of the original materials are still apparent in these resources. The most common alterations within the district are the remodeling of doors and windows, and less frequently, the addition of nonhistoric siding. A few buildings have been enlarged with enclosed entrance bays or small wings, but none of the additions is large or intrusive enough to diminish the integrity of the buildings. In general, the buildings within the district maintain a high integrity of design, scale, location, craftsmanship, setting, and materials, and as a group convey the historic associations which resulted in their creation.

Physical Characteristics of Historic Resources at Camp George West

The physical characteristics of the buildings erected at Camp George West were determined by the themes set by the early architecture of the post and the materials and manpower available at the time of construction. The first permanent building erected on the post was an officers' clubhouse/caretaker's residence, designed by architect Albert Bryan. Built in 1911-1912 south of South Golden Road, the officers' clubhouse/caretaker's residence utilized native stone construction with design elements such as a gabled roof, overhanging eaves with exposed rafters, and multi-pane windows. These elements influenced subsequent buildings and resulted in the creation of a unique architectural environment. Buildings erected during the 1910s and 1920s repeated elements of Bryan's work.

During the 1930s, a quarry that operated under the auspices of various public works programs supplied materials, and public relief agencies supplied manpower for buildings. George H. Merchant, architect for the buildings constructed during this period, used native stone for the post's buildings. The building design of this era had numerous narrow windows, wall buttresses, and complex rooflines in order to utilize as much labor as possible, thereby giving work to unemployed men. The built environment of the post grew substantially during the 1930s as a result of these public works projects.

During World War II, a small number of temporary buildings were erected following standard plans provided by the Quartermaster Corps. To conserve materials and time, these temporary buildings were simple frame structures similar to thousands of others built on military installations across the country.

Descriptions of the Potentially Affected Resources

Table D-1 lists the potentially affected resources at Camp George West, their year of construction, their historic status (contributing or noncontributing), and the nearest corridor(s) along which each resource lies. Of the 15 potentially affected buildings and structures, 13 are contributing resources and 2 are noncontributing resources. All of the potentially affected resources lie north of South Golden Road.

The following sections describe the buildings and structures that could be affected if one of the five proposed corridors is selected. The locations of these resources are shown on Figures D-1 and D-2.

Table D-1. Camp George West Resources Potentially Affected under the Proposed Action

Resource	Resource Number	Year of Construction	Historic Status	Nearest Proposed Corridor
Administrative and General Support Buildings				
Headquarters	45	1937	Contributing	D
Guardhouse	83	1940	Contributing	D
Equipment and Supply Storage Facilities				
Small Arms/ Ammunition Storage	33	1925	Contributing	D
Motor Vehicle Storage	111	1953	Noncontributing	D
Residences, Cantonment Structures, and Troop Support Buildings				
Mess Hall	12	1936	Contributing	D
Mess Hall	28	1941	Contributing	D
Mess Hall	29	1941	Contributing	D
Recreational Facilities				
Recreation Hall	48	1937	Contributing	D
Outdoor Swimming Pool[a]	49	1936	Contributing	D
Firing Range				
Rifle Firing Range	FR12	1924	Contributing	B
Water Storage and Distribution Structures				
Pump House[a]	84	1927	Contributing	B
Transportation-Related Facilities				
Pedestrian Underpass	50	1934	Contributing	D
Bridge	92	1940	Contributing	B
Bridge	113	1938	Contributing	D
Other Buildings/Structures				
Golden Gun Club Clubhouse[b]	104	1941	Noncontributing	B

a. The Outdoor Swimming Pool and the Pump House are no longer in existence.
b. The Golden Gun Club Clubhouse was lost to fire in July 2009.

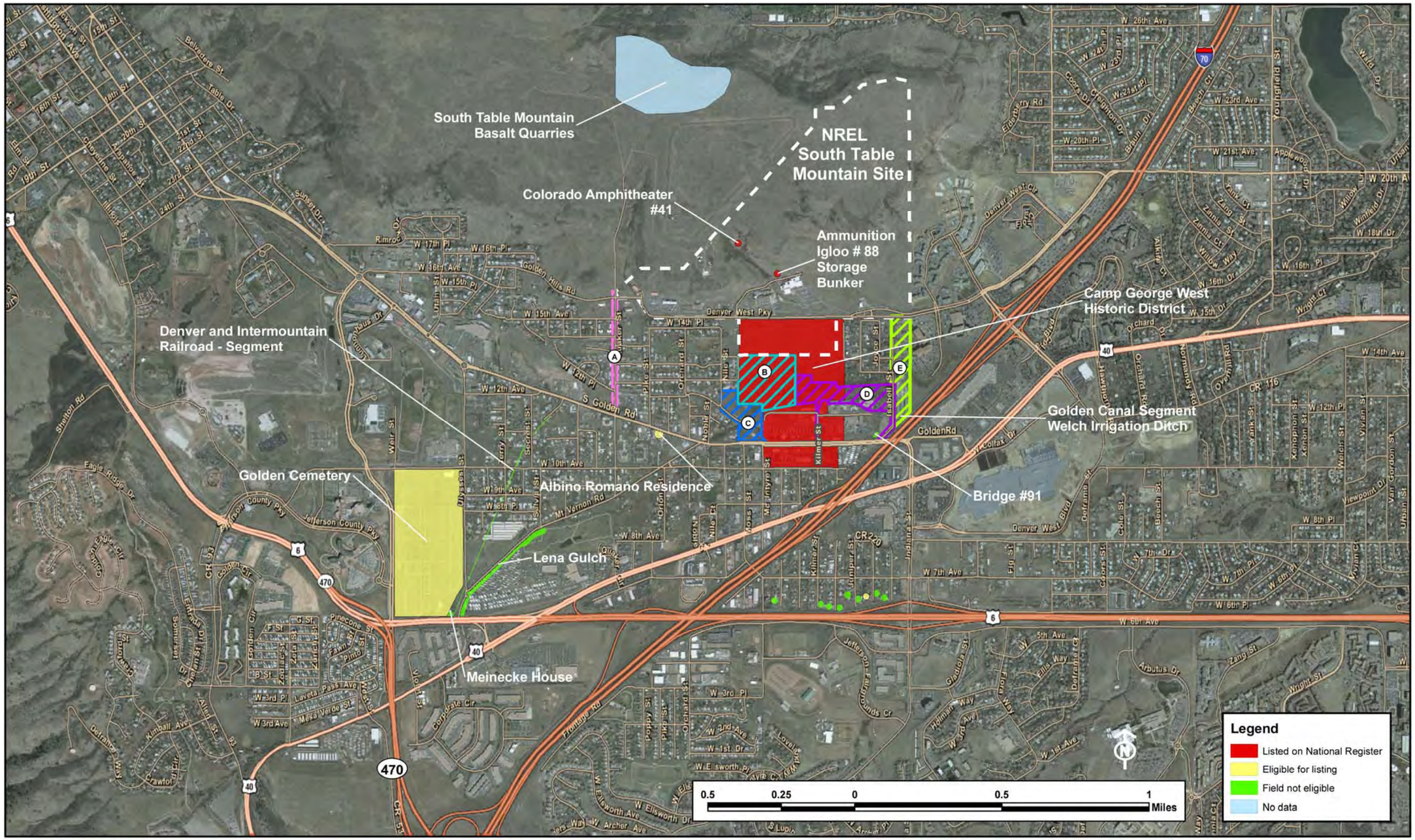

Figure D-1. Historic Resources within or near the Proposed Corridors for a Second Full Service Access Road to the NREL's South Table Mountain Site

Figure D-2. Camp George West Historic Resources within or near the Proposed Corridors for a Second Full Service Access Road to the NREL's South Table Mountain Site

Administrative and General Support Buildings

Headquarters (Building 45)

Building 45—Headquarters (1937)

A focal point of the post is the headquarters building erected in 1937 with funding from the WPA. The building was designed by George H. Merchant to employ as many hours of labor as possible in its construction, thereby providing employment for public relief workers. Included in the design were a complex roofline, many windows, and several wall projections. The one-story split fieldstone building has a central bay with a steeply pitched roof intersected on each end by roof wings. The central bay has a low, shed-roofed projecting façade presenting the building's central entrance. Above the entrance is a pediment arch that is stuccoed and decorated with the state seal. The entrance is flanked by a pair of casement windows with concrete sills. Flanking these are large 16-pane windows.

At the corners of the main bay are engaged stone pilasters. In 1956, a frame addition was added to the eastern wing of the building. The main entrance has been remodeled, as have entrances on the east and west wings.

Guardhouse (Building 83)

Building 83—Guardhouse (1940)

The guardhouse was one of the WPA-funded projects which erected major administrative and support buildings around the central quadrangle of the post. George H. Merchant designed the building to employ a maximum amount of labor through the inclusion of numerous windows and wall projections. The one-story, randomly coursed, split stone building has a pitched roof. A central, slightly projecting entrance features a stepped parapet with cast cement coping. Flanking the entrance are engaged stone pilasters with cast cement trim. Stonework above the entrance opening forms a slight arch. Windows are multi-pane casements with cast sills. The building has a raised concrete foundation, which has been painted. The original main entrance has been enclosed and has a window. The east elevation has an enclosed entrance bay with nonhistoric siding.

Equipment and Supply Storage Facilities

Building 33—Small Arms/Ammunition Storage (1925)

This one-story rectangular frame building has tongue-and-groove siding and a gabled roof with overhanging eaves and exposed rafters. The northern elevation has a central sliding wooden door that opens onto a small loading dock and is flanked by small multi-pane windows. A second sliding door is on the west. Windows are mostly six-pane with wood trim. One window on the east elevation has been replaced with a metal vent.

Small Arms/Ammunition Storage (Building 33)

Building 111—Motor Vehicle Storage (1953)

Built in 1953, after the period of significance (1903 to 1945), Building 111 was constructed north and west of the Headquarters and Guardhouse. This quonset-hut-style building has been designated a noncontributing resource, meaning it lacks any associations, qualities, or values that would contribute to the significance of the Camp George West Historic District.

Motor Vehicle Storage (Building 111)

Residences, Cantonment Structures, and Troop Support Buildings

Building 12—Mess Hall (1936)

This building is one of 11 remaining of 17 mess halls built during the period 1936-1941 on the post. It is representative of the current appearance of the buildings. This mess hall is a one-story front gable building with overhanging eaves. The lower portion of the building to sill height is composed of quarried basaltic stone rubblework; the upper walls are frame, now covered with nonhistoric siding over the original horizontal tongue-and-groove siding. The building has central entrances on gable end walls. The south entrance originally had double doors but now has a single door. Side elevations had central doors that are now covered up. Original six-pane windows have been replaced with sliding windows. Original corrugated iron roofing has been replaced with shingle roofing.

Mess Hall (Building 12)

Buildings 28 and 29—Mess Halls (1941)

The basic design of these mess halls, built approximately 5 years after Building 12, was essentially the same as the design for Building 12. However, the stone masonry on the lower portion of these buildings is more polygonal, with the stones quarried to a flatter surface.

Mess Hall (Building 28)

Mess Hall (Building 29)

Recreational Facilities

Building 48—Recreation Hall (1937)

Recreation Hall (Building 48)

This one-story building was designed to accommodate leisure-time activities of Guardsmen as a WPA public works relief project. The walls of the building are composed of fieldstone set with wide mortar seams. The cross-gabled roof has widely overhanging eaves, decorative beams, and exposed rafters. A projecting, gabled, central entrance bay is flanked by wraparound porches with stone pillar supports and walls. Over the entrance is a flat stone lintel. All windows have multiple panes (six or eight) and cast cement sills. The interior features a large fieldstone fireplace. The building has nonhistoric doors, the windows have metal grills, and a portion of the porch has been enclosed.

Structure 49—Outdoor Swimming Pool (1936)

The concrete outdoor swimming pool is no longer in existence; in its place is a wetland. The pool, built as a public works relief project, was a 50- by 90-foot rectangle that varied in depth from 3 feet on the western shallow end to 8 feet on the eastern end. The edge of the pool was surrounded by a narrow wall approximately 18 inches high, which was topped by a flat concrete top. An L-shaped concrete bench was located northwest of the pool. The pool originally had a diving board in the center of the east end and metal access ladders adjacent to the diving board and at the northeast and southeast corners. The pool was enclosed by a chain link fence.

Wetland occupying the original location of the outdoor swimming pool (Structure 49)

Firing Range

Structure FR12—Rifle Firing Range (1924)

Located northwest of the principal concentration of buildings at Camp George West, on the western edge of the installation, the lines of the firing range are oriented east-west and consist of a 600-yard line (farthest to the south), a 500-yard line, a 300-yard line, and a 200-yard line (farthest to the north). The lines are constructed of concrete, approximately 340 feet long and 1 foot wide, flush with the ground on the side of the shooter and about a foot above the ground on the side of the target. The 600-yard line is intact; the remaining three are missing segments where a dirt road and/or channelized drainage cuts through the lines. The rifle range was utilized during summer encampments of the Colorado National Guard during the 1920s and 1930s. During World War II, the 757th Military Police Battalion used the range.

Rifle Firing Range (FR12)

Water Storage and Distribution Structures

Structure 84—Pump House (1927)

The pump house is no longer in existence. The pump house was a small, wedge-shaped, one-story frame structure with drop siding and a shed roof that extended to the ground. It had a stone foundation and a central door constructed of vertical boards. By the 1980s, the structure was in an advanced state of deterioration (Front Range Research Associates 1992b).

Transportation-Related Facilities

Structure 50—Pedestrian Underpass (1934)

A Civil Works Administration project completed this pedestrian tunnel under South Golden Road and the Denver and Inter-Mountain railroad tracks to connect the northern and southern portions of the camp. The concrete-lined passageway consists of steps and a tunnel with sloping floors toward a level midsection. Entrances on either end are wedge-shaped and composed of split fieldstone. Stone posts with pyramidal tops stand at the corners of the entry and extend beyond the roofline. The roof is slightly curved and covered with a thin layer of concrete. The entrance on the southern end is open, while the one on the north is covered with a metal door and siding.

Pedestrian Underpass (Structure 50)

Bridge (Structure 92)

Structure 92—Bridge (1940)

This bridge over Lena Gulch was built as part of the WPA project to improve the post and provided easier access to the northwest quadrant of the camp and firing range. The one-lane bridge has a reinforced flat concrete deck and a 10-foot roadway with a 3-foot sidewalk on the east. The span of the bridge is 14 feet. The bridge abutments are composed of roughly split basaltic stone laid in courses. The side walls of the bridge are flared, rounded, and tapered and have a top layer of concrete.

Bridge (Structure 113)

Structure 113—Bridge (1938)

This two-lane bridge in the north-central section of Camp George West was constructed in 1938 as a WPA project. The bridge separately spans Lena Gulch and an unnamed tributary to that stream. It has a reinforced concrete slab deck and split fieldstone abutments with thick mortar. The roadway is 20 feet wide with stone walls higher toward the center of the bridge, where the land drops off beneath. A layer of projecting fieldstones is cemented to the top of the bridge walls, and metal railings flank the bridge deck. The total length of the bridge and its approaches is approximately 140 feet.

Other Buildings/Structures

Building 104—Golden Gun Club Clubhouse (1941)

This small one-story gabled building was composed of hand-made concrete blocks with decorative rocks embedded in them in decorative patterns. The building was not built by the military, and the National Guard did not take possession of the building until 1948; therefore, it does not meet the requirements for a contributing resource within the district. This building was destroyed by fire the weekend of July 25-26, 2009.

Golden Gun Club Clubhouse (Building 104)

Golden Gun Club Clubhouse - lost to fire (July 2009)

References

NRHP (National Register of Historic Place), 2008. COLORADO – Jefferson County – Historic Districts, online at http://www.historicddistricts.com/co/Jefferson/districts.html.

Front Range Research Associates, 1992a. National Register of Historic Places, Multiple Property Documentation Form, September 1, 1992, online at http://www.nr.nps.gov/multiples/64500062.pdf.

Front Range Research Associates, 1992b. National Register of Historic Places, Registration Form, September 1, 1992.

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Department of Energy
Golden Field Office
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November 6, 2009

DOE/EA 1440-S-II

FINDING OF NO SIGNIFICANT IMPACT
for
SUPPLEMENT- II TO FINAL SITE-WIDE ENVIRONMENTAL ASSESSMENT OF THE NATIONAL RENEWABLE ENERGY LABORATORY'S SOUTH TABLE MOUNTAIN COMPLEX

AGENCY: Department of Energy, Golden Field Office

ACTION: Finding of No Significant Impact

SUMMARY: In accordance with the Department of Energy (DOE) National Environmental Policy Act (NEPA) implementing regulations, DOE evaluated the potential environmental impacts that will result from five actions at the National Renewable Energy Laboratory's (NREL) South Table Mountain (STM) site.

Proposed Construction and Operation of:

- The Energy Systems Integration Facility (ESIF), a new research facility;
- Phase 2 of planned site infrastructure improvements (Phase 2 of Full Site Development);
- A new second full service access road;
- Expansion of the Waste Handling Facility (WHF); and
- Expansion of the Visitors Center.

The decision to implement these projects required that DOE address NEPA requirements and related environmental documentation and permitting requirements. In compliance with the NEPA (42 U.S.C. 4321) and with DOE's NEPA implementing regulations (10 CFR section 1021.330) and procedures, the supplemental environmental assessment (SEA-II) examines the potential environmental impacts of DOE's decision to support this Proposed Action and also examines a No Action Alternative. Under the No Action Alternative, DOE would not fund these projects and they would not be constructed or operated.

All discussions and findings related to the Proposed Action and the No Action Alternatives are presented in the attached Final SEA–II and Appendices. The Final SEA-II is hereby incorporated by reference.

For many of the environmental resource areas assessed in the EA, the five projects that make up the Proposed Action will not result in either adverse or beneficial impacts because the project area and surrounding area lack sensitive receptors or resource areas that will be impacted (e.g., species of concern;

on-site perennial creeks, low-income or minority populations; agriculturally productive soils; or high commercial- value geologic resources). Additionally, while the proposed site expansion will place additional demands on local infrastructure such as water and electrical supplies, telecommunication systems, and sewage treatment, these demands will neither exceed existing capacities nor require upgrades or modifications to the local systems which supply the STM site. Similarly, because the construction activities will be relatively short-term and of limited scale, and operationally the majority of the workers already exist within local communities, there will be no significant socioeconomic impacts from the proposed action. In general, routine operations of the proposed projects will not significantly impact the off-site public and have no potential to affect members of populations protected by Executive Order on Environmental Justice (*E.O. 12898 Federal Actions to Address Environmental Justice in Minority and Low-Income Populations (59 FR 7629)).* However, implementation of these site projects will result in some environmental impacts.

The proposed increase of staff on the South Table Mountain (STM) site will result in increased traffic at intersections near the STM site. Previous analyses in the SEA-I and revised analyses for this SEA-II predict that, if not mitigated, the increased traffic will lead to an unacceptable degradation of traffic flow in the east bound lanes of the Denver West Parkway/Denver West Marriot Boulevard intersection during evening rush hours. In response to these predicted impacts, DOE and NREL developed a Mitigation Action Plan (MAP) for SEA-I, which is hereby incorporated by reference that stipulated the mechanisms by which traffic flows will be reduced to acceptable levels and the monitoring program which will be utilized to assure the success of the mitigating actions. However, for the projected staffing growth assessed in this SEA-II, the mitigation measures defined in the MAP would not adequately mitigate traffic volumes to acceptable levels of service without a second access road. DOE has determined that utilization of the preferred corridor, alternative B/C, for a route that connecting the STM site with South Golden Road could be accomplished without significant impacts. This conclusion is based on the analyses in SEA-II and the consultations with federal, state, and local agencies that have concurred on the acceptability of this corridor. Further agency consultations will occur to select a specific route within this corridor that can be developed without significant impacts to wetlands, floodplains, or historic resources.

Collectively, the ESIF, WHF and Visitor Center expansions, second access road, and infrastructure upgrades will result in the loss of approximately 6 hectares (15 acres) of grassland and shrubland habitat, some of which will occur in or adjacent to natural drainages, which are among the site's most productive wildlife habitats and corridors. Because this incremental habitat loss is within the total build out plans assessed in the 2003 SWEA and determined to be insignificant, and the fact that DOE's long term plans for the STM site would ultimately develop only 15 percent of the site, setting aside over one half of the entire site for conservation easement, DOE has determined that the habitat loss under the proposed actions evaluated in this SEA-II will not be significant.

Construction will result in short-term (1- 2 years) increases in on-site traffic, noise, fugitive dust, auto and equipment emissions, and construction debris. The equipment and facilities that will be added to the STM site under the Proposed Action are not unique to the site. The appearance of these facilities will in fact be similar to other buildings. As such, the addition of the ESIF and infrastructure upgrades will add to, but not substantially alter the visual impact and character of the site and will not significantly interfere with nearby neighborhood views of South Table Mountain to the north or foothill views to the west. Final design and operations of nighttime lighting for facilities, parking structures, and roadways will integrate operational safety and security requirements with a commitment to minimize the offsite effects of lighting to less than significant impact levels. The proposed actions will not result in untreated operational discharges of pollutants to surface water or groundwater. Drains will be connected to the site's existing or new stormwater and sewage lines, and all discharges to the publicly owned treatment works will meet the requirements of the Metro Wastewater Reclamation District and the Pleasant View Water and Sanitation

District. Operational air emissions from facilities and increased traffic will not exceed permit levels and will not result in any significant increases in health effects.

The new construction will increase the impervious surface area, which could increase quantities of stormwater conveyed off-site. Management practices, including stormwater pollution prevention measures to minimize runoff, which will include permanent detention ponds, will be implemented during construction to minimize degradation of surface water quality due to sediment and various chemicals associated with additional vehicles and construction equipment.

Under the Proposed Action, workers within the ESIF could be directly affected by exposures to hazardous releases, fires, or explosions under the accidents postulated in SEA-II, and serious injuries could occur. However, because the operations are conducted remotely, and workers have standard procedures in place to control hazards, protective equipment, and emergency response procedures, the likelihood of a serious injury to an ESIF worker is small. As design and construction of ESIF proceeds, more detailed hazards analyses will be performed consistent with NREL's Hazard Identification and Control Procedure so that changes in the facility hazards and design are adequately captured and analyzed. This will confirm that facility workers, site workers, and the general public will be adequately protected from any events that may occur after the ESIF becomes operational.

Construction activities near the east and west boundaries of the STM site will occur near residences and noise could be a nuisance for some residents during the duration of construction. Construction-related noise impacts will vary with the phase of construction and will occur intermittently. Because this noise will be short-term, mitigated by distance, occur during normal week day working hours, and will comply with all applicable noise ordinances, it will not result in a significant adverse impact. Operationally, there will be no noise sources that could generate significant noise impact to off-site members of the public.

The Proposed Action will not offer any credible targets of opportunity for terrorists or saboteurs to inflict significant adverse impacts to human life, heath, or safety, nor will the Proposed Action render the STM site as a whole any more susceptible to such acts. However, the consequences of an operational accident as defined in the SEA-II could occur if initiated by an act of terrorism or sabotage.
The Proposed Action will support and promote the overall objectives and mission of NREL and will occur within areas evaluated and committed to for further development in the 2003 site-wide EA.

COPIES OF THE FINAL EA ARE AVAIALBLE FROM:

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DETERMINATION:

Based on the information presented in the Final SEA-II (DOE/EA 1440-S-II), DOE determines that the construction and operation of ESIF; expansions of the WHF and the Visitors Center; the selection of corridor B/C for the second full service access road; and the proposed infrastructure upgrades; do not constitute major Federal actions significantly affecting the quality of the human environment, within the meaning of the National Environmental Policy Act. Therefore, the preparation of an Environmental Impact Statement is not required, and DOE is issuing this Finding of No Significant Impact.

Issued in Golden, Colorado 10th day of November, 2009.

Rita L. Wells
Manager