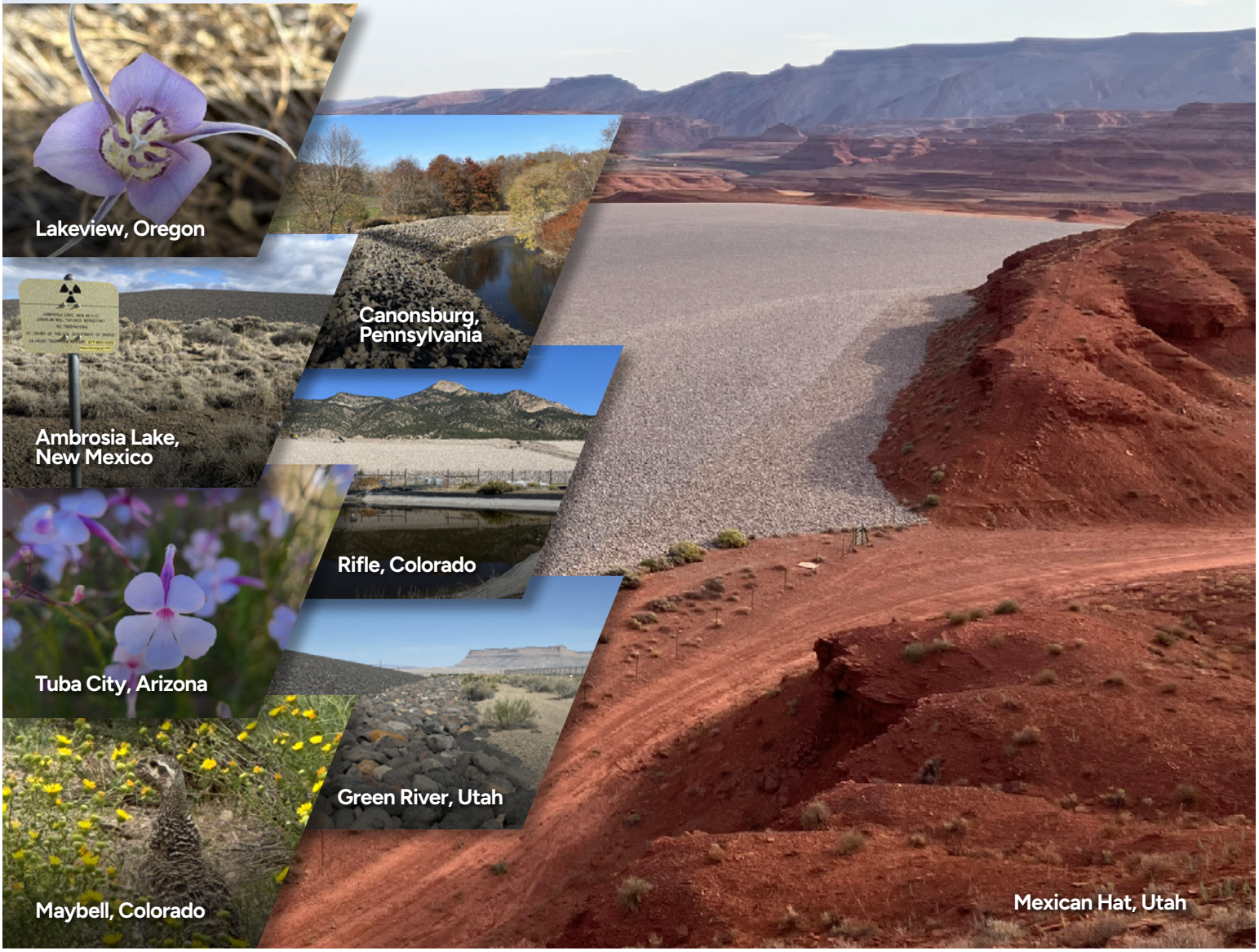
U.S. DEPARTMENT of ENERGY | Legacy Management

LMS/48384

2024
Annual Site Inspection and Monitoring Report
Uranium Mill Tailings Radiation Control Act Title I Disposal Sites

MARCH 2025



This document has been designed for online viewing.

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Abbreviations

ACL	alternate concentration limit
AML	Abandoned Mine Lands
BLM	U.S. Bureau of Land Management
CFR	*Code of Federal Regulations*
DEP	Department of Environmental Protection
DOE	U.S. Department of Energy
EDA	energy dissipation area
EPA	U.S. Environmental Protection Agency
ET	evapotranspiration
ft	feet
GCAP	Groundwater Compliance Action Plan
GEMS	Geospatial Environmental Mapping System
gpm	gallons per minute
GSMT	geotechnical sampling and materials testing
GWTP	groundwater treatment plant
HDPE	high-density polyethylene
IC	institutional control
ICP	interim cover protection
LBNL	Lawrence Berkeley National Laboratory
lidar	light detection and ranging
LM	Office of Legacy Management
LMS	Legacy Management Support
LOESS	locally estimated scatterplot smoothing
LTSP	Long-Term Surveillance Plan
MCL	maximum concentration limit
mg/L	milligrams per liter
N	nitrogen
NAVD 88	North American Vertical Datum of 1988
NECA	Navajo Engineering and Construction Authority
NGVD 29	National Geodetic Vertical Datum of 1929
NLN	National Laboratory Network
NMED	New Mexico Environment Department

NRC	U.S. Nuclear Regulatory Commission
PCB	polychlorinated biphenyl
PL	photograph location
POC	point of compliance
POE	point of exposure
PWE	Pore Water Extraction
SOARS	System Operation and Analysis at Remote Sites
TDS	total dissolved solids
UBL	upper baseline limit
UMTRA	Uranium Mill Tailings Remedial Action
UMTRCA	Uranium Mill Tailings Radiation Control Act
USDA	U.S. Department of Agriculture

Executive Summary

This report, in fulfillment of a U.S. Nuclear Regulatory Commission (NRC) license requirement, presents the results of long-term surveillance and maintenance activities conducted by the U.S. Department of Energy (DOE) Office of Legacy Management (LM) in 2024. These activities occurred at the 19 uranium mill tailings disposal sites established under Title I of the Uranium Mill Tailings Radiation Control Act (UMTRCA)[1] and verify that the UMTRCA Title I disposal sites remain in compliance with license requirements and Long-Term Surveillance Plans (LTSPs). Individual chapters for each site are available on the LM public website at https://energy.gov/lm/sites/lm-sites.

LM manages 18 UMTRCA Title I disposal sites under a general license granted by NRC in accordance with Title 10 *Code of Federal Regulations* Section 40.27 (10 CFR 40.27). LM also manages the UMTRCA Title I Grand Junction, Colorado, Disposal Site, which will not be included under the general license until the operating portion of the disposal cell is closed. Low-level radioactive waste will be received until the disposal cell's legally mandated closure date or until it is filled to capacity, whichever comes first. In December 2020, Congress passed legislation that extended the final disposal cell closure date from 2023 to 2031. Unless additional legislation is enacted by Congress that further extends the final cell closure date, LM's receipt of radioactive waste at the site will cease in September 2031.

Long-term surveillance and maintenance activities for these sites include inspecting and maintaining the sites; monitoring environmental media and institutional controls; conducting any necessary corrective actions; and performing stakeholder relations and administrative, recordkeeping, and other regulatory stewardship functions.

Annual site inspections and monitoring are conducted in accordance with site-specific LTSPs[2] and procedures established by DOE to comply with license requirements. Each site inspection is performed to verify the integrity of visible features at the site; identify changes or new conditions that may affect the long-term performance of the site; and determine the need for maintenance, follow-up inspections, or corrective action in accordance with the LTSPs.

All sites require some degree of routine monitoring and maintenance, which may include groundwater and surface water monitoring, minor erosion control, vegetation control, fence and gate repairs, sign replacement, and minor trash removal.

The following nonroutine activities[3] occurred in 2024:

- The Rifle, Colorado, Disposal Site had improvements made to the original disposal cell pore water extraction system in fall 2023, including upgrading solar power systems and batteries and burying the extraction lines into the frost barrier of the disposal cell cover system to prevent freezing during the winter months. Despite the improvements to the extraction system and continuous pumping since mid-2018, water levels in the standpipes steadily increased between 2012 and early 2023, exceeding the pumping action level in 2016 and the

[1] Congress directed that the Moab, Utah, Processing Site be remediated under Title I of UMTRCA. This site eventually will become the 20th Title I disposal site.
[2] The Grand Junction disposal site is inspected in accordance with an interim LTSP.
[3] Nonroutine activities are implemented in response to changes in site conditions, regulatory setting, or management structure following a regulatory compliance review.

top of the high-density polyethylene (HDPE) liner elevation in 2023. LM completed the high-priority Pore Water Extraction (PWE) Project in 2024 to enhance pore-water extraction by installing 10 extraction wells, 4 monitoring wells, updated solar-powered System Operation and Analysis at Remote Sites (SOARS) systems, a new pore-water discharge pipeline system, and two 108 × 108 feet modular evaporation tanks to contain the extracted leachate for storage and evaporation. The new PWE infrastructure is designed to pump and evaporate 2.6 million gallons of pore water from the southern portion of the disposal cell annually to reduce pore-water elevations below the top elevation of the HPDE liner and pumping action level.

- The NRC-approved evapotranspiration cover conversion pilot study at the Grand Junction disposal site was initiated in 2020 and continued in 2024. The pilot study is conducted on the in-service disposal cell cover and focuses on investigating vegetation management, radon diffusion, plant uptake of contaminants, monitoring techniques, and water balance. The study was designed as a long-term investigation and is expected to continue for several more years. Results from the first phase of the project are included in "Field Hydrology of Armored Earthen Final Covers with and Without Vegetation."
- To facilitate operational safety associated with the receipt and placement of additional material in the disposal cell, DOE initiated upgrades to the Grand Junction disposal site infrastructure in 2023. The upgrades were completed in 2024.

Results of the annual site inspection, maintenance, and monitoring activities are reported in the site-specific chapters that follow this summary. Table ES-1 summarizes actions and issues.

Table ES-1. 2024 Summary of UMTRCA Title I Site Actions and Issues

Site	Chapter	Page	Actions and Issues
Ambrosia Lake, New Mexico	1	1-6	No maintenance needs were identified.
Burrell, Pennsylvania	2	2-7	Two concrete well pads were installed at monitoring wells 0424 and 0524.
		2-7	Cracks were repaired in existing well pads for monitoring wells 0422 and 0522.
Canonsburg, Pennsylvania	3	3-8	Inspectors observed a downed tree on the perimeter fence from a recent windstorm. The fence remains serviceable, and removal and assessment activities are scheduled for 2025.
		3-8	Repairs to the protective casing and well pad on monitoring well 0412 are scheduled to be completed in 2025.
Durango, Colorado	4	4-6	Woody vegetation on the side and top slopes of the disposal cell was treated.
		4-7	Groundwater monitoring was conducted.
Falls City, Texas	5	5-7	Repairs were conducted at the hog crossing areas between perimeter signs P4 and P5, P5 and P6, P24 and P25, and P26 and P27.
		5-7	Groundwater monitoring was conducted.
Grand Junction, Colorado	6	6-7	Maintenance was completed for the eastern perimeter road, as well as the stormwater retention ponds, sediment collection pond, and drainage channels to better control stormwater and spring runoff.
		6-7	Groundwater monitoring was conducted.

Table ES-1. 2024 Summary of UMTRCA Title I Site Actions and Issues (continued)

Site	Chapter	Page	Actions and Issues
Green River, Utah	7	7-6	The entrance sign and perimeter signs P1, P2, P5, P6, P8, P11, and P12 were replaced.
		7-6	Groundwater monitoring was conducted.
Gunnison, Colorado	8	8-6	Vegetation on the top slope and west side of the disposal cell will be treated.
		8-6	No groundwater monitoring was required.
Lakeview, Oregon	9	9-7	Two signs were added to the entrance gate about prohibited activities and emergency instructions.
		9-8	Groundwater monitoring was conducted.
Lowman, Idaho	10	10-5	Coniferous ponderosa pine on the disposal cell cover and weeds growing on the interceptor benches were treated.
		10-5	No groundwater monitoring was required.
Maybell, Colorado	11	11-6	Noxious weeds on the disposal cell cover were treated.
		11-6	No groundwater monitoring was required.
Mexican Hat, Utah	12	12-6	Eight new SOARS stations were added on the disposal cell.
		12-7	Observational monitoring of designated seeps was conducted.
Naturita, Colorado	13	13-1	No groundwater monitoring was required.
		13-5	Woody vegetation was treated on the southeast slope and apron of the disposal cell.
Rifle, Colorado	14	14-1	Ten extraction wells, four monitoring wells, two 1-acre evaporation ponds, solar power infrastructure, and buried extraction lines were completed.
		14-2	The access road has been repaired as needed during construction activities associated with the PWE Project.
		14-8	Disposal cell pore-water level monitoring was conducted.
Salt Lake City, Utah	15	15-6	Vegetation along the access roads around the disposal cell will be treated.
		15-6	No groundwater monitoring was required.
Shiprock, New Mexico	16	16-6	Two aerial targets at the site were identified as not being needed and will be removed before the next annual inspection.
		16-6	Deep-rooted woody shrubs on the disposal cell will be treated.
Slick Rock, Colorado	17	17-5	Undercutting at perimeter sign P14, erosion at perimeter sign P6 and near perimeter sign P3, and erosion between perimeter signs P31 and P32 were backfilled.
		17-5	No groundwater monitoring was required.
Spook, Wyoming	18	18-5	The original eight boundary monuments, as well as 10 perimeter signs and an entrance sign, were removed and replaced with a new entrance sign, nine boundary monuments, and six new perimeter signs along the new site boundary.
		18-5	No groundwater monitoring was required.
Tuba City, Arizona	19	19-7	Vegetation along the perimeter fence line and deep-rooted vegetation on the disposal cell will be treated.
		19-7	Groundwater monitoring was conducted.

1.0 Ambrosia Lake, New Mexico, Disposal Site

1.1 Compliance Summary

The Ambrosia Lake, New Mexico, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site was inspected on March 19, 2024. No changes were observed on the disposal cell or in the associated drainage features. Inspectors identified no immediate maintenance needs and found no cause for a follow-up or contingency inspection.

Groundwater monitoring is not required at the site. However, the U.S. Department of Energy (DOE) Office of Legacy Management (LM) conducts groundwater monitoring every 3 years at three wells as a best management practice at the request of the New Mexico Environment Department (NMED). The most recent groundwater sampling event with results to report occurred on November 1, 2022. The results from that sampling event are included in Section 1.7 of this chapter.

1.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the site-specific Long-Term Surveillance Plan (DOE 1996) (LTSP) in accordance with procedures established to comply with the requirements of the U.S. Nuclear Regulatory Commission (NRC) general license at Title 10 *Code of Federal Regulations* Section 40.27 (10 CFR 40.27). Table 1-1 lists these requirements.

Table 1-1. License Requirements for the Ambrosia Lake, New Mexico, Disposal Site

Requirement	LTSP	This Report	10 CFR 40.27
Annual Inspection and Report	Section 6.0	Section 1.4	(b)(3)
Follow-Up or Contingency Inspections	Section 7.0	Section 1.5	(b)(4)
Maintenance and Repairs	Section 8.0	Section 1.6	(b)(5)
Groundwater Monitoring	Section 5.0	Section 1.7	(b)(2)
Corrective Action	Section 9.0	Section 1.8	--

1.3 Institutional Controls

The 288-acre site, identified by the property boundary shown in Figure 1-1, is owned by the United States and was accepted under the NRC general license in 1998. DOE is the licensee and, in accordance with the requirements for UMTRCA Title I sites, LM is responsible for the custody and long-term care of the site. Institutional controls (ICs) at the site include federal ownership of the property, administrative controls, and the following physical ICs that are inspected annually: the disposal cell and associated drainage features, access road, entrance sign, perimeter signs, site markers, survey and boundary monuments, mine vent shaft, quality control monuments, and wellhead protectors.

1.4 Inspection Results

Inspection of the site, 25 miles north of Grants, New Mexico, was conducted by D. Atkinson, C. Murphy, J. Graham, and N. Lind of the Legacy Management Support contractor. A. Rheubottom (NMED) attended the inspection. The purposes of the inspection were to confirm the integrity of visible features at the site, identify changes in conditions that might affect conformance with the LTSP, and evaluate whether maintenance or follow-up inspection and monitoring are needed.

1.4.1 Site Surveillance Features

Figure 1-1 shows the locations of site features, including site surveillance features and inspection areas, in black and gray font. Some site features that are present but not required to be inspected are shown in italic font. Observations from previous inspections that are currently monitored are shown in blue, and new observations identified during the 2024 annual inspection are shown in red. Inspection results and recommended maintenance activities associated with site surveillance features are described in the following subsections. Photographs to support specific observations are noted in the text and in Figure 1-1 by photograph location (PL) numbers. The photographs and photograph log are presented in Section 1.10.

1.4.1.1 Access Road, Entrance Gate, and Entrance Sign

Access to the site is from a gravel road that crosses private property and leads to the site approximately 1 mile from New Mexico Highway 509. Entrance to the site is through a locked steel gate at the intersection of the access road and Highway 509. The access road continues east past the site to private mining and grazing interests. The gate and access road are owned by Rio Algom Mining LLC. LM has been granted permanent access to the site but does not maintain the gate or the access road. The entrance sign (PL-1) is near the access road next to site marker SMK-1. No maintenance needs were identified.

1.4.1.2 Perimeter Signs

There are 70 perimeter signs, attached to steel posts set in concrete, positioned along the unfenced property boundary. Posts for perimeter signs P1 through P15 include additional warning signs about mining restrictions. Many of the perimeter signs were cracked and weathered but remain legible. Erosional gullies have formed around the base of perimeter signs P12 (PL-2), P38, and P41, but all perimeter signs are stable. Prairie dog colonies were identified near perimeter signs P17 and P18 (PL-3) during the 2021 inspection and have been observed during every inspection since. The colony does not threaten the integrity of either of the perimeter signs; therefore, no additional action is needed. No maintenance needs were identified.

1.4.1.3 Site Markers

The site has two granite site markers. Site marker SMK-1 is just inside the site entrance, and site marker SMK-2 (PL-4) is on the top slope of the disposal cell. No maintenance needs were identified.

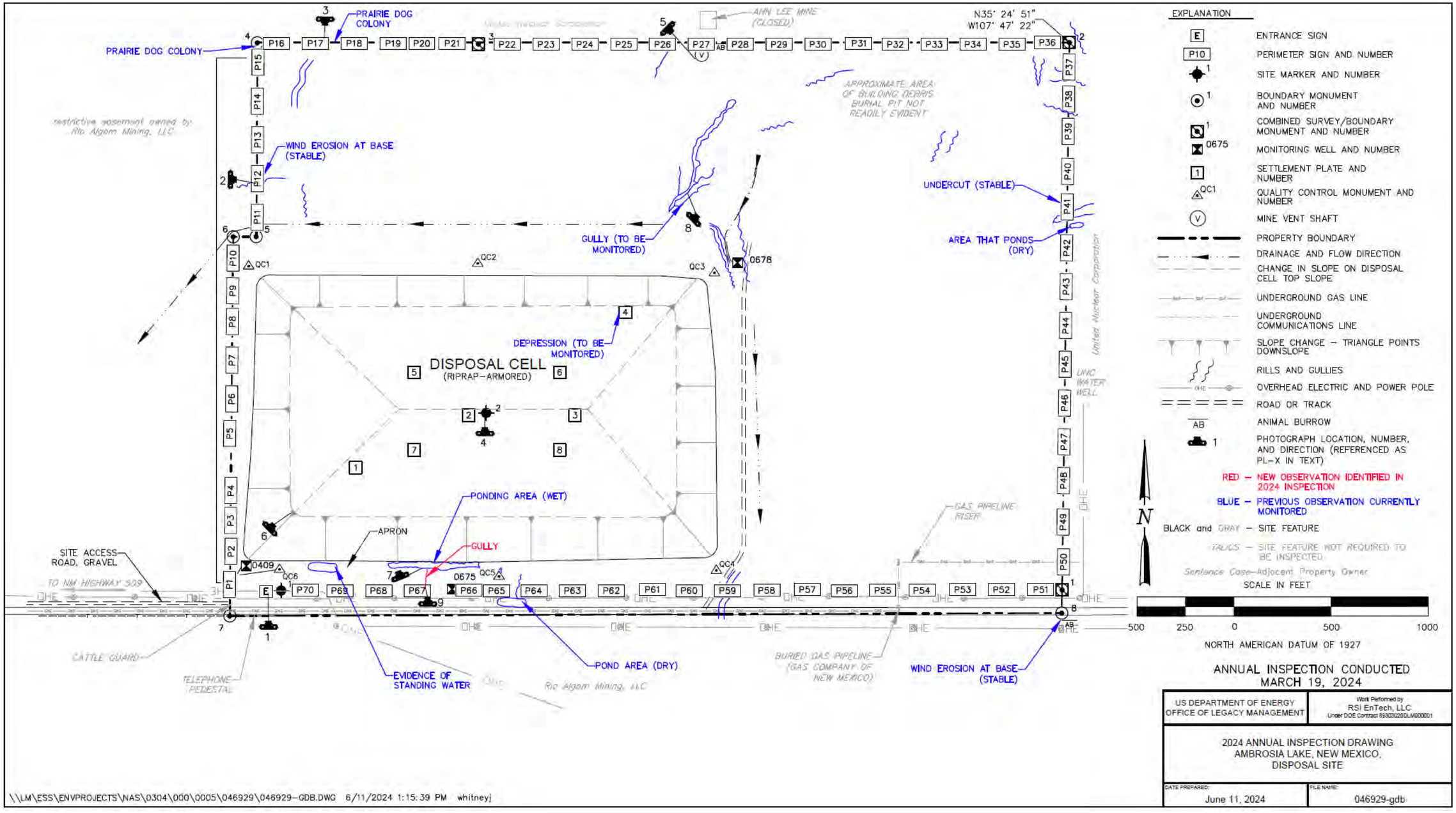


Figure 1-1. 2024 Annual Inspection Drawing for the Ambrosia Lake, New Mexico, Disposal Site

1.4.1.4 Survey and Boundary Monuments

Three combined survey and boundary monuments and five additional boundary monuments delineate the property corners and boundary. Steel T-posts were installed next to boundary monuments to help inspectors locate them. At boundary monument BM-2, a new erosional gully has developed since the 2022 inspection. The boundary monument is stable, but monitoring will continue. Erosion has occurred around the base of boundary monument BM-8, but the monument is stable. Prairie dog colonies were observed near boundary monument BM-4 in 2021. Neither the erosion nor the colony threaten the integrity of the boundary monuments, and inspectors will continue to monitor these locations. No maintenance needs were identified.

1.4.1.5 Aerial Survey Quality Control Monuments

Six aerial survey quality control monuments were inspected during the 2024 annual inspection. No maintenance needs were identified.

1.4.1.6 Monitoring Wells

The site has three monitoring wells. A gully adjacent to well 0678 appears to be stable, and the well is not affected by the erosion. All wellhead protectors observed during the inspection were undamaged, locked, and properly labeled. No maintenance needs were identified.

1.4.1.7 Mine Vent

A mine vent shaft associated with an abandoned underground mine is within the site boundary in the northern portion of the site (PL-5). Inspectors monitor the condition of the vent to ensure that the closure remains secure. The vent has a spot-welded cover and a casing that rises approximately 3 feet (ft) above the ground. The vent was secure at the time of the inspection. No maintenance needs were identified.

1.4.2 Inspection Areas

In accordance with the LTSP, the site is divided into four inspection areas to ensure a thorough and efficient inspection. The inspection areas are (1) the top of the disposal cell, (2) the side slopes and apron of the cell, (3) the graded and revegetated area between the disposal cell and the site perimeter, and (4) the outlying area. Inspectors examined specific site surveillance features within each area and looked for evidence of erosion, settling, slumping, or other modifying processes that might affect the site's conformance with LTSP requirements.

1.4.2.1 Top of Disposal Cell

The disposal cell, completed in 1994, occupies 91 acres and is armored with basalt riprap to control erosion and deter animal and human intrusion. The top slope showed no evidence of cracking and there was no indication of riprap degradation. A shallow depression around settlement plate SP-4, near the northeast corner of the disposal cell cover, was first noted during the 1997 inspection and continued to grow in depth and area in subsequent years. The depression was repaired in August 2005. Continual visual observations since the 2017 annual inspection indicate that minor additional settlement has occurred since the depression was repaired. During the 2024 annual inspection, the settlement was shallow enough that it was determined not to have

changed significantly. Inspectors will continue to monitor this area during each annual inspection, document surface topography, and note any developing erosional features.

Annual weeds and perennial grasses are sporadically growing on top of the disposal cell (PL-6). In accordance with the LTSP, deep-rooted shrubs are to be removed from the disposal cell cover. No deep-rooted shrubs were noted during the inspection. Weed control is performed as necessary, and the need for weed control will be evaluated again during the next annual inspection.

1.4.2.2 Side Slopes and Apron

The basalt riprap-covered side slopes and apron showed no evidence of erosion, settling, slumping, or cracking. Standing water is occasionally observed in a portion of the south apron, and the area was wet during the 2024 inspection (PL-7). An additional ponding area, which was dry, exists south of the current standing water area near the apron and closer to the access road. These locations are in a topographic low spot along the base of the disposal cell, and stormwater runoff collects in these areas. During the 2022 inspection, rilling and erosion were observed on the south side slope near aerial survey quality control monument QC-5. During the 2024 inspection, these features seemed to be stable. Inspectors will continue to monitor this area. No maintenance needs were identified.

1.4.2.3 Graded and Revegetated Area

In general, site vegetation appeared to be healthy. However, some areas are windswept and have little growth, particularly in an area north of the disposal cell where mill tailings had formerly been stockpiled. Because the site is not fenced, grazing animals occasionally enter it. Inspectors did not observe cattle near the disposal cell, but there was evidence of recent grazing on other areas of the site. Occasional grazing will not affect the long-term or short-term performance of the disposal cell.

Onsite rills and gullies north and east of the disposal cell have been visually monitored for several years, and existing features have continued to develop, particularly to the northeast of the disposal cell. One gully, northeast of the disposal cell, has grown to a depth of 6–8 ft and a width of 8–10 ft (PL-8). Inspectors collected GPS locations and measurements of this gully in 2021 and 2024. While no immediate maintenance needs were identified during the 2024 inspection, an evaluation of the need for erosion control structures around the large gully northeast of the disposal cell is ongoing. Small rills observed around the site during the 2022 annual inspection near perimeter signs P17, P59, and P65 have not grown significantly. An additional small gully was observed in 2024 extending from south of the disposal cell toward perimeter sign P67 (PL-9).

1.4.2.4 Outlying Area

The 0.25-mile area beyond the site boundary was visually observed for erosion, changes in land use, or other phenomena that might affect the long-term integrity of the site. No such impacts were identified. Rills and gullies continue to be observed east of perimeter sign P41. These erosional features do not threaten the long-term integrity of the site because headward erosion is progressing away from the site. Inspectors will continue to monitor these features to ensure that they do not impact site features.

1.5 Follow-Up or Contingency Inspections

LM will conduct follow-up or contingency inspections if (1) a condition is identified during the annual inspection or other site visit that requires a return to the site to evaluate the condition or (2) LM is notified by a citizen or outside agency that conditions at the site are substantially changed. No need for a follow-up or contingency inspection was identified.

1.6 Maintenance and Repairs

No immediate maintenance needs were identified during the 2024 inspection.

1.7 Groundwater Monitoring

In accordance with the LTSP, groundwater monitoring is not required at the site because (1) the groundwater is heavily contaminated from underground uranium mining and naturally occurring mineralization and (2) the uppermost aquifer is of limited use due to its low yield. Consequently, NRC concurred with the application of supplemental standards at the site and the exemption of both compliance and performance groundwater monitoring. However, LM conducts groundwater monitoring at wells 0409, 0675, and 0678 as a best management practice at the request of NMED (Table 1-2 and Figure 1-2) (Kleinrath 2001). LM originally agreed to sample these locations once every 3 years for 30 years; however, LM sampled these locations annually from November 2010 to November 2016 at the request of NMED. After the November 2016 sampling event, sampling returned to a triennial, or once every 3 years, schedule. The most recent sampling event occurred on November 1, 2022.

Table 1-2. Groundwater Monitoring Network at the Ambrosia Lake, New Mexico, Disposal Site

Monitoring Well	Screened Interval Elevations (ft NAVD 88)	Hydrologic Interval Monitored
0409	6939.49 to 6934.73	Contact between alluvium and Tres Hermanos C unit, downgradient
0675	6944.89 to 6934.89	Weathered Mancos Shale, downgradient
0678	6751.71 to 6731.71	Tres Hermanos B unit, downgradient

Abbreviation:
NAVD 88 = North American Vertical Datum of 1988

Well 0675 is completed in weathered Mancos Shale just below its contact with the overlying alluvium, and well 0678 is completed in the Tres Hermanos B Sandstone unit of the Mancos Shale. LM installed well 0409 in May 2011 in support of a regional groundwater investigation being conducted by NMED. Well 0409, on DOE property adjacent to the southwest corner of the disposal cell, is completed in an alluvium-filled paleochannel. The bottom of the well screen is at the contact between the alluvium and the sandstone of the Tres Hermanos Unit C member of the Mancos Shale Formation.

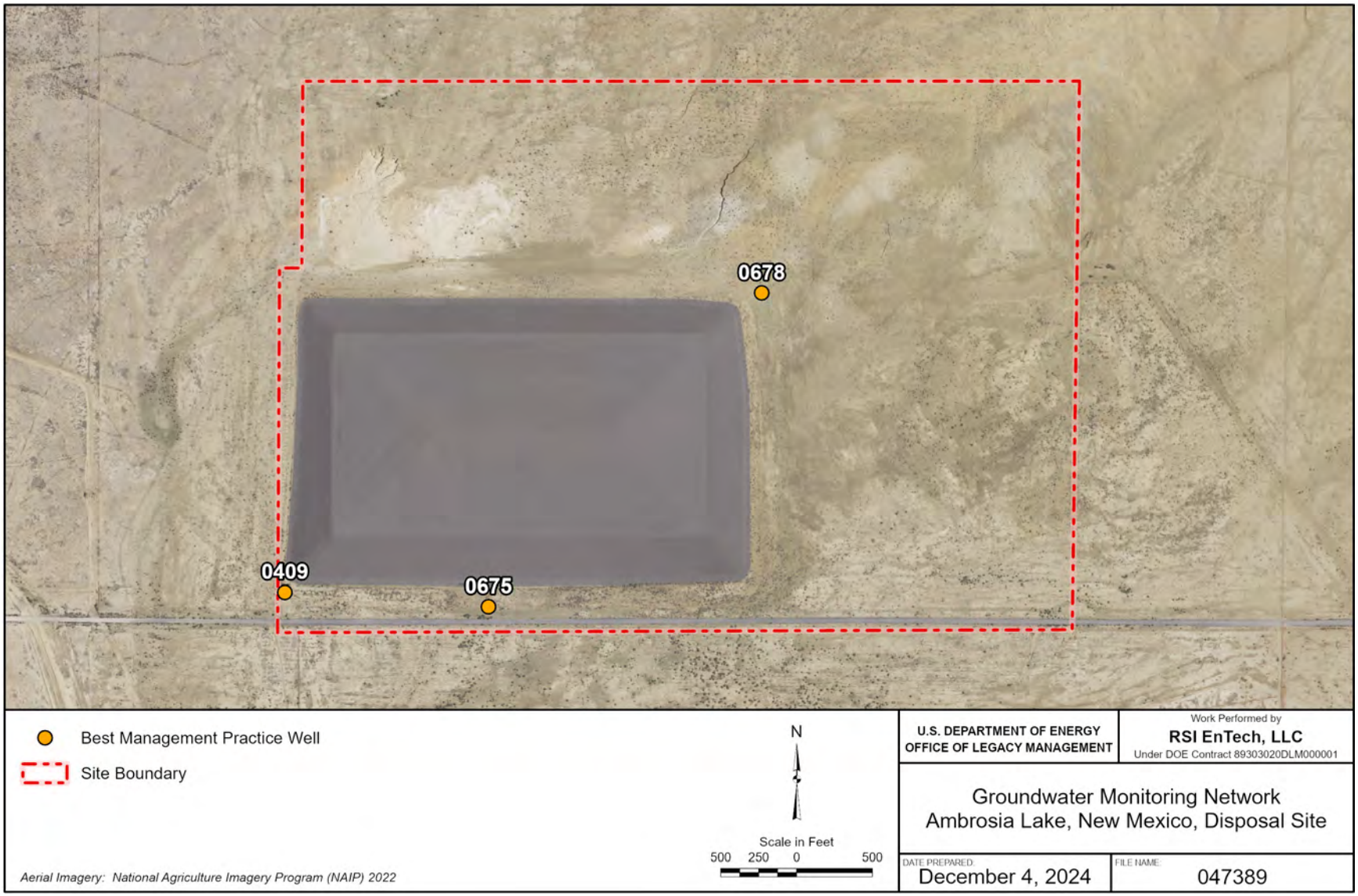
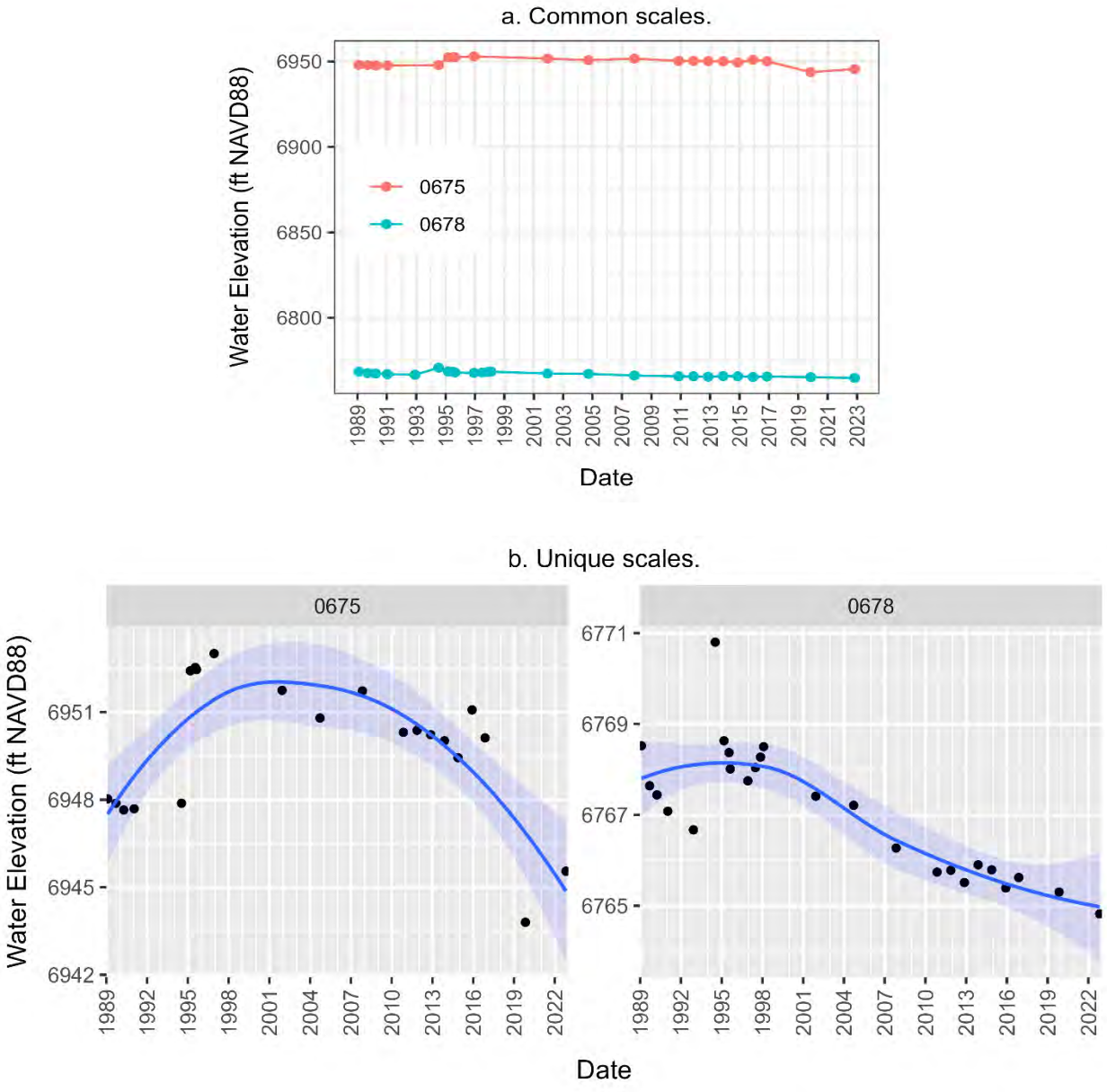


Figure 1-2. Ambrosia Lake Disposal Site Groundwater Best Practice Monitoring Locations

For groundwater elevations, well 0409 has been dry at the time of every sampling event since being installed in 2011. Water-level elevations in well 0675 have fluctuated between 6943.8 and 6953.0 ft since the well was installed in 1989; the lowest water elevations were measured in 2019 and 2022 (Figure 1-3). Over the same duration, water-level elevations in well 0678 have fluctuated between 6764.8 and 6770.8 ft. The vertical hydraulic gradient between the two wells is strongly downward and averages 0.86 ft/ft suggesting that unsaturated conditions potentially exist between the two well screens.



LOESS local regression line and 95% confidence interval

Abbreviations: LOESS = locally estimated scatterplot smoothing, NAVD 88 = North American Vertical Datum of 1988

Figure 1-3. Groundwater Elevation Trends in Ambrosia Lake, New Mexico, Disposal Site Monitoring Wells (a: Common Scales, b: Unique Scales)

The plotting approach used in Figure 1-3b and in remaining time-concentration plots provided in this section entails a faceting approach, whereby data for the two wells (0675 and 0678) are plotted separately. A nonparametric locally estimated scatterplot smoothing (LOESS) method is applied to facilitate interpretation of the figures. Using this approach, overall trends in the data are more apparent and not obscured by "noise" or random variation.

All groundwater monitoring results for the site are reported and published on the LM Geospatial Environmental Mapping System (GEMS) website (https://gems.lm.doe.gov). In accordance with the LTSP, groundwater monitoring results are included in this report. In 2022, wells 0675 and 0678 were sampled for molybdenum, nitrate, selenium, sulfate, uranium, and field parameters. Consistent with previous sampling events, well 0409 was dry.

Molybdenum concentrations in well 0675, screened in the weathered Mancos Shale, have fluctuated widely at times, ranging from 0.004 milligram per liter (mg/L) to 63.0 mg/L from 1989 to 2022 and averaging about 5 mg/L (Figure 1-4). The highest concentrations were measured in 2014 and 2015 (63.0 and 13.0 mg/L, respectively), but levels have since declined (the most recent result was 0.37 mg/L). Well 0678, screened in the Tres Hermanos B Sandstone unit of the Mancos Shale at an elevation approximately 200 ft deeper than well 0675, historically has had molybdenum concentrations below 0.1 mg/L. The most recent result was below the detection limit (<0.0053 mg/L) (Figure 1-4).

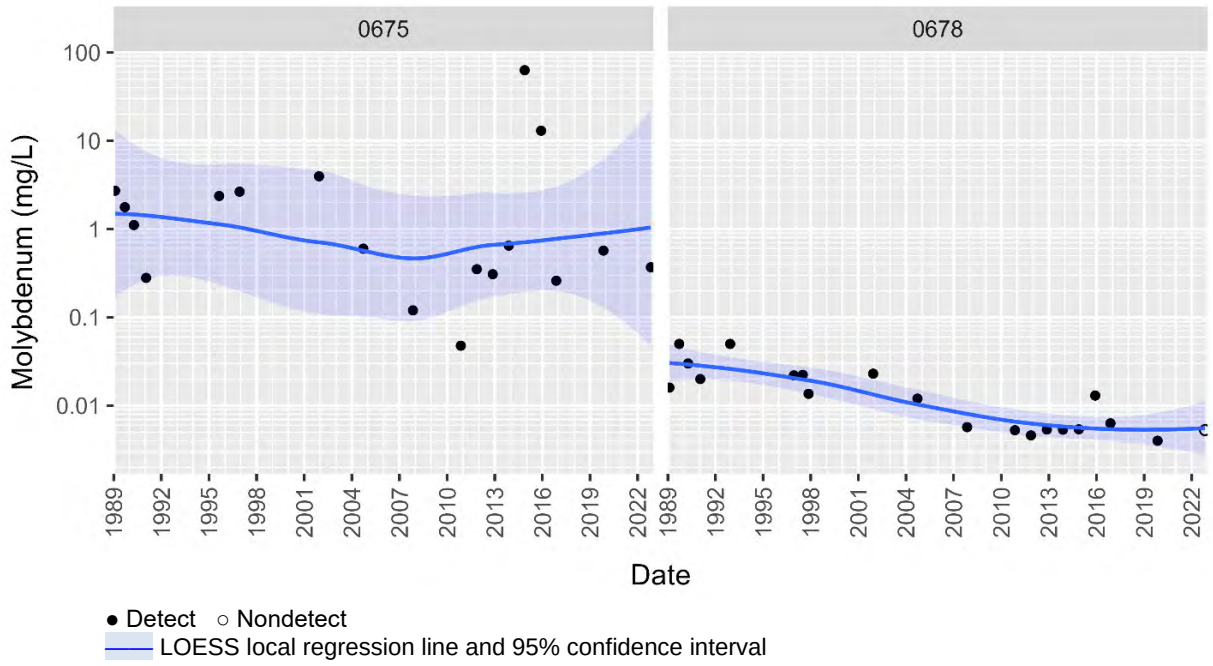
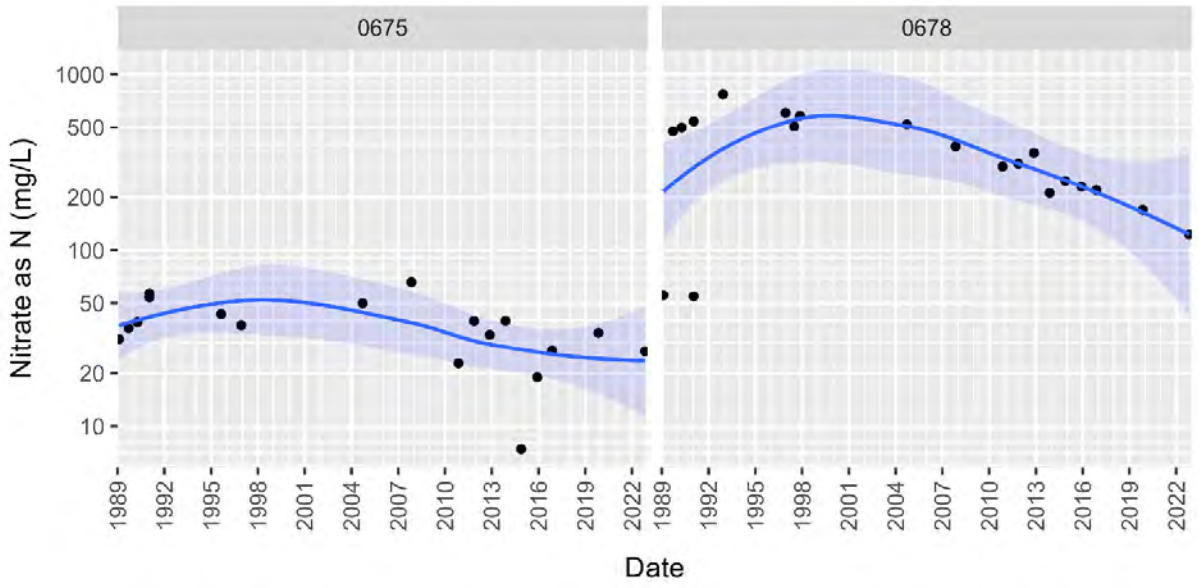


Figure 1-4. Molybdenum Concentrations in Groundwater at the Ambrosia Lake, New Mexico, Disposal Site

Nitrate as nitrogen (N) concentrations in well 0675 have historically remained below 70 mg/L (Figure 1-5). Nitrate (as N) concentrations in the deeper well (0678) reached a maximum concentration of 770.3 mg/L in 1992 and have steadily decreased to a present-day concentration of 123.0 mg/L (Figure 1-5).

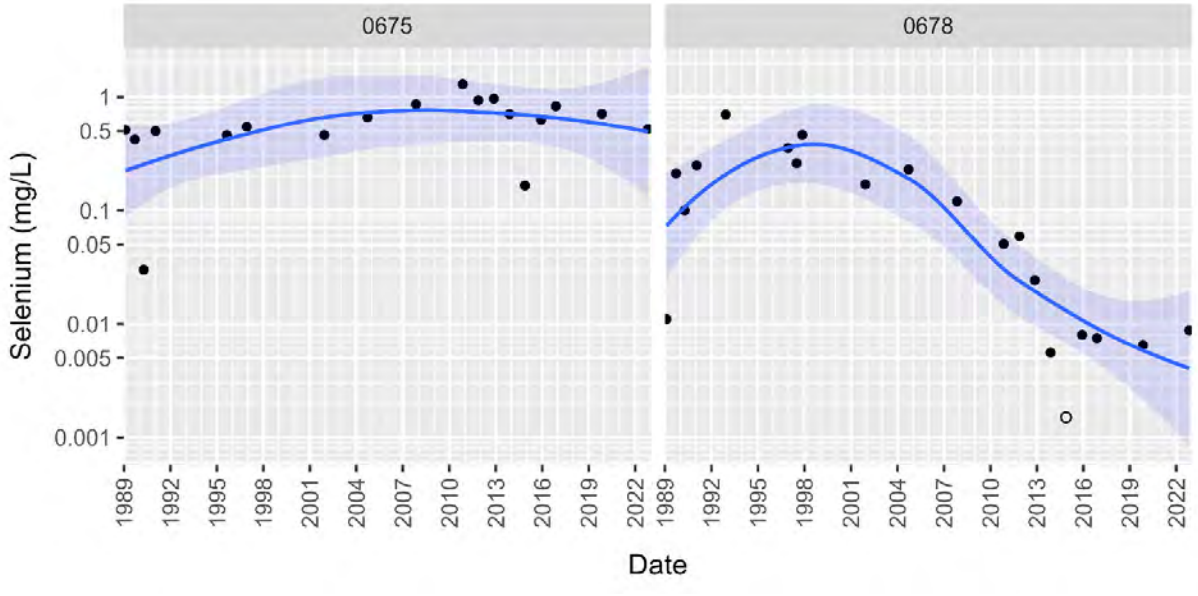


LOESS local regression line and 95% confidence interval

Note: Between 1989 and 2004, groundwater samples were analyzed for nitrate as NO_3. These initial results were converted to nitrate as N equivalents by applying a conversion factor of 0.2259.

Figure 1-5. Nitrate as N Concentrations in Groundwater at the Ambrosia Lake, New Mexico, Disposal Site

Well 0675 had an initial selenium concentration of 0.51 mg/L. Concentrations trended upward and peaked in 2010 at 1.29 mg/L and then declined to 0.17 mg/L in 2014. The most recent result, 0.52 mg/L, is essentially equivalent to the initial (1989) concentration. Selenium concentrations in the deeper well (0678) reached a peak concentration of 0.7 mg/L in 1992 and have declined to present-day concentrations of less than 0.01 mg/L (Figure 1-6).



● Detect ○ Nondetect

LOESS local regression line and 95% confidence interval

Figure 1-6. Selenium Concentrations in Groundwater at the Ambrosia Lake, New Mexico, Disposal Site

Historically, sulfate concentrations in well 0675 have generally ranged between 3000 and at or just above 4000 mg/L (Figure 1-7). There are two exceptions: the 2014 measurement (5380 mg/L) and the most recent (2022) result of 7180 mg/L, the maximum sulfate concentration measured in that well. The deeper well (0678) had an initial sulfate concentration of 2638 mg/L; this early measurement is an outlier relative to subsequent results that have exceeded 6000 mg/L. Since September 1989 (6240 mg/L), sulfate concentrations gradually increased to levels between 7000 and 10,000 mg/L (Figure 1-7). The most recent result was 7920 mg/L.

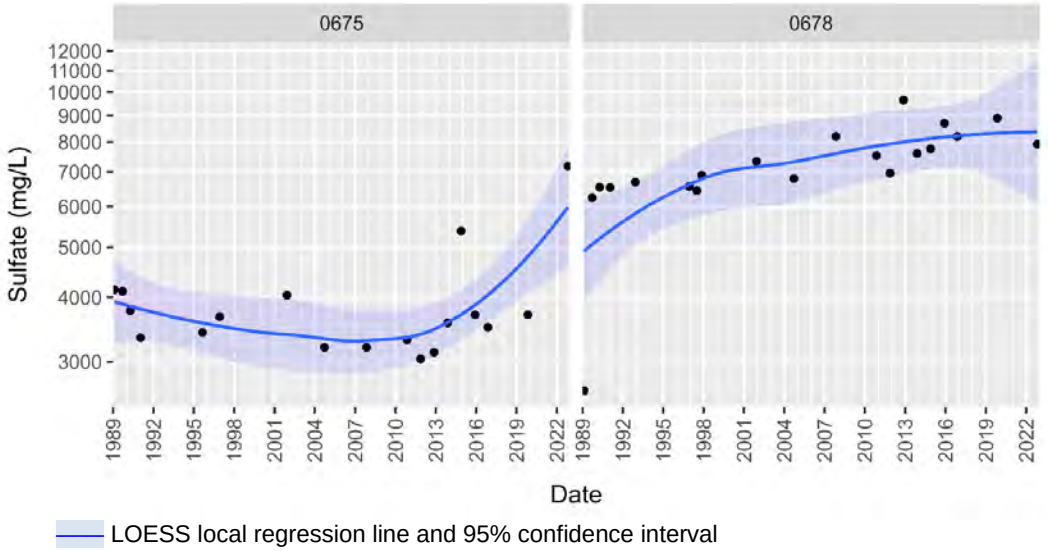


Figure 1-7. Sulfate Concentrations in Groundwater at the Ambrosia Lake, New Mexico, Disposal Site

Uranium concentrations in well 0675 ranged from 0.91 to 3.24 mg/L from 1989–2001 and then declined to a low of 0.14 mg/L in 2010 (Figure 1-8). Concentrations then increased to a high of 11.4 mg/L in 2014 and have declined to a present-day concentration of 1.17 mg/L. Uranium concentrations in the deeper well (0678) have historically remained below 0.1 mg/L (Figure 1-8).

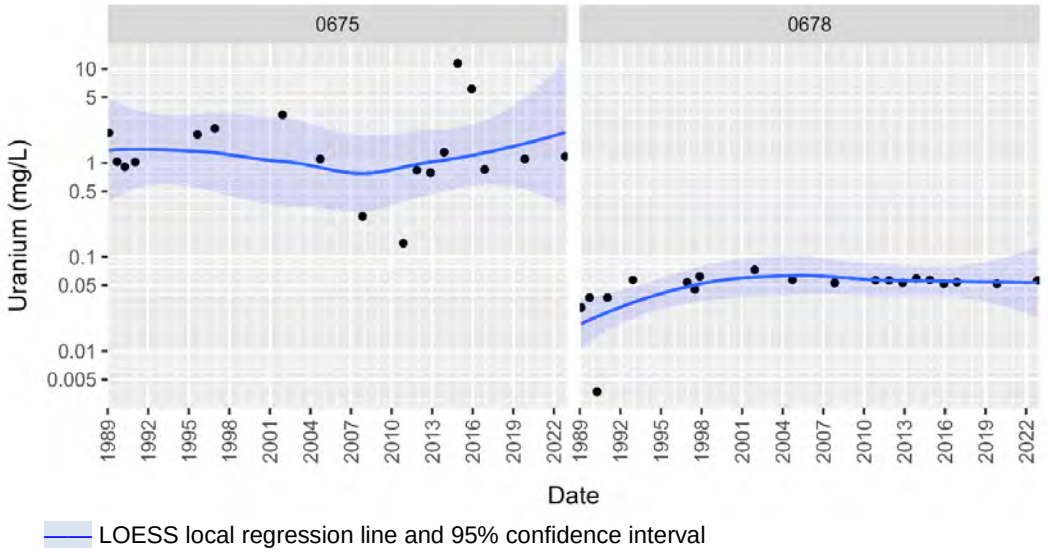


Figure 1-8. Uranium Concentrations in Groundwater at the Ambrosia Lake, New Mexico, Disposal Site

In accordance with its agreement with NMED, LM will continue to monitor groundwater at the Ambrosia Lake site every 3 years until 2031. The next sampling event will be in November 2025.

1.8 Corrective Action

Corrective action is taken to correct out-of-compliance or hazardous conditions that create a potential health and safety problem or that may affect the integrity of the disposal cell or compliance with 40 CFR 192. No need for corrective action was identified.

1.9 References



Note

Site-related documents are available on the LM public webpages at https://lmpublicsearch.lm.doe.gov/SitePages.

10 CFR 40.27. U.S. Nuclear Regulatory Commission, "General License for Custody and Long-Term Care of Residual Radioactive Material Disposal Sites," *Code of Federal Regulations.*

40 CFR 192. U.S. Environmental Protection Agency, "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings," *Code of Federal Regulations*.

DOE (U.S. Department of Energy), 1996. *Long-Term Surveillance Plan for the Ambrosia Lake, New Mexico, Disposal Site*, DOE/AL/62350-211, Rev. 1, Office of Legacy Management, July, https://lmpublicsearch.lm.doe.gov/lmsites/4319-ambrosia_ltsp.pdf.

Kleinrath, A., 2001. A. Kleinrath, program manager, Office of Legacy Management, U.S. Department of Energy, letter (about Contract No. DE-AC13-96GJ87335, Response to New Mexico Environment Department Regarding Monitor Well Decommissioning and Ongoing Groundwater Monitoring at the Ambrosia Lake UMTRCA Title I Disposal Site) to M. Leavitt, branch chief, Ground Water Quality Bureau, New Mexico Environment Department, August 29.

1.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	0	Entrance Sign and Site Marker SMK-1
PL-2	90	Perimeter Sign P12 with Wind Erosion at Base (Stable)
PL-3	180	Prairie Dog Colony near Perimeter Sign P17
PL-4	—	Site Marker SMK-2
PL-5	135	Mine Vent Shaft
PL-6	45	Vegetation on Disposal Cell Top Slope
PL-7	337	Ponding Water on South Disposal Cell Apron
PL-8	45	Gully Northeast of Disposal Cell
PL-9	0	Gully South of Disposal Cell

Note:
— = Photograph taken vertically from above.



PL-1. Entrance Sign and Site Marker SMK-1



PL-2. Perimeter Sign P12 with Wind Erosion at Base (Stable)



PL-3. Prairie Dog Colony near Perimeter Sign P17



PL-4. Site Marker SMK-2



PL-5. Mine Vent Shaft



PL-6. Vegetation on Disposal Cell Top Slope



PL-7. Ponding Water on South Disposal Cell Apron



PL-8. Gully Northeast of Disposal Cell



PL-9. Gully South of Disposal Cell

2.0 Burrell, Pennsylvania, Disposal Site

2.1 Compliance Summary

The Burrell, Pennsylvania, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site was inspected on October 29, 2024. No changes were observed on the disposal cell or in the associated drainage features. Inspectors identified minor maintenance needs but found no cause for a follow-up inspection.

The U.S. Department of Energy (DOE) Office of Legacy Management (LM) conducts groundwater monitoring every 5 years as a best management practice to aid in the evaluation of the disposal cell's performance. Eight monitoring wells and two seep locations are routinely sampled. The most recent groundwater sampling event occurred in October 2023. Monitoring wells 0422 and 0423 could not be sampled because of insufficient recharge. Consistent with most historical observations, seeps 0611 and 0612 were dry during this sampling event. However, seep 0611 was moist during the 2024 inspection. For the remaining six monitoring wells, sampling results in 2023 for the four target analytes (lead, molybdenum, selenium, and uranium) were consistent with historical results and below corresponding maximum concentration limits (MCLs) established under UMTRCA.

2.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the site-specific Long-Term Surveillance Plan (DOE 2000) (LTSP) in accordance with procedures established to comply with the requirements of the U.S. Nuclear Regulatory Commission (NRC) general license at Title 10 *Code of Federal Regulations* Section 40.27 (10 CFR 40.27). Table 2-1 lists these requirements.

Table 2-1. License Requirements for the Burrell, Pennsylvania, Disposal Site

Requirement	LTSP	This Report	10 CFR 40.27
Annual Inspection and Report	Sections 3.3 and 3.4	Section 2.4	(b)(3)
Follow-Up Inspections	Section 3.5	Section 2.5	(b)(4)
Maintenance	Section 3.6	Section 2.6	(b)(5)
Emergency Measures	Section 3.6	Section 2.7	(b)(5)
Environmental Monitoring	Section 3.7	Section 2.8	(b)(2)

2.3 Institutional Controls

The 72-acre site, identified by the property boundary shown in Figure 2-1, is owned by the United States and was accepted under the NRC general license in 1994. DOE is the licensee and, in accordance with the requirements for UMTRCA Title I sites, LM is responsible for the custody and long-term care of the site.

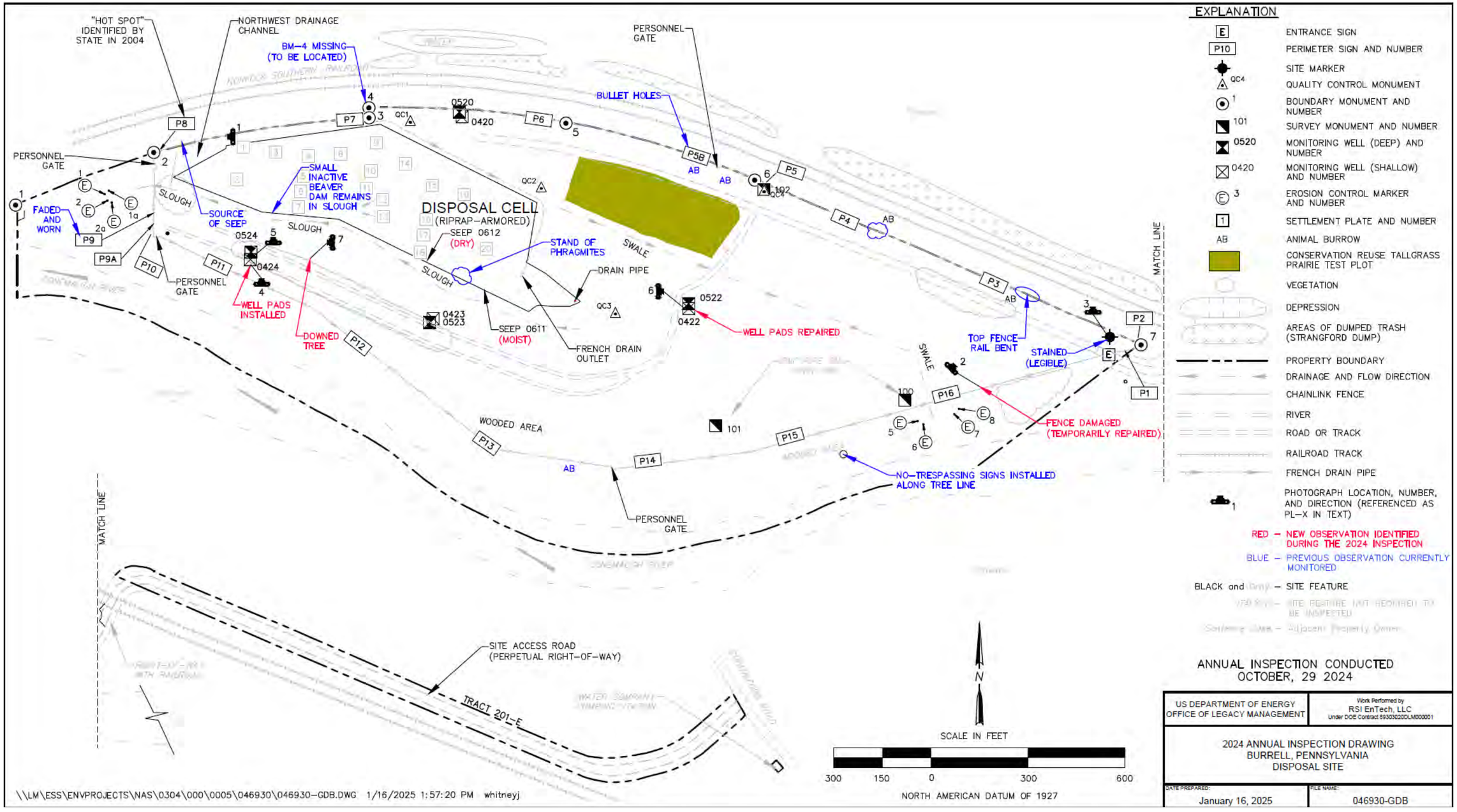


Figure 2-1. 2024 Annual Inspection Drawing for the Burrell, Pennsylvania, Disposal Site

Institutional controls (ICs) at the site include federal ownership of the property, administrative controls, and the following physical ICs that are inspected annually: the disposal cell and associated drainage features, entrance gate and sign, security fence, perimeter signs, site marker, survey and boundary monuments, erosion control markers, quality control monuments, and wellhead protectors.

2.4 Inspection Results

The site, 1 mile east of Blairsville, Pennsylvania, was inspected on October 29, 2024. The inspection was conducted by K. Broberg and L. McHenry of the Legacy Management Support contractor. T. Drake and A. Farinacci (LM) and T. Biller (Lawn RX, the site herbicide subcontractor) attended the inspection. The purposes of the inspection were to confirm the integrity of visible features at the site, identify changes in conditions that might affect conformance with the LTSP, and evaluate whether maintenance or follow-up inspection and monitoring are needed.

2.4.1 Site Surveillance Features

Figure 2-1 shows the locations of site features, including site surveillance features and inspection areas, in black and gray font. Some site features that are present but not required to be inspected are shown in italic font. Observations from previous inspections that are currently monitored are shown in blue, and new observations identified during the 2024 annual inspection are shown in red. Inspection results and recommended maintenance activities associated with site surveillance features are described in the following subsections. Photographs to support specific observations are noted in the text and in Figure 2-1 by photograph location (PL) numbers. The photographs and photograph log are presented in Section 2.10.

2.4.1.1 Access Road, Entrance Gate, and Entrance Sign

Access to the site is from a road leading from Strangford Road, along a DOE right-of-way through a parcel of private property (Tract 201-E), and across DOE's leased crossing over Norfolk Southern Railroad tracks. Entrance to the site is through a locked gate on the east end of the security fence. Residents have historically used the area along the DOE right-of-way for unpermitted dumping, hunting, target shooting, and all-terrain vehicle use. Personnel associated with commercial interests use the road for access to the railroad tracks and several nearby natural gas wells. Because the DOE right-of-way cannot be controlled, NRC concurred that the entrance gate in the site security fence is the IC for site access rather than the gate across the access road. The entrance gate was locked and functional. Entrance signage on the main vehicle entrance gate was updated with new phone numbers. The railroad crossing was improved in 2022 with the installation of an asphalt crossing. No maintenance needs were identified.

2.4.1.2 Security Fence and Perimeter Signs

A chainlink security fence encloses the disposal cell and drainage features. The site herbicide subcontractor keeps the fence line clear of vegetation, which should prolong the life of the security fence (PL-1). In 2023, trees felled by strong winds damaged the fence, compromising its integrity. Repairs were completed following the 2023 inspection. The upper rail of the fence along the southern boundary is bent in a few areas, but the fence remains serviceable, and repairs

are not required at this time. A large tree fell on the fence in 2024. Temporary repairs were made to the fence (PL-2). DOE plans to wait until summer 2025 to make permanent repairs. This decision was based on the observed adequacy of the temporary repairs and the late time of year. If winter and spring storms further damage the fence, repairs can be made all at once.

There are 17 perimeter signs attached to the outside of the security fence. All perimeter signs are present. Perimeter sign P9 has been faded and worn since 2019. It is difficult to replace because it is in a wet slough area. A companion sign was installed during the 2023 inspection a few feet south of perimeter sign P9 (identified in Figure 2-1 as perimeter sign P9A). Some of the perimeter signs have expired phone numbers that need to be replaced. This can be done easily by placing stickers with the new telephone number over the old telephone number. Inspectors did not have enough stickers to replace the number on all perimeter signs. The signs near the entrance gates are current. The rest of the signs will be updated in 2025. No maintenance needs were identified.

2.4.1.3 Site Marker

The site has one granite site marker just inside the main entrance gate. The concrete pad is cracked but remains functional. The surface of the site marker is stained but remains legible (PL-3). No maintenance needs were identified.

2.4.1.4 Survey and Boundary Monuments

The site has three survey monuments and seven boundary monuments. Survey monument SM-102 was noted as missing in the 2017 and 2018 inspections. Quality control monument QC-4 was installed in 2019 as a replacement for survey monument SM-102.

Except for boundary monument BM-4, the remaining six boundary monuments were located during the inspection. Efforts will be made in 2025 to locate BM-4, which is most likely covered by grass. No other maintenance needs were identified.

2.4.1.5 Aerial Survey Quality Control Monuments

Four aerial survey quality control monuments were inspected during the 2024 annual inspection. No maintenance needs were identified.

2.4.1.6 Erosion Control Markers

The site has eight erosion control markers, which were inspected during this visit. No maintenance needs were identified.

2.4.1.7 Monitoring Wells

The site has eight monitoring wells that are sampled as a best management practice every 5 years. During the most recent (October 2023) sampling event, two of the monitoring wells (0422 and 0423) could not be sampled because of insufficient recharge.

In 2024, concrete well pads were installed at the two remaining wells that lacked them (wells 0424 and 0524) (PL-4 and PL-5). Also in 2024, repairs were made to cracked well pads 0422 and 0522 (PL-6). All well pads are now in good condition. All wellhead protectors that were observed during the annual inspection were locked and undamaged. New locks were installed at all of the monitoring wells in 2023.

During the 2022 site inspection, NRC measured a gamma radiation level of 30–40 microrem per hour around the base of the well pad at monitoring well 0420. Background gamma radiation is approximately 10 microrem per hour. The gamma radiation level was assessed by the Pennsylvania Department of Environmental Protection (DEP) in spring 2023 and was unchanged. No NRC or DEP staff participated in the 2024 inspection. The level measured was not considered a risk to human health or the environment. No other maintenance needs were identified.

2.4.2 Inspection Areas

In accordance with the LTSP, the site is divided into four inspection areas (referred to as "transects" in the LTSP) to ensure a thorough and efficient inspection. The inspection areas are (1) the disposal cell, (2) the area adjacent to the disposal cell, (3) the site perimeter, and (4) the outlying area, including the access road that leads to the site. Inspectors examined specific site surveillance features within each area and looked for evidence of erosion, settling, slumping, or other modifying processes that might affect the site's conformance with LTSP requirements.

2.4.2.1 Disposal Cell

The 5-acre disposal cell, completed in 1987, is armored with riprap to control erosion and deter animal intrusion. There was no evidence of erosion, settling, slumping, or any other modifying processes that might affect the integrity of the disposal cell.

Control of vegetation (including woody vegetation) on the disposal cell is not required by the LTSP. A screening-level risk assessment conducted by DOE from 1996 to 1997 concluded that plant succession on the disposal cell does not present significant or credible risk to human health or the environment and, due to reduced hydraulic flux through the cover from evapotranspiration, may improve the long-term performance of the disposal cell. The LTSP was revised in 2000 to reflect these findings; at that time, NRC suggested that LM reevaluate the effects of vegetation on cover performance in 10 or 20 years (i.e., between 2010 and 2020) to confirm performance parameters and predictions. The NRC-suggested assessment would revisit the issue of vegetation growth on the disposal cell cover to evaluate whether it remains protective of human health and the environment or interferes with the ability of inspectors to assess disposal cell cover stability. LM planned to conduct this follow-up assessment in fiscal year 2019, but it was delayed by LM to further consult with NRC on the scope of the study. NRC and LM are jointly analyzing disposal cell cover performance and pedogenesis at other UMTRCA sites to either support development of the scope for a Burrell site study or determine that the additional Burrell site assessment is not required.

Although vegetation is allowed to grow on the disposal cell and site, noxious weeds and invasive plants are controlled through spraying and mowing. In 2008, a site Vegetation Management Plan (DOE 2008) was issued that included the control of noxious and invasive vegetation on the

disposal cell cover to facilitate inspection activities. Vegetation management effectively limits the spread of noxious weeds. Other woody species continue to establish on the disposal cell cover.

Woody vegetation on the disposal cell cover that has been growing since 2000 has progressed to the point that trees are becoming tall enough to create concern that one could fall (e.g., die or be blown down). A fallen tree could create a large root ball and perhaps impact or expose the underlying clay layer of the cell cover. A windstorm in 2024 downed several large trees that were not located on the disposal cell. The size of the root balls on these downed trees illustrates the disposal cell cover concern (PL-7). DOE will work with NRC to develop a path forward to address the trees on the disposal cell cover, considering the potential root ball concern.

2.4.2.2 Area Adjacent to the Disposal Cell

A French drain was installed parallel to the north slope of the disposal cell in 1998 to prevent the ponding of water next to the cell. The outlet for the French drain, on the south slope of the disposal cell, was not flowing during the inspection, and no outflow has been observed during past inspections. Water was not ponded anywhere along the French drain, and no wetland vegetation was observed, which indicates that the drain is operating properly. Inspectors will continue to monitor this area to verify that it continues to operate as designed.

A large tree fell in the slough south of the disposal cell in 2019. As of the 2024 inspection, the downed tree is not interfering with drainage in the slough.

A small, inactive beaver dam remains in the slough south of the disposal cell. The site herbicide contractor indicated that the dam was inactive in 2022, and no new evidence of recent activity has been observed around the dam (e.g., animal tracks, new tree cuts). In its current state, the beaver dam does not interfere with the flow of water enough to warrant action. No maintenance needs were identified.

A hole on the east side of the Conservation Reuse Tallgrass Prairie Test Plot was safely filled in with clay-based topsoil in 2022. Because the Burrell site was once a railroad landfill, the hole is believed to be settlement around some buried railroad landfill debris.

2.4.2.3 Site Perimeter

A seep that has been active in the past is near the north security fence, about 60 feet (ft) east of perimeter sign P8 and west of the disposal cell. Access to the seep requires walking down a steep slope of riprap that is difficult to walk on. During the inspection, the seep was not flowing, but the area around the seep was moist. The water for the seep along the fence line appears to be coming from the bluffs north of the railroad tracks. Conceivably, the seep could destabilize the nearby railroad embankment. The seep does not pose a threat to the integrity of the disposal cell, and inspectors will continue to monitor this area. No maintenance needs were identified.

2.4.2.4 Outlying Area

The 0.25-mile area beyond the site boundary was visually observed for erosion, changes in land use, or other phenomena that might affect the long-term integrity of the site. No activities that could affect the long-term integrity of the site were observed.

North of the site, a dirt road parallels the railroad tracks and provides access to a long, narrow wooded area that has been used as an illegal dump. No new piles of trash were observed during the inspection. Inspectors will continue to note any dumping activity. The south side of the site is bordered by the Conemaugh River.

In 2004, a representative from Pennsylvania DEP showed inspectors a "hot spot" (an area with gamma radiation levels of 5 millirem per hour or 5000 microrem per hour) in the rock ballast adjacent to the railroad tracks northeast of perimeter sign P8. A review of LM records confirmed that the area in question was addressed in a property completion report for the Uranium Mill Tailings Remedial Action Project. Supplemental standards have been applied to contamination beneath the tracks because the benefit of removal does not justify the cost. LM communicated the results of a records search to the Commonwealth of Pennsylvania in late 2004. The hot spot was the subject of a follow-up discussion with Pennsylvania representatives in 2006. In October 2018, NRC personnel revisited the hot spot area and measured a gamma radiation level of 200 microrem per hour, which is considerably lower than the 2004 measurement. During the 2022 inspection, NRC personnel measured a gamma radiation level of 120 microrem per hour. The area is marked on the site inspection map for future reference. The area is not on DOE property; the Commonwealth of Pennsylvania is the responsible authority. No maintenance needs were identified.

During the 2022 inspection, a temporary hunting blind was discovered on the south side of the site outside of the site security fence. In 2023, the blind was removed, and several no-trespassing signs were installed along the tree line. A removable chain was also installed south of the main entrance gate to further delineate the no-trespassing area. No visible signs of trespass were noted during the 2024 inspection.

2.5 Follow-Up Inspections

LM will conduct follow-up inspections if (1) a condition is identified during the annual inspection or other site visit that requires a return to the site to evaluate the condition or (2) LM is notified by a citizen or outside agency that conditions at the site are substantially changed. No need for a follow-up inspection was identified.

2.6 Maintenance

The following maintenance items were completed before the 2024 inspection:

- Well pads were installed at wells 0424 and 0524
- Cracks were repaired in existing well pads for monitoring wells 0422 and 0522

The following maintenance items were identified during the 2024 inspection:

- Boundary monument BM-4 was not located. It is believed to be covered by grass. Efforts will be made during the 2025 annual inspection to locate boundary monument BM-4.
- Telephone numbers on some site perimeter signs were outdated. Stickers with updated phone numbers were placed on the perimeter signs near the entrance gates. The rest of the perimeter signs will be updated in 2025.
- Damaged fence from downed tree was temporarily repaired, and further repairs are planned for 2025.

2.7 Emergency Measures

Emergency measures are actions LM will take in response to unusual damage or disruption that threatens or compromises site safety, security, or integrity in compliance with 10 CFR 40 Appendix A. No need for emergency measures was identified.

2.8 Environmental Monitoring

2.8.1 Groundwater Monitoring

In accordance with the LTSP, LM conducts routine groundwater monitoring every 5 years as a best management practice to evaluate the disposal cell's performance. The groundwater monitoring network consists of four sets of monitoring wells (eight monitoring wells total) and two seeps (Table 2-2 and Figure 2-2). Each set of wells consists of a shallow well completed in unconsolidated fill and alluvium (400-series wells) and a deeper well completed in the bedrock of the Casselman Formation (500-series wells). Groundwater is sampled for standard water quality indicators (e.g., pH, major ions, total dissolved solids) and four target analytes: lead, molybdenum, selenium, and uranium. The MCLs for these four analytes in groundwater (as described in 40 CFR 192 Subpart A Table 1) are listed in Table 2-3.

Table 2-2. Groundwater Monitoring Network for the Burrell, Pennsylvania, Disposal Site

Monitoring Well or Seep	Hydrologic Relationship
0420 and 0520	Upgradient or background monitoring well
0422 and 0522	Cross-gradient monitoring well
0423 and 0523	Downgradient monitoring well
0424 and 0524	Downgradient monitoring well
0611 and 0612	Seep

Table 2-3. MCLs for Target Analytes in Groundwater at the Burrell, Pennsylvania, Disposal Site

Constituent	MCL[a] (mg/L)
Lead	0.05
Molybdenum	0.1
Selenium	0.01
Uranium	0.044

Note:
[a] MCLs as listed in 40 CFR 192 Subpart A Table 1.

Abbreviation:
mg/L = milligrams per liter

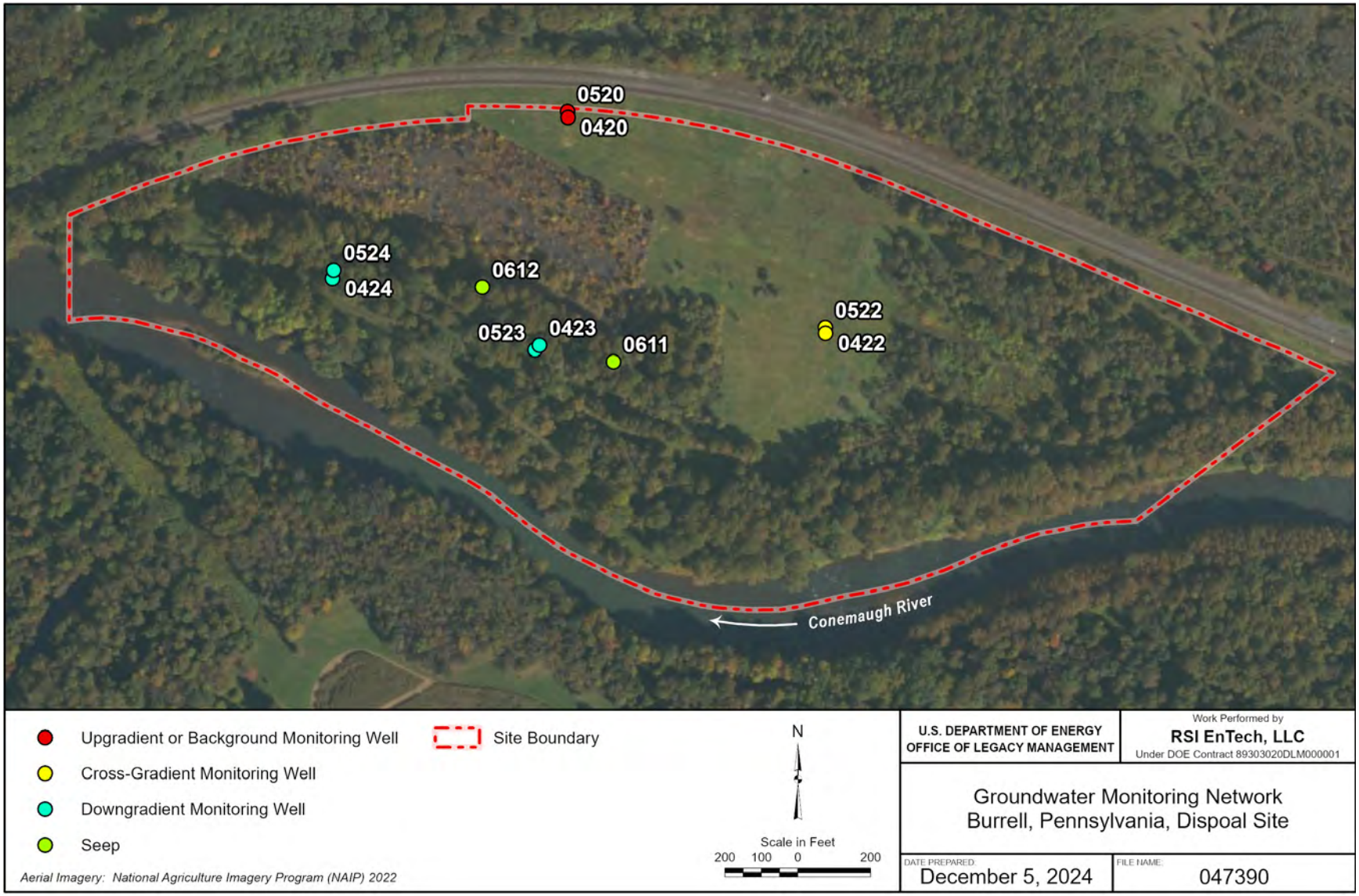


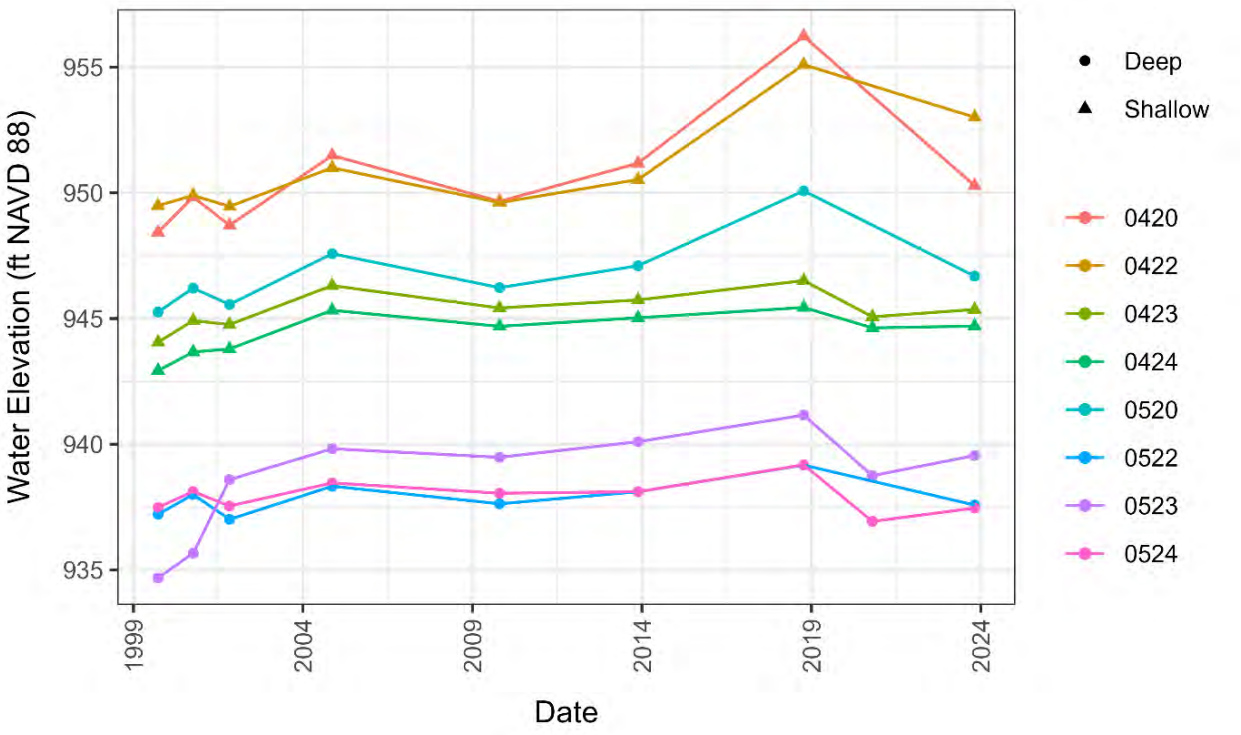
Figure 2-2. Groundwater Monitoring Network for the Burrell, Pennsylvania, Disposal Site

Although the LTSP states that groundwater will be monitored routinely in the fall at 5-year intervals beginning in 1999 (DOE 2000), additional nonroutine events have been conducted when deemed appropriate. Therefore, depending on the location, as many as three additional sampling events have been conducted since 1999 relative to the routine 5-year schedule. For example, LM resampled the four downgradient wells for all analytes in October 2020. This sampling was 3 years ahead of the required 5-year sampling frequency to determine if the increase in molybdenum noted previously (DOE 2019) was continuing. Data from these nonroutine sampling results are reported in previous annual reports (e.g., DOE 2022) and can be accessed via LM's Geospatial Environmental Mapping System (GEMS) website (https://gems.lm.doe.gov).

The most recent sampling event occurred in October 2023. Two of the shallow monitoring wells (wells 0422 and 0423) had insufficient recharge to sample. Consistent with most historical observations, seeps 0611 and 0612 were also dry at that time. However, seep 0611 was moist during the 2024 inspection.

Initial (1987–1999) groundwater elevation measurements at the site indicated seasonal variations of up to 3–4 ft (DOE 2000). Routine measurements since 1999 (most taken in the fall) indicate that water elevations have been relatively stable in most wells as shown in Figure 2-3.

Mann-Kendall trend analysis indicates no statistically significant trends in water levels except for deep well 0523, where water levels have increased approximately 5 ft since 1999.



Abbreviation: NAVD 88 = North American Vertical Datum of 1988

Figure 2-3. Hydrographs for Monitoring Wells at the Burrell, Pennsylvania, Disposal Site, 1999–2023

Time-series plots for each target analyte (i.e., molybdenum, uranium, lead, and selenium) are presented in Figure 2-4 through Figure 2-7 and are based on water quality data from 1996–2023. The time-series plots in this year's report have a new look. Details of how the plots were constructed can be found in the footnote of Figure 2-4. MCL concentrations are shown on each plot as a red line. As shown in the plots, concentrations of the target analytes in monitoring wells have been consistently below the respective MCLs.

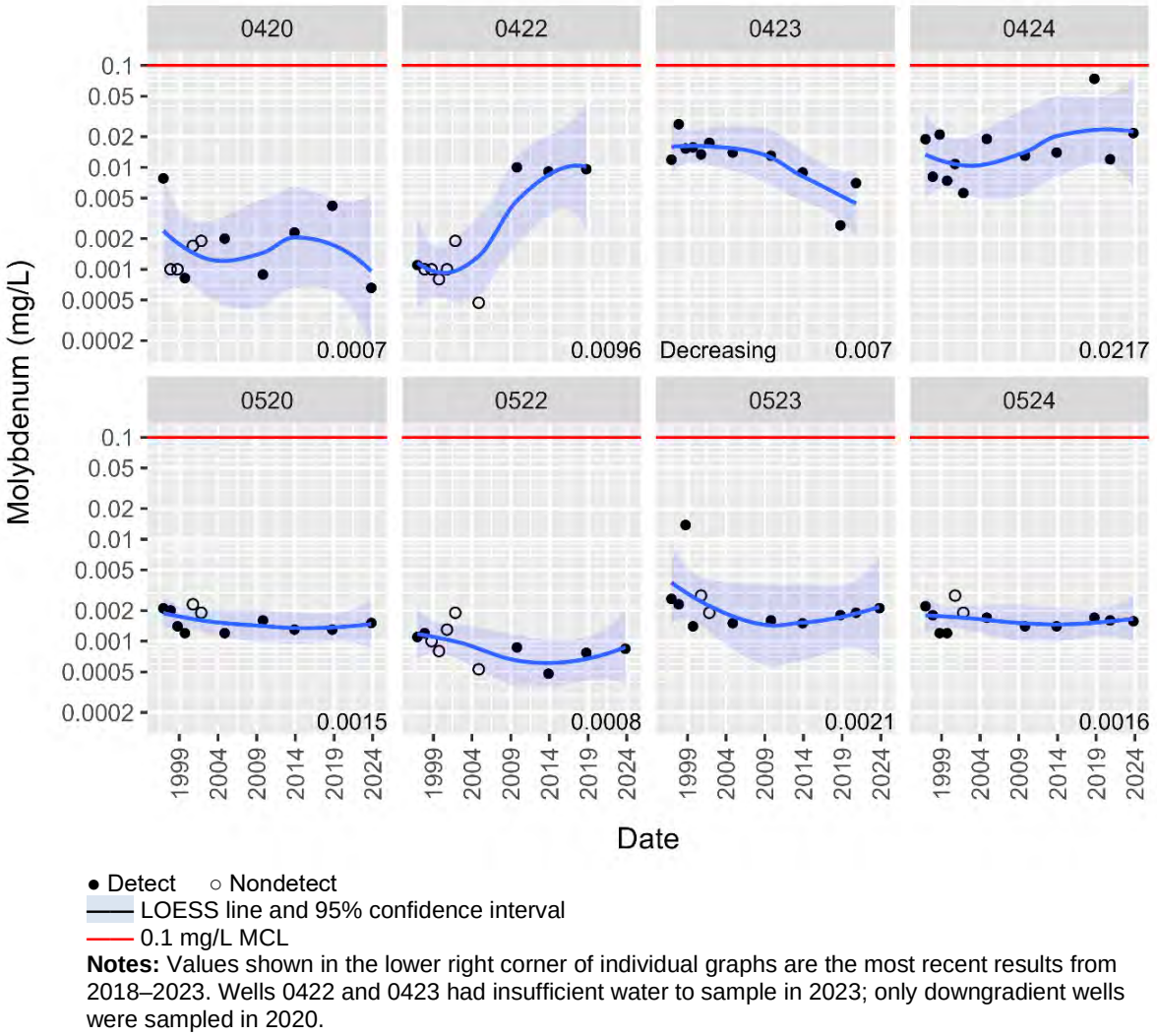
The following figures were developed using a faceting approach, whereby data are partitioned into a matrix of panels, with each panel plotting data for a single well. In each facet plot, a nonparametric smoothing method—locally estimated scatterplot smoothing (LOESS)—is applied. The surrounding shaded area represents the 95% pointwise confidence interval. Because of the wide range in analyte concentrations across the well network, a semilogarithmic scale is used.

A statistical trend analysis was performed for each target analyte to determine if concentrations are increasing, decreasing, or remaining stable. Statistically significant decreasing and increasing trends are labeled in the figures. With the exception of two target analytes, no statistically significant trends were detected. The two exceptions are as follows:

- Molybdenum (well 0423): statistically significant decreasing trend.
- Lead (well 0423): statistically increasing trend.

It should be noted that because insufficient recharge precluded collection of a water sample in well 0423 in 2023, the trend results for well 0423 are based on data through October 2020.

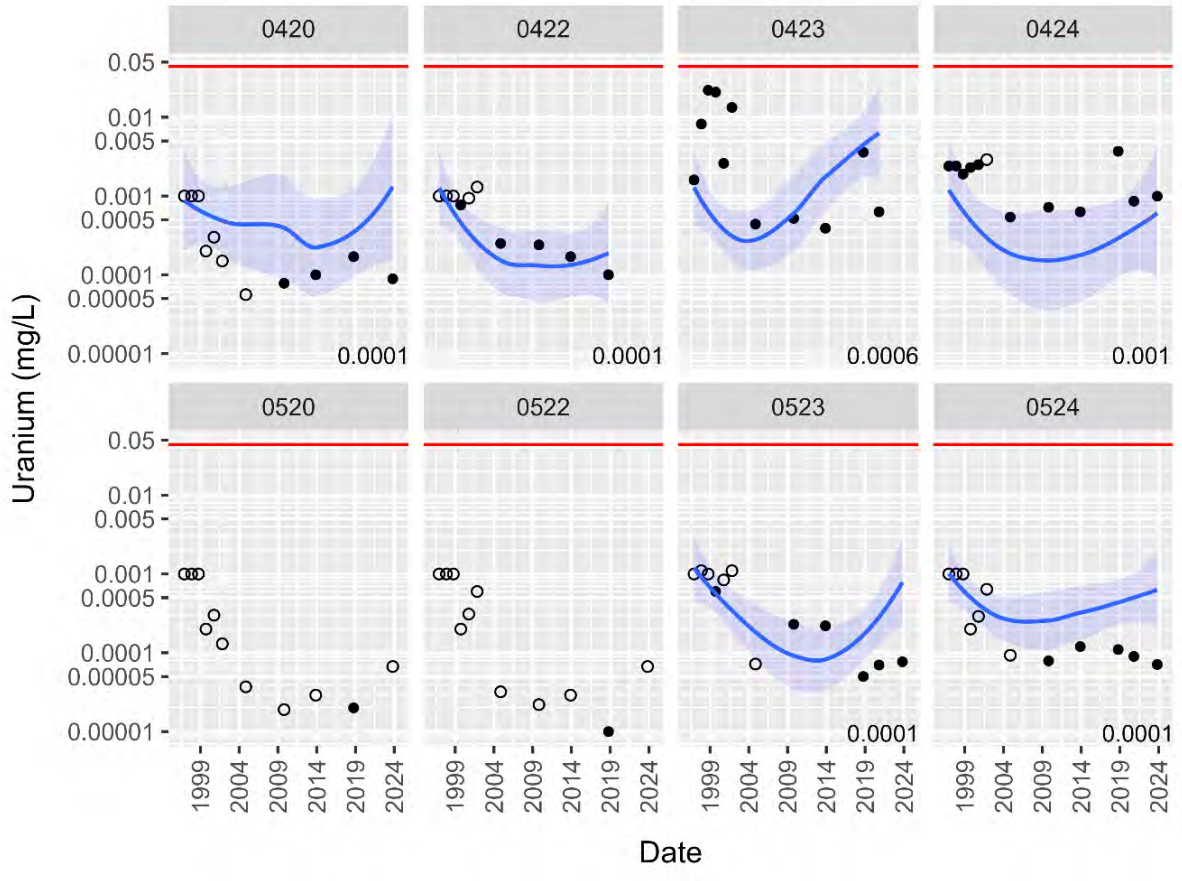
Molybdenum concentrations in all wells remain below the 0.1 milligram per liter (mg/L) MCL, with all trends now stable or decreasing (Figure 2-4). The 0.074 mg/L result for well 0424 in 2018 prompted the 2020 nonroutine sampling event given concerns that the MCL could soon be exceeded. However, the two most recent molybdenum results for this well (0.012 and 0.022 mg/L in 2020 and 2023, respectively) are consistent with pre-2018 results.



Notes: Values shown in the lower right corner of individual graphs are the most recent results from 2018–2023. Wells 0422 and 0423 had insufficient water to sample in 2023; only downgradient wells were sampled in 2020.

Figure 2-4. Molybdenum Concentrations in Groundwater at the Burrell, Pennsylvania, Disposal Site

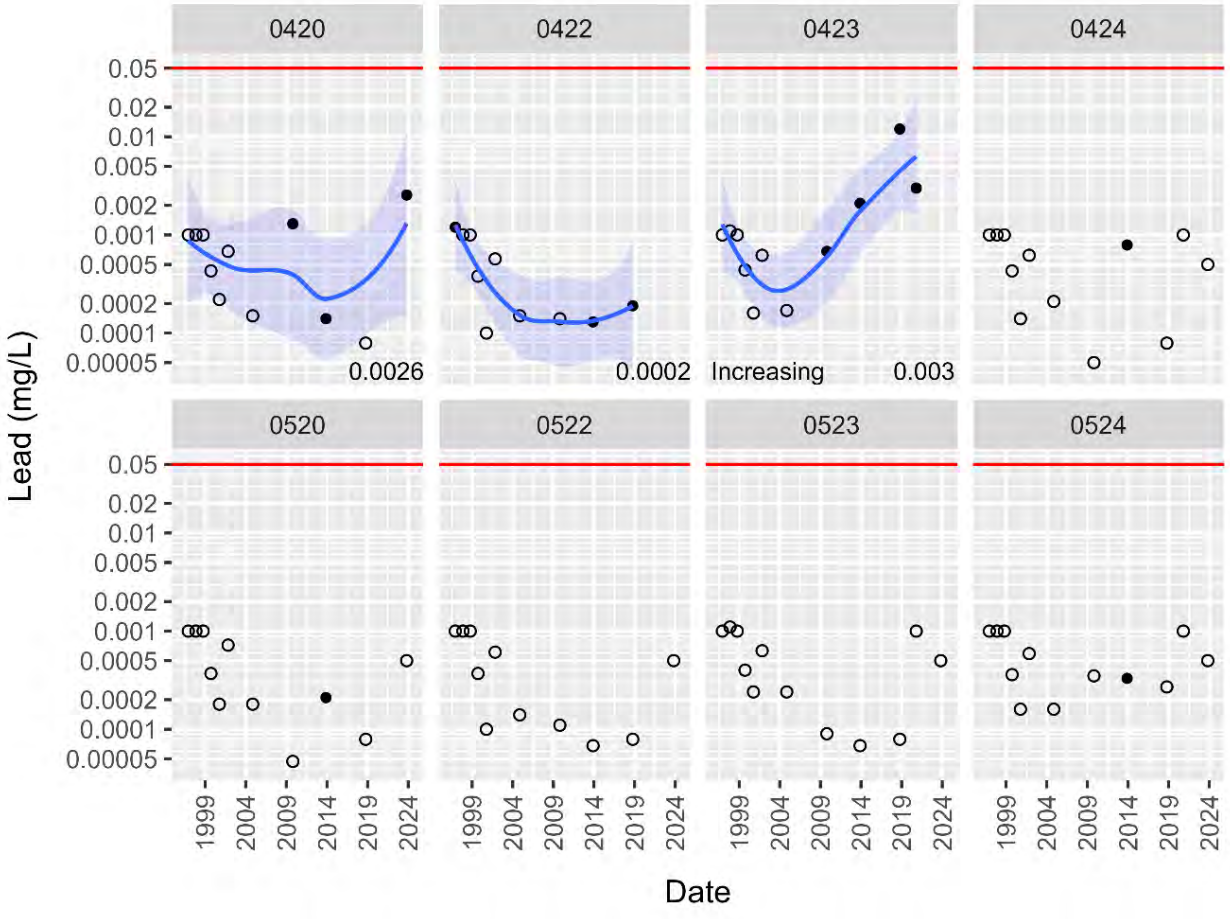
Based on the most recent (2018–2023) results, uranium concentrations in all wells are ≤0.001 mg/L, which is well below the 0.044 mg/L MCL (Figure 2-5). Most results for deeper wells (shown in the bottom row of figure) have been below the laboratory detection limit. Despite the apparent decreasing uranium concentration trend in deep wells, none of these trends are statistically significant because of the high proportion of nondetects.



Notes: Values shown in the lower right corner of individual graphs are the most recent results from 2018–2023 (nondetect values not shown). Accounting for nondetects, no significant concentration trends were found for any well.

Figure 2-5. Uranium Concentrations in Groundwater at the Burrell, Pennsylvania, Disposal Site

Figure 2-6 and Figure 2-7 plot temporal data for lead and selenium, showing the high proportion of nondetects (about 86%) for both analytes across the monitoring well network. Lead concentrations have been consistently below the MCL and, with few exceptions, below detectable levels in deep wells (Figure 2-6). The statistically significant increasing trend found for well 0423 reflects the increase from 0.0007 mg/L (2009) to 0.012 mg/L in 2018. The most recent (2020) result, 0.003 mg/L, is more than 1 order of magnitude below the 0.05 mg/L MCL. Similar observations apply to selenium; the most recent results (2018–2023) were all below the detection limit as shown in Figure 2-7.



● Detect ○ Nondetect
LOESS line and 95% confidence interval (applied only to wells with detection frequencies > 25%)
0.05 mg/L MCL
Notes: For results above the detection limit, values shown in the lower right corner of individual graphs are the most recent results from 2018–2023.

Figure 2-6. Lead Concentrations in Groundwater at the Burrell, Pennsylvania, Disposal Site

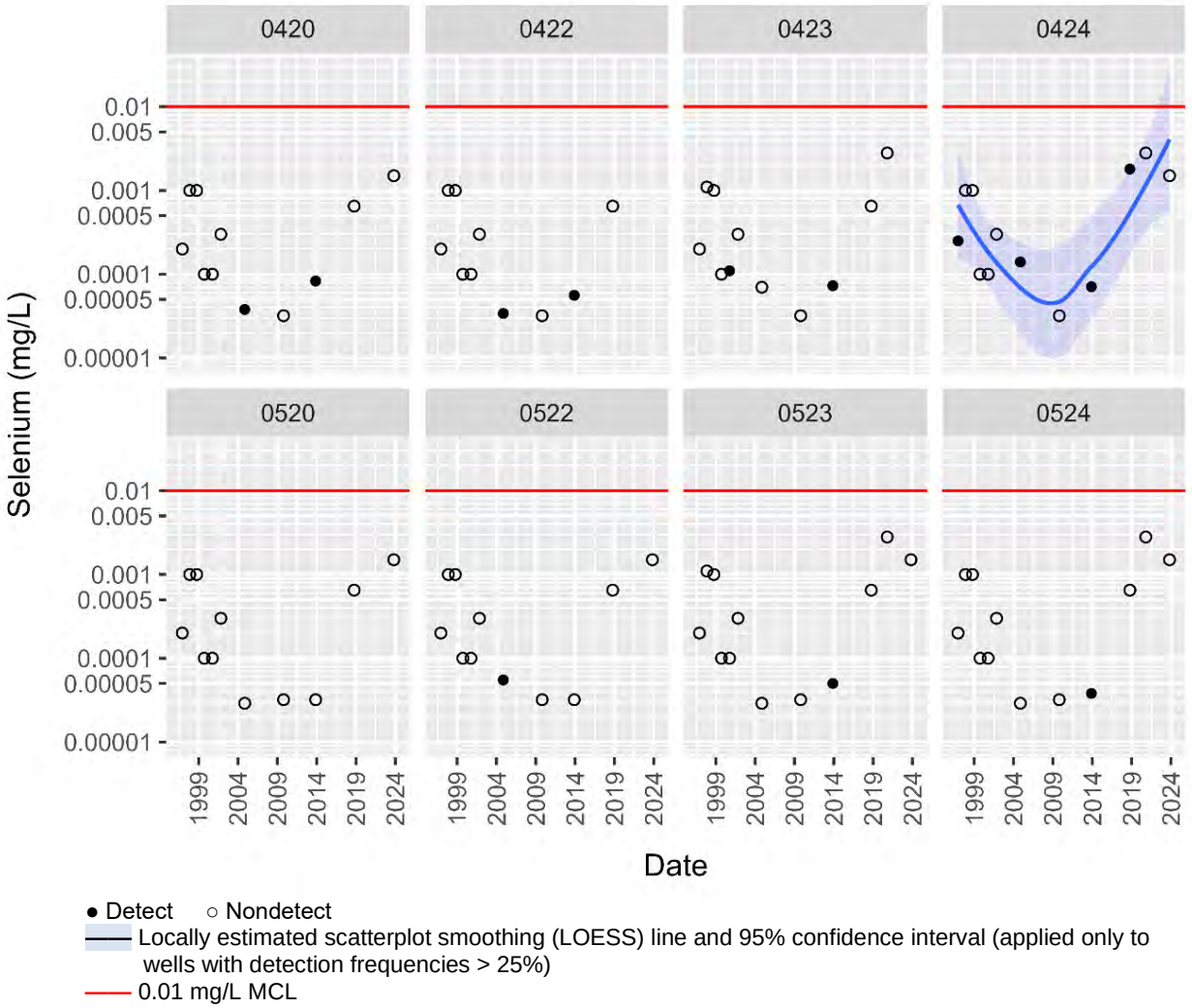


Figure 2-7. Selenium Concentrations in Groundwater at the Burrell, Pennsylvania, Disposal Site

Seeps 0611 and 0612 have typically been dry. As shown in Figure 2-8, when it has been possible to collect samples at these locations, concentrations of target analytes have been consistently below the corresponding MCLs and often below detection limits.

Based on the monitoring results to date, there is no indication of degradation of groundwater quality at the Burrell site. The next disposal cell groundwater monitoring event is scheduled for 2028. Given the inability to sample shallow wells 0422 and 0423 in 2023, LM may consider an interim event to sample those wells, as well as rescheduling the sampling event from the fall to the spring. Seasonal water levels should be at their highest level in the spring.

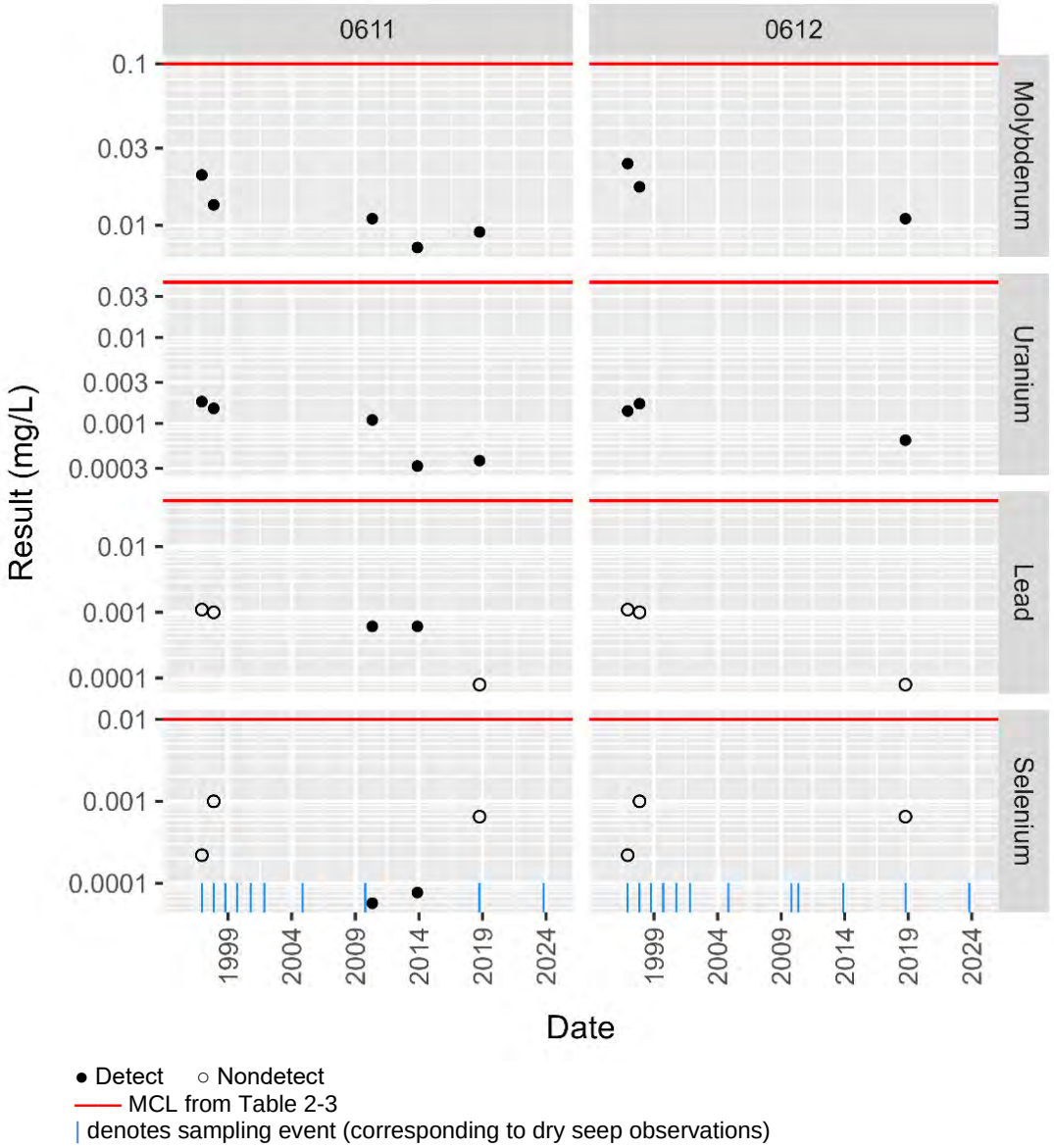


Figure 2-8. Historical Results for Seep Locations, Burrell, Pennsylvania, Disposal Site

2.8.2 Vegetation Management

In accordance with the Vegetation Management Plan, mowing and spot herbicide application continues. Vegetation management activities include ensuring that the fence line and access paths remain clear of the invasive species Japanese knotweed (*Reynoutria japonica*), applying herbicides where needed, and regularly mowing open areas of the site. These activities have been successful in controlling Pennsylvania-listed noxious weeds onsite. Pennsylvania-listed noxious weeds purple loosestrife (*Lythrum salicaria*), poison hemlock (*Conium maculatum*), and multiflora rose (*Rosa multiflora*) were not observed in 2024, except for sporadic resprouts following mowing. Several other invasive plants, including Japanese knotweed and common reed (*Phragmites australis*), persist. A stand of common reed that was identified during previous inspections remains at the west end of the disposal cell and has spread along the southern edge of the disposal cell. This stand is very difficult to access because of standing water and its location

adjacent to the perimeter fence. Wooded areas remained heavily vegetated with Japanese knotweed. Privet (*Ligustrum sp.*) is an invasive shrub that was observed in several areas. Oriental bittersweet (*Celastrus orbiculatus*) is an invasive vine listed as a noxious weed in Pennsylvania. It was observed in several wooded areas and growing on the disposal cell cover. Pursuant to the Vegetation Management Plan, access paths to monitoring wells and the fence line have been effectively maintained.

A conservation reuse initiative is being pursued at the site that involves the establishment of a tallgrass prairie. In 2017, a 2-acre plot in the mowed field east of the disposal cell was staked out as a test plot. In October 2018, that area was prepped and seeded. Maintenance through 2019 included mowing that helped prevent the establishment of unwanted vegetation. Following the 2019 inspection, field personnel broadcast Indiangrass (*Sorghastrum nutans*) to augment the 2018 seeding effort. The prairie was mowed in 2023 to help keep woody vegetation from becoming established. It was not mowed in 2024.

The test prairie appears to be progressing, though a diverse flowering community is not expected for several years. It is recommended that the prairie continue to be mowed at least every 2 years while flowers are on the cool-season grasses and clovers and before they set seed. Mowing the last 2 weeks of May or the first week of June should prevent the cool-season grasses from seeding out and will open the canopy for the native species when they are beginning to leaf out.

Maintaining a tallgrass prairie at an unoccupied site is challenging, especially when the prairie is in an area of the country that wants to revert to forest. For now, DOE intends to continue with the current maintenance effort of mowing approximately every 2 years as described above. Rather than continuing with a tall prairie grass pollinator plot, it may be more advantageous to plant some flowering shrubs and small trees for the same pollinator reuse objective. Such an approach would be more in line with the surrounding area and require less long-term maintenance, making it more cost-effective.

2.9 References



Note

Site-related documents are available on the LM public webpages at https://lmpublicsearch.lm.doe.gov/SitePages.

10 CFR 40 Appendix A. U.S. Nuclear Regulatory Commission, “Criteria Relating to the Operation of Uranium Mills and the Disposition of Tailings or Wastes Produced by the Extraction or Concentration of Source Material from Ores Processed Primarily for Their Source Material Content,” *Code of Federal Regulations*.

10 CFR 40.27. U.S. Nuclear Regulatory Commission, “General License for Custody and Long-Term Care of Residual Radioactive Material Disposal Sites,” *Code of Federal Regulations*.

40 CFR 192 Subpart A Table 1. U.S. Environmental Protection Agency, “Maximum Concentration of Constituents for Groundwater Protection,” *Code of Federal Regulations*.

DOE (U.S. Department of Energy), 2000. *Long-Term Surveillance Plan for the U.S. Department of Energy Burrell Vicinity Property, Blairsville, Pennsylvania,* GJO-2002-331-TAR, April.

DOE (U.S. Department of Energy), 2008. *Burrell, Pennsylvania, Site Vegetation Management Plan*, DOE-LM/1566-2008, Office of Legacy Management, January.

DOE (U.S. Department of Energy), 2019. *2018 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites*, LMS/S22053, Office of Legacy Management, March.

DOE (U.S. Department of Energy), 2022. *2021 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings and Radiation Control Act Title I Disposal Sites*, LMS/S33843, Office of Legacy Management, March.

Lee, L., 2020. "NADA: Nondetects and Data Analysis for Environmental Data," R package, version 1.6-1.1, https://CRAN.R-project.org/package=NADA, accessed November 22, 2024.

R Core Team, 2024. "R: A Language and Environment for Statistical Computing," The R Foundation for Statistical Computing, version 4.3.3, https://www.r-project.org, accessed November 22, 2024.

2.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	270	Fence Line
PL-2	45	Temporary Fence Repair
PL-3	0	Site Marker
PL-4	—	New Well Pad at Well 0424
PL-5	—	New Well Pad at Well 0524
PL-6	90	Crack Repaired at Well Pad of Monitoring Well 0422
PL-7	270	Large Root Ball on Downed Tree

Note:
— = Photograph taken vertically from above.



PL-1. Fence Line



PL-2. Temporary Fence Repair



PL-3. Site Marker



PL-4. New Well Pad at Well 0424



PL-5. New Well Pad at Well 0524



PL-6. Crack Repaired at Well Pad of Monitoring Well 0422



PL-7. Large Root Ball on Downed Tree

3.0 Canonsburg, Pennsylvania, Disposal Site

3.1 Compliance Summary

The Canonsburg, Pennsylvania, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site was inspected on October 30, 2024. No changes were observed on the disposal cell or in the associated drainage features. No evidence of site trespassing was observed. A tree was down on the perimeter fence, the result of a recent windstorm. The integrity of the fence appears to be functional but will need to be assessed further once the tree is removed. A few minor maintenance items were identified. No cause for a follow-up inspection was identified.

The U.S. Department of Energy (DOE) Office of Legacy Management (LM) conducts groundwater and surface water monitoring every 5 years to provide data to document that the site remains protective of human health, safety, and the environment. The most recent sampling event occurred in October 2023. In 2023, concentrations of uranium, the only constituent of concern at the site, were below the site-specific alternate concentration limit (ACL) of 1.0 milligram per liter (mg/L) in groundwater samples and, for the Chartiers Creek sample, below the point of exposure (POE) limit of 0.01 mg/L established for surface water.

In 2023, Lawrence Berkeley National Laboratory (LBNL) published the results of a study conducted on LM sites to evaluate climate change vulnerability. In its study of the Canonsburg site, LBNL found that increased flooding of Chartiers Creek, adjacent to the site, posed a potential risk to the long-term integrity of the disposal cell at the site. In response to LBNL recommendations, LM completed two projects in 2024 to help address the risk of increased flooding. In June 2024, water level transducers were installed in monitoring wells to measure changes in water table elevations beneath the disposal cell. The transducers will help to better monitor changes in groundwater elevation and understand the impact of extreme precipitation events. In September 2024, approximately 50 flowering trees and bushes were planted along Chartiers Creek to further stabilize a riparian forest buffer area that was planted in 2019.

3.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the site-specific *Long-Term Surveillance Plan for the U.S. Department of Energy Canonsburg Uranium Mill Tailings Disposal Site, Canonsburg, Pennsylvania* (DOE 2013) (LTSP) in accordance with procedures established to comply with the requirements of the U.S. Nuclear Regulatory Commission (NRC) general license at Title 10 *Code of Federal Regulations* Section 40.27 (10 CFR 40.27). Table 3-1 lists these requirements.

Table 3-1. License Requirements for the Canonsburg, Pennsylvania, Disposal Site

Requirement	LTSP	This Report	10 CFR 40.27
Annual Inspection and Report	Section 3.3	Section 3.4	(b)(3)
Follow-Up Inspections	Section 3.4	Section 3.6	(b)(4)
Maintenance	Section 3.5	Section 3.7	(b)(5)
Environmental Monitoring	Section 3.7	Section 3.8	(b)(2)
Emergency Response	Section 3.6	Section 3.9	(b)(5)

3.3 Institutional Controls

The 34.2-acre site, identified by the property boundary shown in Figure 3-1, is owned by the United States and was accepted under the NRC general license in 1996. DOE is the licensee and, in accordance with the requirements for UMTRCA Title I sites, LM is responsible for the custody and long-term care of the site. Institutional controls (ICs) at the site include federal ownership of the property, administrative controls, and the following physical ICs that are inspected annually: the disposal cell and associated drainage features, entrance gates and sign, security fence, perimeter signs, site markers, survey and boundary monuments, erosion control markers, quality control monuments, and wellhead protectors.

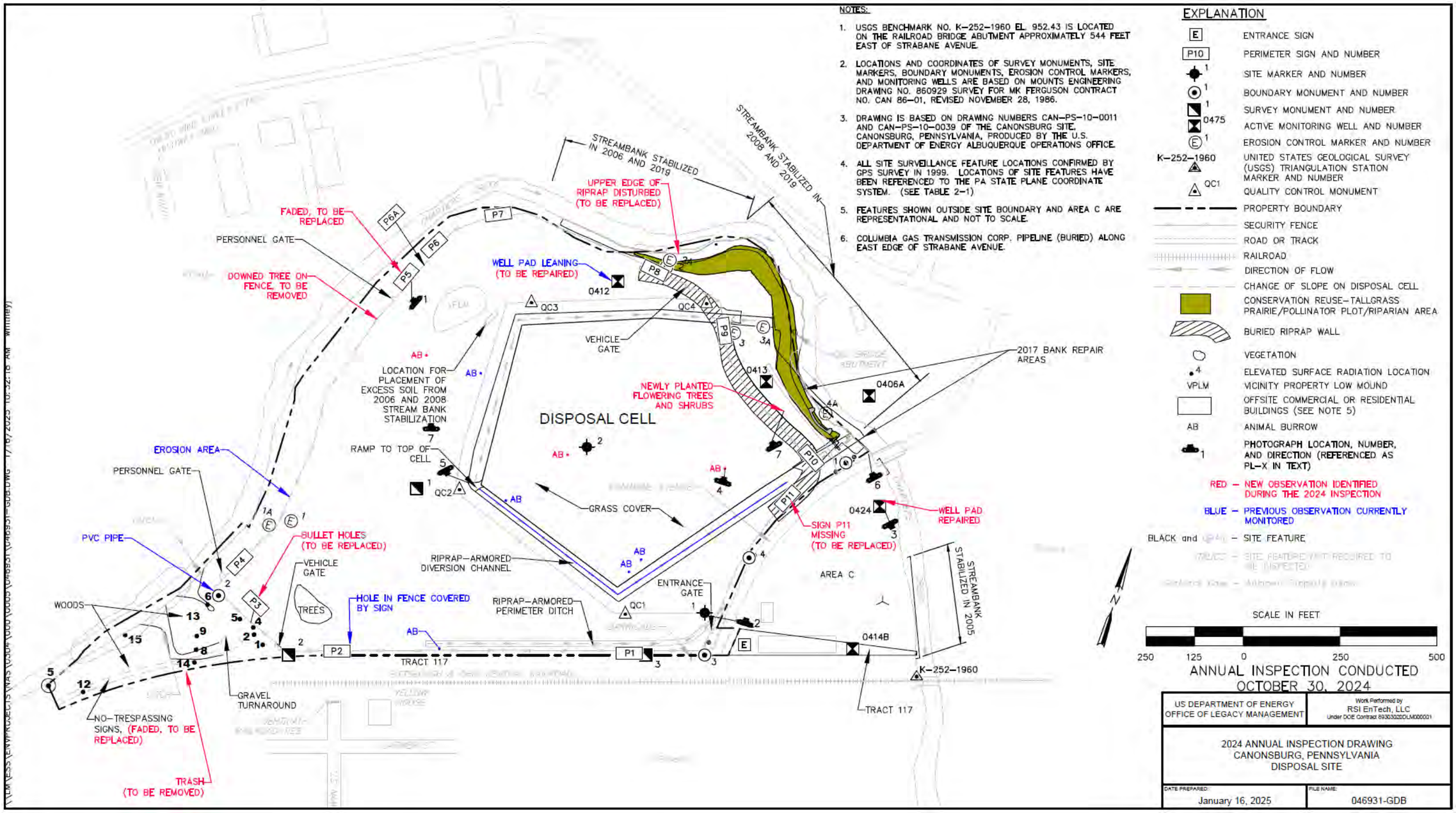
In addition to the area within the property boundary, separate ICs are applied to Area C and the east portion of Tract 117, both of which are southeast of Strabane Avenue. Area C (3.1 acres) was sold and transferred to a private owner in 2005, and the east portion of Tract 117 (0.431 acre) was sold and transferred in 2009 to the same buyer. DOE and the Commonwealth of Pennsylvania complied with restrictions on parcel transfers stipulated in UMTRCA and in the Cooperative Agreement between DOE and the commonwealth. The deeds for Area C and Tract 117 restrict excavation, prohibit disturbance of the streambank, ensure continued access for monitoring and streambank maintenance, and prevent the areas from being used for residential purposes. Use of groundwater is unrestricted. Adherence to these ICs is evaluated during the annual inspection. There was no evidence that any of the ICs were violated.

3.4 Inspection Results

The site, in Canonsburg, Pennsylvania, was inspected on October 30, 2024. The inspection was conducted by K. Broberg and L. McHenry of the Legacy Management Support (LMS) contractor. T. Drake and A. Farinacci (LM) and T. Biller (site herbicide contractor) attended the inspection. Canonsburg Mayor Rhome visited with the inspection team at the beginning of the inspection. The purposes of the inspection were to confirm the integrity of visible features at the site, identify changes in conditions that might affect conformance with the LTSP, and evaluate whether maintenance or follow-up inspection and monitoring are needed.

3.4.1 Site Surveillance Features

Figure 3-1 shows the locations of site features, including site surveillance features and inspection areas, in black and gray font. Some site features that are present but not required to be inspected are shown in italic font. Observations from previous inspections that are currently monitored are shown in blue, and new observations identified during the 2024 annual inspection are shown in red. Inspection results and recommended maintenance activities associated with site surveillance features are described in the following subsections. Photographs to support specific observations are noted in the text and in Figure 3-1 by photograph location (PL) numbers. The photographs and photograph log are presented in Section 3.11.



Abbreviations: PA = Pennsylvania, VPLM = Vicinity Property Low-Level Mound

Figure 3-1. 2024 Annual Inspection Drawing for the Canonsburg, Pennsylvania, Disposal Site

3.4.1.1 Site Access, Entrance Gates, and Entrance Sign

Main access to the site is from Strabane Avenue. There are three vehicle gates: the main entrance gate at the southeast corner of the site along Strabane Avenue, a vehicle access gate at the southwest corner of the site, and a vehicle access gate north of the disposal cell between perimeter signs P8 and P9. There are also two personnel access gates. All gates were locked and functional. The entrance sign is posted on the main entrance gate. Three additional information signs are also posted on the main entrance gate. All the signs contained current information.

3.4.1.2 Security Fence and Perimeter Signs

A chainlink security fence encloses most of the site. A vegetation-free buffer zone is maintained around the entire security fence. An eroded area remains under the west security fence. The area appears to be stable; the erosion area has not expanded in several years. For added security, slats were installed in 2016 in the area beneath the fence to help close the gap. Inspectors noted that the slats were undisturbed. Inspectors observed a downed tree on the perimeter fence from a recent windstorm. The fence remains serviceable. LMS personnel will remove the tree in 2025.

There are 11 perimeter signs attached to the security fence. Theft of perimeter signs from the southwest fence line that borders the railroad tracks is an ongoing challenge. Since the 2020 inspection, two signs have been cut out of the fence fabric on the southwest fence line and replaced. During this year's inspection, perimeter sign P11 on the southeast fence line that borders Strabane Avenue was missing. The fence fabric around the sign had been cut and the sign removed. During the 2023 inspection, a new perimeter sign (P6A) was installed between perimeter signs P5 and P6 to improve coverage. Perimeter sign P5 is weathered to a point where it needs to be replaced (PL-1). A few signs were observed to have outdated emergency contact numbers. These were corrected by placing a sticker with the current number over the outdated number. A few signs still have the wrong emergency contact number posted and will need to be corrected in 2025. Perimeter sign P3 has a few bullet holes in it but is still serviceable. No other maintenance needs were identified.

3.4.1.3 Site Markers

The site has two granite site markers. Site marker SMK-1 is just inside the main entrance gate (PL-2), and site marker SMK-2 is on the top slope of the disposal cell. No maintenance needs were identified.

3.4.1.4 Survey and Boundary Monuments

Before 2021, the site had three survey monuments and four boundary monuments. In 2021, a fifth boundary monument was installed at the southwest corner of the property. All five boundary monuments were located during the inspection. Boundary monuments BM-1, BM-2, and BM-3 have all sunk approximately 6 inches below the present grade of the ground surface. A surveying crew located them in summer 2021 using GPS coordinates on file. Rather than raise the boundary monuments, their locations are marked with a section of PVC pipe filled with pea gravel. No maintenance needs were identified.

3.4.1.5 Aerial Survey Quality Control Monuments

Four aerial survey quality control monuments used for ground control for aerial surveys were located during the 2024 annual inspection. No maintenance needs were identified.

3.4.1.6 Erosion Control Markers

The site has four pairs of erosion control markers along the bank of Chartiers Creek. All four pairs were located during the 2024 annual inspection. No maintenance needs were identified.

3.4.1.7 Monitoring Wells

The site has five groundwater monitoring wells that are sampled every 5 years (Figure 3-1); 2023 was the most recent sampling year. All wells were locked. Well locks were replaced in 2023 with new locks. In 2024, repairs were made to cracks at well pad 0424 (PL-3). The well pad of monitoring well 0412 is leaning. The interior of the protective casing is encroaching on the actual well casing. A field crew was sent in 2024 to straighten the protective casing but, upon further assessment, determined that additional equipment would be needed to perform the task safely and effectively. LM is planning to send a crew back out to straighten the casing in 2025. No other maintenance needs were identified.

3.4.2 Inspection Areas

In accordance with the LTSP, the site is divided into five inspection areas (referred to as "transects" in the LTSP) to ensure a thorough and efficient inspection. The inspection areas are (1) the disposal cell, (2) the area adjacent to the disposal cell, (3) the diversion channels and perimeter ditches, (4) the site perimeter and security fence, and (5) the outlying areas. Inspectors examined specific site surveillance features within each area and looked for evidence of erosion, settling, slumping, or other modifying processes that might affect the site's conformance with LTSP requirements.

3.4.2.1 Disposal Cell

The disposal cell, completed in 1985, occupies 6.8 acres and is covered in grass. There was no evidence of erosion, settling, slumping, or other modifying processes that might affect the integrity of the disposal cell. Animals burrow on the disposal cell cover, but the burrows should not pose a risk to disposal cell integrity or public health because the buried tailings are overlain by a 36-inch-thick clay layer (radon barrier), an 18-inch-thick biointrusion rock layer, and a 12-inch-thick topsoil layer. Biointrusion down to or through the radon barrier is unlikely. A couple of new burrows were observed on the disposal cell (PL-4) during the inspection. The locations were noted on the inspection map. They will be collapsed and filled in with clay-rich soil. Inspectors will continue to monitor the location and significance of burrows. No other maintenance needs were identified.

3.4.2.2 Area Adjacent to the Disposal Cell

The site consists primarily of mowed grasses within the security fence and on the disposal cell cover. Seeded fescues and crown vetch (*Securigera varia*) are the most prevalent species. The spray-and-mow approach to vegetation management at the site continues to be effective.

Noxious weeds within the security fence area are limited to resprouting seedlings that were observed in portions of mowed areas. A new animal burrow was identified west of the disposal cell. It was noted on the inspection map and will be monitored for changes. No maintenance needs were identified.

3.4.2.3 Diversion Channels and Perimeter Ditches

There was no evidence of rock deterioration or woody vegetation in the diversion channels and perimeter ditches (PL-5). Periodic physical removal and spot herbicide applications have been effective at reducing woody vegetation and will continue to be conducted as needed. No maintenance needs were identified.

3.4.2.4 Site Perimeter

In 2007, a radiological survey was conducted on a small parcel of land southwest of the security fence to evaluate its release for industrial reuse. The survey identified isolated radium-226 contamination in the soil in excess of the established average criterion for the site. As a result, the release criteria were not satisfied for the entire parcel, and the parcel was removed as a reuse candidate. Under current property usage, these radiological conditions do not pose a risk to personnel, and no corrective measures are required. LM controls land use through ownership. Inspectors will continue to check the area for evidence of trespassing.

During the 2017 annual inspection, an abandoned campsite was observed on the southwest corner of the site. The site and associated trash were removed in December 2017, and no-trespassing signs were posted. No evidence of recent trespassing was observed in this area during the 2024 annual inspection.

A local plastics company has cleared some of DOE's property north of the railroad tracks and spread gravel to create a turnaround for its trucks. No-trespassing signs are now posted around this area to prevent unauthorized expansion of the turnaround. A 5-year access agreement was established in 2017 with the plastics company for continued use of the turnaround. The agreement was renewed for another 5 years in 2022. No changes to the size of the turnaround were observed in 2022. The no-trespassing signs marking the edge of the turnaround are weathered and in need of replacement. LM plans to replace those signs in 2025.

A small, new pile of trash was west of the turnaround and north of the railroad tracks. The trash consisted of empty cans and some paper material. Arrangements will be made to remove this trash. No other maintenance needs were identified.

3.4.2.5 Outlying Area

Chartiers Creek Bank: Chartiers Creek is an active, meandering waterway west, north, and east of the disposal site. Bedrock outcrops and mature trees on the streambank west of the site indicate that the bank of that creek is stable.

Several riprap streambank stabilization projects have been conducted north and east of the site. From 2001 to 2008, riprap armoring was installed along the streambanks. Years of flow and heavy flow events in Chartiers Creek in late 2017 and early 2018 damaged those riprap installations. In late summer 2019, the entire length of the riprap embankment along

Chartiers Creek north of the disposal cell (approximately 1200 linear feet) was repaired during low streamflow conditions. The work consisted of minor grading, replacing geotextile filter fabric, and importing and placing 2-foot-thick riprap slopes. A minor concern was observed with the current riprap embankment during the inspection (PL-6). Flooding over the past year had moved some of the riprap from the top edge of the embankment. This riprap should be relocated back to the top of the embankment.

As part of the 2019 repair project, a riparian forest buffer was planted above and along the embankment. Disturbed areas were seeded with a pollinator-friendly native grass and wildflower mix. This riparian forest buffer corridor will work with the engineered riprap embankment to further stabilize the bank against future stream flooding events and reduce erosion along the top edge of the riprap embankment. Plantings in the riparian forest buffer have experienced a 4-year survival rate of over 90%. The main challenge for the young plants is being damaged by deer. In 2022, the plastic sleeves (originally installed when the trees were planted) protecting the trees from deer rub were removed and replaced with larger wire cages. The cages, made from welded wire fencing mounted on metal T-posts, are more durable and offer better protection than plastic deer tubes and wooden stakes.

The riparian forest buffer is also recognized to improve stream quality. This effort is part of the commonwealth's goal to establish 95,000 acres of riparian forest buffer by 2025. The Pennsylvania Department of Conservation and Natural Resources was notified of the project. The general long-term health prospect is good for the young plants in the riparian buffer given the installation of the protective wire cages. As discussed below in Section 3.5, the riparian forest buffer area was further enhanced in 2024 by the planting of additional flowering trees and shrubs. A chain limiting vehicle access to the site near the riparian forest buffer and reuse prairie was reinstalled in 2024. No signs of trespassing were noted during the 2024 inspection.

Area C and Tract 117: Area C and Tract 117 form a triangular parcel of property east of the site bounded by Strabane Avenue, Chartiers Creek, and the Pittsburgh and Ohio Central Railroad. Area C and Tract 117 are included in the annual inspection to ensure compliance with ICs that were put into place to address land-use and site access requirements. There was no evidence that any of the ICs in place for Area C and Tract 117 had been violated.

Additional control of invasive vegetation in Area C between Strabane Avenue and monitoring well 0424 began in 2021 to enhance the health of the riparian corridor being established along Chartiers Creek north of the disposal cell. Mowing and spraying in this area limits the spread of invasive vegetation from Area C to the recently planted riparian buffer area.

Strabane Avenue: The maintenance subcontractor, Lawn RX, periodically removes trash found on and adjacent to the site to maintain the site's appearance. Inspectors also pick up trash as necessary. Inspectors observed that Strabane Avenue, next to the site, was relatively clear of trash. No other maintenance needs were identified.

3.5 Climate Resiliency

In January 2023, LBNL published the results of a study conducted on LM sites to evaluate climate change vulnerability (LBNL 2023). The study was in response to a U.S. Government Accountability Office environmental liabilities audit of LM sites, which found that "LM has not

made plans to assess the effects of climate change on its sites or to mitigate those effects" (GAO 2020). As part of the study, one of LBNL's goals was to use one or more case studies with climate forecast data to serve as a template for LM and LMS staff to use to assess or reassess environmental liabilities for all the sites. The Canonsburg site was selected for one of the case studies.

In its study of the Canonsburg site, LBNL found that increased flooding of Chartiers Creek, adjacent to the site, posed a potential risk to the long-term integrity of the disposal cell at the site. In response to LBNL recommendations, two projects were completed at the Canonsburg site in 2024 to help address the risk of increased flooding. In June 2024, water level transducers were installed in monitoring wells 0412, 0413, 0424, and 0414B to measure changes in water table elevations beneath the disposal cell. The transducers will help to better monitor changes in groundwater elevation and understand the impact of extreme precipitation events. In September 2024, approximately 50 flowering trees and shrubs were planted along Chartiers Creek to further stabilize a riparian forest buffer area that was established in 2019 (PL-7).

The planting of 50 additional flowering trees and shrubs in the pollinator grass area will begin a transition of the prairie grass area into a pollinator-friendly, wooded edge habitat. The habitat will require less long-term maintenance than the pollinator prairie and will better compliment the natural progression of the area back to being wooded. The forested edge habitat will better protect the upper edge of the riparian corridor, provide a pollinator-friendly habitat, and lower long-term maintenance costs for the care and maintenance of the streambank against future flooding events predicted as a risk due to climate change.

3.6 Follow-Up Inspections

LM will conduct follow-up inspections if (1) a condition is identified during the annual inspection or other site visit that requires a return to the site to evaluate the condition or (2) LM is notified by a citizen or outside agency that conditions at the site have substantially changed. No need for a follow-up inspection was identified.

3.7 Maintenance

The following minor maintenance items were identified during the 2024 inspection and will be scheduled to be addressed:

- Repair of the protective casing and well pad at monitoring well 0412
- Removal of the small pile of trash west of the turnaround area
- Removal of the downed tree from the perimeter fence and assessment of the integrity of the damaged fence
- Complete replacement of emergency phone numbers on perimeter signs
- Replacement of missing perimeter sign P11
- Replacement of faded no-trespassing signs in the turnaround area
- Replacement of perimeter sign P3 due to bullet holes
- Replacement of perimeter sign P5 due to weathering
- Replacement of the disturbed riprap on the top edge of the embankment

3.8 Environmental Monitoring

In accordance with the LTSP, LM conducts groundwater and surface water monitoring every 5 years to provide data to document that the site remains protective of human health, safety, and the environment. The current environmental monitoring network consists of five monitoring wells and one surface water location in Chartiers Creek (Figure 3-2).

The most recent sampling event occurred in October 2023. Historical static water level and water quality data addressed in this section are available on the LM Geospatial Environmental Mapping System (GEMS) website (https://gems.lm.doe.gov).

As discussed in Section 3.5, in 2024, water level transducers were installed in monitoring wells 0412, 0413, 0424, and 0414B as part of a climate resiliency project. DOE plans to initially download data from the transducers on a quarterly basis and provide water level interpretations in the annual site inspection reports. The data downloading frequency will be further discussed in annual site inspection reports if the need arises.

3.8.1 Groundwater Monitoring

LM conducts routine monitoring to (1) evaluate downgradient contaminant trends in groundwater in the shallow, unconsolidated materials and in surface water; (2) demonstrate that concentrations of uranium at point of compliance (POC) wells are decreasing as predicted and that the system remains in compliance with the *Ground Water Compliance Action Plan for the Canonsburg, Pennsylvania, UMTRA Project Site* (DOE 2000) (GCAP); and (3) ensure that remedial actions at the disposal site and Area C continue to protect human health, safety, and the environment (DOE 2013).

The groundwater monitoring network consists of five monitoring wells: three POC wells and two best management practice wells (Figure 3-2 and Table 3-2). All monitoring wells are completed in the uppermost aquifer consisting of unconsolidated materials overlying the bedrock of the Casselman Formation.

Table 3-2. Groundwater Monitoring Network for the Canonsburg, Pennsylvania, Disposal Site

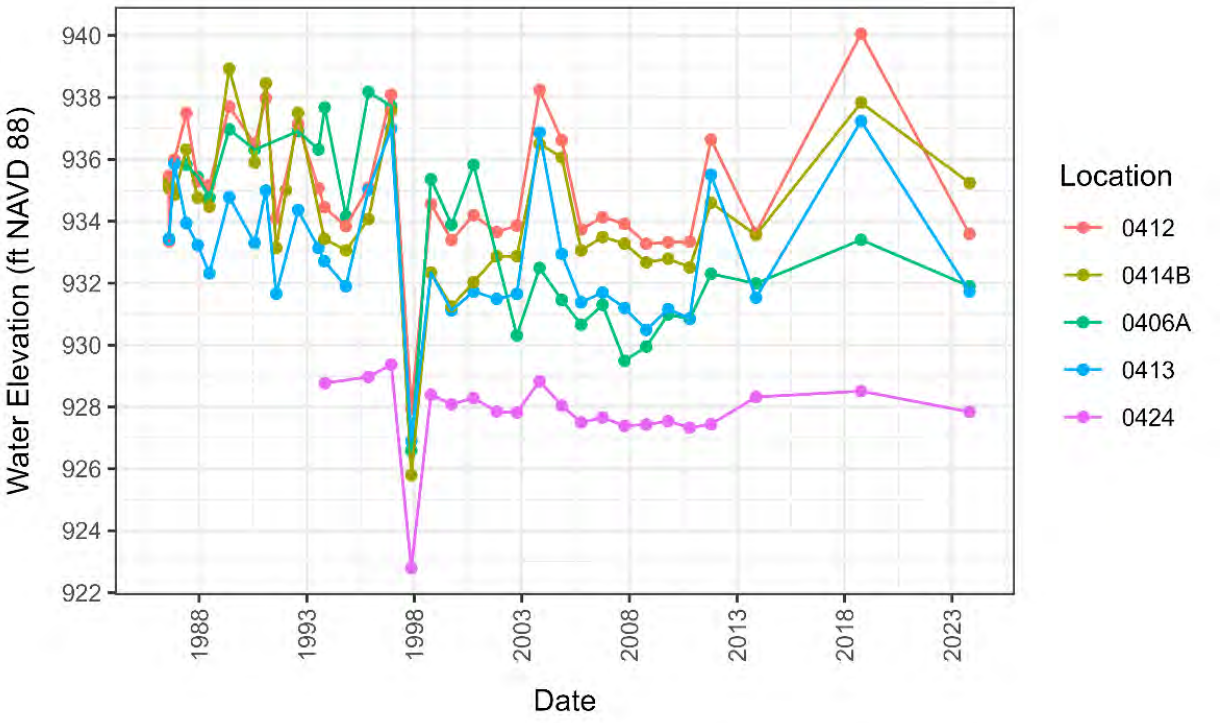
Monitoring Well	Hydrologic Relationship	Groundwater Monitoring Purpose
0412	Downgradient	POC
0413	Downgradient	POC
0414B	Cross gradient	POC
0406A	Downgradient (north of creek)	Best management practice
0424	Downgradient	Best management practice

Note:
Two of the original POC wells—0406 and 0414—have since been replaced due to previous damage. Well 0414 has been replaced twice, in May 2001 (well 0414A) and again in October 2004 (well 0414B, the current POC). Well 0406 was replaced with monitoring well 0406A in January 2002. Subsequent figures combine the data for these colocated locations.



Figure 3-2. Groundwater and Surface Water Monitoring Network for the Canonsburg, Pennsylvania, Disposal Site

Manual water level measurements since 1986 (most taken in the fall) indicate that water elevations, though fluctuating, have usually been within the historical range of water elevations measured at the site (Figure 3-3). Exceptions have occurred in 1997, with the lowest recorded water elevations, and most recently in 2018, when maximum groundwater elevations were recorded for all wells except well 0424.



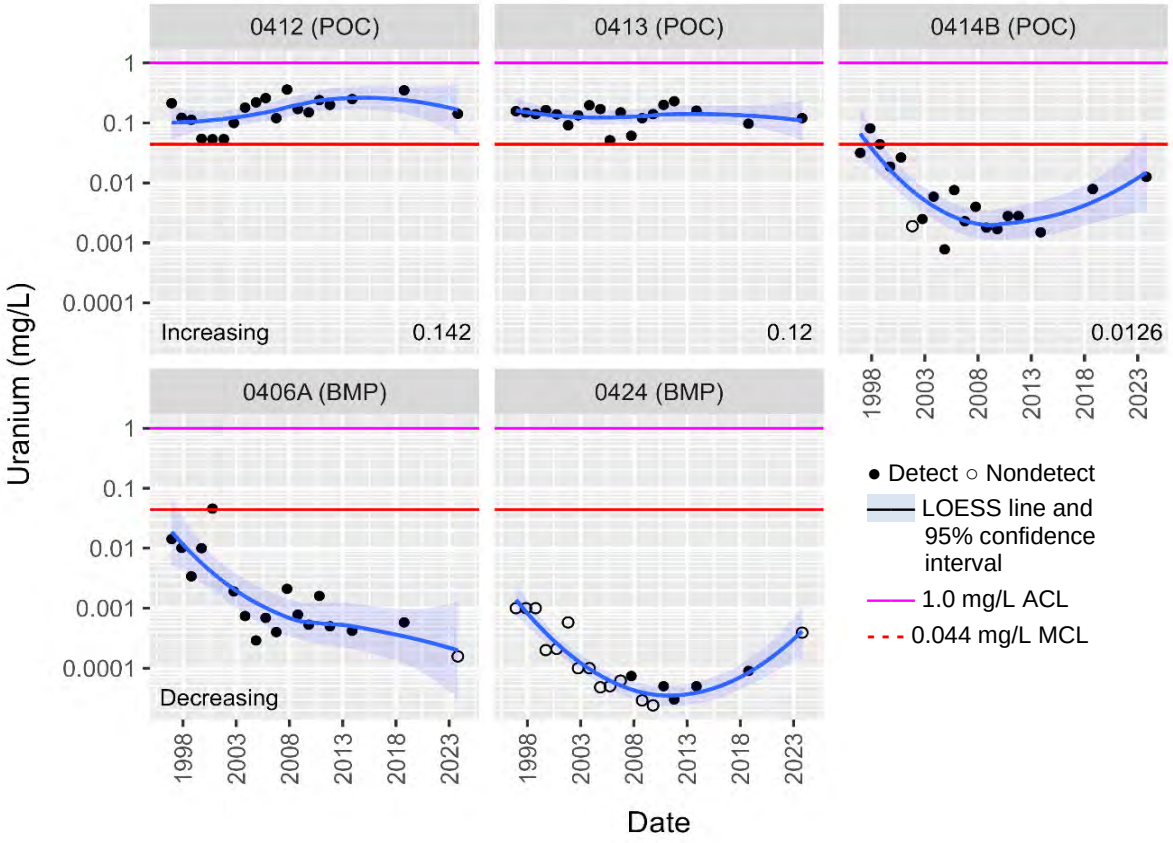
Note: In the legend, wells are listed in order of descending average groundwater elevation.
Abbreviations: ft = feet, NAVD 88 = North American Vertical Datum of 1988

Figure 3-3. Temporal Trends of Water Elevations in Canonsburg Disposal Site Monitoring Wells

Groundwater is sampled and analyzed for uranium, the only remaining constituent of concern since the GCAP was issued in 2000. The ACL established in the LTSP for uranium in groundwater (applied to POC wells) is 1.0 mg/L (DOE 2013). Figure 3-4 plots historical data for the POC and best management practice wells for 1996–2023. MCL concentrations are shown on each plot as a red line. ACL concentrations are shown on the plot as a magenta line. As shown in Figure 3-4, uranium concentrations in all wells have been consistently below the ACL.

The following figure was developed using a faceting approach, whereby each panel plots data for a single well. A nonparametric smoothing method—locally estimated scatterplot smoothing (LOESS)—is also applied. Using this approach, overall trends in the data are more apparent and not obscured by "noise" or random variation. Because of the wide range in uranium concentrations across the well network, a semilogarithmic scale is used.

A statistical trend analysis applied to the 1996–2023 dataset indicates a statistically significant increasing trend in uranium concentrations for well 0412.[1] Despite observed increases between 2000 and 2018 (accounting for the significant trend), uranium results for well 0412 have often fluctuated. Between 2018 and 2023, the result decreased from 0.35 to 0.14 mg/L.



Notes: Values shown in the lower right corner of individual graphs are the most recent (2023) results (applied to detections only). For the wells with a statistically significant trend, the direction of the trend is also noted. Data for well 0414B include data from former well 0414 (1996–2000) and 0414A (2001–2003). Data for well 0406A include data from former well 0406 (1996–2000) (see Table 3-2).
Abbreviations: BMP = best management practice, MCL = maximum concentration limit

Figure 3-4. Uranium Concentrations in Groundwater at the Canonsburg, Pennsylvania, Disposal Site

Although no significant trend was found for POC well 0414B, uranium concentrations in this well have increased since 2013 and are approaching levels measured from 1996–2000, as well as the maximum concentration limit (MCL) of 0.044 mg/L (Figure 3-4). Uranium concentrations in the two best management practice monitoring wells, 0406A and 0424, have historically been well below the MCL of 0.044 mg/L. A statistically significant decreasing trend was found for well 0406A. The most recent (2023) results in both wells were below detectable levels (≤0.0004 mg/L).

[1] Trend analysis was conducted using the NADA package (Lee 2022) for R version 4.3.3 (R Core Team 2024). The NADA trend test is similar to the traditional Mann-Kendall trend test except that it accounts for the presence of nondetects. Trend analyses were conducted at the 0.05 significance (or alpha) level using a two-sided test.

3.8.2 Surface Water Monitoring

Only one location, 0602 (Figure 3-2), is currently sampled in Chartiers Creek; the most recent sampling event occurred in October 2023. This location is considered a POE for the site and is sampled for uranium, to which an ACL of 0.01 mg/L is applied (DOE 2013).

Before the LTSP revision in 2008, two additional locations were sampled in Chartiers Creek: upstream location 0601 and downstream location 0603. As shown in previous reports (e.g., DOE 2019), uranium concentrations measured at these locations were historically aligned with those for POE location 0602 (all ≤0.001 mg/L). These locations are no longer required to be sampled.

In 2023, the uranium result for surface water location 0602 was below detectable levels (<0.00034 mg/L), well below the established ACL of 0.01 mg/L (Figure 3-5).

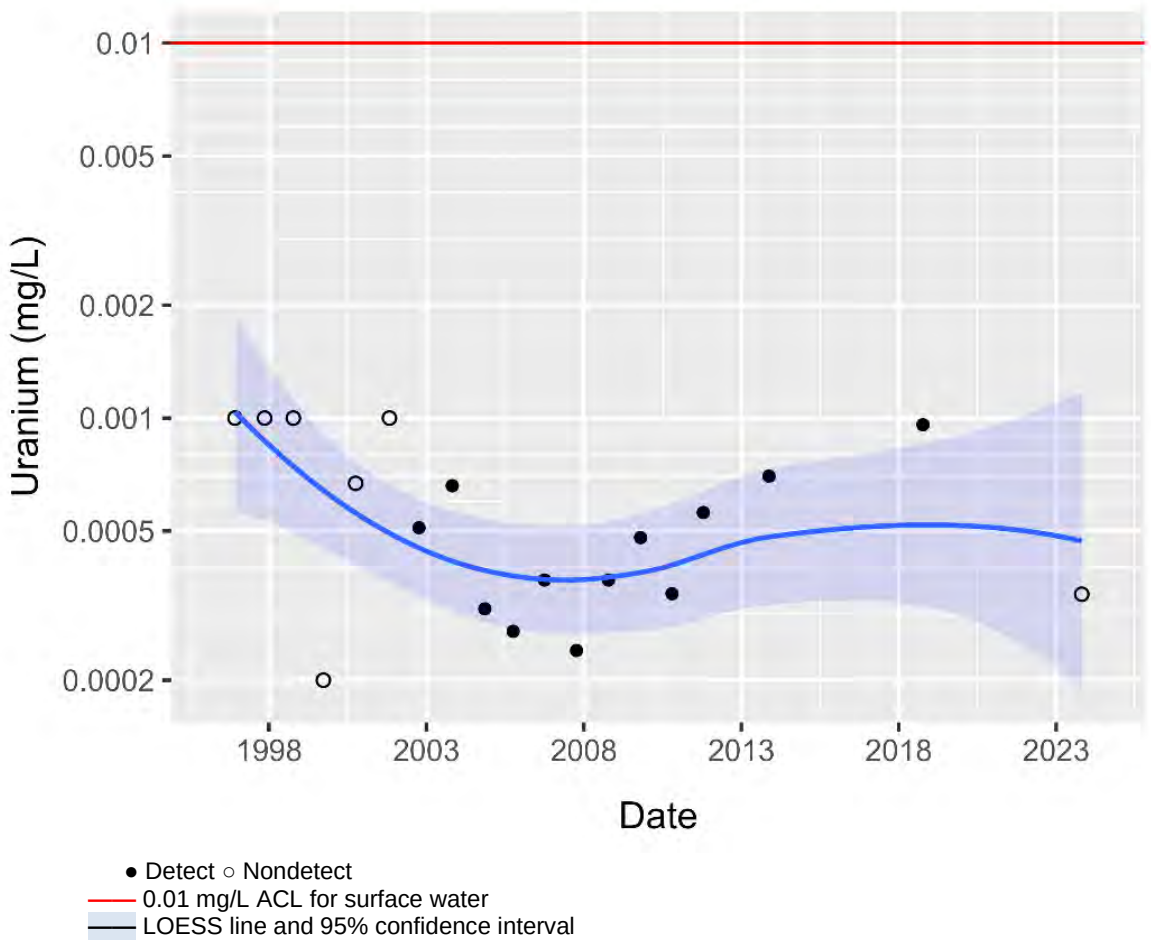


Figure 3-5. Uranium Concentrations at POE Location 0602 (Chartiers Creek) Canonsburg, Pennsylvania, Disposal Site

3.8.3 Vegetation Management

Vegetation management continues at the site in accordance with the LTSP. Activities include spot-treating invasive species, physically removing plants, using spot application of herbicides to target woody vegetation in diversion channels and perimeter ditches, and using the spray-and-mow approach. These activities remain successful. Noxious weeds observed within the fenced area during this year's inspection included crown vetch. These areas are limited to resprouting seedlings that were observed in portions of mowed areas. No changes to the current vegetation management approach are recommended.

3.9 Emergency Response

Emergency responses are the actions LM will take in response to unusual damage or disruption that threatens or compromises site safety, security, or integrity in compliance with 10 CFR 40 Appendix A Criterion 12. No need for emergency response was identified.

3.10 References



Note

Site-related documents are available on the LM public webpages at https://lmpublicsearch.lm.doe.gov/SitePages.

10 CFR 40 Appendix A. U.S. Nuclear Regulatory Commission, "Criteria Relating to the Operation of Uranium Mills and the Disposition of Tailings or Wastes Produced by the Extraction or Concentration of Source Material from Ores Processed Primarily for Their Source Material Content," *Code of Federal Regulations*.

10 CFR 40.27. U.S. Nuclear Regulatory Commission, "General License for Custody and Long-Term Care of Residual Radioactive Material Disposal Sites," *Code of Federal Regulations*.

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R Core Team, 2024. "R: A Language and Environment for Statistical Computing," The R Foundation for Statistical Computing, version 4.3.3, https://www.r-project.org, accessed November 22, 2024.

3.11 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	292.5	Perimeter Sign P5
PL-2	—	Site Marker SMK-1
PL-3	135	Repaired Well Pad at Monitoring Well 0424
PL-4	—	New Animal Burrow
PL-5	135	Riprap-Armored Diversion Channel
PL-6	315	Riprap-Armored Streambank
PL-7	315	Newly Planted Flowering Trees and Shrubs

Note:
— = Photograph taken vertically from above.



PL-1. Perimeter Sign P5



PL-2. Site Marker SMK-1



PL-3. Repaired Well Pad at Monitoring Well 0424



PL-4. New Animal Burrow



PL-5. Riprap-Armored Diversion Channel



PL-6. Riprap-Armored Streambank



PL-7. Newly Planted Flowering Trees and Shrubs

4.0 Durango, Colorado, Disposal Site

4.1 Compliance Summary

The U.S. Department of Energy (DOE) Office of Legacy Management (LM) conducted the Durango, Colorado, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site annual inspection on May 15, 2024, and the annual groundwater monitoring event in June 2024. No cause for a follow-up inspection was identified.

No changes were observed to the disposal cell or to its associated drainage features. Inspectors identified minor maintenance items listed in Section 4.6.

The 2024 annual groundwater sampling event identified concentrations of molybdenum, selenium, and uranium at the three point of compliance (POC) wells (wells 0607, 0612, and 0621) below site-specific thresholds. In addition to the annual sampling event, LM samples monitoring wells 0608 and 0618 and POC well 0621 monthly (weather permitting) as a best management practice to monitor variable uranium concentrations. Concentrations are typically above site-specific thresholds in well 0618.

4.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the site-specific *Long-Term Surveillance Plan for the Durango, Colorado, Disposal Site* (DOE 2019) (LTSP) in accordance with procedures established to comply with the requirements of the U.S. Nuclear Regulatory Commission (NRC) general license at Title 10 *Code of Federal Regulations* Section 40.27 (10 CFR 40.27). Table 4-1 lists these requirements.

Table 4-1. License Requirements for the Durango, Colorado, Disposal Site

Requirement	LTSP	This Report	10 CFR 40.27
Annual Inspection and Report	Section 3.3	Section 4.4	(b)(3)
Follow-Up Inspections	Section 3.4	Section 4.5	(b)(4)
Maintenance	Section 3.5	Section 4.6	(b)(5)
Emergency Measures	Section 3.5	Section 4.7	(b)(5)
Environmental Monitoring	Section 3.6	Section 4.8	(b)(2)
Corrective Action	Section 3.6	Section 4.9	--

4.3 Institutional Controls

The 121-acre site, identified by the property boundary shown in Figure 4-1, is owned by the United States and was accepted under the NRC general license in 1996. DOE is the licensee and, in accordance with the requirements for UMTRCA Title I sites, LM is responsible for the custody and long-term care of the site.

Institutional controls (ICs) at the site include federal ownership of the property, administrative controls, and the following physical ICs that are inspected annually: the disposal cell and associated drainage features, entrance gates, warning or no-trespassing signs (entrance and perimeter signs), site markers, survey and boundary monuments, and wellhead protectors.

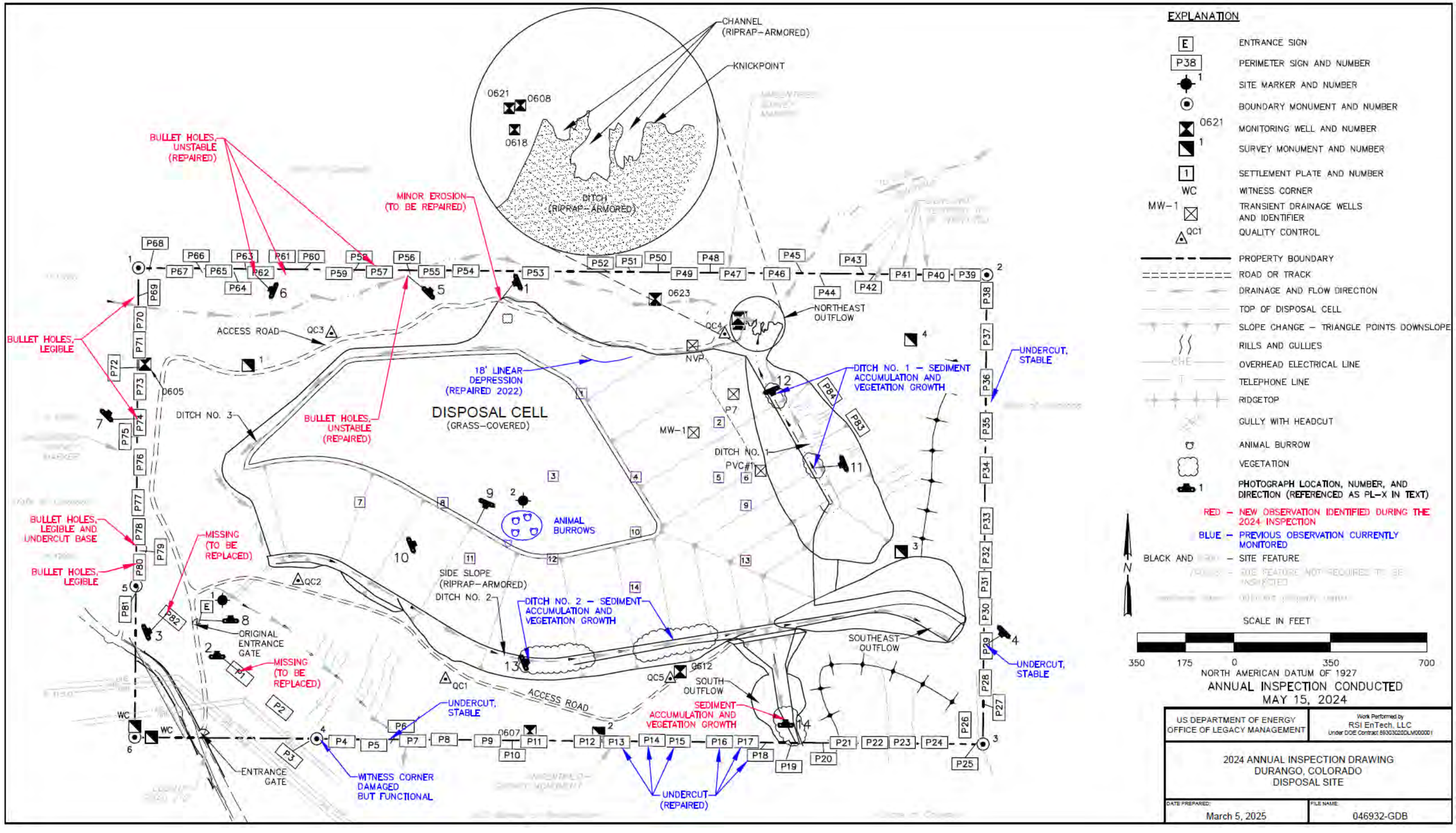


Figure 4-1. 2024 Annual Inspection Drawing for the Durango, Colorado, Disposal Site

4.4 Inspection Results

The site, 3.5 miles southwest of Durango, Colorado, was inspected on May 15, 2024. The inspection was conducted by D. Atkinson and E. Garcia of the Legacy Management Support contractor. J. Dayvault (LM) and M. Cosby and A. Lawrence (Colorado Department of Public Health and Environment) also attended the inspection. The purposes of the inspection were to confirm the integrity of visible features at the site, identify changes in conditions that might affect conformance with the LTSP, and evaluate whether maintenance or follow-up inspection and monitoring are needed.

4.4.1 Site Surveillance Features

Figure 4-1 shows the locations of site features, including site surveillance features and inspection areas, in black and gray font. Some site features that are present but not required to be inspected are shown in italic font. Observations from previous inspections that are currently monitored are shown in blue, and new observations identified during the 2024 annual inspection are shown in red. Inspection results and recommended maintenance activities associated with site surveillance features are described in the following subsections. Photographs to support specific observations are noted in the text and in Figure 4-1 by photograph location (PL) numbers. The photographs and photograph log are presented in Section 4.11.

4.4.1.1 Site Access, Entrance Gates, and Entrance Sign

Access to the site is via La Plata County Road 212, an improved dirt road that is accessed via a locked gate along La Plata County Road 210. Entrance to the site is through the locked steel entrance gate along La Plata County Road 212 and an older, original entrance gate. All gates were locked and functional. The entrance sign is at the older entrance gate inside the property boundary. A minor erosional feature is forming on the northern portion of the access road within the site boundary (PL-1), and maintenance will be conducted before the next site inspection.

4.4.1.2 Perimeter Signs

There are 82 perimeter signs, attached to steel posts set in concrete, that delineate the property boundary. Perimeter signs are inspected for legibility and position to ensure that they are functioning as intended. Two additional perimeter signs (P83 and P84), also attached to steel posts, were installed in 2014 inside the property boundary along the east perimeter of Ditch No. 1. These additions act as surrogates for perimeter signs P40−P43, which are on a steep, densely wooded hillside. Perimeter signs P40–P43 are not routinely inspected because of their locations and the surrounding vegetation.

Inspectors noted that perimeter signs P1 (PL-2) and P82 (PL-3) were missing and will be replaced before the next inspection. Before the 2024 annual inspection, perimeter signs P13–P18 were chosen to be the test subjects for the water diversions installed above the signs to try to prevent undercutting. This maintenance effort was successful, and new erosion was minimal. The concrete bases of perimeter signs P6, P29 (PL-4) and P35 are undercut but stable. The undercutting at perimeter signs P56 (PL-5), P61, P62 (PL-6), and P79 is advanced enough that the signs require repair. Perimeter sign P57 was previously fixed for erosional issues and will need further repair. Maintenance will be done before the next inspection.

Perimeter signs P69, P74 (PL-7), P79, and P80 have new bullet holes but are still legible. No other maintenance needs were identified.

4.4.1.3 Site Markers

The site has two site markers. Site marker SMK-1 is just inside the original entrance gate and was in good condition (PL-8). Site marker SMK-2 is on the top slope of the disposal cell and was also in good condition. No maintenance needs were identified.

4.4.1.4 Survey and Boundary Monuments

Four survey monuments and six boundary monuments (each with two witness corners) delineate the property boundary. All boundary monuments and survey monuments were inspected during 2024. The southeast witness corner for boundary monument BM-4 is damaged but remains intact. All other monuments are in good condition, and no maintenance needs were identified.

4.4.1.5 Aerial Survey Quality Control Monuments

Five aerial survey quality control monuments were inspected during the 2024 annual inspection. No maintenance needs were identified.

4.4.1.6 Monitoring Wells

The site has seven monitoring wells and two transient drainage wells. All wellhead protectors observed during the inspection were undamaged and locked. No maintenance needs were identified.

4.4.2 Inspection Areas

In accordance with the LTSP, the site is divided into six inspection areas (referred to as "transects" in the LTSP) to ensure a thorough and efficient inspection. The inspection areas are (1) the top of the disposal cell, (2) the side slopes of the disposal cell, (3) the drainage ditches, (4) the holding pond, (5) the site boundary, and (6) the outlying areas. Inspectors examined specific site surveillance features within each area and looked for evidence of erosion, settling, slumping, or other modifying processes that might affect the site's conformance with LTSP requirements.

4.4.2.1 Top of Disposal Cell

The disposal cell, completed in 1990, occupies 60 acres. It has a vegetated cover consisting primarily of perennial grasses and broadleaf plants. There was no evidence of erosion, settling, slumping, or other modifying processes on the top of the disposal cell. Animal burrows were noted in previous inspections, but there was no evidence of new animal burrows. No maintenance needs on the disposal cell top slope were identified.

4.4.2.2 Side Slopes of Disposal Cell

The side slopes of the disposal cell are armored with rock riprap (PL-9). A linear depression, approximately 18 feet long, was first observed along the north toe of the disposal cell in 2015. The depression was repaired in October 2022, and inspectors have been unable to detect any settling or other changes since the repair.

A subtle topographic variation in the surface of the northeast side slope, first observed during the 2018 annual inspection, was observed again in 2022. Inspectors were unable to discern the variations during the 2024 inspection. Inspectors will continue to monitor the variation.

Inspectors found several new young woody plants growing on side slopes of the disposal cell (PL-10). The plants will be cut or treated, or both, before the next inspection. Sediment accumulation and nonwoody vegetation growth was observed on the east side slope and will be monitored (PL-11). No other maintenance needs were identified.

4.4.2.3 Drainage Ditches

Rock-armored drainage ditches are constructed at the toes of the side slopes on the east (Ditch No. 1), south (Ditch No. 2), and northwest and west (Ditch No. 3) sides of the disposal cell. Stormwater is directed into these ditches and conveyed away from the site into natural drainages. The ditches have sufficient depth and rock protection to carry stormwater runoff from a probable maximum precipitation event. Erosion occurs on some of the steep slopes above the ditches, depositing sediment in the riprap-armored channel. This sediment favors plant establishment but does not adversely affect the performance of the ditches, so maintenance is not required. The riprap-covered outflows of the drainage ditches were designed to self-armor over time.

Inspectors observed silt accumulation and vegetation growth along Ditch No. 1 (PL-12), but no more than in previous years. Inspectors observed silt accumulation and vegetation growth (PL-13) along Ditch No. 2, but no more than previous years. A large boxelder tree is still growing along the edge of the south outflow channel but does not affect the stability or effectiveness of the channel. Grass and other plants are growing in the south outflow, and sediment accumulation was observed (PL-14). Ditch No. 3 was inspected, and no new findings were observed.

4.4.2.4 Holding Pond

Inspectors noted that the former holding pond area, removed in 2017, is revegetating successfully and contains several species of native, pollinator-friendly wildflowers. No evidence of erosion or damage to the newly vegetated area was observed. No maintenance needs were identified.

4.4.2.5 Site Boundary

Boundary monuments and perimeter signs delineate the site boundary with one exception: the site boundary marked by boundary monument BM-6 is not delineated with perimeter signs because the signs cut across the corner of the site (perimeter signs P82, P1, P2, and P3). Inspectors noted no new activities or changes to the site boundary area. Gullies on the southeast

and southwest portion of the site remain stable and do not threaten the integrity of the disposal cell or drainage ditches. No maintenance needs were identified.

4.4.2.6 Outlying Areas

The 0.25-mile area beyond the site boundary was visually observed for erosion, changes in land use, or other phenomena that might affect the long-term integrity of the site. No changes or new features were identified. Colorado Parks and Wildlife manages land to the north, west, and east of the site, and the U.S. Bureau of Reclamation manages land to the south. The primary land uses are wildlife habitat and recreation. Mountain bikers, hikers, and other recreational users commonly use La Plata County Road 212.

4.5 Follow-Up Inspections

LM will conduct follow-up inspections if (1) a condition is identified during the annual inspection or other site visit that requires a return to the site to evaluate the condition or (2) LM is notified by a citizen or outside agency that conditions at the site are substantially changed. No need for a follow-up inspection was identified in the 2024 annual inspection.

4.6 Maintenance

Maintenance identified in the 2023 inspection was performed on the following areas before the 2024 inspection:

- All tree seedlings on disposal cell side slopes were cut or treated, or both.
- Perimeters signs P13–P18 were chosen to be the test subjects for the water diversions installed above the signs to try to prevent undercutting. Undercut bases were restored.

Inspectors noted the following maintenance needs that will be completed before the next inspection:

- Replace perimeter signs P1 and P82
- Treat new woody vegetation on the side slopes of the disposal cell
- Repair undercut perimeter signs P56, P57, P61, P62, and P79

4.7 Emergency Measures

Emergency measures are the actions that LM will take in response to “unusual damage or disruption” that threatens or compromises site safety, security, or integrity in compliance with Criterion 12 of 10 CFR 40, Appendix A. No need for emergency measures was identified.

4.8 Environmental Monitoring

4.8.1 Groundwater Monitoring

LM conducts annual groundwater sampling and analysis to monitor disposal cell performance. The monitoring network consists of seven wells, including three POC wells, three wells monitored as a best management practice, and one background well (Figure 4-2). The most recent annual sampling event occurred at the site in June 2024.

The LTSP (DOE 2019) establishes three POC wells at the site: wells 0607, 0612, and 0621. These wells are completed in the uppermost aquifer (bedrock of the Cliff House Sandstone and the Menefee Formation) because of the limited extent of saturated alluvium underlying the site. A background well (well 0605) is also completed in the uppermost bedrock aquifer. Monitoring wells 0608, 0618, and 0623 are completed in the overlying alluvium.

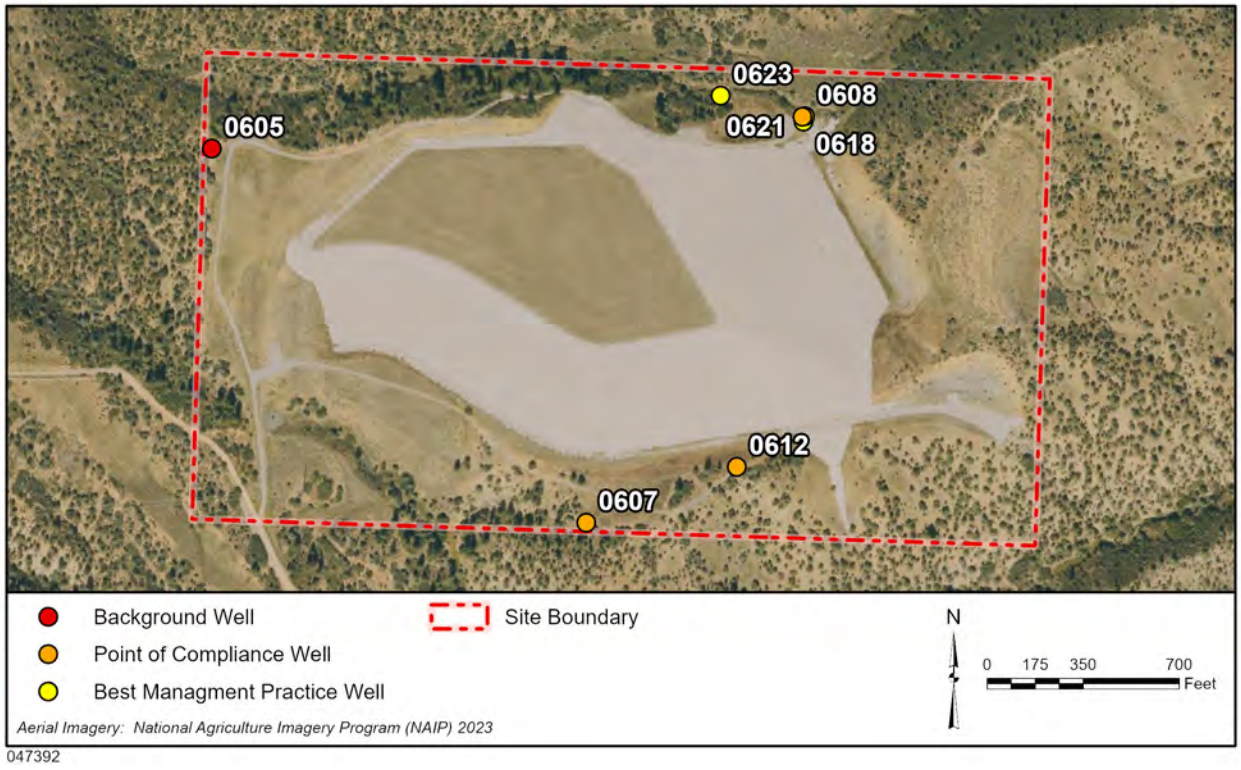


Figure 4-2. Groundwater Monitoring Network for the Durango, Colorado, Disposal Site

In addition to the annual sampling event and as a best management practice, LM samples monitoring wells 0608 and 0618 and POC well 0621 on a monthly basis (weather permitting) to monitor variable uranium concentrations in well 0618 that are typically above site-specific thresholds. Table 4-2 presents the current groundwater monitoring network.

Table 4-2. Groundwater Monitoring Network for the Durango, Colorado, Disposal Site

Monitoring Well	Well Compliance Type	Hydrologic Relationship (LTSP)
0605	Background	Upgradient (bedrock aquifer)
0607	POC	Downgradient (uppermost aquifer)
0608	NA	Downgradient (alluvium)
0612	POC	Downgradient (bedrock aquifer)
0618	NA	Downgradient (alluvium)
0621	POC	Downgradient (bedrock aquifer)
0623	NA	Upgradient (alluvium)

Note:
Monitoring wells sampled as a best management practice have no compliance type and are indicated as NA.

Abbreviation:
NA = not applicable

Groundwater is sampled annually for three constituents: molybdenum, selenium, and uranium. The site-specific concentration thresholds or standards for the three constituents represent the respective maximum observed background concentrations reported in groundwater samples collected from wells completed in the bedrock aquifer, as identified in Table 4 of the LTSP (DOE 2019). Table 4-3 provides these site-specific standards.

Table 4-3. Site-Specific Groundwater Standards for the Durango, Colorado, Disposal Site Based on Background Concentrations

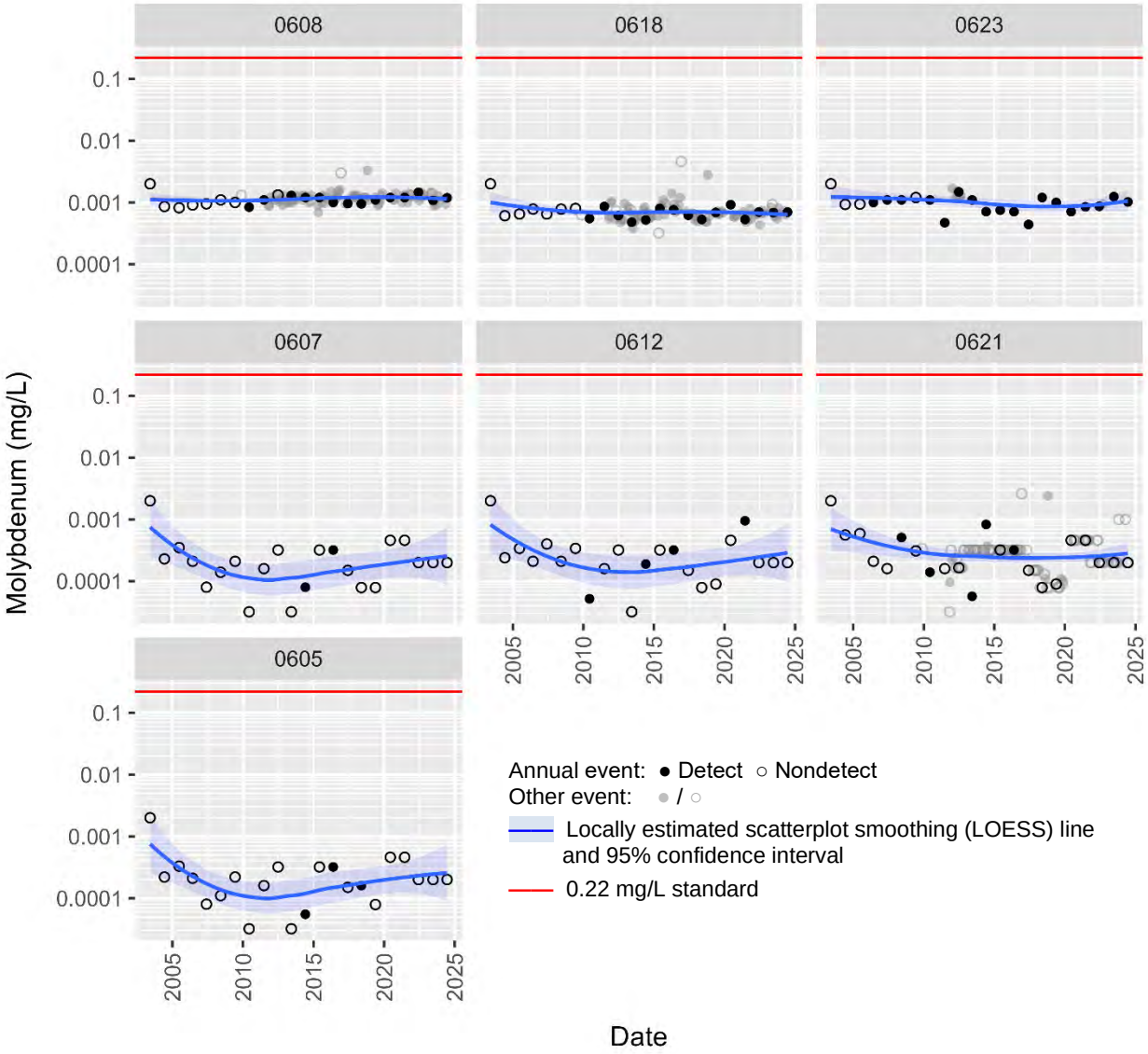
Constituent	Standard (mg/L)
Molybdenum	0.22
Selenium	0.042
Uranium	0.077

Abbreviation:
mg/L = milligrams per liter

Figure 4-3 through Figure 4-5 show the time-concentration plots for the three constituents, along with corresponding site-specific standards. These figures were developed using a faceting approach, whereby data are partitioned into a matrix of panels, with each panel plotting data for a single well. In each facet plot, a nonparametric smoothing method—locally estimated scatterplot smoothing (LOESS)—is used. The surrounding shaded area represents the 95% pointwise confidence interval. Because of the wide range in indicator parameter concentrations measured in site wells, a semilogarithmic scale is used.[1] All groundwater monitoring results plotted in the following figures are reported and published on the LM Geospatial Environmental Mapping System (GEMS) website (https://gems.lm.doe.gov).

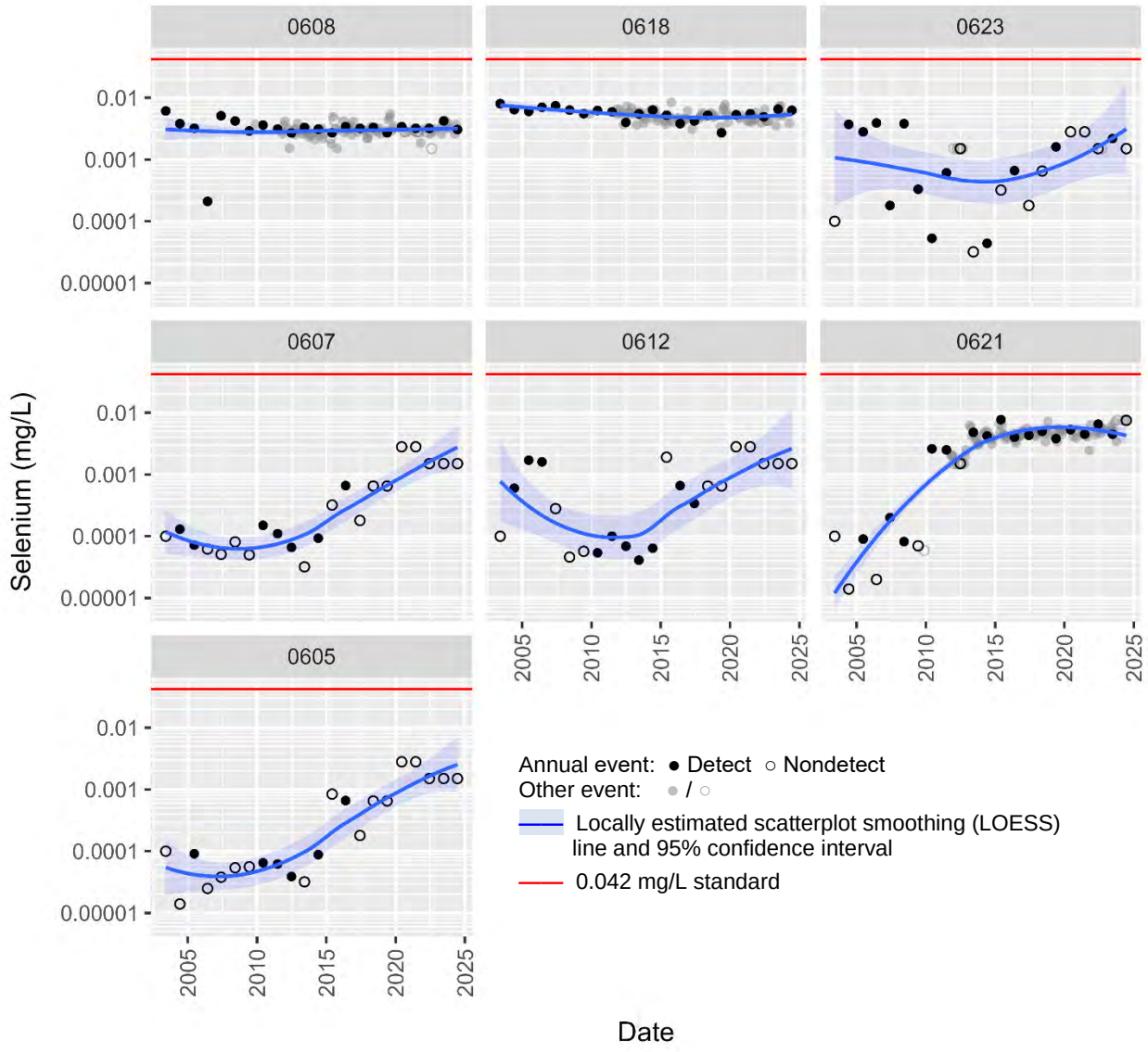
[1] These figures were developed using R, version 4.3.3 (R Core Team 2024), and the ggplot2 package, version 3.5.1 (Wickham 2016).

As shown in Figure 4-3 through Figure 4-5, concentrations of indicator parameters (molybdenum, selenium, and uranium) in POC wells 0607, 0612, and 0621 in the uppermost aquifer continue to be below respective standards. Uranium concentrations in well 0618 have consistently been variable and typically higher than concentrations in the other onsite wells.



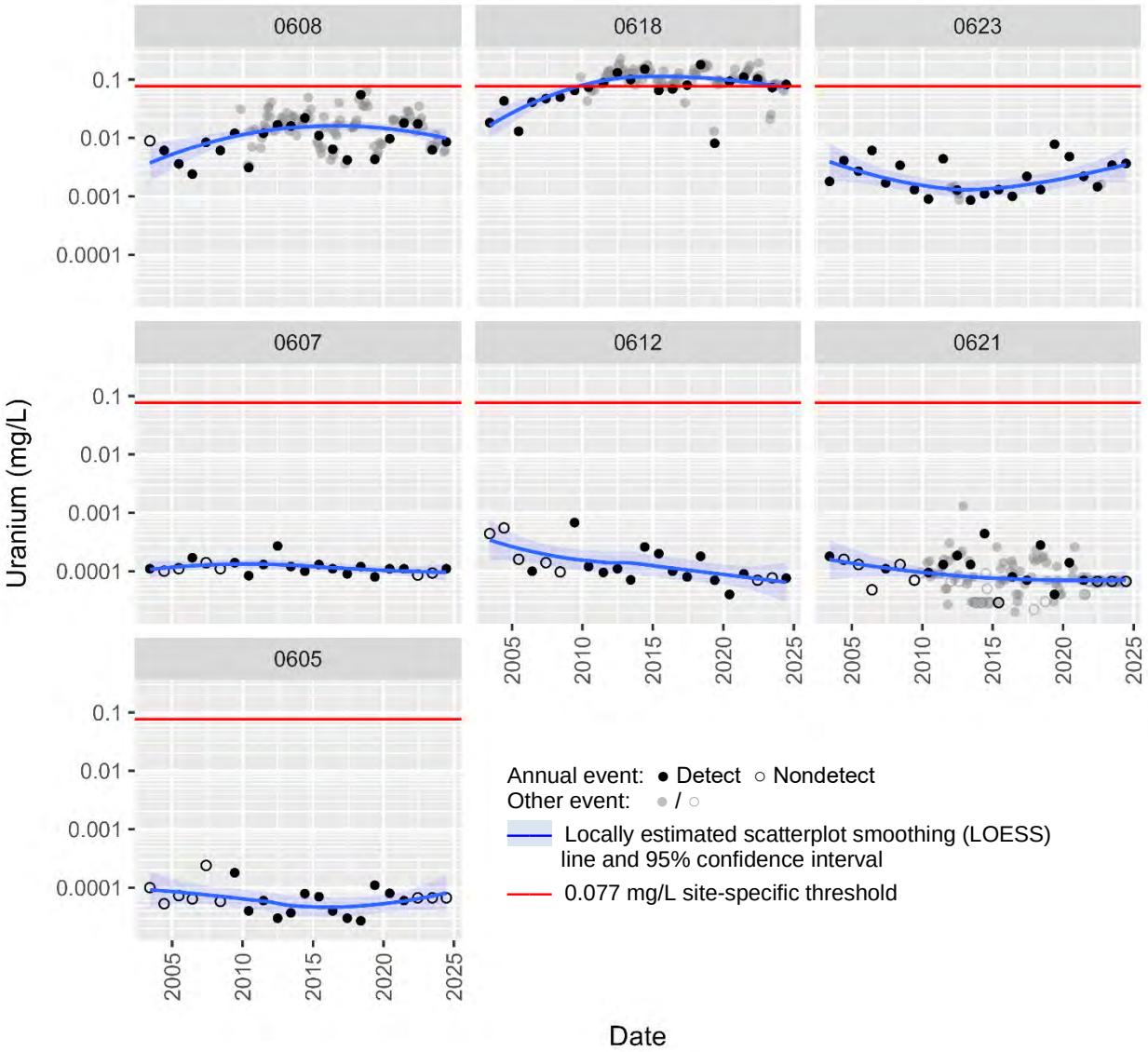
Notes: Wells are ordered by purpose: alluvial monitoring wells are listed in the top row, followed by POC wells (second row). Data for background well 0605 are plotted last.
Abbreviation: mg/L = milligrams per liter

Figure 4-3. Molybdenum Concentrations in Groundwater at the Durango, Colorado, Disposal Site, 2003–2024



Notes: Wells are ordered by purpose: alluvial monitoring wells are listed in the top row, followed by POC wells (second row). Data for background well 0605 are plotted last.
Abbreviation: mg/L = milligrams per liter

Figure 4-4. Selenium Concentrations in Groundwater at the Durango, Colorado, Disposal Site, 2003–2024



Notes: Wells are ordered by purpose: alluvial monitoring wells are listed in the top row, followed by POC wells (second row). Data for background well 0605 are plotted last.
Abbreviation: mg/L = milligrams per liter

Figure 4-5. Uranium Concentrations in Groundwater at the Durango, Colorado, Disposal Site, 2003–2024

4.8.2 Vegetation Monitoring

Several noxious weeds were identified at the time of the inspection and will be treated before the next year's inspection.

4.9 Corrective Action

The LTSP, Section 3.6, describes the criteria for corrective action. No need for corrective action was identified.

4.10 References



Note

Site-related documents are available on the LM public webpages at https://lmpublicsearch.lm.doe.gov/SitePages.

10 CFR 40 Appendix A. U.S. Nuclear Regulatory Commission, "Criteria Relating to the Operation of Uranium Mills and the Disposition of Tailings or Wastes Produced by the Extraction or Concentration of Source Material from Ores Processed Primarily for Their Source Material Content," *Code of Federal Regulations*.

10 CFR 40.27. U.S. Nuclear Regulatory Commission, "General License for Custody and Long-Term Care of Residual Radioactive Material Disposal Sites," *Code of Federal Regulations*.

DOE (U.S. Department of Energy) 2019. *Long-Term Surveillance Plan for the Durango, Colorado, Disposal Site*, LMS/DUD/S06297, Office of Legacy Management, May.

R Core Team, 2024. "R: A Language and Environment for Statistical Computing," The R Foundation for Statistical Computing, version 4.3.3, https://www.R-project.org, accessed October 31, 2024.

Wickham, H., 2016. "ggplot2: Elegant Graphics for Data Analysis," Springer-Verlag, New York, https://ggplot2.tidyverse.org, accessed October 31, 2024.

4.11 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	247	Access Road Erosion
PL-2	0	Perimeter Sign P1 Missing
PL-3	67	Perimeter Sign P82 Missing
PL-4	225	Perimeter Sign P29 with Undercut Base but Stable
PL-5	45	Perimeter Sign P56 with Undercut Base and Unstable
PL-6	292	Perimeter Sign P62 with Undercut Base and Unstable
PL-7	45	Perimeter Sign P74 with Bullet Holes
PL-8	0	Site Marker SMK-1 at Entrance Gate
PL-9	202	South Side Slope
PL-10	67	Woody Plant Growing in Riprap
PL-11	247	East Side Slope—Sediment Accumulation and Vegetation Growth
PL-12	157	Ditch No. 1—Silt Accumulation and Vegetation Growth
PL-13	67	Ditch No. 2—Nonwoody Vegetation
PL-14	0	South Outflow—Vegetation Growth



PL-1. Access Road Erosion



PL-2. Perimeter Sign P1 Missing



PL-3. Perimeter Sign P82 Missing



PL-4. Perimeter Sign P29 with Undercut Base but Stable



PL-5. Perimeter Sign P56 with Undercut Base and Unstable



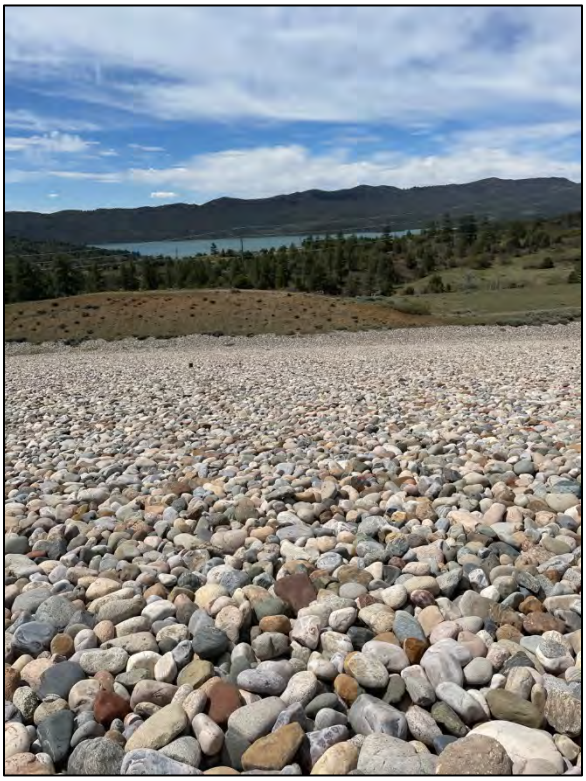
PL-6. Perimeter Sign P62 with Undercut Base and Unstable



PL-7. Perimeter Sign P74 with Bullet Holes



PL-8. Site Marker SMK-1 at Entrance Gate



PL-9. South Side Slope



PL-10. Woody Plant Growing in Riprap



PL-11. East Side Slope—Sediment Accumulation and Vegetation Growth



PL-12. Ditch No. 1—Silt Accumulation and Vegetation Growth



PL-13. Ditch No. 2—Nonwoody Vegetation



PL-14. South Outflow—Vegetation Growth

5.0 Falls City, Texas, Disposal Site

5.1 Compliance Summary

The Falls City, Texas, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site was inspected on April 2, 2024. No changes were observed in the disposal cell or associated drainage features, and personnel found no cause for a follow-up inspection.

The U.S. Department of Energy (DOE) Office of Legacy Management (LM) conducts annual groundwater monitoring as a best management practice. LM conducts two types of groundwater monitoring at the Falls City site: disposal cell performance monitoring and groundwater compliance monitoring. In the original Long-Term Surveillance Plan (DOE 1997b) (1997 LTSP), DOE committed to 5 years of disposal cell performance monitoring for changes in groundwater quality over the initial ambient conditions. In the original Groundwater Compliance Action Plan (DOE 1998), DOE proposed a compliance strategy of no groundwater remediation and application of supplemental standards because site-related contamination in the uppermost aquifer poses no risk to human health as it is not used for human consumption and is classified as limited use. The limited use classification was due to widespread ambient contamination not due to milling and that could not be cleaned up with methods reasonably employed by public water systems. Therefore, no concentration limits or points of compliance have been established.

In 2008, DOE issued an updated LTSP, the *Long-Term Surveillance Plan for the U.S. Department of Energy Falls City Uranium Mill Tailings Disposal Site, Falls City, Texas* (DOE 2008). DOE committed to continue annual groundwater monitoring as a best management practice. DOE submitted the *Groundwater Monitoring Assessment, Falls City, Texas, Disposal Site* (DOE 2010) to the U.S. Nuclear Regulatory Commission (NRC) in 2010. In the 2010 report, DOE evaluated groundwater monitoring results from 2006 to 2010 and compared them to previous results. DOE recommended termination of the monitoring program based on the requirements specified in the 2008 LTSP and requested concurrence from NRC for groundwater monitoring activities to be discontinued at the site (Dayvault 2010). Because DOE has not received concurrence from NRC regarding the request, annual best management practice groundwater monitoring continues to be conducted. The most recent sampling event occurred on January 31, 2024.

5.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the site-specific 2008 LTSP in accordance with procedures established to comply with the requirements of the NRC general license at Title 10 *Code of Federal Regulations* Section 40.27 (10 CFR 40.27). Table 5-1 lists these requirements.

Table 5-1. License Requirements for the Falls City, Texas, Disposal Site

Requirement	LTSP	This Report	10 CFR 40.27
Annual Inspection and Report	Section 3.3	Section 5.4	(b)(3)
Follow-Up Inspections	Section 3.4	Section 5.5	(b)(4)
Maintenance	Section 3.5	Section 5.6	(b)(5)
Emergency Response	Section 3.6	Section 5.7	(b)(5)
Environmental Monitoring	Section 3.7	Section 5.8	(b)(2)

5.3 Institutional Controls

The 231-acre site, identified by the property boundary shown in Figure 5-1, is owned by the United States and was accepted under the NRC general license in 1997. DOE is the licensee and, in accordance with the requirements for UMTRCA Title I sites, LM is responsible for the custody and long-term care of the site. Institutional controls (ICs) at the site include federal ownership of the property, administrative controls, and the following physical ICs that are inspected annually: the disposal cell and associated drainage structures, entrance gate and sign, perimeter fence and signs, site markers, survey and boundary monuments, and wellhead protectors.

An adjacent 513-acre offsite property was sold by the State of Texas to Alamo Funding Group in 2005. The state initially acquired this land as part of the designated processing site, but this portion of the processing site was not incorporated into the final DOE-owned site. The warranty deed stipulates that the new owners agree not to use any groundwater underlying the property for commercial or industrial uses in accordance with requirements for parcel transfers stipulated in UMTRCA. No human habitation structures will be constructed on the property, and nothing may be done to affect groundwater quality or interfere with UMTRCA groundwater remediation activities. Permission must be obtained from the Texas Commission on Environmental Quality and LM before (1) constructing wells or otherwise exposing groundwater to the surface; (2) performing construction, excavation, or soil removal of any kind; or (3) selling the property. Alamo Funding Group subdivided the land and sold it to two parties in 2011 and 2012. LM confirmed that the deed restrictions remained in recorded real property documents. The two landowners will seek approval from LM and the state for any future construction.

5.4 Inspection Results

The site, 8 miles southwest of Falls City, Texas, was inspected on April 2, 2024, by J. Graham and L. Martin of the Legacy Management Support (LMS) contractor. C. Boger (LM site manager) and R. Lyssy (LMS maintenance subcontractor) attended the inspection. The purposes of the inspection were to confirm the integrity of visible features at the site, identify changes in conditions that might affect conformance with the 2008 LTSP, and evaluate whether maintenance or follow-up inspection and monitoring are needed.

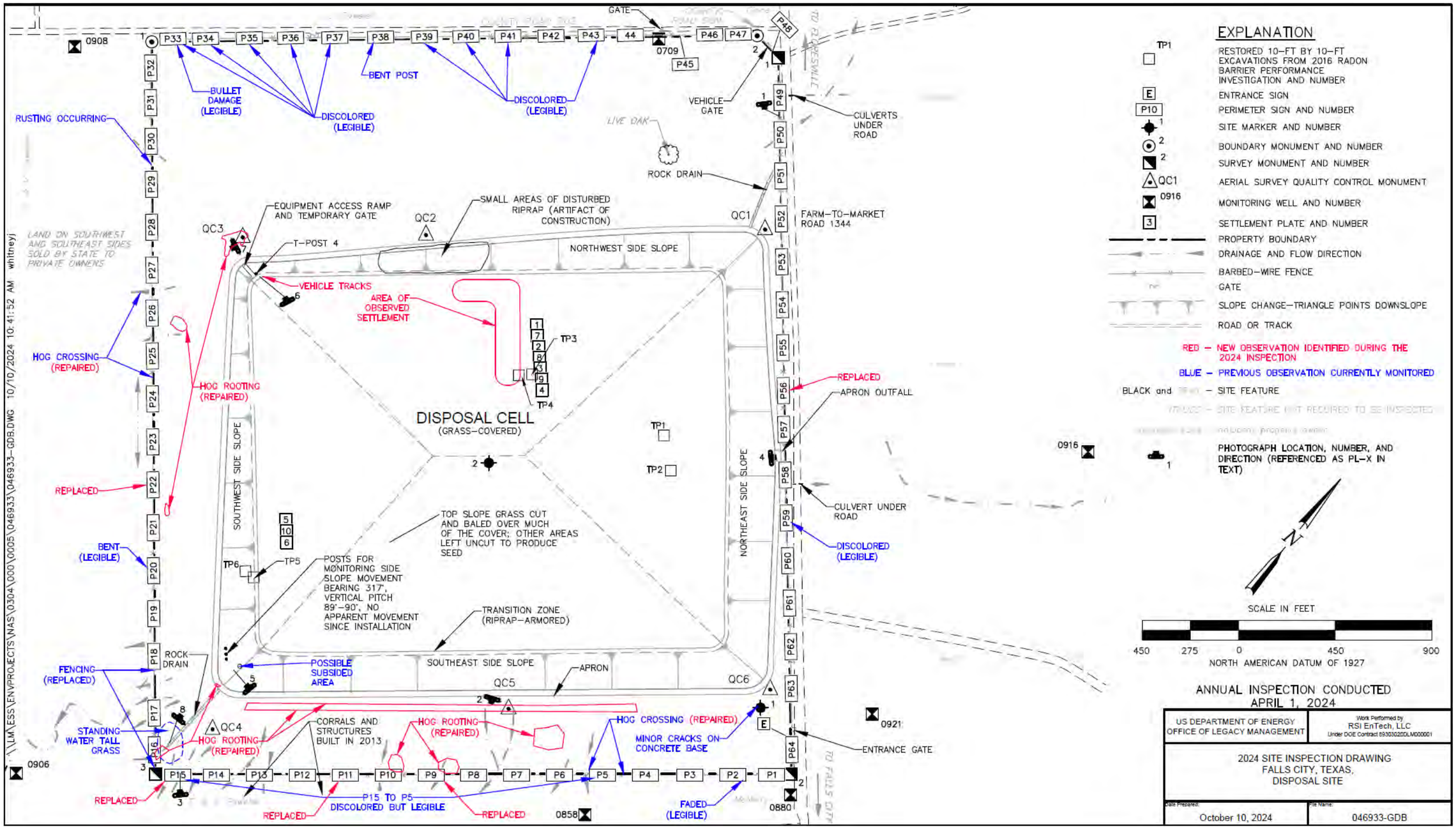


Figure 5-1. 2024 Annual Inspection Drawing for the Falls City, Texas, Disposal Site

5.4.1 Site Surveillance Features

Figure 5-1 shows the locations of site features, including site surveillance features and inspection areas, in black and gray font. Some site features that are present but not required to be inspected are shown in italic font. Observations from previous inspections that are currently monitored are shown in blue, and new observations identified during the 2024 annual inspection are shown in red. Inspection results and recommended maintenance activities associated with site surveillance features are described in the following subsections. Photographs to support specific observations are noted in the text and in Figure 5-1 by photograph location (PL) numbers. The photographs and photograph log are presented in Section 5.10.

5.4.1.1 Site Access, Entrance Gate, and Entrance Sign

Access to the site is from Farm-to-Market Road 1344. The entrance gate at the east corner of the site and the vehicle gate at the north corner were locked and functional. There are two entrance signs. One sign is on the north entrance, and one sign is on the east entrance. The east entrance sign was illegible and was replaced following the inspection. No other maintenance needs were identified.

5.4.1.2 Perimeter Fence and Signs

A five-strand barbed-wire perimeter fence encloses the site. As noted in previous inspections, perimeter fence strands and posts are beginning to rust except along the northwest side where the fence was replaced in 2006. The general fence conditions are poor (PL-1), and the fence is scheduled to be replaced. The rusting occurring between perimeter signs P29 and P32 that was identified in the 2023 inspection will continue to be monitored. The post at perimeter sign P38 is bent but functional.

Due to an influx in invasive animal activity in the area, multiple locations on the west, southwest, south, and southeast portions of the site were identified during the inspection, where surficial damage has occurred due to hog rooting (PL-2). Additionally, multiple hog crossing areas along the west, southwest, south, and southeast portions of the fence line were identified during the 2024 site inspection. The crossings are routinely repaired by the LMS maintenance subcontractor, as these crossings can potentially compromise the integrity of the perimeter fence or damage haying equipment. Hogs have not been able to access the disposal cell due to the riprap. The planned fence replacement, mentioned above, will incorporate design features to deter feral hogs from entering the site.

There are 64 perimeter signs attached to steel posts set in concrete and positioned along the property boundary and set back 5 feet (ft). Perimeter signs P9, P11, P15 (PL-3), P22, and P56 were illegible and faded and were replaced following the inspection. Perimeter sign P33 has bullet damage but remains legible. Additional perimeter signs are fading but remain legible. No other maintenance needs were identified.

5.4.1.3 Site Markers

The site has two site markers. Site marker SMK-1 is just inside the entrance gate. The corners of the concrete base around the marker are cracked. The cracks are unchanged since the last inspection, and repairs are not needed. No maintenance needs were identified.

5.4.1.4 Survey and Boundary Monuments

Three survey monuments and two boundary monuments delineate the corners of the property. No maintenance needs were identified.

5.4.1.5 Aerial Survey Quality Controls Monuments

Six aerial survey quality control monuments were installed in February 2023. All monuments were in good condition during the inspection. No maintenance needs were identified.

5.4.1.6 Monitoring Wells

There is one monitoring well onsite; 11 monitoring wells are offsite. All monitoring wells were inspected during the January 2024 sampling event, and wellhead protectors were undamaged and locked. No maintenance needs were identified.

5.4.2 Inspection Areas

In accordance with the 2008 LTSP, the site was divided into three inspection areas (referred to as "transects" in the LTSP) to ensure a thorough and efficient inspection. The inspection areas are (1) the top and side slopes of the disposal cell, apron outfall (PL-4), and rock drains; (2) the region between the apron at the toe of the side slopes and the site perimeter; and (3) the outlying area. Inspectors examined specific site surveillance features within each area and looked for evidence of erosion, settling, slumping, or other modifying processes that might affect the site's conformance with LTSP requirements.

5.4.2.1 Top and Side Slopes of the Disposal Cell, Apron Outfall, and Rock Drains

The disposal cell, completed in 1994, occupies 127 acres. Its vegetated cover consists primarily of well-established coastal Bermudagrass and kleingrass, with other species interspersed. The site, including the disposal cell, is managed for hay production, which ensures that turf vitality is maintained. The LMS maintenance subcontractor can take as many as three cuttings of hay each year from the site. The LMS maintenance subcontractor spot-sprays woody vegetation distributed in the uncut grass. At the time of the April 2024 inspection, hay bales were not present on the property.

During the inspection, potential settling on the northwest portion of the top cover was identified. LMS engineers reviewed baseline aerial survey data collected in April 2024 and the site's Completion Report and determined that this settling on top of the disposal cell was within design specifications and does not threaten the integrity of the disposal cell (DOE 1996). This area will continue to be monitored for any significant changes.

On the southwest side slope, there was tall grass overgrown at the transition point from the top of the side slope to the riprap side slope that was treated following the inspection (PL-5). LM has also monitored several small depressions on the northwest side slope of the disposal cell since 2010. These depressions do not compromise the protectiveness of the riprap side slope, and no changes have been observed since 2010. Inspectors will continue to monitor these areas.

An equipment access ramp to the top of the disposal cell is at the west corner of the side slope. The ramp was installed in 2006 using clean, angular riprap of progressively smaller rock sizes to provide a free-draining and stable driving surface that does not encourage vegetation encroachment. During the 2024 inspection, an area of possible erosion was identified on the north side of the ramp, but after a subject matter expert reviewed the area, it was determined to be vehicle or tractor tracks attributable to the ramp's intended use (PL-6). This area will continue to be monitored. Some displacement of smaller rock has occurred, as would be expected from use, but the ramp continues to provide a stable driving surface. During the 2024 inspection, hog damage was identified at the toe of the ramp and was repaired after the inspection (PL-7). The LMS maintenance subcontractor installed a temporary gate at the bottom of the disposal cell ramp to deter animals from accessing the top cover of the disposal cell on the smoother surface of the ramp.

Vegetation management is conducted on the top of the disposal cell and on the side slopes. Much of the vegetation observed on the side slopes was dead or dormant grass and continues to be treated by the subcontractor. The grass does not affect disposal cell performance. Because deep roots of woody vegetation could penetrate the radon barrier, woody vegetation is controlled annually through cutting and applying herbicide. A peach tree was observed growing on top of the disposal cell and was treated following the inspection. No additional maintenance concerns were noted on the top and side slopes of the disposal cell.

LM participated in a project sponsored by NRC to investigate the effect of soil-forming processes on the performance of the radon barrier on UMTRCA disposal cells. In April 2016, researchers excavated through the cover materials (cover soil and underlying radon barrier) at six locations to measure radon flux and document soil structure (Figure 5-1). Although significant soil structure was developing, radon flux did not exceed the U.S. Environmental Protection Agency (EPA) standard. LM will continue to monitor these locations to confirm that positive drainage is preserved and vegetation continues to thrive at the grass-covered test pits.

There was water slowly flowing in the south rock drain during the inspection with water ponding on the south corner (PL-8). Willows that grow along the south drain are periodically removed by the LMS maintenance subcontractor. No water was observed in the north rock drain. Vegetation is left uncut at the outlets of the rock drains to help dissipate the energy of stormwater runoff and reduce soil erosion. No maintenance needs were identified.

5.4.2.2 Region Between the Apron at the Toe of the Side Slopes and the Site Perimeter

The area between the perimeter fence and the apron at the toe of the disposal cell side slopes is covered with well-established grass, which is primarily kleingrass with some coastal Bermudagrass. The grass is cut and baled one to three times annually, depending on precipitation. It is usually left uncut along the fence, along rock drains, and around some surveillance features, such as survey monuments that cannot be accessed with conventional farming equipment. No maintenance needs were identified.

5.4.2.3 Outlying Area

The area 0.25 mile beyond the site boundary was visually observed for erosion, changes in land use, or other phenomena that might affect the long-term integrity of the site. No such impacts were observed.

A portion of the site has been sold to another owner who is using the area for occasional livestock grazing. The new owners have removed some of the brush on their property to facilitate grazing.

Karnes County Road 202 runs along the northwest side of the property boundary. Public access to the road was restricted by a locked gate before 2011. The road has been open since then, but this has not led to increased vandalism or trespassing at the site.

5.5 Follow-Up Inspections

LM will conduct follow-up inspections if (1) a condition is identified during the annual inspection or other site visit that requires a return to the site to evaluate the condition or (2) LM is notified by a citizen or outside agency that conditions at the site are substantially changed. No need for a follow-up inspection was observed.

5.6 Maintenance

Inspectors noted the following minor maintenance items that were completed following the inspection:

- Replacement of perimeter signs P9, P11, P15, P22, and P56
- Repair of the hog crossings between perimeter signs P4 and P5, P5 and P6, P24 and P25, P26 and P27
- Repair of the hog rooting areas on the west, southwest, and southeast outlying areas
- Removal of the tall grass and vegetation on the northeast and southwest side slope transitions

No other maintenance needs were identified.

5.7 Emergency Response

An emergency response is action LM will take in response to unusual damage or disruption that threatens or compromises site safety, security, or integrity in compliance with 10 CFR 40 Appendix A Criterion 12. No need for an emergency response was found.

5.8 Environmental Monitoring

5.8.1 Groundwater Monitoring

In accordance with the 2008 LTSP, annual groundwater monitoring is conducted as a best management practice. The most recent sampling event occurred in January 2024. The compliance strategy for groundwater protection at the site is no further remediation and application of supplemental standards in accordance with 40 CFR 192.21(g). Because supplemental standards apply to the uppermost aquifer at the site, no concentration limits or point of compliance locations have been established. Groundwater in the uppermost aquifer beneath the site meets the EPA definition of limited use (Class III) because it is not currently or potentially a source of drinking

water due to widespread ambient contamination that cannot be remediated using methods reasonably employed by public water supply systems (40 CFR 192.11[e]).

As prescribed in the LTSP, the site groundwater monitoring program has the following purposes:

- Disposal cell performance monitoring
- Groundwater compliance monitoring to demonstrate that potential users of groundwater downgradient of the site are not exposed to contamination related to the former processing site

Two hydraulically connected groundwater units comprise the uppermost aquifer beneath the site. The shallower of the two units consists of the Deweesville Sandstone, which is underlain by the Conquista Clay of the Whitsett Formation. Groundwater flow in the Conquista Clay occurs mainly in the middle sandstone subunit with clay subunits above and below, though continuously low permeability strata have not been identified (DOE 1997a). Thus, these two units together are often referred to as the Deweesville/Conquista aquifer. The Dilworth Sandstone of the Whitsett Formation is below the Conquista Clay.

A downward hydraulic gradient occurs between the Deweesville/Conquista aquifer to the Dilworth aquifer, but the main communication between the two occurs through past mining company boreholes that were not abandoned properly (DOE 1997a). With this, the Dilworth is included as part of the uppermost aquifer. The 2008 LTSP states that the Dilworth Sandstone is underlain by the Manning Clay, a 300-foot-thick aquitard that isolates the uppermost aquifer from higher-quality groundwater in deeper aquifers. Samples are collected from the Deweesville/Conquista and the Dilworth groundwater units. Table 5-2 describes the groundwater monitoring network at the site, which includes the disposal cell performance monitoring wells and the groundwater compliance monitoring wells.

Table 5-2. Groundwater Monitoring Network for the Falls City, Texas, Disposal Site

Groundwater Monitoring Purpose	Monitoring Wells	Completion Unit	Comments
Disposal cell performance monitoring	0880	Deweesville	Characterized by historic elevated uranium concentrations and low pH.
	0709, 0858, 0906, 0908, 0916, 0921	Conquista	Wells 0908 and 0916 have been dry since 1987.
Groundwater compliance monitoring	0886	Deweesville	Well 0886 is considered a sentinel well for groundwater flow toward the Conquista site.
	0924, 0963	Conquista	Well 0924 is considered a sentinel well for the Conquista Clay toward the south (DOE 1997a).
	0862, 0891	Dilworth	Well 0891 is considered a sentinel well for the Dilworth Sandstone toward the northeast (DOE 1997a).

Note:
Groundwater monitoring purpose and sentinel well designations are from DOE (1997a).

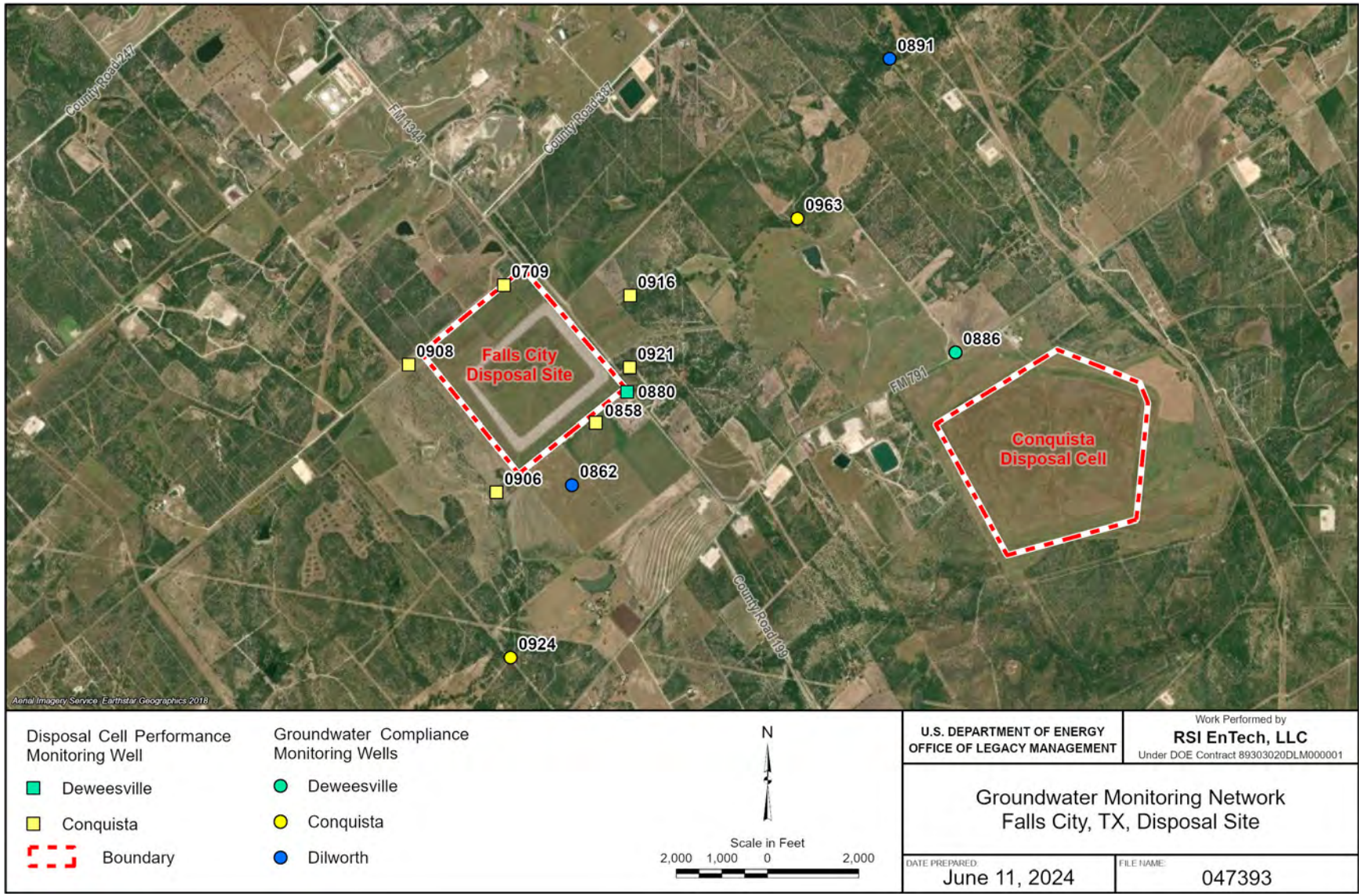
As shown in Figure 5-2, the disposal cell performance monitoring wells are near the disposal cell and are all completed in the Deweesville and Conquista units. The groundwater compliance monitoring wells are downgradient of the site and completed in the Deweesville and Conquista units and the Dilworth unit.

Groundwater is sampled annually for total uranium and field measurements of water level, temperature, pH, conductivity, turbidity, alkalinity, dissolved oxygen, and oxidation-reduction potential. Of particular interest are total uranium, pH, and water levels. The *Final Site Observational Work Plan for the UMTRA Project Site at Falls City, Texas* (DOE 1997a) identifies low pH in groundwater as an indicator of the extent and movement of the tailings-derived groundwater plumes. However, in the 2008 LTSP, subsequent monitoring results indicate that pH is not always an indicator of contaminant concentrations at the site. Therefore, increasing uranium concentrations at a monitoring well without an attendant drop in pH might still indicate movement of processing-related contamination.

The following sections (Sections 5.8.2 and 5.8.3) present monitoring results for groundwater elevations and groundwater quality (pH and uranium), respectively. To support these discussions, the time-series plots use a faceting approach, whereby data are partitioned into a matrix of panels, with each panel plotting data for a single well. In each facet plot, a nonparametric smoothing method—locally estimated scatterplot smoothing (LOESS)—is used. The surrounding shaded area represents the 95% pointwise confidence interval. Using this approach, overall trends in the data are more apparent and not obscured by "noise" or random variation. The time-series figures were developed using R, version 4.3.3 (R Core Team 2024), and the ggplot2 package, version 3.5.1 (Wickham 2016). Because of the wide range in uranium contaminant concentrations measured in site wells (0.00032–14 milligrams per liter [mg/L]), a semilogarithmic scale is used.

To support interpretation of these figures, Mann-Kendall trend analysis was performed for each well-parameter combination to assess whether trends in water levels, pH, or uranium are upward, stable (no trend), or declining. Detailed Mann-Kendall trend test results are documented at the end of Section 5.8.3 for the 1996–2024 time frame (Table 5-3). For wells with statistically significant trends in pH or uranium concentrations, the direction of the trend is indicated in the corresponding figures.

All groundwater monitoring results presented in the following sections are reported and published on the LM Geospatial Environmental Mapping System (GEMS) website (https://gems.lm.doe.gov).

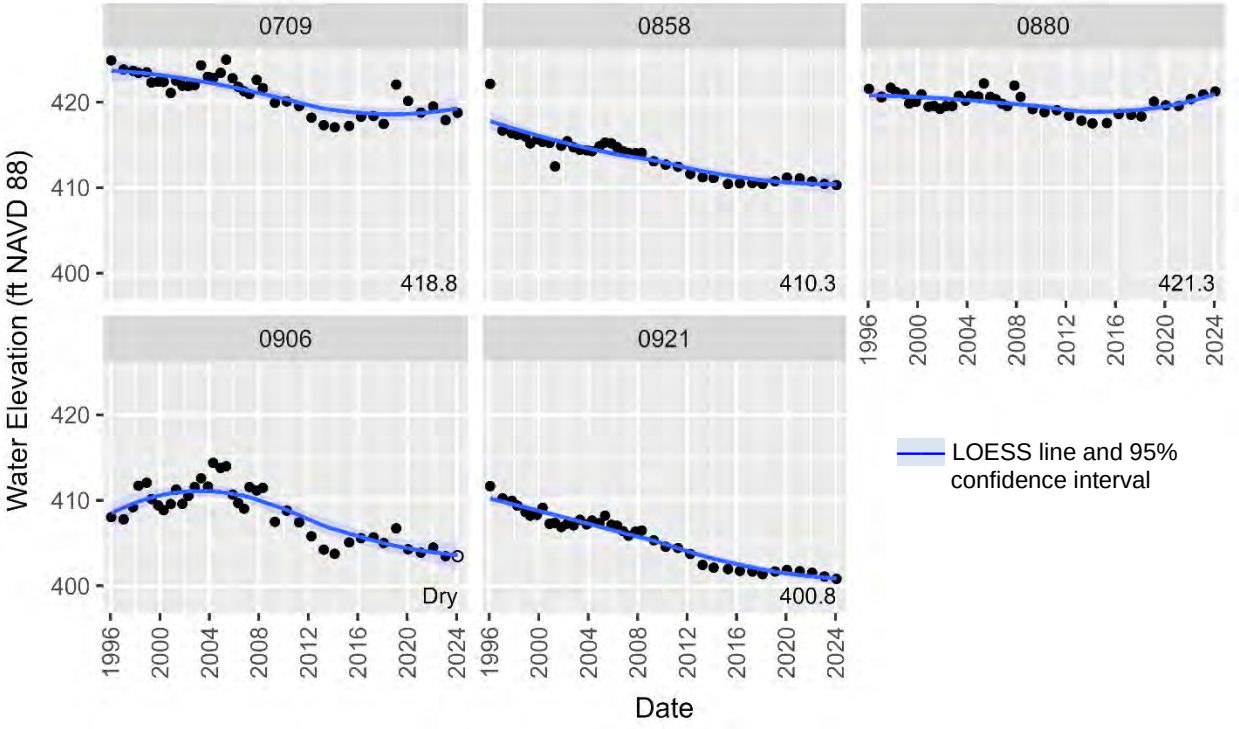


Note: The Conquista disposal site boundary is not finalized, so only the Conquista disposal cell boundary is outlined.

Figure 5-2. Groundwater Monitoring Well Network at the Falls City, Texas, Disposal Site

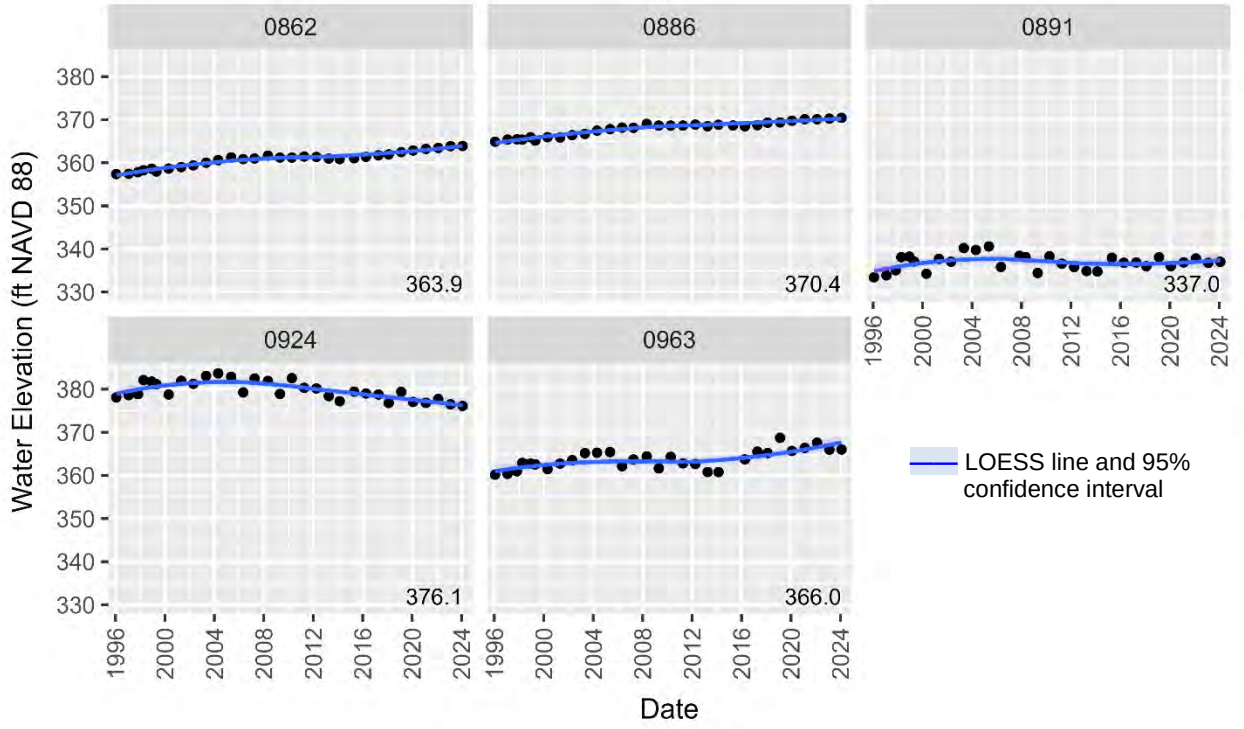
5.8.2 Groundwater Elevation Monitoring Results

Figure 5-3 and Figure 5-4 plot groundwater elevations measured between 1996 and 2024 in disposal cell performance and groundwater compliance monitoring wells, respectively. The data plotted in these figures are referenced to the North American Vertical Datum of 1988 (NAVD 88). Water levels in all disposal cell performance wells have statistically significant decreasing trends from 1996 to 2024 based on Mann-Kendall trend analyses (Table 5-3). Since 2018, however, water levels in most of these wells have been relatively stable and those in well 0880 have increased slightly.



Notes: Disposal cell performance monitoring wells 0908 and 0916 have been dry since 1987. The most recent (January 2024) water elevations are labeled in the lower right corner of each plot. A hollow symbol denotes that the well was dry or had insufficient water to sample.

Figure 5-3. Water-Level Measurements at Disposal Cell Performance Monitoring Wells at the Falls City, Texas, Disposal Site



Note: The most recent (January 2024) water elevations are labeled in the lower right corner of each plot.

Figure 5-4. Water-Level Measurements at Groundwater Compliance Monitoring Wells at the Falls City, Texas, Disposal Site

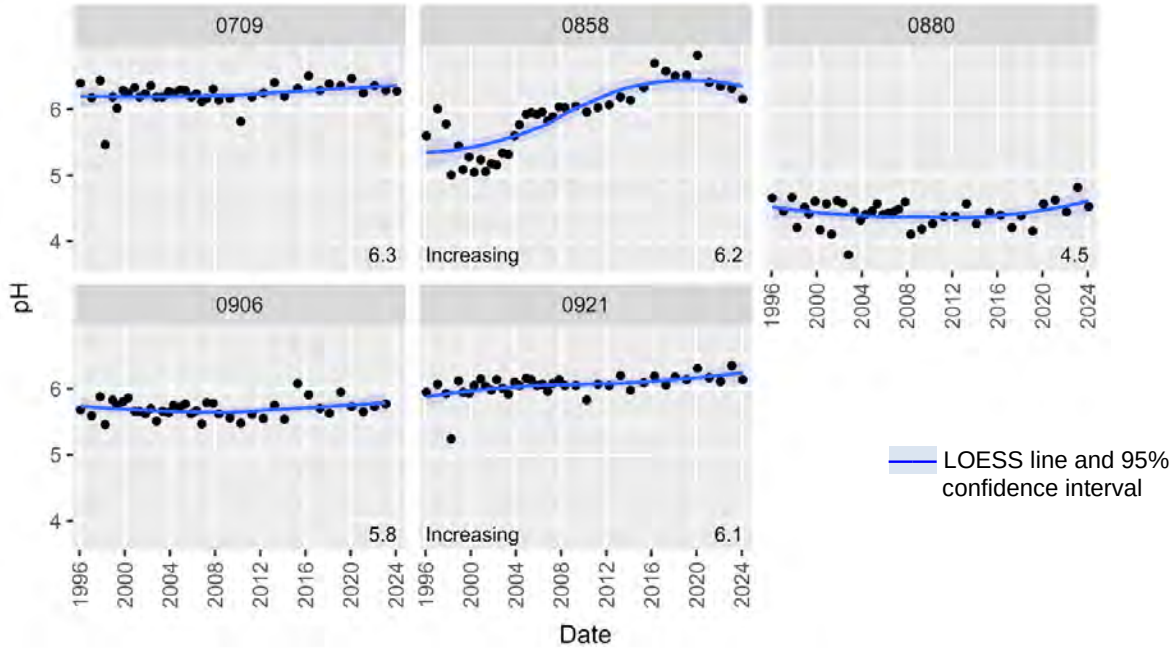
In contrast to the disposal cell monitoring wells (with predominantly decreasing trends), water elevations in most groundwater compliance wells are increasing or have no trend (Table 5-3). Water levels in wells 0862, 0886, and 0963 have increased significantly (5 to 7 ft) since 1996. Groundwater elevations in well 0891, completed in the Dilworth aquifer, have been relatively stable (no trend) at about 330–340 ft NAVD 88. A significant decreasing trend was found for well 0924, where water levels have declined 2.0 ft since 1996.

5.8.3 Groundwater Quality Monitoring Results

pH: As shown in Figure 5-5, trends in pH are stable (no trend) or increasing in all disposal cell performance monitoring wells; no recent changes are evident. The pH values in well 0880 remain relatively low, ranging from 3.8 to 4.8 for the 1996–2024 period shown in Figure 5-5. The most recent measurement (4.5) is over an order of magnitude lower than the pH in the remaining disposal cell monitoring wells (range of 5.8–6.5 in 2023–2024). The pH has been most variable in well 0858, where it increased significantly (by nearly 2 standard units [s.u.]) between 2002 and about 2018, but has since stabilized. An increasing trend was also found for well 0921, but this increase has been more gradual and the range in pH more narrow (5.2–6.4). No significant trends were identified for the remaining disposal cell performance wells.

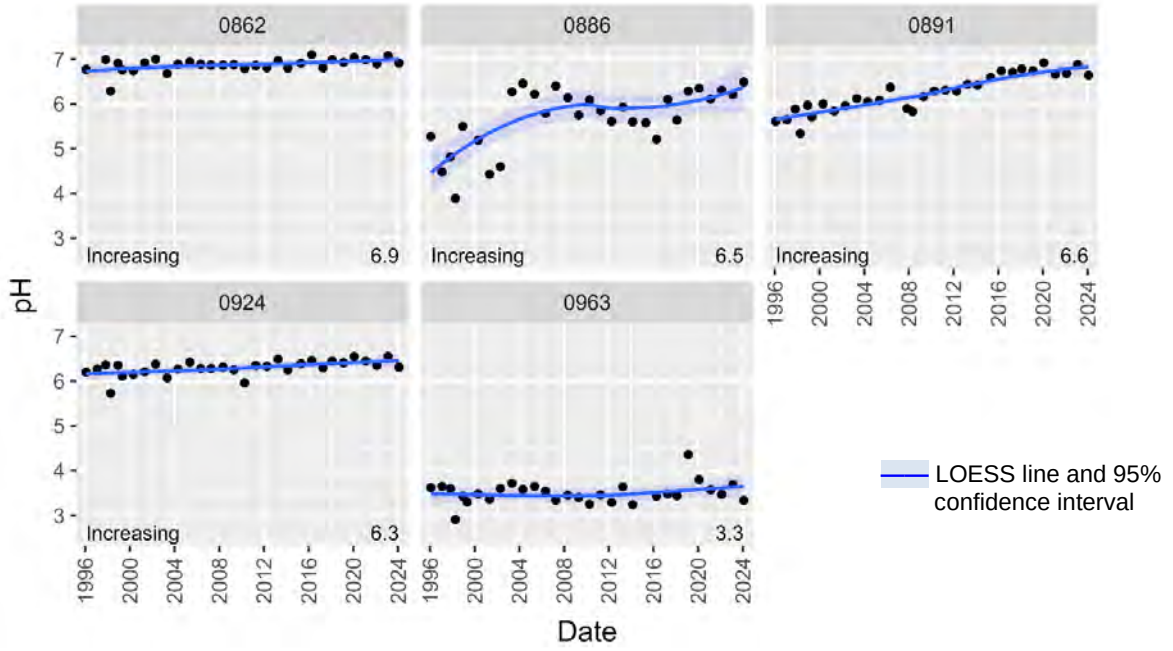
For compliance monitoring wells, statistically significant increasing trends in pH are found for all wells except well 0963 with no trend (Figure 5-6; Table 5-3). Historically, the pH in monitoring well 0963 has been lower than at the other groundwater compliance wells (and the

disposal cell performance monitoring wells), with a pH of 3.3 in 2024 compared to between 6.0 and 7.0 in the other compliance wells.



Notes: Disposal cell performance monitoring wells 0908 and 0916 have been dry since 1987; well 0906 was dry in 2024. The most recent pH values are labeled in the lower right corner of each plot.

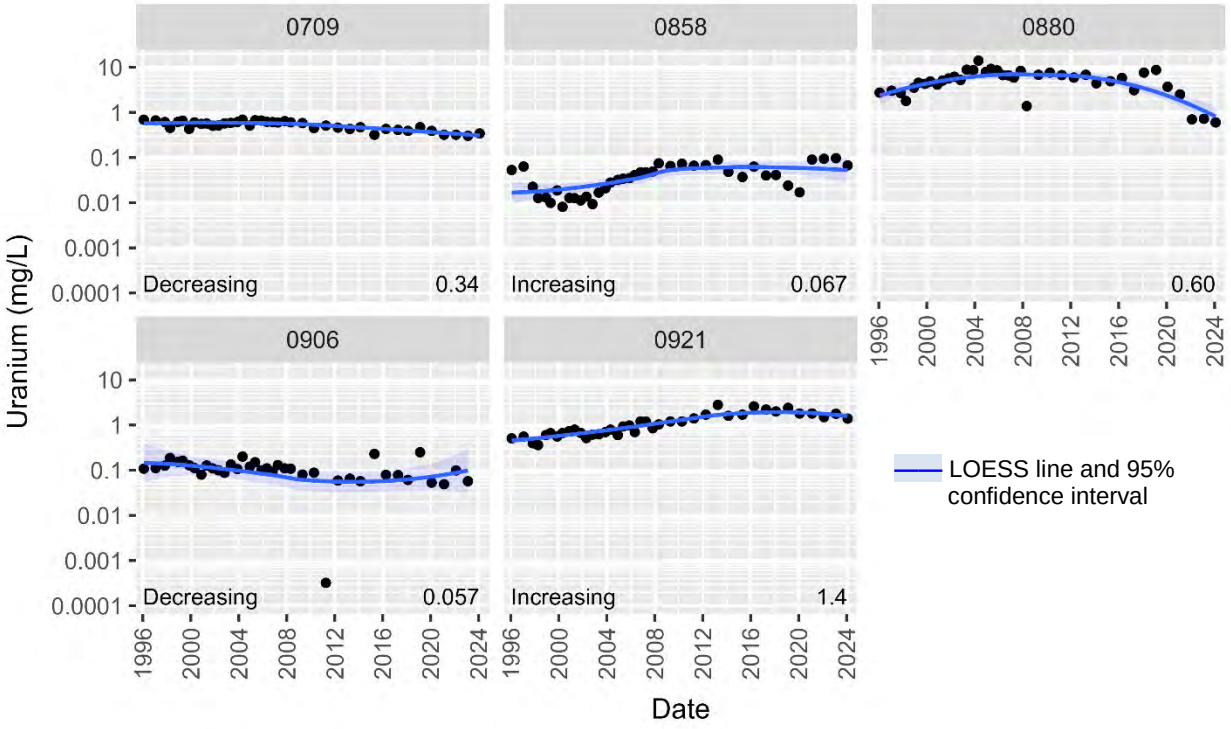
Figure 5-5. pH at Disposal Cell Performance Monitoring Wells at the Falls City, Texas, Disposal Site



Note: The most recent pH values are labeled in the lower right corner of each plot.

Figure 5-6. pH at Groundwater Compliance Monitoring Wells at the Falls City, Texas, Disposal Site

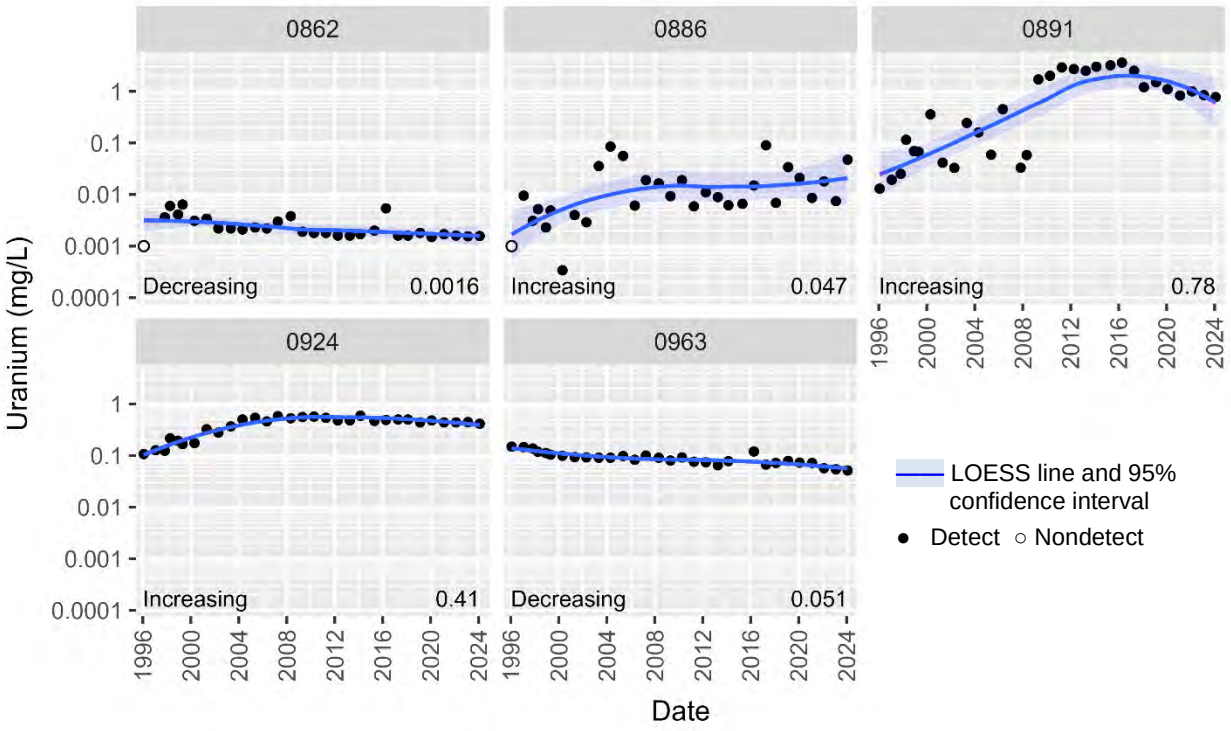
Uranium: The 2024 uranium concentrations for disposal cell performance monitoring wells are similar to those reported in recent years (Figure 5-7) (DOE 2024). No changes in trends were observed (Table 5-3). Using data since 1996, Mann-Kendall trend analysis indicates statistically significant increasing trends in wells 0858 and 0921 (Table 5-3). Significant decreasing trends were found for wells 0709 and 0906. Historically, uranium concentrations have been the highest in monitoring well 0880 (maximum of 14 mg/L in 2004). Although no significant trend was found for the 1996–2024 dataset (Table 5-3), uranium concentrations in well 0880 have been decreasing in the last 5 years (Figure 5-7). The 2024 result of 0.60 mg/L is the lowest on record for this well.



Note: The most recent uranium values are labeled in the lower right corner of each plot.

Figure 5-7. Uranium Concentrations at Disposal Cell Performance Monitoring Wells at the Falls City, Texas, Disposal Site

In 2024, uranium concentrations in groundwater compliance monitoring wells were consistent with the findings documented in the previous annual report (Figure 5-8) (DOE 2024). No changes in trends were observed (Table 5-3). Although statistically significant increasing uranium concentration trends were found for wells 0886, 0891, and 0924 for the 1996–2024 monitoring period (Table 5-3), trends in all three wells have since stabilized or declined. Uranium concentrations in well 0924 stabilized after about 2004 (most recent result of 0.41 mg/L), while those in farthest downgradient well 0891 (completed in the Dilworth aquifer) have declined since 2016. Significant decreasing uranium concentrations occurred at Dilworth well 0862 (characterized by low uranium concentrations) and well 0963.



Note: The most recent uranium values are labeled in the lower right corner of each plot.

Figure 5-8. Uranium Concentrations in Groundwater Compliance Monitoring Wells at the Falls City, Texas, Disposal Site

Table 5-3. Mann-Kendall Trend Analysis Results for Falls City Site Monitoring Wells, 1996–2024

Parameter	Well	Monitoring Purpose	Initial Trend Analysis Date[a]	Number of Samples	Mann-Kendall Trend Analysis Results[b]		
					Kendall's tau[c]	p-value[d]	Trend
Water Level	0709	Disposal Cell Performance	1/24/1996	40	−0.59	<0.001	Decreasing
Water Level	0858	Disposal Cell Performance	1/24/1996	40	−0.81	<0.001	Decreasing
Water Level	0880	Disposal Cell Performance	1/24/1996	41	−0.30	0.005	Decreasing
Water Level	0906	Disposal Cell Performance	1/24/1996	40	−0.46	<0.001	Decreasing
Water Level	0921	Disposal Cell Performance	1/24/1996	40	−0.87	<0.001	Decreasing
Water Level	0862	Groundwater Compliance	1/24/1996	31	0.85	<0.001	Increasing
Water Level	0886	Groundwater Compliance	1/24/1996	31	0.85	<0.001	Increasing
Water Level	0891	Groundwater Compliance	1/24/1996	31	0.028	0.84	No Trend
Water Level	0924	Groundwater Compliance	1/24/1996	31	−0.39	0.002	Decreasing
Water Level	0963	Groundwater Compliance	1/24/1996	30	0.50	<0.001	Increasing
pH	0709	Disposal Cell Performance	1/30/1996	40	0.19	0.09	No Trend
pH	0858	Disposal Cell Performance	1/28/1996	40	0.70	<0.001	Increasing
pH	0880	Disposal Cell Performance	1/25/1996	40	−0.06	0.59	No Trend
pH	0906	Disposal Cell Performance	1/30/1996	39	0.018	0.88	No Trend
pH	0921	Disposal Cell Performance	1/27/1996	40	0.40	<0.001	Increasing
pH	0862	Groundwater Compliance	1/30/1996	30	0.29	0.028	Increasing
pH	0886	Groundwater Compliance	1/25/1996	30	0.39	0.003	Increasing
pH	0891	Groundwater Compliance	1/27/1996	31	0.76	<0.001	Increasing
pH	0924	Groundwater Compliance	1/29/1996	31	0.43	<0.001	Increasing
pH	0963	Groundwater Compliance	1/26/1996	30	0.009	0.96	No Trend
Uranium	0709	Disposal Cell Performance	1/30/1996	40	−0.52	<0.001	Decreasing
Uranium	0858	Disposal Cell Performance	1/28/1996	40	0.50	<0.001	Increasing
Uranium	0880	Disposal Cell Performance	1/25/1996	40	0.015	0.90	No Trend
Uranium	0906	Disposal Cell Performance	1/30/1996	39	−0.41	<0.001	Decreasing[e]
Uranium	0921	Disposal Cell Performance	1/27/1996	40	0.73	<0.001	Increasing
Uranium	0862	Groundwater Compliance	1/30/1996	30	−0.54	<0.001	Decreasing
Uranium	0886	Groundwater Compliance	1/25/1996	31	0.34	0.007	Increasing
Uranium	0891	Groundwater Compliance	1/27/1996	31	0.45	<0.001	Increasing
Uranium	0924	Groundwater Compliance	1/29/1996	31	0.31	0.016	Increasing
Uranium	0963	Groundwater Compliance	1/26/1996	30	−0.76	<0.001	Decreasing

Notes:

[a] For most well-parameter combinations, the final trend analysis date for this period is January 31, 2024. The only exception is well 0906, last sampled on February 8, 2023 (the well was dry in 2024).

[b] Trend tests were performed using the Kendall package in R, version 2.2.1 (McLeod 2022). Trend analyses were conducted at the 0.05 significance level using a two-sided test.

[c] The test statistic, Kendall's tau, is a measure of the strength of the association between two variables, with values always falling between −1 and +1.

[d] A calculated p-value of <0.05 indicates that the null hypothesis is rejected and a significant trend in the time series exists.

[e] The decreasing trend for uranium in well 0906 is still statistically significant if the extreme low outlier (0.00032 mg/L in April 2011 [Figure 5-7]) is removed from the analysis. The results were nearly equivalent to those cited above.

5.8.4 Evaluation of Groundwater Monitoring

No change in disposal cell performance is indicated by the following data from the disposal cell performance monitoring wells: (1) overall decreasing water-level trends (Table 5-3 and Figure 5-3) and (2) no declining pH trends (Table 5-3 and Figure 5-5). These results are consistent with declining drainage rates of low-pH tailings pore water into the underlying geology. However, water levels in well 0880 have been trending higher since 2014 (Figure 5-3). Disposal cell performance wells 0858 and 0921 have statistically significant increases in uranium (Table 5-3), though the uranium increase in well 0921 occurred before 2014 (Figure 5-7). The uranium increase in well 0858 was mainly in the last 3 years (Figure 5-7).

Site-related contamination in the uppermost aquifer poses no risk to human health because groundwater from this aquifer is not used for human consumption and is designated as limited use. Potable water is produced locally from the Carrizo Sandstone that lies 2000 ft beneath the surface near the site. Additionally, a 300-foot-thick aquitard isolates the uppermost aquifer from the higher-quality groundwater in deeper aquifers.

For the groundwater compliance monitoring wells, wells 0886, 0891, and 0924 have statistically significant increasing uranium concentrations (Table 5-3), though these increases occurred in the past (Figure 5-8). According to DOE (1997a) and the 2008 LTSP, these results are not unexpected, as these three wells were at the downgradient edge of low-pH groundwater plumes with mill processing-derived fluids and elevated uranium concentrations. Currently, the pH values in these three wells are increasing (Figure 5-6 and Table 5-3), thereby confirming that in the longer term, the low-pH areas do not necessarily define areas with uranium contamination. This correlation of increasing uranium concentrations with decreasing pH was true in the past (DOE 1997a), during the continued addition of low-pH fluids from uranium processing, and low-pH fluids being produced by tailings oxidation. Currently, these processes are no longer occurring, and uranium concentrations can continue to increase even with increasing pH values.

The higher uranium concentrations in groundwater compliance well 0891, which increased between 1996 and 2016 and subsequently declined, likely reflects the passage of groundwater with elevated uranium flowing from the direction of former mill tailings (specifically tailings pile no. 3) (DOE 1997a). To maintain the protection of human health and the environment, LM is currently evaluating the groundwater flow and potential uranium transport downgradient of wells 0886, 0891, and 0924 to confirm that groundwater quality continues to meet the groundwater use classification.

Best management practice groundwater monitoring of the current monitoring well network will continue as scheduled until a modified frequency (based on LM's ongoing evaluation) receives NRC concurrence.

5.9 References



Note

Site-related documents are available on the LM public webpages at https://lmpublicsearch.lm.doe.gov/SitePages.

10 CFR 40 Appendix A. U.S. Nuclear Regulatory Commission, "Criteria Relating to the Operation of Uranium Mills and the Disposition of Tailings or Wastes Produced by the Extraction or Concentration of Source Material from Ores Processed Primarily for Their Source Material Content," *Code of Federal Regulations*.

10 CFR 40.27. U.S. Nuclear Regulatory Commission, "General License for Custody and Long-Term Care of Residual Radioactive Material Disposal Sites," *Code of Federal Regulations*.

40 CFR 192. U.S. Environmental Protection Agency, "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings," *Code of Federal Regulations*.

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McLeod, A.I., 2022. "Kendall: Kendall Rank Correlation and Mann-Kendall Trend Test," R package version 2.2.1, https://cran.r-project.org/web/packages/Kendall/index.html, accessed September 12, 2024.

R Core Team, 2024. "R: A Language and Environment for Statistical Computing," The R Foundation for Statistical Computing, version 4.3.3, https://www.r-project.org, accessed September 12, 2024.

Wickham, H., 2016. "ggplot2: Elegant Graphics for Data Analysis," Springer-Verlag, New York, https://ggplot2.tidyverse.org, accessed September 12, 2024.

5.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	135	Damaged Fence Line
PL-2	157.5	Hog Rooting in Southeast Outlying Area
PL-3	315	Faded Perimeter Sign P15
PL-4	45	Apron
PL-5	315	Vegetation Growth on Southwest Slope of Disposal Cell
PL-6	292.5	Vehicle Tracks on West Slope of Disposal Cell
PL-7	202.5	Hog Rooting at Base of Ramp
PL-8	—	Surface Water Present at South Rock Drain

Note:
— = Photograph taken vertically from above.



PL-1. Damaged Fence Line



PL-2. Hog Rooting in Southeast Outlying Area



PL-3. Faded Perimeter Sign P15



PL-4. Apron



PL-5. Vegetation Growth on Southwest Slope of Disposal Cell



PL-6. Vehicle Tracks on West Slope of Disposal Cell



PL-7. Hog Rooting at Base of Ramp



PL-8. Surface Water Present at South Rock Drain

6.0 Grand Junction, Colorado, Disposal Site

6.1 Compliance Summary

The Grand Junction, Colorado, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site was inspected on November 12 and December 17, 2024. No major changes were observed on the disposal cell or in the associated drainage features. Inspectors identified minor maintenance needs that will be addressed before the next inspection, but no cause for a follow-up inspection was identified.

A portion of the disposal cell remains open to receive low-activity radioactive materials from specified sources. The open disposal cell and its supporting structures and facilities are not included in the annual inspection. Ongoing disposal cell cover study areas, which include cover studies on top of the disposal cell and on lysimeter facilities adjacent to the north and west sides of the disposal cell, are not inspected. This annual inspection includes the closed portion of the disposal cell and the remaining portions of the disposal site.

The U.S. Department of Energy (DOE) Office of Legacy Management (LM) conducts annual groundwater monitoring at the site as a best management practice. Two monitoring wells (0731 and 0732) are sampled to verify that groundwater in onsite paleochannels is not affected by potential seepage from the disposal cell. A third monitoring well (0733) is primarily used to measure water levels within the disposal cell. These wells are routinely monitored for eight indicator analytes. Groundwater monitoring of all three wells was completed on July 23–24, 2024. Historical results for five of the indicator analytes—nitrate, selenium, uranium, sulfate, and total dissolved solids (TDS)—indicate that the two paleochannel wells may be affected by potential seepage from the disposal cell. Because there are no set compliance standards for this best management practice monitoring, no need for corrective action was identified. However, LM will continue to monitor these trends to ensure the protection of human health and the environment.

6.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the closed portion of the disposal cell and the remaining portions of the site are specified in the site-specific Interim Long-Term Surveillance Plan (DOE 1998) (LTSP) in accordance with procedures established to comply with the requirements of the U.S. Nuclear Regulatory Commission (NRC) general license at Title 10 *Code of Federal Regulations* Section 40.27 (10 CFR 40.27). Table 6-1 lists these requirements.

Table 6-1. Interim Requirements for the Grand Junction, Colorado, Disposal Site

Requirement	LTSP	This Report	10 CFR 40.27
Annual Inspection and Report	Sections 3.0 and 6.2	Section 6.4	(b)(3)
Follow-Up Inspections	Section 3.4	Section 6.5	(b)(4)
Maintenance and Repairs	Sections 2.7.3 and 4.0	Section 6.6	(b)(5)
Groundwater Monitoring	Section 2.6	Section 6.7	(b)(2), (b)(3)
Corrective Action	Section 5.0	Section 6.8	—

In December 2020, Congress passed legislation that extends the final disposal cell closure date from 2023 to 2031. Unless additional legislation is enacted by Congress to further extend the final cell closure date, LM's operations to receive radioactive waste at the site are planned to cease in September 2031. Following final closure of the disposal cell, the Interim LTSP (DOE 1998) for the site will be revised and finalized; with NRC acceptance of the final LTSP, the site will be subject to the NRC general license.

6.3 Institutional Controls

The 360-acre site, identified by the property boundary shown in Figure 6-1, is owned by the United States. Low-activity radioactive waste will be received until the disposal cell's legally mandated closure date or until it is filled to capacity, whichever comes first. Institutional controls (ICs) at the site include federal ownership of the property, administrative controls, and the following physical ICs that are inspected annually: the closed portion of the disposal cell and associated drainage features, access and entrance gates and signs, perimeter fence and signs, boundary monuments, and wellhead protectors.

6.4 Inspection Results

The site, 18 miles southeast of Grand Junction, Colorado, was inspected on November 12 and December 17, 2024. The inspection was conducted by J. Lobato, D. Atkinson, P. Wetherstein, and H. Petrie of the Legacy Management Support contractor. M. Cosby and A. Lawrence (Colorado Department of Public Health and Environment) and J. Pearce (U.S. Bureau of Land Management [BLM]) also attended the inspection. The purposes of the inspection were to confirm the integrity of visible features at the site, identify changes in conditions that might affect conformance with the Interim LTSP, and evaluate whether maintenance or follow-up inspection and monitoring are needed.

6.4.1 Site Surveillance Features

Figure 6-1 shows the locations of site features, including site surveillance features and inspection areas, in black and gray font. Some site features that are present but not required to be inspected are shown in italic font. Observations from previous inspections that are currently monitored are shown in blue, and new observations identified during the 2024 annual inspection are shown in red. Inspection results and recommended maintenance activities associated with site surveillance features are described in the following subsections. Photographs to support specific observations are noted in the text and in Figure 6-1 by photograph location (PL) numbers. The photographs and photograph log are presented in Section 6.10.

6.4.1.1 Access Road, Entrance Gates, and Entrance Signs

Access to the site is from U.S. Highway 50 by a right-of-way grant on federal land that is administered by BLM. A steel double-swing gate along the highway right-of-way fence provides access to the BLM-administered right-of-way that leads to the site entrance gate. The access gate was secured at the time of the inspection, and the gate lock is the new style LM lock. Site access signs next to the gate were in good condition. No maintenance needs were identified.

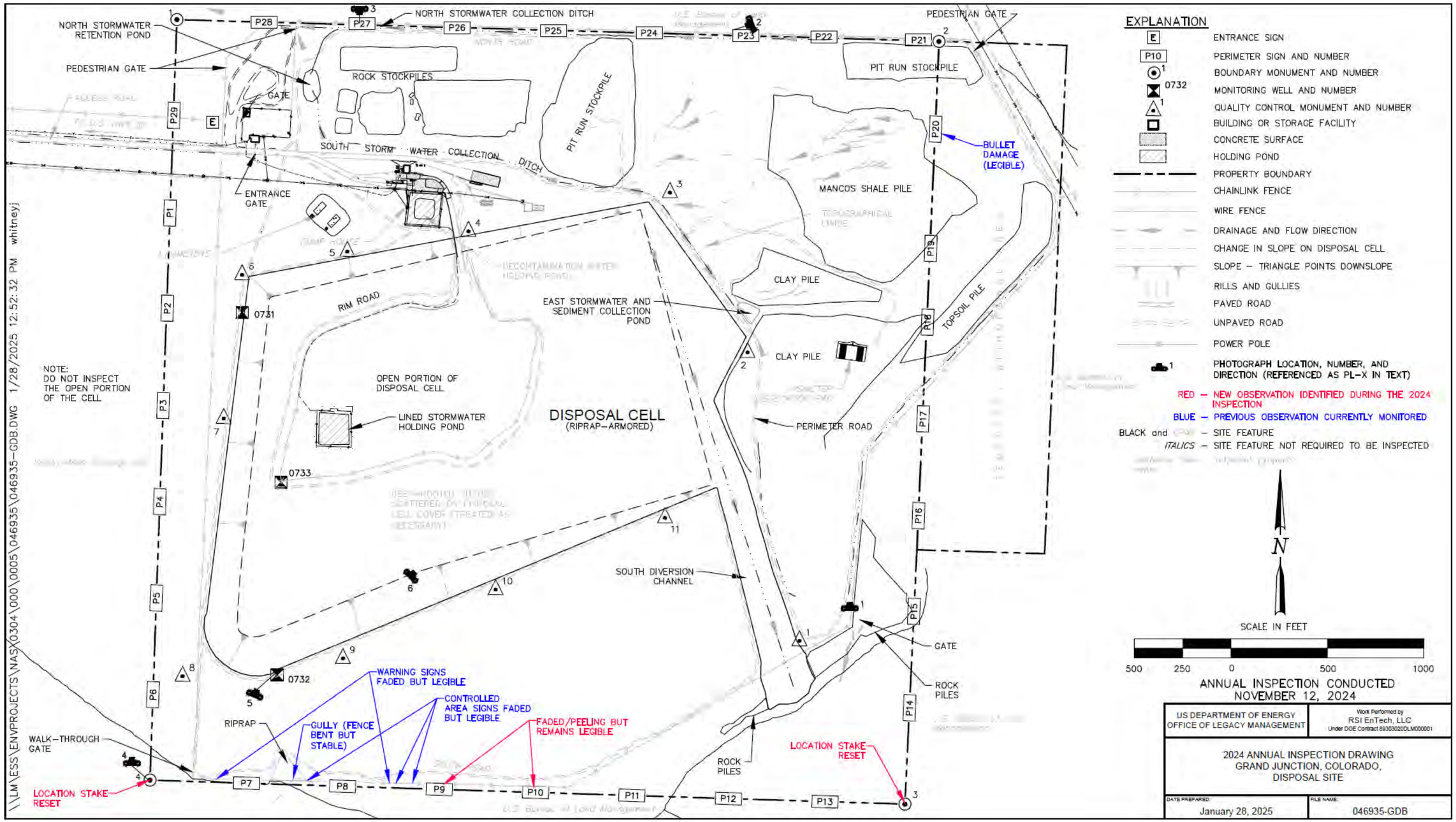


Figure 6-1. 2024 Annual Inspection Drawing for the Grand Junction, Colorado, Disposal Site

Although it is not required by the Interim LTSP, LM maintains the site access road and associated right-of-way. The right-of-way is bounded by two barbed-wire fences that parallel the north and south sides of the site access road, with two stock gates included in each fence. Locks have been replaced with the new style LM lock on all access gates. No other maintenance needs were identified.

The solar-powered site entrance gate is secured by an electronic locking device that requires entering a keypad code to open the gate. The entrance gate was functional at the time of the inspection. Site entrance signs on and next to the entrance gate were in good condition. The DOE contact number on the main entrance sign was updated with the new number. No maintenance needs were identified.

6.4.1.2 Perimeter Fence and Signs

A perimeter fence encloses the disposal cell features and operations areas (PL-1). It consists of a standard four-strand barbed-wire fence in some areas and a woven wire fence topped with barbed wire in others. The perimeter fence does not match the property boundary in several areas. The perimeter fence includes warning signs ("No-Trespassing" and "Controlled Area" signs) positioned at regular intervals. Many of the no-trespassing signs around the perimeter are faded but remain legible (PL-2). A section of fence spanning a gully near perimeter sign P7 is bent but stable. No other maintenance needs were identified.

There are 29 perimeter signs attached to steel posts set in concrete that are positioned at regular intervals along the property boundary (PL-3). Several perimeter signs along the south property boundary are faded or peeling but remain legible. Perimeter sign P20, replaced in 2021 because of bullet damage, has bullet damage again but remains legible. No other maintenance needs were identified.

6.4.1.3 Site Markers

Granite site markers similar to those at other UMTRCA sites will not be installed until final closure of the disposal cell in 2031.

6.4.1.4 Boundary Monuments

Four boundary monuments delineate the corners of the property boundary (PL-4). All were present and in good condition. The location stakes at boundary monuments BM-3 and BM-4 were reset following the 2023 inspection. No other maintenance needs were identified.

6.4.1.5 Aerial Survey Quality Control Monuments

Eleven aerial survey quality control monuments were inspected. No maintenance needs were identified.

6.4.1.6 Monitoring Wells

The groundwater monitoring network consists of three monitoring wells: 0731, 0732 (PL-5), and 0733 (Figure 6-2). All wellhead protectors were locked and undamaged.



Figure 6-2. Groundwater Monitoring Network for the Grand Junction, Colorado, Disposal Site

Root growth was observed in the well screens of monitoring wells 0731 and 0732 in 2021 (DOE 2022). The wells were redeveloped in 2022 (DOE 2023), and no root growth issues were observed during the 2024 sampling event. Weed spraying around each wellhead was completed in spring and fall 2024 to prevent the establishment of any deep-rooted plants. No other maintenance needs were identified.

6.4.2 Inspection Areas

In accordance with the Interim LTSP, the site is divided into four inspection areas to ensure a thorough and efficient inspection. The inspection areas are (1) the closed portion of the disposal cell, (2) the diversion structures and drainage channels, (3) the area between the disposal cell and the property boundary or site perimeter fence, and (4) the outlying area. Inspectors examined specific site surveillance features within each area and looked for evidence of erosion, settling, slumping, or other modifying processes that might affect the integrity of the disposal cell and the site's conformance with the Interim LTSP requirements.

6.4.2.1 Closed Portion of the Disposal Cell

The closed portion of the disposal cell is armored with basalt riprap to control erosion. The rock showed no significant weathering. During the 2022 inspection, inspectors noted an area, approximately 23 × 12 feet (ft), east of monitoring well 0733 that appeared to be a low area. In 2024, inspectors noted no change to this area. Inspectors will continue to monitor this area. There was no evidence of erosion, settling, slumping, rock degradation, or other modifying processes that might affect the integrity of the disposal cell.

Grasses and weeds were growing on most of the disposal cell cover (PL-6). Historically, deep-rooted shrubs on top of the disposal cell have been treated with herbicide. Although treatment is not required by the Interim LTSP, LM plans to continue controlling the deep-rooted shrubs as needed. No maintenance needs were identified.

6.4.2.2 Diversion Structures and Drainage Channels

The south diversion channel is a large, riprap-armored structure that intercepts run-on water from offsite and onsite, as well as stormwater runoff from the disposal cell and conveys the water into a natural drainage that flows away from the site to the southwest. Grasses, weeds, and shrubs growing within the diversion channel are not expected to affect the channel's performance. The discharge area of the channel is armored with large-diameter basalt riprap. No maintenance needs were identified.

Other drainage features at the site include north and south stormwater collection ditches, the north stormwater retention pond, and the east stormwater and sediment collection pond. In June 2024, DOE completed maintenance of the stormwater retention ponds, sediment collection pond, and drainage channels to better control stormwater and spring runoff. No maintenance needs were identified.

6.4.2.3 Area Between the Disposal Cell and the Site Boundary or Perimeter Fence

There are 11 discrete stockpiles of rock and soil between the disposal cell and the perimeter fence on the north and west sides of the site. Most of these materials eventually will be used to

cover and close the open portion of the disposal cell. Vegetation and surface rocks generally protect the stockpiles from significant erosion.

Most of the flat areas between the disposal cell and the property boundary are vegetated with native shrubs, scant perennial grasses, and annual weeds. This area includes roads adjacent to the inside of the site perimeter fence, the disposal cell, the south diversion channel, the stormwater collection ditches, and a few other locations. Localized erosion was reported in 2021 at two locations on the perimeter road adjacent to the east side of the south diversion channel. In June 2024, DOE completed maintenance of the previously observed localized erosion on the perimeter road and stormwater collection ditches. No other maintenance needs were identified.

6.4.2.4 Outlying Area

The 0.25-mile area beyond the site boundary was visually observed for erosion, changes in land use, or other phenomena that might affect the long-term integrity of the site. No such changes were identified. Most of the land surrounding the site is rangeland administered by BLM, and private property on the west side is used primarily for cattle grazing. No land-use changes were evident in those areas. Outside the site's eastern boundary is a 40-acre temporary withdrawal area that was issued by BLM to DOE for stockpiled materials. Some of the withdrawal area is included within the site perimeter fence and contains stockpiled materials. This area is not included in the Interim LTSP. No maintenance needs were identified.

6.5 Follow-Up Inspections

LM will conduct follow-up inspections if (1) a condition is identified during the annual inspection or other site visit that requires a return to the site to evaluate the condition or (2) LM is notified by a citizen or outside agency that conditions at the site are substantially changed. No need for a follow-up inspection was identified.

6.6 Maintenance and Repairs

Before the inspection, the following maintenance items were completed:

- Resetting of the location stakes at boundary monuments BM-3 and BM-4.
- Maintenance of the previously observed localized erosion on the perimeter road (completed in June 2024). Maintenance was also completed for the stormwater retention ponds, sediment collection pond, and drainage channels to better control stormwater and spring runoff.

No other maintenance needs were identified during the 2024 inspection.

6.7 Groundwater Monitoring

In accordance with the Interim LTSP, LM conducts annual groundwater monitoring as a best management practice. Groundwater at the site qualifies for supplemental standards because it is designated as limited use with no numerical concentration limits for hazardous constituents identified at the site (DOE 1998). This designation applies when groundwater in the upper aquifer is not a current or potential source of drinking water. The disposal cell is underlain by

5 to 40 ft of alluvium. Beneath the alluvium is approximately 700 ft of Mancos Shale, which overlies the uppermost aquifer at the site, the Dakota Sandstone. Groundwater in the site area occurs in thin paleochannels within lower portions of alluvium deposits and in the confined Dakota Sandstone unit. Groundwater in the Dakota Sandstone is designated as limited use because TDS concentrations exceed 10,000 milligrams per liter (mg/L).

LM monitors groundwater from three monitoring wells adjacent to and in the disposal cell to determine if groundwater in onsite paleochannels is affected by seepage (i.e., transient drainage) from the disposal cell (Table 6-2 and Figure 6-2). The most recent sampling event occurred on July 23–24, 2024.

Table 6-2. Groundwater Monitoring Network at the Grand Junction, Colorado, Disposal Site

Monitoring Well	Hydrologic Relationship
0731	Paleochannel, downgradient, edge of disposal cell, north side
0732	Paleochannel, downgradient, edge of disposal cell, south side
0733	Disposal cell, deepest location, center

Monitoring wells 0731 and 0732 are screened within the alluvial paleochannels adjacent to the disposal cell and extend 5 to 7.5 ft into weathered Mancos Shale. These wells are in two separate paleochannel systems downgradient from the disposal cell (DOE 1998). Monitoring well 0733 is screened in the lower tailings within the disposal cell at an elevation that is below the paleochannel monitoring wells (Figure 6-2). Disposal cell construction was initiated by excavating Mancos Shale, which resulted in the base of the disposal cell being below the weathered Mancos Shale horizon. Monitoring well 0733 is primarily used to measure water levels within the disposal cell.

All groundwater monitoring results and static water level data for the site are reported and published on the LM Geospatial Environmental Mapping System (GEMS) website (https://gems.lm.doe.gov).

6.7.1 Groundwater-Level Monitoring

Static water-level measurements are obtained from each monitoring well before water quality samples are collected. In January 2024, the site's vertical datum (National Geodetic Vertical Datum of 1929) was transformed to North American Vertical Datum of 1988 (NAVD 88). The transformation resulted in an increase of 3.52 ft in elevation measurements across the site.

Figure 6-3 plots groundwater elevations based on manual water-level measurements from 1998–2024. The start date (1998) for this and subsequent figures coincides with the issuance of the Interim LTSP and the installation of well 0733. As such, data from 1995–1997 for wells 0731 and 0732 are not shown. The timing of groundwater elevation fluctuations in wells 0731 and 0732 is similar, suggesting that the two paleochannel systems are influenced by the same upgradient recharge mechanisms. Water levels in disposal cell monitoring well 0733 have increased approximately 4 ft since 1998 but remain lower than water elevations in the two paleochannel monitoring wells.

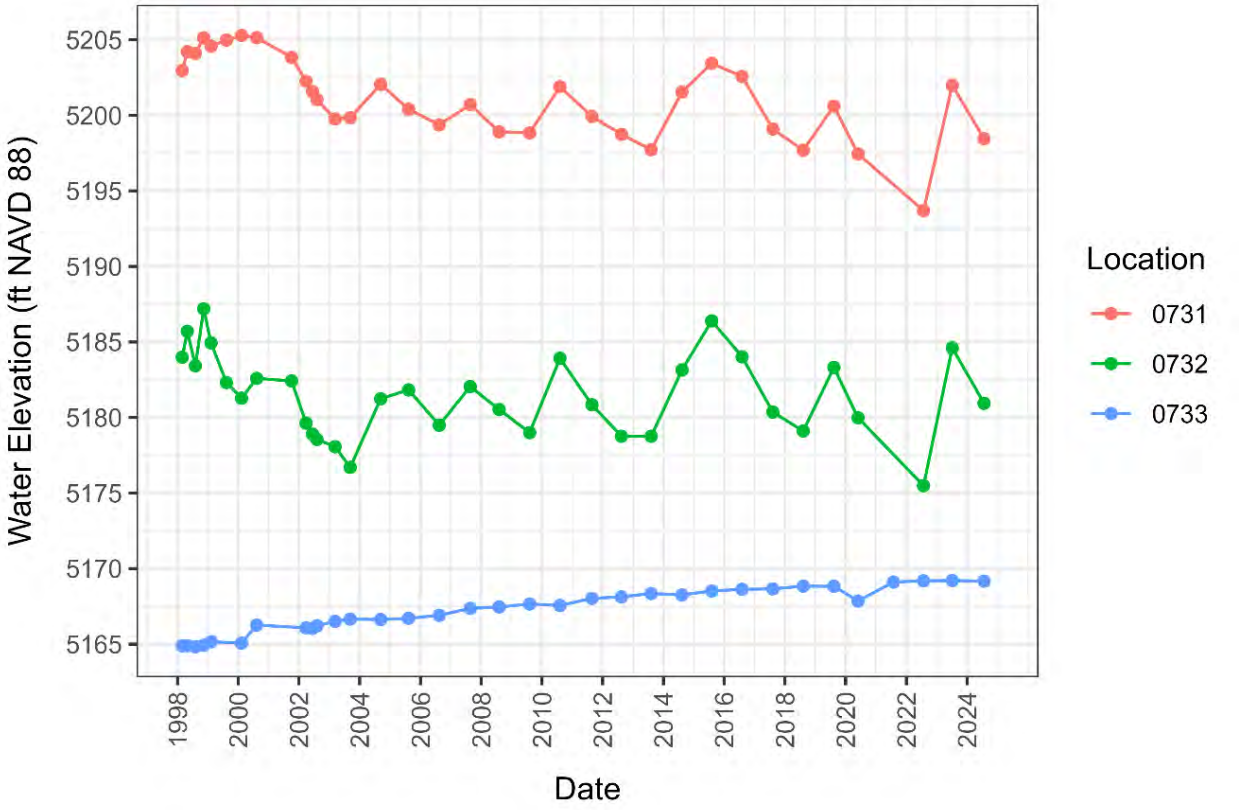
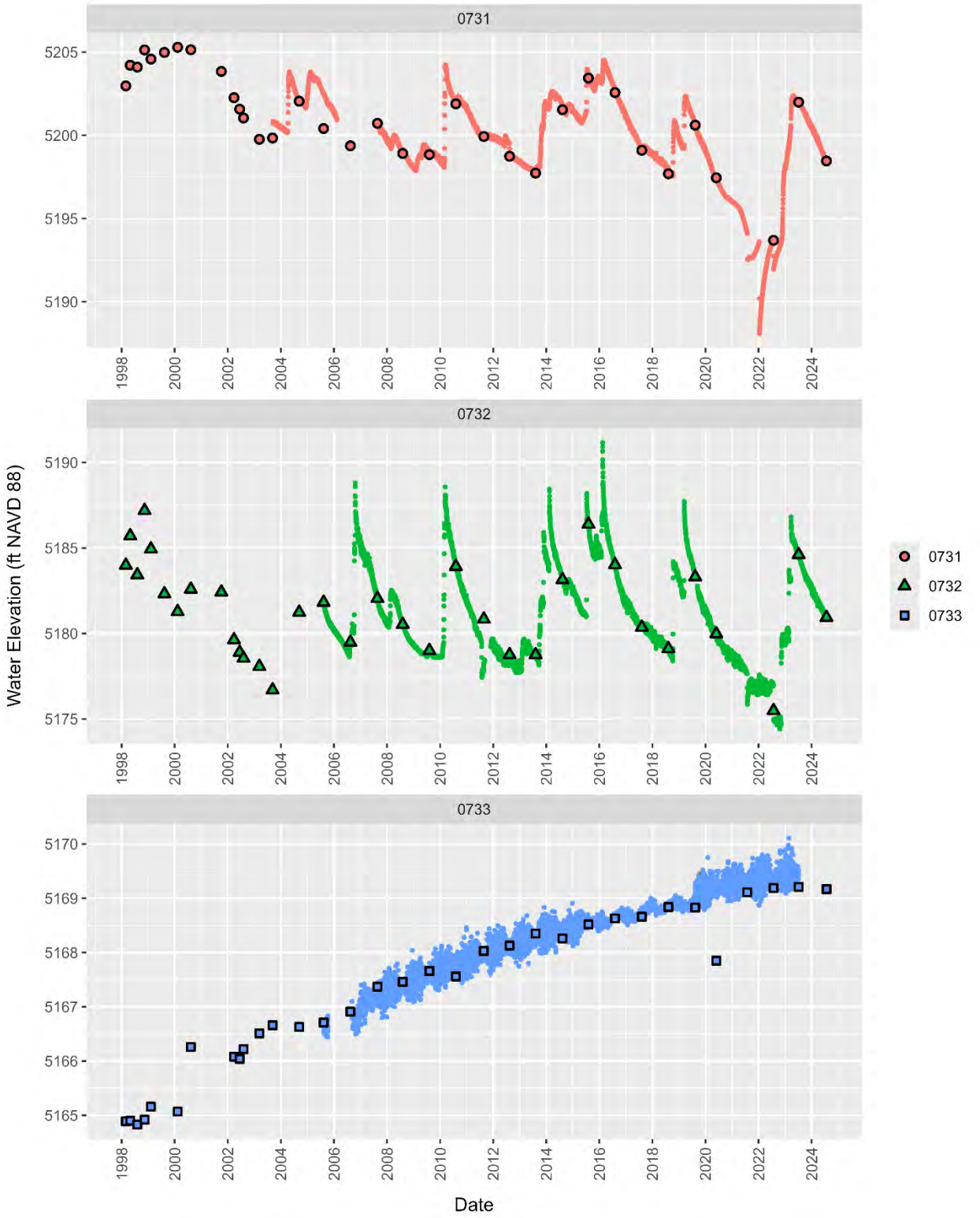


Figure 6-3. Manual Water-Level Measurements at the Grand Junction, Colorado, Disposal Site

Because the scale in Figure 6-3 spans approximately 40 ft, to provide greater resolution, Figure 6-4 plots the same data using unique scales to better show the magnitude of groundwater elevation fluctuations in each individual well. This figure also includes corresponding continuous water-level measurements obtained from pressure transducers installed in each of the wells in accordance with the Interim LTSP (DOE 1998). Higher frequency water-level measurements from the pressure transducers enable better understanding of sources of recharge to the paleochannel systems and fluctuations in analyte concentrations.



Notes: In each subplot, the large, outlined symbols represent discrete water-level measurements from annual sampling events (shown in Figure 6-3). The small symbols (•) are daily averages of corresponding continuous (5-minute) transducer readings. The marked anomalous decline in water elevations shown for well 0731 datalogger data in early 2022 is likely due to a January 12, 2022, well redevelopment event.

Figure 6-4. Water Elevations from Discrete Measurements and Corresponding Transducer Readings

6.7.2 Groundwater Quality Monitoring

In accordance with the Interim LTSP, annual groundwater samples are analyzed for standard field parameters and the following indicator analytes: molybdenum, nitrate, polychlorinated biphenyls (PCBs), selenium, sulfate, TDS, uranium, and vanadium. The key indicator analytes are molybdenum, nitrate, selenium, and uranium. Results for these indicator parameters are compared to UMTRCA maximum concentration limits (MCLs) (40 CFR 192 Subpart A Table 1), background concentrations from groundwater in alluvium, and background concentrations from groundwater in the Mancos Shale (Table 6-3). Background monitoring wells were installed, monitored, and abandoned before the disposal cell was constructed. Monitoring well concentration data are compared to the highest of the three values in Table 6-3 as a best management practice to determine if there is any potential seepage from the disposal cell. MCLs are listed for comparison evaluation only and not for compliance purposes. Although PCBs (Aroclors) continue to be monitored, they have never been detected in site monitoring wells and, therefore, are not addressed further here.

Table 6-3. Maximum Concentration Limits and Maximum Background Concentrations for Groundwater in Alluvium and the Mancos Shale at the Grand Junction, Colorado, Disposal Site

Constituent[a]	MCL[b] (mg/L)	Maximum Concentration in Background Groundwater in Alluvium[c] (mg/L)	Maximum Concentration in Background Groundwater in the Mancos Shale[c] (mg/L)
Molybdenum	0.1	0.070	0.12
Nitrate (as nitrogen)	10	1.1	0.80
Selenium	0.01	0.019	0.11
Uranium	0.044	0.074	0.011
Sulfate	None	860	3700
TDS	None	1700	7000
Vanadium	None	0.060	0.13

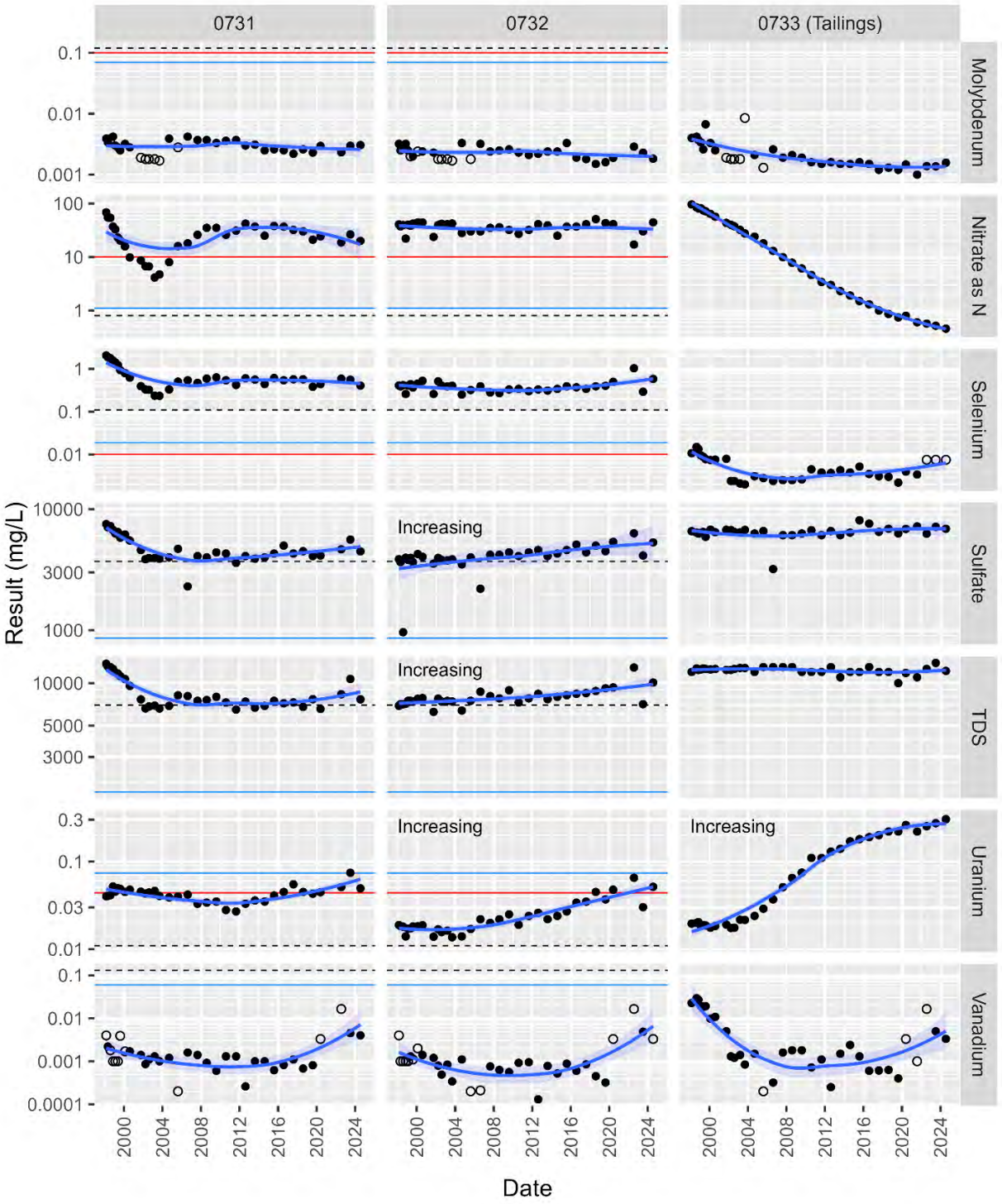
Notes:

[a] PCBs are not included in this table because, in 27 years of monitoring (32 discrete sampling events), no detectable concentrations of PCB (Aroclor) congeners have been measured in any site well.

[b] MCLs as listed in 40 CFR 192 Subpart A Table 1. U.S Environmental Protection Agency (EPA) secondary drinking water standards for sulfate and TDS are 250 and 500 mg/L, respectively. There are no EPA MCLs for vanadium.

[c] Maximum background concentrations listed for groundwater in alluvium and Mancos Shale are from Attachment 3 of DOE 1991, Table 3.34 and Table 3.37, respectively.

Figure 6-5 provides a matrix of time-concentration plots for each site monitoring well and analyte combination from 1998 to the present. Results for the key indicator analytes are shown first, followed by results for remaining analytes (sulfate, TDS, and vanadium). Data for these analytes are plotted relative to the MCLs and maximum background concentrations listed in Table 6-3. In accordance with Interim LTSP requirements to evaluate analyte concentration trends in the monitoring wells (Section 2.6.2 of DOE 1998), Mann-Kendall trend analysis was conducted for all indicator analyte-well combinations to characterize the direction of concentration trends. Results of the trend analyses are listed in Table 6-4.



● Detect ○ Nondetect —— LOESS local regression line and 95% pointwise confidence interval

Limits or comparative maximum background concentrations from Table 6-3 (not appliable to tailings well 0733):

—— MCL

—— Maximum background concentration in alluvium

- - - Maximum background concentration in Mancos Shale

Notes: Wells 0731 and 0732 were sampled in 2021, but the analytical results were rejected and deemed nonreportable (DOE 2022). Any statistically significant increasing trends for the 1998–2024 time frame (Table 6-4) are indicated on the appropriate plots.

Abbreviations: LOESS = locally estimated scatterplot smoothing, N = nitrogen

Figure 6-5. Time-Concentration Plots of All Analytes in Groundwater (1998–2024)

Table 6-4. Mann-Kendall Trend Analysis Results for Indicator Parameters in Grand Junction, Colorado, Disposal Site Monitoring Wells, 1998–2024

Parameter[a]	Well	Number of Samples	Number of Nondetects	Kendall's tau[b, c]	p-value[b, c]	Trend[b, c]
Key Indicator Analytes						
Molybdenum	0731	34	7	−0.13	0.28	No Trend
Molybdenum	0732	34	7	−0.15	0.22	No Trend
Molybdenum	0733	34	6	−0.53	<0.001	Decreasing
Nitrate as N	0731	34	0	−0.03	0.82	No Trend
Nitrate as N	0732	34	0	0.002	1.0	No Trend
Nitrate as N	0733	34	0	−0.99	<0.001	Decreasing
Selenium	0731	34	0	−0.30	0.012	Decreasing
Selenium	0732	34	0	−0.005	0.98	No Trend
Selenium	0733	34	3	−0.29	0.017	Decreasing
Uranium	0731	34	0	−0.03	0.80	No Trend
Uranium	0732	34	0	0.62	<0.001	Increasing
Uranium	0733	34	0	0.83	<0.001	Increasing
Remaining Analytes						
Sulfate	0731	34	0	−0.25	0.036	Decreasing
Sulfate	0732	34	0	0.59	<0.001	Increasing
Sulfate	0733	34	0	0.18	0.14	No Trend
TDS	0731	34	0	−0.39	0.001	Decreasing
TDS	0732	34	0	0.57	<0.001	Increasing
TDS	0733	34	0	−0.14	0.24	No Trend
Vanadium	0731	34	10	−0.002	1.0	No Trend
Vanadium	0732	34	12	−0.04	0.75	No Trend
Vanadium	0733	34	4	−0.43	<0.001	Decreasing

Notes:

[a] For all well-parameter combinations, the initial trend analysis date is February 27, 1998, and the final trend analysis date is July 23 or July 24, 2024.

[b] Trend tests were performed using the "NADA: Nondetects and Data Analysis for Environmental Data" package in R, version 1.6-1.1 (Lee 2020). The NADA trend test is similar to the traditional Mann-Kendall trend test except that it accounts for the presence of nondetects at multiple detection limits.

[c] Trend analyses were conducted at the 0.05 significance level using a two-sided test. A calculated p-value of less than 0.05 indicates that a significant trend in the time series exists. The test statistic, Kendall's tau, is a measure of the strength of the association between two variables, with values always falling between −1 and +1.

Abbreviation:

N = nitrogen

Key Indicator Analytes

Molybdenum concentrations in all three monitoring wells have been consistently below both the MCL of 0.1 mg/L and corresponding background concentrations (by at least 1 order of magnitude), with results ranging from 0.0010–0.0067 mg/L overall and from 0.0016–0.0031 mg/L in 2024. A statistically significant decreasing trend was identified for well 0733, while concentrations in the two paleochannel wells have remained steady (no significant trend) since 1998 (Table 6-4).

With few exceptions, nitrate (as nitrogen) concentrations in paleochannel monitoring wells 0731 and 0732 have consistently exceeded the 10 mg/L MCL and corresponding background concentrations, generally ranging between about 20–40 mg/L (Figure 6-5). Exceptions apply to the 2000–2004 period, when nitrate concentrations in well 0731 decreased to as low as 4.6 mg/L, which is below the MCL. The results in 2024 were 20 mg/L and 44 mg/L, respectively, for wells 0731 and 0732. As noted in previous annual reports (e.g., DOE 2024), nitrate concentrations in disposal cell monitoring well 0733 have decreased significantly (Table 6-4), and this trend appears to be inversely correlated with the increasing trend in uranium concentrations (discussed below). Nitrate concentrations declined steadily from 96 mg/L in 1998 to 0.46 mg/L in 2024 (Figure 6-5). A possible explanation for this trend is increased reducing conditions (less oxygen) over time in this well, but this hypothesis has not been confirmed.

Selenium occurs naturally in the Mancos Shale deposits that underlie the disposal cell (DOE 1991), with concentrations ranging as high as 0.11 mg/L, exceeding the MCL of 0.01 mg/L (Table 6-3). Selenium concentrations in wells 0731 and 0732 have consistently exceeded background and the corresponding MCL of 0.01 mg/L, with most results ranging from 0.23 to 0.63 mg/L (Figure 6-5). The highest selenium concentrations have been measured in well 0731, where concentrations declined from 2.1 mg/L in 1998 to 0.30 mg/L in 2002, accounting for the statistically significant decreasing trend noted in Table 6-4. Concentrations in this well have remained fairly stable since then. No significant trend was found for selenium in well 0732, where concentrations have ranged from 0.24 to 1.0 mg/L. The most recent (2024) result in this well was 0.58 mg/L. The influence of the Mancos Shale is not evident in disposal cell monitoring well 0733 (screened in the lower tailings), where selenium concentrations have ranged from 0.0020 to 0.015 mg/L. Selenium results have been below the detection limit (<0.0075 mg/L) in this well for the last 3 years (Figure 6-5).

Uranium concentrations in well 0731 have typically ranged from 0.03 to 0.05 mg/L, periodically exceeding the 0.044 mg/L MCL but usually consistently below the maximum concentration in background alluvial groundwater (0.074 mg/L) (Figure 6-5). The only exception was the 2023 result of 0.0745 mg/L, a historical maximum essentially equal to the background value. Uranium concentrations in wells 0732 and 0733 continue to exhibit statistically significant increasing trends (Table 6-3). The maximum concentration in well 0732 (0.065 mg/L) was measured in 2022; the concentration declined in 2023 to 0.030 mg/L but increased in 2024 (0.052 mg/L), again exceeding the MCL. Uranium concentrations in tailings well 0733 (a well screened in the disposal cell tailings) continue to increase significantly (Figure 6-5). The most recent (2024) uranium result, 0.30 mg/L, is the highest on record for this well. Relatively high concentrations of uranium and other constituents are expected for a well in this location. Concentrations of constituents of concern in well 0733 are not subject to compliance goals and are monitored solely for information gathering purposes.

Remaining Analytes

As there are no comparative concentration limits for the non-key indicator analytes, this discussion is limited to a brief summary of overall trends for sulfate, TDS, and vanadium.

Statistically significant trends in sulfate and TDS concentrations continue to be found for both paleochannel wells, with trends decreasing in well 0731 and increasing in well 0732 (Table 6-3). Sulfate concentrations in wells 0731 and 0732 have averaged between

approximately 4000 and 5000 mg/L, while those in tailings well 0733 (with no significant trend) have been slightly higher (6000–7000 mg/L). The most recent (2024) sulfate results for wells 0731 and 0732 (4480 and 5320 mg/L, respectively) exceed both the alluvial and Mancos Shale background values of 860 and 3700 mg/L, respectively (Figure 6-5). The most recent sulfate concentration in tailings well 0733 was 6890 mg/L.

TDS concentrations are also highest (generally 12,000–13,000 mg/L), in tailings well 0733; the most recent (2024) result was 12,200 mg/L. TDS concentrations in paleochannel wells have been lower. The most recent (2024) TDS results for paleochannel wells 0731 and 0732 (7680 and 10,100 mg/L, respectively) exceed both the alluvial and Mancos Shale background values of 1700 and 7000 mg/L, respectively (Figure 6-5).

Vanadium concentrations in paleochannel wells 0731 and 0732 have typically ranged from 0.0010 to 0.0020 mg/L, with about 30% of results below detection limits (Figure 6-5 and Table 6-4). A statistically significant decreasing trend was found for vanadium in well 0733 (Table 6-4), stemming largely from the early sharp decrease in concentrations between 1998 and 2002, from 0.029 to 0.0012 mg/L. Since 2002, vanadium concentrations in this well have been generally stable, with most results ranging from 0.0010–0.0030 mg/L. In 2024, vanadium concentrations in wells 0731, 0732, and 0733 were 0.0040, <0.0033, and 0.0033 mg/L, respectively. Vanadium concentrations in wells 0731 and 0732 have been well below Mancos Shale and alluvial groundwater background values of 0.013 and 0.060 mg/L, respectively (Figure 6-5).

6.8 Corrective Action

Corrective action is taken to correct out-of-compliance or hazardous conditions that create a potential health and safety problem or that may affect the integrity of the disposal cell or compliance with 40 CFR 192. No need for corrective action was identified. However, monitoring wells 0731 and 0732 are sampled as a best management practice to verify that groundwater in onsite paleochannels is not affected by potential seepage from the disposal cell. There are no set compliance standards for this best management practice monitoring, but NRC and state notification is required if any constituents have increasing trends (for three consecutive sampling rounds) above respective MCLs as specified in the Interim LTSP (DOE 1998). This has not occurred with recent data but will continue to be evaluated.

Based on the exceedance of background concentrations for nitrate, selenium, uranium, sulfate, and TDS from groundwater in the alluvium or the Mancos Shale, current data indicate that these two wells may be affected by potential disposal cell seepage. LM has initiated an alluvial aquifer characterization effort to further evaluate the data from wells 0731 and 0732 and follow the requirements of the Interim LTSP (DOE 1998) for past, current, and future constituent concentrations (including uranium).

6.9 References

Note

Site-related documents are available on the LM public webpages at https://lmpublicsearch.lm.doe.gov/SitePages.

10 CFR 40.27. U.S. Nuclear Regulatory Commission, "General License for Custody and Long-Term Care of Residual Radioactive Material Disposal Sites," *Code of Federal Regulations*.

40 CFR 192. U.S. Environmental Protection Agency, "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings," *Code of Federal Regulations*.

40 CFR 192 Subpart A Table 1. U.S. Environmental Protection Agency, "Maximum Concentration of Constituents for Groundwater Protection," *Code of Federal Regulations*.

DOE (U.S. Department of Energy), 1991. *Remedial Action Plan and Site Design for Stabilization of the Inactive Uranium Mill Tailings Site at Grand Junction, Colorado*, DOE/AL/050505.0000, UMTRA Project Team, September.

DOE (U.S. Department of Energy), 1998. *Interim Long-Term Surveillance Plan for the Cheney Disposal Site Near Grand Junction, Colorado*, DOE/AL/62350–243, Rev. 1, Environmental Restoration Division, UMTRA Project Team, April.

DOE (U.S. Department of Energy), 2022. *2021 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites*, LMS/S33843, Office of Legacy Management, March.

DOE (U.S. Department of Energy), 2023. *2022 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites*, LMS/S38159, Office of Legacy Management, March.

DOE (U.S. Department of Energy), 2024. *2023 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites*, LMS/43755, Office of Legacy Management, March.

Lee, L., 2020. "NADA: Nondetects and Data Analysis for Environmental Data," R package, version 1.6-1.1, https://CRAN.R-project.org/package=NADA, accessed December 10, 2024.

6.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	0	Perimeter Fence
PL-2	248	No-Trespassing Sign (Faded but Legible)
PL-3	180	Perimeter Sign P27
PL-4	0	Boundary Monument BM-4
PL-5	23	Monitoring Well 0732
PL-6	45	Grasses Growing on Disposal Cell Cover



PL-1. Perimeter Fence



PL-2. No-Trespassing Sign (Faded but Legible)



PL-3. Perimeter Sign P27



PL-4. Boundary Monument BM-4



PL-5. Monitoring Well 0732



PL-6. Grasses Growing on Disposal Cell Cover

7.0 Green River, Utah, Disposal Site

7.1 Compliance Summary

The Green River, Utah, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site was inspected on April 30, 2024. No changes were observed on the disposal cell or in the associated drainage features. Inspectors identified several minor maintenance issues at the site but did not identify concerns that required a follow-up or contingency inspection.

The U.S. Department of Energy (DOE) Office of Legacy Management (LM) conducts annual groundwater monitoring of four point of compliance (POC) wells to track disposal cell performance in accordance with the site-specific Long-Term Surveillance Plan (DOE 1998) (LTSP). Groundwater analytical results presented in this chapter are evaluated with respect to requirements and concentration limits specified in the LTSP. Groundwater monitoring was conducted on June 10, 2024. Consistent with previous observations, concentrations of routinely monitored analytes exceeded corresponding concentration limits in several POC wells: nitrate in wells 0171 and 0173; sulfate in wells 0171, 0173, and 0181; and uranium in well 0171.

7.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the site-specific LTSP (DOE 1998) in accordance with procedures established to comply with the requirements of the U.S. Nuclear Regulatory Commission (NRC) general license at Title 10 *Code of Federal Regulations* Section 40.27 (10 CFR 40.27). Table 7-1 lists these requirements.

Table 7-1. License Requirements for the Green River, Utah, Disposal Site

Requirement	LTSP	This Report	10 CFR 40.27
Annual Inspection and Report	Section 6.0	Section 7.4	(b)(3)
Follow-Up or Contingency Inspections	Section 7.0	Section 7.5	(b)(4)
Maintenance and Repairs	Section 8.0	Section 7.6	(b)(5)
Groundwater Monitoring	Section 5.2	Section 7.7	(b)(2)
Corrective Action	Section 9.0	Section 7.8	—

7.3 Institutional Controls

The 25-acre site, identified by the property boundary shown in Figure 7-1, is owned by the United States and was accepted under the NRC general license in 1998. DOE is the licensee and, in accordance with the requirements for UMTRCA Title I sites, LM is responsible for the custody and long-term care of the site. Institutional controls (ICs) at the site include federal ownership of the property, administrative controls, and the following physical ICs that are inspected annually: the disposal cell and associated drainage features; entrance gate and sign; security fence around the disposal cell; perimeter signs; uncrewed aircraft system signs; site markers; survey, boundary, and aerial survey quality control monuments; and wellhead protectors.

7.4 Inspection Results

The site, 1 mile southeast of Green River, Utah, was inspected on April 30, 2024. The inspection was conducted by D. Atkinson, J. Carman, and T. Santonastaso of the Legacy Management Support (LMS) contractor. M. Young (LM site manager), W. Frazier (LM), H. Mickelson (State of Utah representative), and S. Mantanona (guest of DOE) also attended the inspection. The purposes of the inspection were to confirm the integrity of visible features at the site, identify changes in conditions that might affect conformance with the LTSP, and evaluate whether maintenance or follow-up inspection and monitoring are needed.

7.4.1 Site Surveillance Features

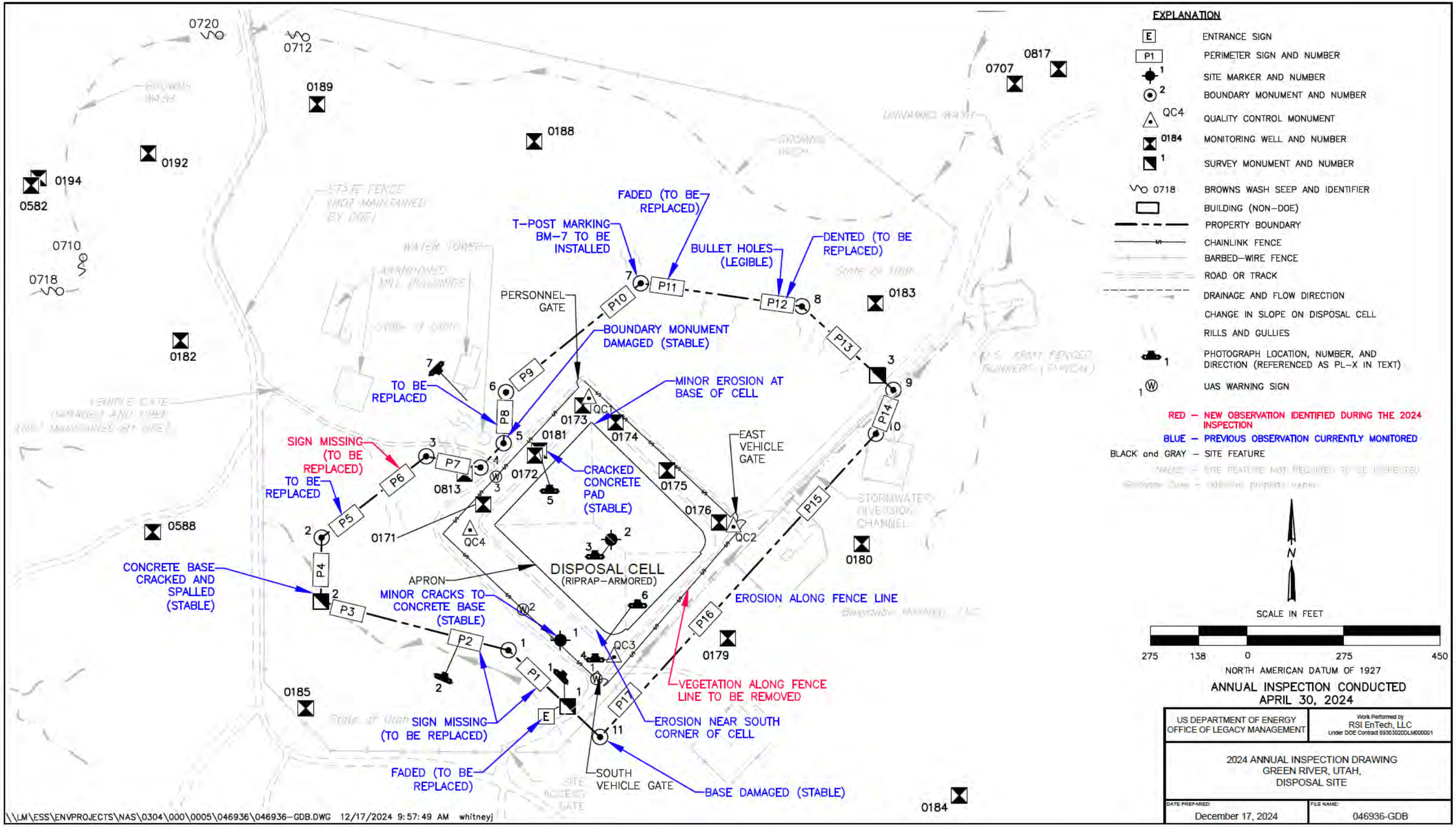
Figure 7-1 shows the locations of site features, including site surveillance features and inspection areas, in black and gray font. Some site features that are present but not required to be inspected are shown in italic font. Observations from previous inspections that are currently monitored are shown in blue, and new observations identified during the 2024 annual inspection are shown in red. Inspection results and recommended maintenance activities associated with site surveillance features are described in the following subsections. Photographs to support specific observations are noted in the text and in Figure 7-1 by photograph location (PL) numbers. The photographs and photograph log are presented in Section 7.10.

7.4.1.1 Access Road, Entrance Gate, and Entrance Sign

Access to the site is either from U.S. Highway 6 and 50 heading east from the Town of Green River or from U.S. Interstate 70 via S 1600 E Street. The paved access road crosses property owned by the state and the U.S. Army. Access was granted to LM through right-of-way agreements with both entities. Entrance to the site is through an open gate in the paved road right-of-way fence; LM does not own the gate or the right-of-way fence and access via the gate is not controlled. Past this gate, a dirt road leads across state land to the site. The access road divides near the entrance to the disposal cell, with one branch leading to a locked gate in the security fence that encloses the disposal cell and the other providing access around the outside of the security fence. The entrance sign is next to the access road where it enters the site. The sign is heavily faded and will be replaced before the next annual inspection (PL-1). The lock on the steel site access gate in the right-of-way was in place and working as intended. No other maintenance needs were identified.

7.4.1.2 Security Fence, Perimeter Signs, and Warning Signs

A chainlink security fence encloses the portion of the site that contains the disposal cell. Vehicle gates are at the south and east corners of the security fence, and a personnel gate is at the north corner of the security fence. The security fence was intact, but inspectors observed vegetation growth along the fence line and a buildup of tumbleweeds that will need to be removed. The vegetation will be treated, and the tumbleweeds will be removed before the next annual inspection to ensure that no damage to the fence occurs. A minor erosional rill that was observed under the fence near perimeter sign P16 during the previous inspection seems to be stable. This rill poses little risk at this time because it remains small and is not adjacent to a fence post. Inspectors will continue to monitor this area. The gates were operable and locked at the time of the inspection.



Abbreviation: UAS = uncrewed aircraft system

Figure 7-1. 2024 Annual Inspection Drawing for the Green River, Utah, Disposal Site

Seventeen perimeter signs, attached to steel posts set in concrete, are positioned along the unfenced property boundary. Perimeter signs P1, P2 (PL-2), P5, and P6 were missing and will be replaced before the next annual inspection. Perimeter signs P8 and P11 were faded and will be replaced before the next annual inspection. Perimeter sign P12 was dented and will be replaced before the next annual inspection. All other perimeter signs were present with several that were dented, had bullet holes, or sun damage (faded or illegible). Perimeter signs P1, P2, P5, P6, P8, P11, and P12 will be replaced before the next annual inspection along with any other perimeter signs exhibiting damage. Two new signs for prohibited activities and emergency instructions were installed along the security fence at the entrance gate during the 2024 inspection. No other maintenance needs were identified.

7.4.1.3 Site Markers

The site has two granite markers. Site marker SMK-1 is inside the security fence near the southwest corner of the site, and site marker SMK-2 (PL-3) is on the top of the disposal cell. The concrete base of site marker SMK-1 has several minor cracks, but they do not compromise the integrity of the base, and repairs are not necessary at this time. No maintenance needs were identified.

7.4.1.4 Survey and Boundary Monuments

Eleven boundary monuments and three survey monuments delineate the property boundary. As reported in 2021, boundary monument BM-5 is bent from being hit by a vehicle, and the concrete base around survey monument SM-2 is cracked and spalled. Both boundary monument BM-5 and survey monument SM-2 are fully functional, and repairs of these monuments are not needed at this time but will be continually monitored. The base of boundary monument BM-11 is damaged but stable, and no repairs are needed at this time. Boundary monument BM-7 is difficult to find and will be marked with a T-post before the next annual inspection.

7.4.1.5 Aerial Survey Quality Control Monuments

Four aerial survey quality control monuments (PL-4) were inspected. No maintenance needs were identified.

7.4.1.6 Monitoring Wells

Twenty-two monitoring wells are on or near the site. The LTSP establishes four POC wells at the site for postclosure groundwater monitoring. All wellhead protectors observed during the inspection were undamaged. Monitoring well 0181 has a cracked concrete pad (PL-5). Some of the concrete monitoring well pads were cracked, but the wellhead protectors at those wells are stable, and repairs are not necessary at this time. No other maintenance needs were identified.

7.4.2 Inspection Areas

In accordance with the LTSP, the site is divided into three inspection areas to ensure a thorough and efficient inspection. The inspection areas are (1) the disposal cell and adjacent area inside the security fence, (2) the site perimeter between the security fence and the site boundary, and (3) the outlying area. Inspectors examined specific site surveillance features within each area and

looked for evidence of settlement, erosion, or other modifying processes that might affect the site's conformance with LTSP requirements.

7.4.2.1 Disposal Cell and Adjacent Area Inside the Security Fence

The disposal cell, completed in 1989, occupies 6 acres. The slopes of the disposal cell cover are armored with riprap, consisting primarily of competent basalt with a small fraction of sedimentary rocks, to control erosion. A small percentage of the rock, mainly sedimentary rock, has degraded, but the riprap cover is functioning as designed. Inspectors found no evidence of settling, slumping, erosion, or other modifying processes that might affect the integrity of the disposal cell.

A boulder-filled trench, known as an apron, surrounds the disposal cell. The apron was intact and stable. Inspectors noted small (less than 8 square feet) instances of erosion and possible soil piping features along the base of the side slopes that have been observed during previous inspections. The rills and piping features are formed from stormwater runoff along the perimeter road draining into the disposal cell apron. This occurrence is not a concern because the erosion is minor and the sediment has not filled the apron or become visible in the apron, indicating that the apron's performance is not adversely affected. Inspectors will continue to monitor these features. Possible erosion or an animal burrow was found on the south corner of the drainage channel (PL-6). Inspectors will continue to monitor the area in the future. No additional maintenance is needed.

The area between the disposal cell and the security fence contains the perimeter dirt road, several monitoring wells, and sparsely vegetated open space. The road was passable, and there was no indication of trespassing in the open space. Vegetation has grown along the fence and debris has collected on the fence. Maintenance will be performed before the next inspection to clear the vegetation and the debris. No other maintenance needs were identified.

7.4.2.2 Perimeter Area Between the Security Fence and the Site Boundary

The area between the security fence and the site boundary is primarily open space but includes access roads, a stormwater diversion channel, and monitoring wells. The site property boundary is not fenced, and trespassing occurs on the site from several access points through state- and privately owned land. Unauthorized access to the site is primarily from the west through a former mill access gate that has been broken off its hinges; LM is not responsible for the gate or associated fence. The site is also accessible through remote, unfenced, open-access points to the north and east. The site will continue to be monitored for adverse public use typically indicated by trash, tire ruts, fire rings, and vandalism. Inspectors did not find new trash dumps or indications of vandalism (except for missing perimeter sign P2) during the inspection.

Signs of erosion noted during previous inspections appear in multiple areas in the site perimeter. Erosional rills are present on the west side of the site near perimeter sign P7 and the water tower (PL-7) but are currently not affecting site surveillance features. Rills and gullies are also present along the escarpment northeast of the disposal cell between boundary monument BM-7 and survey monument SM-3 (approximately 400 feet [ft] from the base of the disposal cell). The maximum gully depth in this area is approximately 3 ft, but the erosion appears to be stabilizing as larger rocks drop to the bottom of the gullies and provide armoring. A portion of the

stormwater diversion channel along the southeast side of the site continues to erode slowly. These erosional features could eventually damage site surveillance features (i.e., perimeter signs, boundary monuments, and the security fence). The closest erosional features are approximately 300 ft from the disposal cell and do not pose a risk to its integrity at this time. Inspectors will continue to monitor these features. No immediate maintenance needs were identified.

7.4.2.3 Outlying Area

The 0.25-mile area beyond the site boundary was visually observed for erosion, changes in land use, or other phenomena that might affect the long-term integrity of the site. Drilling activities were observed northwest of the site in early 2024. LM and the LMS contractor are in communication with the drilling and mining company to ensure that the drilling activities do not affect the integrity of the disposal site. Abandoned buildings and a water tower associated with the former milling activities are on state land northwest of the site. The buildings are not maintained and are in disrepair, and debris tends to blow onto the site from surrounding buildings (e.g., shingles, siding, plastic). The accumulation of windblown debris is minor and will continue to be monitored. The trash will also be removed.

Areas of erosion noted during previous inspections include the natural drainage near the southwest side of the site and rills and gullies northwest of the water tower. Evidence of continued erosion in these areas was apparent but does not threaten the integrity of the disposal cell or site surveillance features. Inspectors will continue to monitor these erosional features. No maintenance needs were identified.

7.5 Follow-Up or Contingency Inspections

LM will conduct follow-up or contingency inspections if (1) a condition is identified during the annual inspection or other site visit that requires a return to the site to evaluate the condition or (2) LM is notified by a citizen or outside agency that conditions at the site are substantially changed. No need for a follow-up or contingency inspection was identified.

7.6 Maintenance and Repairs

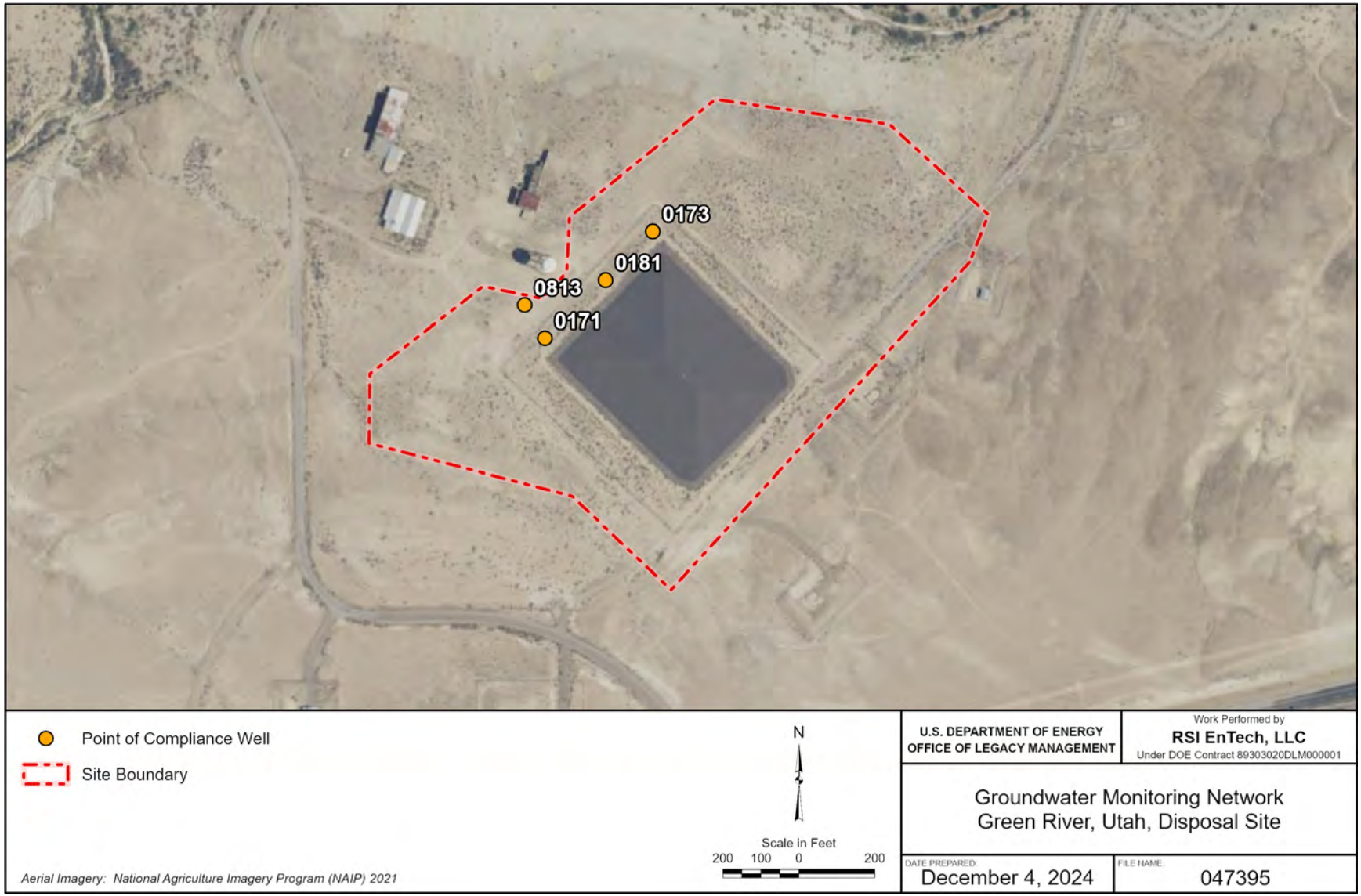
The following maintenance and repairs will be performed before the next annual inspection:

- Replacement of the entrance sign
- Replacement of perimeter signs P1, P2, P5, P6, P8, P11, and P12
- Installation of a T-post as a marker near boundary monument BM-7
- Treatment of vegetation and debris along the security fence

No other maintenance needs were identified.

7.7 Groundwater Monitoring

In accordance with the LTSP, annual groundwater monitoring is conducted at four POC wells to evaluate the performance of the disposal cell (DOE 1998). The most recent sampling event occurred on June 10, 2024. The locations of the four POC wells are shown in Figure 7-2. Table 7-2 lists the wells included in the current site groundwater monitoring network.



Note: Well 0181 was installed in June 2002 to replace former POC well 0172 (refer to discussion in text).

Figure 7-2. POC Groundwater Monitoring Network at the Green River, Utah, Disposal Site

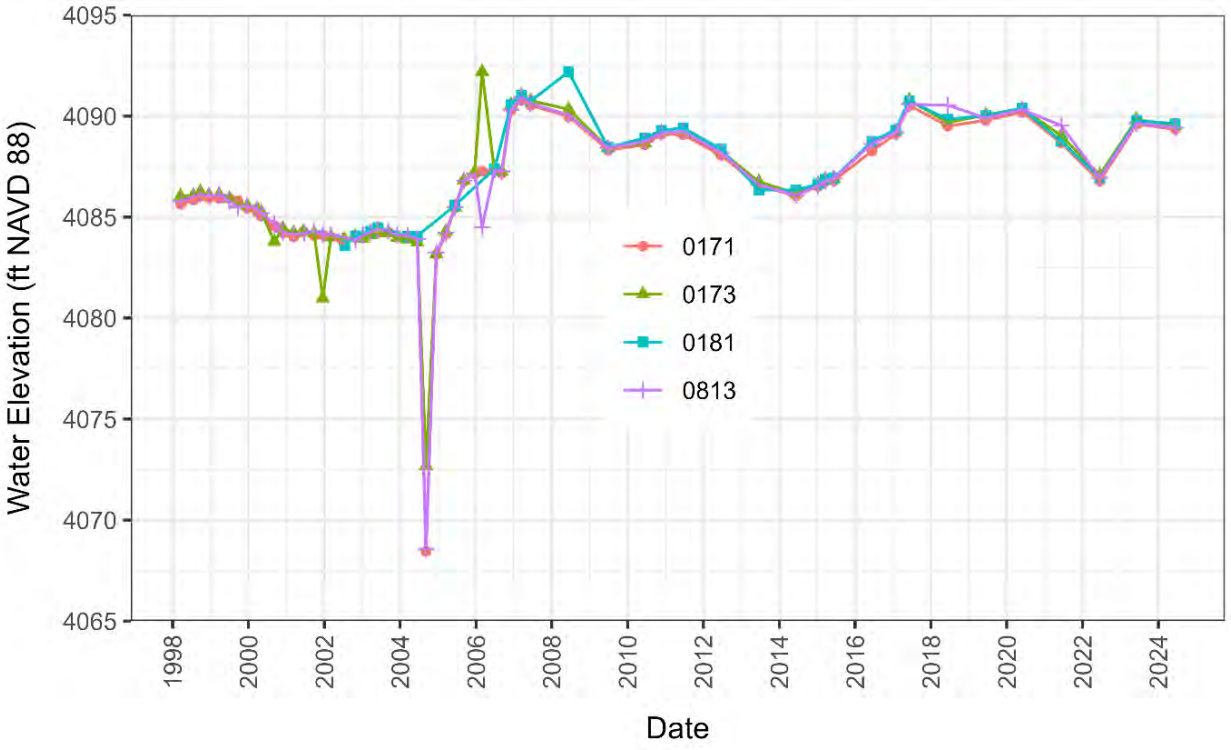
Table 7-2. POC Groundwater Monitoring Network for the Green River, Utah, Disposal Site

Groundwater Monitoring Purpose	Monitoring Wells
POC well	0171, 0173, 0181, and 0813

The LTSP included monitoring well 0172, but its construction integrity was suspect, and the well was replaced with monitoring well 0181 in June 2002. Well 0181 has been monitored as the replacement POC well since July 2002. POC wells are sampled for nitrate (nitrate + nitrite as nitrogen [N]), sulfate, and uranium. Groundwater monitoring results are reported and published on the LM Geospatial Environmental Mapping System (GEMS) website at https://gems.lm.doe.gov.

7.7.1 Water Level Monitoring

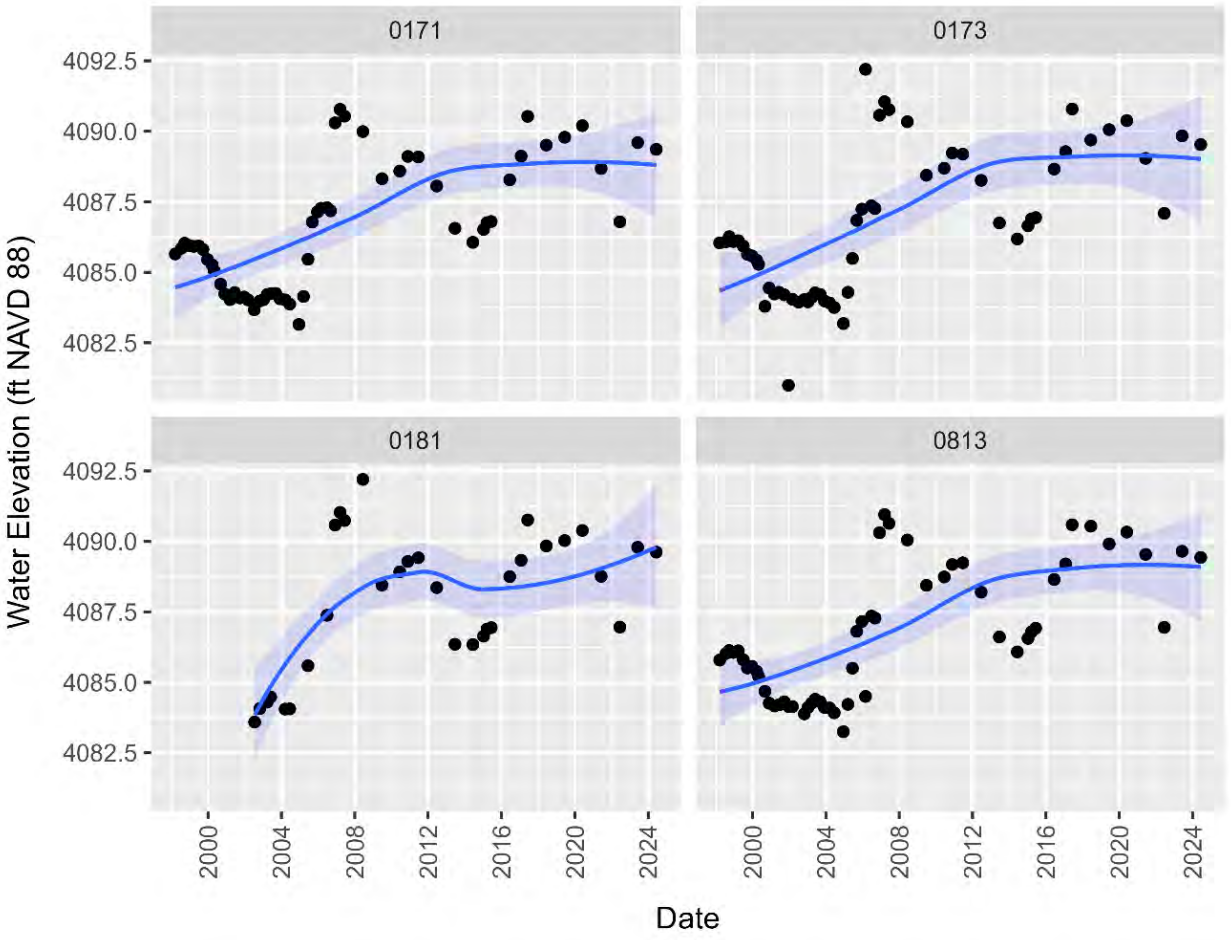
In accordance with the LTSP, water levels in the POC wells are measured routinely. As shown in Figure 7-3, groundwater elevations measured from 1998 to 2024 typically have been consistent across the four POC wells, generally ranging from 4085 to 4090 ft. Water level data plotted in this figure are referenced to the North American Vertical Datum of 1988 (NAVD 88).



Note: The 11–15 ft drop in water levels in wells 0171, 0173, and 0813 recorded in September 2004 may have been due to instrument error or human error in recording the original field record. However, there is no conclusive evidence of error and the data as shown are consistent with available documentation.

Figure 7-3. Groundwater Elevations at the Green River, Utah, Disposal Site, 1998–2024

To provide greater resolution on the historical groundwater elevation data, Figure 7-4 plots the same results as those shown in Figure 7-3 but excludes the three 2004 outliers. In contrast with the initial line plot, Figure 7-4 was developed using a faceting approach, whereby data are partitioned into a matrix of panels, with each panel plotting data for a single well. In each facet plot, a nonparametric smoothing method—locally estimated scatterplot smoothing (LOESS)—is used. The surrounding shaded area represents the 95% pointwise confidence interval.



Note: This figure excludes the following three low outlier water level measurements recorded on September 7, 2004 (<4075 ft, shown in Figure 7-3).

Figure 7-4. 1998–2024 Groundwater Elevations at Green River, Utah, Disposal Site, POC Wells Excluding September 2004 Outlier Measurements

Groundwater elevations in all four POC wells increased about 5 ft between 2004 and 2008 and have fluctuated since then (Figure 7-4). For the 1998–2024 time frame, Mann-Kendall trend analysis indicates statistically significant increasing trends in all four wells. Because of the periodic wide fluctuations in water levels since 2004, no significant trend is indicated if the dataset is limited to 2010–2024.

7.7.2 Disposal Cell Performance Monitoring

Table 7-3 lists the concentration limits in milligrams per liter (mg/L) for POC wells established in the LTSP. The concentration limits determined for uranium and nitrate were the higher value from either the U.S. Environmental Protection Agency maximum concentration limits (MCLs) (40 CFR 192 Table 1 Subpart A) or the background concentration levels present before construction of the disposal cell (DOE 1998). The background water quality in the Cedar Mountain Formation is characterized by high total dissolved solids and concentrations of sulfate that exceed national primary and secondary drinking water standards (DOE 1998). In accordance with the LTSP, sulfate results are compared to well-specific background concentration limits (Table 7-3). Table 7-4 lists the most recent (June 2024) analytical results for the four POC wells.

Table 7-3. LTSP Concentration Limits for POC Wells at the Green River, Utah, Disposal Site

Monitoring Well	Nitrate[a] (mg/L)	Sulfate (mg/L)	Uranium (mg/L)
0171	10[b]	3334	0.044[b]
0173	10[b]	4000	0.044[b]
0181[c]	102	4985	0.067
0813	10[b]	4440	0.069

Notes:
[a] Nitrate = nitrate + nitrite as N.
[b] MCL (40 CFR 192 Table 1 Subpart A).
[c] Concentration limits for well 0181 correspond to those derived initially for well 0172 (Table 5.1 of DOE 1998).

Table 7-4. 2024 Analytical Results for POC Wells at the Green River, Utah, Disposal Site

Monitoring Well	Nitrate[a] (mg/L)	Sulfate (mg/L)	Uranium (mg/L)
0171	*38.8*	*3780*	*0.086*
0173	*83.1*	*5830*	0.014
0181	52.0	*6690*	0.022
0813	<0.017	3500	0.068

Notes:
Results in italic denote concentrations equal to or exceeding the LTSP-driven concentration limit.
[a] Nitrate = nitrate + nitrite as N.

Figure 7-5 shows the time-concentration plots for nitrate in the four POC wells along with corresponding concentration limits. In this and subsequent figures, the most recent (2024) results are labeled in the lower right corner of each plot. For wells with statistically significant trends ($p < 0.05$) (Table 7-5), the direction of the trend is also indicated.

Nitrate concentrations continue to exceed the 10 mg/L MCL in wells 0171, 0173, and 0181 (Figure 7-5). Nitrate concentrations have been stable in well 0171, averaging about 43 mg/L, but highly variable in well 0173 (with a mean and standard deviation of 181 ± 118 mg/L). Nitrate concentrations in well 0181 (52.0 mg/L in 2024) have been below the concentration limit (background value of 102 mg/L) since 2009 but typically above the 10 mg/L MCL. Nitrate concentrations in well 0813 have been well below the 10 mg/L MCL; most results have been below detection limits.

For the 1998–2024 time frame, a significant decreasing trend in nitrate concentrations was found for well 0181 (no significant trend in the remaining wells). For the 2008–2024 dataset (after 2008, wells were consistently sampled annually), significant decreasing trends were found for all wells except well 0813 (Table 7-5).

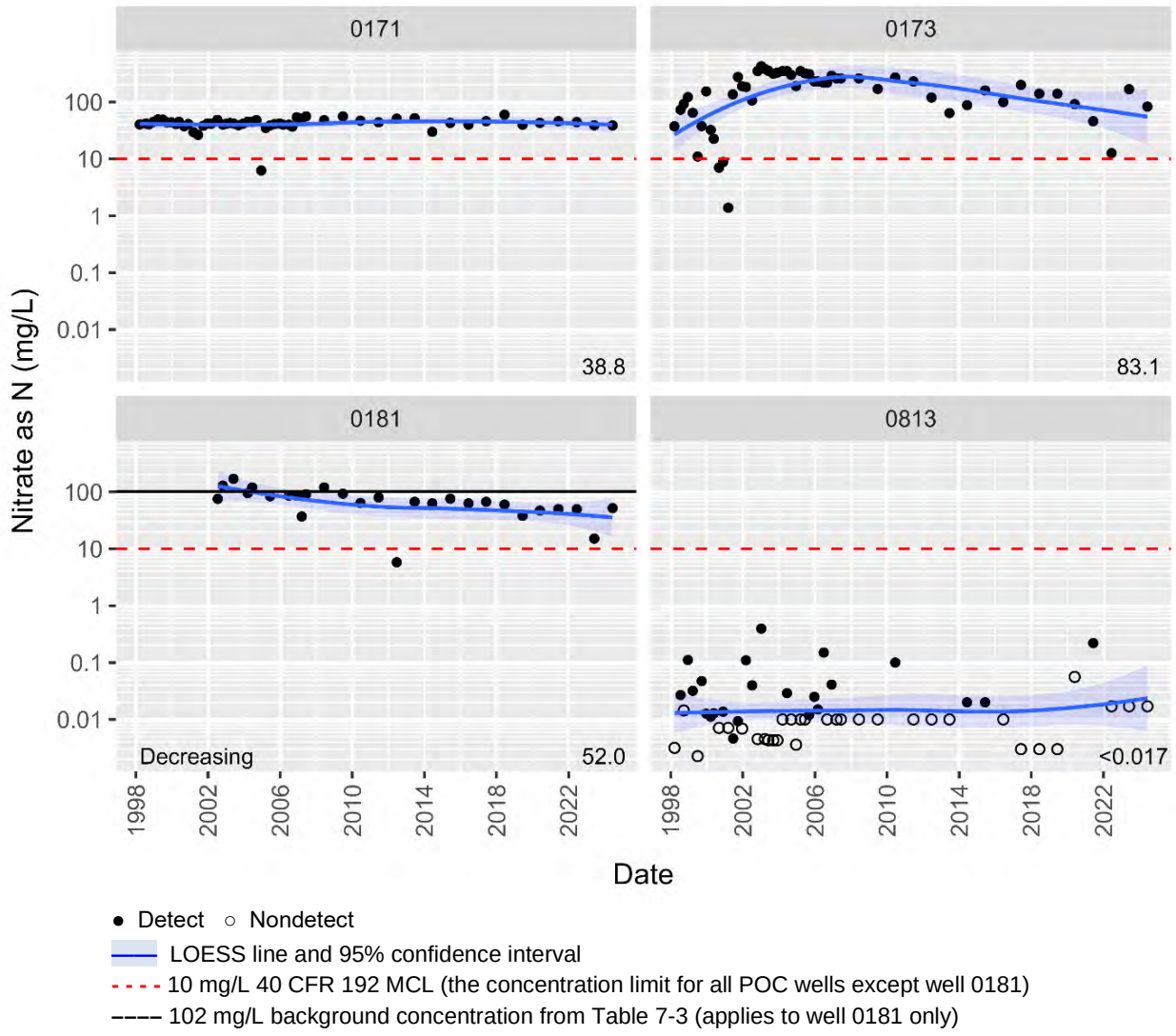


Figure 7-5. Nitrate Concentrations at POC Wells at the Green River, Utah, Disposal Site

Table 7-5. Mann-Kendall Trend Analysis Results for Nitrate, Sulfate, and Uranium in Green River, Utah, Disposal Site POC Wells, 1998–2024

POC Well	Initial Trend Analysis Date[a]	No. of Samples[b] (No. of Nondetects)	Kendall's tau[c]	p-value[c]	Trend[c]	Trend Since 2008[d]
Nitrate[e]						
0171	3/20/1998	55	0.09	0.34	No Trend	Decreasing
0173	3/17/1998	55	0.01	0.96	No Trend	Decreasing
0181	7/17/2002	27	−0.57	<0.001	Decreasing	Decreasing
0813	3/20/1998	55 (32)	−0.11	0.24	No Trend	No Trend
Sulfate						
0171	3/20/1998	49	−0.14	0.17	No Trend	No Trend
0173	3/17/1998	49	0.28	0.005	Increasing[e]	No Trend
0181	7/17/2002	22	0.38	0.015	Increasing	No Trend
0813	3/20/1998	49	−0.13	0.18	No Trend	No Trend
Uranium						
0171	3/20/1998	55	0.63	<0.001	Increasing	No Trend
0173	3/17/1998	55	0.70	<0.001	Increasing	No Trend
0181	7/17/2002	27	0.07	0.63	No Trend	Increasing
0813	3/20/1998	55	0.75	<0.001	Increasing	Increasing

Notes:

[a] Initial trend analysis dates vary as indicated above. For all well-parameter combinations, the final trend analysis date is June 10, 2024.

[b] POC wells were sampled more frequently between 1998 and 2008 (about four times per year). Starting in 2008, samples were collected on an annual basis, usually in June.

[c] Trend tests were conducted using the "NADA: Nondetects and Data Analysis for Environmental Data" package, version 1.6-1.1 (Lee 2020) in R, version 4.3.3 (R Core Team 2024). The NADA trend test is similar to the traditional Mann-Kendall trend test, except that it accounts for the presence of nondetects at multiple detection limits. Trend analyses were conducted at the 0.05 significance level using a two-sided test. The test statistic, Kendall's tau, is a measure of the strength of the association between two variables, with values always falling between −1 and +1.

[d] Because of the inconsistent sampling frequencies in early years noted above, and also to account for more recent trends, trend tests were also run for the 2008–2024 time frame. Only trend directions are listed above; corresponding tau and p-values are not shown.

[e] Nitrate is expressed as nitrate + nitrite as N. Results before 2004 were converted from nitrate as NO_3.

Figure 7-6 shows the time-concentration plots for sulfate in POC wells relative to the corresponding well-specific background concentration limits listed in Table 7-3. Sulfate concentrations typically exceed the LTSP background concentrations in all wells except 0813 (Figure 7-6). Sulfate concentrations in well 0171 have been stable (averaging about 4000 mg/L), while those in well 0173 have been the highest and most variable, particularly since 2010. Consistent with most historical measurements, sulfate concentrations in well 0181 exceeded the corresponding concentration limit (4985 mg/L). Sulfate concentrations in well 0813 remain below the corresponding concentration limit of 4440 mg/L (Figure 7-6).

Using the full (1998–2024) dataset, significant increasing trends in sulfate concentrations were found for wells 0173 and 0181 (Table 7-5). For well 0173, this finding stems largely from the approximate doubling of sulfate concentrations between 1998 and 2006. Using the 2008–2024 time frame, no significant trend in sulfate concentrations were found for any POC well.

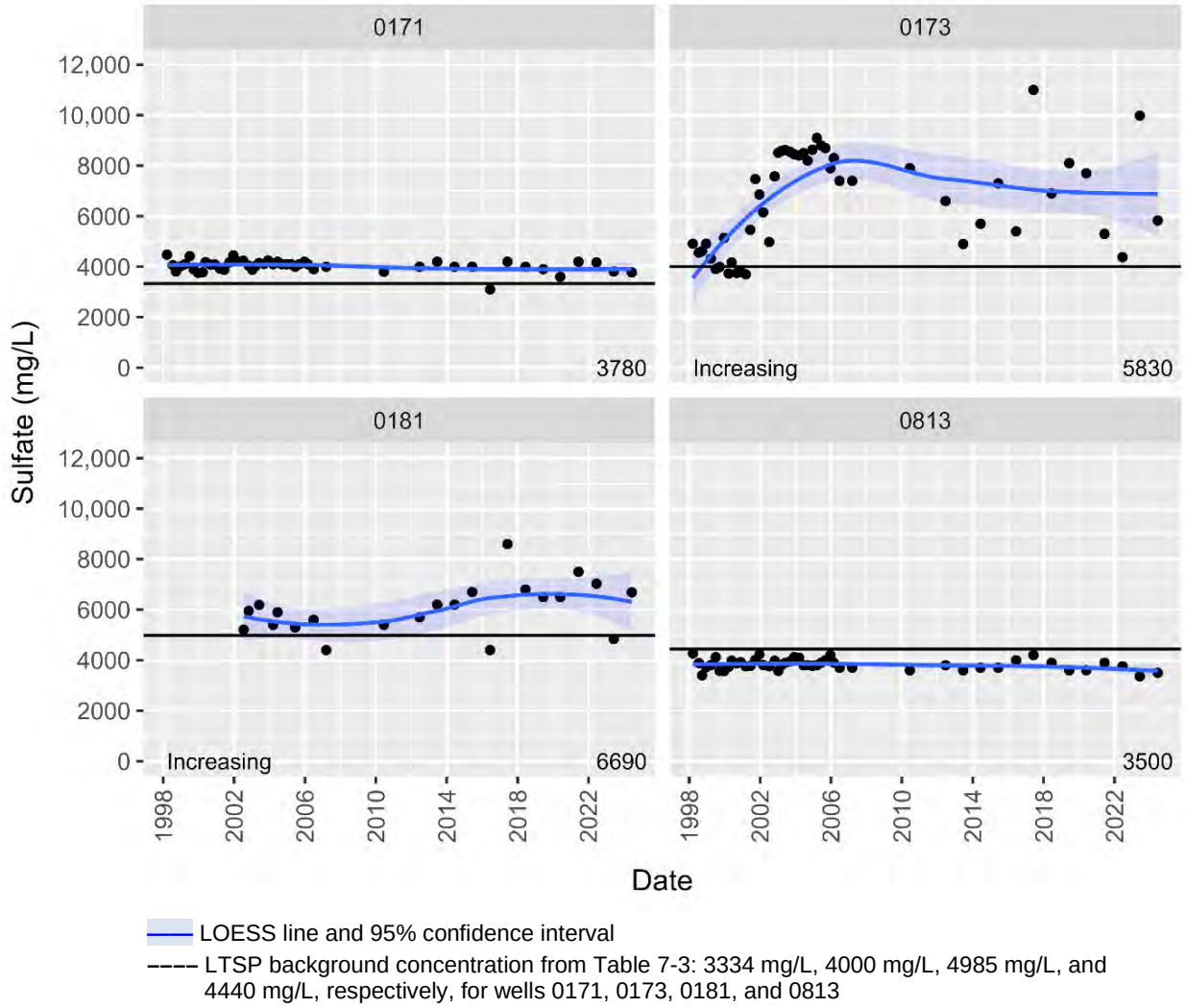


Figure 7-6. Sulfate Concentrations at POC Wells at the Green River, Utah, Disposal Site

Figure 7-7 shows the time-concentration plots for uranium in POC wells relative to the LTSP concentration limits listed in Table 7-3. In 2024, uranium concentrations exceeded the corresponding LTSP concentration limit only in well 0171 (Table 7-4), where results have exceeded the 0.044 mg/L MCL since late 2002 (with one exception). As observed for nitrate and sulfate, uranium concentrations in well 0173 have been highly variable since 2010 and appear to be somewhat correlated with fluctuating water levels in this well (Figure 7-4).

Based on the full (1998–2024) dataset, a significant increasing trend in uranium concentrations was found for all but one well (0181). For the 2008–2024 time frame, the trend is still increasing for wells 0173 and 0813 (Table 7-5). This increasing trend is particularly apparent in well 0813, where the most recent result (0.068 mg/L)—the highest on record for this well since the LTSP was issued—is nearly equal to the corresponding 0.069 mg/L concentration limit.

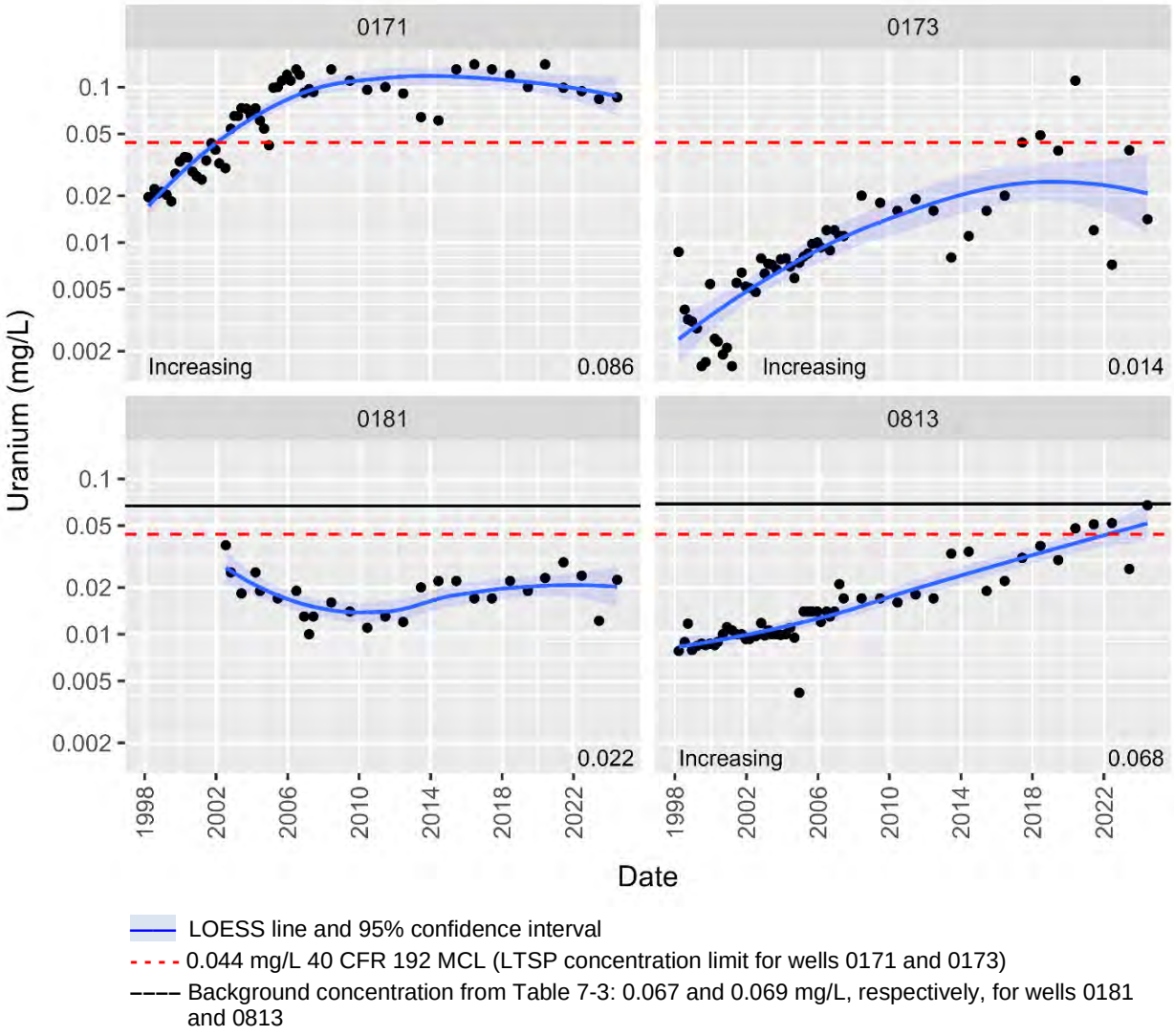


Figure 7-7. Uranium Concentrations at POC Wells at the Green River, Utah, Disposal Site

In summary, in 2024, concentrations of the routinely monitored analytes exceeded corresponding concentration limits in several POC wells: nitrate in wells 0171 and 0173; sulfate in all wells except well 0813; and uranium in well 0171. Based on data collected since 1998, Mann-Kendall trend analysis indicates statistically significant increasing trends for several well-parameter combinations: sulfate in wells 0173 and 0181 and uranium in wells 0171, 1073, and 0813. When the trend analysis was limited to data since 2008, significant increasing trends were found only for uranium in wells 0181 and 0813.

7.8 Corrective Action

Corrective action is taken to correct out-of-compliance or hazardous conditions that create a potential health and safety problem or that may affect the integrity of the disposal cell or compliance with 40 CFR 192. No need for corrective action was identified.

7.9 References

Note

Site-related documents are available on the LM public webpages at https://lmpublicsearch.lm.doe.gov/SitePages.

10 CFR 40.27. U.S. Nuclear Regulatory Commission, "General License for Custody and Long-Term Care of Residual Radioactive Material Disposal Sites," *Code of Federal Regulations*.

40 CFR 192. U.S. Environmental Protection Agency, "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings," *Code of Federal Regulations.*

40 CFR 192 Table 1 Subpart A. U.S. Environmental Protection Agency, "Maximum Concentration of Constituents for Groundwater Protection," *Code of Federal Regulations*.

DOE (U.S. Department of Energy), 1998. *Long-Term Surveillance Plan for the Green River, Utah, Disposal Site*, DOE/AL/62350-89, Rev. 2, July.

Lee, L., 2020. "NADA: Nondetects and Data Analysis for Environmental Data," R package, version 1.6-1.1, https://CRAN.R-project.org/package=NADA, accessed November 7, 2024.

R Core Team, 2024. "R: A Language and Environment for Statistical Computing," The R Foundation for Statistical Computing, version 4.3.3, https://www.r-project.org, accessed November 7, 2024.

7.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	45	Entrance Sign
PL-2	135	Perimeter Sign P2
PL-3	0	Site Marker SMK-2
PL-4	—	Quality Control Monument QC-3
PL-5	0	Monitoring Well 0181
PL-6	—	Erosion at South Corner of Disposal Cell
PL-7	135	Erosion near Perimeter Sign P7 and the Water Tower

Note:
— = Photograph taken vertically from above.



PL-1. Entrance Sign



PL-2. Perimeter Sign P2



PL-3. Site Marker SMK-2



PL-4. Quality Control Monument QC-3



PL-5. Monitoring Well 0181



PL-6. Erosion at South Corner of Disposal Cell



PL-7. Erosion near Perimeter Sign P7 and the Water Tower

8.0 Gunnison, Colorado, Disposal Site

8.1 Compliance Summary

The U.S. Department of Energy (DOE) Office of Legacy Management (LM) conducted the Gunnison, Colorado, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site inspection on September 10, 2024. No cause for a follow-up inspection was identified.

No changes were observed on the disposal cell or in the associated diversion channels. Inspectors identified several minor maintenance items that will be addressed during the next maintenance visit to the site.

The most recent groundwater sampling event occurred in July 2021. The next scheduled monitoring event will occur in 2026. Groundwater monitoring results were below the site-specific uranium action level in the six point of compliance (POC) wells.

8.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the site-specific Long-Term Surveillance Plan (DOE 1997) (LTSP) in accordance with procedures established to comply with the requirements of the U.S. Nuclear Regulatory Commission (NRC) general license at Title 10 *Code of Federal Regulations* Section 40.27 (10 CFR 40.27). Table 8-1 lists these requirements.

Table 8-1. License Requirements for the Gunnison, Colorado, Disposal Site

Requirement	LTSP	This Report	10 CFR 40.27
Annual Inspection and Report	Section 3.0	Section 8.4	(b)(3)
Follow-Up Inspections	Section 3.5	Section 8.5	(b)(4)
Maintenance and Repairs	Section 5.0	Section 8.6	(b)(5)
Environmental Monitoring	Section 4.0	Section 8.7	(b)(2)
Corrective Action	Section 6.0	Section 8.8	--

8.3 Institutional Controls

The 92-acre site, identified by the property boundary shown in Figure 8-1, is owned by the United States and was accepted under the NRC general license in 1997. DOE is the licensee and, in accordance with the requirements for UMTRCA Title I sites, LM is responsible for the custody and long-term care of the site. Institutional controls (ICs) at the site include federal ownership of the property, administrative controls, and the following physical ICs that are inspected annually: the disposal cell and associated diversion channels, entrance gate, and sign; perimeter fence and signs; site markers; survey and boundary monuments; quality control monuments; and wellhead protectors.

8.4 Inspection Results

The site, 6 miles southeast of Gunnison, Colorado, was inspected on September 10, 2024. The inspection was conducted by J. Lobato and D. Atkinson of the Legacy Management Support contractor. A. Farinacci (LM site manager) and M. Cosby and A. Lawrence (Colorado Department of Public Health and Environment) also attended the inspection. The purposes of the inspection were to confirm the integrity of visible features at the site, identify changes in conditions that might affect conformance with the LTSP, and evaluate whether maintenance or follow-up inspection and monitoring are needed.

8.4.1 Site Surveillance Features

Figure 8-1 shows the locations of site features, including site surveillance features and inspection areas, in black and gray font. Some site features that are present but not required to be inspected are shown in italic font. Observations from previous inspections that are currently monitored are shown in blue, and new observations identified during the 2024 annual inspection are shown in red. Inspection results and recommended maintenance activities associated with site surveillance features are described in the following subsections. Photographs to support specific observations are noted in the text and in Figure 8-1 by photograph location (PL) numbers. The photographs and photograph log are presented in Section 8.9.

8.4.1.1 Site Access, Entrance Gate, and Entrance Sign

Access to the site is from Gunnison County Road 42 onto U.S. Bureau of Land Management (BLM) Route 3068, a gravel road maintained by BLM. Entrance to the site is through a locked gate that is part of the perimeter fence (PL-1). The entrance gate was locked and functional, and the entrance sign was intact and legible. The site has two additional access gates, one on the east fence line and the other on the north fence line, that provide access to several offsite monitoring wells. Although not part of the inspection results, all three barbed-wire gates were replaced with metal gates following the inspection. Gates were locked at the time of the inspection. No maintenance needs were identified.

8.4.1.2 Perimeter Fence and Signs

A three-strand barbed-wire perimeter fence encloses the site, which is set along or within the property boundary. In 2019, fence flagging was added to help protect sage-grouse and antelope from becoming entangled. The perimeter fence was intact. In 2023, the barbed-wire gates along the perimeter fence were replaced with metal gates.

There are 45 perimeter signs bolted to the perimeter fence posts. Perimeter signs P2, P3, P35, P44, and P45 have bullet damage but remain legible. Perimeter signs P38 and P40 are missing. No other maintenance needs were identified.

8.4.1.3 Site Markers

The site has two granite site markers. Site marker SMK-1 (PL-2) is just inside the entrance gate, and site marker SMK-2 is on the top slope of the disposal cell. The concrete base of site marker SMK-2 has cracks lining up with each of the four monument corners but remains stable. No maintenance needs were identified.

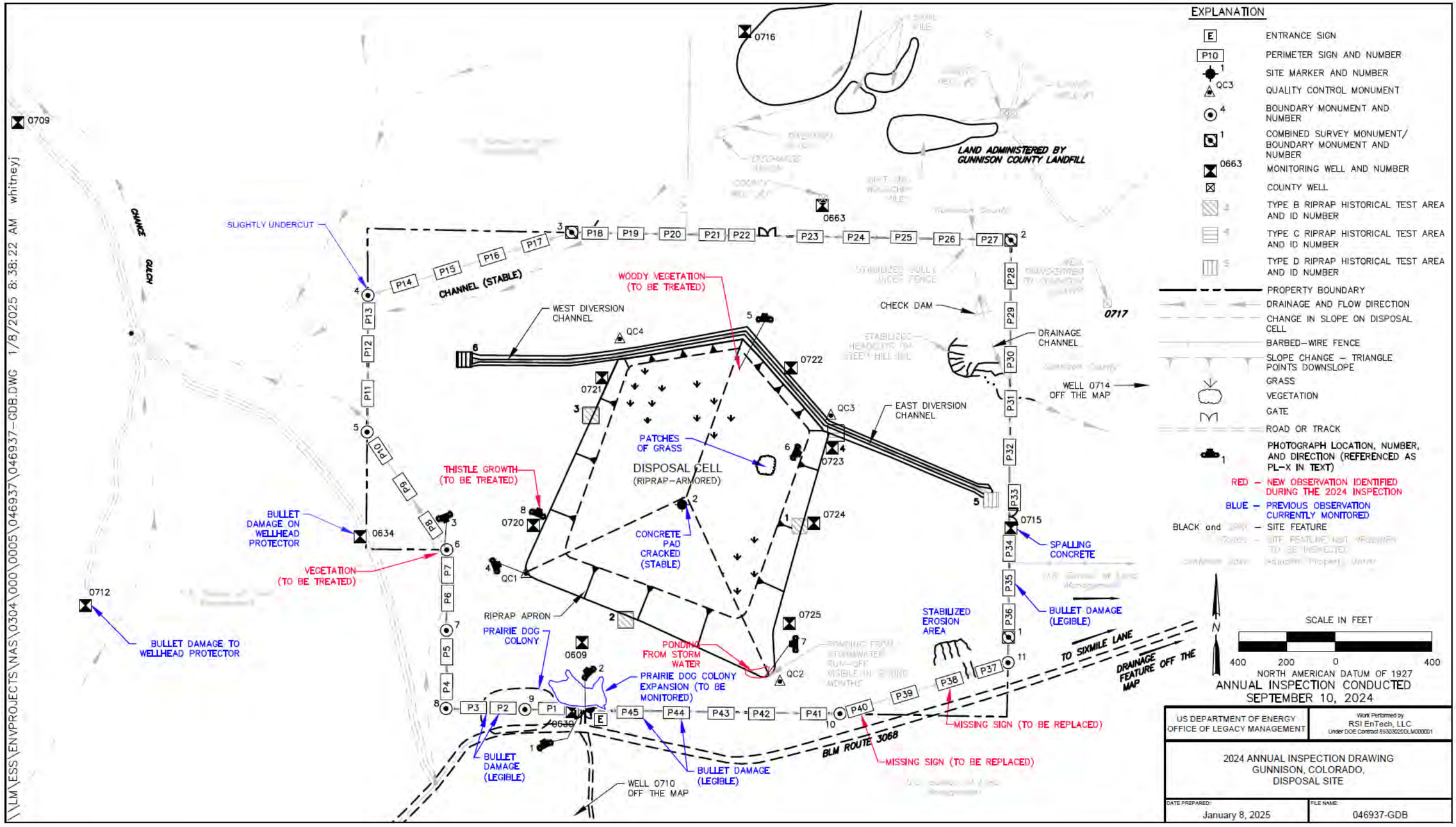


Figure 8-1. 2024 Annual Inspection Drawing for the Gunnison, Colorado, Disposal Site

8.4.1.4 Survey and Boundary Monuments

Three combined survey and boundary monuments and eight additional boundary monuments delineate the property boundary. Inspectors noted that boundary monument BM-6 is obscured by vegetation (PL-3), which will be treated. During the 2023 inspection, inspectors noted that boundary monument BM-4 was slightly undercut but remains stable. No other maintenance needs were identified.

8.4.1.5 Aerial Survey Quality Control Monuments

In October 2022, four permanent aerial survey quality control monuments were installed at the site for an aerial survey of the disposal cell (PL-4). No maintenance needs were identified.

8.4.1.6 Monitoring Wells

The site has 16 groundwater monitoring wells. The wellhead protectors were locked and properly labeled. There is bullet damage on the wellhead protector of monitoring wells 0634 and 0712, but the well casings are not impacted and remain functional. Monitoring well 0716 is on landfill property. Gunnison County landfill operators have placed concrete barriers to protect monitoring well 0716 from landfill activities. The concrete around monitoring well 0715 is beginning to spall. Monitoring well locks have been replaced with new DOE locks as part of a programmatic effort. No maintenance needs were identified.

8.4.2 Inspection Areas

In accordance with the LTSP, the site is divided into four inspection areas to ensure a thorough and efficient inspection. The inspection areas are (1) the top of the disposal cell; (2) the disposal cell side slopes, apron, and diversion channels; (3) the area between the disposal cell and the site boundary; and (4) the outlying area. Inspectors examined specific site surveillance features within each area and looked for evidence of erosion, settling, slumping, or other modifying processes that might affect the site's conformance with LTSP requirements.

8.4.2.1 Top of the Disposal Cell

There was no evidence of settling, slumping, erosion, or any other modifying process that might affect the integrity of the top slope of the disposal cell. Inspectors noted a woody plant growing on the north side of the top of the disposal cell (PL-5), which will be treated. Several isolated patches of grass have established on the top slope; however, these shallow-rooted plants do not degrade the performance of the radon barrier component of the disposal cell's engineered cover. No other maintenance needs were identified.

8.4.2.2 Disposal Cell Side Slopes, Apron, and Diversion Channels

The disposal cell, completed in 1995, occupies 29 acres and is armored with basalt riprap to control erosion. Basalt riprap armors the disposal cell side slopes (PL-6), the apron that collects and diverts stormwater runoff from the disposal cell, and the two diversion channels that protect the disposal cell from precipitation run-on. There was no evidence of settling, slumping, erosion, or any other modifying process that might affect the integrity of the disposal cell side slopes, apron, or diversion channels. Six historical test areas that were armored with riprap were last

inspected during the 2017 annual inspection; in accordance with the LTSP (DOE 1997), monitoring is no longer required because no rock degradation has been observed. Stormwater runoff from the disposal cell occasionally accumulates in a low-lying area at the southeast corner of the disposal cell apron (PL-7). The riparian-type vegetation that has become established there indicates that the area retains moisture. Water collection in this area does not pose a problem because the disposal cell surfaces are designed to drain to the southeast, and any water that ponds there is below the elevation of tailings placed under the engineered cover. No maintenance needs were identified.

8.4.2.3 Area Between the Disposal Cell and the Site Boundary

Reclaimed and undisturbed areas comprise the area between the disposal cell and the site boundary. In general, the vegetation in the reseeded, reclaimed areas consists of well-established grass; native plants are much less abundant and less diverse in reclaimed areas than they are in undisturbed areas. Former erosion areas are stable and naturally revegetating with native plant species. Inspectors noted dense thistle growth along the west side of the disposal cell (PL-8), which will be treated. Inspectors have been monitoring several prairie dog burrows inside the perimeter fence near perimeter signs P1, P2, and P3. Inspectors noted that the prairie dog colony appears to be expanding and will be monitored to ensure that the holes do not damage any DOE assets or become a nuisance. The closest burrow to the southern riprap apron is approximately 280 feet away. No other maintenance needs were identified.

8.4.2.4 Outlying Area

In accordance with the LTSP, a drainage feature from the southeast corner of the site and along BLM Route 3068 was checked for indications of seepage from the vadose zone. The feature, which follows the borrow ditch along the road, was dry and showed no signs of seepage.

The 0.25-mile area beyond the site boundary was visually observed for erosion, changes in land use, or other phenomena that might affect the long-term integrity of the site. A prairie dog colony that had been observed along the southwestern boundary of the site during the 2023 inspection has expanded further to the north inside the perimeter fence in 2024, as noted in Section 8.4.2.3. Inspectors will continue to monitor and track the extent of the prairie dog colony in this area.

Gunnison County owns the land adjacent to the site boundary to the north and east and uses the land for a municipal landfill. The nearest landfill operations continue to be approximately 400 feet north of the property boundary. Although landfill activities do not affect the site, inspectors will continue to monitor the level of activity occurring near the site boundary and surveillance features (e.g., fences and monitoring wells). There is a spoil pile near monitoring well 0716 (Figure 8-1) that inspectors will continue to monitor. No maintenance needs were identified.

8.5 Follow-Up or Contingency Inspections

LM will conduct follow-up inspections if (1) a condition is identified during the annual inspection or other site visit that requires a return to the site to evaluate the condition or (2) LM is notified by a citizen or outside agency that conditions at the site are substantially changed. No need for a follow-up inspection was identified.

8.6 Maintenance and Repairs

Inspectors identified the following maintenance items during the 2024 inspection:

- Perimeter signs P38 and P40 will be replaced
- Vegetation obscuring boundary monument BM-6 will be treated
- The woody plant growing on the north side of the top of the disposal cell will be treated
- Dense thistle growth along the west side of the disposal cell will be treated

Annual maintenance is scheduled to occur in 2025. The maintenance items listed will be resolved at that time. No other maintenance needs were identified.

8.7 Environmental Monitoring

8.7.1 Groundwater Monitoring

In accordance with the LTSP (DOE 1997), LM conducts groundwater monitoring every 5 years to demonstrate that the site-specific uranium action level has not been exceeded. Groundwater was sampled and groundwater levels were measured annually from 1998 to 2001. Following the 2001 sampling event, the monitoring frequency changed to once every 5 years. The most recent sampling event occurred in July 2021. Groundwater monitoring results for the site are reported and published on the LM Geospatial Environmental Mapping System (GEMS) website https://gems.lm.doe.gov. The next sampling event is planned for 2026.

The groundwater monitoring network consists of 16 monitoring wells. This total includes six POC wells, two monitoring wells to monitor background groundwater quality, and eight wells to monitor groundwater levels.

The indicator analyte for disposal cell performance is uranium, which was selected because of its presence in tailings pore fluid, relatively high mobility in groundwater, and low concentration in background groundwater samples, as stated in Section 2.5 in the LTSP (DOE 1997).

The site-specific screening monitoring action level (action level) concentration for uranium is 0.013 milligram per liter (mg/L). The basis for this action level is the maximum observed concentration of uranium in background samples before long-term surveillance and maintenance activities began. The U.S. Environmental Protection Agency established a maximum concentration limit for uranium of 0.044 mg/L in groundwater (40 CFR 192 Subpart A Table 1). Water levels are measured at each monitoring well during groundwater monitoring events. A rising water level trend in monitoring wells 0663, 0715, 0716, and 0721 through 0725 was noted in the 2021 monitoring report results. In 2022, DOE initiated a new project to investigate the rising water level. Data for the rising water level project have been collected, and DOE is reviewing the results.

The concentrations of uranium in samples collected and analyzed from the POC wells in 2021 ranged from 0.001 mg/L to 0.005 mg/L. In 2021, uranium concentrations were consistent with historical results in five of the POC wells; however, they slightly exceeded the historical maximum in POC well 0721. Uranium results from the POC wells in 2021 were below the action level of 0.013 mg/L.

Table 8-2 lists the site's groundwater monitoring network, and Figure 8-2 presents the locations of the groundwater monitoring network.

Table 8-2. Groundwater Monitoring Network for the Gunnison, Colorado, Disposal Site

POC and Background Wells	Groundwater Level Wells
0720 (POC)	0630
0721 (POC)	0634
0722 (POC)	0663
0723 (POC)	0709
0724 (POC)	0710
0725 (POC)	0712
0609 (background)	0714
0716 (background)	0715

8.8 Corrective Action

Corrective actions may be warranted to address hazardous conditions that create a potential health and safety problem or conditions that may affect the integrity of the disposal cell or compliance with 40 CFR 192.04. No need for corrective action was identified as part of this inspection.

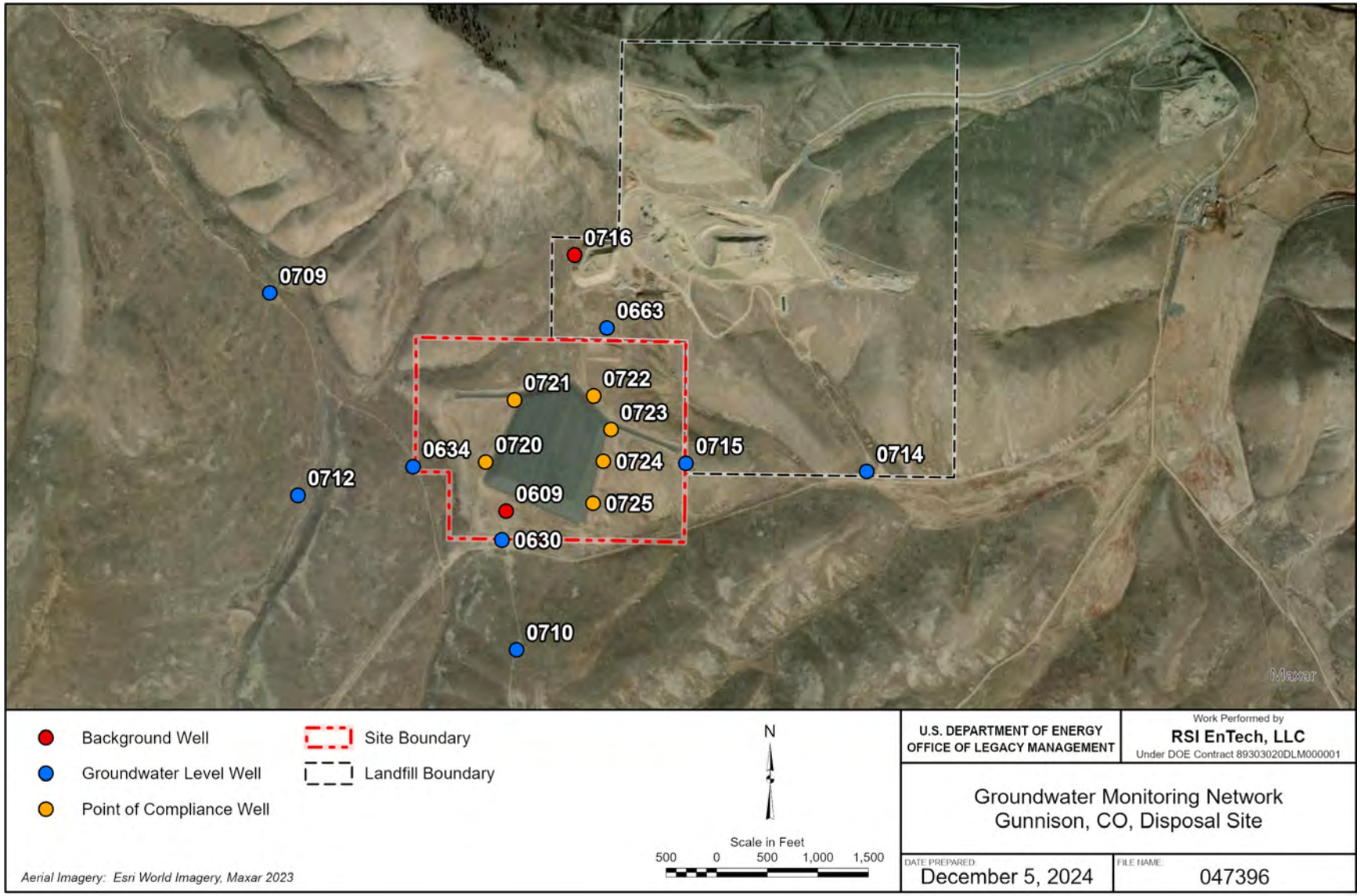


Figure 8-2. Groundwater Monitoring Network at the Gunnison, Colorado, Disposal Site

8.9 References

Note

Site-related documents are available on the LM public webpages at https://lmpublicsearch.lm.doe.gov/SitePages.

10 CFR 40.27. U.S. Nuclear Regulatory Commission, "General License for Custody and Long-Term Care of Residual Radioactive Material Disposal Sites," *Code of Federal Regulations*.

40 CFR 192 Subpart A Table 1. U.S. Environmental Protection Agency, "Maximum Concentration of Constituents for Groundwater Protection," *Code of Federal Regulations.*

40 CFR 192.04. U.S. Environmental Protection Agency, "Corrective Action," *Code of Federal Regulations*.

DOE (U.S. Department of Energy), 1997. *Long-Term Surveillance Plan for the Gunnison, Colorado, Disposal Site*, DOE/AL/62350-222, Rev. 2, April.

8.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	338	Entrance Gate
PL-2	315	Site Marker SMK-1
PL-3	158	Boundary Monument BM-6
PL-4	68	Quality Control Monument QC-1
PL-5	—	Woody Vegetation on Disposal Cell
PL-6	113	East Side Slope
PL-7	270	Ponding from Stormwater Runoff
PL-8	23	Dense Thistle Growth

Note:
— = Photograph taken vertically from above.



PL-1. Entrance Gate



PL-2. Site Marker SMK-1



PL-3. Boundary Monument BM-6



PL-4. Quality Control Monument QC-1



PL-5. Woody Vegetation on Disposal Cell



PL-6. East Side Slope



PL-7. Ponding from Stormwater Runoff



PL-8. Dense Thistle Growth

9.0 Lakeview, Oregon, Disposal Site

9.1 Compliance Summary

The Lakeview, Oregon, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site was inspected on July 10, 2024. No changes were observed on the disposal cell or in the drainage features. Inspectors identified minor maintenance needs but found no cause for a follow-up or contingency inspection.

Disposal cell riprap gradation monitoring has been performed annually since 1997 at random locations on the west side slope due to concerns over premature rock degradation. With the approval of the U.S. Nuclear Regulatory Commission (NRC) in 2019 to discontinue rock gradation monitoring at the site (Mandeville 2019), rock gradation monitoring was discontinued in 2020. Photographs have been collected since 2020 and were collected during the 2024 inspection. No evidence of settling, slumping, erosion, or any other modifying process on the disposal cell side slopes was observed that might affect the integrity of the cell.

The U.S. Department of Energy (DOE) Office of Legacy Management (LM) conducts groundwater monitoring every 5 years to demonstrate compliance with established groundwater quality protection standards. The most recent sampling event occurred in July 2024. Groundwater monitoring results for the three analytes routinely monitored at the site—arsenic, cadmium, and uranium—were below the corresponding U.S. Environmental Protection Agency (EPA) maximum concentration limits (MCLs) in all monitoring wells.

9.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the site-specific Long-Term Surveillance Plan (DOE 1994) (LTSP) in accordance with procedures established to comply with the requirements of the NRC general license at Title 10 *Code of Federal Regulations* Section 40.27 (10 CFR 40.27). Table 9-1 lists these requirements.

Table 9-1. License Requirements for the Lakeview, Oregon, Disposal Site

Requirement	LTSP	This Report	10 CFR 40.27
Annual Inspection and Report	Section 6.0	Section 9.4	(b)(3)
Follow-Up or Contingency Inspections	Section 7.0	Section 9.5	(b)(4)
Maintenance and Repairs	Section 8.0	Section 9.6	(b)(5)
Groundwater Monitoring	Section 5.3	Section 9.7	(b)(2)
Corrective Action	Section 9.0	Section 9.8	—

9.3 Institutional Controls

The 40-acre site, identified by the property boundary shown in Figure 9-1, is owned by the United States and was accepted under the NRC general license in 1995. DOE is the licensee and, in accordance with the requirements for UMTRCA Title I sites, LM is responsible for the custody and long-term care of the site.

Institutional controls (ICs) at the site include federal ownership of the property, administrative controls, and the following physical ICs that are inspected annually: the disposal cell and associated drainage features, entrance gate and sign, perimeter fence and signs, site markers, survey and boundary monuments, and wellhead protectors.

9.4 Inspection Results

The site, approximately 7 miles northwest of Lakeview, Oregon, was inspected on July 10, 2024. The inspection was conducted by T. Santonastaso and L. Sheader of the Legacy Management Support contractor. T. Sicilia and M. Hendrickson (Oregon Department of Energy) and M. Bia and J. Engel (LM) participated in the inspection. The purposes of the inspection were to confirm the integrity of visible features at the site, identify changes in conditions that might affect conformance with the LTSP, and evaluate whether maintenance or follow-up inspection and monitoring are needed.

9.4.1 Site Surveillance Features

Figure 9-1 shows the locations of site features, including site surveillance features and inspection areas, in black and gray font. Some site features that are present but not required to be inspected are shown in italic font. Observations from previous inspections that are currently monitored are shown in blue, and new observations identified during the 2024 annual inspection are shown in red. Inspection results and recommended maintenance activities associated with site surveillance features are described in the following subsections. Photographs to support specific observations are noted in the text and in Figure 9-1 by photograph location (PL) numbers. The photographs and photograph log are presented in Section 9.10.

9.4.1.1 Access Road, Entrance Gate, and Entrance Sign

Access to the site is from a gravel road that heads west from Lake County Road 2-16B. DOE was granted a perpetual easement on the approximately 1.2-mile access road between the county road and the property boundary. A lockable gate across the access road on the adjacent privately owned land limits access to the site. The entrance gate to the site is in the southeast corner of the perimeter fence. The entrance gate was locked and undamaged. The entrance sign is attached to a steel post set in concrete along the access road and was undamaged (PL-1). A pedestrian gate in the northwest corner of the site was locked and undamaged. No maintenance needs were identified.

9.4.1.2 Perimeter Fence and Signs

A sheep fence and four- or five-strand barbed wire enclose the site. Sheep fencing is on the southeastern and southern boundaries of the site. Some juniper trees and other vegetation are growing near, or entangled in, the perimeter fence line (PL-2), but the fence appears stable and remains functional. An empty post was found near the southern fence and will be removed in the future. A small hole in the sheep fence was observed in the southern fence line. The hole appears to be man-made, possibly to help small animals escape through the fence. Evidence of minor erosion from animals digging under the fence was identified near the southeast corner of the fence line and along the northern fence line during the 2022 and 2023 inspections, but these areas are not a concern to site security or the integrity of the fence. New evidence of animal digging was observed along the eastern fence line during the 2024 inspection (PL-3).

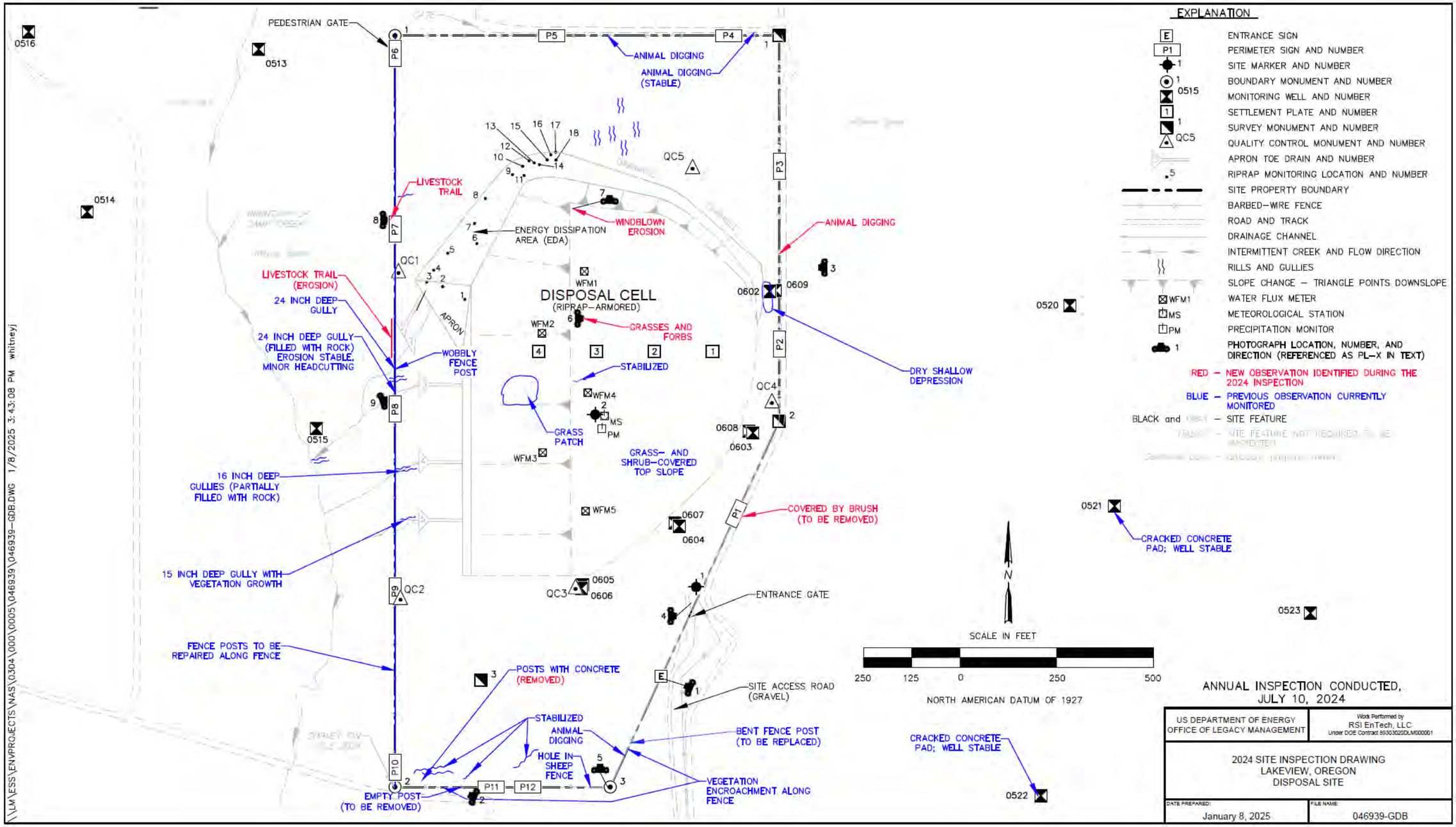


Figure 9-1. 2024 Annual Inspection Drawing for the Lakeview, Oregon, Disposal Site

There are 12 perimeter signs attached to steel posts set in concrete and positioned along the property boundary. Perimeter sign P1 has brush growing around the signpost and the perimeter sign that will need to be removed. No other maintenance needs were identified.

9.4.1.3 Site Markers

The site has two granite site markers. Site marker SMK-1 (PL-4) is just inside the entrance gate, and site marker SMK-2 is on the top slope of the disposal cell. No maintenance needs were identified.

9.4.1.4 Survey and Boundary Monuments

Three survey monuments and three boundary monuments (PL-5) delineate the property boundary. No maintenance needs were identified.

9.4.1.5 Aerial Survey Quality Control Monuments

There are five permanent aerial survey quality control monuments installed at the site to provide control during aerial surveys of the disposal cell. A baseline aerial survey was performed in October 2021. The quality control monuments were inspected in 2024. No maintenance needs were identified.

9.4.1.6 Monitoring Wells

The LM groundwater monitoring network at the site consists of eight onsite wells directly downgradient of the disposal cell and one upgradient background monitoring well (0515) west of the site boundary (Figure 9-1). Seven additional LM-owned monitoring wells on private property adjacent to the site—upgradient wells 0513, 0514, and 0516 and offsite downgradient wells 0520, 0521, 0522, and 0523—are not required to be sampled as identified in the LTSP.

Offsite downgradient wells 0521 and 0522 have surficial concrete bases around the well casing that are cracked, but the wellhead protectors remain stable. A dry, shallow depression remains near onsite well 0602, as noted in previous inspections. The wellhead protectors were locked and undamaged. No maintenance needs were identified.

9.4.2 Inspection Areas

In accordance with the LTSP, the site is divided into three inspection areas to ensure a thorough and efficient inspection. The inspection areas are (1) the top of the disposal cell; (2) the side slopes of the disposal cell, adjacent drainage channel, and aprons; and (3) the site perimeter and outlying area. The inspectors examined specific site surveillance features within each area and looked for evidence of erosion, settling, slumping, or other modifying processes that might affect the site's conformance with LTSP requirements.

9.4.2.1 Top of Disposal Cell

The disposal cell, completed in 1988, occupies 16 acres. At the time of disposal cell construction, the entire top slope of the disposal cell was covered in 12 inches of type B-sized riprap. In 1989, at the request of the State of Oregon, 4 inches of soil was added over the riprap to allow a

vegetative cover to be established and help minimize the visual impact of the disposal cell. The design for the top of the disposal cell has created conditions that favor the growth of deep-rooted plants. The growth of shrubs on the disposal cell top slope is favored by movement of precipitation through the topsoil, riprap, and bedding layers; the compacted soil (radon barrier) inhibits root growth from reaching the tailings. Grasses and forbs growing on the top slope have gradually increased over the years (PL-6), but some areas, such as near the System Operation and Analysis at Remote Sites (SOARS) station, remain sparsely vegetated. This plant growth pattern is consistent with surrounding offsite areas. Riprap was observed through the soil on the top slope in several small areas during the inspection. These areas are sporadic across the top slope and are likely caused by the soil infilling the spaces without riprap. No structural or disposal cell performance concerns are associated with the riprap becoming visible on the top slope.

Wind erosion of the soil is evident in places on the disposal cell cover. In these areas, the roots of vegetation have been exposed as wind carries the soil away (PL-7). Previously identified erosional features such as small rills were not observed in 2024 and are assumed to have stabilized through natural processes. No structural or disposal cell performance concerns are associated with soil erosion because the riprap rock cover is continuous beneath the top slope soil cover, slope crests, and side slopes. Inspectors will continue to monitor this condition.

The contact boundary between the disposal cell top and side slopes was inspected and generally appears stable and uniform. Windblown erosion was observed during the 2024 inspection at the northwest corner of the crest on the west side slope and the disposal cell top slope; both appear to be stable. Inspectors will continue to monitor the transition zone between the disposal cell top slope and the west side slope for erosion development. There was no evidence of settling, slumping, erosion, or any other modifying process on the top of the disposal cell that might affect the integrity of the disposal cell.

9.4.2.2 Disposal Cell Side Slopes and Adjacent Drainage Channel, Apron, and Toe Drains

Deterioration of the basalt riprap that armors the disposal cell side slopes is a result of physical and chemical weathering processes. In accordance with the LTSP, deterioration monitoring at the site consists of rock gradation monitoring on the west side slope and photographic monitoring in the energy dissipation area (EDA). Addendums to the LTSP commit LM to annually assess the mean diameter value of the riprap on the west side slope through gradation monitoring to ensure that the riprap remains large enough to protect the disposal cell from erosion during a major precipitation event, as designed. The thickness of the riprap on the west side slope was doubled during construction due to concerns over rock quality.

In 2015, LM proposed to replace annual gradation monitoring with rill inspections. The rills may form along the interface between the vegetated soil and rock top slope and the rock-covered west side slope (Dayvault 2015). Focusing on these areas allows LM to assess conditions that may indicate the development of potential failure points along the side slope. In 2019, NRC concurred with the discontinuation of rock gradation monitoring (Mandeville 2019); therefore, it was not performed in 2024. DOE is updating the LTSP to reflect this change. No rills or erosional features were observed along the side slope.

Annual photographic monitoring of the 18 locations for long-term rock monitoring was conducted during the 2024 inspection. Minor rock degradation has been observed in the EDA

since monitoring began at the original 10 photograph locations established in 1997 and at the 8 additional locations established in 2000. No significant degradation of the EDA rock has been observed since monitoring began.

In the past, water has been observed in a large depression in the EDA at the lower end of the drainage channel. Standing water is a potential concern in this depression because inundation can accelerate the deterioration of large riprap by the freeze-thaw process. No surface water was observed in the EDA depression during the 2024 inspection. The soils were moist in this area in 2024, and the moisture extended south through a swale that has formed at the western edge of the site. The swale appears to seasonally collect water from disposal cell runoff and supports a mixture of hydrophytic and dryland vegetation. There is no rock cover in the swale, except at the very top edge, so moisture is unlikely to affect riprap on the cell.

Small amounts of vegetation (primarily grass) have encroached on the riprap on the side slopes, on the upper (eastern) portion of the stormwater drainage channel (i.e., diversion channel), and on the west side slope's apron. During the 2023 inspection, a patch of grass approximately 2.5 × 2.5 feet (ft) was observed on the west side slope toward the bottom between water flux meters WFM2 and WFM3. During the 2024 inspection, the size of the patch of grass had decreased; continued observations will be made during future site inspections. The relatively sparse plant growth in these features will not affect their performance (i.e., channels were designed to control stormwater runoff from affecting encapsulated materials within the disposal cell). There are a few small shrubs in the upper (eastern) portion of the drainage channel, but they will not obstruct water flow. An area of dense, tall grass near Apron Toe Drains 1 and 3 in the swale area described above suggests that conditions are periodically wetter in this area because stormwater runoff is channeled there by control features. During the 2024 inspection, there was no flowing water in these apron toe drains. No ponded water was observed during the inspection. Minor erosion was observed near the fence line near Apron Toe Drain 3 during past inspections but appears to be stable. Two livestock trails were observed: one near perimeter sign P7 (PL-8) and one between Apron Toe Drains 1 and 2, along the outside of the fence, where erosion is starting. There was no evidence of settling, slumping, erosion, or any other modifying process on the disposal cell side slopes that might affect the integrity of the disposal cell. No maintenance needs were identified.

9.4.2.3 Site Perimeter and Outlying Area

The area beyond the site boundary for a distance of 0.25 mile was observed for erosion, changes in land use, or other phenomena that might affect the long-term integrity of the site. This includes the seeded grass area extending from the disposal cell to the site boundary and perimeter fence. No such impacts were observed. Livestock were observed outside the 0.25-mile distance.

In September and October 2021, the Cougar Peak Wildfire burned approximately 91,000 acres to the west of the site, mostly within the Fremont-Winema National Forest. The fire perimeter was within 2 miles of the site, and the burn scar can be clearly seen from the site. No negative effects from the fire have been observed on the site.

Gullies that formed in seeded areas extending west of Apron Toe Drains 1 through 5 were filled with rock in 2000. Although the rock has generally arrested the headcutting that was advancing eastward from the adjacent private property onto DOE property, some minor headcutting is still

evident (PL-9). Several small gullies have been observed on the private property directly west of the site in the heavily grazed areas downslope of the perimeter fence line near monitoring well 0515. Several rills and shallow gullies were also observed onsite on the slope north of the disposal cell where grass reestablishment has been limited, in a drainage area north of perimeter sign P7, north of perimeter sign P8, and in the southwest corner of the site. These rills and gullies were identified during previous annual inspections but appear to have stabilized, as no significant changes were observed in 2024. The gullies do not pose a threat to disposal cell integrity, and inspectors will continue to monitor these areas. In previous years, inspectors have observed a pile of galvanized posts with concrete bases in the southwest corner of the site. These galvanized posts and bases were removed by the adjacent landowner in July 2024. No other maintenance needs were identified.

9.5 Follow-Up or Contingency Inspections

LM will conduct follow-up or contingency inspections if (1) a condition is identified during the annual inspection or other site visit that requires a return to the site to evaluate the condition or (2) LM is notified by a citizen or outside agency that conditions at the site are substantially changed. No need for a follow-up or contingency inspection was identified.

9.6 Maintenance and Repairs

In July 2024, the adjacent landowner removed the debris in the southwest corner. Two signs were added to the entrance gate regarding prohibited activities and emergency instructions. No other maintenance was performed in 2024.

Inspectors documented the following minor maintenance during the 2023 inspection to be addressed in the future:

- Replace a bent fence post near the southeast corner of the site
- Repair the fence on the south side
- Raise fence posts along the western fence line that have been pushed into the ground by the snow
- Remove the empty post found on the southern fence line

Inspectors documented the following minor maintenance during the 2024 inspection to be addressed in the future:

- Remove brush covering perimeter sign P1
- Trim back vegetation encroaching along the southern and southeastern fence lines

No other maintenance needs were identified.

9.7 Groundwater Monitoring

In accordance with the LTSP, LM conducts groundwater monitoring every 5 years to demonstrate compliance with established groundwater quality protections standards. The most recent sampling event occurred on July 9, 2024, and the next event will occur in 2029. The groundwater monitoring network consists of nine monitoring wells, including eight downgradient point of compliance (POC) wells installed in four clusters of two wells (one shallow and one deep) and one upgradient background monitoring well (Table 9-2 and Figure 9-2).

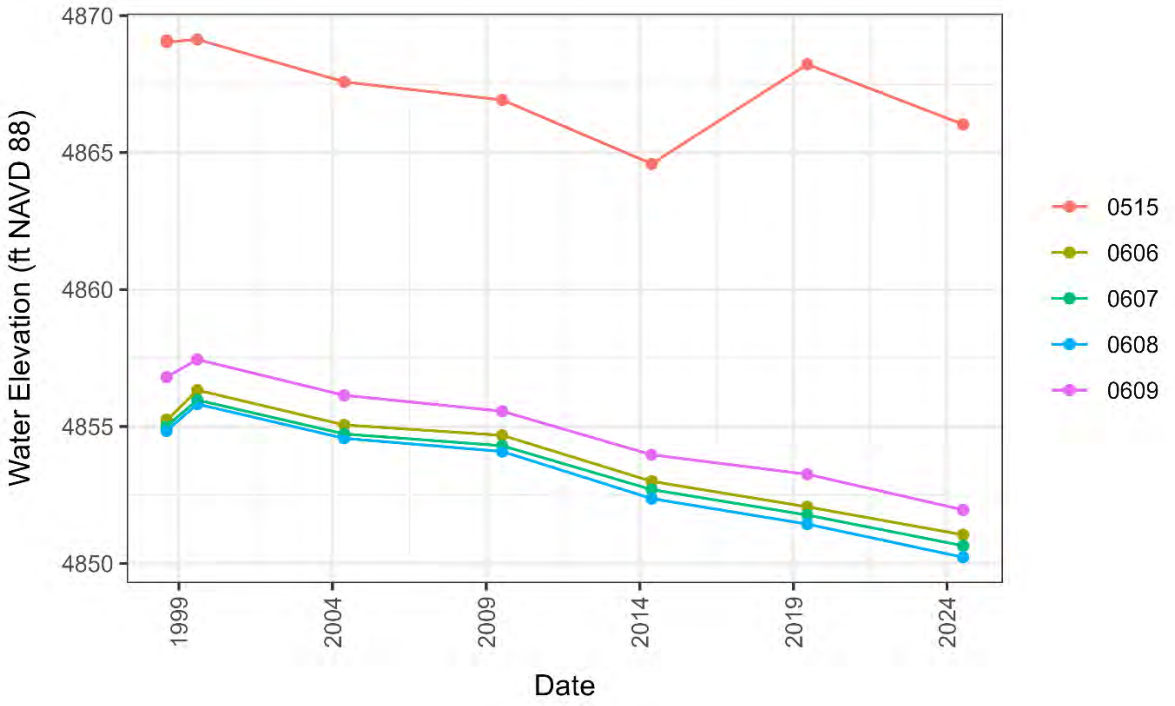
Table 9-2. Groundwater Monitoring Network for the Lakeview, Oregon, Disposal Site

Groundwater Monitoring Purpose	Monitoring Wells
Paired POC wells	0602/0609
Paired POC wells	0603/0608
Paired POC wells	0604/0607
Paired POC wells	0605/0606
Upgradient (background)	0515



Figure 9-2. Groundwater Monitoring Network, Lakeview, Oregon, Disposal Site

At the POC locations, each cluster consists of two wells: a shallow well screened at approximately 100 ft below ground surface (bgs) and a deeper well screened at approximately 150 ft bgs. Historically, the shallow wells (0602, 0603, 0604, and 0605) have been consistently dry or have had insufficient water to sample. This was again the case during the July 2024 sampling event. In accordance with Section 5.2 of the LTSP (requiring routine evaluation of historical groundwater levels), Figure 9-3 plots water elevations over time for 1998–2024, the period since the LTSP was issued. For the reasons stated above, the dataset is limited to background and deeper POC wells. Since 1999, on average, water levels in the deeper POC wells (0606 through 0609) have decreased approximately 5 ft, while those in the shallow upgradient wells have decreased about 3 ft.



Note: Shallow wells 0602, 0603, 0604, and 0605 have been dry and have had insufficient water to sample.
Abbreviation: NAVD 88 = North American Vertical Datum of 1988

Figure 9-3. Hydrographs for Background and Deeper POC Wells at the Lakeview, Oregon, Disposal Site, 1998–2024

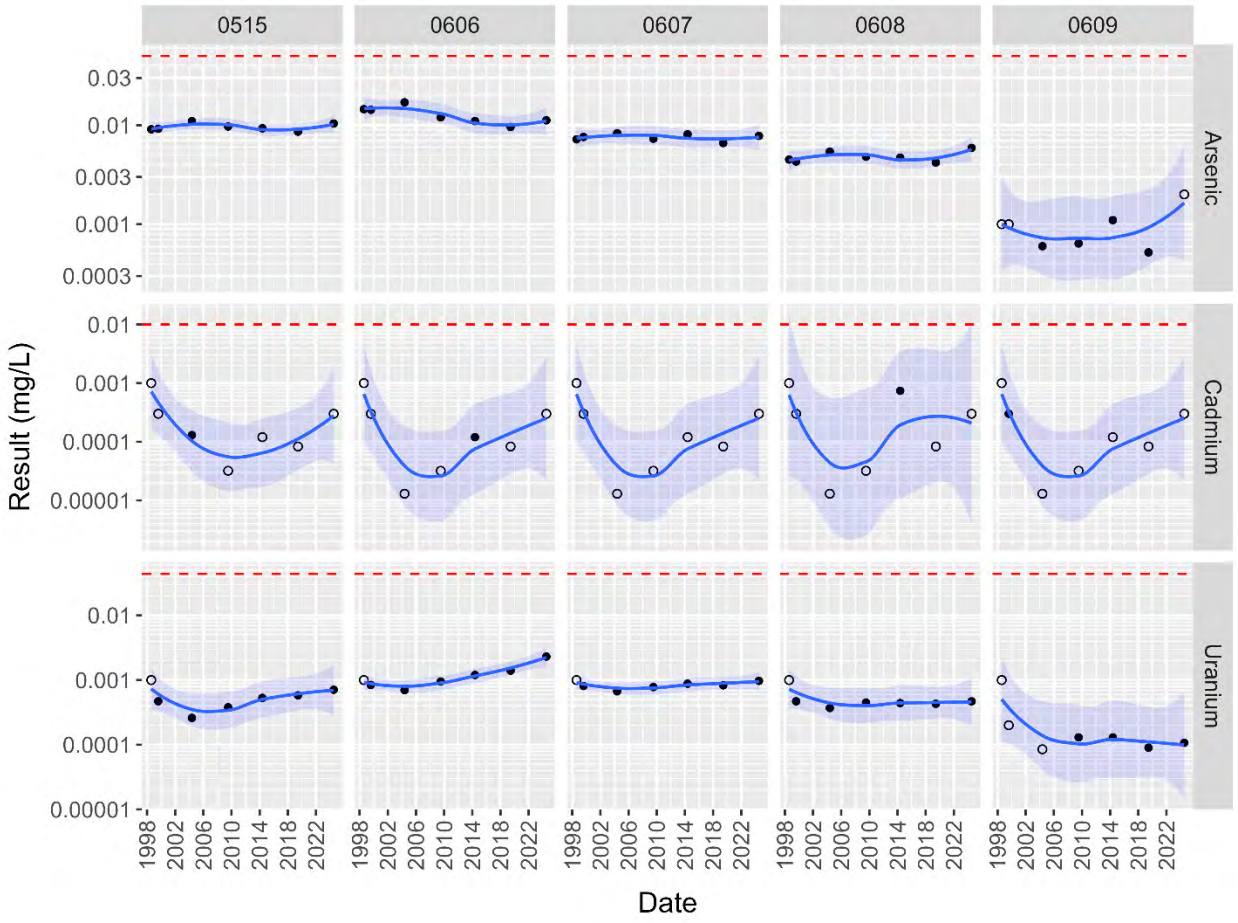
The constituents monitored in site groundwater are arsenic, cadmium, and uranium (DOE 1994). EPA established MCLs for these analytes in groundwater in 40 CFR 192 Subpart A Table 1 (Table 9-3).

Table 9-3. Maximum Concentration Limits for Groundwater at the Lakeview, Oregon, Disposal Site

Constituent	MCL[a] (mg/L)
Arsenic	0.05
Cadmium	0.01
Uranium	0.044

Note: [a] MCL (40 CFR 192 Subpart A Table 1).
Abbreviation: mg/L = milligrams per liter

Consistent with historical observations, concentrations of these constituents continue to remain below their respective MCLs in 2024 (Figure 9-4). Arsenic concentrations were ≤0.01 milligrams per liter (mg/L) and comparable to or less than the background (well 0515) measurement. As is true for most results since 1998, cadmium results for all wells were below the laboratory detection limit of 0.0003 mg/L. Uranium concentrations remained stable in most wells, with only results for wells 0606 and 0607 slightly exceeding background. The results of Mann-Kendall trend analysis indicate no significant concentration trend except for uranium in southernmost well 0606, with a significant increasing trend (p-value of 0.020).[1] The most recent uranium result for this well, 0.0023 mg/L, is still well below the corresponding 0.044 mg/L MCL.



Locally estimated scatterplot smoothing (LOESS) line and 95% confidence interval
MCL from Table 9-3
● Detect ○ Nondetect
Notes: The date scale begins in 1998, the first sampling event after the 1994 LTSP was issued. Monitoring data are only available for background well 0515 and the deeper POC wells at each cluster shown in Figure 9-2.

Figure 9-4. Time-Concentration Plots of Arsenic, Cadmium, and Uranium in Monitoring Wells at the Lakeview, Oregon, Disposal Site

[1] Trend analysis was conducted using the "NADA: Nondetects and Data Analysis for Environmental Data" package (Lee 2020) for R, version 4.3.3 (R Core Team 2024). Results are not tabulated here because all but one of the trends were stable (no significant concentration trend).

All groundwater monitoring results for the site are reported and published on the LM Geospatial Environmental Mapping System (GEMS) website (https://gems.lm.doe.gov). Based on the monitoring results to date, there is no indication of degradation of groundwater quality near the site. The next disposal cell groundwater monitoring event is scheduled for 2029.

9.8 Corrective Action

In accordance with the LTSP, corrective action is taken to correct out-of-compliance or hazardous conditions that create a potential health and safety problem or that may affect the integrity of the disposal cell or compliance with 40 CFR 192. No need for corrective action was identified.

9.9 References



Note

Site-related documents are available on the LM public webpages at https://lmpublicsearch.lm.doe.gov/SitePages.

10 CFR 40.27. U.S. Nuclear Regulatory Commission, "General License for Custody and Long-Term Care of Residual Radioactive Material Disposal Sites," *Code of Federal Regulations*.

40 CFR 192. U.S. Environmental Protection Agency, "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings," *Code of Federal Regulations*.

40 CFR 192 Subpart A Table 1. U.S. Environmental Protection Agency, "Maximum Concentration of Constituents for Groundwater Protection," *Code of Federal Regulations*.

Dayvault, J., 2015. J. Dayvault, UMTRCA site manager, Office of Legacy Management, U.S. Department of Energy, letter (about Lakeview, Oregon, Uranium Mill Tailings Radiation Control Act [UMTRCA] Title I Disposal Site's West Side Slope Rock Degradation Assessment) to U.S. Nuclear Regulatory Commission, March 2.

DOE (U.S. Department of Energy), 1994. *Long-Term Surveillance Plan for the Collins Ranch Disposal Site, Lakeview, Oregon*, DOE/AL/62350-19F, Rev. 3, August.

Lee, L., 2020. "NADA: Nondetects and Data Analysis for Environmental Data," R package, version 1.6-1.1, https://CRAN.R-project.org/package=NADA, accessed November 15, 2024.

Mandeville, D., 2019. D. Mandeville, project manager, U.S. Nuclear Regulatory Commission, letter (about Lakeview Rock Degradation Monitoring Program) to Jason Nguyen, UMTRCA site manager, Office of Legacy Management, U.S. Department of Energy, October 11.

R Core Team, 2024. "R: A Language and Environment for Statistical Computing," The R Foundation for Statistical Computing, version 4.3.3, https://www.r-project.org, accessed November 15, 2024.

9.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	292	Entrance Sign
PL-2	292	Entangled Brush and Juniper Trees in Southern Fence Line
PL-3	270	Animal Digging Under Eastern Fence Line
PL-4	90	Site Marker SMK-1 near the Entrance Gate
PL-5	—	Boundary Monument BM-3
PL-6	90	Grasses and Forbs on Top of the Disposal Cell
PL-7	—	Windblown Erosion on Northwest Corner of the Disposal Cell
PL-8	90	Livestock Trail Outside Site Boundary
PL-9	67	Headcutting at Apron Toe Drain 3

Note:
— = Photograph taken vertically from above.



PL-1. Entrance Sign



PL-2. Entangled Brush and Juniper Trees in Southern Fence Line



PL-3. Animal Digging Under Eastern Fence Line



PL-4. Site Marker SMK-1 near the Entrance Gate



PL-5. Boundary Monument BM-3



PL-6. Grasses and Forbs on Top of the Disposal Cell



PL-7. Windblown Erosion on Northwest Corner of the Disposal Cell



PL-8. Livestock Trail Outside Site Boundary



PL-9. Headcutting at Apron Toe Drain 3

10.0 Lowman, Idaho, Disposal Site

10.1 Compliance Summary

The Lowman, Idaho, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site was inspected on May 14, 2024. No significant changes were observed on the disposal cell or in the associated drainage features. Inspectors identified minor maintenance needs that were completed following the inspection but found no cause for a follow-up inspection. Groundwater monitoring is not required and was discontinued in 2004.

10.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the site-specific *Long-Term Surveillance Plan for the U.S. Department of Energy Lowman, Idaho, (UMTRCA Title I) Disposal Site* (DOE 2005) (LTSP) in accordance with procedures established to comply with the requirements of the U.S. Nuclear Regulatory Commission (NRC) general license at Title 10 *Code of Federal Regulations* Section 40.27 (10 CFR 40.27). Table 10-1 lists these requirements.

Table 10-1. License Requirements for the Lowman, Idaho, Disposal Site

Requirement	LTSP	This Report	10 CFR 40.27
Annual Inspection and Report	Section 3.3	Section 10.4	(b)(3)
Follow-Up Inspections	Section 3.4	Section 10.5	(b)(4)
Site Maintenance	Section 3.5	Section 10.6	(b)(5)
Emergency Response	Section 3.6	Section 10.7	(b)(5)
Environmental Monitoring	Section 3.7	Section 10.8	(b)(2)

10.3 Institutional Controls

The 18-acre site, identified by the property boundary shown in Figure 10-1, is owned by the United States and was accepted under the NRC general license in 1994. The U.S. Department of Energy (DOE) is the licensee and, in accordance with the requirements for UMTRCA Title I sites, the Office of Legacy Management (LM) is responsible for the custody and long-term care of the site. Institutional controls (ICs) at the site include federal ownership of the property, administrative controls, and the following physical ICs that are inspected annually: the disposal cell and associated drainage features; entrance gate, entrance sign, perimeter signs, and site markers; and survey and boundary monuments.

10.4 Inspection Results

The site, 0.5 mile east of Lowman, Idaho, was inspected on May 14, 2024. The inspection was conducted by Z. Aldous and M. Guziak of the Legacy Management Support contractor. Additional attendees included K. Kreie and W. Frazier (LM); R. Evans and E. McManus (NRC); and P. Rekow, D. Nygard, and K. McGee (State of Idaho). The purposes of the inspection were to confirm the integrity of visible features at the site, identify changes in conditions that might

affect conformance with the LTSP, and evaluate whether maintenance or follow-up inspection and monitoring are needed.

10.4.1 Site Surveillance Features

Figure 10-1 shows the locations of site features, including site surveillance features and inspection areas, in black and gray font. Some site features that are present but not required to be inspected are shown in italic font. Observations from previous inspections that are currently monitored are shown in blue, and new observations identified during the 2024 annual inspection are shown in red. Inspection results and recommended maintenance activities associated with site surveillance features are described in the following subsections. Photographs to support specific observations are noted in the text and in Figure 10-1 by photograph location (PL) numbers. The photographs and photograph log are presented in Section 10.10.

10.4.1.1 Access Road, Entrance Gate, and Entrance Sign

The site is about 650 feet (ft) north of Idaho Highway 21 and is accessed by a gravel road. A locked steel gate on the site access road is about 150 ft from the highway. The site is not fenced, but the topography and mature forests prevent vehicle access around the entrance gate and along the property boundary. The entrance gate was locked and functional. The access road was passable, and the entrance sign was present and legible. No maintenance needs were identified.

10.4.1.2 Perimeter Signs

There are 18 perimeter signs attached to steel posts set in concrete and positioned along the unfenced property boundary. Several perimeter signs (P4, P13, and P15) have bullet damage but remain legible. Perimeter sign P3 had bullet damage that was obscuring the trefoil and was replaced in the field (PL-1). Perimeter sign P7 is slightly bent from treefall but remains legible. No additional maintenance needs were identified.

10.4.1.3 Site Markers

The site has two granite site markers. Site marker SMK-1 is just inside the southwest property boundary, and site marker SMK-2 (PL-2) is on the top slope of the disposal cell. No maintenance needs were identified.

10.4.1.4 Survey and Boundary Monuments

Three combined survey and boundary monuments and four boundary monuments delineate the property boundary. Steel T-posts are installed next to the survey and boundary monuments to help inspectors locate them. Several years ago, the U.S. Department of Agriculture (USDA) surveyed its lands managed by the U.S. Forest Service and placed boundary monuments along the shared DOE-USDA border. Inspectors noted that the USDA survey monuments were about 5 to 15 ft outside DOE survey monuments. No maintenance needs were identified.

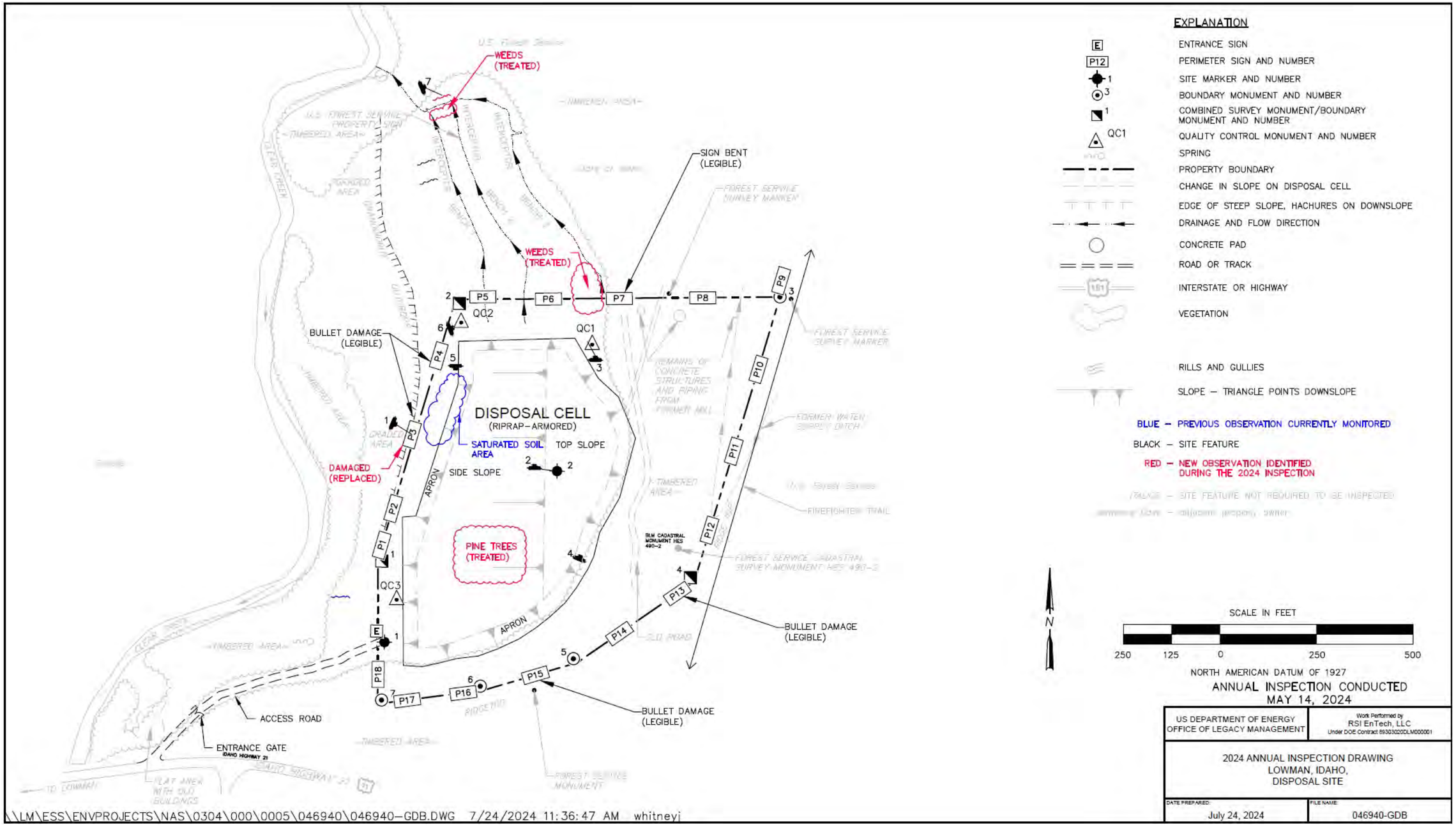


Figure 10-1. 2024 Annual Inspection Drawing for the Lowman, Idaho, Disposal Site

10.4.1.5 Aerial Survey Quality Control Monuments

Three aerial survey quality control monuments were inspected during the 2024 annual inspection (PL-3). No maintenance needs were identified.

10.4.2 Inspection Areas

In accordance with the LTSP, the site is divided into three inspection areas (referred to as "transects") to ensure a thorough and efficient inspection. The inspection areas are (1) the top and side slopes of the disposal cell, (2) the area between the disposal cell and the site boundary, and (3) the outlying area. Inspectors examined the specific site surveillance features within each area and looked for evidence of erosion, settling, slumping, or other modifying processes that might affect the site's conformance with LTSP requirements.

10.4.2.1 Top and Side Slopes of the Disposal Cell

The disposal cell, completed in 1991, occupies 8.29 acres. The disposal cell top and side slopes are armored with basalt riprap to control erosion (PL-4). An apron of larger riprap surrounds the disposal cell on all sides. There was no evidence of erosion, settling, slumping, rock degradation, or other modifying processes that might affect the integrity of the disposal cell. A saturated soil area was observed on the northwest side of the cell, confirming that the disposal cell is shedding precipitation appropriately (PL-5).

Natural vegetation continues to encroach on the top and side slopes of the disposal cell. Although the LTSP states that control of vegetation growth on the cell is not needed, LM concluded that controlling the growth of conifers—primarily ponderosa pine but also Douglas fir—would be a best management practice. Mature conifers could potentially become uprooted during windstorms and damage the surface of the disposal cell. Numerous ponderosa pine trees were cut down in 2018. Additional ponderosa pine and Douglas fir trees have established since then and were removed in 2023 and 2024. Other plants growing on the disposal cell do not threaten the integrity of the disposal cell and are not controlled. Inspectors will continue to monitor this area. No other maintenance needs were identified.

10.4.2.2 Area Between the Disposal Cell and the Site Boundary

The steep slopes east and south of the disposal cell are stable and vegetated with well-established conifers, shrubs, and grasses. Several features from historical milling operations remain on the steep hillside east of the disposal cell, including a water-supply ditch and the remains of a water piping system from former milling operations. The slopes north and west of the disposal cell were highly disturbed during site remediation, but they are now stable and vegetated. No maintenance needs were identified.

10.4.2.3 Outlying Area

The area within 0.25 mile of the site boundary was inspected for evidence of construction, development, logging, or changes in land use that might affect the site. No evidence of change was observed in 2024. A seep southwest of the site is discharging into Clear Creek. Several wildfires have occurred in the area during the last decade, and some have come near the site. A

wildland firefighter trail was identified during the 2020 inspection outside the site boundary along the ridgeline east of the site, but the trail does not affect the site. LM will evaluate the need for a fire mitigation plan at the site.

The reclaimed area north of the disposal cell and outside the site boundary is a steep area, owned by the state, that was disturbed during site remediation. LM installed three interceptor benches across the steep slope in this area in 1998 to intercept stormwater runoff and route it offsite into Clear Creek (PL-6). Over time, minor erosion has breached the benches in several locations, and LM repaired this erosion in 2016. Rock armoring has been very successful in preventing further erosion, and vegetation has become well established. Minor erosion was noted within and around the geocell grid on the north end of the interceptor benches where they are routed into Clear Creek (PL-7). This will continue to be monitored. Weeds were found growing on the North and South ends of the interceptor benches and were treated following the inspection. No other maintenance needs were identified.

10.5 Follow-Up Inspections

LM will conduct follow-up inspections if (1) a condition is identified during the annual inspection or other site visit that requires a return to the site to evaluate the condition or (2) LM is notified by a citizen or outside agency that conditions at the site have substantially changed. No need for a follow-up inspection was identified.

10.6 Maintenance

Inspectors noted the following maintenance items in 2024 that were completed during or following the inspection:

- Perimeter sign P3 had bullet damage and was replaced during the site inspection
- One coniferous tree that had established on the disposal cell was removed
- Weeds growing on the interceptor benches were treated

No other maintenance needs were identified.

10.7 Emergency Response

Emergency response is action LM will take in response to unusual damage or disruption that threatens or compromises site safety, security, or integrity in compliance with 10 CFR 40 Appendix A. No need for an emergency response was identified.

10.8 Environmental Monitoring

In accordance with the LTSP, groundwater monitoring is not required and was discontinued in 2004. Groundwater monitoring is not required because (1) the disposal cell is performing as designed and (2) the groundwater monitoring program demonstrated that the site complies with groundwater protection standards and no site-related contamination exists in groundwater near the site. All monitoring wells at the site were decommissioned in 2006.

10.9 References



Note

Site-related documents are available on the LM public webpages at https://lmpublicsearch.lm.doe.gov/SitePages.

10 CFR 40 Appendix A. U.S. Nuclear Regulatory Commission, "Criteria Relating to the Operation of Uranium Mills and the Disposition of Tailings or Wastes Produced by the Extraction or Concentration of Source Material from Ores Processed Primarily for Their Source Material Content," *Code of Federal Regulations.*

10 CFR 40.27. U.S. Nuclear Regulatory Commission, "General License for Custody and Long-Term Care of Residual Radioactive Material Disposal Sites," *Code of Federal Regulations.*

DOE (U.S. Department of Energy), 2005. *Long-Term Surveillance Plan for the U.S. Department of Energy Lowman, Idaho, (UMTRCA Title I) Disposal Site*, LMS/S00583, DOE-LM/GJ771-2005, Office of Legacy Management, January.

10.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	110	Replaced Perimeter Sign P3
PL-2	—	Site Marker SMK-2
PL-3	—	Quality Control Monument QC-1
PL-4	25	Eastern Side of Disposal Cell
PL-5	180	Vegetation Growing in Saturated Soil Area
PL-6	65	Interceptor Benches
PL-7	65	Erosion on North Interceptor Bench

Note:
— = Photograph taken vertically from above.



PL-1. Replaced Perimeter Sign P3



PL-2. Site Marker SMK-2



PL-3. Quality Control Monument QC-1



PL-4. Eastern Side of Disposal Cell



PL-5. Vegetation Growing in Saturated Soil Area



PL-6. Interceptor Benches



PL-7. Erosion on North Interceptor Bench

11.0 Maybell, Colorado, Disposal Site

11.1 Compliance Summary

The Maybell, Colorado, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site was inspected on September 18, 2024. Inspectors identified several minor maintenance needs but found no cause for a follow-up inspection. Groundwater monitoring is not required.

11.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the site-specific *Long-Term Surveillance Plan for the Maybell, Colorado (UMTRCA Title I) Disposal Site, Moffat County, Colorado* (DOE 2008) (LTSP) in accordance with procedures established to comply with the requirements of the U.S. Nuclear Regulatory Commission (NRC) general license at Title 10 *Code of Federal Regulations* Section 40.27 (10 CFR 40.27). Table 11-1 lists these requirements.

Table 11-1. License Requirements for the Maybell, Colorado, Disposal Site

Requirement	LTSP	This Report	10 CFR 40.27
Annual Inspection and Report	Sections 3.3 and 3.4	Section 11.4	(b)(3)
Follow-Up Inspections	Section 3.5	Section 11.5	(b)(4)
Maintenance	Section 3.6	Section 11.6	(b)(5)
Emergency Measures	Section 3.6	Section 11.7	(b)(5)
Environmental Monitoring	Section 3.7	Section 11.8	(b)(2)

11.3 Institutional Controls

The 251-acre site, identified by the property boundary shown in Figure 11-1, is owned by the United States and was accepted under the NRC general license in 1999. The U.S. Department of Energy (DOE) is the licensee and, in accordance with the requirements for UMTRCA Title I sites, the Office of Legacy Management (LM) is responsible for the custody and long-term care of the site. Institutional controls (ICs) at the site include federal ownership of the property, administrative controls, and the following physical ICs that are inspected annually: the disposal cell and associated drainage features, entrance gate and sign, perimeter fence and perimeter (warning) signs, site markers, and survey and boundary monuments.

11.4 Inspection Results

The site, 25 miles west of Craig, Colorado, was inspected on September 18, 2024. The inspection was conducted by Z. Aldous, C. Wentz, G. Mitchell, and G. Nishimura of the Legacy Management Support contractor. M. Kautsky (LM) and M. Cosby and A. Lawrence (Colorado Department of Public Health and Environment) also attended the inspection. The purposes of the inspection were to confirm the integrity of visible features at the site, identify changes in conditions that might affect conformance with the LTSP, and evaluate whether maintenance or follow-up inspection and monitoring are needed.

11.4.1 Site Surveillance Features

Figure 11-1 shows the locations of site features, including site surveillance features and inspection areas, in black and gray font. Some site features that are present but not required to be inspected are shown in italic font. Observations from previous inspections that are currently monitored are shown in blue, and new observations identified during the 2024 annual inspection are shown in red. Inspection results and recommended maintenance activities associated with site surveillance features are described in the following subsections. Photographs to support specific observations are noted in the text and in Figure 11-1 by photograph location (PL) numbers. The photographs and photograph log are presented in Section 11.10.

11.4.1.1 Access Road, Entrance Gate, and Entrance Sign

Access to the site is from the gravel-surfaced Moffat County Road 53, which runs north from U.S. Highway 40, approximately 8 miles east of Maybell, Colorado. County Road 53 ends at an unlocked gate near the northeast corner of the site (approximately 3 miles from the highway). The road continues west as a dirt two-track road directly north of the site from the end of County Road 53 to the site entrance gate (the road continues to the UMTRCA Title II Maybell West, Colorado, Disposal Site). LM is responsible for road maintenance under a U.S. Bureau of Land Management (BLM) right-of-way permit. Entrance to the site is through two locked, metal stock gates in the perimeter fence. One is the entrance gate, which is adjacent to site marker SMK-1 and the entrance sign (PL-1). The second gate is between perimeter signs P3 and P4 in the northwest corner of the property. Both gates were locked and functional. The entrance sign is near the entrance gate and is mounted on a T-post in the perimeter fence. The entrance sign has bullet damage but remains legible. No maintenance needs were identified.

11.4.1.2 Perimeter Fence and Signs

To facilitate LM's land management, a four-strand barbed-wire perimeter fence encloses the disposal cell, drainage structures, and much of the site. The site is in wintering grounds frequented by big-game animals (primarily pronghorn, deer, and elk) and is also surrounded by open range used to graze cattle. Periodically, animals cause minor damage to the perimeter fence. In 2021, plastic fence flags were attached to the top strand of the perimeter fence to alert wildlife and reduce animal entanglements or strikes against fence lines. The fence had been cut or damaged in several locations, primarily on the southern side of the property (PL-2) and was repaired following the inspection.

There are 26 perimeter signs. On the northern, western, and southern sides of the site, perimeter signs are attached to T-posts in the perimeter fence. On the eastern side of the site, perimeter signs are attached to steel posts set in concrete and are inside the property boundary approximately midway between the disposal cell and the perimeter fence. Several of the perimeter signs along the dirt road to the north and west of the site (perimeter signs P5, P6, P8, and P11) have bullet damage but remain legible. The concrete base of a corner post between perimeter signs P13 and P14 has been exposed through erosion but is still functional. No other maintenance needs were identified.

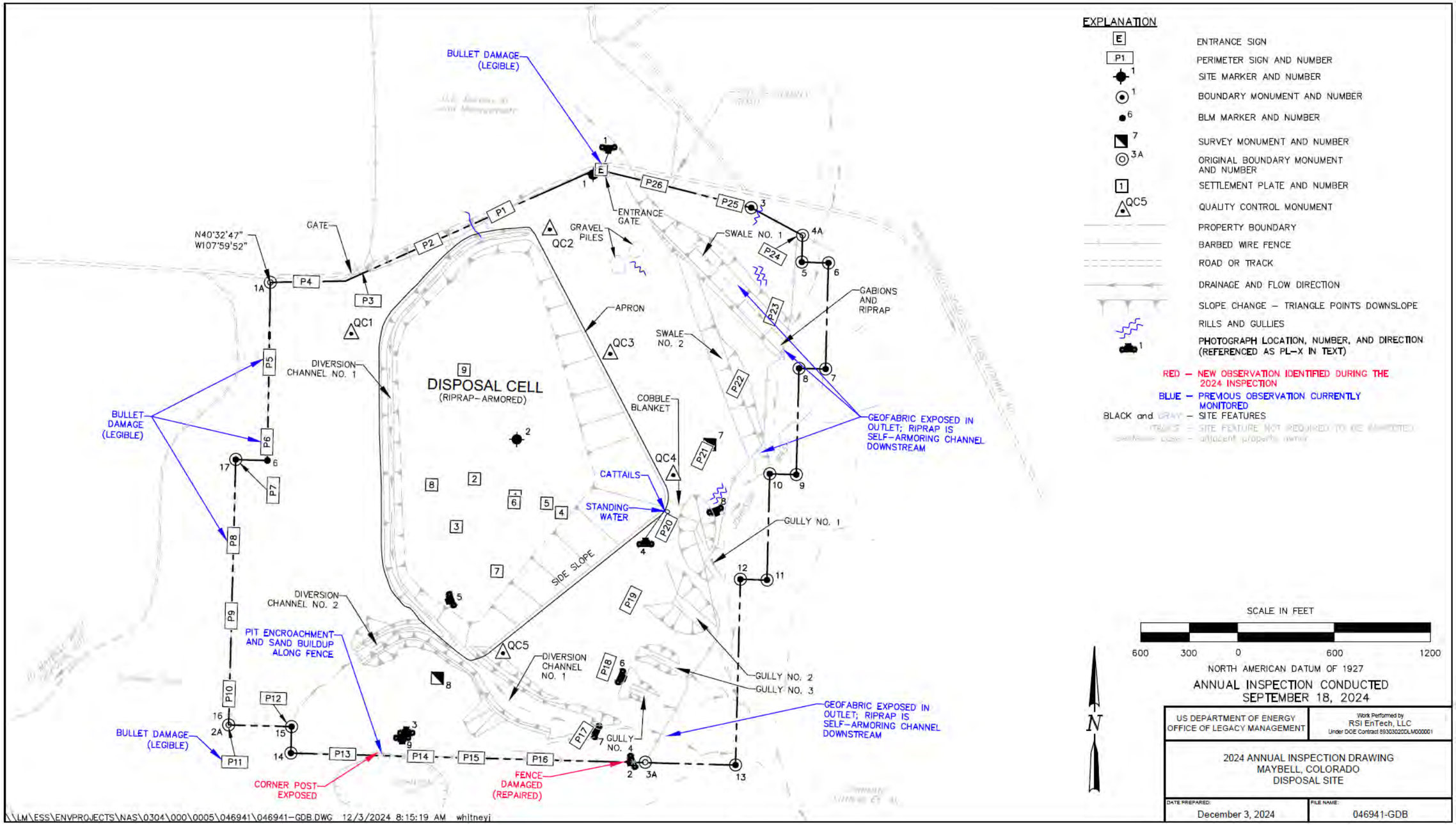


Figure 11-1. 2024 Annual Inspection Drawing for the Maybell, Colorado, Disposal Site

11.4.1.3 Site Markers

The site has two granite site markers. Site marker SMK-1 is just inside the entrance gate, and site marker SMK-2 is on the top slope of the disposal cell. No maintenance needs were identified.

11.4.1.4 Survey and Boundary Monuments

The site has two survey monuments. Survey monument SM-7 is on the bench above Johnson Wash just north of perimeter sign P21, and survey monument SM-8 is south of the disposal cell on the bench above Diversion Channel No. 2. The two survey monuments are historical site features that are difficult to locate. Seventeen boundary monuments delineate the property boundary. No maintenance needs were identified.

11.4.1.5 Aerial Survey Quality Control Monuments

Five aerial survey quality control monuments were inspected during the 2024 inspection. No maintenance needs were identified.

11.4.2 Inspection Areas

In accordance with the LTSP, the site is divided into three inspection areas (referred to as "transects" in the LTSP) to ensure a thorough and efficient inspection. The inspection areas are (1) the disposal cell, (2) other areas inside the site boundary, and (3) the outlying area. Inspectors examined the specific site surveillance features within each area and looked for evidence of erosion, settling, slumping, or other modifying processes that might affect the site's conformance with LTSP requirements.

11.4.2.1 Disposal Cell

The disposal cell, completed in 1998, occupies 66 acres; it is armored with riprap to control erosion and deter animal and human intrusion (PL-3). There was no evidence of erosion, settling, slumping, rock degradation, or other modifying processes that might affect the integrity of the disposal cell. Scattered plants continue to establish on the disposal cell top slope, but they are not affecting the integrity of the disposal cell.

In accordance with the LTSP, inspectors looked for seeps on the east and southeast side slopes of the disposal cell because slimes were encapsulated in this portion of the cell. No seeps were observed at the toe of the disposal cell in these areas. A 2003 laboratory analysis of evaporite minerals from this location confirmed that no constituents attributable to the disposal cell contents were present.

Stormwater runoff from the disposal cell discharges into the cobble blanket and continues into Gully No. 1. Cattails are present in this area indicating regular pooling of water. During the 2021 inspection, as well as during the 2024 inspection, standing water was observed in the easternmost portion of the disposal cell toe slope apron upgradient of the cobble blanket (PL-4). No maintenance needs were identified.

11.4.2.2 Other Areas Inside the Site Boundary

Surface conditions at the site are a combination of rock-armored drainage and diversion channels, along with contouring of soil surfaces to achieve the necessary surface water drainage control to protect the disposal cell from erosion. The rock-armored diversion channels (PL-5), swales, and gullies (PL-6) are performing as designed.

Erosion directly downgradient of the outlets of Diversion Channel No. 1 (PL-7), Swale No. 1, and Swale No. 2 has exposed the underlying geofabric, but the erosion does not appear to be worsening. Riprap placed in the outlets continues to protect against headcutting. Minor rills adjacent to Swale No. 1 and Gully No. 1 (PL-8) continue to stabilize as a result of natural armoring and increased vegetation growth.

Minor erosion on the northern portion of the site directly downslope of the perimeter fence between perimeter signs P1 and P2 continues to stabilize. Minor erosion perpendicular to the perimeter fence near boundary monument BM-3 continues to be monitored, with no significant changes observed during the annual inspection. Documented erosion does not threaten the disposal cell, and there was no evidence of sediment moving offsite into Johnson Wash. No maintenance needs were identified.

11.4.2.3 Outlying Area

The area 0.25 mile beyond the site boundary was visually observed for erosion, changes in land use, or other phenomena that might affect the long-term integrity of the site. During the 2024 inspection, it was noted that exploratory uranium drilling was being conducted 0.5 mile northwest of the disposal cell. Drilling is outside of the site boundary and does not affect the site condition.

Directly south of the site is a former open-pit uranium mine known as the Johnson Pit. Over time, slumping of the pit wall caused the pit to encroach several feet onto property now owned by DOE. This encroachment presents no threat to the integrity of the disposal cell at this time. This encroachment is visually monitored annually; it is periodically documented with photographs to assess whether the pit wall has slumped further and to verify the integrity and functionality of the perimeter fence. At the time of the inspection, there was no evidence of any additional encroachment of the pit onto the site. However, windblown sand continues to accumulate along the northern crest of the pit wall along the perimeter fence line (PL-9). The perimeter fence remains functional, but continued accumulation of sand will require vertically extending the fence or removing the sand. Inspectors will continue to monitor this area. No immediate maintenance needs were identified.

11.5 Follow-Up Inspections

LM will conduct follow-up inspections if (1) a condition is identified during the annual inspection or other site visit that requires a return to the site to evaluate the condition or (2) LM is notified by a citizen or outside agency that conditions at the site are substantially changed. No need for a follow-up inspection was identified.

11.6 Maintenance

Maintenance conducted after the 2024 inspection included the following:

- Spraying noxious weeds
- Repairing a damaged fence line

11.7 Emergency Measures

In compliance with the LTSP, emergency measures are the actions that LM will take in response to unusual damage or disruption that threatens or compromises site safety, security, or integrity. No need for emergency measures was identified.

11.8 Environmental Monitoring

11.8.1 Groundwater Monitoring

In accordance with the LTSP, groundwater monitoring is not required. Supplemental standards have been applied to site groundwater because it is designated as limited use—a designation given to groundwater that is not a current or potential source of drinking water. Groundwater in the uppermost aquifer is designated as limited use because it contains widespread ambient contamination that cannot be cleaned up by treatment methods employed in public water systems (40 CFR 192.11[e]). There are no current or future uses of the uppermost aquifer in the area. Water-level monitoring, conducted from 1995 to 2004, did not detect disposal cell-related impacts to the groundwater system, such as transient drainage downgradient of the cell. NRC concurred that stipulated groundwater-level monitoring requirements had been satisfied (Janosko 2005). Therefore, no further groundwater monitoring was required.

11.8.2 Vegetation Monitoring

In accordance with the LTSP, visual inspections are conducted annually to verify the continued health of onsite vegetation and to ensure that undesirable plant species (e.g., deep-rooted plants on the disposal cell cover and noxious weeds) do not proliferate onsite. Noxious weeds or deep-rooted vegetation found on the disposal cell, drainages, or diversion channels are treated by a subcontractor following the inspection. Following reclamation, the disturbed soil surfaces on the site were revegetated with a mix of native and adaptive grasses to provide soil stability. These revegetated areas appeared to be healthy, with similar diversity and density as the surrounding undisturbed areas.

11.9 References



Note

Site-related documents are available on the LM public webpages at https://lmpublicsearch.lm.doe.gov/SitePages.

10 CFR 40.27. U.S. Nuclear Regulatory Commission, “General License for Custody and Long-Term Care of Residual Radioactive Material Disposal Sites,” *Code of Federal Regulations*.

40 CFR 192. U.S. Environmental Protection Agency, "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings," *Code of Federal Regulations*.

DOE (U.S. Department of Energy), 2008. *Long-Term Surveillance Plan for the Maybell, Colorado (UMTRCA Title I) Disposal Site, Moffat County, Colorado*, LMS/MAY/S03649, DOE-LM/1605-2008, Office of Legacy Management, April.

Janosko, G., 2005. G. Janosko, chief of Fuel Cycle Facilities Branch, U.S. Nuclear Regulatory Commission, letter (about Decommissioning of Monitor Wells at the Maybell, Colorado, Uranium Mill Tailings Radiation Control Act [UMTRCA] Title I Disposal Site) to M. Tucker, site manager, Office of Legacy Management, U.S. Department of Energy, January 5.

11.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	180	Entrance Sign
PL-2	247	Fence Damage
PL-3	0	Disposal Cell Overview
PL-4	—	Standing Water at Disposal Cell Toe
PL-5	247	Diversion Channel No. 2
PL-6	112	Gully No. 4
PL-7	292	Geofabric Exposed in Channel
PL-8	157	Rills near Gully No. 1
PL-9	180	Sand Buildup Along Fence near Johnson Pit

Note:
— = Photograph taken vertically from above.



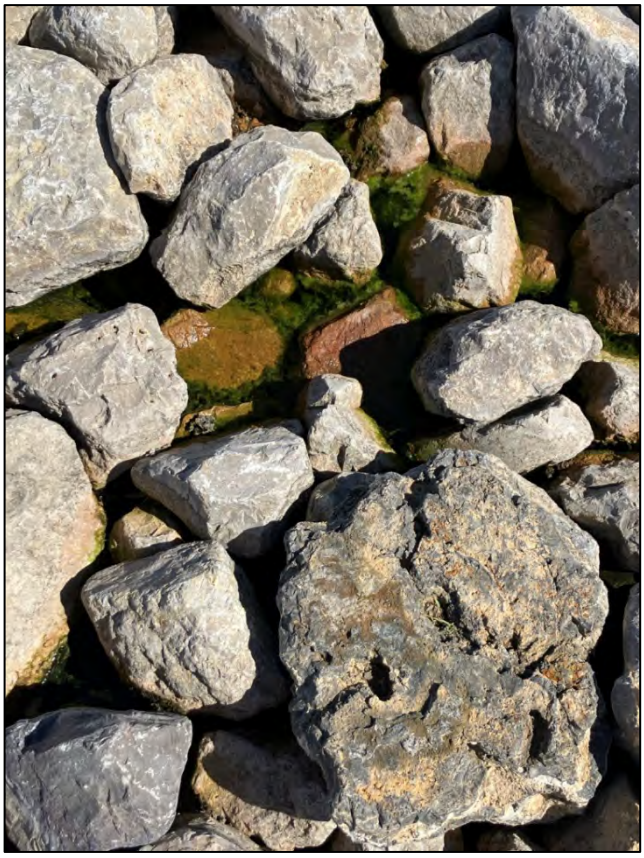
PL-1. Entrance Sign



PL-2. Fence Damage



PL-3. Disposal Cell Overview



PL-4. Standing Water at Disposal Cell Toe



PL-5. Diversion Channel No. 2



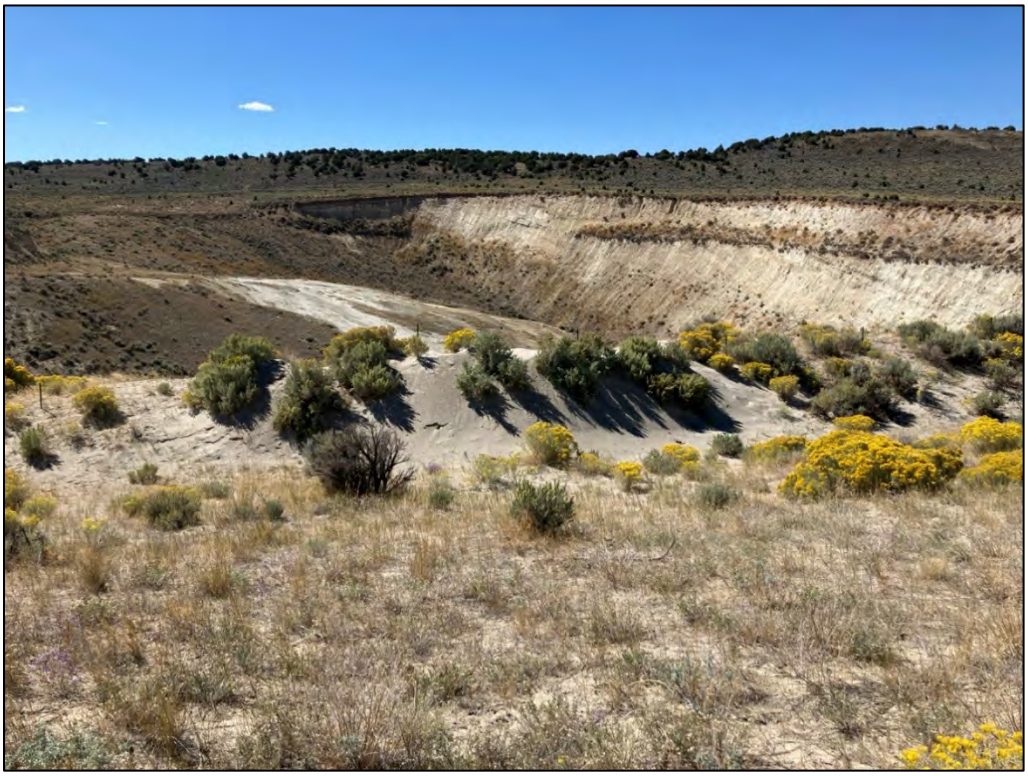
PL-6. Gully No. 4



PL-7. Geofabric Exposed in Channel



PL-8. Rills near Gully No. 1



PL-9. Sand Buildup Along Fence near Johnson Pit

12.0 Mexican Hat, Utah, Disposal Site

12.1 Compliance Summary

The Mexican Hat, Utah, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site was inspected on September 10, 2024.

In response to the cell depressions identified in 2016, the U.S. Department of Energy (DOE) Office of Legacy Management (LM) has continued investigations and performed geotechnical sampling and materials testing (GSMT) on the disposal cell cover components in April 2019 (DOE 2019a) and April 2024. Data obtained through the 2019 GSMT were used to identify causes for cover degradation features observed at the site, and these causes are highlighted in the *Erosional Piping Characterization and Data Report, Mexican Hat, Utah, Disposal Cell* (DOE 2020). Data obtained through the 2024 GSMT are still being processed and will be used to develop corrective action for mitigating erosion and supporting the long-term performance design for the disposal cell cover.

An interim cover protection (ICP) project was conducted in 2019 as a temporary measure to replace and restore portions of the cover to the original design specifications until a long-term solution can be assessed. The ICP project focused on the degradation associated with the lower portions of the northeast side slope.

Changes in the cover have since been observed in other locations on the disposal cell, but no new major erosion, settling, slumping, rock degradation, or other modifying processes that might affect the integrity of the disposal cell were evident during the 2024 inspection.

During the annual inspection, LM also conducted annual observational seep monitoring. The results are described in Section 12.8.2. Groundwater monitoring is not required.

12.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the site-specific Long-Term Surveillance Plan (DOE 2007) (LTSP) in accordance with procedures established to comply with the requirements of the U.S. Nuclear Regulatory Commission (NRC) general license at Title 10 *Code of Federal Regulations* Section 40.27 (10 CFR 40.27). Table 12-1 lists these requirements.

Table 12-1. License Requirements for the Mexican Hat, Utah, Disposal Site

Requirement	LTSP	This Report	10 CFR 40.27
Annual Inspection and Report	Sections 3.3 and 3.4	Section 12.4	(b)(3)
Follow-Up Inspections	Section 3.5	Section 12.5	(b)(4)
Maintenance	Section 3.6	Section 12.6	(b)(5)
Emergency Measures	Section 3.6	Section 12.7	(b)(5)
Environmental Monitoring	Section 3.7	Section 12.8	(b)(2)

12.3 Institutional Controls

The 119-acre site, identified by the property boundary shown in Figure 12-1, is held in trust by the U.S. Bureau of Indian Affairs. The Navajo Nation retains title to the land. UMTRCA authorized DOE to enter into a Cooperative Agreement with the Navajo Nation to perform remedial actions at former uranium processing sites. DOE and the Navajo Nation executed a Custodial Access Agreement that provides perpetual access to DOE for custody and long-term care at the site.

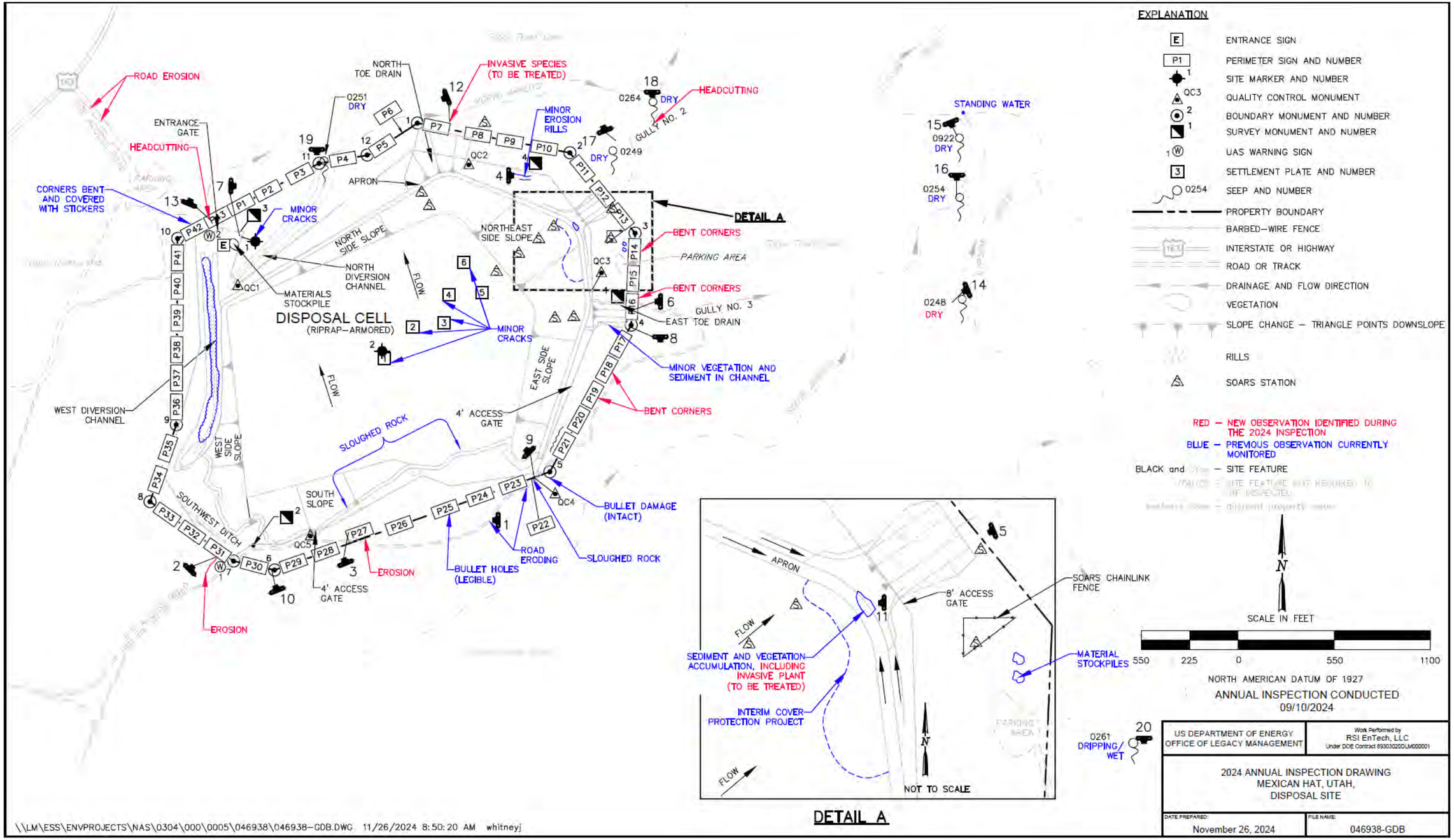
The site was accepted under the NRC general license in 1997. DOE is the licensee and, in accordance with the requirements for UMTRCA Title I sites, LM is responsible for the custody and long-term care of the site. Institutional controls (ICs) at the site include federal custody of the disposal cell and its engineered features, administrative controls, and the following physical ICs that are inspected annually: the disposal cell and associated drainage features, entrance gate and sign, fence, perimeter signs, site markers, and survey and boundary monuments.

12.4 Inspection Results

The site was inspected on September 10, 2024. The inspection was conducted by E. Garcia, C. Mueller, Z. Aldous, and G. Mitchell of the Legacy Management Support (LMS) contractor. The purposes of the inspection were to confirm the integrity of visible features at the site, identify changes in conditions that might affect conformance with the LTSP, and evaluate whether maintenance or follow-up inspection and monitoring are needed.

12.4.1 Site Surveillance Features

Figure 12-1 shows the locations of site features, including site surveillance features and inspection areas, in black and gray font. Some site features that are present but not required to be inspected are shown in italic font. Observations from previous inspections that are currently monitored are shown in blue, and new observations identified during the 2024 annual inspection are shown in red. Inspection results and recommended maintenance activities associated with site surveillance features are described in the following subsections. Photographs to support specific observations are noted in the text and in Figure 12-1 by photograph location (PL) numbers. The photographs and photograph log are presented in Section 12.10.



Abbreviation: UAS = uncrewed aircraft system

Figure 12-1. 2024 Annual Inspection Drawing for the Mexican Hat, Utah, Disposal Site

12.4.1.1 Site Access, Entrance Gate, and Entrance Sign

Northern access to the site is from an unmarked dirt road off U.S. Highway 163 that ends at a graded parking area, and southern access to the site is from an unmarked dirt road through Halchita, Utah, that ends at a graded parking area and the System Operation and Analysis at Remote Sites (SOARS) weather monitoring station.

As part of the 2019 ICP project, road repairs to the southern access route were performed to provide site access for haul trucks, delivery trucks, and other vehicles. Two incised areas were stabilized by installing geocell with standard U.S. Department of Transportation-specific rock types that allow proper drainage. The southern access road was examined during the inspection and found to be functional. The repaired areas were also examined and appeared to be performing as designed with minimal changes to the armored drainages since the 2023 inspection (PL-1). Inspectors will continue to monitor these areas.

The northern access road was examined during the inspection and two minor erosional features were observed, but the road is still functional. Inspectors will continue to monitor the access roads.

The steel entrance gate at the northwest corner of the site was locked and functional. The entrance sign is affixed to a steel post immediately behind the entrance gate. No maintenance needs were identified.

12.4.1.2 Fence and Perimeter Signs

A barbed-wire fence encloses the disposal cell. Minor erosion is occurring under the south fence line in two different areas (PL-2 and PL-3) and will continue to be monitored. A group of rills is growing near the northeast area of the fence and will continue to be monitored (PL-4). Two 4-foot access gates and one 8-foot access gate were permanently installed in 2018 to the perimeter barbed-wire fence to support past disposal cell cover evaluations and maintenance activities. These gates were all locked and functional.

A perimeter chainlink fence was installed in 2019 around the SOARS weather monitoring station. Approximately 260 linear feet of 6-foot-tall chainlink fence and a lockable double-swing gate were installed on existing dirt and rock surfaces around the SOARS station. The fence, equipment, and gates were all in good condition.

Barbed-wire fencing encloses two new SOARS monitoring stations that were installed in December 2023. All fencing and equipment were in good condition (PL-5).

There are 43 pairs of perimeter signs, designated P1 through P43 (each pair consisting of an upper sign indicating property ownership and barring trespassing and a lower sign identifying the site as a radioactive materials disposal site), positioned along the property boundary. Each paired perimeter sign is attached to a single steel post set in concrete. The corners of the lower perimeter sign on P14, P16 (PL-6), P18, and P19 are bent, possibly from burro contact, but still legible. Perimeter sign P25 has bullet holes but is legible. Perimeter sign P42 has bent corners and is covered in stickers but is legible. All remaining perimeter signs are in good condition.

Two signs prohibiting unauthorized uncrewed aircraft system flights are in good condition. One sign was installed by the entrance gate at the northwest corner of the site, and one sign was installed on the southwest corner between perimeter sign P31 and boundary monument BM-7.

12.4.1.3 Site Markers

The site has two granite site markers. Site marker SMK-1 is just inside the fence near the entrance gate; the concrete base has several minor cracks (PL-7), which have been noted during previous inspections. This does not compromise the integrity of the base, and repairs are currently unnecessary. Site marker SMK-2 is on the top slope of the disposal cell and is in good condition. No maintenance needs were identified.

12.4.1.4 Survey and Boundary Monuments

During construction of the disposal cell, four survey monuments were installed. Twelve boundary monuments (PL-8) delineate the property boundary. As noted previously, vandalism has resulted in bullet damage to boundary monument BM-5, but the monument remains legible and intact. All other monuments are in good condition, and no maintenance needs were identified.

12.4.1.5 Aerial Survey Quality Control Monuments

Five aerial survey quality control monuments (PL-9) were inspected during the 2024 annual inspection, and no maintenance needs were identified.

12.4.1.6 Settlement Plates

Six settlement plates were inspected during the 2024 annual inspection. All settlement plates have minor cracking in the concrete bases, which has been noted during previous inspections. The integrity of the bases is not compromised, and repairs are unnecessary at this time.

12.4.2 Inspection Areas

In accordance with the LTSP, the site is divided into four inspection areas (referred to as "transects" in the LTSP) to ensure a thorough and efficient inspection. The inspection areas are (1) the disposal cell, (2) the toe drains and diversion channels, (3) the balance of the site and the site perimeter, and (4) the outlying area. Inspectors examined specific site surveillance features within each area and looked for evidence of settlement, erosion, or other modifying processes that might affect the site's conformance with LTSP requirements.

12.4.2.1 Disposal Cell

The disposal cell, completed in 1994, occupies 68 acres and is armored with riprap to control erosion. Depressions in the riprap cover along the toe and lower portions of the northeast side slope of the disposal cell were identified during the 2016 annual inspection and a follow-up inspection on April 8, 2016 (DOE 2017). Additional site visits to further characterize the depression features have been completed and are detailed in the *Mexican Hat UMTRCA Disposal Cell Side Slope Cover Depressions Evaluation Report, Mexican Hat, Utah* (DOE 2019b). The ICP project was conducted in 2019 as a temporary measure to replace and restore the cover to

the original design specifications until a long-term solution to the degradation associated with the lower portions of the northeast side slope can be assessed.

Changes in the cover have since been observed in other locations on the disposal cell, but no new major erosion, settling, slumping, rock degradation, or other modifying processes that might affect the integrity of the disposal cell were evident during the 2024 inspection, and the site remains protective of human health and the environment. No maintenance needs were identified.

Eight new SOARS stations were added on the disposal cell in April 2024. All new and existing SOARS stations were inspected (PL-5), and no maintenance needs were identified.

12.4.2.2 Toe Drains and Diversion Channels

Sediment accumulation in the west diversion channel, likely transported from upgradient offsite erosion, has promoted the growth of vegetation, although no more than in previous inspections (PL-10).

Sediment and vegetation accumulation has also been observed along the transition zone from the apron to the northeast toe drain. Possible sources of sediment include a windblown material that originates offsite or radon barrier material associated with the erosion on the northeast side slope of the disposal cell, or both. Visual observations during the inspection did not identify any apparent increases in the sediment accumulation compared to previous visual observations, although more vegetation is accumulating (PL-11), including an invasive species.

12.4.2.3 Balance of the Site and Site Perimeter

Minor erosion continues in upgradient areas along the southwest portions of the site. This is an expected natural process, as the exposed geology at the site is composed of interbedded silty sandstone, siltstone, and shale with varying degrees of cementation and susceptibility to erosion. Inspectors will continue to monitor erosion in these areas.

Sloughed rock from an overhanging exposure of Halgaito Shale continues to be observed along the southern perimeter of the site. Although no visual changes were evident and this material appears to be stable, the sloughed rock is approaching the barbed-wire fence between perimeter signs P22 and P23 and will likely need to be removed or secured in the future to protect the fence from damage or a potential breach.

Scattered trash (broken glass, bottles, cans, cardboard, and paper containers) continues to accumulate in areas of the site that are accessible to vehicles (e.g., outside the perimeter of the barbed-wire fence).

Old bedding material removed during the ICP project and excess new bedding material were stockpiled near the SOARS monitoring station. Straw wattles were installed around this material for stormwater runoff protection. This area was evaluated during the inspection and is performing as designed. No maintenance needs were identified.

12.4.2.4 Outlying Area

The area 0.25 mile beyond the site boundary was visually observed for erosion, changes in land use, or other phenomena that might affect the long-term integrity of the site. A large invasive tree (*Tamarisk* sp.) was observed at the base of the north toe in the arroyo (PL-12). Headcutting at the north arroyo (PL-13) is expanding and encroaching on perimeter sign P43. Headcutting at the northeast arroyo is also expanding. Both erosion features will continue to be monitored, but no action is needed at this time. No other impacts were identified.

12.5 Follow-Up Inspections

LM will conduct follow-up inspections if (1) a condition is identified during the annual inspection or other site visit that requires a return to the site to evaluate the condition or (2) LM is notified by a citizen or outside agency that conditions at the site have substantially changed. No other follow-up inspections or evaluations are needed based on the inspection results.

12.6 Maintenance

Inspectors noted the following maintenance item that will be completed before the next inspection: vegetation maintenance at the northeast apron and north toe to remove invasive trees.

12.7 Emergency Measures

Emergency measures are the actions that LM will take in response to unusual damage or disruption that threatens or compromises site safety, security, or integrity in compliance with 10 CFR 40 Appendix A Criterion 12. The depression features identified in 2016 along the disposal cell's northeast side slope, and any other erosional features observed since, do not meet the criteria for implementing an emergency action; therefore, no need for emergency measures was identified.

12.8 Environmental Monitoring

12.8.1 Groundwater Monitoring

In accordance with the LTSP, groundwater monitoring is not required because the uppermost aquifer is hydrogeologically isolated from contamination in the overlying formation.

12.8.2 Seep Monitoring

In accordance with Section 3.7.2 of the LTSP, LM conducts observational monitoring of seven designated seeps during annual inspections as specified in an approved monitoring plan (DOE 2019c). Observational monitoring consists of visual observations and photographic documentation of the seven seep locations specified in the LTSP. The observed seep locations, shown in Figure 12-2, are primarily the result of the infiltration of precipitation into the surrounding formation or perched water that leaked from the former processing site tailings pond. Most seeps have exhibited dry conditions during the previous years of observational monitoring.

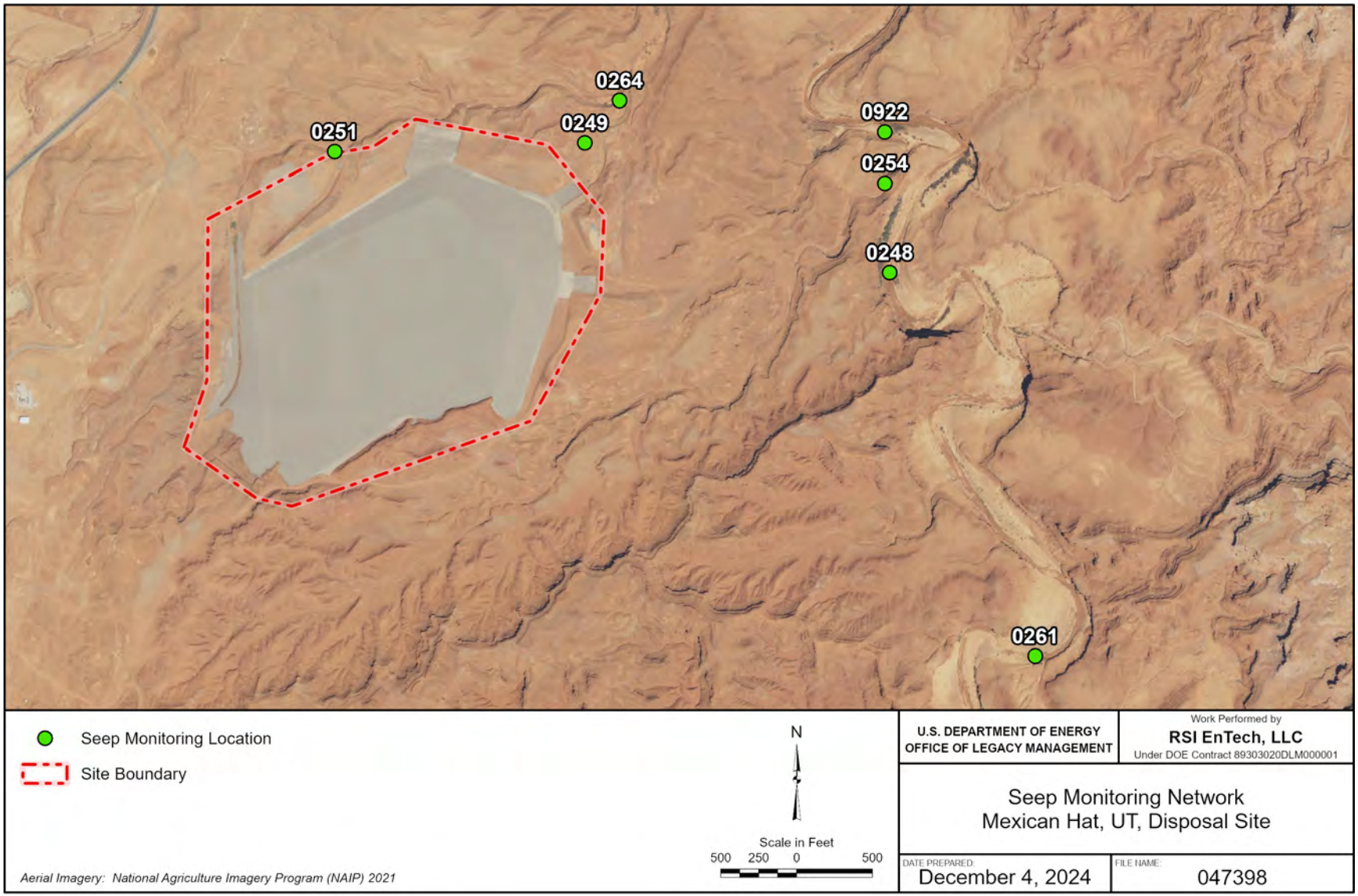


Figure 12-2. Seep Monitoring Locations at the Mexican Hat, Utah, Disposal Site

The LTSP required annual visual monitoring of the seven designated seeps through 2016, when an evaluation was to be conducted and a decision was to be made about whether to continue or discontinue visual seep monitoring. The evaluation has been completed and as described in the *Seep Monitoring Evaluation Report, Mexican Hat, Utah, UMTRCA Title I Disposal Site* (DOE 2019c), visual monitoring will continue to be performed during the annual site inspections.

Observational documentation consists of photographing seeps (PL-14 through PL-20) and providing descriptions of the conditions observed at the seven designated seeps. Since 2010, groundwater discharge has been observed at cross-gradient seep 0248, which typically exhibits dripping conditions; during the 2024 inspection, seep 0248 was dry (PL-14). Seeps 0922 (PL-15) and 0254 (PL-16) were dry, but the ephemeral drainage nearby had standing water. Seeps 0249 (PL-17), 0264 (PL-18), and 0251 (PL-19) were dry, and ephemeral drainages near these seeps were also dry.

Upgradient (background) seep 0261 (PL-20), approximately 0.5 mile upstream of seep 0248 in Gypsum Creek, was observed to be dripping during the inspection.

Table 12-2 documents the conditions of each monitored seep observed during the inspection with the respective drainage in which each seep occurs and a reference to photographic documentation.

Table 12-2. Observations of Seeps near the Mexican Hat, Utah, Disposal Site

Seep Location Number	Drainage	Location Relative to Disposal Cell	Photograph Location Number	Observed Seep Conditions
0248	Gypsum Creek	Cross gradient	PL-14	Dry conditions; thick vegetation surrounding seep area is limiting visibility of warning sign.
0249	Gully No. 2	Downgradient	PL-17	Dry conditions; seep area is covered with gray limestone that presumably is extra riprap apron material from disposal cell construction. Warning sign not posted at this location since this seep has never been documented to be discharging water.
0251	North Arroyo	Downgradient	PL-19	Dry conditions.
0254	South Arroyo	Downgradient	PL-16	Dry conditions. Warning sign not posted at this location due to seasonal flash flood conditions in the ephemeral drainage.
0261	Gypsum Creek	Upgradient (background)	PL-20	Seep was dripping. This seep discharges directly into Gypsum Creek, which had flowing water in multiple locations. Warning sign not posted since this seep is a background location.
0264	North Arroyo	Downgradient	PL-18	Dry conditions.
0922	Gypsum Creek	Downgradient	PL-15	Dry conditions. Seep is along the south side of Gypsum Creek, which was noted to have flowing water present.

12.8.3 Vegetation Monitoring

In accordance with the LTSP, vegetation conditions are observed during annual inspections to ensure that undesirable plant species, including deep-rooted plants on the disposal cell cover and noxious weeds, do not proliferate at the site. Except for deep-rooted vegetation, natural plant community succession is expected and will not adversely impact the performance of the disposal cell. During the 2024 inspection, minimal plant growth was noted on the top slope of the disposal cell. Shrubs and grasses are continuing to grow in the east and northeast toe drains, as well as in the west diversion channel (PL-10), but no more than in previous years. A new invasive tree (*Tamarisk* sp.) was observed in the northeast apron (PL-11). A large tree (*Tamarisk* sp.) is also growing at the base of the north toe apron in the arroyo (PL-12). Vegetation maintenance will be conducted to remove these trees before the next inspection. Overall vegetation growth will continue to be monitored during annual inspections to ensure that it does not negatively affect the performance of the cell.

12.9 References



Note

Site-related documents are available on the LM public webpages at https://lmpublicsearch.lm.doe.gov/SitePages.

10 CFR 40 Appendix A. U.S. Nuclear Regulatory Commission, "Criteria Relating to the Operation of Uranium Mills and the Disposition of Tailings or Wastes Produced by the Extraction or Concentration of Source Material from Ores Processed Primarily for Their Source Material Content," *Code of Federal Regulations.*

10 CFR 40.27. U.S. Nuclear Regulatory Commission, "General License for Custody and Long-Term Care of Residual Radioactive Material Disposal Sites," *Code of Federal Regulations*.

DOE (U.S. Department of Energy), 2007. *Long-Term Surveillance Plan for the Mexican Hat, Utah (UMTRCA Title I), Disposal Site, San Juan County, Utah,* DOE-LM/1530-2007, Rev. 3, October.

DOE (U.S. Department of Energy), 2017. *2016 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites,* LMS/S15036, Office of Legacy Management, March.

DOE (U.S. Department of Energy), 2019a. *Geotechnical Sampling and Materials Testing Work Plan for the Mexican Hat, Utah, UMTRCA Title I Disposal Site*, LMS/HAT/S20483, Rev. 1, Office of Legacy Management, January.

DOE (U.S. Department of Energy), 2019b. *Mexican Hat UMTRCA Disposal Cell Side Slope Cover Depressions Evaluation Report, Mexican Hat, Utah,* LMS/HAT/S14765, Office of Legacy Management, January.

DOE (U.S. Department of Energy), 2019c. *Seep Monitoring Evaluation Report, Mexican Hat, Utah, UMTRCA Title I Disposal Site,* LMS/HAT/S15190, Office of Legacy Management, December.

DOE (U.S. Department of Energy), 2020. *Erosional Piping Characterization and Data Report, Mexican Hat, Utah, Disposal Cell*, LMS/HAT/S29391, Office of Legacy Management, December.

12.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	270	Minor Road Erosion at Armored Drainage; Geocell Exposed
PL-2	45	Erosion Under Fence
PL-3	337	Erosion Under Fence; Concrete Base Exposed
PL-4	90	Group of Rills
PL-5	247	Northeast SOARS Station
PL-6	270	Perimeter Sign P16 with Bent Corners
PL-7	90	Site Marker SMK-1 with Minor Cracks in Concrete Base
PL-8	180	Boundary Monument BM-4
PL-9	315	Aerial Survey Quality Control Monument QC-4
PL-10	337	West Ditch
PL-11	270	Sediment and Vegetation Accumulation in Northeast Toe Drain
PL-12	247	Large Tamarisk Tree
PL-13	22	Headcutting Encroaching on Perimeter Sign P43
PL-14	247	Seep 0248, Dry
PL-15	157	Seep 0922, Dry
PL-16	180	Seep 0254, Dry
PL-17	337	Seep 0249, Dry
PL-18	180	Seep 0264, Dry
PL-19	180	Seep 0251, Dry
PL-20	180	Seep 0261, Background Seep, Dripping



PL-1. Minor Road Erosion at Armored Drainage; Geocell Exposed



PL-2. Erosion Under Fence



PL-3. Erosion Under Fence; Concrete Base Exposed



PL-4. Group of Rills



PL-5. Northeast SOARS Station



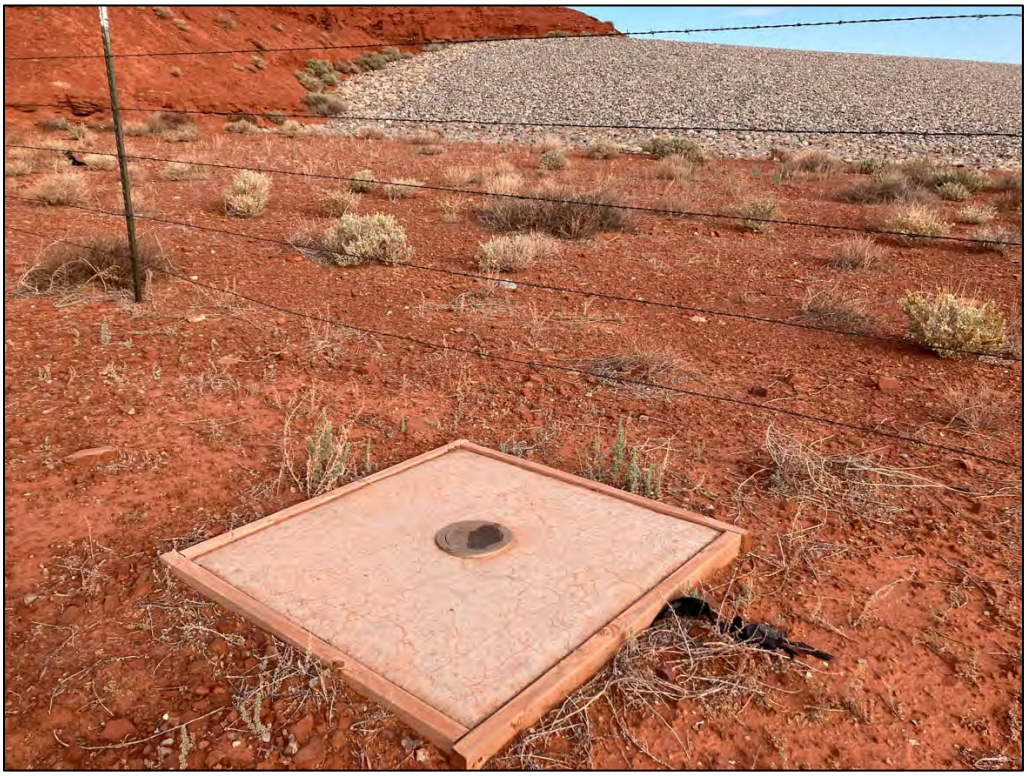
PL-6. Perimeter Sign P16 with Bent Corners



PL-7. Site Marker SMK-1 with Minor Cracks in Concrete Base



PL-8. Boundary Monument BM-4



PL-9. Aerial Survey Quality Control Monument QC-4



PL-10. West Ditch



PL-11. Sediment and Vegetation Accumulation in Northeast Toe Drain



PL-12. Large Tamarisk Tree



PL-13. Headcutting Encroaching on Perimeter Sign P43



PL-14. Seep 0248, Dry



PL-15. Seep 0922, Dry



PL-16. Seep 0254, Dry



PL-17. Seep 0249, Dry



PL-18. Seep 0264, Dry



PL-19. Seep 0251, Dry



PL-20. Seep 0261, Background Seep, Dripping

13.0 Naturita, Colorado, Disposal Site

13.1 Compliance Summary

The Naturita, Colorado, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site was inspected on May 30, 2024. No changes were observed on the disposal cell or in the associated drainage features. Inspectors identified a minor maintenance item but found no cause for a follow-up inspection.

Groundwater monitoring is not required and was discontinued in 2014. The site-specific *Long-Term Surveillance Plan for the Naturita, Colorado, Disposal Site* (DOE 2019) (LTSP) was revised in 2019 to remove the groundwater monitoring requirement.

13.2 Compliance Requirements

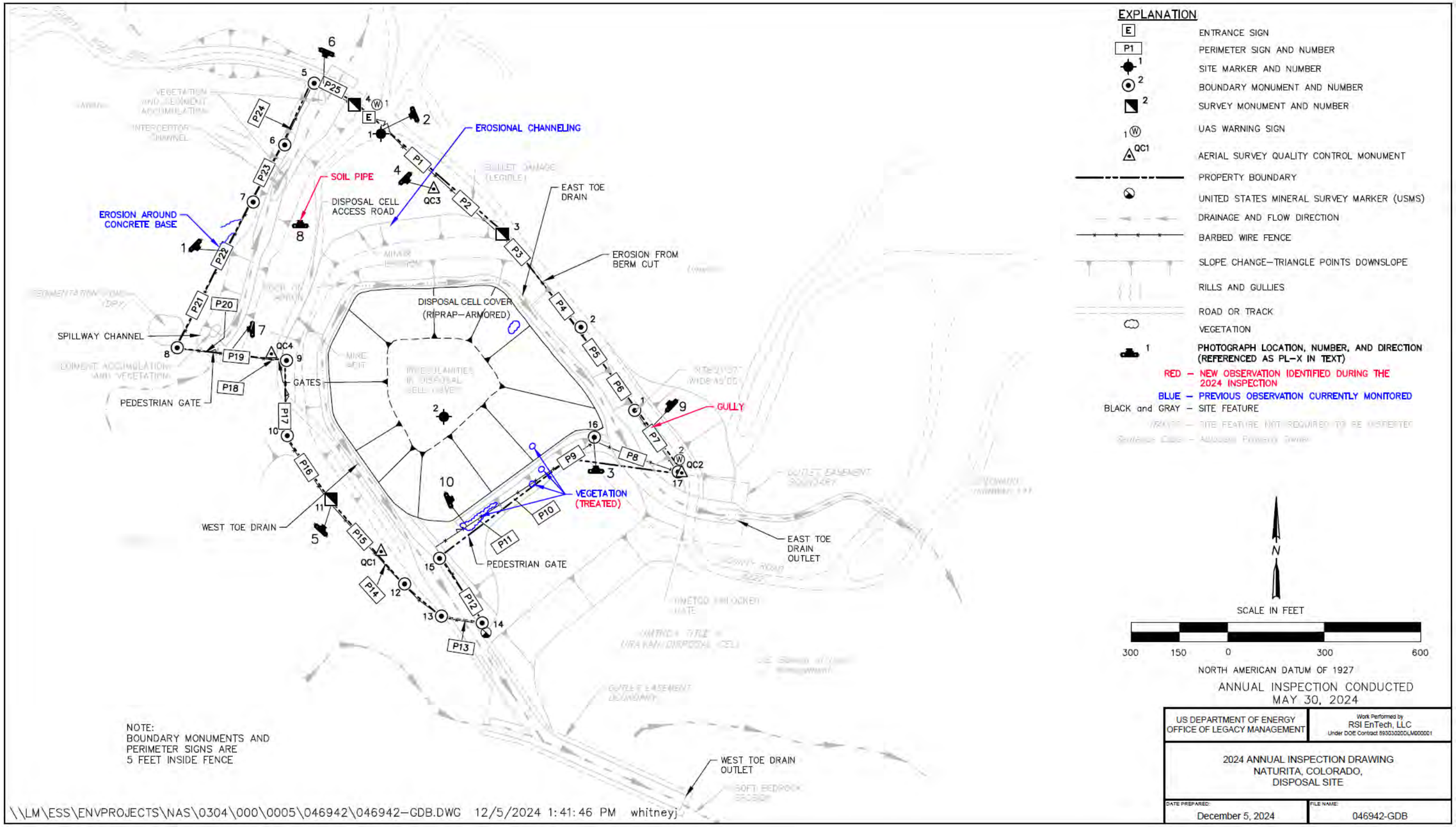
Requirements for the long-term surveillance and maintenance of the site are specified in the site-specific LTSP (DOE 2019) in accordance with procedures established to comply with the requirements of the U.S. Nuclear Regulatory Commission (NRC) general license at Title 10 *Code of Federal Regulations* Section 40.27 (10 CFR 40.27). Table 13-1 lists these requirements.

Table 13-1. License Requirements for the Naturita, Colorado, Disposal Site

Requirement	LTSP	This Report	10 CFR 40.27
Annual Inspection and Report	Sections 3.2, 3.3	Section 13.4	(b)(3)
Follow-Up Inspections	Section 3.4	Section 13.5	(b)(4)
Site Maintenance	Section 3.5.1	Section 13.6	(b)(5)
Environmental Monitoring	Section 3.6	Section 13.7	(b)(2)
Emergency Measures	Section 3.5.2	Section 13.8	—

13.3 Institutional Controls

The 26.65-acre site, identified by the property boundary shown in Figure 13-1, is owned by the United States and was accepted under the NRC general license in 1999. The U.S. Department of Energy (DOE) is the licensee and, in accordance with the requirements for UMTRCA Title I sites, the Office of Legacy Management (LM) is responsible for the custody and long-term care of the site. Institutional controls (ICs) at the site include federal ownership of the property, administrative controls, and the following physical ICs that are inspected annually: the disposal cell and associated drainage features, entrance gate and sign, perimeter fence and signs, site markers, survey and boundary monuments, and aerial survey quality control monuments.



Abbreviation: UAS = uncrewed aircraft system

Figure 13-1. 2024 Annual Inspection Drawing for the Naturita, Colorado, Disposal Site

13.4 Inspection Results

The site, 13 miles northwest of Naturita, Colorado, was inspected on May 30, 2024. The inspection was conducted by K. Meadows, M. Guziak, E. Gaasche, and N. McDonald of the Legacy Management Support (LMS) contractor. M. Hurt, the LM site manager, along with M. Cosby and A. Lawrence from the Colorado Department of Public Health and Environment, also attended the inspection. The purposes of the inspection were to confirm the integrity of visible features at the site, identify changes in conditions that might affect conformance with the LTSP, and evaluate whether maintenance or follow-up inspection and monitoring are needed.

13.4.1 Site Surveillance Features

Figure 13-1 shows the locations of site features, including site surveillance features and inspection areas, in black and gray font. Some site features that are present but not required to be inspected are shown in italic font. Observations from previous inspections that are currently monitored are shown in blue, and new observations identified during the 2024 annual inspection are shown in red. Inspection results and recommended maintenance activities associated with site surveillance features are described in the following subsections. Photographs to support specific observations are noted in the text and in Figure 13-1 by photograph location (PL) numbers. The photographs and photograph log are presented in Section 13.10.

13.4.1.1 Site Access, Entrance Gate, and Entrance Sign

Access to the site is from Colorado Highway 141 to Montrose County Road EE22, which borders the northeast side of the site. The main entrance to the site is through a locked steel gate directly off County Road EE22. The entrance sign next to the entrance gate was intact at the inspection. No maintenance needs were identified.

13.4.1.2 Perimeter Fence and Signs

A barbed-wire perimeter fence encloses the site. There are 25 perimeter signs positioned along the perimeter fence that are attached to steel posts set in concrete and set back 5 feet from the property boundary. Erosion around the concrete base of perimeter sign P22 is continually present and will be monitored (PL-1). No other maintenance needs were identified.

13.4.1.3 Site Markers

The site has two granite site markers. Site marker SMK-1 is just inside the entrance gate (PL-2), and site marker SMK-2 is on the top slope of the disposal cell. No maintenance needs were identified.

13.4.1.4 Survey and Boundary Monuments

Three survey monuments and 14 boundary monuments delineate the property boundary (PL-3). Boundary monuments BM-3, BM-4, and BM-11 are dual-purpose monuments that also represent survey monuments SM-3, SM-4, and SM-11, respectively. No maintenance needs were identified.

13.4.1.5 Aerial Survey Quality Control Monuments

Four aerial survey quality control monuments used during aerial surveys for ground control were inspected (PL-4). No maintenance needs were identified.

13.4.2 Inspection Areas

In accordance with the LTSP, the site is divided into three inspection areas to ensure a thorough and efficient inspection. The inspection areas are (1) the disposal cell, (2) the remainder of the site, and (3) the outlying area. Inspectors examined specific site surveillance features within each area and looked for evidence of erosion, settling, slumping, or other modifying processes that might affect the site's conformance with LTSP requirements.

13.4.2.1 Disposal Cell

The disposal cell, completed in 1998, occupies 10 acres (PL-5). The disposal cell is armored with riprap to control erosion. The riprap is rounded, with larger diameter rock on the side slopes than on the top slope. There was no evidence of settling, slumping, erosion, rock degradation, or other modifying processes that might affect the integrity of the disposal cell.

The top slope of the disposal cell appears to have slightly darker rock than the surrounding areas but seems to have not changed over time.

Vehicle tracks in the apron area on the west side of the disposal cell continue to be observed. Inspectors will continue to monitor these areas for potential impacts.

Sediment is accumulating in the apron on the northeast side of the disposal cell from erosion caused by the culvert break along County Road EE22. Vegetation is becoming established in this area. No maintenance needs were identified.

13.4.2.2 Remainder of the Site

Two riprap-armored toe drains (the west and east toe drains) collect water from the disposal cell side slopes and divert it to the southeast. The west toe drain outlet is south of the site in an easement. Soft bedrock is being eroded near the west toe drain outlet, but that erosion does not threaten the performance of the toe drain, and repairs are not necessary. The east toe drain outlet is southeast of the site in an easement. Water is conveyed to the east toe drain outlet through the east toe drain and five culverts under County Road EE22. Erosion has exposed resistant bedrock near the east toe drain outlet but does not threaten the performance of the toe drain, and repairs are not necessary. Some sediment has accumulated in the upper end of the east and west toe drains, allowing scattered vegetation to grow, but this has not adversely affected the performance of the toe drains.

A riprap-armored interceptor channel, upgradient and northwest of the disposal cell, diverts stormwater and snowmelt runoff to the northeast under County Road EE22. Some sediment has eroded from the offsite area upslope from the channel and is being deposited in the channel. Sediment accumulation and associated vegetation have not adversely affected the performance of the interceptor channel (PL-6). Herbicide is applied to rabbitbrush plants when it is deemed necessary by LMS ecologists. Due to trace amounts of woody vegetation on the southeastern apron of the disposal cell, herbicide treatments are only performed intermittently.

Headcutting erosion has been observed within the spillway channel below the sedimentation pond on the outlying area northwest of the site. Inspectors noted minor increases in rock slumping in this area during the 2023 inspection and will continue to monitor this area (PL-7).

The disposal cell access road along the northwest side of the site descends through shale and sandstone units of the Salt Wash Member of the Morrison Formation. The road provides access to the disposal cell on the west side of the site. A vertical soil pipe is forming 60 feet west of the road on the upper bench of the site (PL-8). Although there are no current concerns, inspectors will continue to monitor this feature. The road surface was in good condition at the time of inspection and no maintenance needs were identified.

Erosion in the steep cliff below the previous berm cut alongside County Road EE22 does not threaten the integrity of the disposal cell or site features. The berm cut was repaired in 2020. Inspectors continue to monitor this area.

Inspectors confirmed the small erosional channeling reported in 2022 occurring along the cliff north of the disposal cell. These channels appear to be formed from small soil pipes. Inspectors will continue to monitor the area for further signs of erosion. No maintenance needs were identified.

13.4.2.3 Outlying Area

The 0.25-mile area beyond the site boundary was visually observed for erosion, changes in land use, or other phenomena that might affect the long-term integrity of the site. The area has been highly disturbed by mining, quarrying, reclamation, and road building.

The gully that has formed on the outlying area along the northern site boundary near perimeter signs P22 and P23 has naturally filled in near the fence and is not currently posing any potential threat to the fence line. Inspectors will continue to monitor this area for ongoing erosion and resulting impacts.

A gully has formed outside of and perpendicular to the fence near the southeast corner of the site (PL-9). Inspectors will continue to monitor to ensure that it does not cut under the fence line. No maintenance needs were identified.

13.5 Follow-Up Inspections

LM will conduct follow-up inspections if (1) a condition is identified during the annual inspection or other site visit that requires a return to the site to evaluate the condition or (2) LM is notified by a citizen or outside agency that conditions at the site are substantially changed. No need for a follow-up inspection was identified.

13.6 Maintenance and Repair

Inspectors noted the following maintenance item that was completed after the inspection:

- Woody vegetation was treated on the southeast slope and apron of the disposal cell

No other maintenance needs were identified.

13.7 Environmental Monitoring

In accordance with the LTSP, LM ensures that a plant specialist or other qualified person conducts vegetation monitoring periodically.

If volunteer plant growth or sedimentation becomes extreme enough to potentially degrade the function of engineered structures, LM will evaluate the potential impact and select appropriate responses. Woody vegetation (rabbitbrush) is beginning to grow on the southeast slope and apron (PL-10). This vegetation was treated after the inspection.

13.8 Emergency Measures

Emergency measures are actions DOE will take in response to "unusual damage or disruption" that threatens or compromises site safety, security, or integrity (10 CFR 40 Appendix A Criterion 12). No need for emergency measures was identified.

13.9 References



Note

Site-related documents are available on the LM public webpages at https://lmpublicsearch.lm.doe.gov/SitePages.

10 CFR 40 Appendix A. U.S. Nuclear Regulatory Commission, "Criteria Relating to the Operation of Uranium Mills and the Disposition of Tailings or Wastes Produced by the Extraction or Concentration of Source Material from Ores Processed Primarily for Their Source Material Content," *Code of Federal Regulations*.

10 CFR 40.27. U.S. Nuclear Regulatory Commission, "General License for Custody and Long-Term Care of Residual Radioactive Material Disposal Sites," *Code of Federal Regulations*.

DOE (U.S. Department of Energy), 2019. *Long-Term Surveillance Plan for the Naturita, Colorado, Disposal Site*, LMS/NAD/S13227, Office of Legacy Management, December.

13.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	135	Erosion Around Concrete Base of Perimeter Sign P22
PL-2	248	Site Marker SMK-1
PL-3	—	Boundary Monument BM-16
PL-4	135	Aerial Survey Quality Control Monument QC-3
PL-5	45	Disposal Cell
PL-6	202	Interceptor Trench on North Side of Site
PL-7	270	Rocks in Spillway
PL-8	—	Soil Piping West of Access Road
PL-9	315	Gully near Southeast Fence Line
PL-10	68	Woody Vegetation Growth on Southeast Slopes of Disposal Cell

Note:
— = Photograph taken vertically from above.



PL-1. Erosion Around Concrete Base of Perimeter Sign P22



PL-2. Site Marker SMK-1



PL-3. Boundary Monument BM-16



PL-4. Aerial Survey Quality Control Monument QC-3



PL-5. Disposal Cell



PL-6. Interceptor Trench on North Side of Site



PL-7. Rocks in Spillway



PL-8. Soil Piping West of Access Road



PL-9. Gully near Southeast Fence Line



PL-10. Woody Vegetation Growth on Southeast Slopes of Disposal Cell

14.0 Rifle, Colorado, Disposal Site

14.1 Compliance Summary

The Rifle, Colorado, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site was inspected on October 16, 2024. Minor depressions observed during the 2023 site inspection were noted as no change in conditions and no new minor depressions were observed. No other changes were observed on the disposal cell; however, infrastructure has been added and construction activities associated with the Pore Water Extraction (PWE) Project were being conducted on the disposal cell and U.S Department of Energy (DOE) property during the time of the inspection. No changes were observed in the associated drainage features. Inspectors did not identify any maintenance items and found no cause for a follow-up inspection.

Since 2001, DOE has actively pumped pore water from the disposal cell into an evaporation pond to facilitate reduction of pore-water levels within the cell. Despite these efforts, pore water continues to accumulate and water levels in the disposal cell are increasing. Three unplanned system shutdowns occurred since the 2022 annual site inspection that caused the elevation of the pore water within the disposal cell to rise above the elevation of the top of the disposal cell liner for short durations. To address these issues, DOE initiated accelerated planning and actions to increase the extraction and management of pore water building up within the disposal cell. PWE Project field activities were conducted between June and December 2024 and included the installation of 10 extraction wells, 4 monitoring wells, updated solar-powered System Operation and Analysis at Remote Sites (SOARS) systems, a new pore-water discharge pipeline system, and two 108 × 108 feet (ft) modular evaporation tanks to contain the extracted leachate for storage and evaporation. This new system is designed to lower the pore-water levels within the disposal cell to below compliance action levels within the next few years. DOE has initiated further plans to study and address root causes of pore-water infiltration into the disposal cell to determine a long-term, sustainable solution for managing the pore water.

14.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the site-specific Long-Term Surveillance Plan (DOE 1997) (LTSP) in accordance with procedures established to comply with the requirements of the U.S. Nuclear Regulatory Commission (NRC) general license at Title 10 *Code of Federal Regulations* Section 40.27 (10 CFR 40.27). Table 14-1 lists these requirements.

Table 14-1. License Requirements for the Rifle, Colorado, Disposal Site

Requirement	LTSP	This Report	10 CFR 40.27
Annual Inspection and Report	Section 3.0	Section 14.4	(b)(3)
Follow-Up Inspections	Section 3.4	Section 14.5	(b)(4)
Maintenance and Repairs	Section 4.0	Section 14.6	(b)(5)
Groundwater Monitoring	Section 2.6	Section 14.7	(b)(2)
Disposal Cell Pore-Water Level Monitoring	Appendix	Section 14.8	—
Corrective Action	Section 5.0	Section 14.9	—

14.3 Institutional Controls

The 205-acre site, identified by the property boundary shown in Figure 14-1, is owned by the United States and was accepted under the NRC general license in 1998. DOE is the licensee and, in accordance with the requirements for UMTRCA Title I sites, the Office of Legacy Management (LM) is responsible for the custody and long-term care of the site. Institutional controls (ICs) at the site include federal ownership of the property, administrative controls, and the following physical ICs that are inspected annually: the disposal cell and associated drainage features, entrance gates and sign, site fence, perimeter signs, site markers, survey and boundary monuments, standpipes, and evaporation pond. With the addition of PWE Project infrastructure to the site, extraction and monitoring wells, as well as modular evaporation tanks, will be included in future inspections.

14.4 Inspection Results

The site, 6 miles north of Rifle, Colorado, was inspected on October 16, 2024. The inspection was conducted by C. Murphy, C. Mueller, K. MacDougall, N. Lind, and E. Garcia of the Legacy Management Support contractor. M. Young (LM), A. Lawrence and M. Cosby (Colorado Department of Public Health and Environment), and K. Davis and J. Lopez Pearce (U.S. Bureau of Land Management [BLM]) also attended the inspection. The purposes of the inspection were to confirm the integrity of visible features at the site, identify changes in conditions that might affect conformance with the LTSP, and evaluate whether maintenance or follow-up inspection and monitoring are needed.

14.4.1 Site Surveillance Features

Figure 14-1 shows the locations of site features, including site surveillance features and inspection areas, in black and gray font. Some site features that are present but not required to be inspected are shown in italic font. Observations from previous inspections that are currently monitored are shown in blue, and new observations identified during the 2024 annual inspection are shown in red. Inspection results and recommended maintenance activities associated with site surveillance features are described in the following subsections. Photographs to support specific observations are noted in the text and in Figure 14-1 by photograph location (PL) numbers. The photographs and photograph log are presented in Section 14.11.

14.4.1.1 Access Road, Entrance Gates, and Entrance Sign

Access to the site is from an improved gravel road northeast of Colorado Highway 13. A perpetual right-of-way across BLM property provides access to the site. Entrance to the site is through two locked gates on the access road: an outer reinforced metal gate about 1700 ft south of the site and an inner metal gate at the site fence (PL-1). The entrance sign, which is next to the inner gate, was faded and had minor cracks but remains legible. The access road has been repaired as needed in 2024 during construction activities associated with the PWE Project. However, the cattle guard at the turn off from Colorado Highway 13 and beginning of the site access road was observed to be filled with sediment and has been identified as a maintenance need that should be cleaned out.

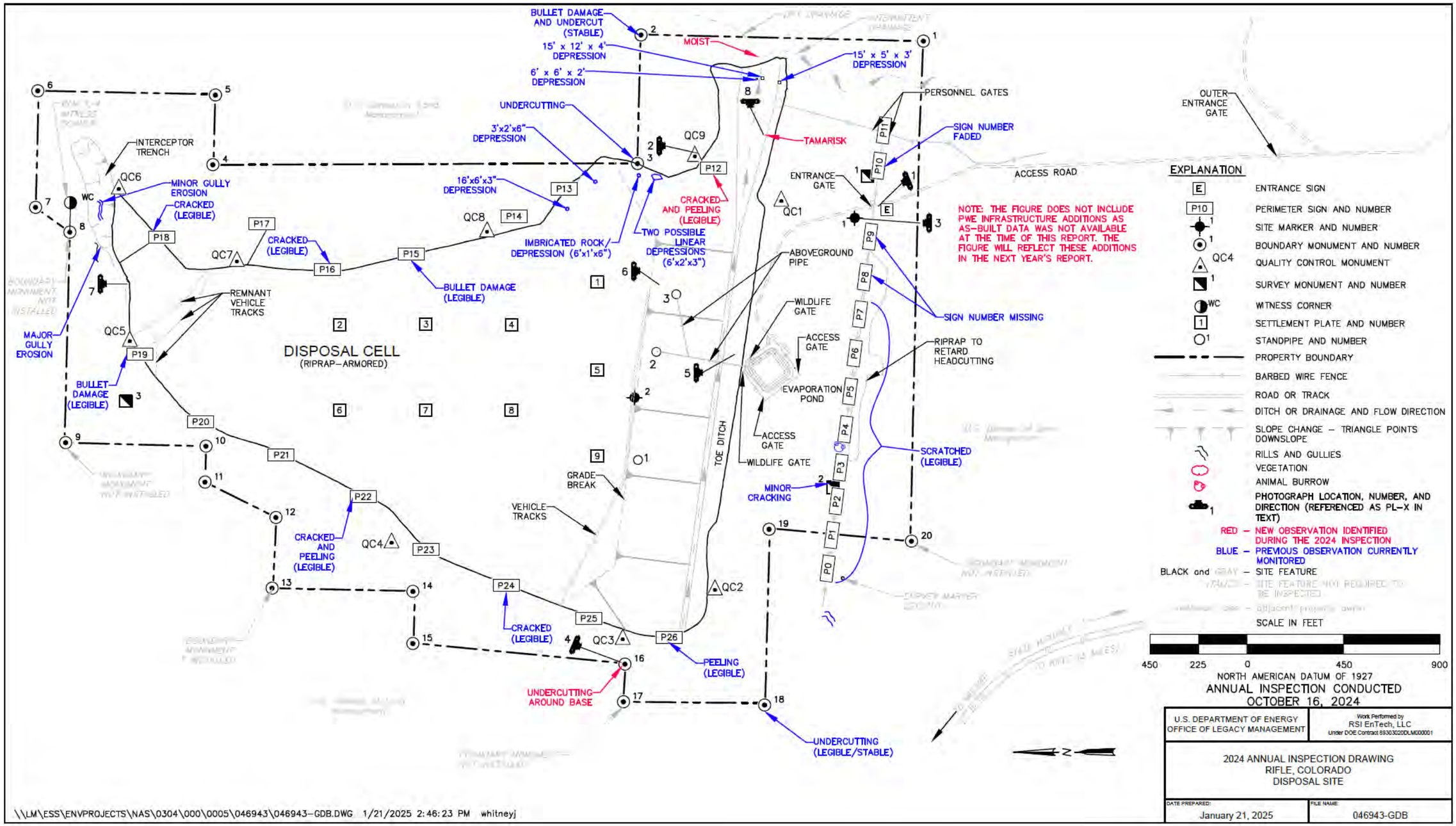


Figure 14-1. 2024 Annual Inspection Drawing for the Rifle, Colorado, Disposal Site

14.4.1.2 Site Fence and Perimeter Signs

A four-strand barbed-wire site fence at the southern end of the site extends to the edge of steep-sided arroyos that bound the site on the east and west. In previous years, livestock associated with an adjacent BLM grazing allotment would go around the fence to graze on the site vegetation. Inspectors noticed little to no evidence of continued livestock grazing during the 2024 inspection. This is discussed further in Section 14.4.2.3. Two personnel gates are at the southeast corner of the site. No maintenance needs were identified.

There are 27 perimeter signs positioned along the site perimeter. Perimeter signs P0 through P11 are attached to the site fence, and perimeter signs P12 through P26 are attached to steel posts set in concrete and set back 5 ft from the boundary. Perimeter signs P15 and P19 have bullet damage but remain legible. Perimeter signs P12 (PL-2), P16, P18, P22, P24, and P26 have minor cracks and are peeling but remain legible. The sign number on perimeter sign P10 is faded, and the sign numbers on perimeter signs P8 and P9 are missing. Perimeter signs P0 through P7 are scratched but legible. No maintenance needs were identified.

14.4.1.3 Site Markers

The site has two granite site markers. Site marker SMK-1 (PL-3) is just inside the inner entrance gate, and site marker SMK-2 is on the top slope of the disposal cell. No maintenance needs were identified.

14.4.1.4 Survey and Boundary Monuments

Three survey monuments and 15 boundary monuments delineate the property boundary. The boundary monuments are set at the corners of the irregular site boundary. Although the site boundary has 20 corners, only 15 are marked by boundary monuments because 5 of the corners are on extremely steep terrain that is not safely accessible. Consequently, boundary monuments BM-8, BM-9, BM-13, BM-17, and BM-20 were never installed. GPS is used to identify and inspect existing boundary monuments that are in hard-to-access areas. Boundary monument BM-2 has several bullet holes but remains intact. Boundary monuments BM-2, BM-3, BM-16 (PL-4) have undercutting at the ground surface but remain stable. Boundary monument BM-18 was previously reported to have undercutting, but it was not inspected during the 2024 inspection because it was too difficult to access. Survey monument SM-2 has slight cracking in the concrete, but the cracking does not affect the integrity of the survey monument. No maintenance needs were identified.

14.4.1.5 Aerial Survey Quality Control Monuments

Nine aerial survey quality control monuments were inspected during the 2024 annual inspection. No maintenance needs were identified.

14.4.1.6 Standpipes

Three 18-inch-diameter standpipes (MW01, MW02, and MW03) on the south side slope of the disposal cell are used to monitor pore-water levels in the disposal cell.[1] During the inspection, disposal cell pore water was being pumped from standpipes MW02 and MW03 into the evaporation pond. A third standpipe, MW01, is currently dry and not part of the leachate removal system.

No routine maintenance needs were identified for the standpipes. However, in conjunction with the disposal cell pore-water level monitoring efforts (Section 14.8), the surface components for standpipes MW02 and MW03 were modified in fall 2023 by installing protective vaults over the standpipes and burying the pipeline that transmits water to the evaporation pond (PL-5).

Concurrent with the 2024 inspection, 10 4-inch extraction wells and four 4-inch monitoring wells were being installed on the disposal cell north of the standpipes.

14.4.1.7 Evaporation Pond

A lined evaporation pond was constructed adjacent to the disposal cell in 2001 to receive water pumped from standpipes MW02 and MW03. The pond contained water during the inspection. Evaluation of the pond liner's integrity was completed in fall 2020 by a professional geosynthetic liner installation and inspection company. Two minor holes, approximately 2 inches in diameter, were identified at the top slope of the liner and repaired in May 2021. Due to the priority of the PWE Project and the addition of the two modular evaporation ponds, liner replacement plans have been delayed.

During the 2024 inspection, the security fence around the pond was intact and effectively preventing livestock from entering the area. The vehicular access gates on the northern and western corners of the fence were closed and locked during the inspection. A meteorological station alongside the pond was functioning normally. No other maintenance needs were identified.

Concurrent with the 2024 inspection, two modular tanks were being constructed to receive water pumped out of the 10 extraction wells that were installed in the disposal cell in 2024 (PL-6).

14.4.2 Inspection Areas

In accordance with the LTSP, the site is divided into four areas to ensure a thorough and efficient inspection. The inspection areas are (1) the disposal cell and interceptor trench, (2) the toe ditch and toe ditch outlet, (3) onsite reclaimed areas, and (4) the outlying area. Inspectors examined specific site surveillance features within each area and looked for evidence of settlement, erosion, or other modifying processes that might affect the site's conformance with LTSP requirements.

[1] Before 2023, previous annual reports referred to the standpipes using an "SP-" prefix (e.g., SP-01, SP-02, and SP-03) (e.g., DOE 2023a). This nomenclature was changed in 2023 to be consistent with terminology used in both the LTSP and LM's authoritative database (https://gems.lm.doe.gov) (DOE 2024a).

14.4.2.1 Disposal Cell and Interceptor Trench

The disposal cell, completed in 1996, occupies 71 acres and is armored with riprap consisting of river cobbles and boulders to control erosion and deter animal and human intrusion (PL-7). During the 2023 inspection, inspectors noted five depressions on the southeast side of the top of the disposal cell. The largest was approximately 16 ft × 6 ft × 3 inches. During the 2024 inspection, these depressions were not located and there was no evidence of further erosion, settling, slumping, or other modifying processes that might affect the integrity of the disposal cell. No additional depressions were identified.

Remnant vehicle tracks, which formed on the cover during well decommissioning activities in 2002, remain evident in the northern portion of the disposal cell. Additional vehicle tracks continue to be visible in the southern portion of the disposal cell and are attributable to the installation of solar panels and pumps at standpipes MW02 and MW03. Riprap disturbance was also noticeable from the pipeline burial activities that were performed on the side slope and the toe of the disposal cell in fall 2023.

Trenching operations were observed during the 2024 inspection associated with the PWE Project pipeline installation for the 10 extraction wells. This trenching extends from the new well field due north of standpipes MW02 and MW03 on the top of the disposal cell and down the side slope to the toe of the cell toward the new modular evaporation tanks.

Tamarisk was noted in the toe ditch during the inspection and will be monitored (PL-8). Small, isolated patches of other grasses were present on the disposal cell cover and side slope, but they do not present a concern and do not require treatment.

A vegetated interceptor trench was constructed at the top of the disposal cell to protect it from stormwater and snowmelt runoff. The trench appeared to be functioning as designed, although minor gully erosion has been occurring in the lower portion of the trench. The gully did not appear to be increasing significantly in depth or width. In the outfall area below the trench (down the steep-sided natural slope), stormwater runoff has formed a major gully to the north of the armoring riprap. The gully did not appear to be increasing in depth or width during the 2024 inspection. The outfall area will continue to be monitored to assess if additional riprap is needed on the slope to prevent upstream gully migration. No maintenance needs were identified.

14.4.2.2 Toe Ditch and Toe Ditch Outlet

A toe ditch runs along the downslope (southern) edge of the disposal cell and is armored with the same rock that protects the disposal cell. The toe ditch diverts stormwater runoff from the disposal cell offsite to the east. The ditch was stable and functioning as designed. During the inspection, no water was running from the toe ditch, but it was found to be moist.

Minor erosion, anticipated in the design, remains evident in the channel at the toe ditch outlet. Rock previously placed in the outlet to stabilize the erosion has dropped into and armored the eroded areas. Inspectors found two depressions in the rock during the 2017 annual inspection (one about 15 × 12 ft in area and 4 ft deep and one about 6 × 6 ft in area and 2 ft deep) and another depression during the 2018 annual inspection (about 15 × 5 ft in area and 3 ft deep). These depressions were formed near the outlet of the toe ditch on the east end after the

underlying soil eroded away. They are not a concern at this time but will continue to be monitored. No maintenance needs were identified.

14.4.2.3 Onsite Reclaimed Areas

Disturbed areas around the edges and south of the disposal cell were reseeded in 1996 and, overall, have been successfully reclaimed. Before 2012, there was little evidence of grazing within the site boundaries. Since 2012, however, cattle grazing has been regularly observed, and cattle trails have been identified meandering up the steep arroyos on the unfenced, southwest side of the site. There was little to no evidence of cattle grazing observed during the 2024 inspection. LM is evaluating additional fencing installation options on the southwest side of the site to prevent cattle access.

Three arroyos are present in the reclaimed area south of the disposal cell and outside the site fence. A rock apron was placed between the site fence and the headcuts in these arroyos to prevent headward migration toward the disposal cell. As erosion has migrated into the rock apron, the rock has naturally armored the arroyos and effectively stabilized them from further erosion. Inspectors will continue to monitor this area. No maintenance needs were identified.

14.4.2.4 Outlying Area

The 0.25-mile area beyond the site boundary was visually observed for erosion, changes in land use, or other phenomena that might affect the long-term integrity of the site. The primary land uses in the area are grazing, hunting, recreation, and wildlife habitat. The Rifle Arch Trailhead is approximately 0.25 mile southwest of the site along Highway 13. The City of Rifle has constructed multiple mountain biking trails since 2021 that follow the Rifle Arch Trail. Historically, trash has been dumped along the access road between Highway 13 and the outer entrance gate, and BLM has periodically removed it. No other changes to the outlying area were observed.

14.5 Follow-Up Inspections

LM will conduct follow-up inspections if (1) a condition is identified during the annual inspection or other site visit that requires a return to the site to evaluate the condition or (2) LM is notified by a citizen or outside agency that conditions at the site are substantially changed. No need for a follow-up inspection was identified.

14.6 Maintenance and Repairs

The only maintenance need identified during the 2024 inspection was the cattle guard at the beginning of the site access road off Colorado Highway 13 that was observed to be full of sediment. Tamarisk identified in the toe ditch of the disposal cell will be monitored.

14.7 Groundwater Monitoring

Groundwater monitoring is not required by the LTSP (DOE 1997). Transient drainage from the disposal cell enters the Wasatch Formation, a 3800 ft thick sequence of shales, siltstones, and fine-grained sandstones (DOE 1997). The Wasatch Formation separates the disposal cell from the uppermost usable aquifer (the Mesaverde Group). Groundwater in the Wasatch Formation is

classified as limited use due to naturally occurring concentrations of total dissolved solids that exceed 10,000 milligrams per liter (DOE 1997). Additionally, this unit produces very little water and is not considered to be an aquifer. Based on data from 1998–1992, background levels of barium, cadmium, chromium, molybdenum, and selenium exceed corresponding U.S. Environmental Protection Agency maximum concentration limits. The LTSP concluded that no further groundwater monitoring is required at the site because (1) the Wasatch Formation does not represent a usable source of water and (2) no exposure pathways to site-related groundwater exist at the site (DOE 1997). Therefore, all site monitoring wells installed before construction of the disposal cell were decommissioned by 2002.

14.8 Disposal Cell Pore-Water Level Monitoring

In accordance with the LTSP, LM monitors pore-water levels in the disposal cell at standpipes MW02 and MW03, which are installed at the downgradient end of the disposal cell on the south side slope (Figure 14-1). This monitoring is conducted in conjunction with extraction to maintain water levels below the high-density polyethylene (HDPE) liner that was installed in the toe of the disposal cell at an elevation of 6022.5 ft during original construction (referenced to North American Vertical Datum of 1988 [NAVD 88]).[2] The bottom of standpipe MW01 is at an elevation of 6023.95 ft; as such, it was found to be dry in July 2024.

A contingency plan for control of pore-water levels at the toe of the disposal cell was included as an attachment to the LTSP (DOE 1997). The plan included the installation of a dewatering system and a retention pond to use when water levels reach an elevation of 6016.5 ft and the solar-powered dewatering pump is initiated at a water level elevation of 6018.5 ft, the pump action (or trigger) level. Both the dewatering system and the evaporation pond were constructed in 2001. Water pumped from the standpipes was discharged through an aboveground polyethylene pipe to the evaporation pond.

Table 14-2 lists the total annual dewatering volumes based on the flow meter at the evaporation pond for 2008–2024. Figure 14-2 plots the same data along with corresponding cumulative volumes, accounting for previous (1993–2008) leachate extraction volumes (DOE 2009). The current cumulative dewatering volume (through mid-December 2024) is approximately 7.6 million gallons.

[2] All elevation data presented in this section are referenced to NAVD 88. The liner elevation cited in the LTSP, 6020 ft, was referenced to National Geodetic Vertical Datum of 1929 (NGVD 29); the corresponding trigger level was 6016 ft NGVD 29 (DOE 1997). In January 2021, the site's vertical datum was transformed to NAVD 88, resulting in an approximate increase of 2.53 ft in elevation measurements across the site relative to the original NGVD 29 datum.

Table 14-2. Total Dewatering Volumes at the Rifle, Colorado, Disposal Site, 2008–2024

Reporting Year[a]	Annual Dewatering Volumes (gal)[b]	Daily Average Dewatering Rate (gal per day)[c]	Days Pumping[d]	Cumulative Dewatering Volumes (gal)[e]
2008	143,078	708	139	143,078
2009	389,601	1070	159	532,680
2010	215,345	590	134	748,025
2011	61,331	169	66	809,355
2012	155,189	424	128	964,544
2013	106,266	291	107	1,070,810
2014	138,571	380	139	1,209,381
2015	154,621	424	149	1,364,002
2016	168,515	460	183	1,532,516
2017	87,741	240	101	1,620,258
2018	137,658	386	173	1,757,916
2019[f]	251,723	697	339	2,009,639
2020	197,280	539	336	2,206,919
2021	300,507	823	343	2,507,426
2022	262,034	718	325	2,769,461
2023	260,242	713	363	3,029,703
2024	237,584	677	351	3,267,287

Notes:

[a] Data are from June 13, 2008, (start of continuous flow measurements) through December 16, 2024.

[b] Annual dewatering volumes are based on average daily flow measurements retrieved from the SOARS (now AQUARIUS) database. Reported volumes for 2008 through 2017 are based solely on the readings from the evaporation pond flow meter, as SOARS measurements from individual standpipes did not begin until July 24, 2018. Volumes reported for subsequent dates and years are also based mostly on readings registered at the pond flow meter. However, in cases when the pond flow meter was not functioning or when readings from the standpipes exceeded those from the pond flow meter, combined (summed) data from standpipes MW02 and MW03 were used to calculate daily dewatering volumes. From 2018 to 2022, the latter approach results in an increase in reported volumes relative to previous annual reports (DOE 2023a; DOE 2024a). In late October 2023, the evaporation pond flow meter was removed during the pipeline infrastructure upgrades. Therefore, reported volumes for 2024 are based solely on combined readings from the individual standpipes.

[c] Daily average dewatering rates were calculated by dividing annual dewatering volumes by the corresponding number of records (357–366 depending on the year). Exceptions apply to 2008 (divisor of 202 given the start date of June 13, 2008) and 2024 (divisor of 351 given the end date of December 16, 2024).

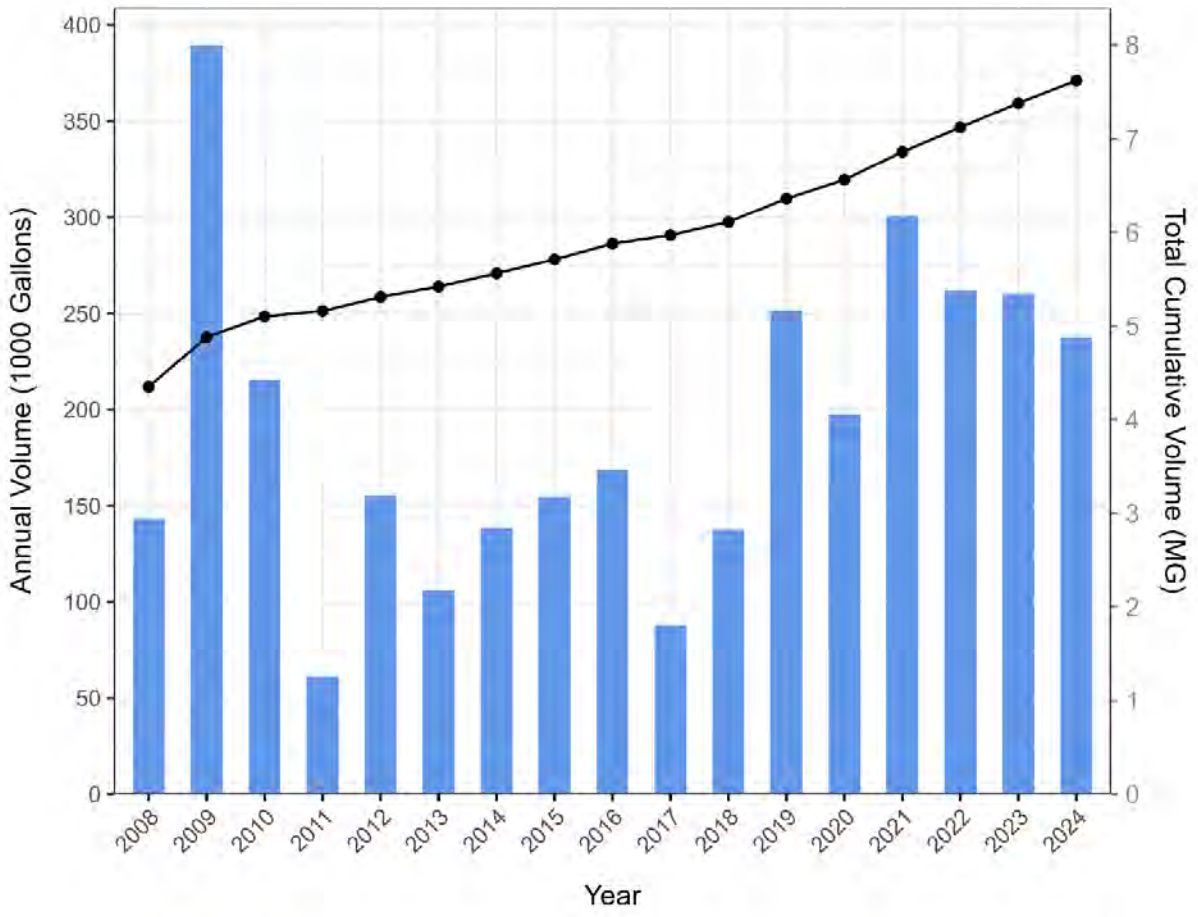
[d] Entries in this column (days pumping) correspond to the number of days with daily flow volumes greater than zero.

[e] Cumulative volumes correspond to the 2008–2024 time frame and do not account for historical volumes. The total measured volume of leachate extracted from the standpipes through 2008 was approximately 4.35 million gallons (DOE 2009).

[f] Continuous pumping began in 2019, a shift from the previous seasonal pumping regime.

Abbreviation:

gal = gallons



Annual Volume (1000 gallons)
Cumulative Volume (MG)

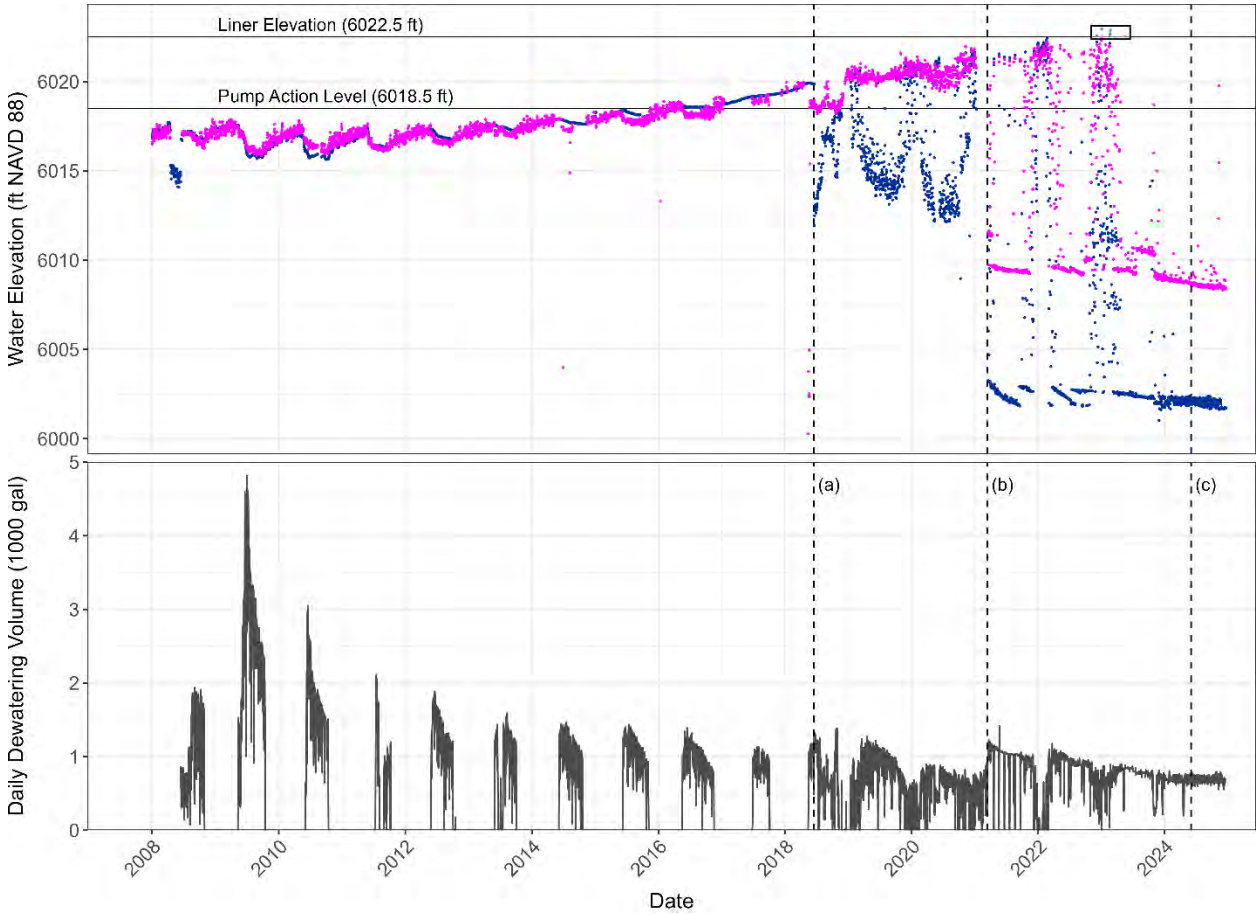
Notes: Annual volumes are from Table 14-2; data are from June 13, 2008, through December 16, 2024. Cumulative volumes are based on the 2008 annual inspection report (DOE 2009), which stated that the total measured volume of leachate extracted from the standpipes through 2008 was approximately 4.35 million gallons.

Abbreviation: MG = million gallons

Figure 14-2. Annual and Cumulative Volumes of Leachate Removed from the Rifle Disposal Cell, 2008–2024

Figure 14-3 plots historical pore-water elevations in standpipes MW02 and MW03 and corresponding dewatering rates for 2008 through December 17, 2024. In contrast to previous annual reports that showed elevation data since 1997, the date scale in Figure 14-3 is truncated to correspond to periods when continuous dewatering data were recorded and to focus on more recent water elevation trends. The 6018.5 ft pump action level was first exceeded between 2001 and 2003, after which elevations declined.[3] Starting in approximately 2012, water elevations in both standpipes began steadily increasing, and the pump action level was again exceeded in 2016. After an approximate 12-year shutdown, pumping at standpipe MW02 resumed in 2018. In 2019, in response to the increasing water elevations, LM began nearly continuous dewatering, a shift from the previous seasonal pumping regime evident in Figure 14-3.

[3] These data are shown in Figures 14-2 and 14-3 of the 2022 and 2023 annual reports, respectively (DOE 2023a; DOE 2024a).



- Standpipe MW02 daily maximum water elevation
- Standpipe MW03 daily maximum water elevation
- - - Denotes changes in system operations:
  - (a) Standpipe MW02 pumping resumed—6/15/2018 (following an approximate 12-year cessation)
  - (b) Collection system upgrades—3/12/2021
  - (c) PWE Project field activities begin—June 2024
- —— Daily dewatering volume (from evaporation pond or standpipe flow meters)
- ▭ Period when pore-water elevations in the standpipes exceeded the top of the liner elevation

Notes: Water elevations shown in the upper portion of this figure represent daily maximum elevations filtered from 5-minute data through December 17, 2024. Exceptions are elevations recorded before June 10, 2009, which are based on 4-hour readings (5-minute data were not available). The upper surface of all data points is the closest representation of static pore-water level conditions in the region of the standpipes, with drawdown associated with pumping periods. Pumping frequency increased in mid-2018. Following exceedances of the liner elevation in late 2022 and early 2023, pumping was continuous, resulting in sustained drawdown in standpipes MW02 and MW03. Although maximum water levels in the two standpipes dropped significantly in 2023 and 2024, it is important to note that this drawdown is localized only to the standpipes and is not representative of static water level conditions within the disposal cell.
Abbreviation: gal = gallons

Figure 14-3. Disposal Cell Pore-Water Elevations in Standpipes MW02 and MW03 and Corresponding Dewatering Rates at the Rifle, Colorado, Disposal Site, 2008–2024

Before spring 2021, the pore-water levels were monitored during monthly pump shutdown periods, which allowed the water levels to equilibrate between the standpipes and the surrounding media. In 2022, the monthly recovery tests ceased due to concerns that the liner would be overtopped during the recurring shutdown periods. Since then, pumps have been

operating continuously except for occasional unplanned system shutdowns caused by maintenance issues or low-temperature (freezing) conditions.

In 2021–2022, prompted by observations of pore water accumulating within the disposal cell, LM collaborated with the National Laboratory Network (NLN) to identify innovative approaches to perform pore-water source investigation and accumulation mitigation strategies for the site (DOE 2023b). LM included NRC in the LM/NLN collaboration process. These efforts culminated in the development of the *Work Plan Disposal Cell Pore-Water Sources Investigation for the Rifle, Colorado, Disposal Site* (DOE 2023c).

In fall 2023, several improvements were made to the original extraction system, including upgrading solar power systems and batteries and burying the extraction lines in the frost barrier of the disposal cell cover system to prevent freezing during the winter months. Despite the increased pumping and system upgrades, the maximum water level in both standpipes continued to rise and peaked in January 2023 (Figure 14-3). As detailed in the previous annual report (DOE 2024a), three unplanned system shutdowns occurred in 2022–2023 that caused the elevation of the pore water within standpipes MW02 and MW03 to rise above the elevation of the top of the HDPE liner for short durations (DOE 2023d). These exceedances occurred in late December 2022 and January and May 2023 (DOE 2024a). The maximum recorded elevation, 6022.96 ft, was recorded at standpipe MW02 on January 2, 2023.

From mid-2023 through 2024, to improve pore-water removal rates from the disposal cell, the standpipe pumps were operated nearly continuously relative to previous operations. In response, measured fluid levels within the standpipes were markedly lower and less variable than in previous years, with maximum elevations of approximately 6008 and 6002 ft for standpipes MW03 and MW02, respectively (Figure 14-3). These levels are not representative of static fluid levels in the disposal cell as a whole; rather, the levels represent drawdown in response to pumping within the two standpipes. Given the relatively low permeability of the tailings, the drawdown cones surrounding the standpipes are expected to be very steep and not extend significant distances away from the standpipes.

Between June and November 2024, 10 extraction wells and 4 monitoring wells were installed near the southern side slope of the disposal cell as part of the PWE Project. As of December 2024, location surveys of the newly installed wells were not yet complete and pumping and water level monitoring activities had just begun. Therefore, consistent with previous annual reports, the preceding discussion was limited to pore-water level monitoring of the two standpipes (MW02 and MW03).

14.9 Corrective Action: PWE Project

Corrective action is taken to correct out-of-compliance or hazardous conditions that create a potential health and safety problem or that may affect the integrity of the disposal cell or compliance with 40 CFR 192. To address the continued rise in pore-water levels, DOE prioritized the work associated with the PWE Project.

As discussed in the previous section, several improvements were made to the original extraction system in fall 2023, including upgrading solar power systems and batteries and burying the extraction lines in the frost barrier of the disposal cell cover system to prevent freezing during

the winter months. Despite the improvements to the extraction system and continuous pumping since mid-2018, water levels in the standpipes steadily increased between 2012 and early 2023, exceeding the pumping action level in 2016 and the top of the HDPE liner elevation in 2023.

As described in Section 14.8, an HDPE liner was installed in the basal portion of the disposal cell encompassing a limited area cover within the side slope of the disposal cell. The "bowl" area (Figure 14-4) was the targeted location for pore-water extraction as pore-water accumulation must be maintained below the top of the HDPE liner at an elevation of 6022.50 ft. Action levels that require pumping are reported at 6018.50 ft (NAVD 88).

To begin the development of a corrective strategy, a stochastic water balance model was created to quantitatively bound the potential sources and sinks of water within the Rifle disposal cell (Calculation Number RFL_003). This effort refined the site conceptual model and directly supported the development of an ensemble of three-dimensional numerical groundwater flow models for extraction system design (Schillig et al. 2024). The PWE Project design specifies an annual average extraction rate of 5 gallons per minute from the 10 extraction wells to successfully decrease pore-water levels below the HDPE liner and pumping action level. Final extraction well and monitoring well locations within the design incorporated the results of the 2024 geophysical investigation. This investigation was conducted to limit drilling refusal by identifying former Old and New Rifle, Colorado, Processing Sites' infrastructure debris placed at the foundation of the disposal cell (HGI 2024).

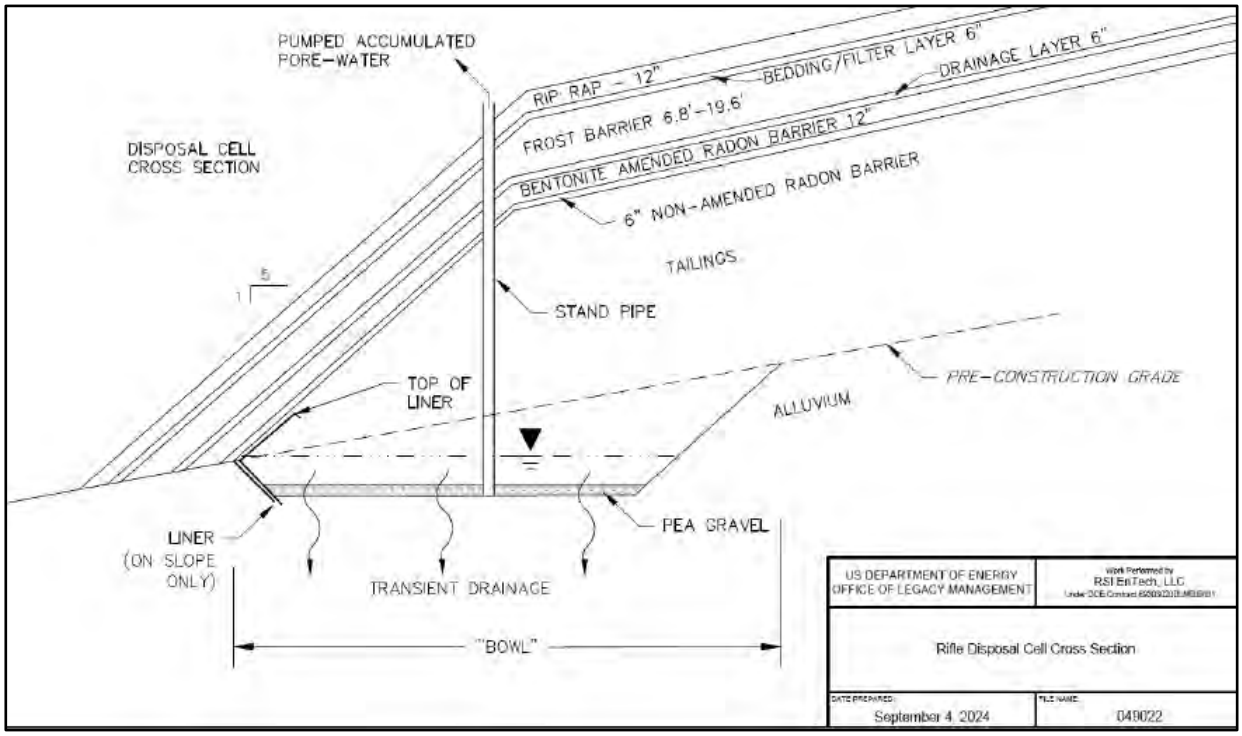


Figure 14-4. Conceptual Cross Section of the Disposal Cell at the Rifle Disposal Site Showing the Cover System, "Bowl" Area, and HDPE Liner (not to scale)

LM completed the high-priority PWE Project in 2024 to enhance pore-water extraction by installing 10 extraction wells, 4 monitoring wells, two 1-acre evaporation ponds, solar power infrastructure, and buried extraction lines. The new PWE Project infrastructure is designed to pump and evaporate 2.6 million gallons annually of pore water from the southern portion of the disposal cell to reduce pore-water elevations below the top elevation of the HPDE liner and pumping action level.

Additionally, with NRC concurrence, LM is investigating an evapotranspiration (ET)-type cover enhancement as a potential mid- to long-term strategy for pore-water management within the disposal cell (DOE 2024b). Implementing an ET cover enhancement could significantly decrease input of percolation to the underlying tailings and provide a sustainable and resilient long-term pore-water management strategy at lower costs and maintenance than the PWE Project pumping system. The goal of the cover enhancement strategy is to target and reduce contributing sources of pore-water accumulation using natural processes. Additionally, DOE plans to explore additional methods to identify sources of pore-water accumulation in the cell to establish a long-term sustainable solution.

14.10 References



Note

Site-related documents are available on the LM public webpages at https://lmpublicsearch.lm.doe.gov/SitePages.

10 CFR 40.27. U.S. Nuclear Regulatory Commission, "General License for Custody and Long-Term Care of Residual Radioactive Material Disposal Sites," *Code of Federal Regulations*.

40 CFR 192. U.S. Environmental Protection Agency, "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings," *Code of Federal Regulations*.

DOE (U.S. Department of Energy), 1997. *Long-Term Surveillance Plan for the Estes Gulch Disposal Site Near Rifle, Colorado*, DOE/AL/62350-235, Rev. 1, November.

DOE (U.S. Department of Energy), 2009. *2008 Annual Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites*, LMS/S04780, Office of Legacy Management, January.

DOE (U.S. Department of Energy), 2023a. *2022 Annual Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites*, LMS/S38159, Office of Legacy Management, March.

DOE (U.S. Department of Energy), 2023b. *LM National Lab Network Collaboration: Rifle, Colorado, Disposal Site*, LMS/RFL/S43383, Office of Legacy Management, March.

DOE (U.S. Department of Energy), 2023c. *Work Plan Disposal Cell Pore-Water Sources Investigation for the Rifle, Colorado, Disposal Site*, LMS/RFL/S32856, Office of Legacy Management, June.

DOE (U.S. Department of Energy), 2023d. M. Young, Rifle site manager, Office of Legacy Management, letter (about Preliminary Assessment Report for Unplanned Pumping System Shutdown and Subsequent Pore-Water Level Rise Within the Rifle, Colorado, Disposal Site) to K. Hayes, hydrogeologist, U.S. Nuclear Regulatory Commission, June 27.

DOE (U.S. Department of Energy), 2024a. *2023 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites*, LMS/43755, Office of Legacy Management, March.

DOE (U.S. Department of Energy), 2024b. *Cover Enhancements at the Rifle, Colorado, Disposal Site Technical Approach for Pilot Tests*, LMS/RFL/48844, Office of Legacy Management, October.

HGI (hydroGEOPHYSICS, Inc.), 2024. *Geophysical Investigation of the Rifle, Colorado, Disposal Cell*, RPT-2024-025, August.

Schillig, P., R. Kent, K. McClain, and A. Laase, 2024. "Applying Iterative Ensemble Smoother Modeling to Evaluate Dewatering Strategies at a Uranium Mill Tailings Disposal Site," at *MODFLOW and More 2024*, Princeton University, Princeton, New Jersey, June 2–5.

14.11 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	338	Site Entry Gate
PL-2	180	Perimeter Sign P12, Cracked but Legible
PL-3	0	Site Marker SMK-1
PL-4	203	Boundary Monument BM-16 with Undercutting
PL-5	180	Buried Discharge Line for Standpipes MW02 and MW03
PL-6	180	Newly Installed Modular Tanks and Construction Overview
PL-7	180	Disposal Cell Overview
PL-8	270	Tamarisk Growing in Toe Ditch



PL-1. Site Entry Gate



PL-2. Perimeter Sign P12, Cracked but Legible



PL-3. Site Marker SMK-1



PL-4. Boundary Monument BM-16 with Undercutting



PL-5. Buried Discharge Line for Standpipes MW02 and MW03



PL-6. Newly Installed Modular Tanks and Construction Overview



PL-7. Disposal Cell Overview



PL-8. Tamarisk Growing in Toe Ditch

15.0 Salt Lake City, Utah, Disposal Site

15.1 Compliance Summary

The Salt Lake City, Utah, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site was inspected on April 9, 2024. Due to an abnormally wet spring in the region around the site, inspectors observed ponded water in drainage channels and increased vegetation around the disposal cell. Observations of rock-quality monitoring plots indicated no significant change from the previous year. Inspectors identified several maintenance needs but found no cause for a follow-up inspection. Maintenance needs that could be addressed during the inspection were completed by inspectors. Groundwater monitoring is not required.

15.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the site-specific Long-Term Surveillance Plan (DOE 1997) (LTSP) in accordance with procedures established to comply with the requirements of the U.S. Nuclear Regulatory Commission (NRC) general license at Title 10 *Code of Federal Regulations* Section 40.27 (10 CFR 40.27). Table 15-1 lists these requirements.

Table 15-1. License Requirements for the Salt Lake City, Utah, Disposal Site

Requirement	LTSP	This Report	10 CFR 40.27
Annual Inspection and Report	Section 3.0	Section 15.4	(b)(3)
Follow-Up Inspections	Section 3.4	Section 15.5	(b)(4)
Maintenance and Repairs	Section 5.0	Section 15.6	(b)(5)
Groundwater Monitoring	Section 4.0	Section 15.7	(b)(2)
Corrective Action	Section 6.0	Section 15.8	—

15.3 Institutional Controls

The 100-acre site, identified by the property boundary shown in Figure 15-1, is owned by the United States and was accepted under the NRC general license in 1997. The U.S. Department of Energy (DOE) is the licensee and, in accordance with the requirements for UMTRCA Title I sites, the Office of Legacy Management (LM) is responsible for the custody and long-term care of the site. Institutional controls (ICs) at the site include federal ownership of the property, administrative controls, and the following physical ICs that are inspected annually: the disposal cell and associated drainage features, entrance gates and sign, fences, perimeter (warning) signs, site markers, and boundary monuments.

15.4 Inspection Results

The site, 81 miles west of Salt Lake City, Utah, was inspected on April 9, 2024. The inspection was conducted by D. Atkinson and T. Santonastaso of the Legacy Management Support (LMS) contractor. S. Pitton and K. Kreie (LM) and H. Mickelson, C. Bishop, and B. Anderson (Utah Department of Environmental Quality) attended the inspection. S. Gurr and N. Clarke of

EnergySolutions (the private operator of the surrounding radioactive waste disposal facility) escorted the inspection group. The purposes of the inspection were to confirm the integrity of visible features at the site, identify changes in conditions that might affect conformance with the LTSP, and evaluate whether maintenance or follow-up inspection and monitoring are needed.

15.4.1 Site Surveillance Features

Figure 15-1 shows the locations of site features, including site surveillance features and inspection areas, in black and gray font. Some site features that are present but not required to be inspected are shown in italic font. Observations from previous inspections that are currently monitored are shown in blue, and new observations identified during the 2024 annual inspection are shown in red. Inspection results and recommended maintenance activities associated with site surveillance features are described in the following subsections. Photographs to support specific observations are noted in the text and in Figure 15-1 by photograph location (PL) numbers. The photographs and photograph log are presented in Section 15.10.

15.4.1.1 Site Access, Entrance Gates, and Entrance Sign

The site is surrounded by the EnergySolutions radioactive waste facility. A perpetual right-of-way easement ensures that LM and its representatives have continued access across the EnergySolutions property to the site. LM also provides EnergySolutions access to the site to perform periodic maintenance activities, as needed, through a signed access agreement. In accordance with the agreement, EnergySolutions is required to provide a minimum 48-hour notice to LM before accessing or conducting maintenance activities at the site.

All personnel entering the EnergySolutions facility must sign in at the security building. Because of the surrounding radioactive waste disposal facility, posted radiological control areas must be crossed to access the site. Therefore, EnergySolutions requires that inspectors and other site visitors receive a radiological hazard awareness briefing, sign the EnergySolutions Radiological Work Permit, wear a dosimeter, and be escorted to and from the site. Hard hats, safety glasses, high-visibility vests, and steel-toed boots are also required on the EnergySolutions property. Following the inspection and before exiting the radiological control area, personnel and equipment are scanned for radiological contamination using a calibrated Ludlum model 2360 alpha-beta ratemeter.

A route across the EnergySolutions property provides access to the southwest corner of the site. Six locked gates around the site limit access to the site and disposal cell. Two gates (Gates 61 and 64) are in the southwest corner of the property, and one gate (Gate 87) is in the northwest corner of the property; these property boundary gates are maintained by EnergySolutions. The remaining three gates (Gate 65 in the northwest corner and Gates 60 and 62 (PL-1) in the southwest corner) are along the interior chainlink security fence that surrounds the disposal cell; these interior gates are maintained by LM. Gates 60, 61, and 64 are considered site entrance gates. The gates were locked and functional. The entrance sign is at Gate 61. Two new signs required by DOE were installed next to the gate at Gate 60 (PL-2). The new signs describe emergency procedures and list prohibited activities on the site. No maintenance needs were identified.

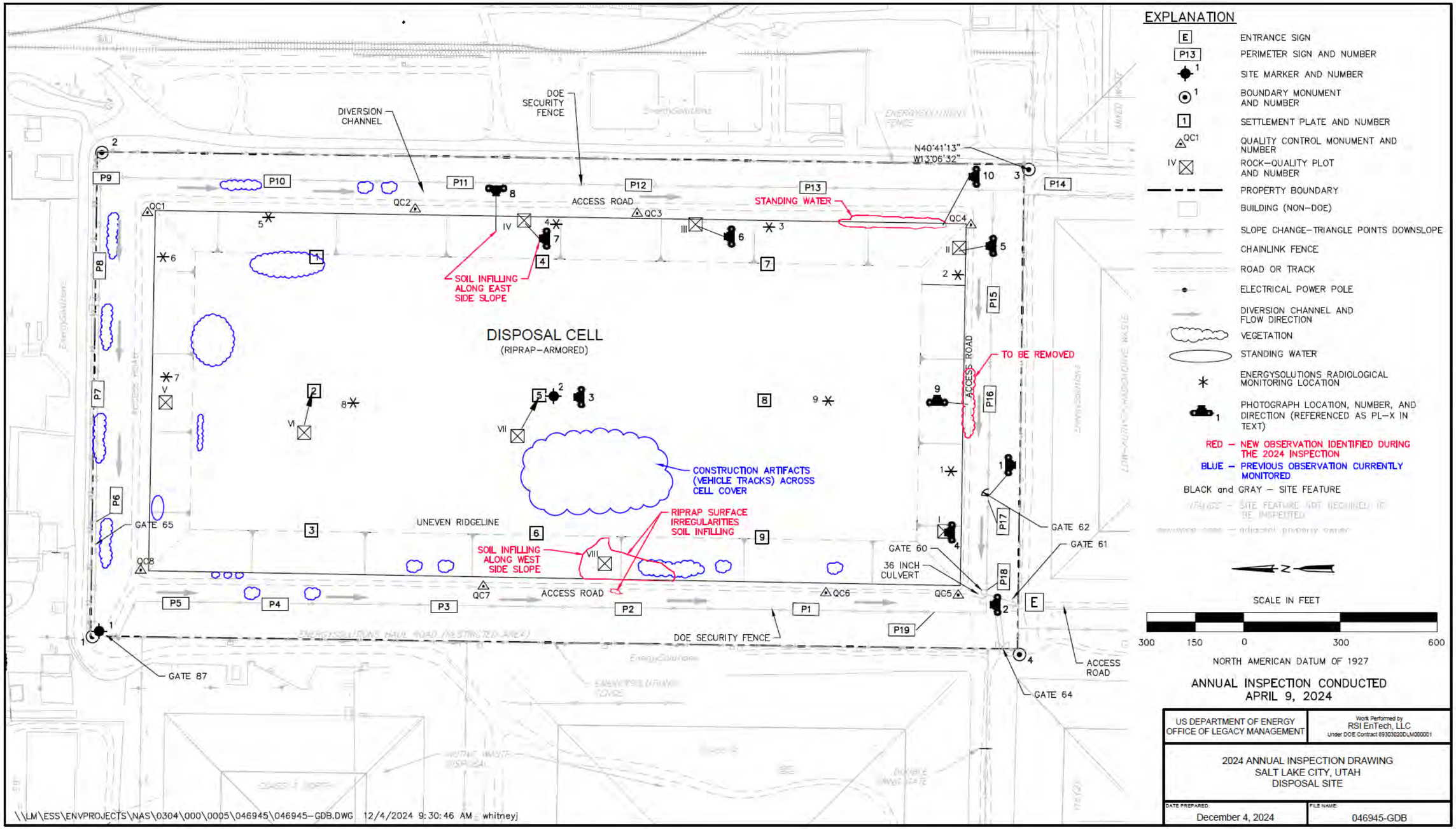


Figure 15-1. 2024 Annual Inspection Drawing for the Salt Lake City, Utah, Disposal Site

15.4.1.2 Fences and Perimeter Signs

The site has two chainlink fences: the exterior EnergySolutions perimeter fence along the property boundary and the interior DOE security fence that encloses the disposal cell and surface water diversion channels. There are 19 perimeter signs attached to the LM security fence; all 19 perimeter signs were present and in good condition. Inspectors noted continued growth of vegetation along the east fence line; treating and removing this vegetation is not required at this time. No other maintenance needs were identified.

15.4.1.3 Site Markers

The site has two granite site markers. Site marker SMK-1 is just inside Gate 87 in the northwest corner of the site. Site marker SMK-2 (PL-3) is on the top slope of the disposal cell. No maintenance needs were identified.

15.4.1.4 Boundary Monuments

Four boundary monuments delineate the corners of the property boundary (boundary monuments BM-1 to BM-4). Protective casings that EnergySolutions installed over each boundary monument continue to protect the boundary monuments from damage by surrounding earthmoving activities. No maintenance needs were identified.

15.4.1.5 Aerial Survey Quality Control Monuments

Eight aerial survey quality control monuments were installed before the 2022 inspection. All aerial survey monuments were in good condition, and no maintenance needs were identified.

15.4.2 Inspection Areas

In accordance with the LTSP, the site is divided into three inspection areas to ensure a thorough and efficient inspection. The inspection areas are (1) the disposal cell, (2) the area between the disposal cell and the site perimeter, and (3) the outlying area. Inspectors examined specific site surveillance features within each area and looked for evidence of erosion, settling, slumping, or other modifying processes that might affect the site's conformance with LTSP requirements.

15.4.2.1 Disposal Cell

The disposal cell, completed in 1988, occupies 54 acres. The disposal cell is armored with riprap to control erosion. Inspectors noted the presence of vehicle tracks from construction at various locations on the top and side slopes of the disposal cell. Because the vehicle tracks are broadly dispersed construction artifacts, they are not shown on the inspection drawing. There was no evidence of erosion, settling, slumping, or other modifying processes that might affect the integrity of the disposal cell. Vehicle use on disposal cells is prohibited without consent from DOE. No maintenance needs were identified.

One of several types of rock found within the mix used for the disposal cell erosion-protection riprap layer has exhibited minor degradation since the disposal cell was constructed. Eight rock-quality monitoring plots, each measuring 1 square meter (indicated by Roman

numerals I–VIII in Figure 15-1), were established in 2010 to monitor for continued rock degradation.

The type of rock exhibiting degradation constitutes approximately 1%–10% of the riprap material; observed rock degradation is thought to result from freeze-thaw weathering. Rock-quality monitoring plots are visually monitored and documented annually with photographs. Photographs of plots I, II, III, and IV (PL-4a through PL-7a) have been included in the report as representative of the rock-quality monitoring plots. Based on visual monitoring of the rock in the plots, there have been no significant changes from the 2023 annual inspection. Comparisons to the initial 2010 rock-quality plot photographs indicate very little (if any) additional rock degradation since monitoring began (PL-4b through PL-7b). The extent of rock degradation observed to date has not reduced the effectiveness of the riprap cover, and, at this time, there is no concern that cover integrity will be affected in the future. Rock-quality monitoring plots will continue to be visually monitored and documented annually with photographs to ensure that the riprap continues to protect the integrity of the disposal cell.

Nine settlement plates are on the top slope of the disposal cell; several outer casings associated with the settlement plates were visually inspected. Surveying of the settlement plates is not required unless settlement appears to be occurring. Every year, EnergySolutions performs light detection and ranging (lidar) surveys of the area that includes the disposal cell. The lidar survey results are available upon request. The LMS contractor completed a baseline aerial survey of the site in 2022 using lidar and photogrammetry. The results of this survey will be used in future assessments of erosion or other modifying processes to help ensure that the disposal cell remains structurally sound and protective of human health and the environment.

Although areas of the disposal cell have continued to have minor perennial grass growth, no deep-rooted plants were present on the disposal cell. Soil infilling and minor settling was observed along the east side slope (PL-8), as well as at one area along the west side slope where it is causing riprap surface irregularities. No immediate maintenance is required, but these areas will be monitored in the future for further settling, slumping, and infilling. No other maintenance needs were identified.

15.4.2.2 Area Between Disposal Cell and Site Perimeter

Inspectors examined the area between the toe of the disposal cell and the EnergySolutions security fence on the property boundary. No evidence of erosion was observed. Vegetation encroaching along the access road will be removed before the next inspection (PL-9). EnergySolutions will continue to remove vegetation along the road as needed.

The surface water diversion channels were functioning as designed. Ponded water and vegetation growth were observed in and along these diversion channels (PL-10) but are not impeding stormwater runoff.

Radiological surveys are performed at least every 2 years on the site by EnergySolutions personnel to confirm there is no spillover or windblown radioactive contamination from surrounding radioactive waste disposal operations. The previous survey occurred in 2023; the next survey will be performed in 2025.

Results from all radiological surveys conducted at the site have been below applicable exposure limits established in the *Radiological Control Manual* (DOE 2023). All results from the 2023 wipe samples collected by EnergySolutions were below the minimum detectable activities (i.e., nondetect) for removable alpha and beta radiation contamination. Therefore, both spillover and windblown radiological contamination from the surrounding radioactive waste disposal operation are not evident. The next radiological survey will occur during the 2025 annual site inspection.

EnergySolutions conducts periodic walkthroughs of the site to remove any windblown debris. The company reported no debris on the site in 2024. No maintenance needs were identified.

15.4.2.3 Outlying Area

The area beyond the site boundary for 0.25 mile was visually observed for erosion, changes in land use, or other phenomena that might affect the long-term integrity of the site. No such impacts were observed.

A variety of features and ongoing waste disposal activities that are managed by EnergySolutions surround the site. The most obvious waste disposal activities are occurring directly west of the site where a Class A (i.e., low-level radioactive waste) disposal cell is being capped. On the northeast and east sides of the site, incoming wastes are unloaded from railcars and transferred to haul trucks; decontamination facilities are also present. Directly to the south is a completed low-level (activity) radioactive waste disposal cell; to the southwest is a waste disposal cell containing Atomic Energy Act Section 11e.(2) byproduct material, as described in Title 42 *United States Code* Section 2011 et seq. (42 USC 2011 et seq.); and to the southeast is an operating mixed-waste treatment and disposal facility. Administration, security, and maintenance buildings lie directly north-northwest of the site. A shredding facility, rotary dump, and railroad spur delivery loop are northwest of the site. These adjacent operations and facilities are not affecting the site.

15.5 Follow-Up Inspections

LM will conduct follow-up inspections if (1) a condition is identified during the annual inspection or other site visit that requires a return to the site to evaluate the condition or (2) LM is notified by a citizen or outside agency that conditions at the site have substantially changed. No need for a follow-up inspection was identified.

15.6 Maintenance and Repairs

Removal of vegetation along the access roads around the disposal cell will be performed before the next annual inspection.

No other maintenance needs were identified.

15.7 Groundwater Monitoring

In accordance with the LTSP, groundwater monitoring is not required. Supplemental standards have been applied as site standards because (1) the uppermost aquifer is classified as limited use due to naturally occurring concentrations of total dissolved solids that exceed 10,000 milligrams

per liter and (2) the site is not contributing to the contamination of any current or potentially useful aquifer. EnergySolutions owns and maintains several groundwater monitoring wells throughout its licensed radioactive waste facility.

15.8 Corrective Action

Corrective action is taken to correct out-of-compliance or hazardous conditions that create a potential health and safety problem or that may affect the integrity of the disposal cell or compliance with 40 CFR 192. No need for corrective action was identified.

15.9 References



Note

Site-related documents are available on the LM public webpages at https://lmpublicsearch.lm.doe.gov/SitePages.

10 CFR 40.27. U.S. Nuclear Regulatory Commission, "General License for Custody and Long-Term Care of Residual Radioactive Material Disposal Sites," *Code of Federal Regulations*.

40 CFR 192. U.S. Environmental Protection Agency, "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings," *Code of Federal Regulations.*

42 USC 2011 et seq. "Atomic Energy Act of 1954," *United States Code.*

DOE (U.S. Department of Energy), 1997. *Long-Term Surveillance Plan for the South Clive Disposal Site, Clive, Utah*, DOE/AL/62350-228, Rev. 2, September.

DOE (U.S. Department of Energy), 2023. *Radiological Control Manual*, LMS/POL/S04322-7.0, Office of Legacy Management, August.

15.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	180	Personnel Gate 62
PL-2	0	Newly Installed Signs on DOE Security Fence near the Site Entrance
PL-3	—	Site Marker SMK-2
PL-4	—	(a) Rock-Quality Monitoring Plot I—2024 (b) Rock-Quality Monitoring Plot I—2010 Photo for Comparison
PL-5	—	(a) Rock-Quality Monitoring Plot II—2024 (b) Rock-Quality Monitoring Plot II—2010 Photo for Comparison
PL-6	—	(a) Rock-Quality Monitoring Plot III—2024 (b) Rock-Quality Monitoring Plot III—2010 Photo for Comparison
PL-7	—	(a) Rock-Quality Monitoring Plot IV—2024 (b) Rock-Quality Monitoring Plot IV—2010 Photo for Comparison
PL-8	270	Soil Infilling in Riprap Along East Side Slope
PL-9	90	Vegetation Along Access Road South of the Disposal Cell
PL-10	0	Standing Water in Toe Drain near Southeast Corner of the Disposal Cell

Note:
— = Photograph taken vertically from above.



PL-1. Personnel Gate 62



PL-2. Newly Installed Signs on DOE Security Fence near the Site Entrance



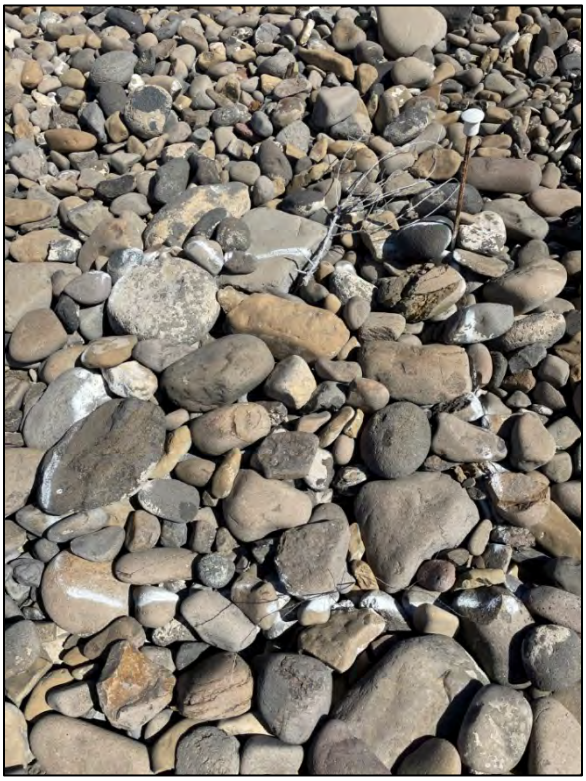
PL-3. Site Marker SMK-2



PL-4a. Rock-Quality Monitoring Plot I—2024



PL-4b. Rock-Quality Monitoring Plot I—2010 Photo for Comparison



PL-5a. Rock-Quality Monitoring Plot II—2024



PL-5b. Rock-Quality Monitoring Plot II—2010 Photo for Comparison



PL-6a. Rock-Quality Monitoring Plot III—2024



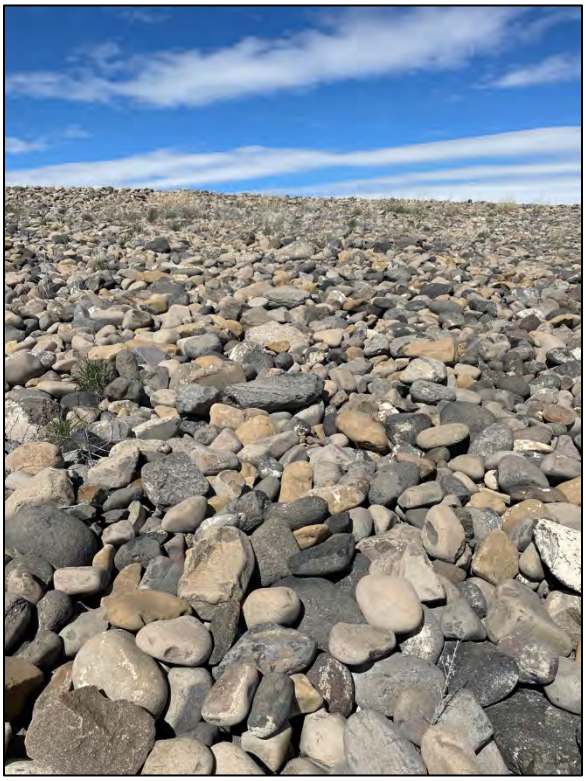
PL-6b. Rock-Quality Monitoring Plot III—2010 Photo for Comparison



PL-7a. Rock-Quality Monitoring Plot IV—2024



PL-7b. Rock-Quality Monitoring Plot IV—2010 Photo for Comparison



PL-8. Soil Infilling in Riprap Along East Side Slope



PL-9. Vegetation Along Access Road South of the Disposal Cell



PL-10. Standing Water in Toe Drain near Southeast Corner of the Disposal Cell

16.0 Shiprock, New Mexico, Disposal Site

16.1 Compliance Summary

The Shiprock, New Mexico, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site was inspected on June 6, 2024. No changes were observed on the disposal cell or in the associated diversion channels. Inspectors identified several minor maintenance needs but found no cause for a follow-up inspection. Groundwater monitoring to evaluate the disposal cell performance is not required.

16.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the site-specific Long-Term Surveillance Plan (DOE 1994) (LTSP) in accordance with procedures established to comply with the requirements of the U.S. Nuclear Regulatory Commission (NRC) general license at Title 10 *Code of Federal Regulations* Section 40.27 (10 CFR 40.27). Table 16-1 lists these requirements.

Table 16-1. License Requirements for the Shiprock, New Mexico, Disposal Site

Requirement	LTSP	This Report	10 CFR 40.27
Annual Inspection and Report	Section 6.0	Section 16.4	(b)(3)
Follow-Up or Contingency Inspections	Section 7.0	Section 16.5	(b)(4)
Maintenance and Repairs	Section 8.0	Section 16.6	(b)(5)
Environmental Monitoring	Sections 5.0 and 6.4	Section 16.7	(b)(2)
Corrective Action	Section 9.0	Section 16.8	—

16.3 Institutional Controls

The 105-acre site, identified by the property boundary shown in Figure 16-1, is held in trust by the U.S. Bureau of Indian Affairs. The Navajo Nation retains the title to the land. UMTRCA authorized the U.S. Department of Energy (DOE) to enter into a Cooperative Agreement (DE-FC04-85AL26731) with the Navajo Nation and required it to be in place before bringing the site under the NRC general license. DOE and the Navajo Nation executed a Custodial Access Agreement that conveys the federal government title to the residual radioactive materials stabilized at the repository site and ensures that DOE has perpetual access to the site.

The site was accepted under the NRC general license in 1996. DOE is the licensee and, in accordance with the requirements for UMTRCA Title I sites, the Office of Legacy Management (LM) is responsible for the custody and long-term care of the site. Institutional controls (ICs) at the site include federal custody of the disposal cell and its engineered features, administrative controls, and the following physical ICs that are inspected annually: the disposal cell and associated drainage features, entrance gates and signs, perimeter fence and signs, site markers, survey and boundary monuments, and erosion control markers.

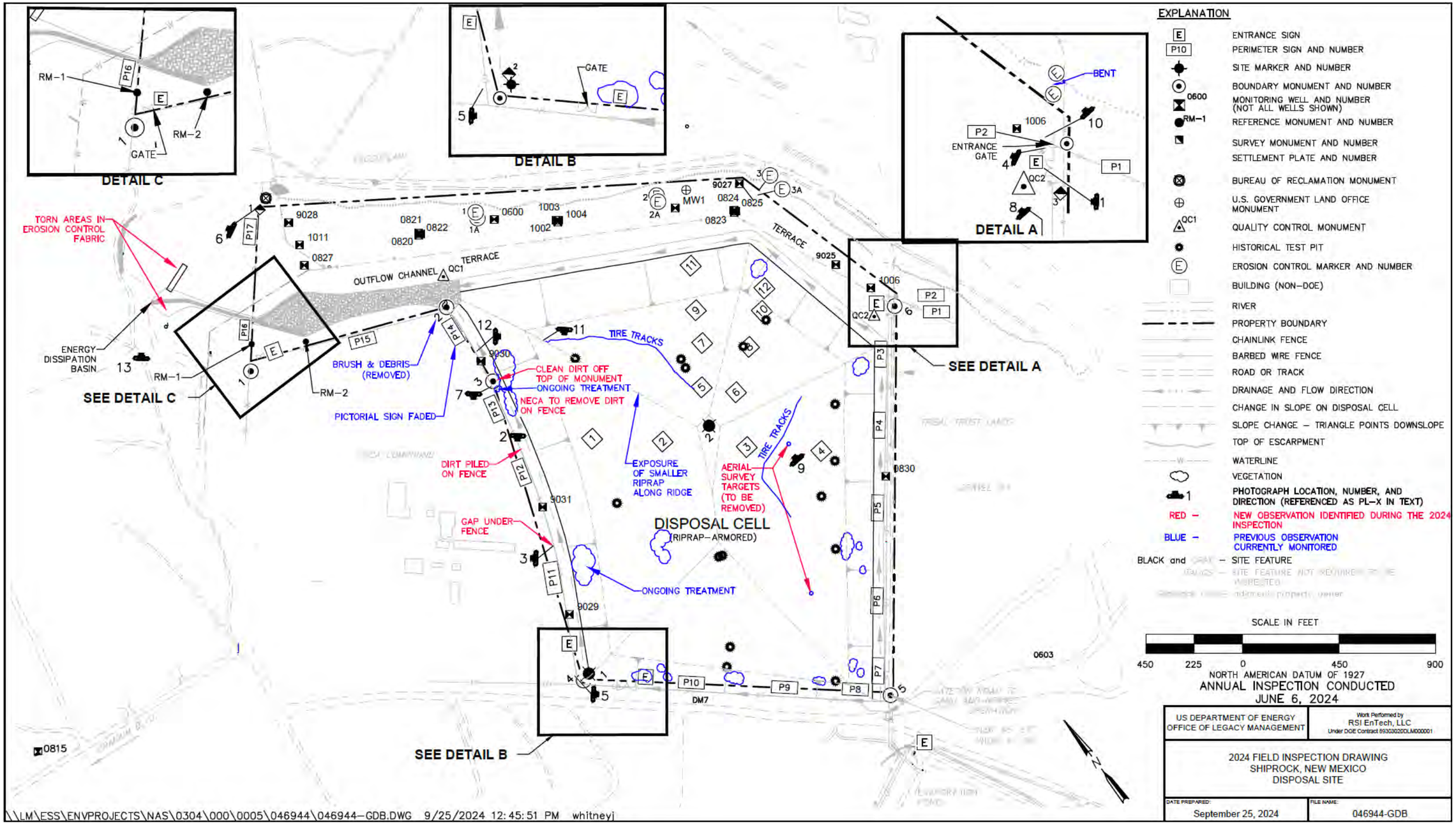


Figure 16-1. 2024 Annual Inspection Drawing for the Shiprock, New Mexico, Disposal Site

16.4 Inspection Results

The site, 1 mile south of Shiprock, New Mexico, was inspected on June 6, 2024. The inspection was conducted by J. Sullivan and E. DuQuette of the Legacy Management Support (LMS) contractor. J. Tallbull (LM), G. Jay (LMS), and D. Lee (Navajo Nation Abandoned Mine Lands Reclamation/Uranium Mill Tailings Remedial Action [AML Reclamation/UMTRA]) attended the inspection. The purposes of the inspection were to confirm the integrity of visible features at the site, identify changes in conditions that might affect conformance with the LTSP, and evaluate whether maintenance or follow-up inspection and monitoring are needed.

16.4.1 Site Surveillance Features

Figure 16-1 shows the locations of site features, including site surveillance features and inspection areas, in black and gray font. Some site features that are present but not required to be inspected are shown in italic font. Observations from previous inspections that are currently monitored are shown in blue, and new observations identified during the 2024 annual inspection are shown in red. Inspection results and recommended maintenance activities associated with site surveillance features are described in the following subsections. Photographs to support specific observations are noted in the text and in Figure 16-1 by photograph location (PL) numbers. The photographs and photograph log are presented in Section 16.10.

16.4.1.1 Access Roads, Entrance Gates, and Entrance Signs

Access to the site is from a gravel road off U.S. Highway 491. Three gates allow access to the site through the perimeter fence: the east gate (the current main entrance gate near the terrace escarpment [PL-1]), the north gate (an auxiliary access gate to the floodplain area of site), and the west gate (the former main entrance gate). Access to the main entrance gate is on the road adjacent to the Navajo Engineering and Construction Authority (NECA) gravel pit. The three gates were locked and functional. Pairs of entrance signs—one pictorial and one textual—are present near each gate. One pair is present at the east and north gates, and two pairs are present at the west gate. Contact information on the evaporation pond entrance sign was verified and is up to date. No maintenance needs were identified.

16.4.1.2 Perimeter Fence and Signs

A chainlink perimeter fence encloses the disposal cell and drainage features. Regular maintenance is ongoing to keep the perimeter fence free of trash, tumbleweeds, and other debris. The northwestern fence that is shared between NECA and DOE had several dirt piles that had been pushed up on the fence from the NECA side (PL-2). At one point, the ground under the fence had eroded, creating a gap (PL-3), which will require maintenance.

Seventeen pairs of perimeter signs, designated P1 through P17 (each pair consisting of one pictorial and one textual sign), are positioned along the perimeter fence[1] (PL-4). Perimeter sign P14, which was found faded during the 2023 inspection, was not able to be replaced due to

[1] Plate 1 of the LTSP shows six sets of perimeter signs on fence fabric along the terrace escarpment. These were not installed because a fence was never installed in this area. Because the escarpment prohibits access to the site, a fence was not needed.

lack of access in the NECA yard. Because it is in a locked area, the sign is not in need of replacement. No other maintenance needs were identified.

16.4.1.3 Site Markers

The site has two granite site markers. Site marker SMK-1 (PL-5) is just inside the west gate and contains minor cracks in its concrete base. Site marker SMK-1 cracks were sealed in 2023. Site marker SMK-2 on the top slope of the disposal cell is stable and legible. No maintenance needs were identified.

16.4.1.4 Survey and Boundary Monuments

Three survey monuments and six boundary monuments delineate the property boundary. Two additional boundary monuments are offsite; monitoring of these offsite monuments was discontinued in 2003. In 2002, boundary monument BM-1 was destroyed or removed by an adjacent landowner. It was replaced, and two reference monuments (RM-1 and RM-2) were installed next to it in 2003. Steel T-posts were installed next to all boundary monuments, as well as spray-painted rocks, to make them more visible and help inspectors locate them. The concrete at survey monument SM-1 (PL-6) was repaired. All survey and most boundary monuments were observed to be clear of vegetation and trash. Boundary monument BM-3 needs to have accumulated dirt cleaned off the top (PL-7). Boundary monument BM-2 was cleared of vegetation and trash following the inspection. No other maintenance needs were identified.

16.4.1.5 Aerial Survey Quality Control Monuments

Two aerial survey quality control monuments (PL-8) are present at the site and were inspected during the 2024 annual inspection. Two aerial targets located at the site were identified as not needed and will be removed before the next annual inspection (PL-9).

16.4.1.6 Erosion Control Markers

The site has pairs of erosion control markers (1/1A, 2/2A, 3/3A, and 5/5A) along the edge of the terrace escarpment that were inspected. Erosion control markers 4/4A are not inspected; they were installed on the terrace east of the site in the gravel pit. Erosion control marker ECM-5A (PL-10), which is near the east entrance gate, was previously bent by a vehicle, but it is functional and does not require repair. No maintenance needs were identified.

16.4.2 Inspection Areas

In accordance with the LTSP, the site is divided into three areas to ensure a thorough and efficient inspection. The inspection areas are (1) the disposal cell, diversion channels at the base of the disposal cell, and the outflow channel; (2) the terrace area north and northeast of the disposal cell; and (3) the outlying area, which includes the fenced evaporation pond south of the disposal cell and the former gravel pit southwest of the disposal cell. Inspectors examined site-specific surveillance features within each area and looked for evidence of erosion, settling, slumping, or other modifying processes that might affect the site's conformance with LTSP requirements.

16.4.2.1 Disposal Cell, Diversion Channels, and Outflow Channel

The disposal cell, completed in 1986, occupies 77 acres and is armored in riprap to control erosion and deter animal and human intrusion. There was no evidence of erosion, settling, slumping, rock degradation, or other modifying processes that might affect the integrity of the disposal cell. Piezocones installed on the disposal cell cover that were associated with a research project are no longer in use. Some of the filled piezocone pits have subsided slightly or were never completely backfilled, which resulted in shallow conical depressions on the cover. As reported in previous site inspection reports, the surface of the disposal cell has numerous ruts associated with past vehicle traffic (PL-11). An area where smaller riprap is exposed along the northern ridge of the disposal cell is monitored each year to detect possible changes that might indicate erosion or degradation of the cover. The inspectors observed no changes in this area in 2024. The condition of other depressions and vehicle ruts is monitored annually and has not changed significantly since the 2014 inspection.

Windblown sediment has accumulated in the rock cover in several places. Woody, deep-rooted shrubs are controlled in accordance with the LTSP. Several woody shrubs found on the top and side slopes of the disposal cell were treated (PL-12).

Diversion channels around the base of the disposal cell contained scattered vegetation, including several woody shrubs. The channel along the southwestern side of the disposal cell has accumulated sediment, and a significant amount of vegetation has grown. Inspectors noted that nonwoody plants were growing within the outflow channel, and woody vegetation was growing on the banks of the outflow channel. Vegetation growth does not adversely affect the performance of any of these channels at this time and is not a concern; however, inspectors will continue to monitor this area. No other maintenance needs were identified.

16.4.2.2 Terrace Area

The terrace area is north and northeast of the disposal cell along the top of a steep escarpment. Other than annual weeds, little vegetation grows on the terrace. The edge of the escarpment varies between 175 and 345 feet from the base of the disposal cell and is prone to slumping. No new significant erosion was evident during the 2024 inspection. The LTSP states that the base of the terrace escarpment should be inspected for signs of seepage, and seeps were identified during previous site inspections. However, this is no longer part of the annual inspection because the seeps are now monitored as part of the groundwater compliance program for the site. No maintenance needs were identified.

16.4.2.3 Outlying Area

The area 0.25 mile beyond the site boundary was visually observed for erosion, changes in land use, or other phenomena that might affect the long-term integrity of the site. No such impacts were observed. A former gravel pit that is no longer used to actively extracting aggregate is immediately southeast of the disposal cell. Inspectors identified no significant changes in land use associated with the gravel pit or with other outlying areas near the disposal cell during the 2024 inspection.

In 2002, LM constructed an 11-acre lined evaporation pond near the disposal cell as part of the groundwater compliance strategy. The pond, surrounded by a chainlink security fence, is maintained under the groundwater compliance program. The security fence was intact and functional at the time of the inspection. A quarterly inspection of the pond liner is conducted by a geotechnical engineer to identify any other potential issues that may arise. Water levels are monitored during the workweek to determine whether any actions need to be taken.

The erosion control fabric on the outflow channel has deteriorated to the point that it needs to be repaired (PL-13).

Fences and warning signs posted in Bob Lee Wash are maintained under the groundwater compliance program and were not examined during the 2024 annual inspection. No maintenance needs were identified.

16.5 Follow-Up or Contingency Inspections

LM will conduct follow-up or contingency inspections if (1) a condition is identified during the annual inspection or other site visit that requires a return to the site to evaluate the condition or (2) LM is notified by a citizen or outside agency that conditions at the site are substantially changed. No need for a follow-up or contingency inspection was identified.

16.6 Maintenance and Repairs

Previous inspections have identified the following minor maintenance need that was not completed because of access restrictions, but it will be conducted before the next inspection:

- Perimeter sign P14 will be left in place due to restricted access from NECA

Inspectors noted the following additional maintenance needs during the 2024 inspection that will be addressed before the next inspection:

- Remove aerial survey quality control monuments targets
- Ask NECA to remove dirt pushed up on the fence
- Replace outflow channel erosion control matting
- Treat deep-rooted woody shrubs on the top and side slopes of the disposal cell
- Clean direct off the top of boundary monument BM-3

16.7 Environmental Monitoring

16.7.1 Groundwater Monitoring

In accordance with the LTSP, groundwater monitoring to evaluate disposal cell performance is not required. However, groundwater monitoring is conducted in accordance with a groundwater compliance strategy. The monitoring wells associated with the groundwater compliance strategy (i.e., along the terrace and at offsite locations) are not included in the annual inspection process. All wells with locking mechanisms observed during the inspection were locked, and no maintenance needs were identified. Two boreholes (9025 and 9026) observed without a locking

mechanism were within the locked perimeter fence of the disposal cell and determined to be secure.

16.7.2 Vegetation Monitoring

In a 1999 letter to the AML Reclamation/UMTRA (Bergman-Tabbert 1999), LM committed to spraying annual weeds on the disposal cell top slope. Annual weeds typically have grown on less than 1% of the top slope. After discussion among LM, AML Reclamation/UMTRA, and LMS ecologists in 2019, LM recommended that it cease treatment of non-noxious weeds on the cell and allow natural plant succession to progress. In 2019, LM wrote to AML Reclamation/UMTRA outlining its proposed vegetation management plan (Kautsky 2019). Under the plan, LM will continue to treat weeds listed as noxious by the State of New Mexico and the Navajo Nation (primarily *Halogeton glomeratus*) in accordance with applicable laws. Deep-rooted woody species will be treated in accordance with the LTSP. Vegetation will continue to be monitored and treated accordingly to inform future management decisions.

16.8 Corrective Action

Corrective action is taken to correct out-of-compliance or hazardous conditions that create a potential health and safety problem or that may affect the integrity of the disposal cell or compliance with 40 CFR 192. No need for corrective action was identified.

16.9 References



Note

Site-related documents are available on the LM public webpages at https://lmpublicsearch.lm.doe.gov/SitePages.

10 CFR 40.27. U.S. Nuclear Regulatory Commission, “General License for Custody and Long-Term Care of Residual Radioactive Material Disposal Sites,” *Code of Federal Regulations*.

40 CFR 192. U.S. Environmental Protection Agency, “Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings,” *Code of Federal Regulations*.

Bergman-Tabbert, 1999. D. Bergman-Tabbert, site manager, Office of Legacy Management, U.S. Department of Energy, letter (about the Shiprock Uranium Mill Tailings Remedial Action Site) to Madeline Roanhorse, director, Navajo Nation UMTRA Program Division of Natural Resources, May 13.

DOE (U.S. Department of Energy), 1994. *Long-Term Surveillance Plan for the Shiprock Disposal Site, Shiprock, New Mexico*, DOE/AL/62350-60F, Rev. 1, September.

Kautsky, 2019. Mark Kautsky, UMTRCA Title I manager, Office of Legacy Management, U.S. Department of Energy, letter (about Updated Agreement for Vegetation Control on the Shiprock Disposal Cell) to Madeline Roanhorse, director, Navajo Nation UMTRA Program Division of Natural Resources, October 10.

16.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	315	Entrance Sign
PL-2	225	Dirt Piled on Fence
PL-3	315	Gap Under Fence
PL-4	337	Perimeter Sign Pair
PL-5	135	Site Marker SMK-1
PL-6	337	Survey Monument SM-1
PL-7	225	Boundary Monument BM-3 (Covered with Rocks)
PL-8	—	Quality Control Monument QC-2
PL-9	—	Aerial Survey Targets
PL-10	—	Erosion Control Marker ECM-5A
PL-11	225	Vehicle Ruts
PL-12	135	Woody Shrubs
PL-13	45	Deteriorated Fabric in Outflow Channel

Note:
— = Photograph taken vertically from above.



PL-1. Entrance Sign



PL-2. Dirt Piled on Fence



PL-3. Gap Under Fence



PL-4. Perimeter Sign Pair



PL-5. Site Marker SMK-1



PL-6. Survey Monument SM-1



PL-7. Boundary Monument BM-3 (Covered with Rocks)



PL-8. Quality Control Monument QC-2



PL-9. Aerial Survey Targets



PL-10. Erosion Control Marker ECM-5A



PL-11. Vehicle Ruts



PL-12. Woody Shrubs



PL-13. Deteriorated Fabric in Outflow Channel

17.0 Slick Rock, Colorado, Disposal Site

17.1 Compliance Summary

The Slick Rock, Colorado, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site was inspected on May 22, 2024. No changes were observed on the disposal cell or in the associated drainage features. Inspectors identified routine maintenance needs but found no cause for a follow-up or contingency inspection. Groundwater monitoring is not required.

17.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the site-specific Long-Term Surveillance Plan (DOE 2024) (LTSP) in accordance with procedures established to comply with the requirements of the U.S. Nuclear Regulatory Commission (NRC) general license at Title 10 *Code of Federal Regulations* Section 40.27 (10 CFR 40.27). Table 17-1 lists these requirements. The revised LTSP was accepted by NRC in a December 21, 2023, letter to DOE (NRC 2023).

Table 17-1. License Requirements for the Slick Rock, Colorado, Disposal Site

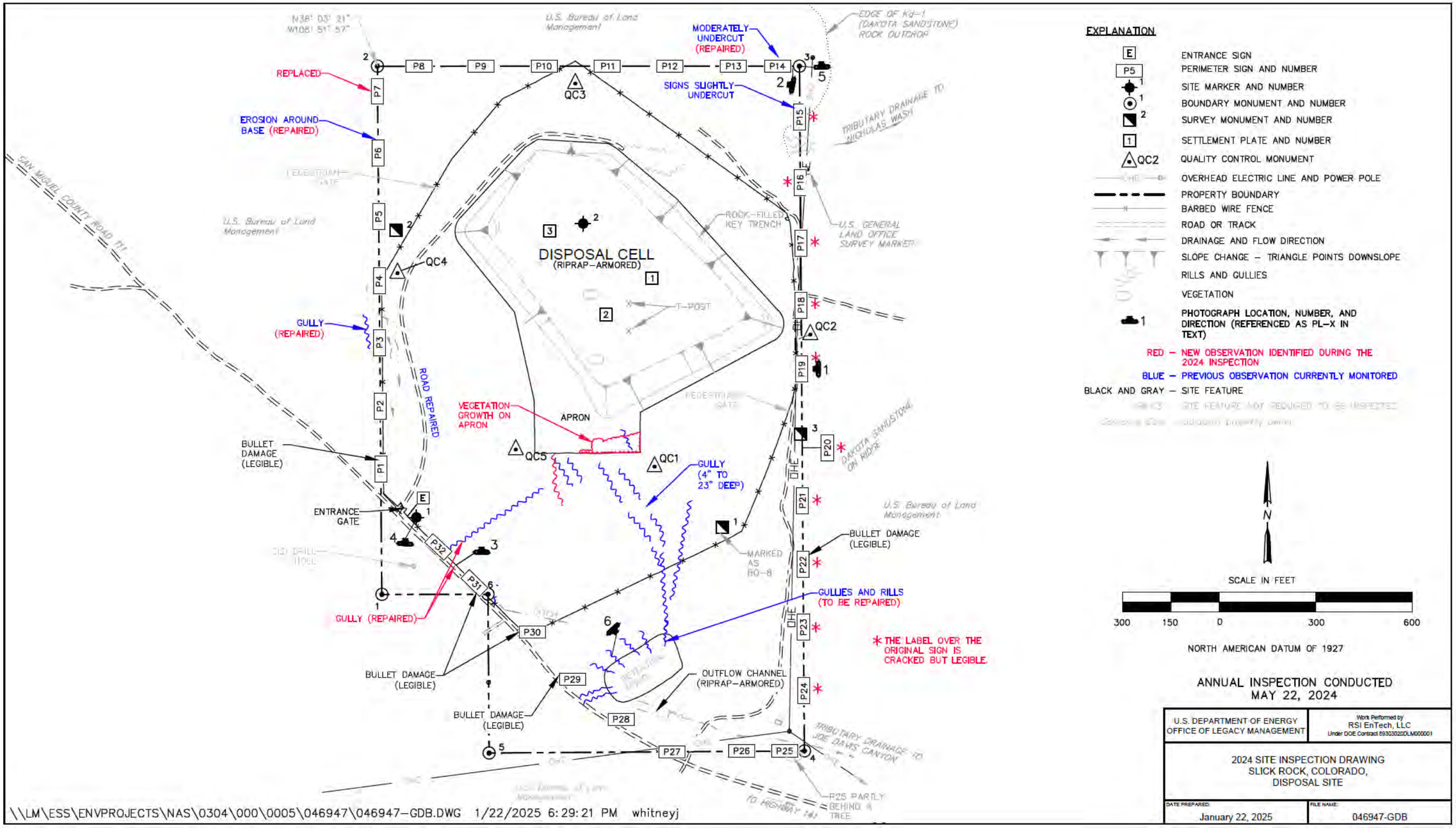
Requirement	LTSP	This Report	10 CFR 40.27
Annual Inspection and Report	Section 3.4	Section 17.4	(b)(3)
Follow-Up Inspections	Section 3.5	Section 17.5	(b)(4)
Maintenance and Repairs	Section 3.6	Section 17.6	(b)(5)
Groundwater Monitoring	Section 2.3	Section 17.7	(b)(2)

17.3 Institutional Controls

The 62-acre site, identified by the property boundary shown in Figure 17-1, is owned by the United States and was accepted under the NRC general license in 1998. The U.S. Department of Energy (DOE) is the licensee and, in accordance with requirements for UMTRCA Title I sites, the Office of Legacy Management (LM) is responsible for the custody and long-term care of the site. Institutional controls (ICs) at the site include federal ownership of the property, administrative controls, and the following physical ICs that are inspected annually: the disposal cell and associated drainage features, entrance gate and sign, perimeter fence and signs, site markers, survey and boundary monuments, and aerial survey quality control monuments.

17.4 Inspection Results

The site, 5 miles northeast of Slick Rock, Colorado, was inspected on May 22, 2024. The inspection was conducted by C. Murphy, L. Sheader, and S. Daly of the Legacy Management Support (LMS) contractor. M. Hurt (LM) and A. Lawrence and M. Cosby (Colorado Department of Public Health and Environment) were also in attendance. The purposes of the inspection were to confirm the integrity of visible features at the site, identify changes in conditions that might affect conformance with the LTSP, and evaluate whether maintenance or follow-up inspection and monitoring are needed.



EXPLANATION

- E — ENTRANCE SIGN
- P5 — PERIMETER SIGN AND NUMBER
- 1 — SITE MARKER AND NUMBER
- 1 — BOUNDARY MONUMENT AND NUMBER
- 2 — SURVEY MONUMENT AND NUMBER
- 1 — SETTLEMENT PLATE AND NUMBER
- QC2 — QUALITY CONTROL MONUMENT
- OHE — OVERHEAD ELECTRIC LINE AND POWER POLE
- PROPERTY BOUNDARY
- BARBED WIRE FENCE
- ROAD OR TRACK
- DRAINAGE AND FLOW DIRECTION
- SLOPE CHANGE – TRIANGLE POINTS DOWNSLOPE
- RILLS AND GULLIES
- VEGETATION
- 1 — PHOTOGRAPH LOCATION, NUMBER, AND DIRECTION (REFERENCED AS PL-X IN TEXT)

RED – NEW OBSERVATION IDENTIFIED DURING THE 2024 INSPECTION

BLUE – PREVIOUS OBSERVATION CURRENTLY MONITORED

BLACK AND GRAY – SITE FEATURE

SITE FEATURE NOT REQUIRED TO BE INSPECTED

Colorado River Basin Salinity Control Program property owner

N

SCALE IN FEET

300 150 0 300 600

NORTH AMERICAN DATUM OF 1927

ANNUAL INSPECTION CONDUCTED
MAY 22, 2024

U.S. DEPARTMENT OF ENERGY OFFICE OF LEGACY MANAGEMENT	Work Performed by RSI EnTech, LLC Under DOE Contract 89303322DLM000001

2024 SITE INSPECTION DRAWING
SLICK ROCK, COLORADO,
DISPOSAL SITE

DATE PREPARED:	FILE NAME:
January 22, 2025	046947-GDB

Figure 17-1. 2024 Annual Inspection Drawing for the Slick Rock, Colorado, Disposal Site

17.4.1 Site Surveillance Features

Figure 17-1 shows the locations of site features, including site surveillance features and inspection areas, in black and gray font. Some site features that are present but not required to be inspected are shown in italic font. Observations from previous inspections that are currently monitored are shown in blue, and new observations identified during the 2024 annual inspection are shown in red. Inspection results and recommended maintenance activities associated with site surveillance features are described in the following subsections. Photographs to support specific observations are noted in the text and in Figure 17-1 by photograph location (PL) numbers. The photographs and photograph log are presented in Section 17.10.

17.4.1.1 Entrance Gate and Sign

Access to the site is from San Miguel County Road T11. Entrance to the site is through a chained and locked gate. The entrance gate was locked and is worn but remains functional. The entrance sign is next to the gate. No maintenance needs were identified.

17.4.1.2 Perimeter Fence and Signs

There are 32 perimeter signs, attached to steel posts set in concrete, positioned along the property boundary. The perimeter signs are set back 5 feet (ft) from the site boundary line with the exception of the southwest corner where they are along the fence line (PL-1). Erosion found during the 2023 inspection around the base of perimeter sign P6 was repaired following this inspection. The printed overlay on perimeter sign P7 was cracked and was replaced following the inspection. The concrete base on perimeter sign P14 (PL-2) was moderately undercut by erosion but was repaired after the inspection. The concrete base on perimeter sign P15 is slightly undercut and remains stable. No other maintenance needs were identified.

A four-strand wire perimeter fence encloses the disposal cell, drainage structures, and much of the site. The top and bottom strands are smooth wire to allow wildlife to pass over and under, and the middle two strands are barbed wire. Erosional features were identified between perimeter signs P31 and P32 during the 2023 inspection and were repaired during the pothole and rill repair in 2024 (PL-3). Erosion identified during the 2023 inspection from a gully near perimeter sign P3 was repaired following this inspection.

17.4.1.3 Site Markers

The site has two granite site markers. Site marker SMK-1 (PL-4) is just inside the entrance gate, and site marker SMK-2 is on top of the disposal cell. No maintenance needs were identified.

17.4.1.4 Survey and Boundary Monuments

The site has three survey monuments. Six boundary monuments delineate the corners of the site boundary (PL-5). No maintenance needs were identified.

17.4.1.5 Aerial Survey Quality Control Monuments

The site has five aerial survey quality control monuments. No maintenance needs were identified.

17.4.2 Inspection Areas

In accordance with the LTSP, the site is divided into three sections to ensure a thorough and efficient inspection. The inspection areas are (1) the disposal cell, including the side slopes, key trench, and apron; (2) the area between the disposal cell and the site boundary; and (3) the outlying area. Inspectors examined specific site surveillance features within each area and looked for evidence of erosion, settling, slumping, or other modifying processes that might affect the site's conformance with LTSP requirements.

17.4.2.1 Disposal Cell, Key Trench, and Apron

The disposal cell, completed in 1996, occupies 12.9 acres and is armored with riprap, consisting of rounded, cobble-sized river rock, to control erosion and deter animal and human intrusion. The inspection found no evidence of erosion, settling, slumping, rock degradation, or other modifying processes that might affect the integrity of the disposal cell. Several patches of grass are growing on the top of the disposal cell but do not require treatment. No maintenance needs were identified.

A key trench that encloses the disposal cell is at the toe of the disposal cell side slopes. The key trench, designed to convey stormwater runoff away from the disposal cell, is approximately 5 ft deep and 20 ft wide and filled with rock. Stormwater runoff from the key trench discharges to an apron at the south (downslope) corner of the disposal cell. The apron extends 50 to 200 ft beyond the key trench. The key trench and apron are covered with rounded cobble- and pebble-sized river rock. Willows (a deep-rooted species) growing on a portion of the apron are not considered harmful to the integrity of the disposal cell. Gullies are forming near the apron but are not considered detrimental to the integrity of the disposal cell. No maintenance needs were identified.

17.4.2.2 Area Between the Disposal Cell and the Site Boundary

The area around the disposal cell includes a stormwater retention pond. Surface drainage from the disposal cell flows south from the apron into the retention pond, which is constructed in a channel tributary that drains to Joe Davis Canyon. An outflow channel below the pond is lined with rounded riprap for a short distance. The pond was not filled with water at the time of inspection. During the 2023 inspection, erosional features were identified on the west side of the disposal cell inside of the perimeter fence. Before the 2024 inspection, the LMS contractor conducted maintenance in the area using pocking and seeding. The LMS contractor also placed new gravel to dress the access road inside of the disposal site. No other maintenance needs in the area were identified.

The site was originally graded for sheet flow from the apron to the retention pond. Gullies have been developing since 1998 on the northwest side of the retention pond and now are 3 or more feet deep adjacent to the pond and shallower farther upslope (PL-6). Most of the gullies have

stabilized or are stabilizing. Deeper gullies identified in the 2023 inspection have grown significantly since the previous inspection but do not threaten the integrity of the disposal cell. Deferred maintenance needs (backfilling the gullies) were identified and will be addressed in fiscal year 2025.

Vegetation in the reclaimed areas were healthy. Noxious weeds are controlled regularly to comply with state and county requirements. No other maintenance needs were identified.

17.4.2.3 Outlying Area

The area beyond the site boundary for 0.25 mile was visually observed for erosion, changes in land use, or other phenomena that might affect the long-term integrity of the site. No such impacts were observed. The natural, undisturbed areas outside the site support grass and scattered pinyon and juniper trees. Steep hillsides extend north and northeast of the site and slope eastward into Nicholas Wash. The primary land use is grazing. The areas north and northeast of the site also are routinely used for cutting firewood and recreational uses, such as hunting and off-road all-terrain vehicle use.

17.5 Follow-Up Inspections

LM will conduct follow-up inspections if (1) a condition is identified during the annual inspection or other site visit that requires a return to the site to evaluate the condition or (2) a citizen or outside agency notifies LM that conditions at the site are substantially changed. No need for a follow-up inspection was identified.

17.6 Maintenance and Repairs

Inspectors noted several maintenance items that were completed following the inspection, including the following:

- Replace perimeter sign P7
- Backfill undercutting at perimeter sign P14
- Backfill erosion at perimeter sign P6, near perimeter sign P3, and between perimeter signs P31 and P32

Inspectors noted one additional maintenance item during the inspection that will be completed in the future:

- Backfill erosion north of the retention pond

No other maintenance needs were identified.

17.7 Groundwater Monitoring

In accordance with the LTSP, groundwater monitoring at this site is not required. Groundwater at the site qualifies for supplemental standards because it is designated as limited use, a designation given to groundwater that is not a current or potential source of drinking water. In addition, the groundwater in the uppermost aquifer is designated as limited use because of low yield since the

aquifer does not yield enough water to be used for beneficial purposes. Monitoring wells were abandoned in 2001, and T-posts were installed to indicate their former locations. The standpipes in the disposal cell were abandoned in 2002. The LTSP has been revised to reflect these changes and was accepted by NRC in December 2023.

17.8 Corrective Action

Corrective action is taken to correct out-of-compliance or hazardous conditions that create a potential health and safety problem or that may affect the integrity of the disposal cell or compliance with 40 CFR 192. No need for corrective action was identified.

17.9 References



Note

Site-related documents are available on the LM public webpages at https://lmpublicsearch.lm.doe.gov/SitePages.

10 CFR 40.27. U.S. Nuclear Regulatory Commission, "General License for Custody and Long-Term Care of Residual Radioactive Material Disposal Sites," *Code of Federal Regulations*.

40 CFR 192. U.S. Environmental Protection Agency, "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings," *Code of Federal Regulations*.

DOE (U.S. Department of Energy), 2024. *Long-Term Surveillance Plan for the Slick Rock, Colorado, Disposal Site*, LMS/SRK/S34803-1.0, Office of Legacy Management, July

NRC (U.S. Nuclear Regulatory Commission), 2023. K. Hayes, P.G., CPG, hydrogeologist NRC, letter, (about accepting DOE's revised Long-Term Surveillance Plan for the Slick Rock, Colorado, Disposal Site) to M. Hurt, DOE site manager, NRC ADAMS Accession No. ML23352A272, December 21.

17.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	270	Perimeter Sign P19
PL-2	293	Erosion Undercut at Concrete Base of Perimeter Sign P14
PL-3	0	Erosion at Fence Line Between Perimeter Signs P31 and P32
PL-4	0	Site Marker SMK-1
PL-5	—	Boundary Monument BM-3
PL-6	135	Gully North of Retention Pond

Note:
— = Photograph taken vertically from above.



PL-1. Perimeter Sign P19



PL-2. Erosion Undercut at Concrete Base of Perimeter Sign P14



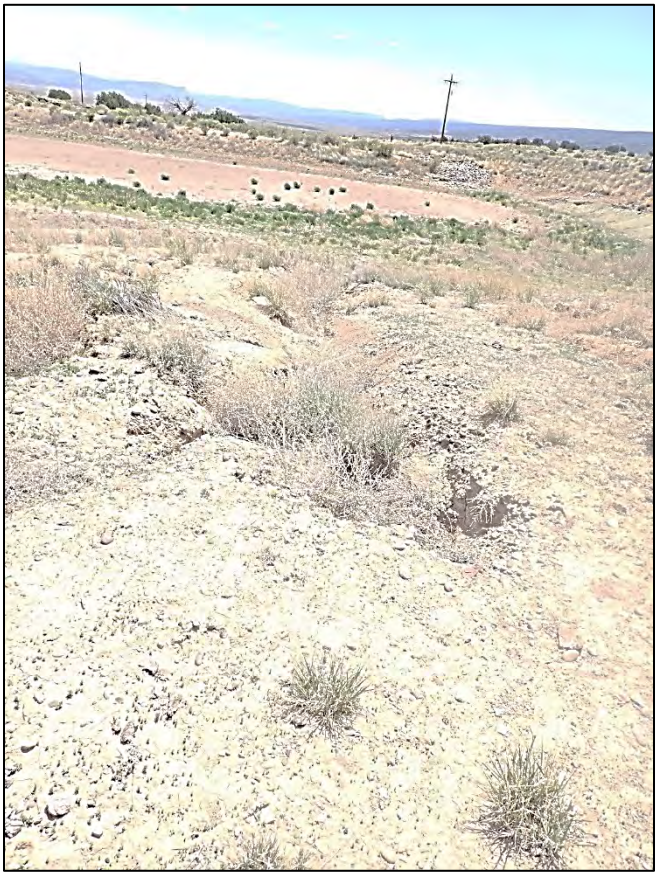
PL-3. Erosion at Fence Line Between Perimeter Signs P31 and P32



PL-4. Site Marker SMK-1



PL-5. Boundary Monument BM-3



PL-6. Gully North of Retention Pond

18.0 Spook, Wyoming, Disposal Site

18.1 Compliance Summary

The Spook, Wyoming, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site was inspected on July 23, 2024. Boundary monuments and perimeter signs were installed in 2024. No changes were observed on the land surface of the disposal cell. Groundwater monitoring is not required.

18.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the site-specific Long-Term Surveillance Plan (DOE 1993) (LTSP) in accordance with procedures established to comply with the requirements of the U.S. Nuclear Regulatory Commission (NRC) general license at Title 10 *Code of Federal Regulations* Section 40.27 (10 CFR 40.27). Table 18-1 lists these requirements.

Table 18-1. License Requirements for the Spook, Wyoming, Disposal Site

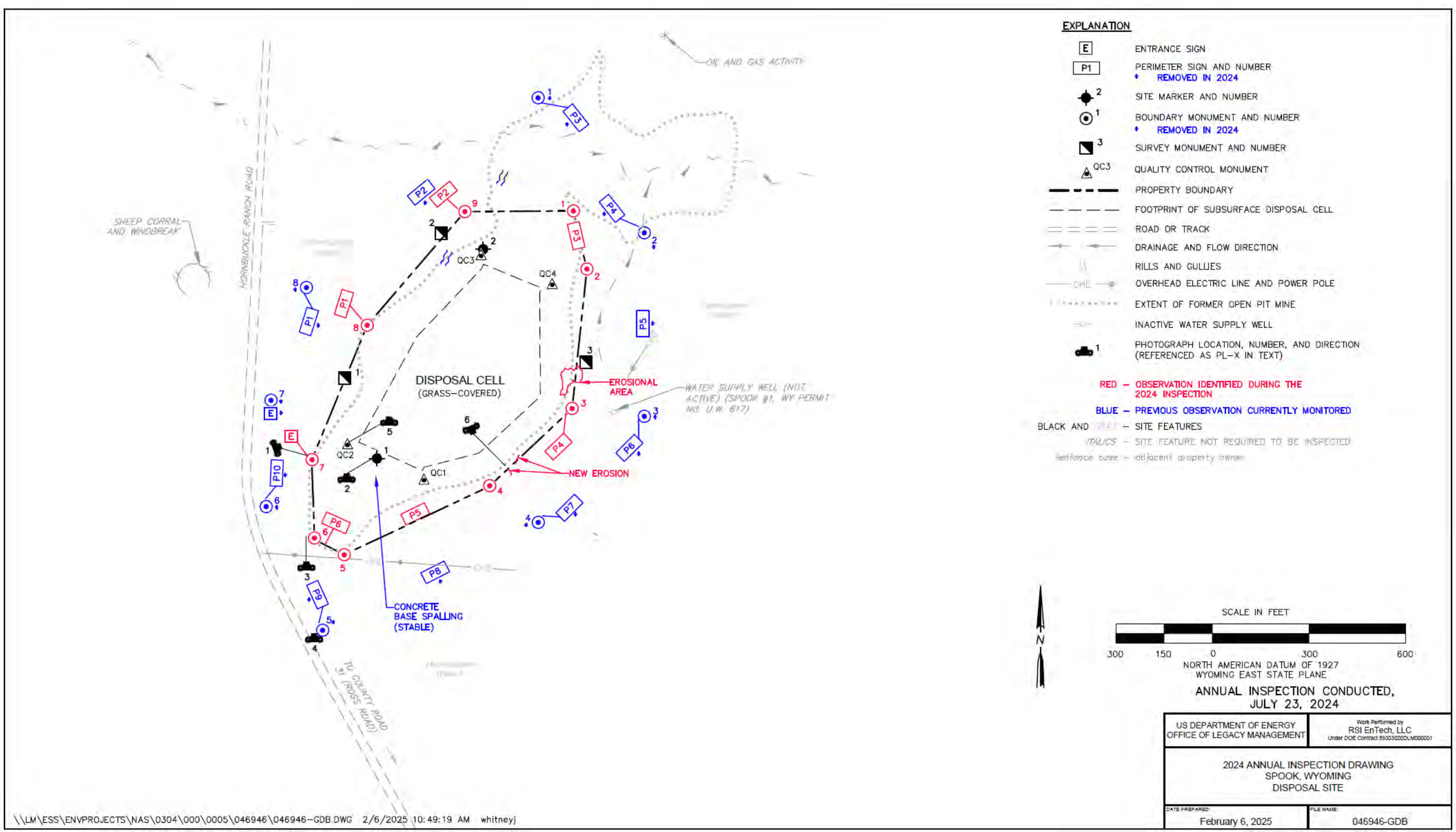
Requirement	LTSP	This Report	10 CFR 40.27
Annual Inspection and Report	Section 6.0	Section 18.4	(b)(3)
Follow-Up or Contingency Inspections	Section 7.0	Section 18.5	(b)(4)
Maintenance and Repairs	Section 8.0	Section 18.6	(b)(5)
Groundwater Monitoring	Section 5.0	Section 18.7	(b)(2)
Corrective Action	Section 9.0	Section 18.8	—

18.3 Institutional Controls

The 14-acre site, identified by the property boundary shown in Figure 18-1, is owned by the United States and was accepted under the NRC general license in 1993. The U.S. Department of Energy (DOE) is the licensee and, in accordance with the requirements for UMTRCA Title I sites, the Office of Legacy Management (LM) is responsible for the custody and long-term care of the site. Institutional controls (ICs) at the site include federal ownership of the property, administrative controls, and the following physical ICs that are inspected annually: the disposal cell, entrance sign, perimeter signs, site markers, and survey and boundary monuments.

18.4 Inspection Results

The site, 48 miles northeast of Casper, Wyoming, was inspected on July 23, 2024. The inspection was conducted by T. Santonastaso, M. Guziak, and A. Barndt of the Legacy Management Support (LMS) contractor. M. Young (LM site manager) also attended the inspection. The purposes of the inspection were to confirm the integrity of visible features at the site, identify changes in conditions that might affect conformance with the LTSP, and evaluate whether maintenance or follow-up inspection and monitoring are needed.



EXPLANATION

- E — ENTRANCE SIGN
- P1 — PERIMETER SIGN AND NUMBER
  - REMOVED IN 2024
- 2 — SITE MARKER AND NUMBER
- 1 — BOUNDARY MONUMENT AND NUMBER
  - REMOVED IN 2024
- 3 — SURVEY MONUMENT AND NUMBER
- QC3 — QUALITY CONTROL MONUMENT
- PROPERTY BOUNDARY
- FOOTPRINT OF SUBSURFACE DISPOSAL CELL
- ROAD OR TRACK
- DRAINAGE AND FLOW DIRECTION
- RILLS AND GULLIES
- OHE — OVERHEAD ELECTRIC LINE AND POWER POLE
- EXTENT OF FORMER OPEN PIT MINE
- INACTIVE WATER SUPPLY WELL
- 1 — PHOTOGRAPH LOCATION, NUMBER, AND DIRECTION (REFERENCED AS PL-X IN TEXT)

RED – OBSERVATION IDENTIFIED DURING THE 2024 INSPECTION

BLUE – PREVIOUS OBSERVATION CURRENTLY MONITORED

BLACK AND GRAY – SITE FEATURES

ITALICS – SITE FEATURE NOT REQUIRED TO BE INSPECTED

sentence case – adjacent property owner

N

SCALE IN FEET

300 150 0 300 600

NORTH AMERICAN DATUM OF 1927
WYOMING EAST STATE PLANE

ANNUAL INSPECTION CONDUCTED, JULY 23, 2024

US DEPARTMENT OF ENERGY OFFICE OF LEGACY MANAGEMENT	Work Performed by RSI EnTech, LLC Under DOE Contract 89303020DLM000001
2024 ANNUAL INSPECTION DRAWING SPOOK, WYOMING DISPOSAL SITE	
DATE PREPARED: February 6, 2025	FILE NAME: 046946-GDB

Figure 18-1. 2024 Annual Inspection Drawing for the Spook, Wyoming, Disposal Site

18.4.1 Site Surveillance Features

Figure 18-1 shows the locations of site features, including site surveillance features and inspection areas, in black and gray font. Some site features that are present but not required to be inspected are shown in italic font. Observations from previous inspections that are currently monitored are shown in blue, and new observations identified during the 2024 annual inspection are shown in red. Inspection results and recommended maintenance activities associated with site surveillance features are described in the following subsections. Photographs to support specific observations are noted in the text and in Figure 18-1 by photograph location (PL) numbers. The photographs and photograph log are presented in Section 18.10.

18.4.1.1 Access Road and Entrance Sign

Access to the site is from Wyoming Highway 95 from Glenrock or Wyoming Highway 93 from Douglas to Converse County Road 31 and onto Hornbuckle Ranch Road. Site access is maintained through perpetual easements across the Hornbuckle Ranch. The graded, hard-packed road to the site is maintained by the ranch. In 2024, the original entrance sign was moved to its new location. The entrance sign is mounted on a steel post set in concrete. No maintenance needs were identified.

18.4.1.2 Perimeter Signs

In July 2024, 6 new perimeter signs and a new entrance sign (PL-1) were placed along the newly corrected site boundary and the previous 10 perimeter signs were removed. These perimeter signs are attached to steel posts set in concrete and positioned around the site outside the unfenced property boundary. Three additional signs were also added to the entrance sign during 2024 (PL-1) that address emergencies, prohibited activities, and uncrewed aircrafts. No other maintenance needs were identified.

18.4.1.3 Site Markers

The site has two granite site markers. Site marker SMK-1 is at the south side of the disposal cell. Its concrete base is damaged due to spalling. This spalling is not affecting the integrity of the site marker (PL-2). Site marker SMK-2 at the north side of the disposal cell is in good condition. No maintenance needs were identified.

18.4.1.4 Survey and Boundary Monuments

The site has three survey monuments and previously had eight boundary monuments. In past inspection reports, it was noted that the boundary monuments were incorrectly placed outside the property boundary. This was confirmed in October 2023 with a property boundary survey using the Spook Pit Parcel recorded deed. In summer 2024, nine new boundary monuments (PL-3) were installed by a licensed surveyor according to the Spook Pit Parcel deed and the original eight boundary monuments were removed (PL-4). No maintenance needs were identified.

18.4.1.5 Aerial Survey Quality Control Monuments

Four aerial survey quality control monuments were inspected (PL-5). No maintenance needs were identified.

18.4.2 Inspection Areas

The site is divided into three inspection areas to ensure a thorough and efficient inspection. The inspection areas are (1) the disposal cell, (2) the site perimeter, and (3) the outlying area. Inspectors examined specific site surveillance features within each area, observed the condition of site vegetation, and looked for evidence of erosion, settling, slumping, or other modifying processes that might affect the site's conformance with the LTSP requirements.

18.4.2.1 Disposal Cell

The site is unique among Title I sites because the mill tailings were placed at the bottom of an open pit mine and covered with 40–60 feet of clean fill and topsoil. Therefore, many of the observations and concerns routinely associated with above-grade disposal cells, such as the quality of the riprap and the stability of side slopes, do not apply to this site. The ground surface over the 5-acre disposal cell, completed in 1989, showed no evidence of settling. Vegetation on the ground surface, consisting of grasses and forbs, was healthy and indistinguishable from that growing on the remainder of the site and on the surrounding ranch land. No maintenance needs were identified.

18.4.2.2 Site Perimeter

There is no perimeter fence at the site. The area between the disposal cell and the site perimeter showed no evidence of settling or active erosion. No maintenance needs were identified.

18.4.2.3 Outlying Area

The area beyond the site boundary for a distance of 0.25 mile was visually observed for erosion, changes in land use, or other phenomena that might affect the long-term integrity of the site. No such impacts were observed. Inspectors noted three areas of concern for erosion where there is headcutting away from the disposal cell, but these areas pose no threat at this time to the site or disposal cell. The first two erosion features are just northeast of perimeter sign P5 and outside the site boundary (PL-6). The other erosional area is north of perimeter sign P4 and just at the edge of the site boundary. Inspectors will continue to monitor these areas for erosion.

The access road has frequent truck traffic to service and maintain oil wells in the area. No evidence of trespassing or vandalism was observed onsite. No maintenance needs were identified.

18.5 Follow-Up or Contingency Inspections

LM will conduct follow-up or contingency inspections if (1) a condition is identified during the annual inspection or other site visit that requires a return to the site to evaluate the condition before the next annual inspection or (2) LM is notified by a citizen or outside agency that conditions at the site are substantially changed. No need for a follow-up or contingency inspection was identified.

18.6 Maintenance and Repairs

In October 2023, it was identified by a survey based off the Spook Pit Parcel recorded deed that the boundary monuments were in the wrong locations. In June 2024, nine boundary monuments were placed at the corners of the Spook site boundary by the LMS certified surveyor. The LMS maintenance crew removed the original eight boundary monuments, as well as 10 perimeter signs and an entrance sign. They replaced the entrance sign, as well as 10 perimeter signs with 6 new perimeter signs along the site boundary. During the 2024 inspection, inspectors took GPS coordinates at the new perimeter sign and entrance sign locations. Three additional signs were also added to the entrance sign during 2024 that address emergencies, prohibited activities, and uncrewed aircrafts. No additional maintenance needs were identified.

18.7 Groundwater Monitoring

In accordance with the LTSP, groundwater monitoring is not required due to the application of supplemental standards. Groundwater at the site qualifies for supplemental standards because it is designated as limited use; this designation is given to groundwater that is not a current or potential source of drinking water. Groundwater in the uppermost aquifer is designated as limited use because it contains contamination from widespread, naturally occurring uranium mineralization and is of limited yield.

18.8 Corrective Action

In accordance with the LTSP, corrective action is taken to correct conditions that threaten the integrity of the disposal cell or compliance with 40 CFR 192. No need for corrective action was identified.

18.9 References



Note

Site-related documents are available on the LM public webpages at https://lmpublicsearch.lm.doe.gov/SitePages.

10 CFR 40.27. U.S. Nuclear Regulatory Commission, “General License for Custody and Long-Term Care of Residual Radioactive Material Disposal Sites,” *Code of Federal Regulations.*

40 CFR 192. U.S. Environmental Protection Agency, “Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings,” *Code of Federal Regulations.*

DOE (U.S. Department of Energy), 1993. *Final Long-Term Surveillance Plan for the Spook, Wyoming, Disposal Site*, UMTRA-DOE/AL-350215.0000, January.

18.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	67	Entrance Sign with Three Additional Signs Added
PL-2	0	Spalling on Base of Site Marker SMK-1
PL-3	—	New Boundary Monument BM-6
PL-4	—	Old Boundary Monument BM-5 (Removed)
PL-5	—	Quality Control Monument QC-2
PL-6	22	Erosional Feature Northeast of Perimeter Sign P5

Note:
— = Photograph taken vertically from above.



PL-1. Entrance Sign with Three Additional Signs Added



PL-2. Spalling on Base of Site Marker SMK-1



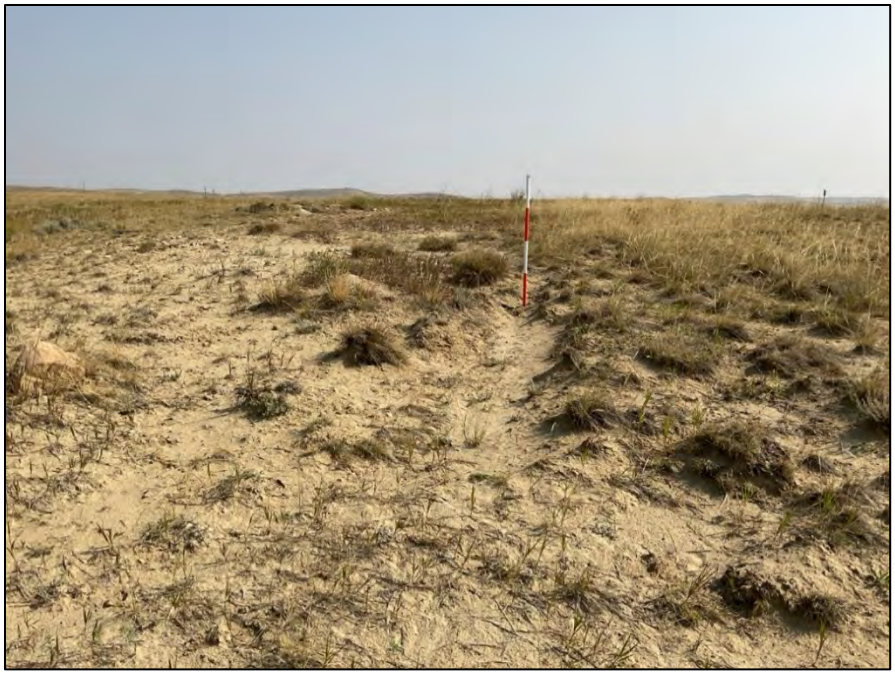
PL-3. New Boundary Monument BM-6



PL-4. Old Boundary Monument BM-5 (Removed)



PL-5. Quality Control Monument QC-2



PL-6. Erosional Feature Northeast of Perimeter Sign P5

19.0 Tuba City, Arizona, Disposal Site

19.1 Compliance Summary

The Tuba City, Arizona, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site was inspected on May 7, 2024. No significant changes were observed on the disposal cell or in the associated drainage features. Inspectors identified maintenance needs but found no cause for a follow-up inspection.

The U.S. Department of Energy (DOE) Office of Legacy Management (LM) conducts semiannual groundwater monitoring at the site to compare current conditions to baseline postconstruction groundwater quality. Evaluative groundwater monitoring is performed instead of normal point of compliance (POC) monitoring, as preexisting milling-related groundwater contamination may mask contamination leaching from the disposal cell. The most recent semiannual sampling events occurred in February and August 2024. Analytical results from the 2024 evaluative monitoring effort indicate that groundwater quality in site wells continues to be degraded relative to baseline conditions. Since 2015, concentrations of nitrate, selenium, and uranium (the primary site contaminants) are significantly increasing in several wells, most notably in offsite downgradient well 0903.

19.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the site-specific Long-Term Surveillance Plan (DOE 1996) (LTSP) in accordance with procedures established to comply with the requirements of the U.S. Nuclear Regulatory Commission (NRC) general license at Title 10 *Code of Federal Regulations* Section 40.27 (10 CFR 40.27). Table 19-1 lists these requirements.

Table 19-1. License Requirements for the Tuba City, Arizona, Disposal Site

Requirement	LTSP	This Report	10 CFR 40.27
Annual Inspection and Report	Section 6.0	Section 19.4	(b)(3)
Follow-Up Inspections	Section 7.0	Section 19.5	(b)(4)
Maintenance and Repairs	Section 8.0	Section 19.6	(b)(5)
Environmental Monitoring	Section 5.2	Section 19.7	(b)(2)
Corrective Action	Section 9.0	Section 19.8	—

19.3 Institutional Controls

The 145-acre site, defined by the property boundary shown in Figure 19-1, is held in trust by the U.S. Bureau of Indian Affairs. The Navajo Nation retains title to the land. UMTRCA authorized DOE to enter into a Cooperative Agreement (DE-FC04-85AL26731) with the Navajo Nation to perform remedial actions at the former uranium processing sites (DOE 1984). DOE and the Navajo Nation executed a Custodial Access Agreement that conveys to the federal government title to the residual radioactive materials stabilized at the site and ensures that DOE has perpetual access to the site.

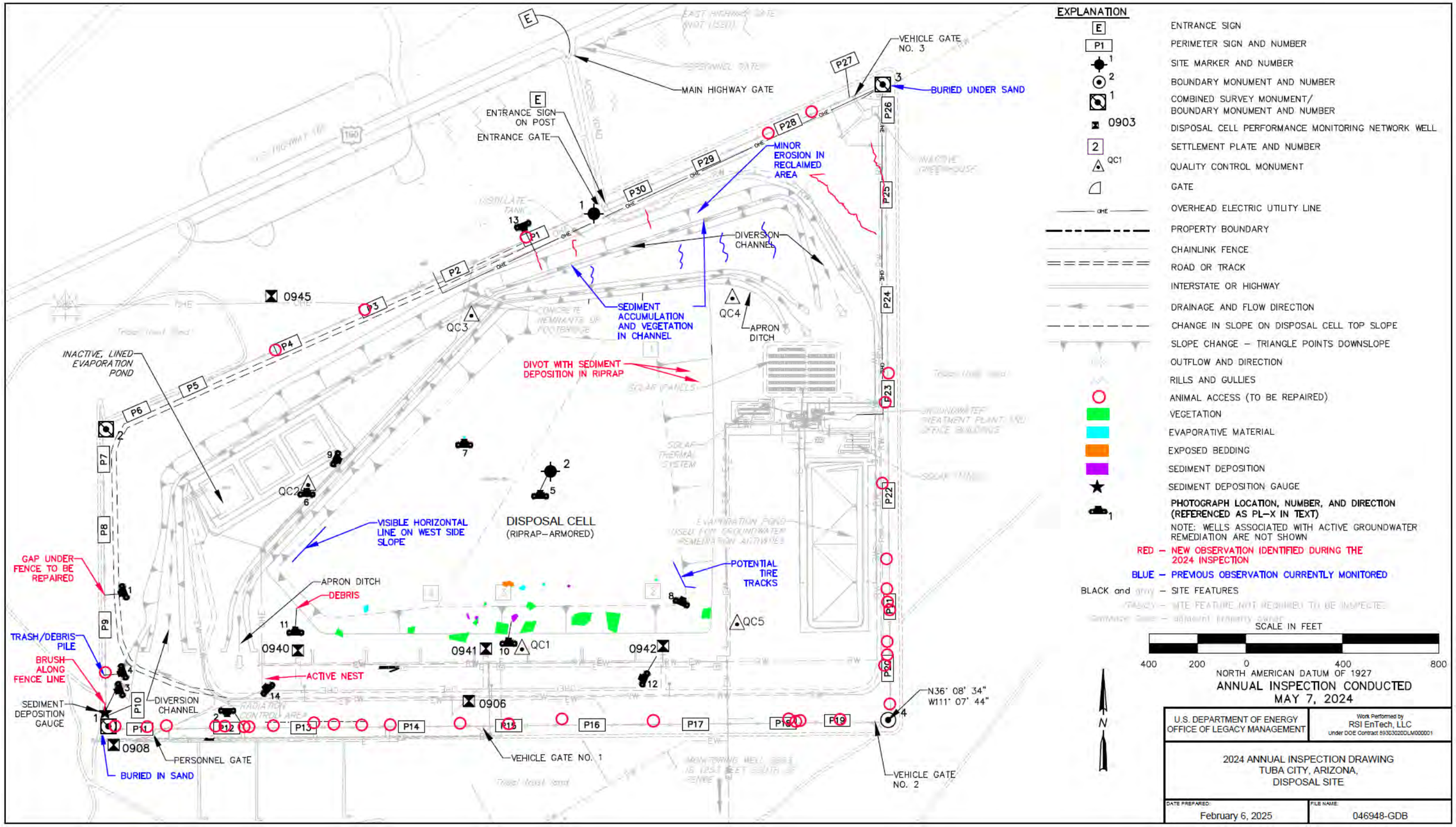


Figure 19-1. 2024 Annual Inspection Drawing for the Tuba City, Arizona, Disposal Site

The site was accepted under the NRC general license in 1996. DOE is the licensee and, in accordance with the requirements for UMTRCA Title I sites, LM is responsible for the custody and long-term care of the site. Institutional controls (ICs) at the site include federal custody of the disposal cell and its engineered features, administrative controls, and the following physical ICs that are inspected annually: the disposal cell and associated drainage features, entrance gates and signs, perimeter fence and signs, site markers, survey and boundary monuments, and wellhead protectors.

19.4 Inspection Results

The site, 6 miles northeast of Tuba City, Arizona, was inspected on May 7, 2024. The inspection was conducted by H. Katz, N. Lind, K. Lund, Z. Schuler, S. Salt, C. Stewart, and P. Wetherstein of the Legacy Management Support contractor. J. Tallbull (LM), R. Lamson (Hopi Tribe Department of Natural Resources, Office of Mining and Mineral Resources), and E. Grayeyes (Navajo Abandoned Mine Lands) also attended the inspection. The purposes of the inspection were to confirm the integrity of visible features at the site, identify changes in conditions that might affect conformance with the LTSP, and evaluate whether maintenance or follow-up inspection and monitoring are needed.

19.4.1 Site Surveillance Features

Figure 19-1 shows the locations of site features, including site surveillance features and inspection areas, in black and gray font. Some site features that are present but not required to be inspected are shown in italic font. Observations from previous inspections that are currently monitored are shown in blue, and new observations identified during the 2024 annual inspection are shown in red. Inspection results and recommended maintenance activities associated with site surveillance features are described in the following subsections. Photographs to support specific observations are noted in the text and in Figure 19-1 by photograph location (PL) numbers. The photographs and photograph log are presented in Section 19.10.

19.4.1.1 Access Road, Entrance Gates, and Entrance Signs

Access to the site is from U.S. Highway 160. Perpetual access to the site is granted by the Custodial Access Agreement. A gate in a chainlink fence on the main highway right-of-way allows access to the site via a gravel road. The entrance gate is in the inner chainlink perimeter fence between perimeter signs P1 and P30. Both gates were operational at the time of the inspection. Vehicle gates are also present in the northeast corner of the site and along the southern fence line to facilitate access for offsite activities. All gates were secured and functional.

Entrance signs are posted on the main highway gate and near the entrance gate. Vehicle gates 1–3 purposefully do not have a sign. An informational sign exists on the main entrance gate. No maintenance needs were identified.

19.4.1.2 Perimeter Fence and Signs

A chainlink perimeter fence encloses the site. Windblown sand and tumbleweeds regularly accumulate along the perimeter fence line. Wind scouring also occurs, which results in gaps

under the fence (PL-1). There are also many gaps under the fence from animal access (PL-2). These areas will be repaired before the next inspection. The sediment deposition gauge installed in 2023 between perimeter signs P9 and P10 will be read every year to quantify sand deposition as part of the annual inspection. At the time of the inspection, sand accumulated to a height of approximately 1.6 feet (PL-3). Similar to previous years, trash and debris have accumulated outside the fence near perimeter sign P9 (PL-4).

Thirty pairs of perimeter signs, designated P1 through P30, are attached to steel posts set in concrete directly inside and along the perimeter fence. One of the sign pairs is textual, and the other is pictorial. No maintenance needs were identified.

19.4.1.3 Site Markers

The site has two granite site markers. Site marker SMK-1 is just inside the entrance gate, and site marker SMK-2 is on the top slope of the disposal cell (PL-5). No maintenance needs were identified.

19.4.1.4 Survey and Boundary Monuments

One boundary monument and three combined survey and boundary monuments delineate the corners of the site. Combined survey and boundary monuments SM/BM-1 and SM/BM-3 tend to get covered with windblown sand and are marked with steel T-posts. All other survey and boundary monuments were located and in good condition. No maintenance needs were identified.

19.4.1.5 Aerial Survey Quality Control Monuments

Five aerial survey quality control monuments were located and in good condition (PL-6).

19.4.1.6 Monitoring Wells

Seven monitoring wells (wells 0903, 0906, 0908, 0940, 0941, 0942, and 0945) constitute the disposal cell performance monitoring network. Monitoring wells 0906, 0908, 0940, 0941, and 0942 are inside or immediately outside the perimeter fence. Inspectors checked the wellhead protectors of these five wells in May 2024; all were found to be undamaged and locked (offsite wells 0903 and 0945 were not checked). No maintenance needs were identified.

19.4.2 Inspection Areas

In accordance with the LTSP, the site is divided into three inspection areas (referred to as “transects” in the LTSP) to ensure a thorough and efficient inspection. The inspection areas are (1) the disposal cell, (2) the area between the disposal cell and the site boundary, and (3) the outlying area. Inspectors examined specific site surveillance features within each area and looked for evidence of erosion, settling, slumping, or other modifying processes that might affect the site’s conformance with LTSP requirements.

19.4.2.1 Disposal Cell

The disposal cell, completed in 1989, occupies 50 acres. The disposal cell is armored with riprap to control erosion and deter animal and human intrusion. Inspectors confirmed parallel tracks on the top slope of the disposal cell that were reported in previous annual reports. An evaporative mineral, caused by water pooling and subsequent evaporation, on top of windblown deposited sediment within riprap matrixes was noted on the top of the disposal cell (PL-7). Some exposed bedding layer was also noted on the top of the disposal cell. Potential tire tracks were observed on the southeast corner of the disposal cell (PL-8). These areas will continue to be monitored. There was no evidence of erosion, settling, slumping, or other modifying processes on the disposal cell.

The riprap-covered side slopes were in good condition. There were visible horizontal channels along the southwest slopes (PL-9). The channels are most likely formed from surface flow from melting snow cover or precipitation, or both. Sediment deposition (PL-10) and debris (PL-11) were noted on the south slope of the disposal cell. Two 3-inch divots with sediment deposition were noted in the riprap of the east slope of the disposal cell. These features do not currently pose a threat to the integrity of the disposal cell; however, continued monitoring is recommended to ensure that erosion features do not create any problems that could undermine the soil and rock interface or the rock side slope below.

In accordance with the LTSP, deep-rooted vegetation is controlled to prevent potential penetration of the radon barrier. Windblown sediments continue to accumulate on the rock-covered surfaces, providing a favorable environment for plant growth. Periodic spot application of herbicide has been effective in controlling deep-rooted vegetation growth on the disposal cell cover. No deep-rooted shrubs were observed on top of the disposal cell, but some shrubs have become established on the side slopes (PL-12), as noted in previous inspections. This will be treated with herbicide before the next inspection.

19.4.2.2 Area Between the Disposal Cell and the Site Boundary

The disposal cell is protected from stormwater runoff by a disposal cell apron ditch and a diversion channel, both of which are armored with riprap along the north and northwest sides of the disposal cell. Windblown sand and vegetation accumulate in the apron ditch and the diversion channel along the north and northwest sides of the disposal cell. The sand deposition and associated vegetation establishment have not adversely affected the performance of these structures.

The north slope above the diversion channel consists of noncohesive sandy soil and is subject to erosion from stormwater runoff. Erosion repair conducted in this area in 2013 reduced the rate of erosion and subsequent soil deposition in the channel. Some erosion and deposition continue north and northeast of the diversion channel—an erosional gully and soil accumulation were observed (PL-13). Erosion will be monitored, and erosion control repairs will be performed as needed.

In 2022, inspectors noted that much of the woody vegetation grew in reclaimed areas around the disposal cell. These areas were of concern to tribal officials (Mr. Honie) as they could present a potential fire hazard. In July 2023, an extensive brush removal effort was completed where dead

vegetation was chipped in place to reduce potential fire hazards at the site. Continued brush removal will occur annually.

Two of the three evaporation ponds near the northwest side of the disposal cell were removed in 2007. The area was reclaimed and seeded with a native seed mix in 2007 and again in 2013.

The remaining historical evaporation pond, containing windblown sand and evaporites, is retained as a backup for the main evaporation pond on the east side of the site. The steel cable and caution signs surrounding the pond and the high-density polyethylene liner were intact. What was previously thought to be a plastic geofabric that stabilizes the south-facing slope of the pond is actually the geocell erosion-prevention grid. The visual exposure is the grid material. Vegetation was establishing in the geocells, and the slope is stable. Inspectors will continue to monitor this area. No other maintenance needs were identified.

Erosional gullies were noted along the northern perimeter fence. These gullies are originating near the main highway and are most prominent between the highway and the inner chainlink perimeter fence. This erosional area will be monitored but does not currently affect the integrity of the disposal cell. No maintenance needs were identified.

There are multiple structures and features associated with the former groundwater treatment system. Beginning in 2002, contaminated groundwater was extracted and treated through ion-exchange and distillation processes and then returned to the aquifer through an infiltration trench upgradient of the disposal cell. Operation of the groundwater treatment plant (GWTP) was suspended in September 2014 due to maintenance challenges. The structures associated with the GWTP remain onsite and include a Control Building; Lab and Shop Building; Evaporator Building; Softener Building; external tanks; solar water-heating system; two photovoltaic panel arrays for utility power generation; evaporation ponds; network of extraction, injection, and monitoring wells; and treated water infiltration trench. An inactive greenhouse and two sheds were removed in 2023. No other maintenance needs were identified.

An active bird nest was identified on a power pole southwest of the disposal cell (PL-14). Environmental Compliance personnel have been notified and measures to identify the type of bird nest are underway. The nest will be addressed to mitigate fire hazards, as well as to prevent electrical issues. This task will be completed before the 2025 inspection.

19.4.2.3 Outlying Area

The 0.25-mile area beyond the site boundary was visually observed for erosion, changes in land use, or other phenomena that might affect the long-term integrity of the site. No evidence of changed land use or maintenance needs were identified.

19.5 Follow-Up Inspections

LM will conduct follow-up inspections if (1) a condition is identified during the annual inspection or other site visit that requires a return to the site to evaluate the condition or (2) LM is notified by a citizen or outside agency that conditions at the site are substantially changed. No need for a follow-up inspection was identified.

19.6 Maintenance and Repairs

Inspectors noted the following maintenance items in 2024 that will be completed before the next inspection:

- Remove the trash and debris along the perimeter fence line
- Repair the animal access areas and gaps along the perimeter fence
- Control deep-rooted vegetation on the disposal cell
- Perform annual brush removal
- Address active bird nest on power pole southwest of disposal cell

19.7 Environmental Monitoring

In accordance with the LTSP, semiannual groundwater monitoring is conducted at the locations shown in Figure 19-2 to compare current conditions at the site to baseline postconstruction groundwater quality. Groundwater quality beneath and downgradient of the disposal cell has been degraded by contamination from former uranium-processing activities. This preexisting milling-related contamination might mask contamination leaching from the disposal cell, which limits the effectiveness of normal POC groundwater monitoring as a reliable indicator of disposal cell performance (40 CFR 192 Subpart A).

19.7.1 Groundwater Monitoring Program

Instead of POC monitoring, groundwater monitoring is performed in accordance with Section 5.2.2 of the LTSP and is defined as evaluative monitoring. Evaluative monitoring is performed to "(1) evaluate trends in ground water quality, (2) monitor the downgradient extent of contamination in ground water, (3) analyze the impacts of transient drainage and surface runoff, and (4) assess the effects of ground water restoration measures associated with containing the contamination related to uranium processing activities" (DOE 1996). Evaluative groundwater monitoring was conducted in August and February 2024 at the locations shown in Figure 19-2. Before addressing the most recent results of the evaluative groundwater monitoring program, a summary of historical and current groundwater remediation approaches is warranted.

Groundwater remediation is being conducted by an active treatment system that includes the operation of extraction wells and discharge of extracted (contaminated) groundwater to the onsite evaporation pond for volume reduction. The progress of groundwater remediation is evaluated and reported routinely (typically annually), separate from this site inspection reporting. As documented in recent performance evaluations, the remediation approach has changed over the years, from the continuous high-volume pumping approach applied at the start of active remediation in 2002 to the short-duration, high-volume pumping strategy currently applied since 2018 (DOE 2022; DOE 2024b).



Note: Well 0942 was converted from a monitoring well to an extraction well in 2015.

Figure 19-2. Evaluative Groundwater Monitoring Network at the Tuba City, Arizona, Disposal Site

Yearly short-duration, high-volume pumping occurs during periods of highest potential for evaporative flux that typically begin in July and end in October. As many as 11 extraction wells operate during this period. The annual extraction volume is currently constrained to about 4.6 million gallons due to the evaporation pond capacity and the evaporation rate of the pond (DOE 2024b). This volume equates to an average annual removal rate of 7 gallons per minute (gpm) using the present extraction system, compared to 80 gpm when the GWTP was operating as designed from 2002–2009.

Seven wells (Figure 19-2 and Table 19-2) identified in the LTSP are monitored for four hazardous constituents: molybdenum, nitrate, selenium, and uranium (DOE 1996). As a baseline for cell performance evaluation, provisional upper baseline limits (UBLs) for the four constituents were calculated in accordance with the U.S. Environmental Protection Agency's *Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Interim Final Guidance* (EPA 1989) and documented in the LTSP (DOE 1996). The UBLs are listed in Table 19-3.

Table 19-2. LTSP Groundwater Monitoring Network at the Tuba City, Arizona, Disposal Site

Monitoring Well	Hydrologic Relationship	Monitoring Frequency
0903	Downgradient (offsite)	Annually
0906	Downgradient	Semiannually
0908	Downgradient	Semiannually
0940[a]	Downgradient	Semiannually
0941	Downgradient	Semiannually
0942[b]	Downgradient	No Longer Monitored[b]
0945	Upgradient (background)	Annually

Notes:
[a] Between August 2004 and February 2010, samples from well 0940 could not be obtained because of an insufficient volume of water. This explains the data gaps in Figure 19-3 through Figure 19-6.
[b] Well 0942 was converted from a monitoring well to an extraction well in 2015 and has not been sampled since then.

Table 19-3. Provisional UBLs for Groundwater at the Tuba City, Arizona, Disposal Site

Constituent	Provisional UBL (mg/L)[a]	MCL (mg/L)[b]
Molybdenum	0.14	0.10
Nitrate (as nitrogen)	311[c]	10
Selenium	0.05	0.01
Uranium	1.17	0.044

Notes:
[a] As documented in the LTSP (DOE 1996).
[b] MCLs as listed in 40 CFR 192 Subpart A.
[c] UBL for nitrate as nitrogen converted from the original UBL cited in the LTSP.

Abbreviations:
MCL = maximum concentration limit
mg/L = milligrams per liter

UBLs were described in the LTSP as provisional because "baseline conditions were established for locations other than the disposal cell monitor wells" (DOE 1996). Baseline conditions were established at wells 0906 and 0908 to determine "transient excursions from baseline conditions, potential chemical gradients between baseline and disposal cell locations, and stabilization of postclosure disposal cell hydrology" (DOE 1996). UBLs are concentrations that, with 95% confidence, would be exceeded less than 5% of the time during long-term monitoring if groundwater conditions near the monitoring well did not change.

Because the four constituents are present in tailings material, relatively mobile in groundwater, and found in low concentrations in background groundwater quality, exceedance of UBLs in more than 5% of sampling events over the long term could indicate that the disposal cell is not performing to design standards. However, the LTSP also notes that elevated concentrations could result from transient drainage of tailings fluid into the subsurface (directly beneath the cell) or from rainfall infiltrating through contamination in the unsaturated zone in the mill ponds area not covered by the disposal cell. Elevated concentrations attributed to transient drainage or infiltration would not be indicative of substandard performance for the cell.

Active groundwater remediation was anticipated when the LTSP was prepared in 1996, and it was expected that deviations from anticipated disposal cell performance could be detected even with ongoing groundwater remediation. However, the LTSP also noted that (1) POC sampling and analysis protocol to monitor cell performance could not be established until groundwater restoration was complete and (2) the LTSP would be revised at that time.

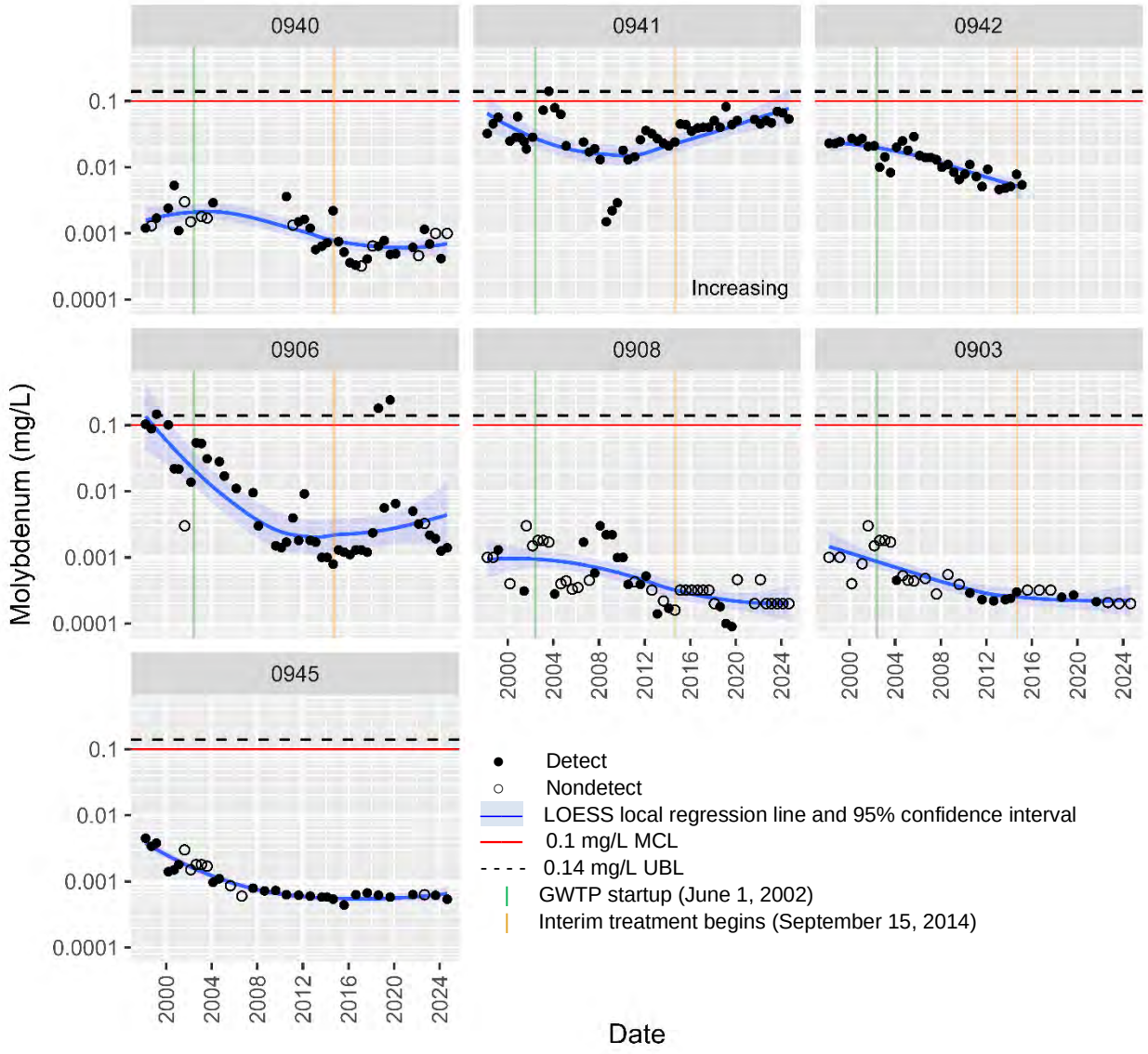
As noted in the LTSP, the UBL value should not be exceeded more than 5% of the time as long as conditions near the monitoring well do not change. Due to implementation of active remediation (2002–2014) and interim treatment (2015 to present), the conditions near the LTSP cell performance wells have constantly been affected, and exceedance of UBLs cannot be attributed to disposal cell performance. Recent operation of the interim treatment system, which potentially affects concentrations of target analytes in the LTSP-specified evaluative monitoring wells, is described in the following paragraphs.

19.7.2 Groundwater Monitoring Results

Figure 19-3 through Figure 19-6 show time-concentration plots for the four target analytes (molybdenum, nitrate, selenium, and uranium) along with corresponding UBLs and maximum concentration limits (MCLs). Interpretations of the analyte-specific data follow each figure. These figures were developed using a faceting approach, whereby data for each well are plotted separately. Downgradient wells (Table 19-2) are ordered in the general direction of groundwater flow or the distance from the disposal cell (Figure 19-2); data for the upgradient background well (0945) are plotted last. In each individual plot, the blue line is the best-fit locally estimated scatterplot smoothing (LOESS) regression line. The surrounding light blue area represents the 95% confidence interval range (above and below) the LOESS line. Although data are plotted for the entire evaluative monitoring network, because well 0942 was converted from a monitoring well to an extraction well in 2015 (precluding sampling), corresponding trends are no longer discussed.

All groundwater monitoring results for the site are reported and published on the LM Geospatial Environmental Mapping System (GEMS) website (https://gems.lm.doe.gov). In this section, the

MCLs shown are presented for informational purposes only. The LTSP requirement related to disposal cell performance is for evaluative monitoring over time, in comparison with the UBLs listed in Table 19-3. In accordance with LTSP requirements to evaluate analyte concentration trends in the monitoring wells (Section 5.2.2 of DOE 1996), Mann-Kendall trend analysis was conducted for all analyte-well combinations. These results are documented in Table 19-4 for the full monitoring period addressed in Figure 19-3 through Figure 19-6 (1998–2024). To facilitate interpretation of more recent trends, Table 19-5 presents the same information, but for the period since interim treatment began (2015 to present).



Note: Any statistically significant increasing trends for the 2015–2024 time frame (Table 19-5) are indicated on the appropriate plots.
Abbreviation: mg/L = milligrams per liter

Figure 19-3. Time-Concentration Plots of Molybdenum in Groundwater at the Tuba City, Arizona, Disposal Site, 1998–2024

Since 1998, molybdenum concentrations have been mostly at or below both the 0.14 milligram per liter (mg/L) UBL and the 0.1 mg/L MCL in all LTSP evaluative monitoring wells (Figure 19-3). The UBL has been exceeded three times in well 0906: 0.15 mg/L in February 1999 and 0.18–0.24 mg/L in 2018–2019. The latter spikes coincide with the short-duration, high-volume pumping occurring in the summer. Although statistically significant decreasing trends were found for three wells (0906, 0940, and 0945) using data since 1998 (Table 19-4), no trend was found for the 2015–2024 time frame (Table 19-5). Molybdenum concentrations in well 0941 have increased since 2015, accounting for the statistically significant trend overall (most recent result of 0.053 mg/L). Most results for wells 0908 and 0903 have been below detection limits.

Table 19-4. Mann-Kendall Trend Analysis Results for Target Analytes in Tuba City, Arizona, Disposal Site Monitoring Wells, 1998–2024

Parameter[a]	Well	Initial Trend Analysis Date	Initial Trend Analysis Date	No. of Samples (No. of Nondetects)	Kendall's tau[b,c]	p-value[b,c]	Trend[b,c]
Molybdenum	0903	3/11/1998	8/27/2024	32 (22)	−0.08	0.48	No Trend
Molybdenum	0906	3/11/1998	8/27/2024	45 (2)	−0.39	<0.001	Decreasing
Molybdenum	0908	3/11/1998	8/28/2024	50 (32)	−0.18	0.056	No Trend
Molybdenum	0940	3/12/1998	8/27/2024	38 (11)	−0.31	0.006	Decreasing
Molybdenum	0941	3/12/1998	8/27/2024	50	0.25	0.012	Increasing
Molybdenum	0945	3/14/1998	8/28/2024	33 (8)	−0.47	<0.001	Decreasing
Nitrate as N	0903	3/11/1998	8/27/2024	32	0.49	<0.001	Increasing
Nitrate as N	0906	3/11/1998	8/27/2024	45	0.03	0.77	No Trend
Nitrate as N	0908	3/11/1998	8/28/2024	50	0.66	<0.001	Increasing
Nitrate as N	0940	3/12/1998	8/27/2024	38	0.13	0.26	No Trend
Nitrate as N	0941	3/12/1998	8/27/2024	50	0.68	<0.001	Increasing
Nitrate as N	0945	3/14/1998	8/28/2024	33	0.54	<0.001	Increasing
Selenium	0903	3/11/1998	8/27/2024	32	0.24	0.056	No Trend
Selenium	0906	3/11/1998	8/27/2024	45	0.37	<0.001	Increasing
Selenium	0908	3/11/1998	8/28/2024	50 (1)	−0.25	0.011	Decreasing
Selenium	0940	3/12/1998	8/27/2024	38	−0.15	0.19	No Trend
Selenium	0941	3/12/1998	8/27/2024	50	0.51	<0.001	Increasing
Selenium	0945	3/14/1998	8/28/2024	33 (2)	0.48	<0.001	Increasing
Uranium	0903	3/11/1998	8/27/2024	32	0.56	<0.001	Increasing
Uranium	0906	3/11/1998	8/27/2024	45	0.11	0.31	No Trend
Uranium	0908	3/11/1998	8/28/2024	50	−0.67	<0.001	Decreasing
Uranium	0940	3/12/1998	8/27/2024	38	0.20	0.078	No Trend
Uranium	0941	3/12/1998	8/27/2024	50	0.59	<0.001	Increasing
Uranium	0945	3/14/1998	8/28/2024	33	−0.19	0.12	No Trend

Notes:

[a] Trends for well 0942 are not shown because sampling was discontinued in 2015.

[b] Trend tests were performed using the "NADA: Nondetects and Data Analysis for Environmental Data" package in R, version 1.6-1.1 (Lee 2020). The NADA trend test is similar to the traditional Mann-Kendall trend test except that it accounts for the presence of nondetects at multiple detection limits.

[c] Trend analyses were conducted at the 0.05 significance level using a two-sided test. A calculated p-value of less than 0.05 indicates that a significant trend in the time series exists. The test statistic, Kendall's tau, is a measure of the strength of the association between two variables, with values always falling between −1 and +1.

Abbreviation:

N = nitrogen

Table 19-5. Mann-Kendall Trend Analysis Results for Target Analytes in Tuba City, Arizona, Disposal Site Monitoring Wells, 2015–2024

Parameter	Well[a]	Initial Trend Analysis Date	Final Trend Analysis Date	No. of Samples (No. of Nondetects)	Kendall's tau[b,c]	p-value[b,c]	Trend[b,c]
Molybdenum	0903	8/12/2015	8/27/2024	9 (6)	−0.28	0.27	No Trend
Molybdenum	0906	2/16/2015	8/27/2024	18 (1)	0.12	0.49	No Trend
Molybdenum	0908	2/16/2015	8/28/2024	18 (15)	−0.02	0.93	No Trend
Molybdenum	0940	2/17/2015	8/27/2024	18 (5)	0.09	0.61	No Trend
Molybdenum	0941	2/17/2015	8/27/2024	18	0.50	0.004	Increasing
Molybdenum	0945	8/11/2015	8/28/2024	9 (1)	−0.19	0.52	No Trend
Nitrate as N	0903	8/12/2015	8/27/2024	9	0.58	0.036	Increasing
Nitrate as N	0906	2/16/2015	8/27/2024	18	−0.56	0.001	Decreasing
Nitrate as N	0908	2/16/2015	8/28/2024	18	0.54	0.002	Increasing
Nitrate as N	0940	2/17/2015	8/27/2024	18	0.21	0.24	No Trend
Nitrate as N	0941	2/17/2015	8/27/2024	18	−0.19	0.28	No Trend
Nitrate as N	0945	8/11/2015	8/28/2024	9	0.08	0.83	No Trend
Selenium	0903	8/12/2015	8/27/2024	9	0.81	0.003	Increasing
Selenium	0906	2/16/2015	8/27/2024	18	0.51	0.004	Increasing
Selenium	0908	2/16/2015	8/28/2024	18 (1)	−0.06	0.76	No Trend
Selenium	0940	2/17/2015	8/27/2024	18	0.69	<0.001	Increasing
Selenium	0941	2/17/2015	8/27/2024	18	0.007	1	No Trend
Selenium	0945	8/11/2015	8/28/2024	9	0.19	0.53	No Trend
Uranium	0903	8/12/2015	8/27/2024	9	0.83	0.002	Increasing
Uranium	0906	2/16/2015	8/27/2024	18	0.83	<0.001	Increasing
Uranium	0908	2/16/2015	8/28/2024	18	−0.52	0.003	Decreasing
Uranium	0940	2/17/2015	8/27/2024	18	−0.30	0.087	No Trend
Uranium	0941	2/17/2015	8/27/2024	18	0.09	0.62	No Trend
Uranium	0945	8/11/2015	8/28/2024	9	−0.14	0.66	No Trend

Notes:

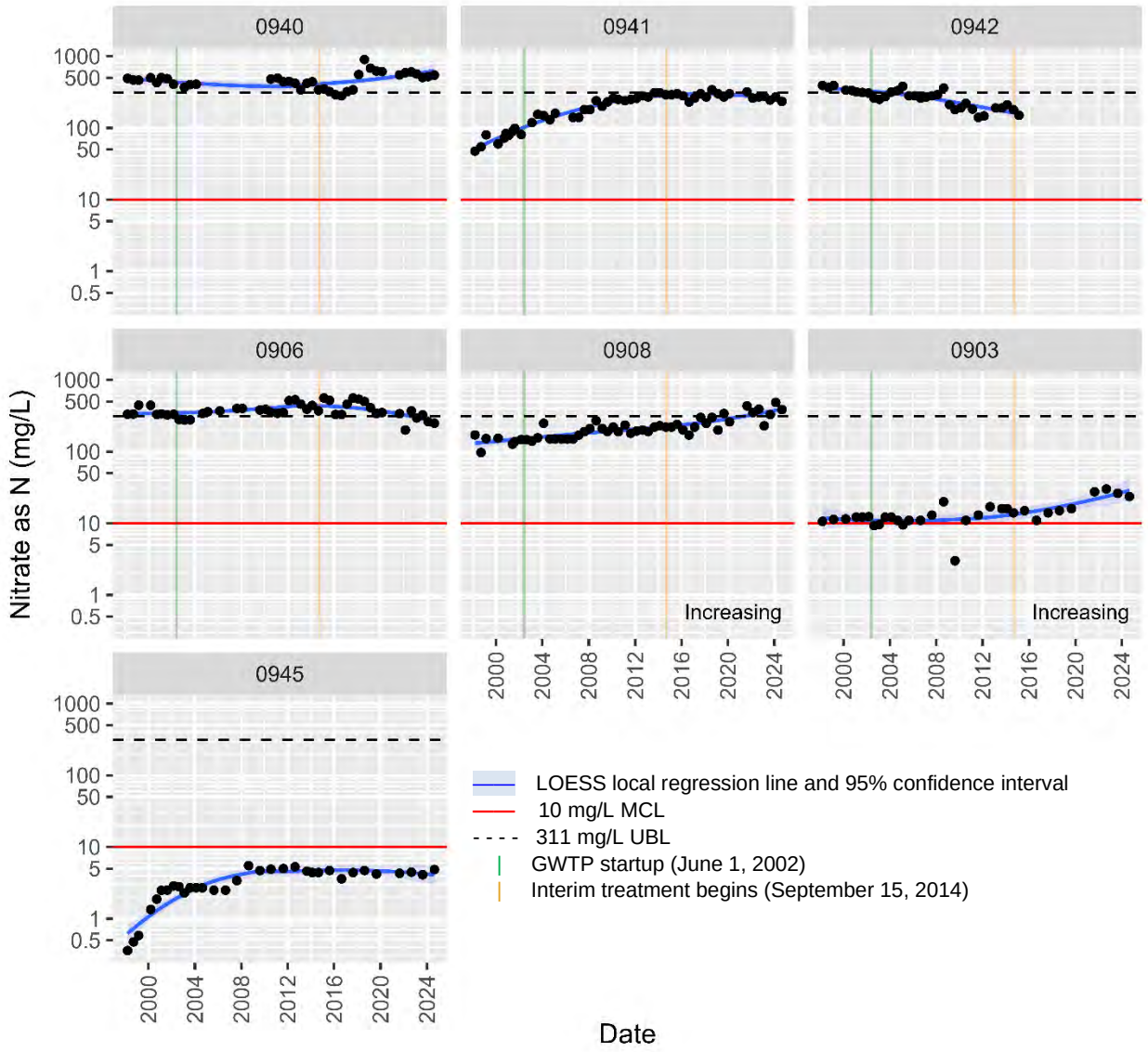
[a] Trends for well 0942 are not shown because sampling was discontinued in 2015.

[b] Trend tests were performed using the "NADA: Nondetects and Data Analysis for Environmental Data" package in R, version 1.6-1.1 (Lee 2020). The NADA trend test is similar to the traditional Mann-Kendall trend test except that it accounts for the presence of nondetects at multiple detection limits.

[c] Trend analyses were conducted at the 0.05 significance level using a two-sided test. A calculated p-value of less than 0.05 indicates that a significant trend in the time series exists. The test statistic, Kendall's tau, is a measure of the strength of the association between two variables, with values always falling between −1 and +1.

Abbreviation:

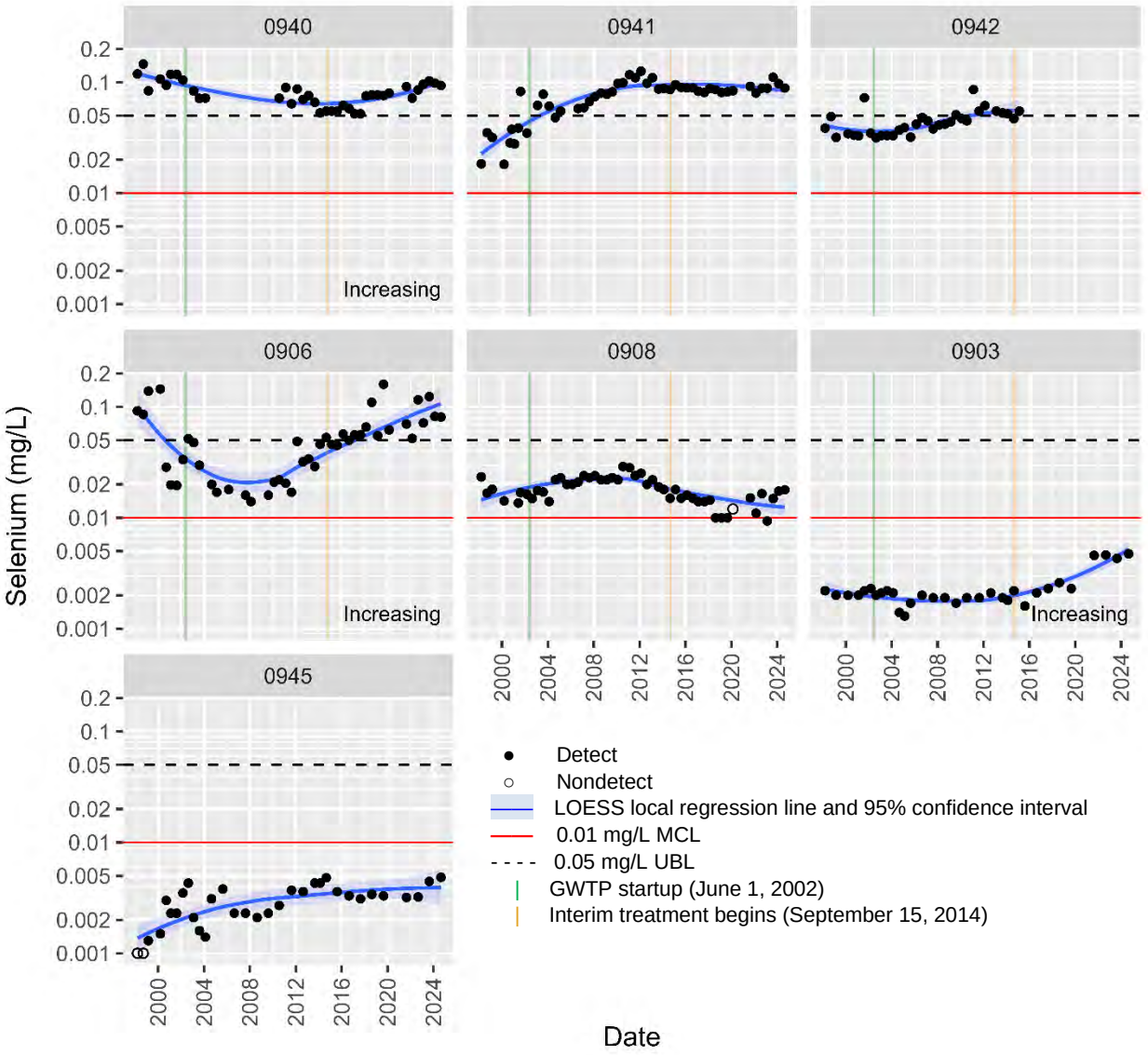
N = nitrogen



Notes: Downgradient wells are ordered in general direction of groundwater flow or distance from the disposal cell; data for upgradient well 0945 are plotted last. Any statistically significant increasing trends for the 2015–2024 time frame (Table 19-5) are indicated on the appropriate plots.
Abbreviation: N = nitrogen

Figure 19-4. Time-Concentration Plots of Nitrate (as N) in Groundwater at the Tuba City, Arizona, Disposal Site, 1998–2024

Nitrate (+ nitrite as nitrogen [N]) concentrations have historically exceeded the 10 mg/L MCL in all LTSP evaluative wells except background well 0945 (Figure 19-4). The 311 mg/L UBL has been exceeded in all downgradient evaluative monitoring wells except southernmost well 0903. In 2024, the UBL was exceeded in only two wells: 0908 (385–486 mg/L) and 0940 (520–545 mg/L). Using data since 1998, Mann-Kendall trend analysis indicates statistically significant increasing nitrate concentration trends in four of the six wells currently monitored: 0903, 0908, 0941, and background well 0945 (Table 19-4). For the 2015–2024 period, trends remain statistically significant only for wells 0908 and 0903 (Table 19-5). Nitrate concentrations in well 0903 have exceeded the 10 mg/L MCL since 2004, the maximum (30.1 mg/L) was detected in August 2022. The most recent (August 2024) nitrate result for well 0903 is 23.6 mg/L.

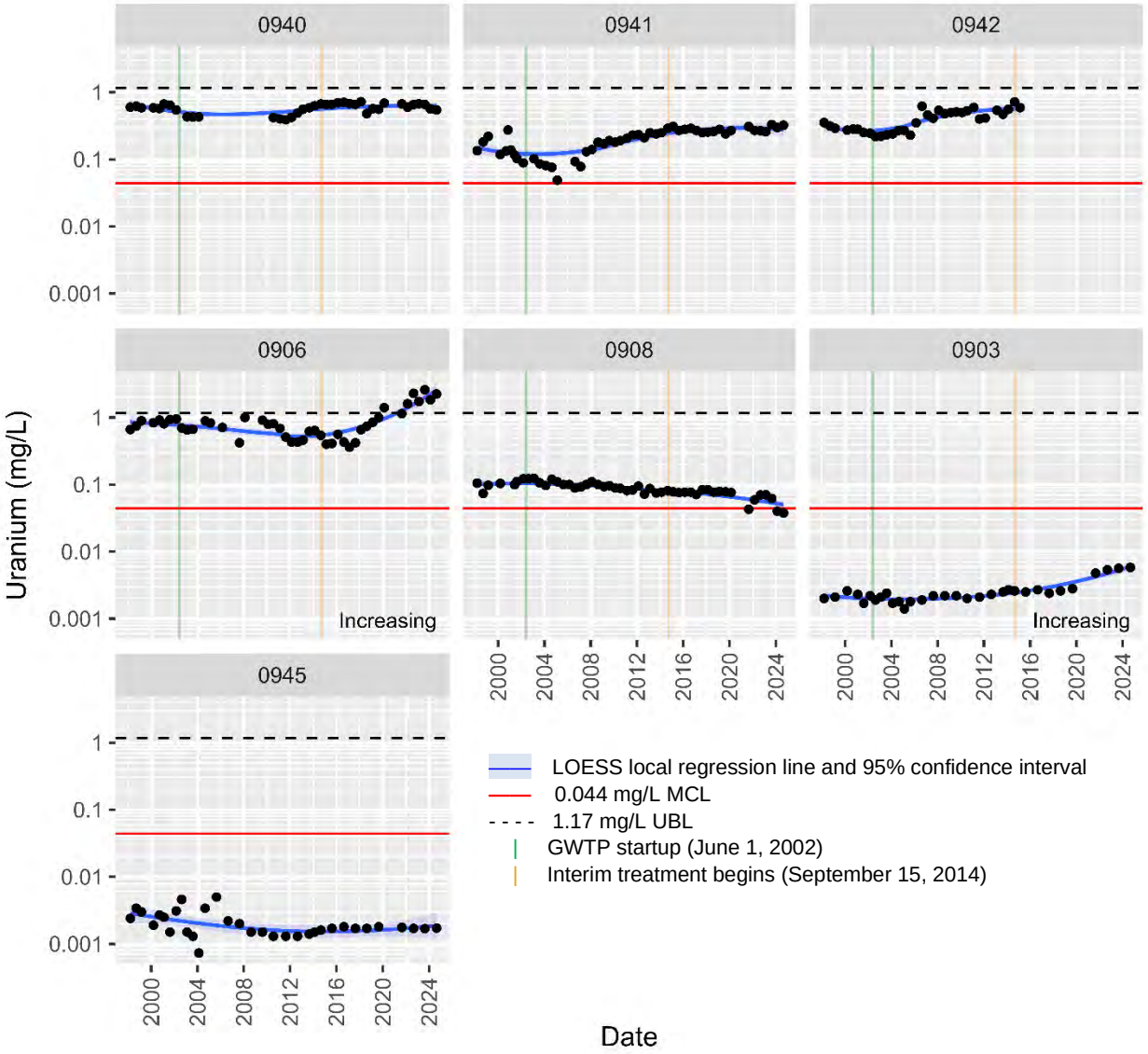


Note: Any statistically significant increasing trends for the 2015–2024 time frame (Table 19-5) are indicated on the appropriate plots.

Figure 19-5. Time-Concentration Plots of Selenium in Groundwater at the Tuba City, Arizona, Disposal Site, 1998–2024

Selenium concentrations have historically exceeded the 0.01 mg/L MCL in all non-background evaluative monitoring wells except southernmost well 0903 (Figure 19-5). Of the wells currently monitored, the 0.05 mg/L UBL has been exceeded in three wells: 0940, 0941, and 0906 (most recent [2024] results of 0.08–0.10 mg/L). Mann-Kendall trend analysis for 1998–2024 indicates statistically significant increasing trends in two of these wells (0941 and 0906), along with background well 0945 (Table 19-4). The increase in selenium concentrations in well 0906 since 2009 correlates with the period when average annual cumulative extraction rates dropped from 80 to 35 gpm due to intermittent shutdowns of the GWTP (DOE 2020). For the more recent period (2015–2024), three wells (0906, 0940, and 0903) have significant increasing trends (Table 19-5). Although below both the UBL and the MCL, selenium concentrations in well 0903 (most recent result of 0.005 mg/L) warrant continued monitoring.

Uranium concentrations have historically exceeded the 0.044 mg/L MCL in all downgradient compliance wells except for well 0903 and (recently) well 0908 (Figure 19-6). The 1.17 mg/L UBL has not been exceeded except for well 0906, where uranium concentrations began increasing significantly after interim treatment started in 2015. The UBL was exceeded for the first time in February 2020 and concentrations have since increased to 2–3 mg/L (most recent result of 2.24 mg/L). Mann-Kendall trend analysis for 1998–2024 indicates statistically significant increasing uranium concentration trends in wells 0941 and 0903. For 2015–2024, the statistically significant increasing trend for downgradient well 0903 continues, in addition to the previously noted trend for well 0906 (Table 19-5). Although still below both the MCL and the UBL, the most recent (August 2024) uranium concentration in well 0903 is the highest result on record for this well at 0.0058 mg/L.



Note: Any statistically significant increasing trends for the 2015–2024 time frame (Table 19-5) are indicated on the appropriate plots.

Figure 19-6. Time-Concentration Plots of Uranium in Groundwater at the Tuba City, Arizona, Disposal Site, 1998–2024

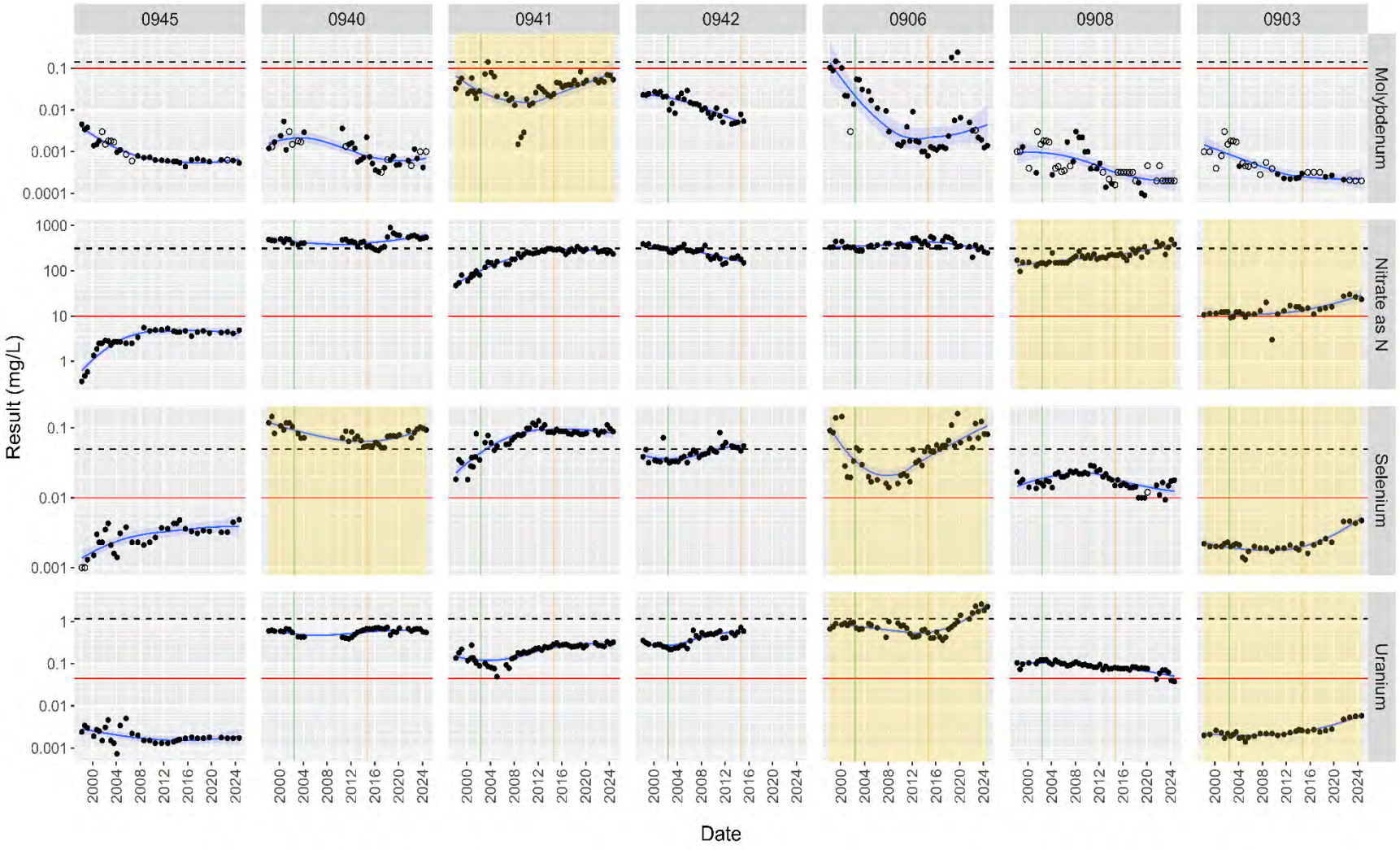
Similar to conclusions drawn in the previous annual report (DOE 2024a), analytical results from the 2024 evaluative monitoring effort indicate that groundwater quality in downgradient wells is still degraded relative to background concentrations in upgradient well 0945 (Figure 19-7). The only exceptions to the latter are molybdenum concentrations in wells 0908 and 0903, which are comparable to background. Since 2015 (when interim treatment began), contaminant concentrations are significantly increasing for the following well-analyte combinations (wells ordered in the general direction of groundwater flow or the distance from the disposal cell):

- Well 0940—selenium
- Well 0941—molybdenum
- Well 0906—selenium and uranium
- Well 0908—nitrate
- Well 0903—nitrate, selenium, and uranium

These increasing trends warrant continued monitoring, especially those in well 0903, the southernmost downgradient well. These increases correlate with the timing of the GWTP shutdown, after which the site began operating under interim treatment with an average annual cumulative extraction rate of 7 gpm. Analysis of water quality trending and progress of the groundwater remedy are reported in the site-specific remedy performance reports for the Tuba City site (DOE 2022; DOE 2024b).

19.8 Corrective Action

Corrective action is taken to correct out-of-compliance or hazardous conditions that create a potential health and safety problem or that may affect the integrity of the disposal cell or compliance with 40 CFR 192. No need for corrective action was identified.



● Detect ○ Nondetect —— LOESS local regression line and 95% confidence interval

Limits from Table 19-3: —— = MCL; - - - = UBL

| GWTP startup (June 1, 2002); | Interim treatment begins (September 15, 2014)

Shaded plots denote well-analyte combinations with statistically significant increasing concentration trends since 2015 (Table 19-5).

Note: Wells are ordered in general direction of groundwater flow or distance from the disposal cell (Figure 19-2); data for upgradient well 0945 are plotted first.

Figure 19-7. Summary of Historical Evaluative Monitoring Results at the Tuba City, Arizona, Disposal Site (1998–2024)

19.9 References



Note

Site-related documents are available on the LM public webpages at https://lmpublicsearch.lm.doe.gov/SitePages.

10 CFR 40.27. U.S. Nuclear Regulatory Commission, "General License for Custody and Long-Term Care of Residual Radioactive Material Disposal Sites," *Code of Federal Regulations*.

40 CFR 192. U.S. Environmental Protection Agency, "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings," *Code of Federal Regulations*.

40 CFR 192 Subpart A. U.S. Environmental Protection Agency, "Standards for the Control of Residual Radioactive Materials from Inactive Uranium Processing Sites," *Code of Federal Regulations.*

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DOE (U.S. Department of Energy), 2024a. *2023 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites*, LMS/43755, Office of Legacy Management, March.

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Lee, L., 2020. "NADA: Nondetects and Data Analysis for Environmental Data," R package, version 1.6-1.1, https://CRAN.R-project.org/package=NADA, accessed December 12, 2024.

19.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	248	Gap Under Fence near Perimeter Sign P9
PL-2	270	Gap Created by Animals Under Fence Between Perimeter Signs P12 and P13
PL-3	248	Sediment Deposition Gauge Between Perimeter Signs P9 and P10
PL-4	248	Debris near Perimeter Sign P9
PL-5	—	Site Marker SMK-2
PL-6	—	Quality Control Monument QC-2
PL-7	—	Evaporative Materials on Top Slope of Disposal Cell
PL-8	90	Potential Tire Tracks on the Southeast Corner of the Disposal Cell
PL-9	113	Horizontal Lines on West Slope of Disposal Cell
PL-10	—	Sediment Deposition on the South Slope of the Disposal Cell
PL-11	—	Debris on the South Slope of Disposal Cell
PL-12	293	Vegetation on South Slope of the Disposal Cell
PL-13	158	Erosional Gully and Soil Accumulation in Diversion Ditch North of Disposal Cell
PL-14	315	Active Bird Nest on Power Pole Southwest of Disposal Cell

Note:
— = Photograph taken vertically from above.



PL-1. Gap Under Fence near Perimeter Sign P9



PL-2. Gap Created by Animals Under Fence Between Perimeter Signs P12 and P13



PL-3. Sediment Deposition Gauge Between Perimeter Signs P9 and P10



PL-4. Debris near Perimeter Sign P9



PL-5. Site Marker SMK-2



PL-6. Quality Control Monument QC-2



PL-7. Evaporative Materials on Top Slope of Disposal Cell



PL-8. Potential Tire Tracks on the Southeast Corner of the Disposal Cell



PL-9. Horizontal Lines on West Slope of Disposal Cell



PL-10. Sediment Deposition on the South Slope of the Disposal Cell



PL-11. Debris on the South Slope of Disposal Cell



PL-12. Vegetation on South Slope of the Disposal Cell



PL-13. Erosional Gully and Soil Accumulation in Diversion Ditch North of Disposal Cell



PL-14. Active Bird Nest on Power Pole Southwest of Disposal Cell