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U.S. DEPARTMENT OF
ENERGY

Legacy
Management

2022 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites

March 2023

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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*
D_{50}	mean diameter
DOE	U.S. Department of Energy
EDA	energy dissipation area
EPA	U.S. Environmental Protection Agency
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
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
NAD22	North American Datum of 2022
NAD27	North American Datum of 1927
NAD83	North American Datum of 1983
NAVD88	North American Vertical Datum of 1988
NGVD29	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
SOARS	System Operation and Analysis at Remote Sites
TDS	total dissolved solids
UAS	unmanned aircraft system
UBL	upper baseline limit
UMTRCA	Uranium Mill Tailings Radiation Control Act
USBR	U.S. Bureau of Reclamation
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 2022. 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 verified 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 internet at https://energy.gov/lm/sites/lm-sites.

LM manages 18 UMTRCA Title I 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 open, 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 will extend the final disposal cell closure date from 2023 to 2031. 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; to identify changes or new conditions that may affect the long-term performance of the site; and to 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.

A major change to how the groundwater monitoring results are presented is debuted in this report. DOE, in agreement with NRC, decided to present data results with more consistency and reliability along with a statistical analysis to provide a robust evaluation of the monitoring results.

The statistical analysis is performed on the dataset using a nonparametric smoothing method—locally estimated scatterplot smoothing (LOESS). The plot surrounding the 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. To support interpretation of these figures, Mann-Kendall trend analysis is performed for each well parameter to characterize

[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.

trends in data results and presented at the end of each section. Trend analyses are conducted at the 0.05 significance level using a two-sided test.

The following nonroutine activities[3] occurred in 2022:

- Resurveys and datum transformations were completed at the remaining four sites to prepare for the upcoming Office of Management and Budget Circular A-16, "Coordination of Geographic Information and Related Spatial Data Activities," datum that will be released in 2024. To date, UMTRCA programmatic geospatial information has been reported and maintained in the North American Datum of 1927 (NAD27) and National Geodetic Vertical Datum of 1929 (NGVD29). To be in compliance with the new datum release, the UMTRCA geospatial information required a transformation from NAD27/NGVD29 datums to the North American Datum of 1983 (NAD83) (2011) and the North American Vertical Datum of 1988 (NAVD88) in preparation for the transformation to the North American Datum of 2022 (NAD22). By 2024, the data will undergo another transformation to the new NAD22. Resurveys were performed to establish high-accuracy coordinates for control points on the site. This will allow accurate monitoring of the site and historical data to be adjusted to match current surveys that are performed.
- Travel restrictions imposed in response to the coronavirus disease 2019 pandemic were lifted, which resulted in many maintenance items being completed this year at the affected sites.
- The NRC-approved evapotranspiration cover conversion pilot study at the Grand Junction disposal site was initiated in 2020 and continued in 2022. 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 data collection is ongoing. There are 2 years of water balance, vegetation, and baseline radon diffusion data, which are expected to be published in 2023 or 2024. Additional revegetation efforts are planned for 2023.

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. 2022 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
		1-6	Conducted groundwater monitoring
Burrell, Pennsylvania	2	2-6	Maintenance to repair hole in Conservation Reuse Tallgrass Prairie Test Plot area
		2-8	No groundwater monitoring required in 2022
Canonsburg, Pennsylvania	3	3-7	Installation of new boundary monument BM-5
		3-10	Conducted vegetation treatment within the fenced area of the site

[3] Nonroutine activities are implemented in response to changes in site conditions, regulatory setting, or management structure following a regulatory compliance review.

Table ES-1. 2022 Summary of UMTRCA Title I Site Actions and Issues (continued)

Site	Chapter	Page	Actions and Issues
Durango, Colorado	4	4-6	Performed depression repair on disposal cell side slope
		4-7	Conducted groundwater monitoring
Falls City, Texas	5	5-7	Replacement of a portion of the perimeter fence
		5-7	Conducted groundwater monitoring
Grand Junction, Colorado	6	6-6	Repairs to the east perimeter road
		6-12	Conducted groundwater monitoring
Green River, Utah	7	7-2	Locks replaced on the access gates
		7-6	Conducted groundwater monitoring
Gunnison, Colorado	8	8-2	Replacement of locks on access gates
		8-6	No groundwater monitoring required in 2022
		-	Datum transformation and resurvey performed
Lakeview, Oregon	9	9-7	Locks on entrance gates were replaced
		9-7	No groundwater monitoring required in 2022
Lowman, Idaho	10	10-5	No maintenance needs were identified
		10-5	No groundwater monitoring required
Maybell, Colorado	11	11-2	Replacement of perimeter signs P16 and P26
		11-6	No groundwater monitoring required
		-	Datum transformation and resurvey performed
Mexican Hat, Utah	12	12-7	No maintenance needs were identified
		12-7	Conducted observational seep monitoring
Naturita, Colorado	13	13-4	Abandoned in place five groundwater monitoring wells
		-	Datum transformation performed
Rifle, Colorado	14	14-7	Conducted vegetation management
		14-7	Conducted disposal cell pore-water level monitoring
Salt Lake City, Utah	15	15-4	Installation of eight aerial survey quality control monuments
		15-6	No groundwater monitoring required
Shiprock, New Mexico	16	16-6	No disposal cell performance monitoring required
Slick Rock, Colorado	17	17-5	No groundwater monitoring required
		-	Datum transformation and resurvey performed
Spook, Wyoming	18	18-2	Replaced perimeter sign P5
		18-5	No groundwater monitoring required
Tuba City, Arizona	19	19-4	Aerial survey quality control monuments installed
		19-7	Conducted semiannual groundwater monitoring

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 17, 2022. 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 in November 2019 with results reported in the 2019 annual inspection report. The 2022 groundwater sampling event was conducted in November 2022. Validated results from that sampling event were not available in time for inclusions into this report but will appear in next years' annual report.

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 0	--

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, entrance sign, perimeter signs, site markers, survey and boundary monuments, and wellhead protectors.

1.4 Inspection Results

Inspection of the site, 25 miles north of Grants, New Mexico, was conducted by J. Cario, Z. Aldous, D. Atkinson, and J. Graham of the Legacy Management Support (LMS) contractor. B. Frazier (LM site manager), A. Rheubottom (NMED), and C. Wentz (LMS) 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 2022 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 is near the access road next to site marker SMK-1 (PL-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 (PL-2). 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. Erosion has occurred around the base of perimeter signs P12 (PL-3) and P41, but both perimeter signs are stable. Prairie dog colonies were identified near perimeter signs P17 and P18 during the 2021 inspection and observed again in 2022 (PL-4). 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 is on the top slope of the disposal cell (PL-5). No maintenance needs were identified.

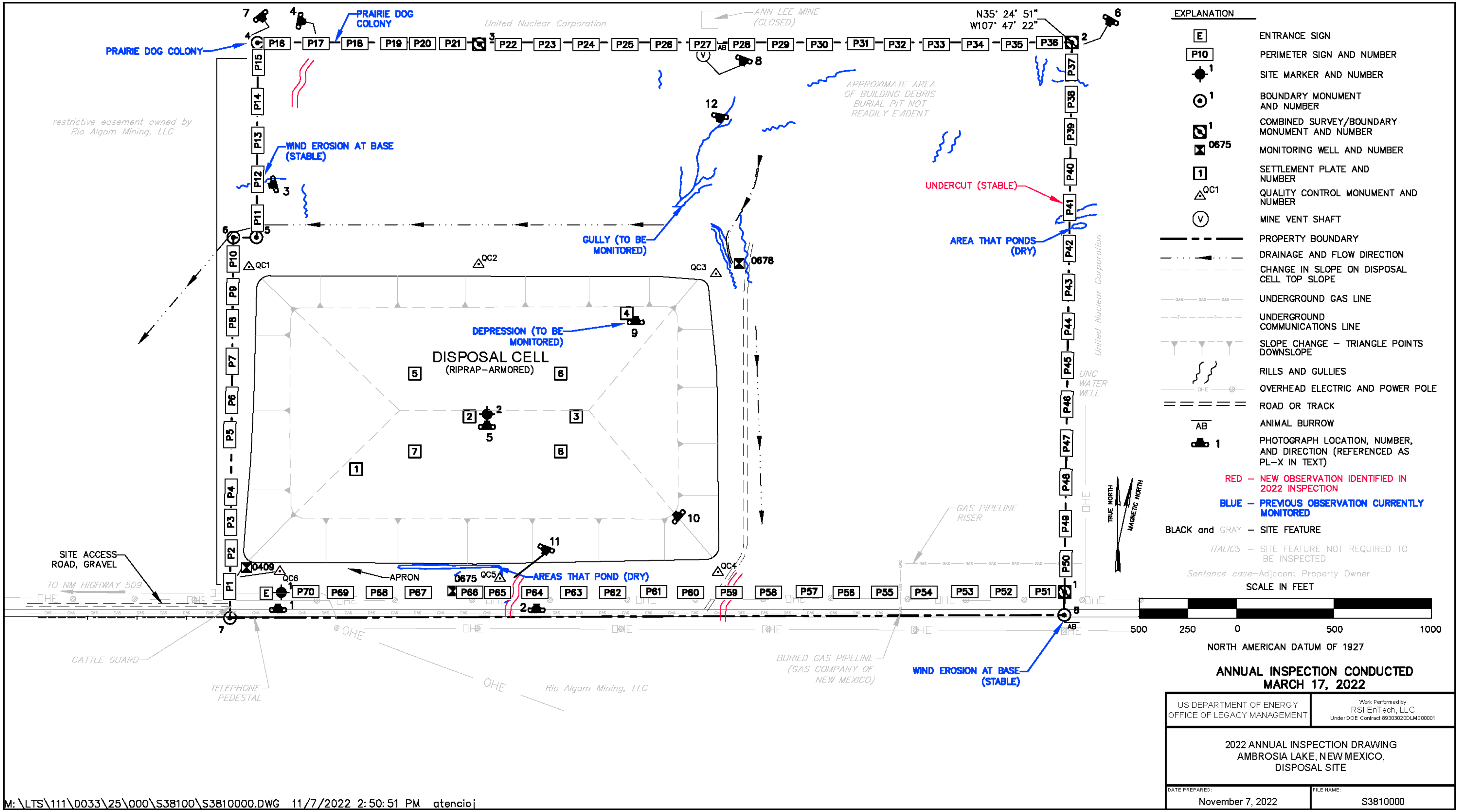


Figure 1-1. 2022 Annual Inspection Drawing for the Ambrosia Lake, New Mexico, Disposal Site

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 (PL-6). Steel T-posts were installed next to boundary monuments to help inspectors locate them. Erosion has occurred around the base of boundary monument BM-8, but the monument is stable. Prairie dog colonies were observed near boundary monuments BM-4 in 2021 (PL-7) and near BM-8 during the 2022 inspection. No maintenance needs were identified.

1.4.1.5 Aerial Survey Quality Control Monuments

Six aerial survey quality control monuments were inspected during the 2022 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-8). 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 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, slumping, or erosion, 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 2022 annual inspection, the settlement was shallow enough that it was determined not to have changed significantly (PL-9). Inspectors will continue to monitor this area during each annual inspection and document surface topography and note any developing erosional features.

Scattered annual weeds and perennial grasses are growing on the top of the disposal cell top (PL-10). 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. No maintenance needs were identified.

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, but the area was dry during the inspection. This location is the topographic low spot along the base of the disposal cell, and stormwater runoff collects in this area. Some rilling and erosion was observed near the base of the south side slope (PL-11) near aerial survey quality control monument QC-5. 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 disposal cell protectiveness or long-term performance, however, grazing animals typically do not walk on riprap-armored surfaces.

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 feet and a width of 8–10 feet (PL-12). Inspectors collected GPS locations and measurements of this gully in 2021. While no immediate maintenance needs were identified, an evaluation of the need for erosion control structures around the large gully northeast of the disposal cell will be conducted. Newly forming small rills were observed around the site during the 2022 annual inspection, near perimeter signs P17, P59, and P65.

1.4.2.4 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 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 2022 inspection. Site engineers will evaluate the need for erosion control measures at the gully feature northeast of the cell.

1.7 Groundwater Monitoring

In accordance with the LTSP, groundwater monitoring is not required at this 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 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 in November 2022. Validated results from that sampling event were not available for inclusion into this report but will be reported in next year's annual report.

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

Monitoring Well	Hydrologic Relationship
0409	Contact between alluvium and Tres Hermanos C unit, downgradient
0675	Weathered Mancos Shale, downgradient
0678	Tres Hermanos B unit, downgradient

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. Well 0409 is dry, which suggests that alluvial groundwater is not leaving the southwest portion of the site.

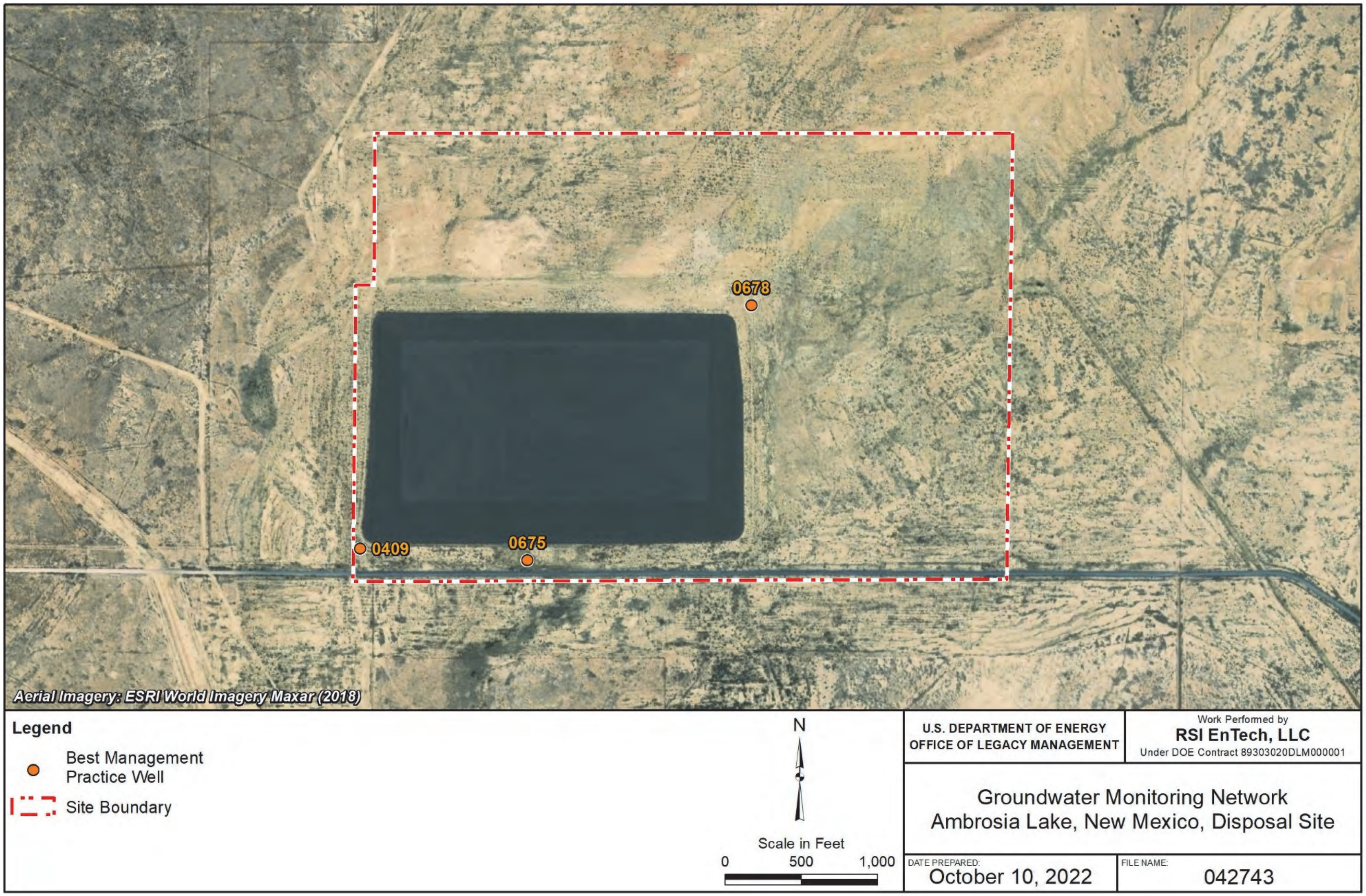


Figure 1-2. Ambrosia Lake, New Mexico, Groundwater Best Practice Monitoring Locations

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/#site=AMB). The *2019 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites* (DOE 2020) reports the most recent monitoring results. Consistent with previous sampling events, well 0409 was dry. Monitoring results for molybdenum, nitrate, selenium, sulfate, and uranium for wells 0675 and 0678 were consistent with historical monitoring results. In accordance with its agreement with NMED, LM will continue to monitor groundwater at the Ambrosia Lake site every 3 years until 2031. The most recent sampling event occurred in November 2022.

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

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.

DOE (U.S. Department of Energy), 2020. *2019 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites*, LMS/S26685, Office of Legacy Management, March.

Kleinrath, 2001. Art 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 Marcy Leavitt, branch chief, New Mexico Environment Department, Groundwater Quality Bureau, August 29.

1.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	0	Entrance Sign and Granite Site Marker SMK-1
PL-2	0	Perimeter Sign P64
PL-3	250	Wind Erosion at Base of Perimeter Sign P12
PL-4	100	Prairie Dog Colony near Perimeter Sign P17
PL-5	—	Site Marker SMK-2
PL-6	210	Combined Survey and Boundary Monument BM-2
PL-7	140	Prairie Dog Colony near Boundary Monument BM-4 and Perimeter Sign P15
PL-8	200	Mine Vent Shaft
PL-9	0	Settlement Plate 4
PL-10	320	Disposal Cell Top Slope
PL-11	200	Rills near Aerial Survey Quality Control Monument QC-5
PL-12	190	Main Channel of Deep Gully

Note:
— = Photograph taken vertically from above.

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

PL-2. Perimeter Sign P64

PL-3. Wind Erosion at Base of Perimeter Sign P12

PL-4. Prairie Dog Colony near Perimeter Sign P17

PL-5. Site Marker SMK-2

PL-6. Combined Survey and Boundary Monument BM-2

PL-7. Prairie Dog Colony near Boundary Monument BM-4 and Perimeter Sign P15

PL-8. Mine Vent Shaft

PL-9. Settlement Plate 4

PL-10. Disposal Cell Top Slope

PL-11. Rills near Aerial Survey Quality Control Monument QC-5

PL-12. Main Channel of Deep Gully

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 27, 2022. 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 routine groundwater monitoring every 5 years as a best management practice to aid evaluation of the disposal cell's performance. The most recent routine groundwater sampling event on all wells was conducted in November 2018. Four downgradient wells were sampled on October 19, 2020, ahead of the required 5-year sampling frequency, to observe whether an identified increase in molybdenum in 2018 persisted. Results from the 2020 samples showed that molybdenum did not continue to increase. All sampling results are reported on the LM Geospatial Environmental Mapping System (GEMS) website (https://gems.lm.doe.gov/#site=BUR). The next routine sampling event is scheduled for 2023.

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. 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 27, 2022. The inspection was conducted by K. Broberg and B. Wulker of the Legacy Management Support contractor. T. Drake (LM site manager), K. Barns and A. Taverna (NRC), D. Shearer and C. Rajkovich (Pennsylvania Department of Environmental Protection [DEP]), and T. Biller (site herbicide subcontractor Lawn RX) 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 2022 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. Local 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. Locks on all access gates were replaced during the inspection. Entrance signage on the main vehicle entrance gate was current. The railroad crossing was improved in 2022 with the installation of an asphalt crossing (PL-1). No maintenance needs were identified.

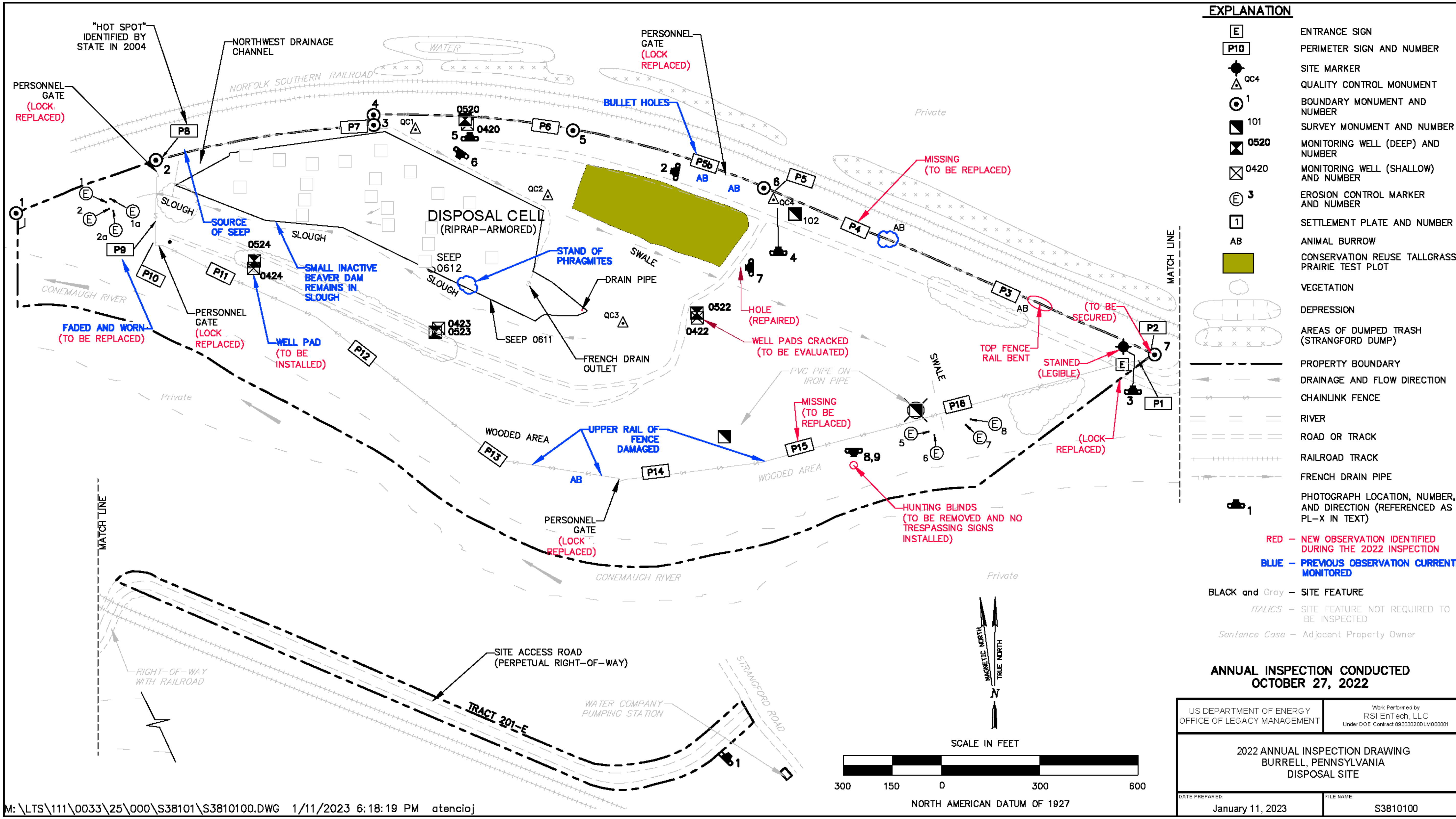


Figure 2-1. 2022 Annual Inspection Drawing for the Burrell, Pennsylvania, Disposal Site

2.4.1.2 Security Fence and Perimeter Signs

A chainlink security fence encloses the disposal cell and drainage features (PL-2). The site herbicide subcontractor keeps the fence line clear of vegetation, which should prolong the life of the security fence. Trees felled by strong storms have bent the upper rail of the south fence in a few spots, but the fence remains serviceable, and repairs are not required at this time.

There are 17 perimeter signs attached to the outside of the security fence. All perimeter signs were present, with the exception of signs P4 and P15, which will be replaced. Perimeter sign P5b on the north fence has some bullet holes but is legible. Perimeter sign P9 has been faded and worn for some time and will be replaced when conditions allow. Inspectors continue to monitor the animal burrows along the northern perimeter fence. No other 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 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 (PL-4).

All seven boundary monuments were located during the inspection. With the exception of boundary monument BM-7, all were in good condition. The top plate (cap) of boundary monument BM-7 was knocked off and found lying next to the post. The cap will be secured back to the post before the next inspection.

2.4.1.5 Aerial Survey Quality Control Monuments

Four aerial survey quality control monuments were inspected during the 2022 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 were last sampled and inspected in October 2018 on the 5-year sampling schedule. Only the four downgradient wells were sampled on October 19, 2020. As a best management practice, concrete well pads were installed at five monitoring wells (0420, 0520, 0422, 0522, and 0523) during the October 2018 sampling event. Monitoring well 0423 already had a concrete well pad. Saturated ground prevented the installation of concrete well pads at monitoring wells 0424 and 0524 in 2018. These will be installed during the next routine sampling event in 2023. Monitoring well pads 0522 and 0422 have developed cracks. The impact of the cracks will be better assessed when the sampling crew is at the site in 2023 to conduct water sampling. All wellhead protectors that were observed during the annual inspection were locked and undamaged. NRC measured a gamma radiation level of 30–40 microrem per hour around the base of the well pad at monitoring well 0420 (PL-5). Background gamma radiation is approximately 10 microrem per hour. The gamma radiation level will be assessed by the Pennsylvania DEP in spring 2023 and again next year when the wells are sampled; results will be included in next year's annual report. 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 disposal cell, completed in 1987, occupies 5 acres and is armored with riprap to control erosion and deter animal intrusion (PL-6). There was no evidence of erosion, settling, slumping, or any other modifying process 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 assessment will 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 a follow-up assessment in fiscal year 2019, but this 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 conclude that the additional Burrell assessment is not required.

Although vegetation is allowed to grow on the disposal cell, noxious weeds and invasive plants are controlled on the disposal cell and the site 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.

Woody vegetation growth on the cell cap since 2000 has progressed to a point where trees are becoming quite tall. There is a concern that a tree could fall (e.g., die or be blown down) in a manner that displaces a large root ball under the tree, and perhaps impacts or exposes the underlying clay layer of the cell cover. DOE will work with NRC to develop a path forward to address the trees on the disposal cell cover in light of 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 ever been observed during past inspections. Water was not ponded anywhere along the French drain, and no wetland vegetation was observed, which indicate 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 2022 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, as no evidence of recent activity was observed around the dam (e.g., animal tracks, new cuts). In its current state, it 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 (PL-7). Given that 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 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 the inspectors will continue to monitor this area. No maintenance needs were identified.

2.4.2.4 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 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 the Pennsylvania DEP showed inspectors a “hot spot” (an area with gamma radiation levels of 5 millirem 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 inspection, a temporary hunting blind was discovered set up on the south side of the site, outside of the site security fence (PL-8 and PL-9). DOE plans to remove the hunting blind and install additional no-trespassing signs along the south edge of the property and to a chain stretched across the mowed pathway along the perimeter fence to further deter trespassing on DOE property.

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

A hole on the east side of the Conservation Reuse Tallgrass Prairie Test Plot was safely filled in with clay-based topsoil before the inspection.

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

- Reattachment of the top plate of boundary monument BM-2
- Replacement of perimeter signs P4, P15, and P9 (if possible)
- Installation of no-trespassing signs along the south edge of the property
- Installation of a chain stretched across the mowed pathway along the perimeter fence with no-trespassing signs attached
- Removal of the temporary hunting blind

Well pads at monitoring wells 0522 and 0422 will be evaluated for repairs during the monitoring event in 2023.

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 as an evaluation of the disposal cell's performance. The next routine sampling event will occur in 2023. 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 and four analytes: lead, molybdenum, selenium, and uranium. The maximum concentration limits (MCLs) for these four analytes in groundwater (40 CFR 192 Table 1 Subpart A) 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. Maximum Concentration Limits for 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 Table 1 Subpart A.

Abbreviation:
mg/L = milligrams per liter

LM resampled the four downgradient wells on October 19, 2020. This sampling was 3 years ahead of the required 5-year sampling frequency to determine if the increase in molybdenum noted previously persists. Samples were also analyzed for lead, selenium, and uranium. The results of the 2020 sampling showed that all constituents remained well below the MCLs. These nonroutine sampling results are reported in the 2021 annual report (DOE 2022) and on the GEMS website (https://gems.lm.doe.gov/#site=BUR). Routine sampling results from the 2018 sampling event are reported in the 2018 annual report (DOE 2019). The next required sampling event will occur in 2023.

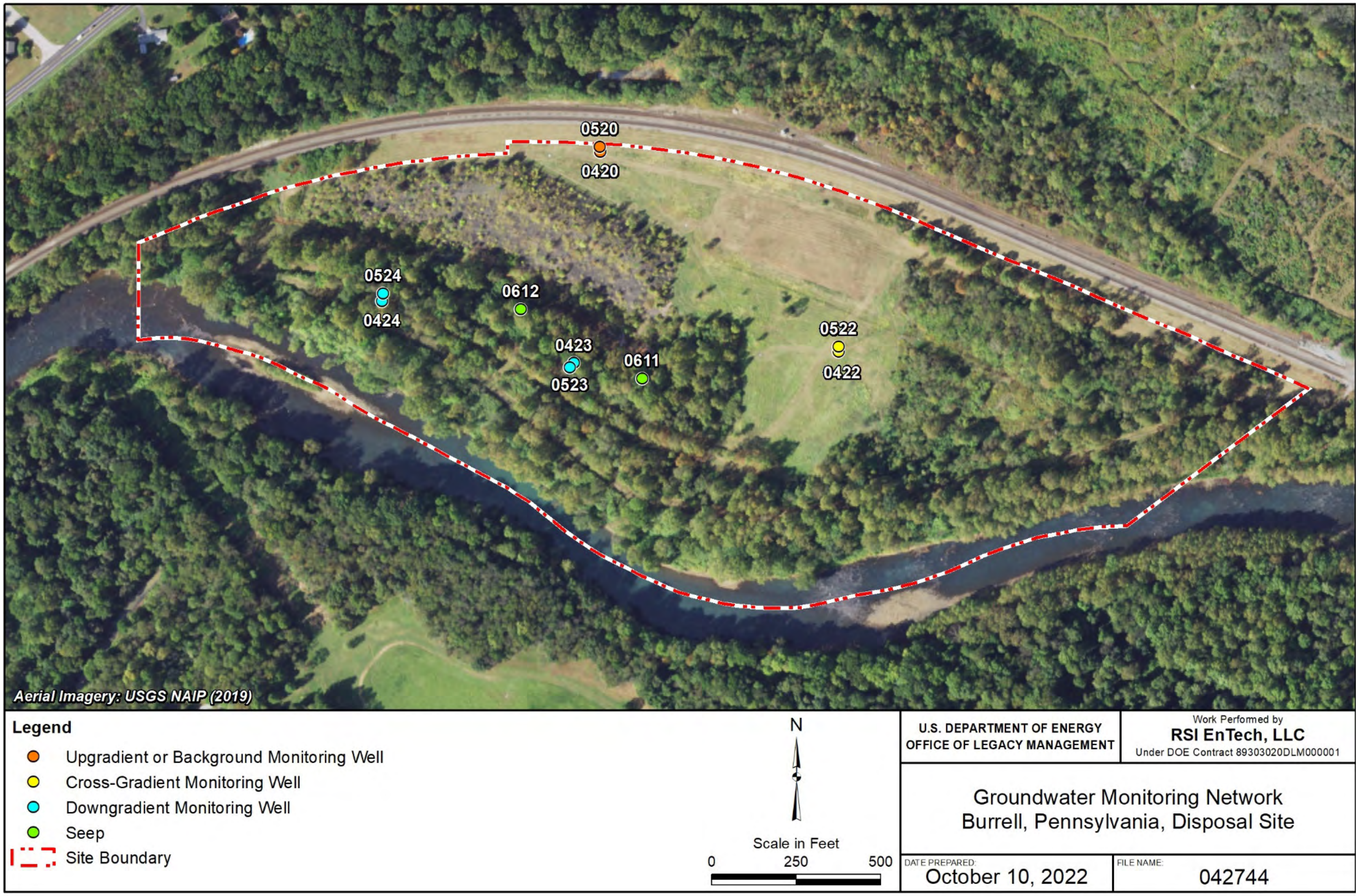


Figure 2-2. Groundwater Monitoring Network for the Burrell, Pennsylvania, Disposal Site

2.8.2 Vegetation Management

In accordance with the Vegetation Management Plan, mowing and spot herbicide application continue. Vegetation management activities include ensuring that the fence line and access paths remain clear of the invasive species Japanese knotweed (*Reynoutia 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 2022, 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 cell cap. 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 not mowed in 2021 or 2022.

The test prairie appears to be progressing, though a diverse flowering community is not expected for several years. It is recommended that the prairie be mowed 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.

2.9 References

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 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), 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.

2.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	45	New Blacktop Crossing to Site Entrance
PL-2	280	North Fence Line
PL-3	—	Site Marker
PL-4	—	Quality Control Monument QC-4 and Survey Monument SM-102
PL-5	—	Monitoring Well 0420
PL-6	215	North Side of Disposal Cell
PL-7	—	Hole Repaired in Conservation Reuse Prairie Test Plot Area
PL-8	—	Unauthorized Hunting Blind to Be Removed
PL-9	—	Unauthorized Hunting Blind to Be Removed

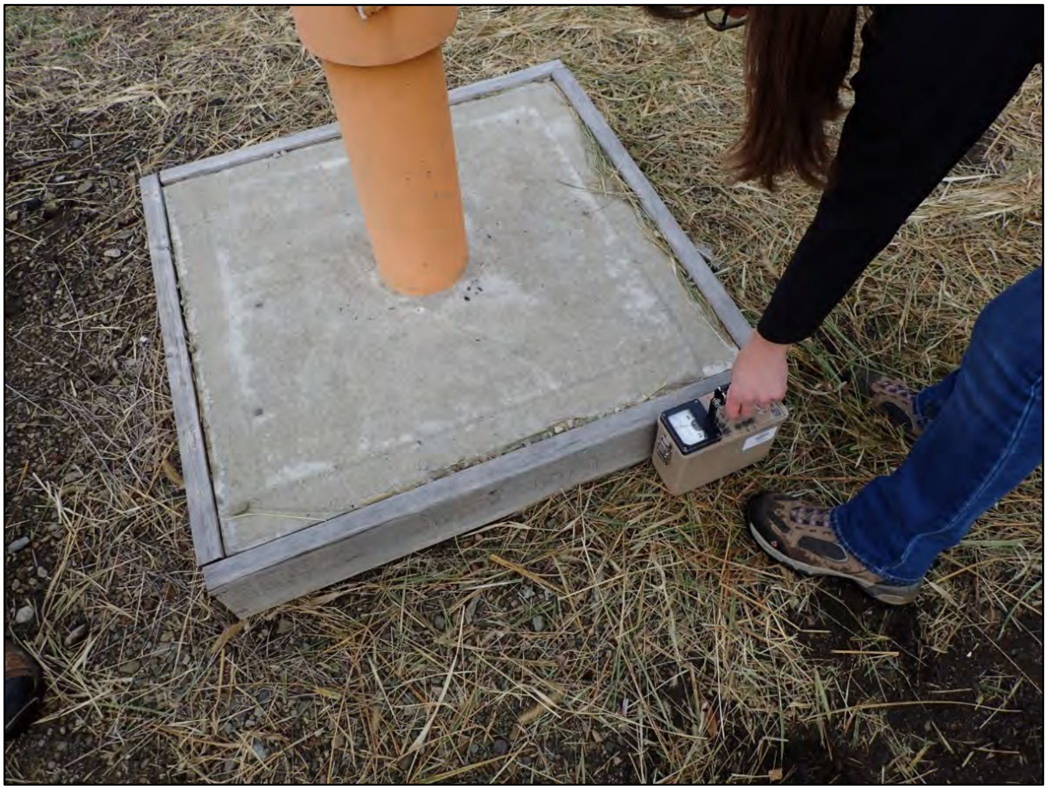
Note:
— = Photograph taken vertically from above.

PL-1. New Blacktop Crossing to Site Entrance

PL-2. North Fence Line

PL-3. Site Marker

PL-4. Quality Control Monument QC-4 and Survey Monument SM-102



PL-5. Monitoring Well 0420

PL-6. North Side of Disposal Cell

PL-7. Hole Repaired in Conservation Reuse Prairie Test Plot Area

PL-8. Unauthorized Hunting Blind to Be Removed

PL-9. Unauthorized Hunting Blind to Be Removed

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 26, 2022. No changes were observed on the disposal cell or in the associated drainage features. No evidence of site trespassing was observed with the exception of a small pile of trash found east of the gravel turnaround and north of the railroad tracks. 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 2018. All sampling results were below the site-specific alternate concentration limit (ACL) for uranium in groundwater and the point of exposure (POE) limit in surface water.

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 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 3.5	(b)(4)
Maintenance	Section 3.5	Section 3.6	(b)(5)
Environmental Monitoring	Section 3.7	Section 3.7	(b)(2)
Emergency Response	Section 3.6	Section 3.8	(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 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 26, 2022. The inspection was conducted by K. Broberg and B. Wulker of the Legacy Management Support contractor. T. Drake (LM), K. Barnes and A. Taverna (NRC), C. Rajkovich (Pennsylvania Department of Environmental Protection), D. Rhome (mayor of Canonsburg), C. Bier (site mowing contractor), and T. Biller (site herbicide contractor) 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.

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 2022 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 3.10.

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. Locks on all gates were replaced during the inspection. The entrance sign is posted on the main entrance gate. Three additional information signs were also posted on the main entrance gate during the inspection. A few minor maintenance needs were identified.

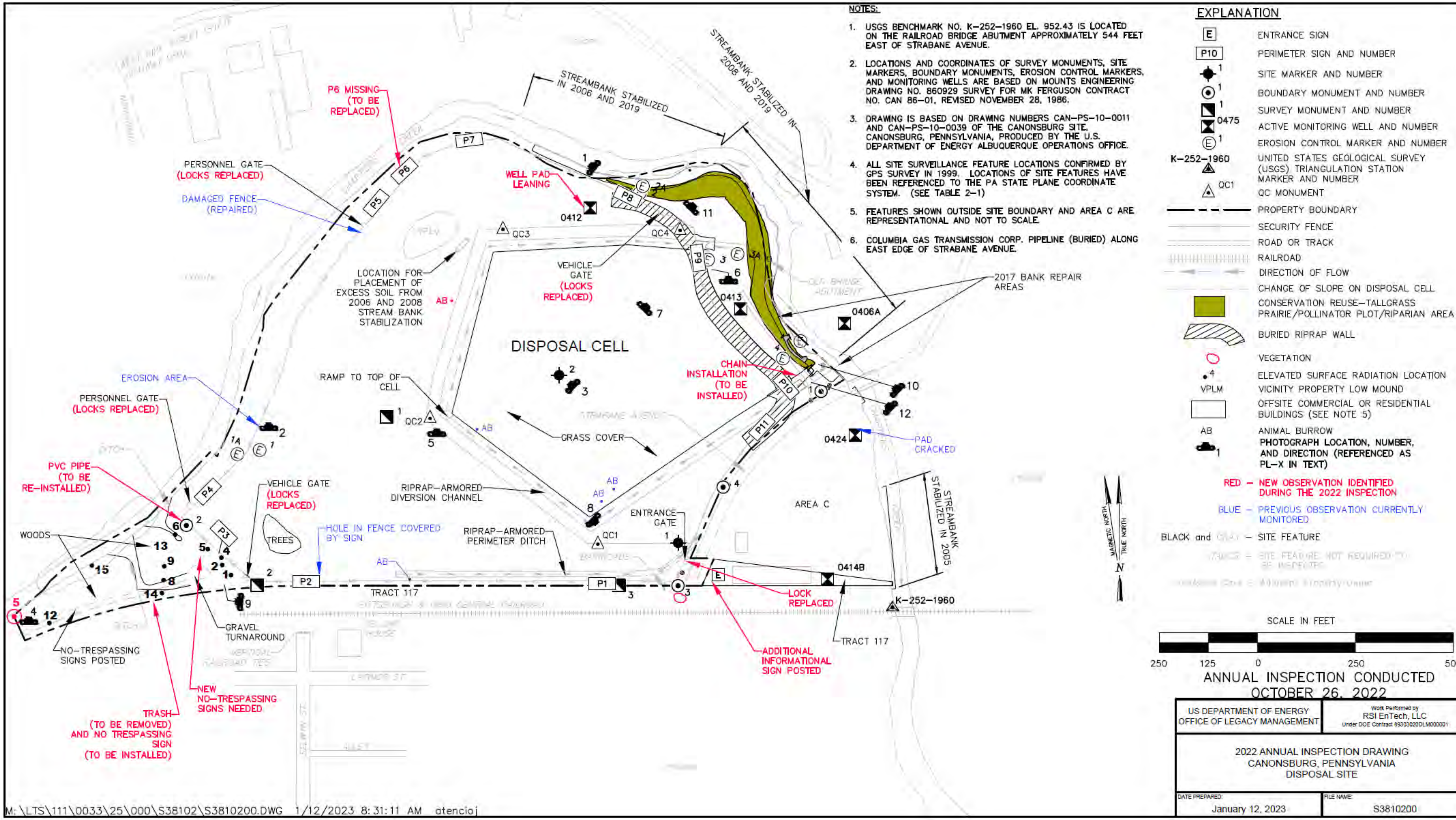


Figure 3-1. 2022 Annual Inspection Drawing for the Canonsburg, Pennsylvania, Disposal Site

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 (PL-1). 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 (PL-2).

There are 11 perimeter signs attached to the security fence. Theft of perimeter signs from the south 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 and replaced. A few minor maintenance items were noted during this year’s inspection. Sign P6 could not be located and needs to be replaced.

3.4.1.3 Site Markers

The site has two granite site markers. Site marker SMK-1 is just inside the main entrance gate, and site marker SMK-2 is on the top slope of the disposal cell (PL-3). 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 (PL-4). 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, it was decided to mark their locations with a section of PVC pipe filled with pea gravel. The PVC pipe marking the location of boundary monument BM-2 had been removed and needs to be reinstalled. The top of the PVC marker at boundary monument BM-3 was hard to locate due to grass growth. Arrangements will be made to have the grass around the marker sprayed to make the marker more visible. No other 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 inspected during the 2022 annual inspection (PL-5). 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. No maintenance needs were identified (PL-6).

3.4.1.7 Monitoring Wells

The site has five groundwater monitoring wells. The well interiors are inspected when they are sampled. Monitoring wells were last sampled and inspected in October 2018. The areas outside the wells were inspected in 2022, and the wellhead protectors were found to be undamaged and locked. There is a crack in the well pad of monitoring well 0424, but the pad remains serviceable. It will be evaluated for replacement or repair during the next regularly scheduled sampling. The well pad of monitoring well 0412 is leaning. The interior of the protective casing will be inspected when the well is next sampled to determine if the protective casing is impinging on the actual well casing. 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 (PL-7). 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 such 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. No new significant burrows were noted on the disposal cell during the inspection. Inspectors will continue to monitor the location and significance of burrows. No 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 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-8). 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 it 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 2022 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 (PL-9). No-trespassing signs marking the edge of the turnaround are faded and worn and in need of replacement.

A small pile of trash was present 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, and additional no-trespassing signage will be installed.

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. No concerns with the current riprap embankment were noted during the inspection (PL-10).

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 3-year survival rate of approximately 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 (PL-11).

The riparian forest buffer is also recognized as a means 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. A chain that limits vehicle access to the site near the riparian forest buffer and reuse prairie was down because the post it was attached to had been removed (PL-12). Repair to this access point will be implemented before the next 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 in 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 on 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 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.

3.6 Maintenance

Before the 2022 inspection, a new boundary monument, BM-5, was installed at the southwestern corner of the site. Inspectors posted three additional information signs on the main entrance gate during the inspection. The following minor maintenance items were identified during the 2022 inspection that will be completed before the next inspection:

- Replacement of perimeter sign P6
- Replacement of the no-trespassing signs surrounding the gravel turnaround
- Replacement of the PVC riser that marks the location of boundary monument BM-2
- Treatment of the vegetation surrounding boundary monument BM-3
- Repair of the well pads of monitoring wells 0412 and 0424
- Replacement of the access chain and post near the riparian forest buffer
- Removal of the small pile of trash west of the turnaround
- Installation of additional no-trespassing signage at the turnaround area

3.7 Environmental Monitoring

3.7.1 Groundwater Monitoring

In accordance with the LTSP, LM conducts groundwater monitoring every 5 years 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 and Alternate Concentration Limits for the Canonsburg, Pennsylvania, UMTRA Project Site* (DOE 2000); and (3) ensure that remedial actions at the disposal site and Area C continue to protect human health, safety, and the environment. The most recent sampling occurred in October 2018.

The groundwater monitoring network consists of five monitoring wells—three POC wells and two best management practice wells (Table 3-2 and Figure 3-2). All monitoring wells are completed in the uppermost aquifer (shallow, unconsolidated materials). Groundwater is sampled and analyzed for the one constituent of concern—uranium. The ACL is 1 milligram per liter (mg/L) for groundwater at the POC wells. With the exception of monitoring wells 0412 and 0413, uranium concentrations in 2018 were also below the UMTRCA maximum concentration limit (MCL) of 0.044 mg/L.

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

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

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/#site=CAN). Additionally, the *2018 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites* (DOE 2019) presents the comprehensive monitoring results for 2018. The next routine sampling event is scheduled for 2023.

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

3.7.2 Surface Water Monitoring

In accordance with the LTSP, LM also conducts surface water monitoring every 5 years. The most recent sampling event occurred in October 2018. Uranium concentrations in surface water sampled in 2018 were below the established ACL of 0.01 mg/L.

One surface water monitoring location, 0602, is the POE for Chartiers Creek and is sampled and analyzed for uranium. In 2018, the uranium concentration from surface water monitoring location 0602 had a concentration of 0.00096 mg/L, significantly below the MCL.

The *2018 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites* (DOE 2019) presents the comprehensive monitoring results for 2018. The next routine sampling event is scheduled for 2023.

3.7.3 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 (*Securigera varia*). 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.

3.8 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.

3.9 References

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), 2000. *Ground Water Compliance Action Plan and Application for Alternate Concentration Limits for the Canonsburg, Pennsylvania, UMTRA Project Site*, LMS/U0035901, February.

DOE (U.S. Department of Energy), 2013. *Long-Term Surveillance Plan for the U.S. Department of Energy Canonsburg Uranium Mill Tailings Disposal Site, Canonsburg, Pennsylvania*, LMS/CAN/S00404, Office of Legacy Management, March.

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.

3.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	310	Riprap Along Streambank
PL-2	—	Slats in Fence at Erosion Area
PL-3	315	Site Marker SMK-2
PL-4	—	Newly Installed Boundary Monument BM-5
PL-5	—	Quality Control Monument QC-2
PL-6	—	Erosion Control Marker 3
PL-7	45	Top of Disposal Cell
PL-8	135	Riprap-Armored Diversion Channel
PL-9	275	Gravel Turnaround Area
PL-10	315	Riprap-Armored Streambank
PL-11	45	Newly Installed Tree Cages
PL-12	315	Restoration Signage at the Riparian Forest Buffer and Reuse Prairie

Note:
— = Photograph taken vertically from above.

PL-1. Riprap Along Streambank

PL-2. Slats in Fence at Erosion Area

PL-3. Site Marker SMK-2

PL-4. Newly Installed Boundary Monument BM-5

PL-5. Quality Control Monument QC-2

PL-6. Erosion Control Marker 3

PL-7. Top of Disposal Cell

PL-8. Riprap-Armored Diversion Channel

PL-9. Gravel Turnaround Area

PL-10. Riprap-Armored Streambank

PL-11. Newly Installed Tree Cages

PL-12. Restoration Signage at the Riparian Forest Buffer and Reuse Prairie

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 June 8, 2022, and the annual groundwater monitoring event in June 2022. No cause for a follow-up inspection was identified.

LM repaired the depression in October 2022. No changes were observed on the top of the disposal cell or associated drainage features. Inspectors identified minor maintenance items listed in Section 4.6.

The most recent annual sampling event occurred in June 2022. Concentrations of molybdenum, selenium, and uranium at the three point of compliance (POC) wells, 0607, 0612, and 0621 are below site-specific thresholds. In addition to the annual sampling event, as a best management practice, LM samples 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.

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.

4.4 Inspection Results

The site, 3.5 miles southwest of Durango, Colorado, was inspected on June 8, 2022. The inspection was conducted by D. Miller, J. Doebele, and T. Thoele of the Legacy Management Support (LMS) contractor. M. Kautsky (LM) and M. Cosby (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 a follow-up inspection is 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 2022 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.

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 surrounding vegetation.

Perimeter sign P6 was obscured by overgrown vegetation that will be treated before the next inspection.

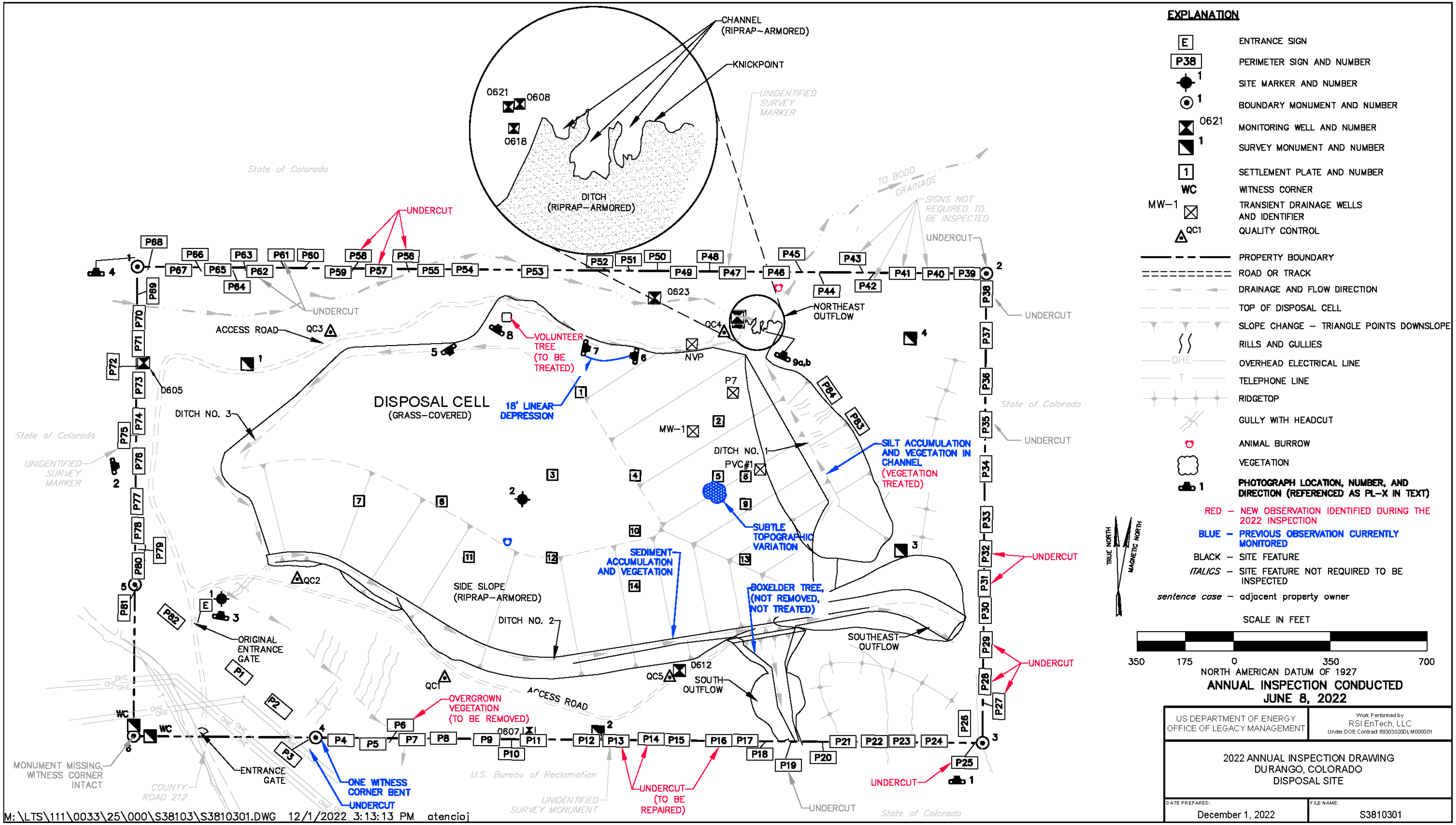


Figure 4-1. 2022 Annual Inspection Drawing for the Durango, Colorado, Disposal Site

The concrete bases of several perimeter signs continue to be undercut. Newly identified undercut signs include perimeter signs P13, P14, P16, P25, P27, P28, P29, P31, P32, P56, P57, and P58 (PL-1). The undercutting at perimeter signs P13, P14, and P16 is advanced enough that the signs require repair.

Several perimeter signs, P17, P34, P71, P74, P76, P79, and P80, have bullet holes but are still legible (PL-2). No other maintenance needs were identified.

4.4.1.3 Site Markers

The site has two site markers. Site marker SMK-1 (PL-3) is just inside the original entrance gate and was in good condition. Site marker SMK-2 is on the top slope of the disposal cell. 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. Boundary monument BM-6 has been missing since the adjacent U.S. Bureau of Reclamation (USBR) pipeline was installed, bringing the current number of boundary monuments to five. However, both witness corners to boundary monument BM-6 were present, so replacement of boundary monument BM-6 is not warranted at this time. Boundary monument BM-1 was visible during the 2022 inspection (PL-4). No other maintenance needs were identified.

4.4.1.5 Aerial Survey Quality Control Monuments

Five aerial survey quality control monuments were inspected during the 2022 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 (PL-5). 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 top of the disposal cell. No maintenance needs were identified.

4.4.2.2 Side Slopes of Disposal Cell

The side slopes of the disposal cell are armored with rock riprap. Rock has moved along the north toe of the disposal cell, resulting in a linear depression approximately 18 feet (ft) long (PL-6) that first was observed in 2015 and continues to be monitored. Inspectors observed changes in length or width, or both, in the depression. The depression was repaired in October 2022 (PL-7).

A subtle topographic variation in the surface of the northeast side slope, first observed during the 2018 annual inspection, was observed again in 2022. The variation does not warrant concern at this time, as no evidence of erosion or subsidence was found during the 2022 inspection. Inspectors will continue to monitor the variation.

Inspectors found several young volunteer trees growing on the north side slope (PL-8). The trees will be treated following the inspection. 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 needed at this time.

The riprap-covered outflows of the drainage ditches were designed to self-armor over time. The outflows and drainage channels below them are monitored annually. A large boxelder tree is growing along the edge of the south outflow channel but does not affect the stability or effectiveness of the channel. A large arroyo has formed below the southeast outflow, which indicates that the drainage ditch is functioning properly. The uplands above the northeast outflow are steadily eroding (PL-9[a] and PL-9[b]), but this is not affecting the stability or effectiveness of the outflow area. No maintenance needs were identified.

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 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 changes or new features were identified. Colorado Parks and Wildlife manages land to the north, west, and east of the site, and USBR 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.

4.6 Maintenance

Noxious weeds growing near the northern side slope of the disposal cell were treated immediately following the 2022 inspection. The following maintenance needs are scheduled to be completed before the next inspection:

- Removal of vegetation around perimeter sign P6
- Treatment of noxious weeds and volunteer trees on the side and top slopes of the disposal cell
- Repair of the undercut perimeter signs P13, P14, and P16

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. Monitoring wells 0608, 0618, and 0623 are sampled more frequently to support the evaluation of variable uranium concentrations observed in well 0618 (DOE 2019). The most recent annual sampling event occurred at the site on June 8, 2022. LM inspected the monitoring wells during the sampling event, and no maintenance needs were identified.

The LTSP establishes three POC wells at the site. The POC 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 is also completed in the uppermost bedrock aquifer.

Concentrations of indicator parameters (molybdenum, selenium, and uranium) in POC wells (0607, 0612, and 0621) in the uppermost aquifer are below respective standards. Wells completed in the alluvium are sampled as a best management practice. Uranium concentrations in well 0618 have consistently been variable and typically higher than concentrations in the other onsite wells.

Table 4-2 presents the current groundwater monitoring network. These locations are shown in Figure 4-2.

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	BMP	Downgradient (alluvium)
0612	POC	Downgradient (bedrock aquifer)
0618	BMP	Downgradient (alluvium)
0621	POC	Downgradient (bedrock aquifer)
0623	BMP	Upgradient (alluvium)

Abbreviation:
BMP = best management practice

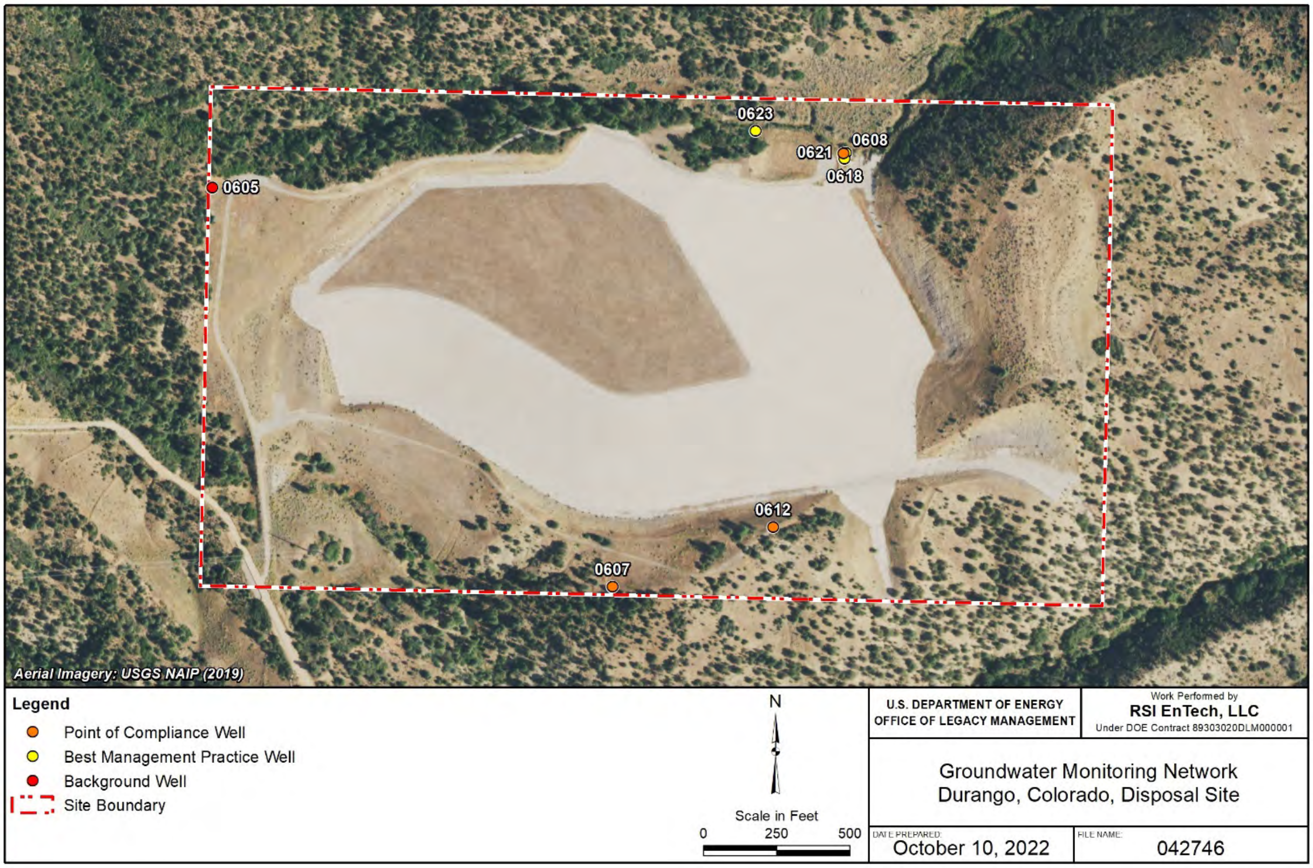


Figure 4-2. Groundwater Monitoring Network for the Durango, Colorado, Disposal Site

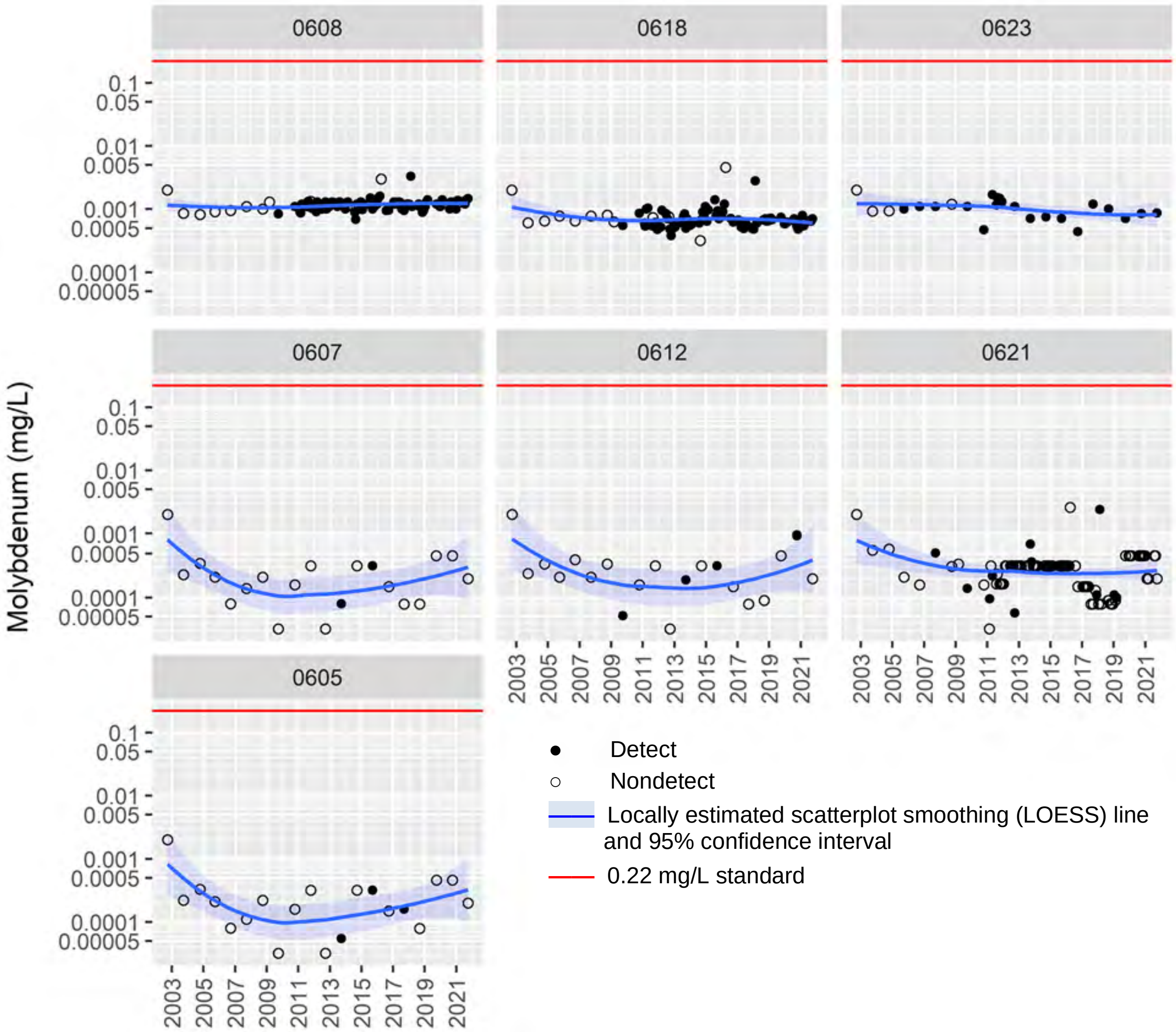
Groundwater is sampled annually for three constituents: molybdenum, selenium, and uranium. The site-specific concentration thresholds or standards for the three constituents represent the respective maximum observed background concentrations reported in groundwater samples collected from wells completed in the bedrock aquifer, as identified in Table 4 of the LTSP. Table 4-3 provides these site-specific standards. Figure 4-3 through Figure 4-5 show the time-concentration plots for the three constituents, along with corresponding site-specific standards. 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/#site=DUD).

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

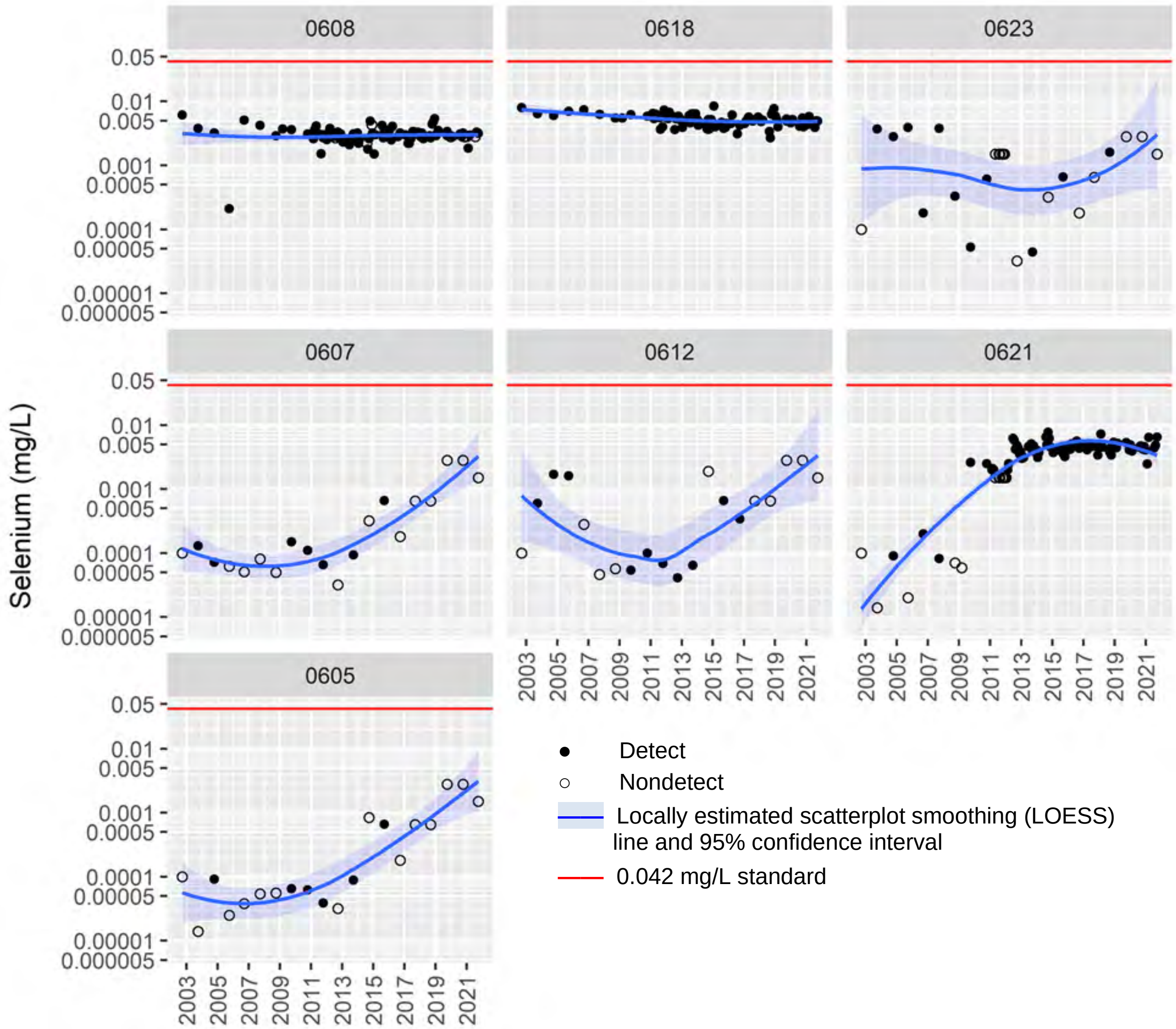
Abbreviation:
mg/L = milligrams per liter

Figure 4-3 through Figure 4-5 show the time-concentration plots for molybdenum, selenium, and uranium, respectively, along with corresponding site-specific standards.



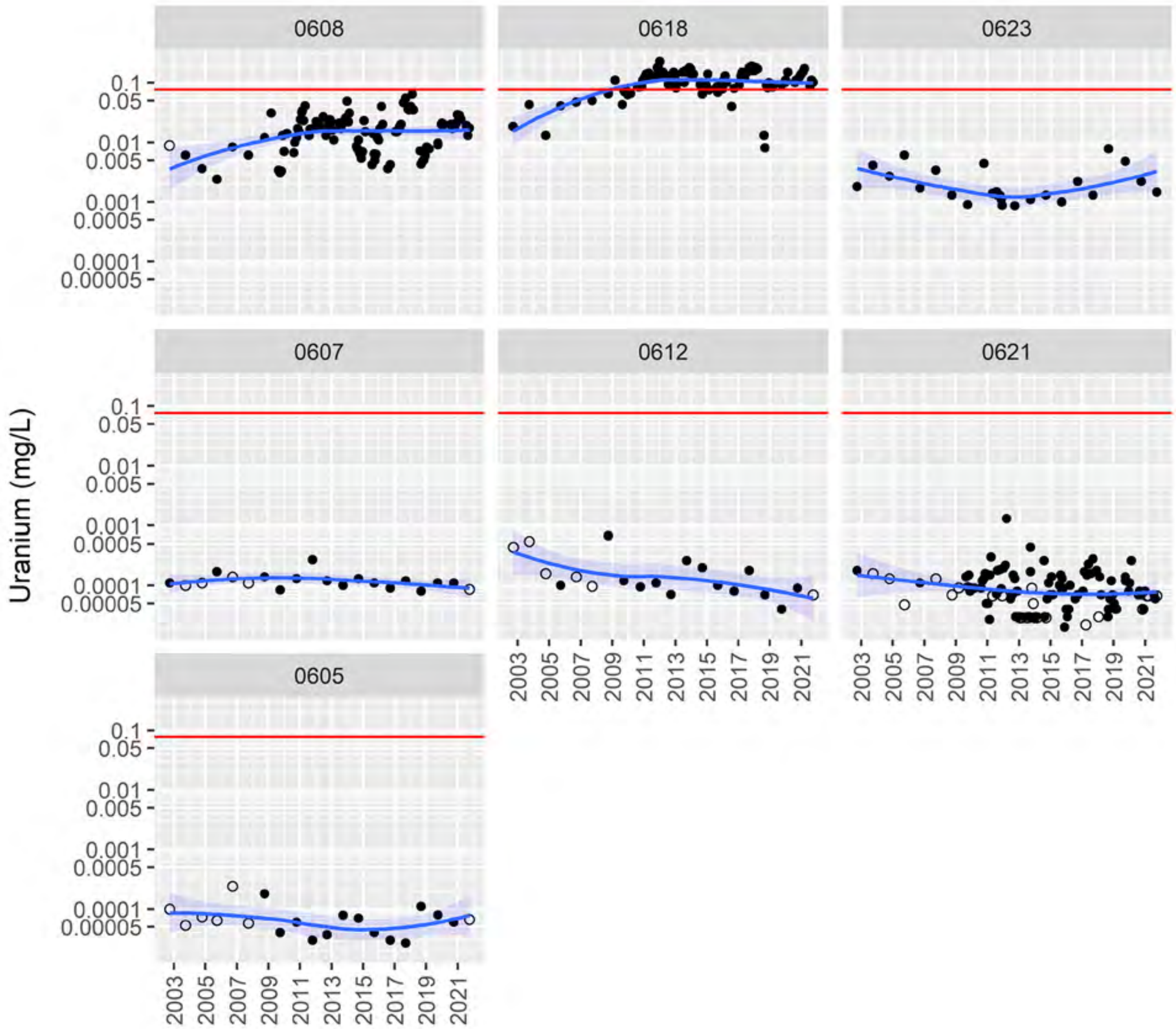
Notes: Wells are ordered by purpose: Monitoring wells with no compliance type are listed in the top row, followed by POC wells (second row). Data for background well 0605 are plotted last.
A faceting approach, whereby data are partitioned into a matrix of panels, with each panel plotting data for a single 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. Because of the wide range in indicator parameter concentrations measured in site wells, a semilogarithmic scale is used. These figures were developed using R, version 4.2.1 (R Foundation 2022), and the ggplot2 package, version 3.3.6 (Wickham 2016).
Abbreviation: mg/L = milligrams per liter

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



Notes: Wells are ordered by purpose: Monitoring wells with no compliance type are listed in the top row, followed by POC wells (second row). Data for background well 0605 are plotted last.
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. Because of the wide range in indicator parameter concentrations measured in site wells, a semilogarithmic scale is used. These figures were developed using R, version 4.2.1 (R Foundation 2022), and the ggplot2 package, version 3.3.6 (Wickham 2016).
Abbreviation: mg/L = milligrams per liter

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



Notes: Wells are ordered by purpose: Monitoring wells with no compliance type are listed in the top row, followed by POC wells (second row). Data for background well 0605 are plotted last.
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. Because of the wide range in indicator parameter concentrations measured in site wells, a semilogarithmic scale is used. These figures were developed using R, version 4.2.1 (R Foundation 2022), and the ggplot2 package, version 3.3.6 (Wickham 2016).
Abbreviation: mg/L = milligrams per liter

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

4.8.2 Vegetation Monitoring

Vegetation on top of the disposal cell remains healthy. The LTSP requires deep-rooted plants on the disposal cell cover and side slopes to be eliminated by either selective spraying or mechanical removal when their shoot height equals or exceeds 3.5 ft. Several noxious weeds identified at the time of the inspection were treated following the 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

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.

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 March 22, 2022.

The R Foundation, 2022. "The R Project for Statistical Computing," The R Foundation for Statistical Computing, version 4.2.1, https://www.r-project.org, accessed July 1, 2022.

Wickham, H., 2016. "ggplot2: Elegant Graphics for Data Analysis," Springer-Verlag, New York, https://ggplot2.tidyverse.org, accessed July 1, 2022.

4.11 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	0	Undercuts of Perimeter Sign P25
PL-2	81	Perimeter Sign P76, with Bullet Holes
PL-3	10	Site Marker SMK-1
PL-4	—	Boundary Monument BM-1
PL-5	147	Top of Disposal Cell, Looking Southeast
PL-6	278	Depression on North Toe of Disposal Cell Before Repair
PL-7	100	Repair to Depression, October 2022
PL-8	31	Young Ponderosa Pines in Riprap Along North Side Slope
PL-9	15 15	(a) Northeast Outflow in 2022 (b) Northeast Outflow in 2006 Photo for Comparison

Note:
— = Photograph taken vertically from above.

PL-1. Undercuts of Perimeter Sign P25

PL-2. Perimeter Sign P76, with Bullet Holes

PL-3. Site Marker SMK-1

PL-4. Boundary Monument BM-1

PL-5. Top of Disposal Cell, Looking Southeast

PL-6. Depression on North Toe of Disposal Cell Before Repair

PL-7. Repair to Depression, October 2022

PL-8. Young Ponderosa Pines in Riprap Along North Side Slope

PL-9(a). Northeast Outflow in 2022

PL-9(b). Northeast Outflow in 2006 Photo for Comparison

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 May 10, 2022. 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) (2008 LTSP) that states that DOE has fulfilled the monitoring requirements for disposal cell performance and groundwater compliance. 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 in February 2022.

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 shall 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.

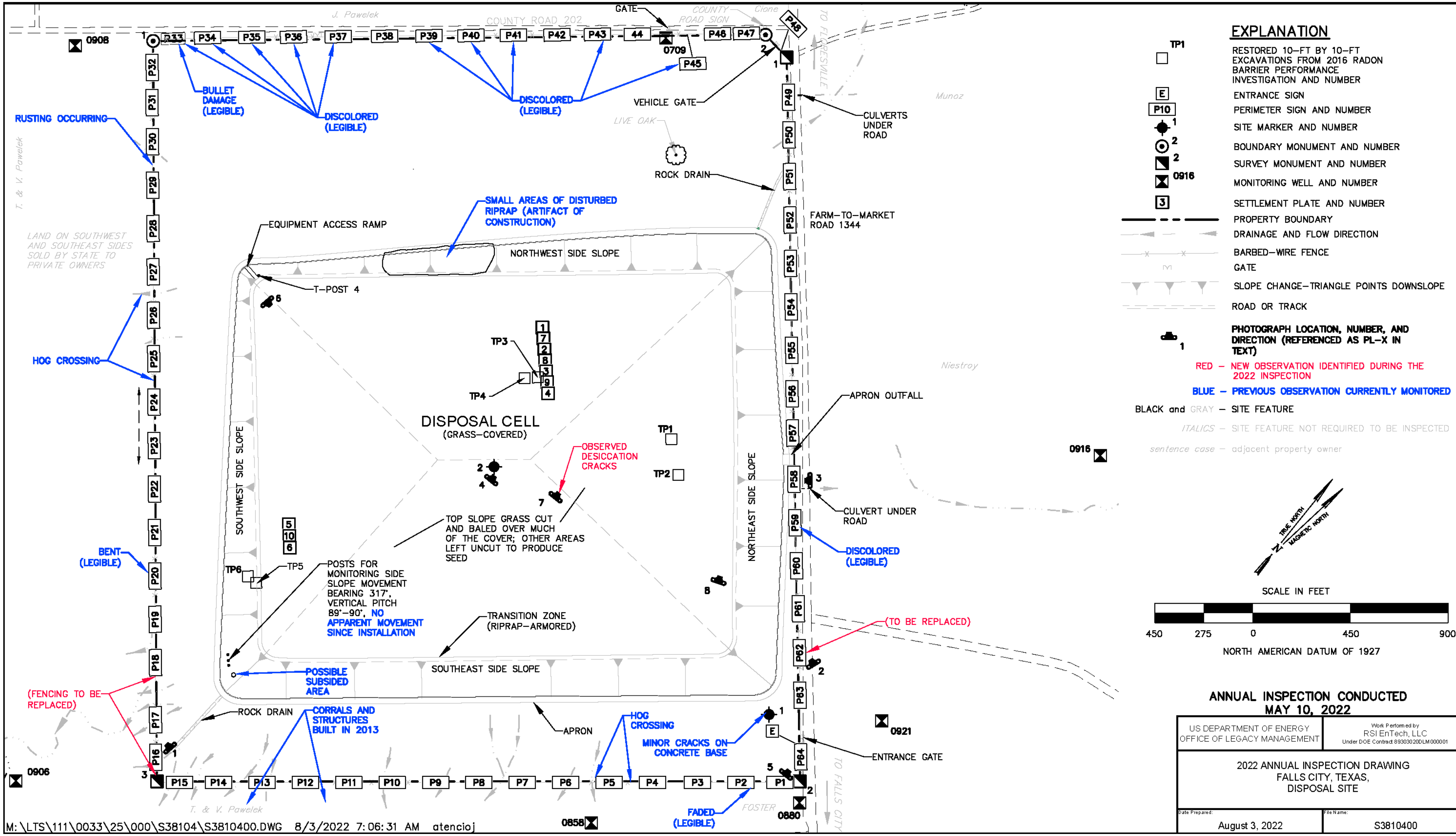


Figure 5-1. 2022 Annual Inspection Drawing for the Falls City, Texas, Disposal Site

5.4 Inspection Results

The site, 8 miles southwest of Falls City, Texas, was inspected on May 10, 2022, by D. Marshall and J. Doebele 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.

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 2022 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. The entrance sign is next to the main entrance gate. No 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 fence on the southwest side, between perimeter sign P18 and survey monument SM-3, showed signs of rust and damage from cattle crossing the fence and accessing the site (PL-1). This section of the fence will be replaced to ensure site security.

Wild hogs dig under the perimeter fence line in some areas. Their crossings are filled in by the LMS maintenance subcontractor, as these crossings can potentially compromise the integrity of the perimeter fence or damage haying equipment.

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 sign P62 was broken in half and will be replaced before the 2023 inspection (PL-2). Perimeter sign P33 has bullet damage but remains legible. Additional perimeter signs are fading but remain legible (PL-3). 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 at this time. Site marker SMK-2 is on the top slope of the disposal cell (PL-4). 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 (PL-5). All monuments were located. No maintenance needs were identified.

5.4.1.5 Monitoring Wells

There is one monitoring well onsite; 11 monitoring wells are offsite. All monitoring wells were inspected during the February 2022 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 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 top and side slopes of the disposal cell, apron outfall, 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 (PL-6). 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 May 2022 inspection, hay bales were present on the property.

Desiccation cracks were observed in the soil on the top of the disposal cell (PL-7). There was no evidence of erosion, settling, slumping, or other modifying processes that might affect the integrity of the disposal cell. No areas of ponded water or areas of settlement were observed on top of the disposal cell during the 2022 inspection.

Riprap armors the disposal cell side slopes and a transition zone where the top slope meets the side slopes (PL-8). LM has 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.

Fractured riprap has been observed on the disposal cell side slopes since it was completed. Pieces of riprap are fractured in place, indicating that the fracturing occurred after placement. Fracturing is likely a consequence of mechanical placement or thermal expansion and contraction; the riprap condition appears stable.

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. Some displacement of smaller rock has occurred, as would be expected from use, but the ramp continues to provide a stable driving surface.

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. 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. 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.

No water was flowing in the south rock drain during the inspection. 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 to 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. Grass is cut and baled 1 to 3 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 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.

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 to be completed before the next inspection:

- Replacement of perimeter sign P62
- Replacement of the perimeter fence between P18 and survey monument SM-3

No other maintenance needs were identified.

5.7 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 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 February 2022. 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, albeit 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 and Figure 5-2 describe and illustrate the groundwater monitoring network at the site, which includes the groundwater compliance monitoring wells and the disposal cell performance monitoring wells. 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.

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

Groundwater Monitoring Purpose	Monitoring Wells	Comments
Disposal cell performance monitoring	0709, 0858, 0880, 0906, 0908, 0916, and 0921	Well 0880 is completed in the Deweesville unit; remaining disposal cell performance wells are completed in the Conquista unit. Wells 0908 and 0916 have been dry since 1987.
Groundwater compliance monitoring	0862, 0886, 0891, 0924, and 0963	Well 0886 is completed in the Deweesville unit and is considered a sentinel well for groundwater flow toward the Conquista site. Wells 0924 and 0963 are completed in the Conquista unit, and wells 0862 and 0891 are completed in the underlying Dilworth unit. Wells 0924 and 0891 are considered sentinel wells for the Conquista and Dilworth units, respectively (DOE 1997a).

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 levels at a monitoring well without an attendant drop in pH might still indicate movement of processing-related contamination.

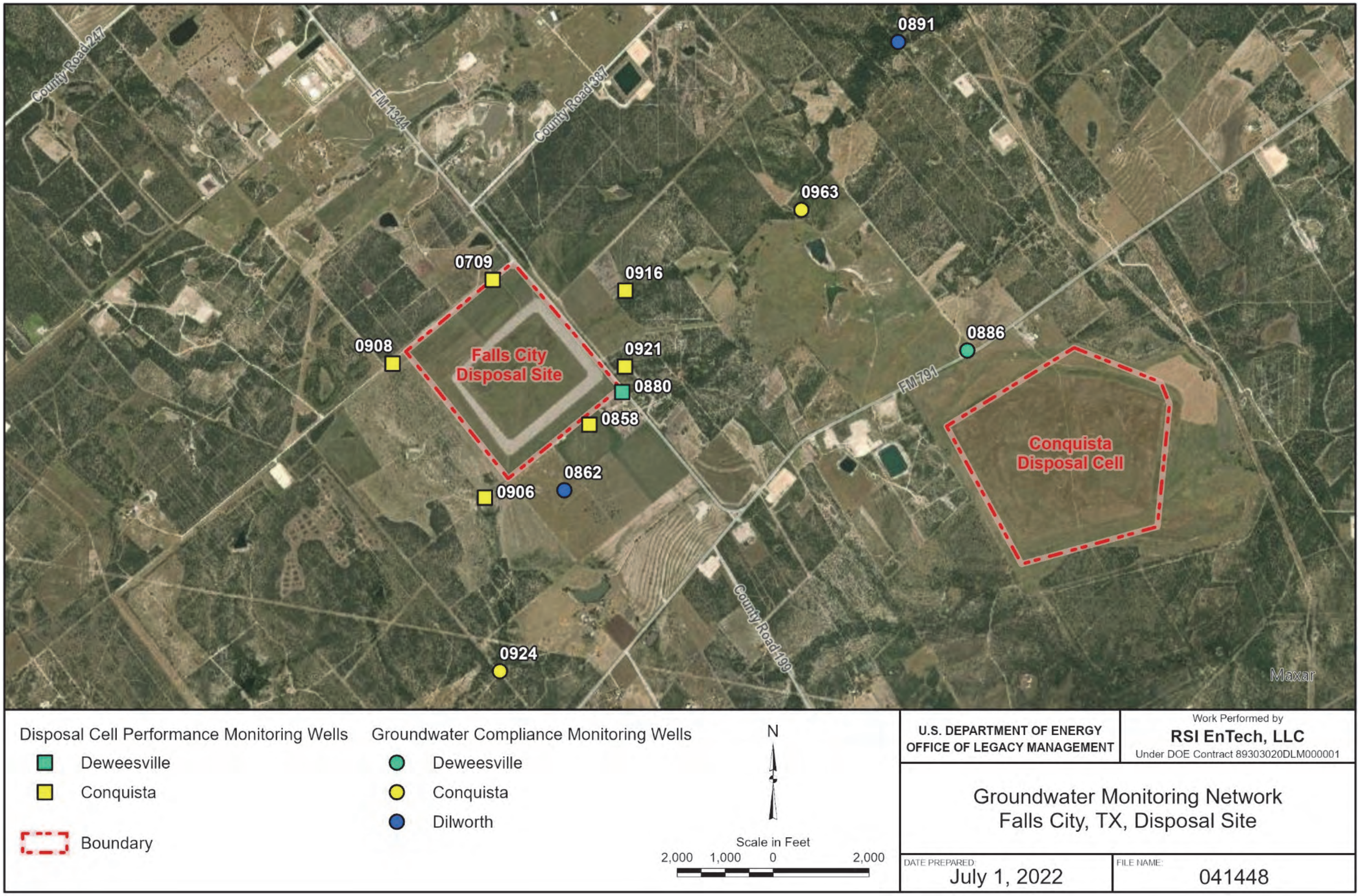


Figure 5-2. Groundwater Monitoring Well Network at the Falls City, Texas, Disposal Site

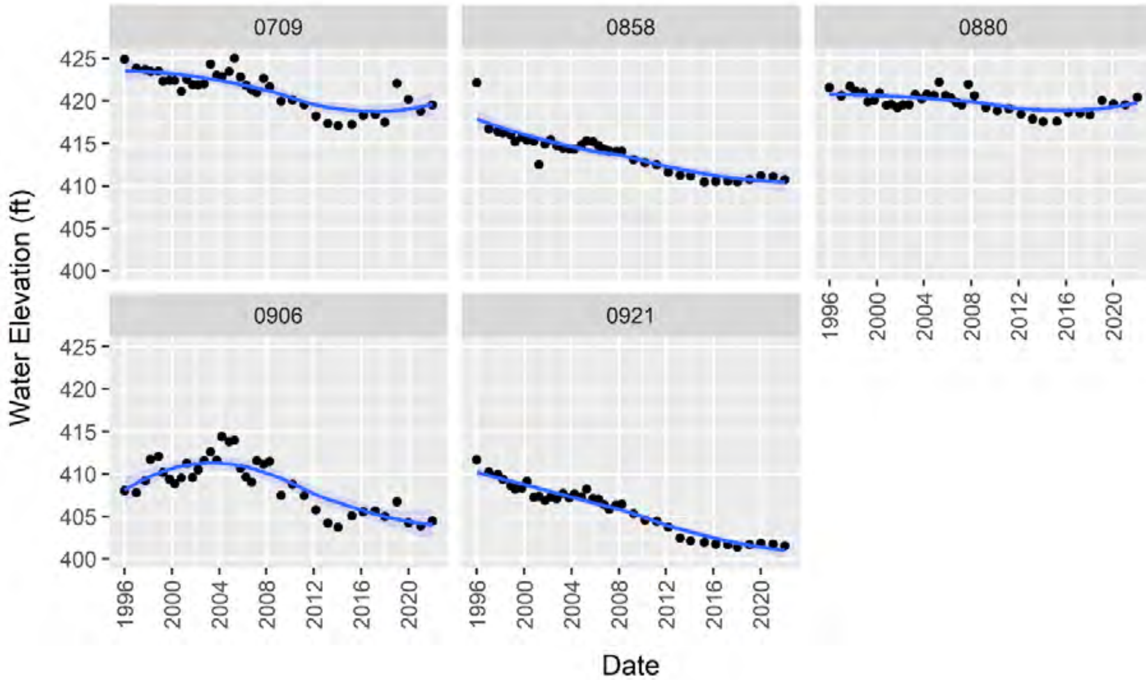
The following sections (Sections 5.8.2 and 5.8.3) present monitoring results for groundwater levels and groundwater quality (pH and uranium), respectively. To support these discussions, Figure 5-3 through Figure 5-8 use a faceting approach, whereby data are partitioned into a matrix of panels, with each 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. Because of the wide range in uranium contaminant concentrations measured in site wells (0.0003–14 milligrams per liter [mg/L]), a semilogarithmic scale is used.

Figure 5-3 through Figure 5-8 were developed using R, version 4.1.2 (R Foundation 2022), and the ggplot2 package, version 3.3.5 (Wickham 2016). To support interpretation of these figures, Mann-Kendall trend analysis was performed for each well-parameter combination to characterize 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 this section (Table 5-3).

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/#site=FCT).

5.8.2 Groundwater Level Monitoring Results

Water levels in all disposal cell performance wells had significant decreasing trends from 1996 to 2022 based on Mann-Kendall trend analyses (Figure 5-3). Since 1996, water levels in wells 0858 and 0921 decreased 10 to 11 ft. Smaller declines are apparent for remaining wells (0709, 0880, and 0906), with 2022 water levels 1.2–5.4 ft lower than corresponding 1996 elevations. Groundwater compliance wells 0862, 0886, and 0963 had significant increasing water level trends since 1996 (5–7 ft increases); well 0891 had no statistically significant trend (Figure 5-4). Although a significant decreasing trend was identified for well 0924, water levels have declined only about 0.4 ft since 1996.



Note: Disposal cell performance monitoring wells 0908 and 0916 have been dry since 1987.

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

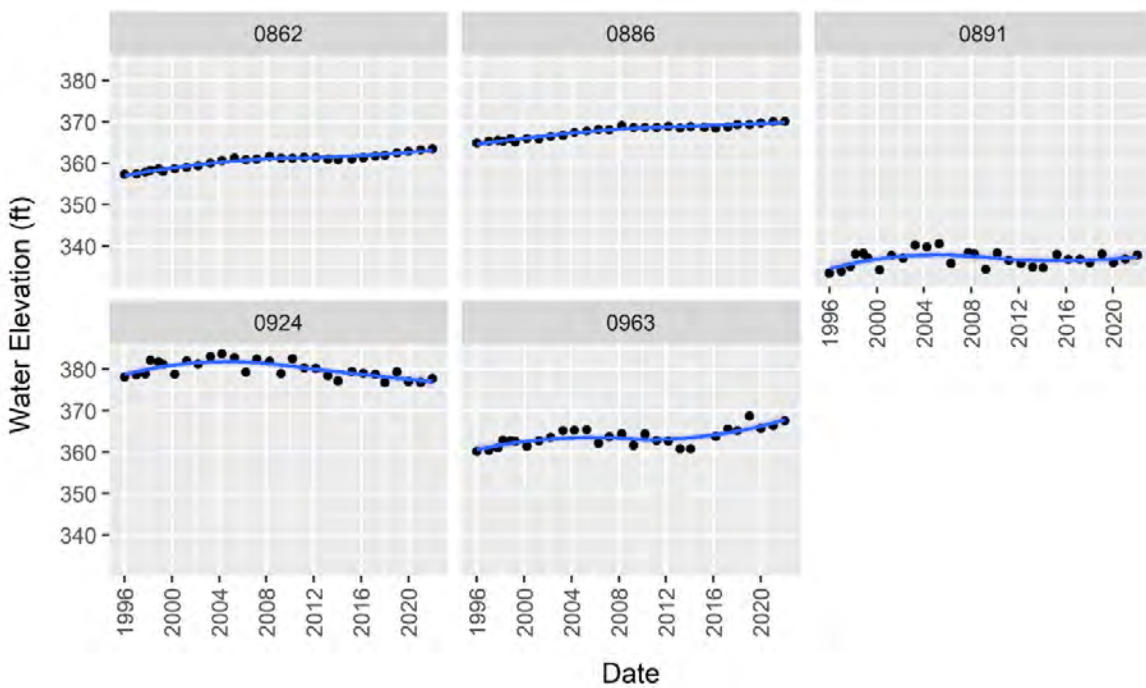
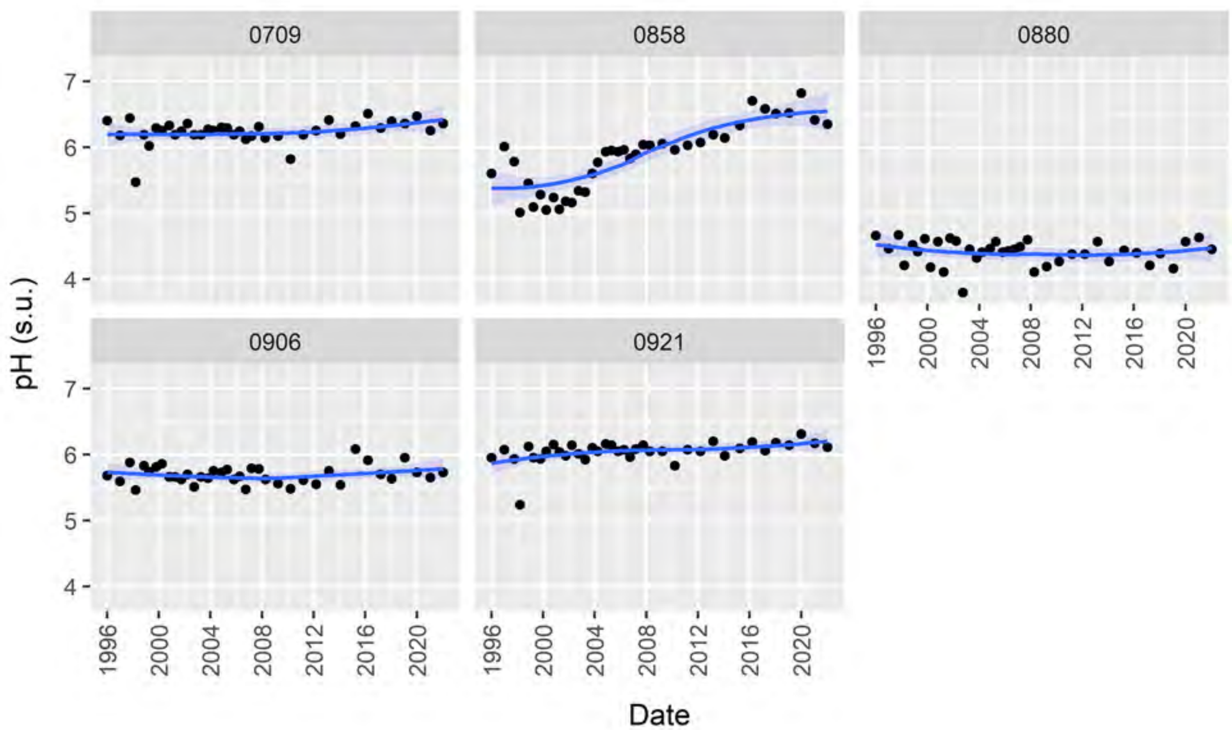


Figure 5-4. Water-Level Measurements at Groundwater Compliance Monitoring Wells at the Falls City, Texas, Disposal Site

5.8.3 Groundwater Quality Monitoring Results

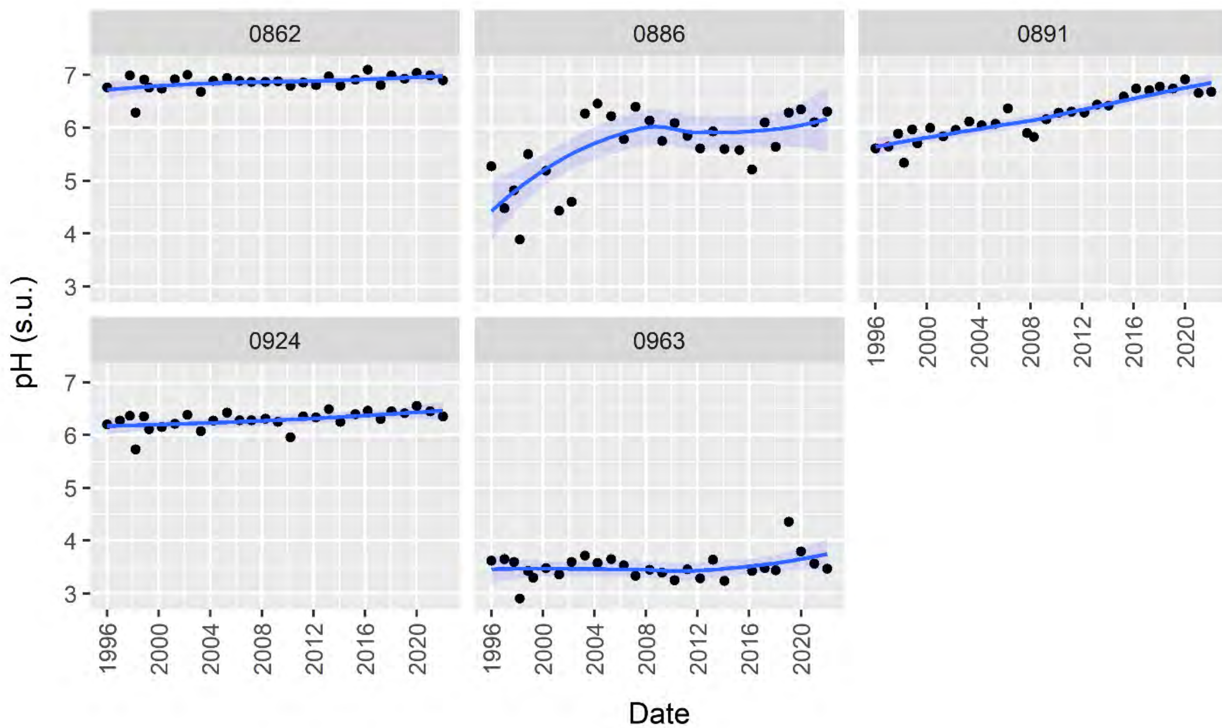
pH: Mann-Kendall trend analysis indicates significant increasing trends in pH (since 1996) for wells 0858 and 0921. No significant trends were identified for the remaining disposal cell performance wells. Although pH levels in all cell performance wells have been greater than that measured in tailings pore fluids (pH of 2.93 [DOE 1997a]), pH levels in well 0880 remain relatively low, ranging from 3.4–5.2 historically and 3.8–4.7 for the 1996–2022 period shown in Figure 5-5. The pH levels measured in 2022 were within the range of historical values for all disposal cell performance monitoring wells; that is, there have been no recent significant changes in pH in these wells (Figure 5-5).

For compliance monitoring wells, statistically significant increasing trends in pH have been identified in wells 0886, 0891, and 0924 since 1996, with no significant trends in wells 0862 and 0963 (Figure 5-6). The pH levels measured in 2022 were within the range of historical values for all groundwater compliance monitoring wells. The pH in monitoring well 0963 historically has been lower than at the other groundwater compliance wells (and the disposal cell performance monitoring wells), with a pH of 3.5 in 2022 compared to between 6.0–7.0 in the other wells.



Note: Disposal cell performance monitoring wells 0908 and 0916 have been dry since 1987.
Abbreviation: s.u. = standard unit

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

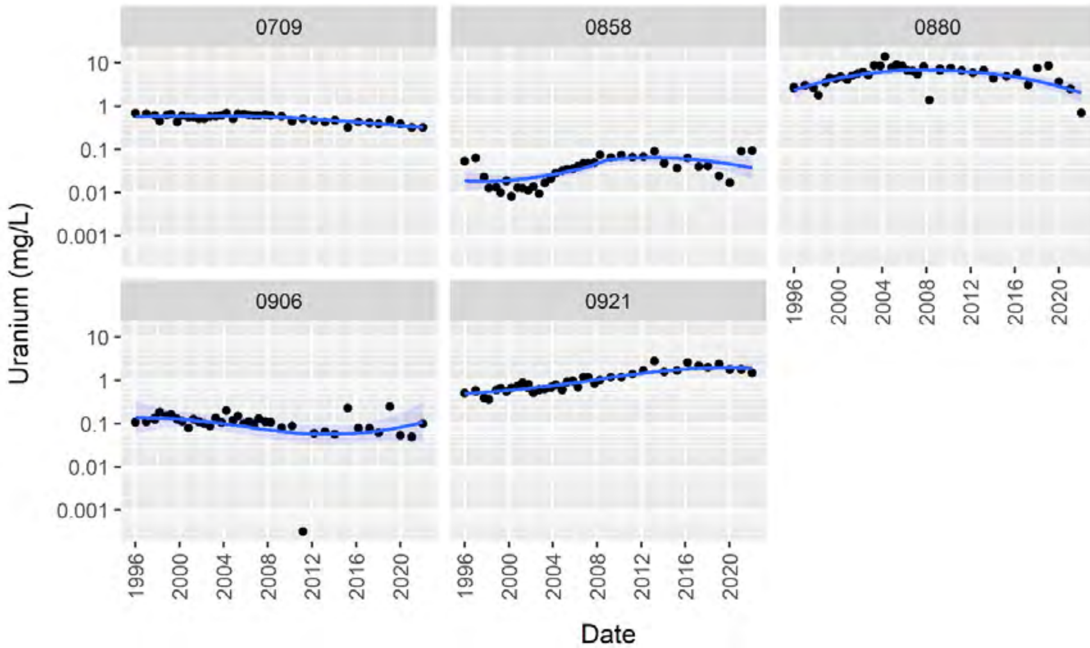


Abbreviation: s.u. = standard unit

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

Uranium: The 2022 uranium concentrations for disposal cell performance monitoring wells were within the range of historical values for all groundwater compliance monitoring wells (Figure 5-7); concentrations measured in 2022 are similar to those reported in recent years. Using data since 1996, Mann-Kendall trend analysis identified significant trends in uranium concentrations in all disposal cell performance monitoring wells except well 0880. Significant increasing trends were found for wells 0858 and 0921, while significant decreasing trends were identified for wells 0709 and 0906. Uranium concentrations in monitoring well 0880 are most variable, ranging from 0.7 mg/L (most recent measurement) to 14 mg/L in 2004.

In 2022, uranium concentrations in groundwater compliance monitoring wells were within the range of historical values (Figure 5-8). Mann-Kendall trend analysis identified significant uranium concentration trends in all wells, with increasing trends found for wells 0886, 0891, and 0924, and decreasing trends in wells 0862 (characterized by low uranium levels) and 0963. Although a significant increasing trend was identified for well 0924, uranium concentrations have been relatively stable since 2004, fluctuating between 0.4 mg/L and 0.6 mg/L. Uranium concentrations in well 0886 have stabilized in recent years (most recent result of 0.018 mg/L). Since 2008, the uranium concentrations measured at monitoring well 0891 have been greater than at other monitoring wells. The 2022 uranium result at this well (1.0 mg/L) is less than the 2016 (maximum) result of 3.6 mg/L.



Note: Disposal cell performance monitoring wells 0908 and 0916 have been dry since 1987.

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

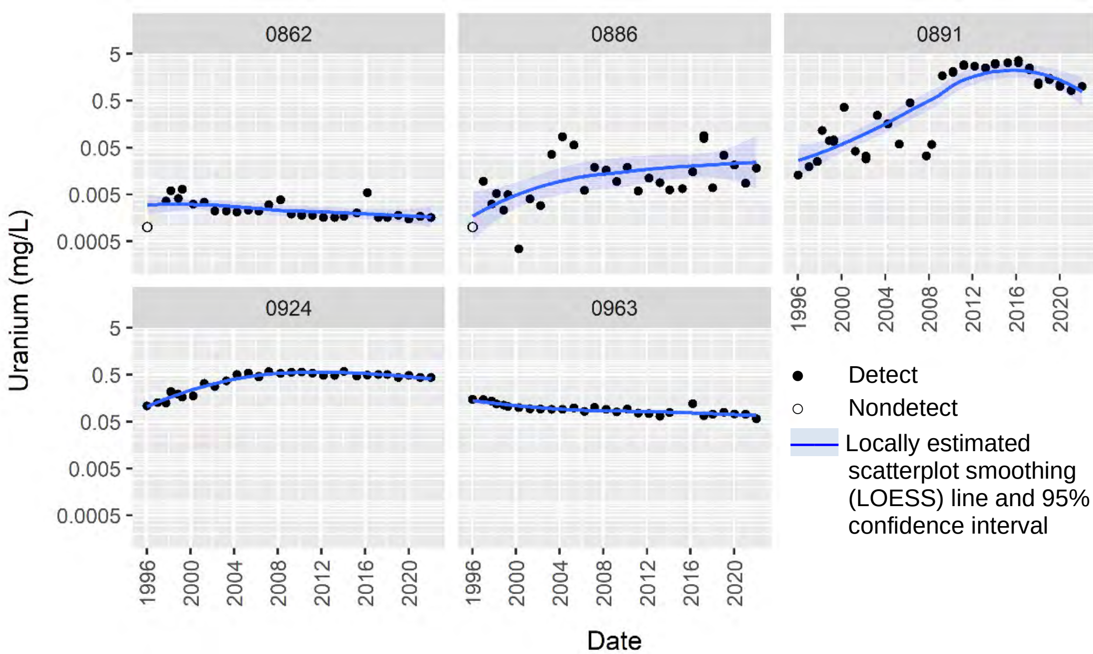


Figure 5-8. Uranium Concentrations in Groundwater Compliance Monitoring Wells at the Falls City, Texas, Disposal Site

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) continued water level declines (Figure 5-3) compared to relatively stable or increasing water levels in groundwater compliance monitoring wells (Figure 5-4), (2) no declining pH trends (Figure 5-5), and (3) no significant increases in uranium concentrations since 2012 (Figure 5-7). Supporting trend analysis results are provided in Table 5-3.

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, and 0891, and 0924 have increasing uranium concentrations (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; Table 5-3), thereby confirming that longer term, the low-pH areas do not necessarily define areas with uranium contamination. This correlation was true in the past (DOE 1997a) during the continued addition of low-pH fluids from uranium processing and low-pH fluids produced from the oxidation of the tailings. Currently, these processes are no longer occurring, but uranium can continue to be mobile with increasing pH values.

The higher uranium concentrations in groundwater compliance well 0891—that increased from 1996–2016 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, DOE is planning on evaluating the groundwater flow and potential uranium transport downgradient of wells 0924, 0886, and 0891 to confirm that (1) groundwater quality continues to meet the groundwater class of use and (2) groundwater discharge to surface water is not an issue. Best management practice groundwater monitoring of the current monitoring well network will be continued at least through, and possibly beyond, the conclusion of this additional evaluation until concurrence for cessation is provided by NRC.

Table 5-3. Mann-Kendall Trend Analysis Results for Falls City Site Monitoring Wells, 1996–2022

Parameter	Well	Monitoring Purpose	Initial Trend Analysis Date	Number of Samples	Kendall's tau	p-value	Trend
Water Level	0709	Disposal Cell Performance	1/24/1996	38	-0.576	<0.0001	Decreasing
Water Level	0858	Disposal Cell Performance	1/24/1996	38	-0.799	<0.0001	Decreasing
Water Level	0880	Disposal Cell Performance	1/24/1996	39	-0.413	0.0002	Decreasing
Water Level	0906	Disposal Cell Performance	1/24/1996	38	-0.404	0.0004	Decreasing
Water Level	0921	Disposal Cell Performance	1/24/1996	38	-0.851	<0.0001	Decreasing
Water Level	0862	Groundwater Compliance	1/24/1996	29	0.831	<0.0001	Increasing
Water Level	0886	Groundwater Compliance	1/24/1996	29	0.826	<0.0001	Increasing
Water Level	0891	Groundwater Compliance	1/24/1996	29	0.039	0.78	No Trend
Water Level	0924	Groundwater Compliance	1/24/1996	29	-0.3	0.023	Decreasing
Water Level	0963	Groundwater Compliance	1/24/1996	28	0.46	0.0006	Increasing
pH	0709	Disposal Cell Performance	1/30/1996	38	0.192	0.098	No Trend
pH	0858	Disposal Cell Performance	1/28/1996	38	0.718	<0.0001	Increasing
pH	0880	Disposal Cell Performance	1/25/1996	38	-0.144	0.21	No Trend
pH	0906	Disposal Cell Performance	1/30/1996	38	-0.009	0.95	No Trend
pH	0921	Disposal Cell Performance	1/27/1996	38	0.357	0.002	Increasing
pH	0862	Groundwater Compliance	1/30/1996	28	0.248	0.069	No Trend
pH	0886	Groundwater Compliance	1/25/1996	28	0.333	0.014	Increasing
pH	0891	Groundwater Compliance	1/27/1996	29	0.765	<0.0001	Increasing
pH	0924	Groundwater Compliance	1/29/1996	29	0.425	0.001	Increasing
pH	0963	Groundwater Compliance	1/26/1996	28	0	1.0	No Trend
Uranium	0709	Disposal Cell Performance	1/30/1996	38	-0.482	<0.0001	Decreasing
Uranium	0858	Disposal Cell Performance	1/28/1996	39	0.459	<0.0001	Increasing
Uranium	0880	Disposal Cell Performance	1/25/1996	41	0.125	0.27	No Trend
Uranium	0906	Disposal Cell Performance	1/30/1996	42	-0.393	0.0005	Decreasing
Uranium	0921	Disposal Cell Performance	1/27/1996	48	0.76	<0.0001	Increasing
Uranium	0862	Groundwater Compliance	1/30/1996	29	-0.501	0.0003	Decreasing
Uranium	0886	Groundwater Compliance	1/25/1996	32	0.333	0.012	Increasing
Uranium	0891	Groundwater Compliance	1/27/1996	45	0.506	0.0001	Increasing
Uranium	0924	Groundwater Compliance	1/29/1996	32	0.383	0.0035	Increasing
Uranium	0963	Groundwater Compliance	1/26/1996	29	-0.723	<0.0001	Decreasing

Notes:
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. 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. The final trend analysis date for this period is February 9, 2022.
Supplementary Mann-Kendall trend analyses performed for the more recent (2012–2022) period identified no significant (increasing or decreasing) trends in uranium concentrations for any site monitoring wells except well 0891 (significant decreasing trend found for 2012–2022). Corresponding tau values for disposal cell monitoring wells were all negative, indicating a decreasing trend.

5.9 References

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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Wickham, H., 2016. ggplot2: Elegant Graphics for Data Analysis, 2nd edition, Springer-Verlag, New York, https://ggplot2.tidyverse.org, accessed July 1, 2022.

5.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	280	Rusted and Damaged Fence Line
PL-2	290	Broken Perimeter Sign P62
PL-3	230	Perimeter Sign P58
PL-4	—	Site Marker SMK-2
PL-5	—	Survey Monument SM-2
PL-6	100	Disposal Cell Cover
PL-7	—	Soil Desiccation Cracks on Top Slope of Disposal Cell
PL-8	340	Northeast Side Slope

Note:
— = Photograph taken vertically from above.

PL-1. Rusted and Damaged Fence Line

PL-2. Broken Perimeter Sign P62

PL-3. Perimeter Sign P58

PL-4. Site Marker SMK-2

PL-5. Survey Monument SM-2

PL-6. Disposal Cell Cover

PL-7. Soil Desiccation Cracks on Top Slope of Disposal Cell

PL-8. Northeast Side Slope

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 December 19, 2022. No major changes were observed on the disposal cell or in the associated drainage features. Inspectors identified minor maintenance needs that will be handled during upcoming site maintenance, 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. Groundwater monitoring of all three wells was completed on July 26, 2022.

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)
Corrective Action	Section 5.0	Section 6.7	—
Groundwater Monitoring	Section 2.6	Section 6.8	(b)(2), (b)(3)

In December 2020, Congress passed legislation that extends the final disposal cell closure date from 2023 to 2031. 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 December 19, 2022. The inspection was conducted by J. Lobato, P. Wetherstein, H. Petrie, R. Mumby, and J. Warkentin of the Legacy Management Support contractor. S. Woods (LM) and M. Cosby (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 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 2022 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 the U.S. Bureau of Land Management (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 (PL-1), and the lock was replaced during the inspection. Site access signs next to the gate were in good condition. No maintenance needs were identified.

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 were replaced on all access gates. No other maintenance needs were identified.

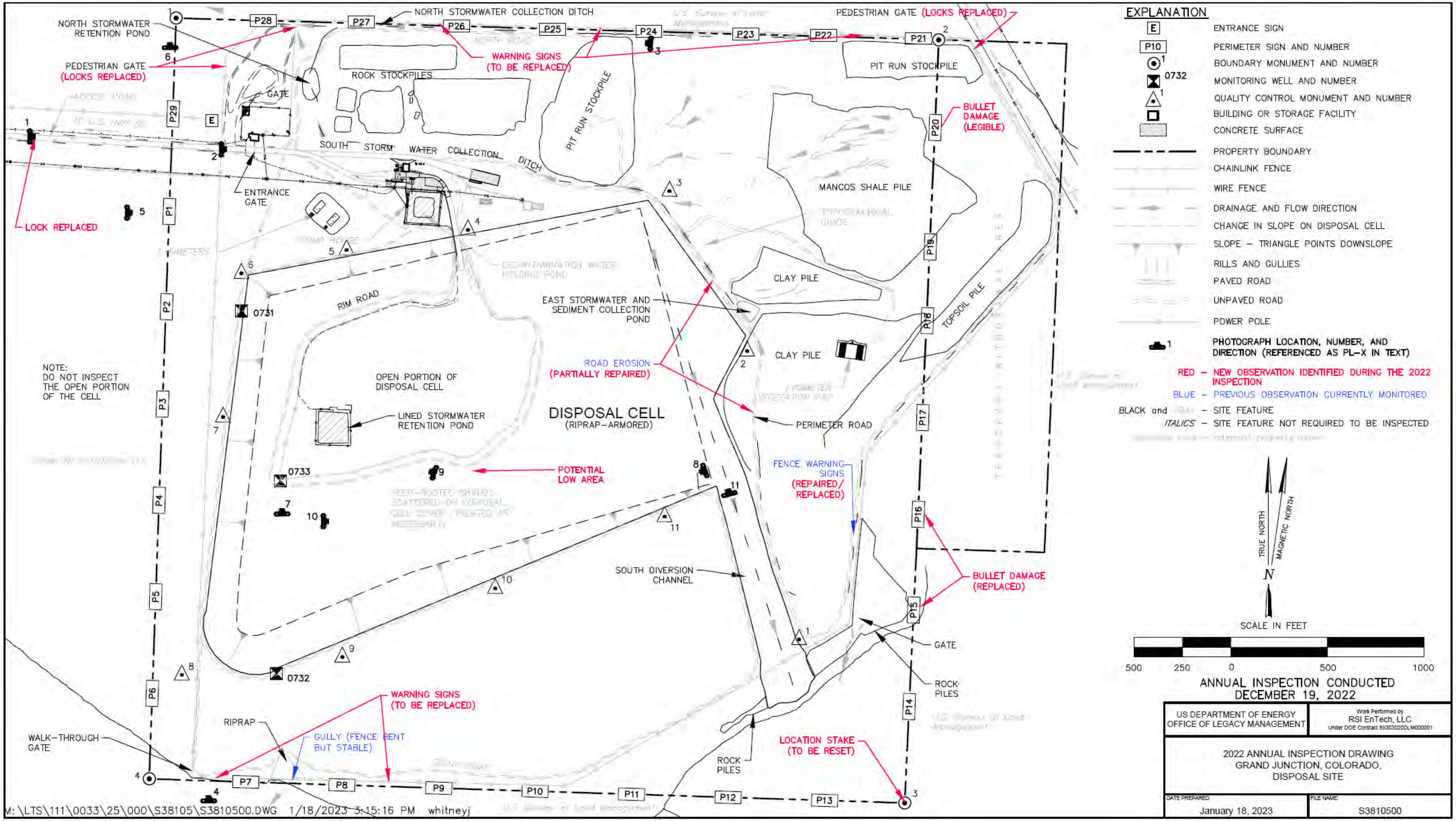


Figure 6-1. 2022 Annual Inspection Drawing for the Grand Junction, Colorado, Disposal Site

The solar-powered site entrance gate is secured by an electronic locking device that requires entry of a keypad code to open the gate. The entrance gate was functional at the time of the inspection (PL-2). Site entrance signs on and next to the entrance gate were in good condition. 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-3). 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. Multiple warning signs require repair or replacement as follows: warning signs on the north perimeter fence that are partially detached, illegible, or missing and two warning signs on the south perimeter fence that are partially detached or illegible (PL-4). Several warning signs on the southeast perimeter fence that were reported in 2021 as damaged or detached were repaired or replaced before the inspection. Affected warning signs will be repaired or replaced before the next inspection.

There are 29 perimeter signs attached to steel posts set in concrete positioned at regular intervals along the property boundary (PL-5). Several perimeter signs along the south property boundary are faded or peeling but remain legible. Perimeter signs P15 and P16, reported in 2021 with bullet damage, were replaced before the inspection. 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 the entire disposal cell is closed.

6.4.1.4 Boundary Monuments

Four boundary monuments delineate the corners of the property boundary (PL-6). All were present and in good condition. The location stake at boundary monument BM-3 needs to be reset. 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, and 0733) (PL-7). All wellhead protectors were locked and undamaged. Root growth was observed in the well screens of monitoring wells 0731 and 0732 in 2021 (DOE 2022). The wells were redeveloped in 2022. Weed spraying around each wellhead was completed in spring 2022 to keep out 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) 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 (PL-8). The rock showed no significant weathering. Inspectors noticed an area, approximately 23 × 12 feet (ft), east of monitoring well 0733 that appears to be a low 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 (PL-9).

Grasses and weeds were growing on most of the disposal cell cover (PL-10). 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 (PL-11). 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. 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 site 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 (Figure 6-1). Those erosion areas were partially repaired in 2022, and repairs will continue with the ongoing maintenance of site stormwater collection ditches (Section 6.4.2.2). In addition, general maintenance of other parts of the perimeter road are planned before the next inspection. No other maintenance needs were identified.

6.4.2.4 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 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 or partially completed:

- Perimeter signs P15 and P16 were replaced in 2022 before the annual inspection
- Replacement of warning signs near the southeast side of the site were replaced before the inspection
- Partial repairs were made to the two eroded areas adjacent to the east side of the perimeter road

Inspectors identified the following maintenance items that will be completed before the next inspection:

- Replacement or repair of warning signs on the north and south perimeter fences
- Reset of the location stake at boundary monument BM-3
- Continued repairs on the areas adjacent to the perimeter road

No other maintenance needs were identified.

6.7 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.

6.8 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 to groundwater that 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 total dissolved solids (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 verify that groundwater in onsite, alluvial paleochannels is not affected by seepage (i.e., transient drainage) from the disposal cell. The most recent sampling event occurred on July 26, 2022.

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 below the paleochannel monitoring wells in the lower tailings in the disposal cell (Table 6-2 and 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 for the site are reported and published on the LM Geospatial Environmental Mapping System (GEMS) website (https://gems.lm.doe.gov/#site=GRJ).

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, downgradient, center

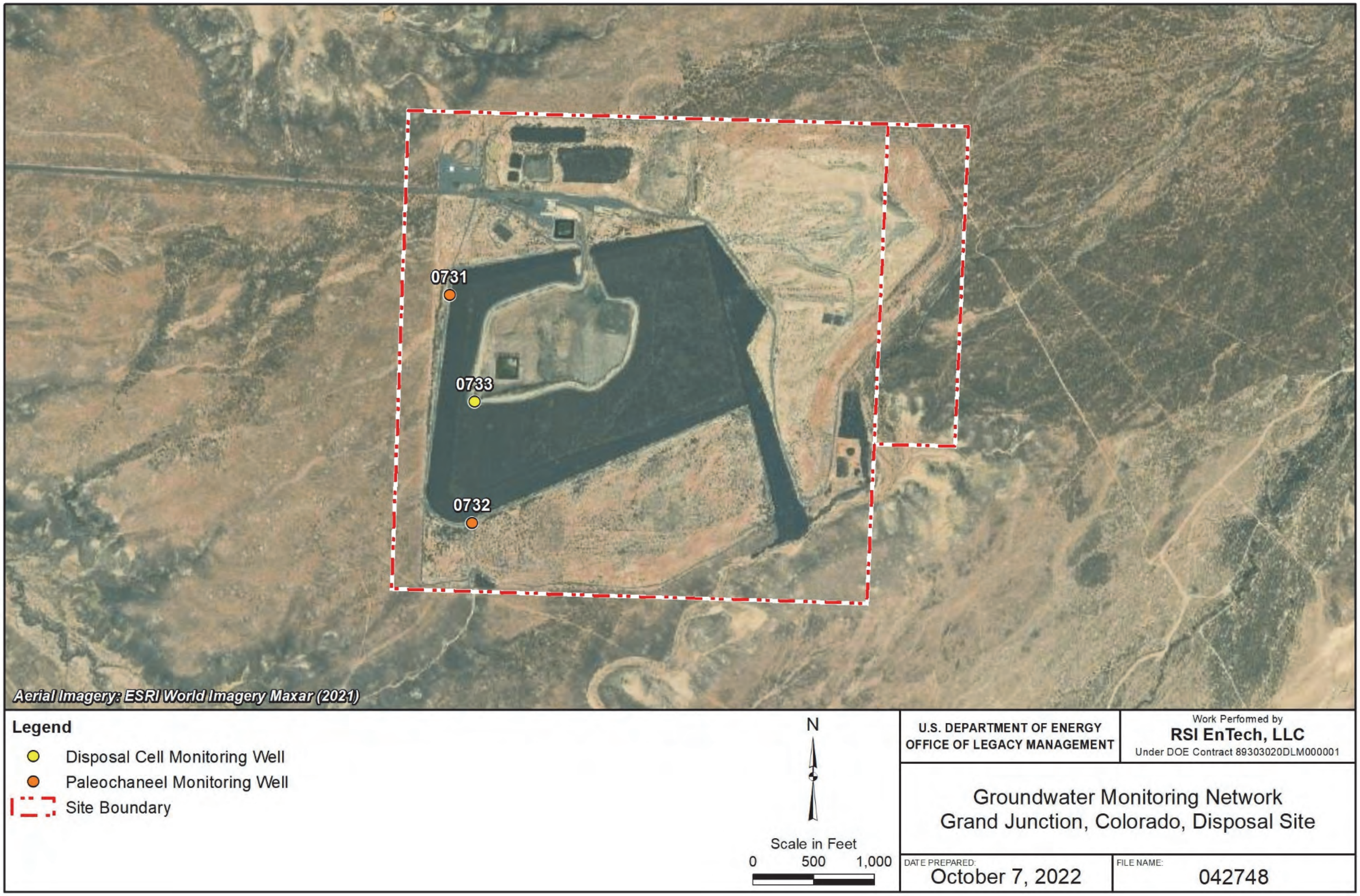
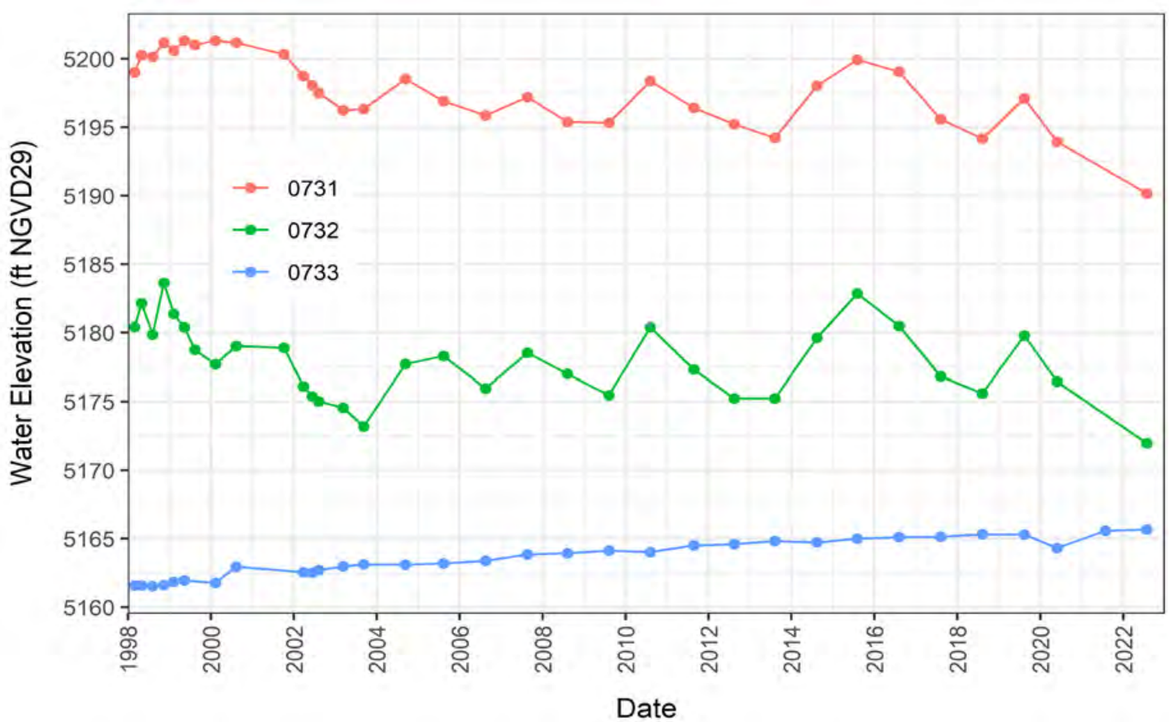


Figure 6-2. Groundwater Monitoring Network for the Grand Junction, Colorado, Disposal Site

6.8.1 Groundwater-Level Monitoring

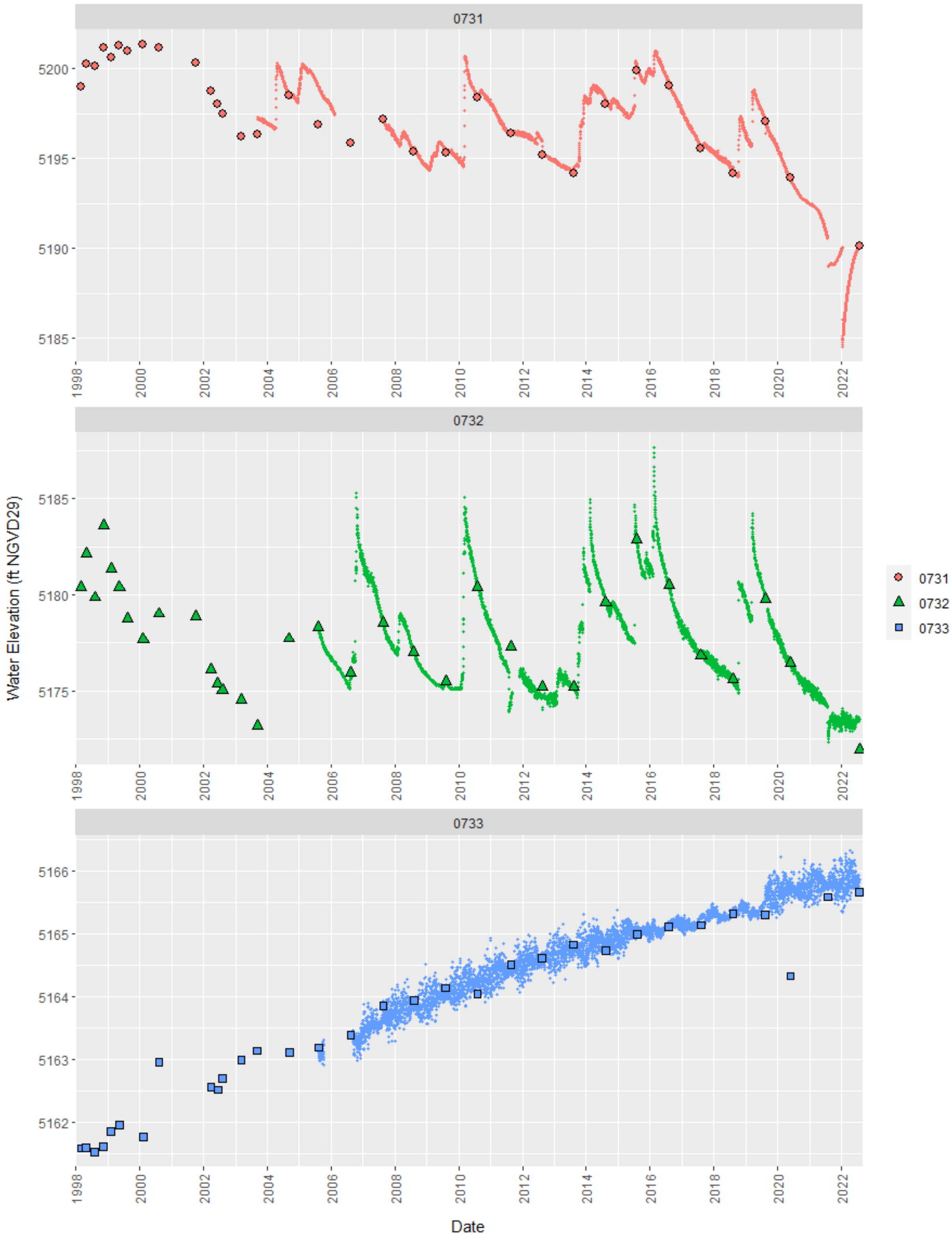
Static water level measurements are obtained from each monitoring well before water quality samples are collected. Water levels in disposal cell monitoring well 0733 increased approximately 4 ft since 1998 and remain lower than water levels in the two paleochannel monitoring wells (Figure 6-3).

Groundwater levels in wells 0731 and 0732 vary periodically and (for the period from 1998 to 2022) have a slight decreasing trend. The timing of groundwater elevation fluctuations is similar in these two wells (Figure 6-3), suggesting that the two paleochannel systems are influenced by the same upgradient recharge mechanisms. 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 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.



Abbreviation: NGVD29 = National Geodetic Vertical Datum of 1929

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



Note: The large symbols represent discrete water level measurements from annual sampling events (shown in Figure 6-3). The small symbols are daily averages of corresponding transducer readings.
Abbreviation: NGVD29 = National Geodetic Vertical Datum of 1929

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

6.8.2 Groundwater Quality Monitoring

In accordance with the 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 U.S. Environmental Protection Agency maximum concentration limits (MCLs) (40 CFR 192 Table 1 Subpart A), background concentrations from groundwater in alluvium, and background concentrations from groundwater in the Mancos Shale (Table 6-3). 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.

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

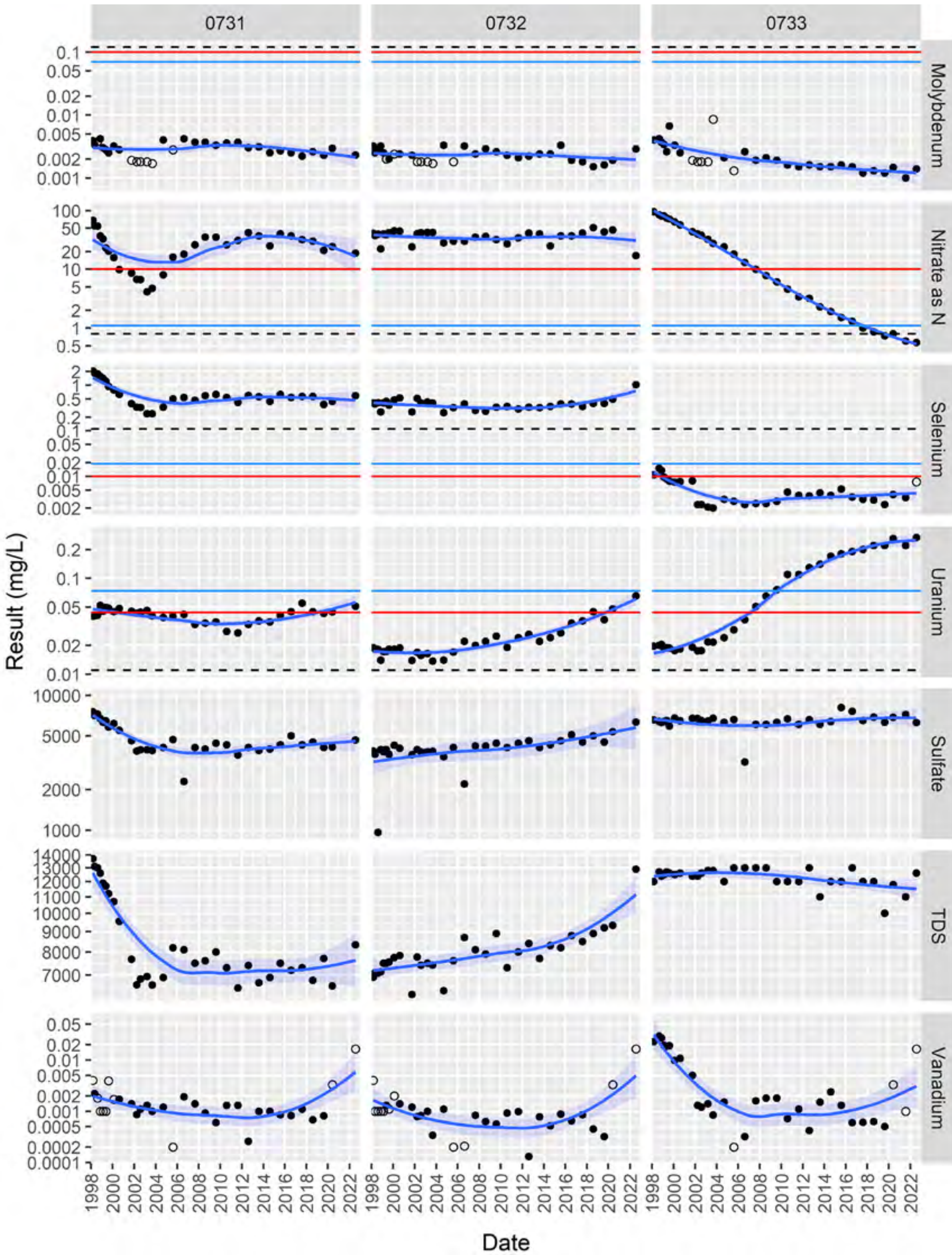
Constituent	MCL[a] (mg/L)	Maximum Concentration in Background Groundwater in Alluvium[b] (mg/L)	Maximum Concentration in Background Groundwater in the Mancos Shale[b] (mg/L)
Molybdenum	0.1	0.070	0.12
Nitrate (as nitrogen)	10	1.1	0.80
Selenium	0.01	0.019	0.11
Uranium	0.044	0.074	0.011

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

As an introduction to the discussion of results that follows, Figure 6-5 provides a matrix of time-concentration plots for each site monitoring well and analyte combination. Results for the key indicator analytes are shown first, followed by results for remaining analytes (sulfate, TDS, and vanadium). Data for the key indicator analytes are plotted relative to the MCLs and maximum background concentrations listed in Table 6-3. In accordance with 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. Table 6-4 identifies analyte-well combinations with statistically significant increasing (or decreasing) trends based on the detailed Mann-Kendall trend test summary.

Key Indicator Analytes

Molybdenum concentrations in all three monitoring wells have remained steady since 1998. Consistent with most historical results, concentrations in 2022 ranged from 0.001 to 0.003 mg/L, well below both the MCL of 0.1 mg/L and the maximum background concentration in the Mancos Shale of 0.12 mg/L.



● Detect
○ Nondetect
—— LOESS local regression line and 95% pointwise confidence interval
Limits or comparative maximum background concentrations from Table 6-3: —— MCL; —— Maximum background concentration in alluvium; - - - Maximum background concentration in Mancos Shale
Notes: Wells 0731 and 0732 were sampled in 2021, but the results were rejected (refer to Section 6.4.1.6). The vertical profiling planned in the previous annual report (see DOE 2022) did not take place due to insufficient water in the two wells.
Abbreviation: N = nitrogen

Figure 6-5. Time-Concentration Plots of All Analytes in Groundwater (1998–2022)

Table 6-4. Mann-Kendall Trend Analysis Results for Indicator Parameters in Grand Junction, Colorado, Disposal Site Monitoring Wells, 1998–2022

Parameter[a]	Well	Number of Samples[b]	Number of Nondetects	Kendall's tau[c,d]	p-value[c,d]	Trend[c,d]
Key Indicator Analytes						
Molybdenum	0731	32	7	–0.171	0.17	No Trend
Molybdenum	0732	32	7	–0.133	0.29	No Trend
Molybdenum	0733	32	6	–0.554	<0.0001	Decreasing
Nitrate as N	0731	32	0	–0.018	0.90	No Trend
Nitrate as N	0732	32	0	–0.028	0.83	No Trend
Nitrate as N	0733	32	0	–0.992	<0.0001	Decreasing
Selenium	0731	32	0	–0.302	0.016	Decreasing
Selenium	0732	32	0	–0.024	0.86	No Trend
Selenium	0733	32	1	–0.292	0.019	Decreasing
Uranium	0731	32	0	–0.147	0.24	No Trend
Uranium	0732	32	0	0.603	<0.0001	Increasing
Uranium	0733	32	0	0.806	<0.0001	Increasing
Remaining Indicator Analytes[e]						
Sulfate	0731	32	0	–0.325	0.009	Decreasing
Sulfate	0732	32	0	0.599	<0.0001	Increasing
Sulfate	0733	32	0	0.105	0.41	No Trend
TDS	0731	32	0	–0.478	0.0001	Decreasing
TDS	0732	32	0	0.625	<0.0001	Increasing
TDS	0733	32	0	–0.210	0.089	No Trend
Vanadium	0731	32	10	–0.125	0.31	No Trend
Vanadium	0732	32	11	–0.105	0.39	No Trend
Vanadium	0733	32	4	–0.536	<0.0001	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 26, 2022.

[b] Duplicate sample results were excluded from the trend analysis.

[c] 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.

[d] 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.

[e] PCBs are not addressed in this summary because results for all wells have been below detection limits.

Abbreviation:
N = nitrogen

Nitrate (as nitrogen) concentrations in paleochannel monitoring wells 0731 and 0732 have been consistently above the 10 mg/L MCL, generally ranging between about 20–40 mg/L (Figure 6-5). Results in 2022 were 18.7 mg/L and 17.1 mg/L, respectively. As noted in previous annual reports (e.g., DOE 2022), nitrate concentrations in disposal cell monitoring well 0733 are significantly decreasing (Table 6-4). Concentrations declined steadily from 96 mg/L in 1998 to 0.57 mg/L in 2022, below the MCL of 10 mg/L (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). Similar to trends observed for nitrate, selenium concentrations in wells 0731 and 0732 have consistently exceeded background, generally ranging between about 0.2 to 0.5 mg/L (Figure 6-5). The highest selenium concentrations have been measured in well 0731, where concentrations declined from 2 mg/L in 1998 to 0.3 mg/L in 2002 and remained fairly stable since then. Selenium concentrations in well 0732 increased from 0.42 mg/L in 2020 to 1 mg/L in 2022. 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 0.002 to 0.015 mg/L, in almost all cases below the MCL (Figure 6-5). The 2022 selenium result for well 0733 was below the detection limit (<0.0075 mg/L).

Uranium concentrations in well 0731 have been fairly stable at about 0.04–0.05 mg/L, periodically exceeding the 0.044 mg/L MCL but consistently below the maximum concentration in background alluvial groundwater (0.074 mg/L) (Figure 6-5). The most recent (2022) result was 0.051 mg/L. Uranium concentrations in wells 0732 and 0733 both exhibit significant increasing trends (Table 6-3). Maximum concentrations in both wells (0.065 mg/L and 0.266 mg/L, respectively) were measured in 2022. Uranium concentrations in well 0732 are approaching the maximum background concentration in the alluvium of 0.074 mg/L, while concentrations in tailings well 0733 have consistently exceeded both the MCL and background since 2009 (Figure 6-5). Relatively high concentrations of uranium and other constituents are expected for a well screened in the disposal cell tailings. Constituents of concern and water levels in well 0733 are not subject to compliance goals and are monitored solely for information gathering purposes.

Remaining Indicator 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, vanadium, and PCBs. Significant increasing concentration trends were found for sulfate and TDS in well 0732 (Table 6-3). For remaining well-analyte combinations, concentrations are decreasing or exhibit no trend. Sulfate concentrations in wells 0731 and 0732 have averaged between approximately 4000–5000 mg/L, while those in well 0733 have been slightly higher (about 6500 mg/L). TDS concentrations are also highest in tailings well 0733 (12,000–13,000 mg/L), relative to those in wells 0731 and 0732 (8000–8600 mg/L). Vanadium concentrations in well 0733 decreased from 0.03 mg/L in 1998 to 0.001 mg/L in 2002 and since then have been stable. Concentrations in wells 0731 and 0732 have averaged about 0.001 to 0.002 mg/L. In 2022, vanadium results for all three wells were below detection limits (<0.0165 mg/L). PCBs have never been detected in site monitoring wells.

6.9 References

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), 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, 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 March 22, 2022.

6.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL–1	85	Site Access Gate
PL–2	90	Site Entrance Gate
PL–3	275	North Perimeter Fence
PL–4	0	Partially Detached Perimeter Fence Sign
PL–5	90	Perimeter Sign P1
PL–6	—	Boundary Monument BM-1
PL–7	0	Monitoring Well 0733
PL–8	250	South Side Slope of Disposal Cell
PL–9	290	Top Slope of Disposal Cell
PL–10	90	Top of Disposal Cell
PL–11	345	South Diversion Channel

Note:
— = Photograph taken vertically from above.

PL–1. Site Access Gate

PL–2. Site Entrance Gate

PL–3. North Perimeter Fence

PL–4. Partially Detached Perimeter Fence Sign

PL–5. Perimeter Sign P1

PL–6. Boundary Monument BM-1

PL–7. Monitoring Well 0733

PL–8. South Side Slope of Disposal Cell

PL–9. Top Slope of Disposal Cell

PL–10. Top of Disposal Cell

PL–11. South Diversion Channel

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 March 17, 2022. 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 to track disposal cell performance in accordance with the site-specific Long-Term Surveillance Plan (DOE 1998) (LTSP). In 2011, LM developed a Draft Groundwater Compliance Action Plan (DOE 2011) (Draft GCAP) to update the groundwater monitoring requirements as specified in the LTSP. The Draft GCAP has been approved by the State of Utah but had not been accepted at the time of this report's publication by the U.S. Nuclear Regulatory Commission (NRC). Groundwater analytical results presented in this report are evaluated with respect to requirements and concentration limits specified in the LTSP (DOE 1998). Groundwater monitoring was conducted in June 2022. Concentrations of routinely monitored analytes exceeded corresponding concentration limits in several point of compliance (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 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; unmanned aircraft system (UAS) 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 March 17, 2022. The inspection was conducted by P. Lemke and L. Sheader of the Legacy Management Support (LMS) contractor. A. Denny (LM site manager), H. Mickelson and R. Topham (State of Utah representatives), and P. Schwarz and E. Gaasche (LMS) 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 2022 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 a locked steel gate in the paved road right-of-way fence; LM does not own the gate or the right-of-way fence. 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 lock on the steel site access gate in the right-of-way fence was replaced during the inspection with a new lock that uses a different key. 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 (PL-1). The vegetation will be monitored to ensure no damage to the fence occurs or erosional damage is evident. The gates were operable and locked at the time of the inspection. During the inspection, the three existing locks were replaced.

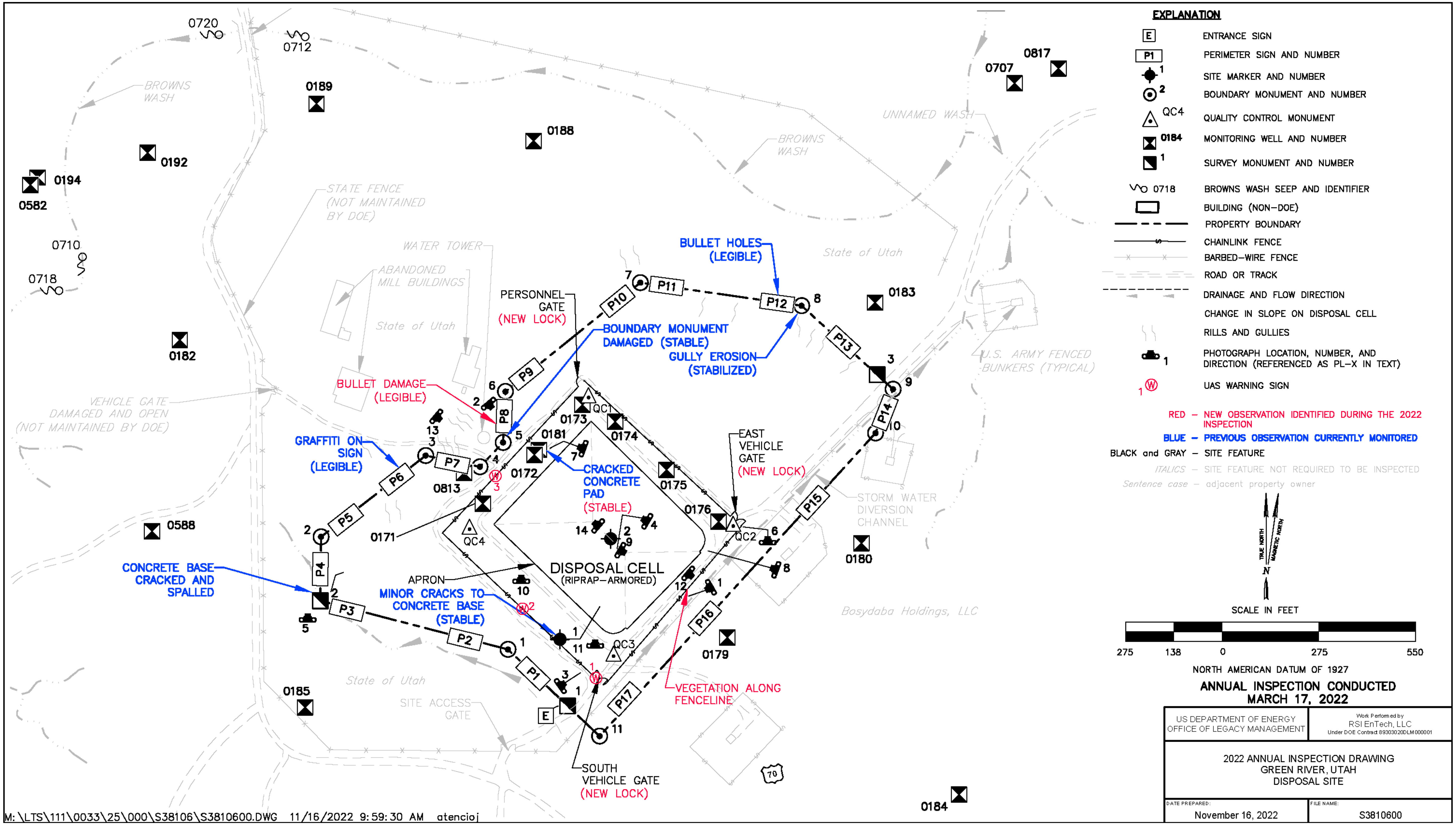


Figure 7-1. 2022 Annual Inspection Drawing for the Green River, Utah, Disposal Site

Seventeen perimeter signs, attached to steel posts set in concrete, are positioned along the unfenced property boundary. All perimeter signs were present with some exhibiting bullet hole damage but remain legible (PL-2).

Three new UAS signs were installed along the security fence prior to the inspection (PL-3). No 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 SMK-2 is on the crest of the disposal cell (PL-4). The concrete base of 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 (PL-5). Repairs of these monuments are not needed at this time.

7.4.1.5 Aerial Survey Quality Control Monuments

Four aerial survey quality control monuments were inspected (PL-6). 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 and locked. Some of the concrete monitoring well collars were cracked, but the wellhead protectors are stable, and repairs are not necessary at this time (PL-7). 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 process that might affect the integrity of the disposal cell (PL-8 and PL-9).

A boulder-filled trench, known as an apron, surrounds the disposal cell. The apron was intact and stable, with no observed erosion along the base of the side slopes. Small erosion rills and possible soil piping features (PL-10 and PL-11) were present along portions of the outside edge of the apron. The rills and piping features form as stormwater runoff along the perimeter road drains 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 the area.

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. A small erosional rill is forming at the east side of the chainlink security fence but is not next to a fence post, posing no immediate risk (PL-12). Inspectors will continue to monitor this area. No maintenance needs were identified at this time.

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 bullet holes on perimeter sign P8) 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-13) 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). 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 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. Abandoned buildings and a water tower associated with the former milling activities are northwest of the site (PL-14). 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). Accumulation of windblown debris is minor; it will continue to be monitored, and trash will 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

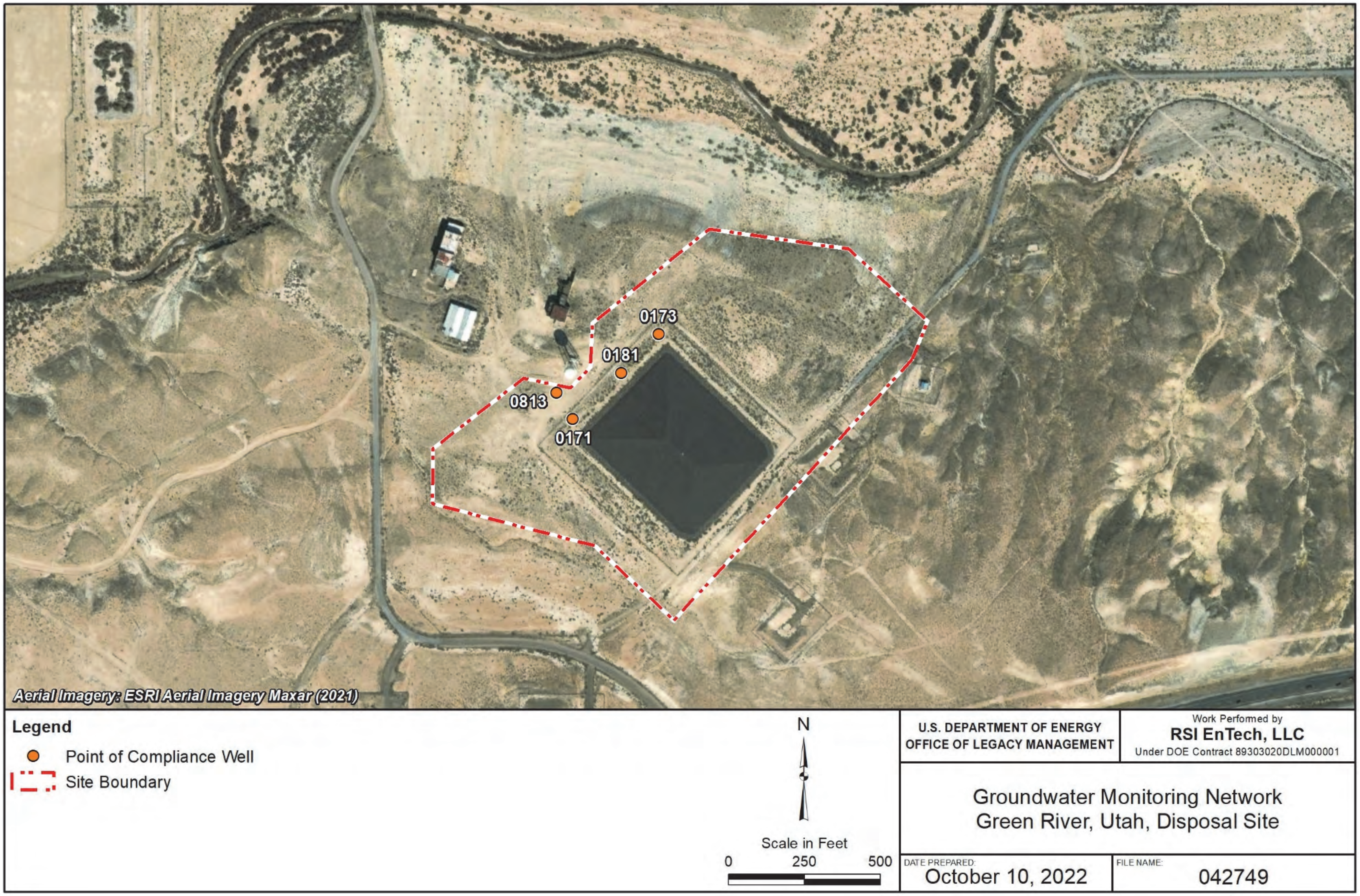
LM will conduct follow-up or contingency inspections if (1) a condition is identified during the annual inspection or other site visit that requires a return to the site to evaluate the condition or (2) LM is notified by a citizen or outside agency that conditions at the site are substantially changed.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

7.6 Maintenance and Repairs

Three UAS signs were installed prior to the inspection. Inspectors replaced the locks on the access gates during the inspection. No other maintenance needs were identified.

7.7 Groundwater Monitoring

In accordance with the LTSP, annual groundwater monitoring is conducted to evaluate the performance of the disposal cell. In 2011, LM developed a Draft GCAP (DOE 2011) that was approved by the State of Utah but has yet to receive NRC’s concurrence. The most recent sampling event occurred on June 14–15, 2022. Because the Draft GCAP has not been accepted, this section addresses only those wells designated in the LTSP for postclosure groundwater monitoring (DOE 1998). Locations of the four POC wells are shown in Figure 7-2.



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

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

The POC wells represent the intersection of a vertical plane with the uppermost aquifer (the middle sandstone unit of the Cedar Mountain Formation) underlying the site. 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. Table 7-2 lists the wells included in the current site groundwater monitoring network; the corresponding locations are shown in Figure 7-2.

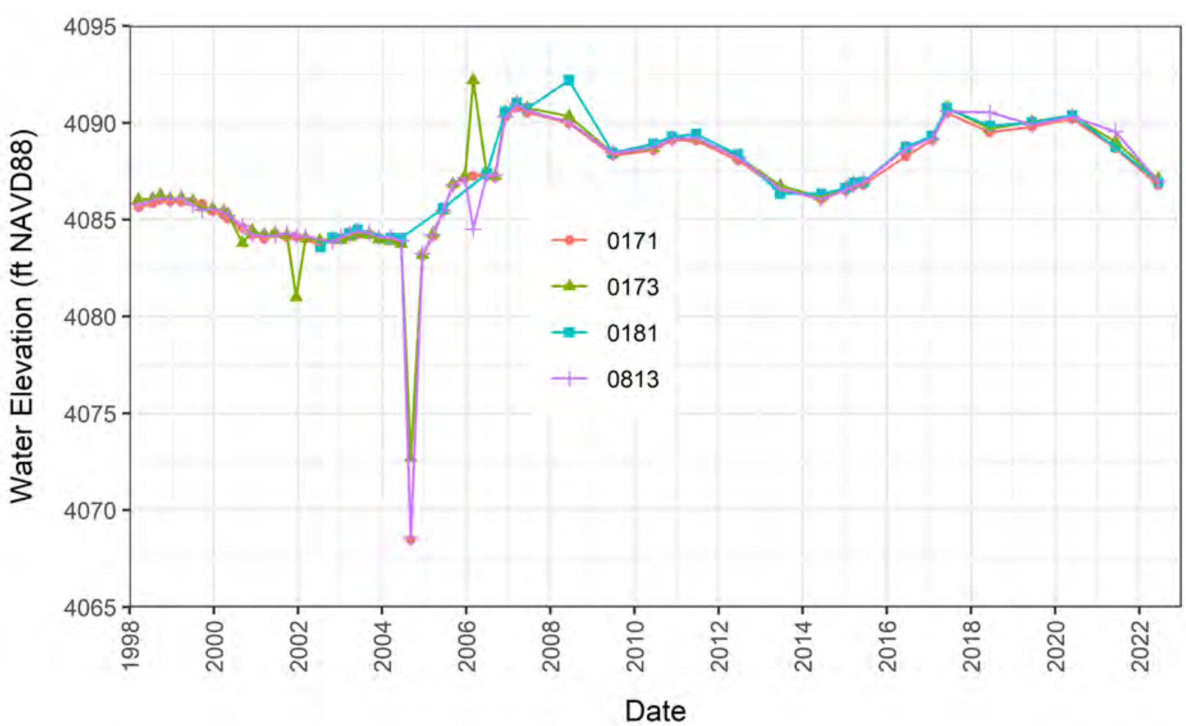
Table 7-2. Groundwater Monitoring Network for the Green River, Utah, Disposal Site

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

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 https://gems.lm.doe.gov/#site=GRN.

7.7.1 Water Level Monitoring

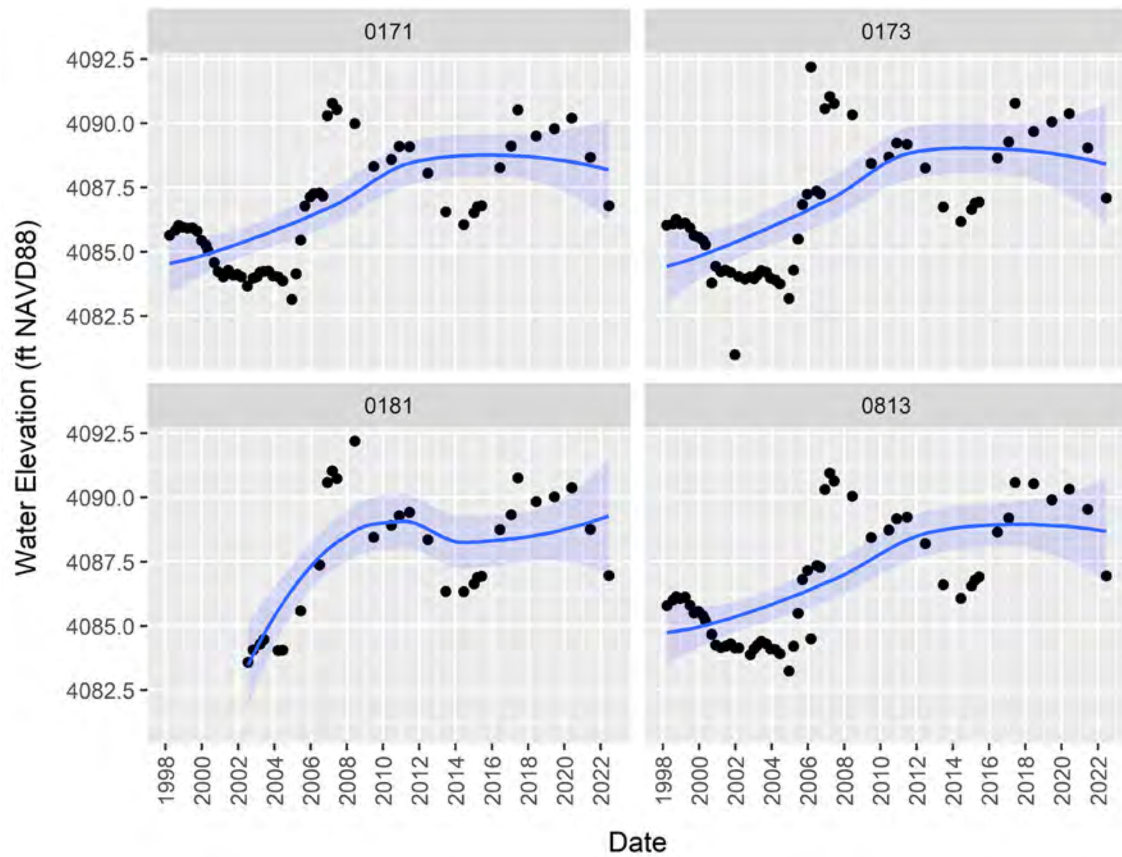
Water levels in the POC wells have been measured manually every year since 1991. As shown in Figure 7-3, groundwater elevations measured from 1998 through 2022 have been generally consistent across the four POC wells, with few exceptions ranging from approximately 4083 to 4093 ft.



Abbreviation: NAVD88 = North American Vertical Datum of 1988

Figure 7-3. Groundwater Elevations at the Green River, Utah, Disposal Site, 1998–2022

The sharp (11–15 ft) drop in water levels in wells 0171, 0173, and 0813 recorded in September 2004 (Figure 7-3) may have been due to instrument error or human error in recording the original field record. However, there is no definitive evidence of error and the data as shown are consistent with available documentation. The three other water level measurements taken in these wells in 2004 (in March, June, and December) are consistent with previous and subsequent nonoutlier water elevations. 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 outliers discussed above. 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. Using this approach, overall trends in the data are more apparent and not obscured by "noise" or random variation.



Abbreviation: NAVD88 = North American Vertical Datum of 1988

Figure 7-4. 1998–2022 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 1998–2022 time frame, Mann-Kendall trend analysis indicates statistically significant increasing trends in all four wells. No significant trend is indicated if the dataset is limited to 2010–2022.

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 2022) 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	102	4985	0.067
0813	10[b]	4440	0.069

Notes:
[a] Nitrate = nitrate plus nitrite as nitrogen.
[b] MCL (40 CFR 192 Table 1 Subpart A).

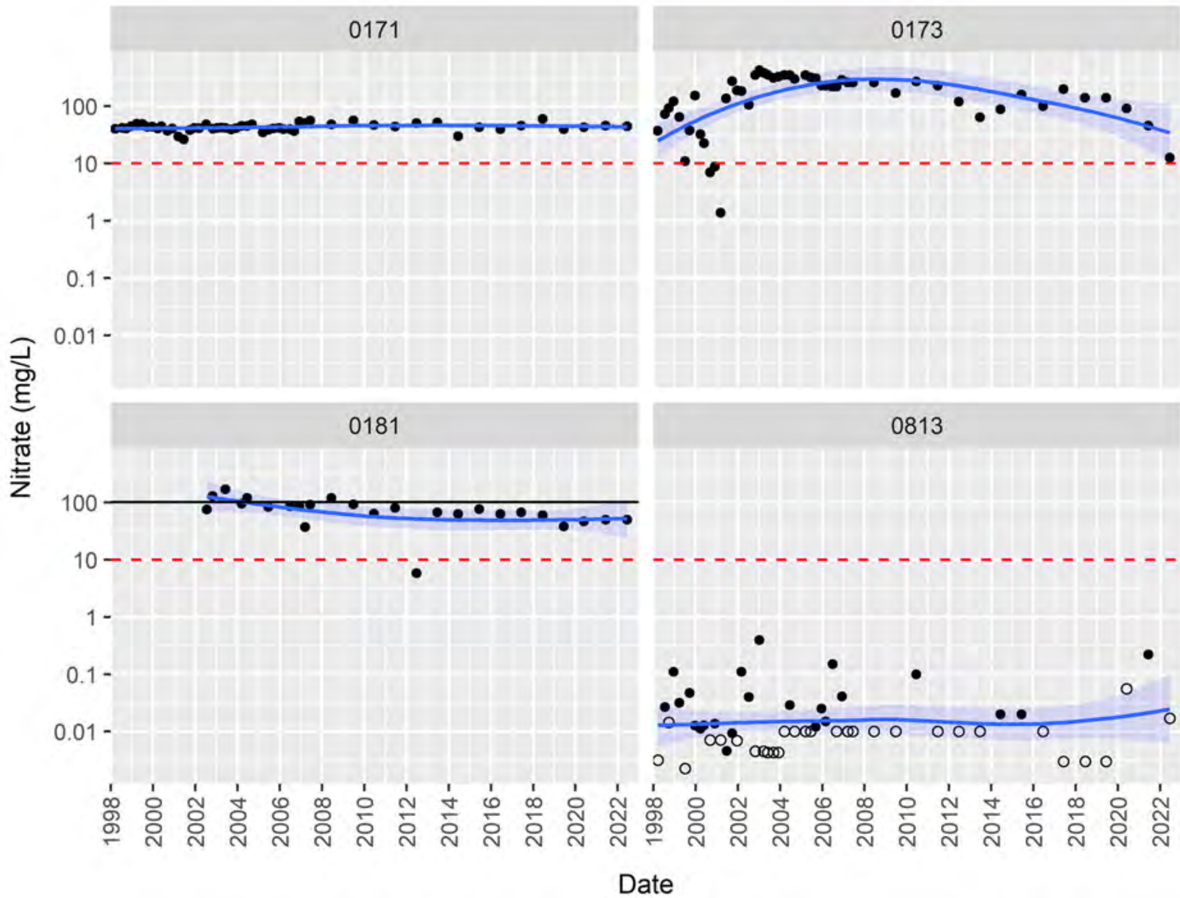
Table 7-4. 2022 Analytical Results for POC Wells at the Green River, Utah, Disposal Site

Monitoring Well	Nitrate[a] (mg/L)	Sulfate (mg/L)	Uranium (mg/L)
0171	44.5	4170	0.094
0173	12.6	4380	0.0072
0181	49.7	7030	0.024
0813	<0.017	3760	0.052

Notes:
Results in red font denote concentrations equal to or exceeding the LTSP-driven concentration limit.
[a] Nitrate = nitrate plus nitrite as nitrogen.

Figure 7-5 through Figure 7-7 show the time-concentration plots for nitrate, sulfate, and uranium along with corresponding MCLs. Nitrate concentrations continue to exceed the MCL in POC wells 0171 and 0173 (Figure 7-5). Nitrate concentrations in well 0181 also exceeded the 10 mg/L MCL but not the corresponding concentration limit (background value of 102 mg/L). Mann-Kendall trend analysis (Table 7-5) identified a significant decreasing trend in nitrate concentrations for well 0181 but no significant trend in the remaining POC wells. Nitrate concentrations in well 0171 have been stable, averaging about 40 mg/L. The majority of nitrate results for well 0813 (56%) have been below detection limits.

As has been the case historically, sulfate concentrations continue to exceed the LTSP background concentrations in all POC wells except POC well 0813 (Figure 7-6). Sulfate concentrations have been highest and the most variable in well 0173, ranging from 3700 to 11,000 mg/L. Sulfate concentrations in POC well 0171 have been stable, at about 4000 mg/L.



● Detect ○ Nondetect

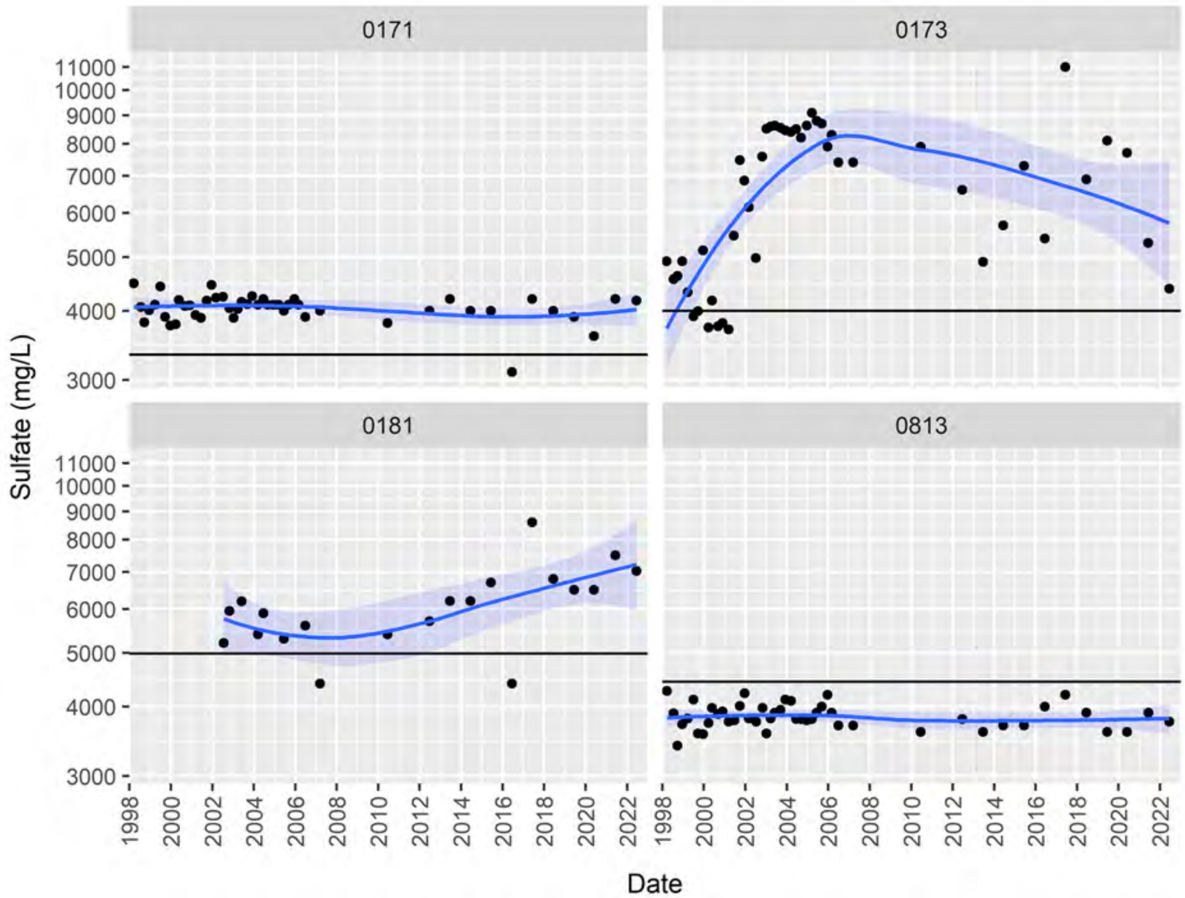
Locally estimated scatterplot smoothing (LOESS) line and 95% confidence interval

- - - - 10 mg/L 40 CFR 192 MCL

–––– 102 mg/L background concentration from Table 7-3 (applies to well 0181 only)

Notes: Nitrate expressed as nitrate plus nitrite as nitrogen; results before 2004 were converted from nitrate as NO_3. Results include validated data only; results below the detection limit are presented at the laboratory reported value.

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

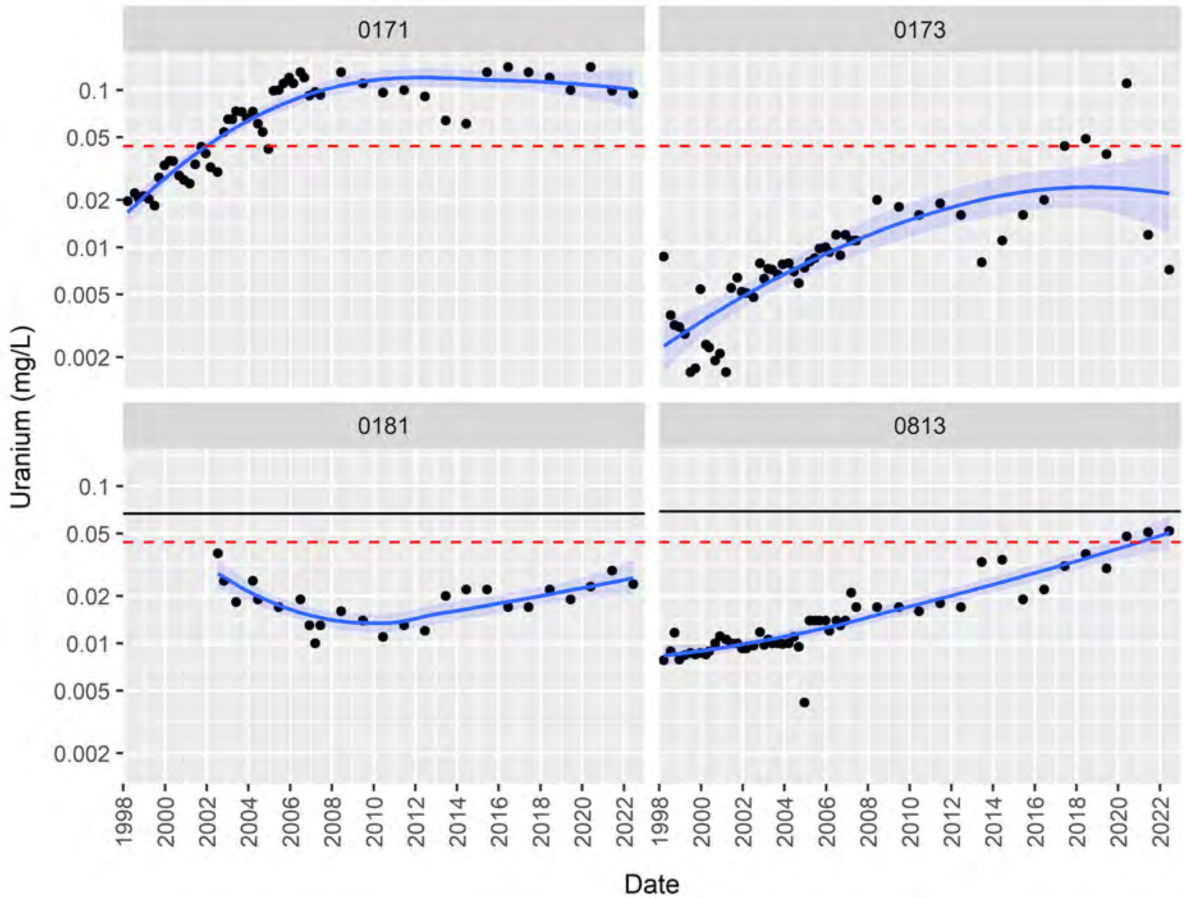


Locally estimated scatterplot smoothing (LOESS) line and 95% confidence interval

–––– LTSP background concentration from Table 7-3: 3334 mg/L, 4000 mg/L, 4985 mg/L, and 4440 mg/L, respectively, for wells 0171, 0173, 0181, and 0813

Note: Results include validated data only.

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



Locally estimated scatterplot smoothing (LOESS) line and 95% confidence interval

0.044 mg/L 40 CFR 192 MCL (LTSP concentration limit for wells 0171 and 0173)

Background concentration from Table 7-3: 0.067 and 0.069 mg/L, respectively, for wells 0181 and 0813

Note: Results include validated data only.

Figure 7-7. Uranium 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, 1998–2022

Parameter[a]	POC Well	Initial Trend Analysis Date[b]	Number of Samples[c]	Kendall's tau[d]	p-value[d]	Trend[d]
Nitrate	0171	3/20/1998	52	0.161	0.093	No Trend
Nitrate	0173	3/17/1998	52	0.026	0.79	No Trend
Nitrate	0181	7/17/2002	25	-0.057	0.0001	Decreasing
Nitrate	0813	3/20/1998	52[e]	-0.094	0.32	No Trend
Sulfate	0171	3/20/1998	47	-0.076	0.46	No Trend
Sulfate	0173	3/17/1998	47	0.268	0.008	Increasing
Sulfate	0181	7/17/2002	20	0.484	0.003	Increasing
Sulfate	0813	3/20/1998	47	-0.062	0.54	No Trend
Uranium	0171	3/20/1998	53	0.665	<0.0001	Increasing
Uranium	0173	3/17/1998	53	0.697	<0.0001	Increasing
Uranium	0181	7/17/2002	25	0.097	0.51	No Trend
Uranium	0813	3/20/1998	53	0.747	<0.0001	Increasing

Notes:

[a] Nitrate expressed as nitrate plus nitrite as nitrogen. Results before 2004 were converted from nitrate as NO_3.

[b] Initial trend analysis dates vary as indicated above. For all well-parameter combinations, the final trend analysis date is June 15, 2022.

[c] Duplicate sample results were excluded from the analysis. As shown in Figure 7-5 through Figure 7-7, POC wells were sampled more frequently between 1998 and 2008 (about four times per year). After 1998, samples were collected on an annual basis. This inconsistency in frequency likely has some bearing on trend analysis results.

[d] 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. 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.

[e] Of the 52 nitrate results for well 0813, only 23 were detected (detection frequency of 44%).

For the 1998–2022 time frame, Mann-Kendall trend analysis identified a significant decreasing trend in sulfate concentrations for wells 0173 and 0181 (Table 7-5). For well 0173, this increasing trend stems largely from the marked increase in sulfate concentrations between 1998 and approximately 2006. Since then, although highly variable, sulfate concentrations have declined overall. Mann-Kendall trend analysis rerun for the 2010–2022 time frame indicates no significant concentration trend for well 0173. Sulfate concentrations in well 0813 remain below the 4440 mg/L LTSP concentration limit (Figure 7-6).

In 2022, uranium concentrations exceeded the corresponding LTSP concentration limit only in well 0171. Uranium concentrations in this well were initially below the 0.044 mg/L MCL (minimum of 0.0184 mg/L in 1999) but increased to about 0.1 mg/L by 2008 and have remained at that level since (Figure 7-7). Although uranium concentrations in well 0813 have exceeded the MCL since 2020 (most recent result of 0.052 mg/L), levels are still below the corresponding 0.069 mg/L concentration limit. Mann-Kendall trend analysis indicates significant increasing trends in uranium concentrations for all POC wells except well 0181 (Table 7-5). Uranium concentrations in well 0173 exceeded the MCL in 2018 and 2020 but have since declined (Figure 7-7). Uranium concentrations in well 0181 remain below the corresponding concentration limit and the trend is stable.

In summary, in 2022, concentrations of the 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. Based on data collected since 1998, Mann-Kendall trend analysis indicates significant increasing trends for several well-parameter combinations: sulfate in wells 0173 and 0181, and uranium in all POC wells except 0181. Groundwater monitoring and disposal cell performance evaluation will continue at the site in accordance with the requirements set forth in the LTSP until the Draft GCAP has been finalized.

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

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.

DOE (U.S. Department of Energy), 2011. *Draft Groundwater Compliance Action Plan for the Green River, Utah, Disposal Site*, LMS/GRN/S07892, Office of Legacy Management, December.

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 March 22, 2022.

7.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	240	Vegetation Along Chainlink Security Fence
PL-2	140	Perimeter Sign P8 with Bullet Holes
PL-3	55	New UAS Sign on South Gate Entrance
PL-4	300	Disposal Cell Southwest Side Slope and Site Marker SMK-2
PL-5	—	Survey Monument SM-2
PL-6	—	Quality Control Monument QC-2
PL-7	290	Cracked Concrete Around Monitoring Well 0181 (Onsite) and Abandoned Mill Buildings (Offsite)
PL-8	290	Northeast Side Slope of Disposal Cell
PL-9	120	Southeast Side Slope of Disposal Cell
PL-10	—	Soil Erosion Along Southwest Side Apron (Onsite)
PL-11	—	Possible Soil Piping near South Corner of Disposal Cell
PL-12	130	Soil Erosion Along Southeast Side Chainlink Security Fence
PL-13	130	Soil Erosion near Perimeter Sign P7
PL-14	310	Northwest Disposal Cell Side Slope

Note:
— = Photograph taken vertically from above.

PL-1. Vegetation Along Chainlink Security Fence

PL-2. Perimeter Sign P8 with Bullet Holes

PL-3. New UAS Sign on South Gate Entrance

PL-4. Disposal Cell Southwest Side Slope and Site Marker SMK-2

PL-5. Survey Monument SM-2

PL-6. Quality Control Monument QC-2

PL-7. Cracked Concrete Around Monitoring Well 0181 (Onsite) and Abandoned Mill Buildings (Offsite)

PL-8. Northeast Side Slope of Disposal Cell

PL-9. Southeast Side Slope of Disposal Cell

PL-10. Soil Erosion Along Southwest Side Apron (Onsite)

PL-11. Possible Soil Piping near South Corner of Disposal Cell

PL-12. Soil Erosion Along Southeast Side Chainlink Security Fence

PL-13. Soil Erosion near Perimeter Sign P7

PL-14. Northwest Disposal Cell Side Slope

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 7, 2022. 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 were addressed following the annual inspection.

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)
Groundwater 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, and wellhead protectors.

8.4 Inspection Results

The site, 6 miles southeast of Gunnison, Colorado, was inspected on September 7, 2022. The inspection was conducted by J. Lobato and D. Atkinson of the Legacy Management Support contractor. M. Hurt (LM site manager), M. Cosby (Colorado Department of Public Health and Environment), and R. Evans and B. Tharakan (NRC) 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 2022 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 8.10.

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. The entrance gate was locked and functional, and the entrance sign was intact and legible (PL-1). Locks were replaced at the access gates during the inspection. No other 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 protect sage-grouse and antelope that occupy the area. The perimeter fence was intact.

There are two gates—one on the east fence line and the other on the north fence line—that provide access from the site to offsite monitoring wells. Both gates were locked at the time of the inspection. Locks on the gates were replaced during the inspection.

There are 45 perimeter signs bolted to the perimeter fence posts. Perimeter signs P2, P3, and P43 have bullet damage but remain legible. 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.

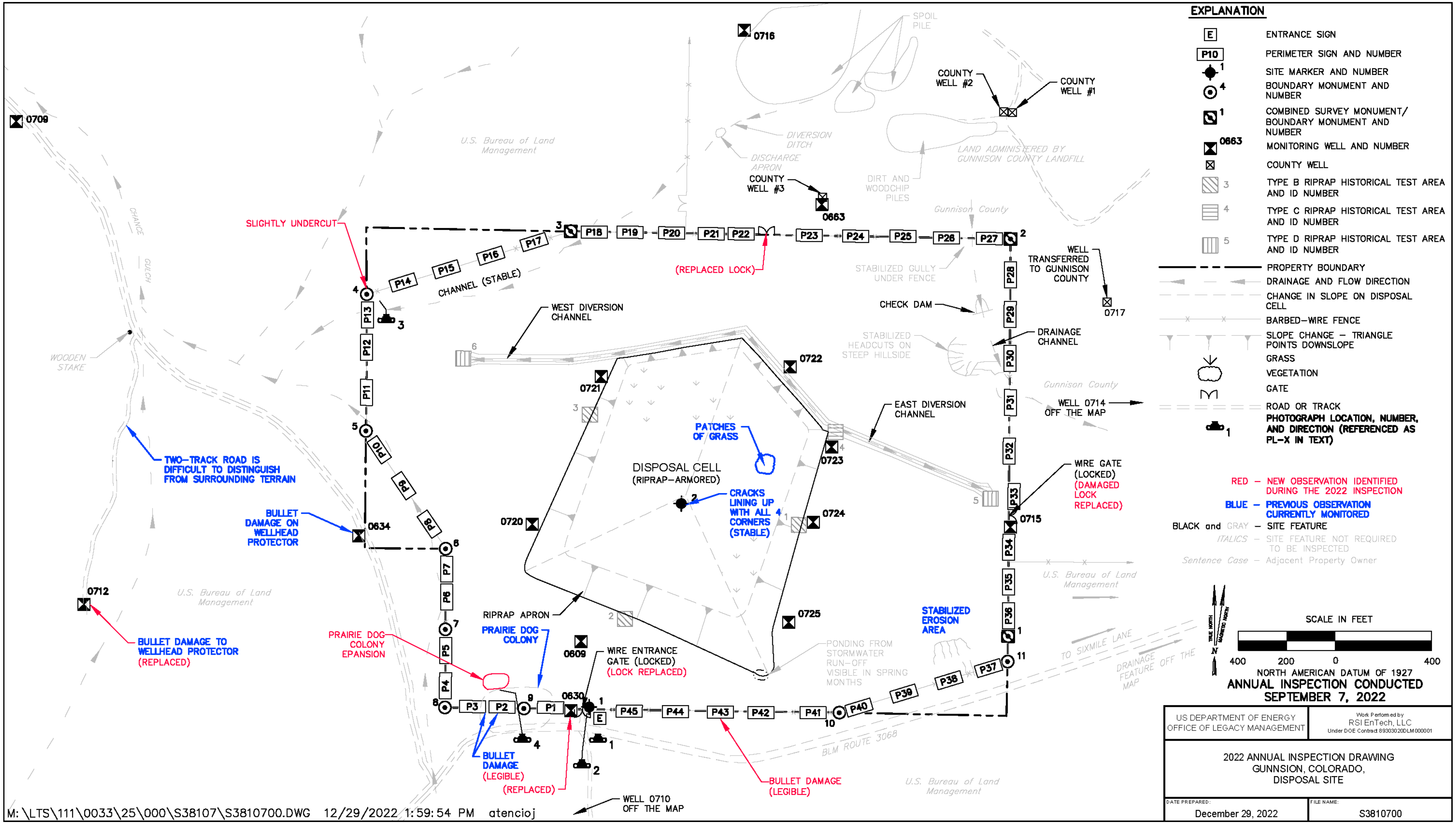


Figure 8-1. 2022 Annual Inspection Drawing for the Gunnison, Colorado, Disposal Site

8.4.1.4 Survey and Boundary Monuments

Three combined survey and boundary monuments and eight additional boundary monuments delineate the property boundary (PL-3). Inspectors noted that boundary monument BM-4 is slightly undercut but remains stable. No maintenance needs were identified.

8.4.1.5 Monitoring Wells

The site has 16 groundwater monitoring wells. The wellhead protectors were locked and properly labeled except for monitoring well 0716, which was found unlocked but was relocked by the inspectors. Bullet damage is on the wellhead protector of monitoring wells 0634 and 0712, but the well casings are not impacted and remain functional. The bullet-damaged locks reported in an earlier inspection report (on wells 0630 and 0712) were replaced following the inspection. The remaining monitoring well locks are being replaced as part of a programmatic effort.

Gunnison County landfill operators have placed concrete barriers to protect monitoring well 0716, located on landfill property, from landfill activities. 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. 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. This vegetation was treated before the inspection. 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, 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 rock-monitoring test areas 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 ponds in a low-lying area at the southeast corner of the disposal cell apron. 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 other 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. Several new prairie dog burrows were observed by inspectors inside the perimeter fence near perimeter signs P1, P2, and P3 (PL-4). 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. No 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 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. A prairie dog colony that has been observed along the southwestern boundary of the site appears to be moving inside the perimeter fence as noted in Section 8.4.2.3. Inspectors will continue to monitor 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 site. 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

Locks were replaced on the access gates and all monitoring well covers except at four locations (wells 0634, 0710, 0714, and 0715) during the inspection. Inspectors noted that the remaining locks will be replaced before the next inspection. 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/#site=GUD. 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 well 0715 was noted in the 2021 monitoring report results. In 2022, DOE initiated a new project to investigate the rising water level. Data collection for the rising water level project is ongoing.

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. The next sampling event is scheduled for 2026.

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

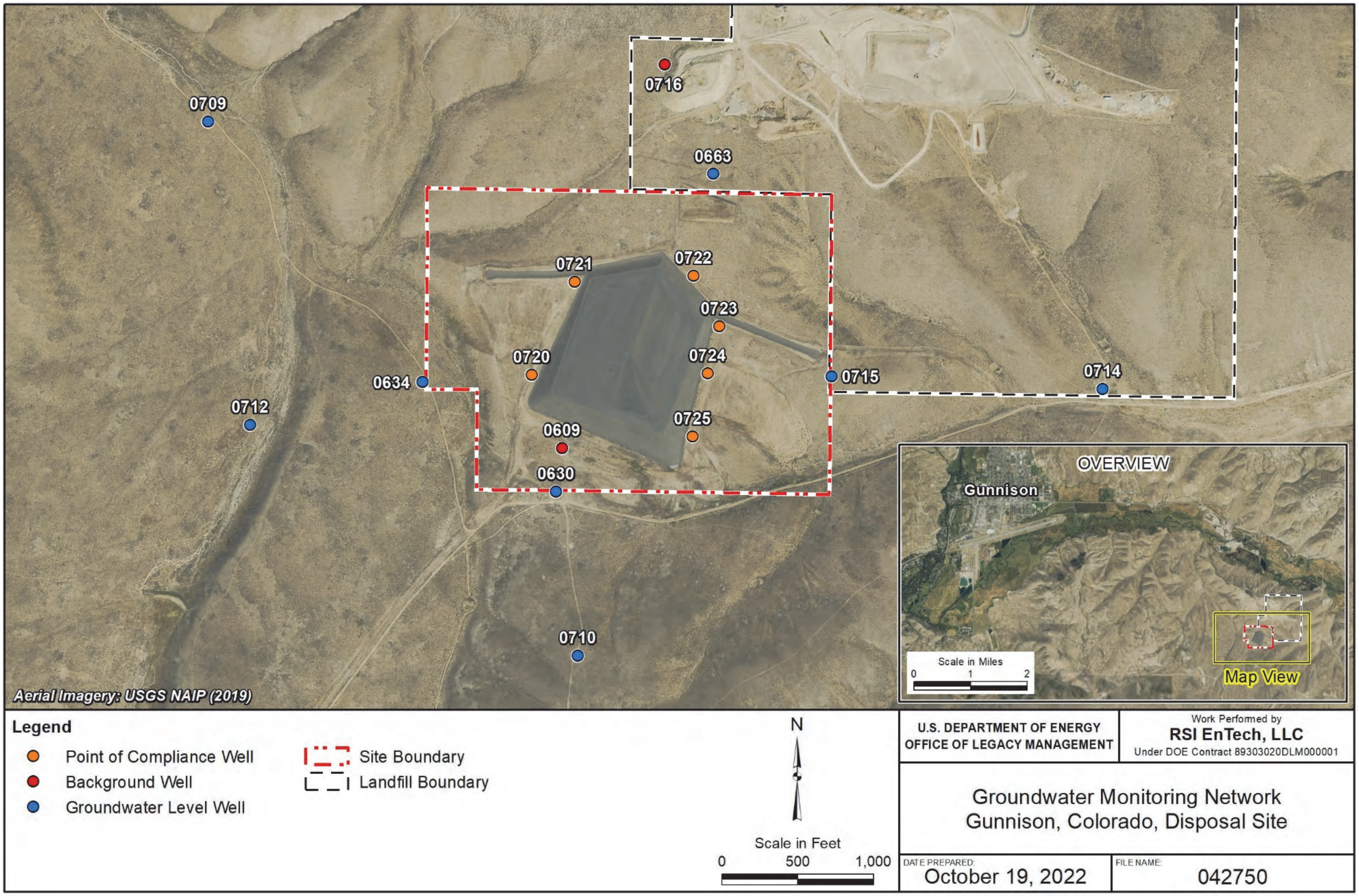


Figure 8-2. Groundwater Monitoring Network at the Gunnison, Colorado, Disposal Site

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.

8.9 References

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	0	Entrance Sign
PL-2	—	Site Marker SMK-1
PL-3	300	Boundary Monument BM-4 with Corner Posts in Background
PL-4	—	Prairie Dog Hole near Perimeter Sign P2

Note:
— = Photograph taken vertically from above.

PL-1. Entrance Sign

PL-2. Site Marker SMK-1

PL-3. Boundary Monument BM-4 with Corner Posts in Background

PL-4. Prairie Dog Hole near Perimeter Sign P2

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 June 28, 2022. 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 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 not performed in 2022. The 2022 annual inspection found no evidence of settling, slumping, erosion, or any other modifying process on the disposal cell side slopes 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 June 2019. Groundwater monitoring results were below the U.S. Environmental Protection Agency (EPA) designated 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 June 28, 2022. The inspection was conducted by C. Wentz and Z. Aldous of the Legacy Management Support (LMS) contractor. T. Sicilia (Oregon Department of Energy) and A. Denny (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 a 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 2022 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 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 (PL-2). The locks on the entrance gate and the pedestrian gate were replaced during the 2022 inspection. No maintenance needs were identified.

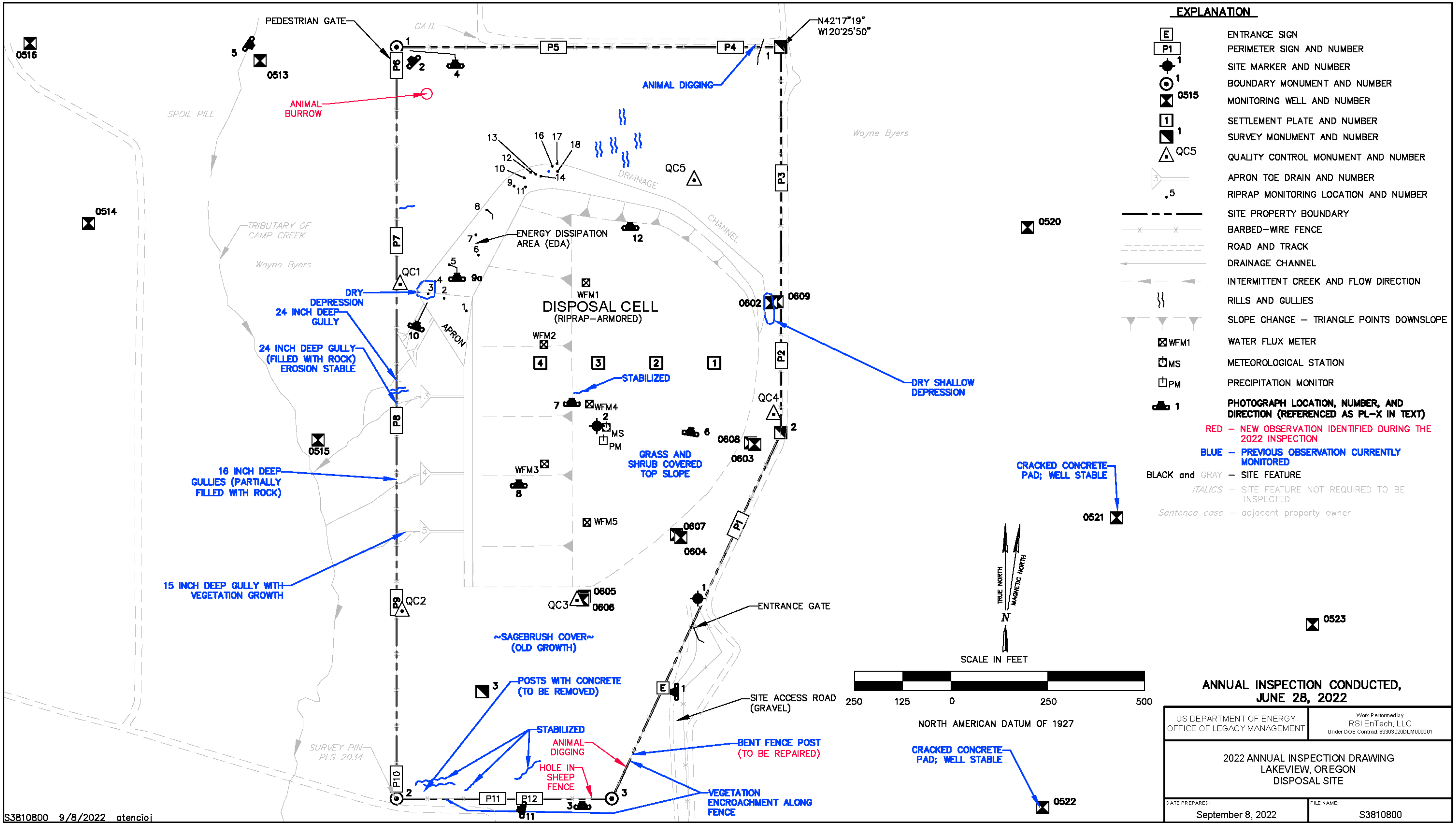


Figure 9-1. 2022 Annual Inspection Drawing for the Lakeview, Oregon, Disposal Site

9.4.1.2 Perimeter Fence and Signs

A four-strand barbed-wire perimeter fence (five-strand along much of the western boundary) encloses the site. There is also sheep fencing on the southeastern and southern boundaries of the site. Some vegetation is growing near, and entangled in, the perimeter fence line, but the fence appeared stable and remains functional. A bent fence post was observed during the 2021 inspection near the southeast corner of the site and will be repaired in the future. A small hole in the sheep fence was observed in the south fence line (PL-3). The hole appears to be man-made, possibly to help young animals escape through the fence. Evidence of minor erosion due to digging by animals under the fence was identified near the northeast and southeast corners of the fence line, but this is not a concern to the site security or the integrity of the fence.

There are 12 perimeter signs, attached to steel posts set in concrete and positioned along the property boundary. No new maintenance needs were identified.

9.4.1.3 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.

9.4.1.4 Survey and Boundary Monuments

Three survey monuments and three boundary monuments (PL-4) 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 2022. No maintenance needs were identified.

9.4.1.6 Monitoring Wells

The site has 12 downgradient groundwater monitoring wells with four wells offsite to the east. Four upgradient wells are offsite to the west (PL-5). Wells 0522 and 0521 have concrete bases that are cracked, but the wellhead protectors remain stable. A dry, shallow depression remains near 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-size 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, but some areas remain sparsely vegetated. This plant growth pattern is consistent with surrounding offsite areas (PL-6). 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 riprap-void spaces. No structural or disposal cell performance concerns are associated with the riprap becoming visible on the top slope.

The incipient development of checkerboard soil erosion patterns was observed in some of the more sparsely vegetated areas on the top slope (consistent with similar areas offsite). A previously identified shallow rill on the top slope could not be found and was assumed to have stabilized from natural weathering processes. No additional changes were noted during the inspection. No structural or disposal cell performance concerns are associated with this condition 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 (PL-7). No erosion was observed during the inspection at the crest of the west side slope and the disposal cell top slope, and 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.

LM is participating in an NRC-sponsored project to investigate the effect of soil-forming processes on the performance of the radon barrier on UMTRCA disposal cells. In October 2017, researchers excavated through the cover materials (soil, riprap, bedding material, and underlying radon barrier) at six locations on the disposal cell (five on the top slope and one on the west side slope) to support the study. Areas restored and reseeded in 2017 as part of the study were observed to have vegetation growth. The restored locations were inspected to confirm that no settlement is occurring, positive drainage is preserved, and vegetation is reestablishing. No maintenance needs were identified.

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. Deterioration monitoring at the site consists of rock gradation monitoring on the west side slope and photographic monitoring in the energy dissipation area (EDA) in accordance with the LTSP. Addendums to the LTSP commit LM to annually assess the mean diameter (D_{50}) value of the riprap on the west side slope through gradation monitoring to ensure 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 2022. DOE is updating the LTSP to reflect this change. No rills or erosional features were observed along the side slope (PL-8) and the interface between the vegetated soil and rock top slope during the inspection.

Annual photographic monitoring of the 18 locations for long-term rock monitoring was conducted during the 2022 inspection (PL-9a). 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 (PL-9b). No significant degradation of the EDA rock has been observed since monitoring began.

In the past, water has been observed in the large depression in the EDA at the lower end of the drainage channel. Water is a potential concern because inundation may accelerate deterioration of the large riprap by the freeze-thaw process. Dry conditions were again observed in the EDA depression during the 2022 inspection (PL-10).

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. 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 Toe Drains 1 and 3 suggests that conditions are periodically wetter in this area because stormwater runoff is channeled there by control features. No ponded water was observed during the inspection. Minor erosion was observed near the fence line near Toe Drain 3 but appears to be stable. 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 other 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 visually 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. An active animal burrow was observed in the northwest corner of the site near the pedestrian gate but does not pose a threat to any site features.

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 (PL-11).

Gullies that formed in seeded areas extending west of 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. 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. Several rills and shallow gullies were also observed onsite on the slope north of the disposal cell where grass reestablishment has been limited (PL-12), in a drainage area on the site north of perimeter sign P7, north of perimeter sign P8, and in the southwest corner of the site. These gullies and rills were identified during previous annual inspections but appear to have stabilized, as no significant changes were observed in 2022. 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 cut telephone poles and signposts with concrete bases in the southwest corner of the site. The cut telephone poles were removed in June 2019; however, the fence posts with cement bases were too heavy to remove by hand. Though this remaining debris does not affect site integrity, it will be removed in the future. 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

During the inspection, the locks on the entrance gate and the pedestrian gate were replaced. No additional maintenance was performed.

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

- Replacement of a bent fence post near the southeast corner of the site
- Removal of the signposts with concrete bases from the southwest corner of the site

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 June 13, 2019, and the next event will occur in 2024.

The groundwater monitoring network consists of nine monitoring wells, including eight downgradient point of compliance (POC) wells and one upgradient background monitoring well (Table 9-2 and Figure 9-2). Four of the nine monitoring wells were observed to be dry on June 13, 2019, and could not be sampled.

Seven additional LM-owned monitoring wells (wells 0513, 0514, 0516, 0520, 0521, 0522, and 0523) are on private property adjacent to the site but are no longer required to be sampled as identified in the LTSP (Figure 9-1). The constituents monitored in site groundwater are arsenic, cadmium, and uranium. EPA established MCLs for these analytes in groundwater in 40 CFR 192 Table 1 Subpart A (Table 9-3).

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	0515

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 Table 1 Subpart A)

Abbreviation:
mg/L = milligrams per liter

Concentrations of these constituents continued to remain significantly below their respective MCLs in 2019. Arsenic concentrations were similar to the 2014 results, all cadmium concentration results were below the laboratory detection limit of 0.000083 milligrams per liter, and uranium concentrations remained stable or have slightly increased (DOE 2020).

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/#site=LKD). The *2019 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites* (DOE 2020) shows the most recent monitoring results. All monitoring results were within the range of historical monitoring results, with the exception of the uranium concentration at monitoring well 0606, which showed a slight increase but remains below the MCL. Based on the monitoring results to date, there is no indication of any degradation of groundwater quality near the site. The next disposal cell groundwater monitoring event is scheduled for 2024.

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.

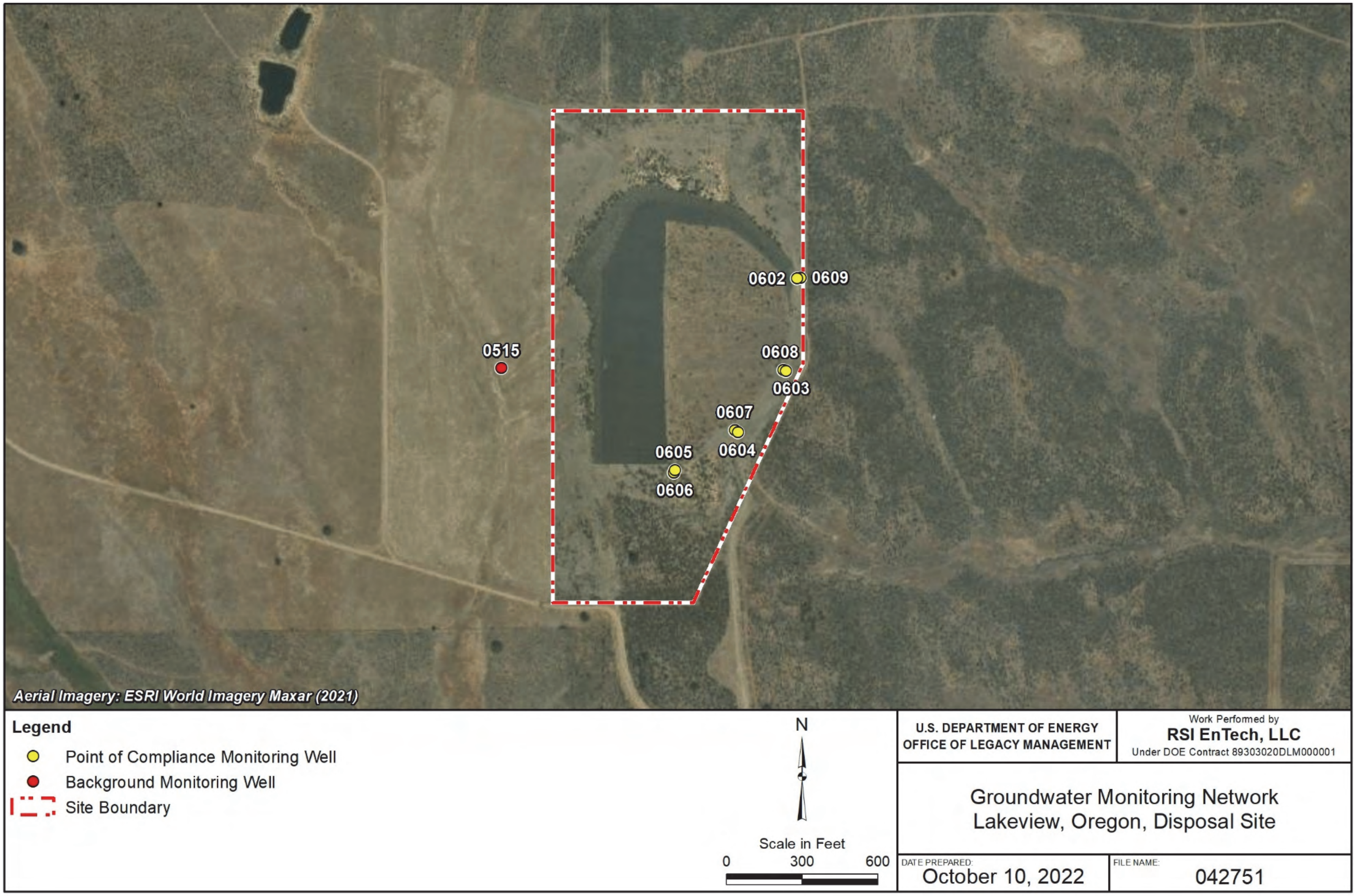


Figure 9-2. Groundwater Monitoring Network, Lakeview, Oregon, Disposal Site

9.9 References

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*.

Dayvault, 2015. Jalena 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.

DOE (U.S. Department of Energy), 2020. *2019 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites*, LMS/S26685, Office of Legacy Management, March.

Mandeville, 2019. Doug 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.

9.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	270	Site Entrance Sign
PL-2	315	Pedestrian Gate
PL-3	—	Hole in Sheep Fence
PL-4	—	Boundary Monument BM-1
PL-5	125	Monitoring Well 0513
PL-6	10	Vegetation on Top Slope of Disposal Cell
PL-7	0	West Side of Disposal Cell
PL-8	0	West Side Slope of Disposal Cell
PL-9	—	(a) Riprap Monitoring Location No.5 in EDA (b) Historical (2006) Photo of Riprap Monitoring Location No.5 in EDA
PL-10	20	Dry Depression in EDA
PL-11	280	Southern Fence Line with Cougar Peak Fire Burn Scar in Distance
PL-12	0	Erosional Features on North Slope of Disposal Cell

Note:
— = Photograph taken vertically from above.

PL-1. Site Entrance Sign

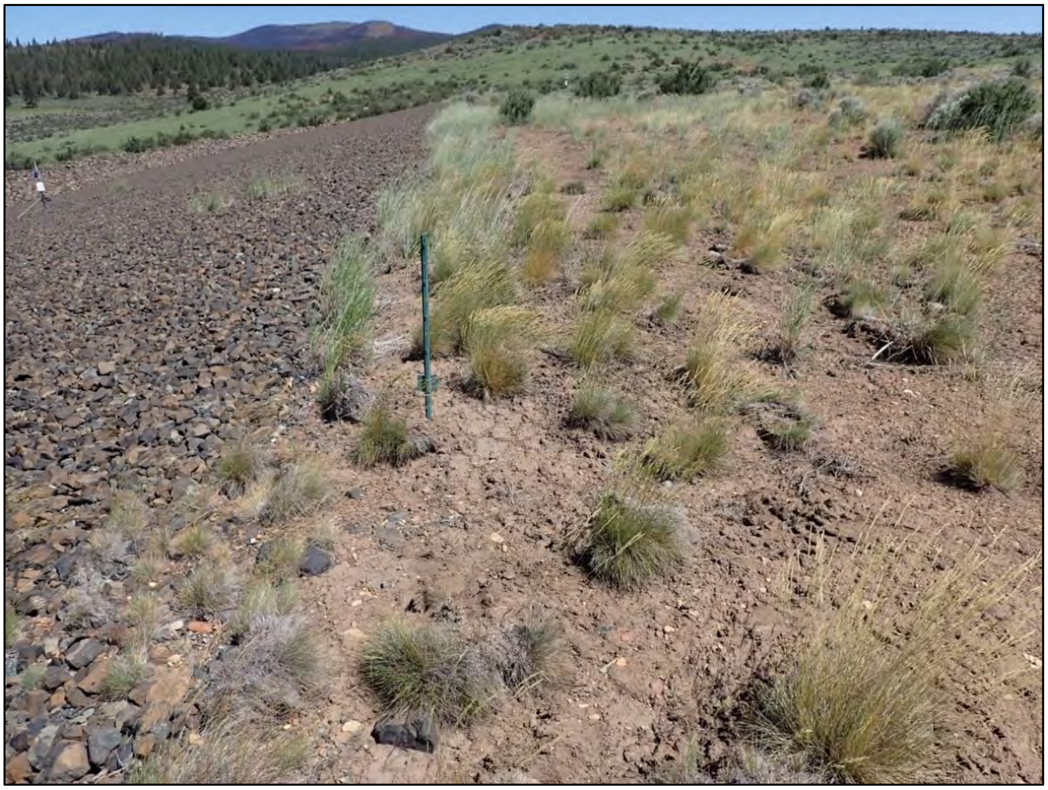
PL-2. Pedestrian Gate

PL-3. Hole in Sheep Fence

PL-4. Boundary Monument BM-1

PL-5. Monitoring Well 0513

PL-6. Vegetation on Top Slope of Disposal Cell



PL-7. West Side of Disposal Cell

PL-8. West Side Slope of Disposal Cell

PL-9a. Riprap Monitoring Location No.5 in EDA

PL-9b. Historical (2006) Photo of Riprap Monitoring Location No.5 in EDA

PL-10. Dry Depression in EDA

PL-11. Southern Fence Line with Cougar Peak Fire Burn Scar in Distance

PL-12. Erosional Features on North Slope of Disposal Cell

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 June 7, 2022. No changes were observed on the disposal cell or in the associated drainage features. Inspectors identified no maintenance needs and 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, 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 June 7, 2022. The inspection was conducted by Z. Aldous and L. Sheader of the Legacy Management Support (LMS) contractor. K. Kreie and M. Young of LM; P. Rekow, D. Nygard, and T. Richardson from the State of Idaho; and M. Williams of the LMS contractor attended the inspection. The area had received a significant amount of precipitation before 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.

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 and new observations identified during the 2022 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 (PL-1). 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 lock to the entrance gate was replaced with a new lock during the 2022 annual inspection. 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 positioned along the unfenced property boundary. Several perimeter signs (P3, P4, P13, and P15) have bullet damage but remain legible (PL-2). Perimeter sign P7 is slightly bent from treefall but remains legible. No 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-3) 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 (PL-4) 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 survey monuments were about 5 to 15 ft outside DOE survey monuments. No maintenance needs were identified.

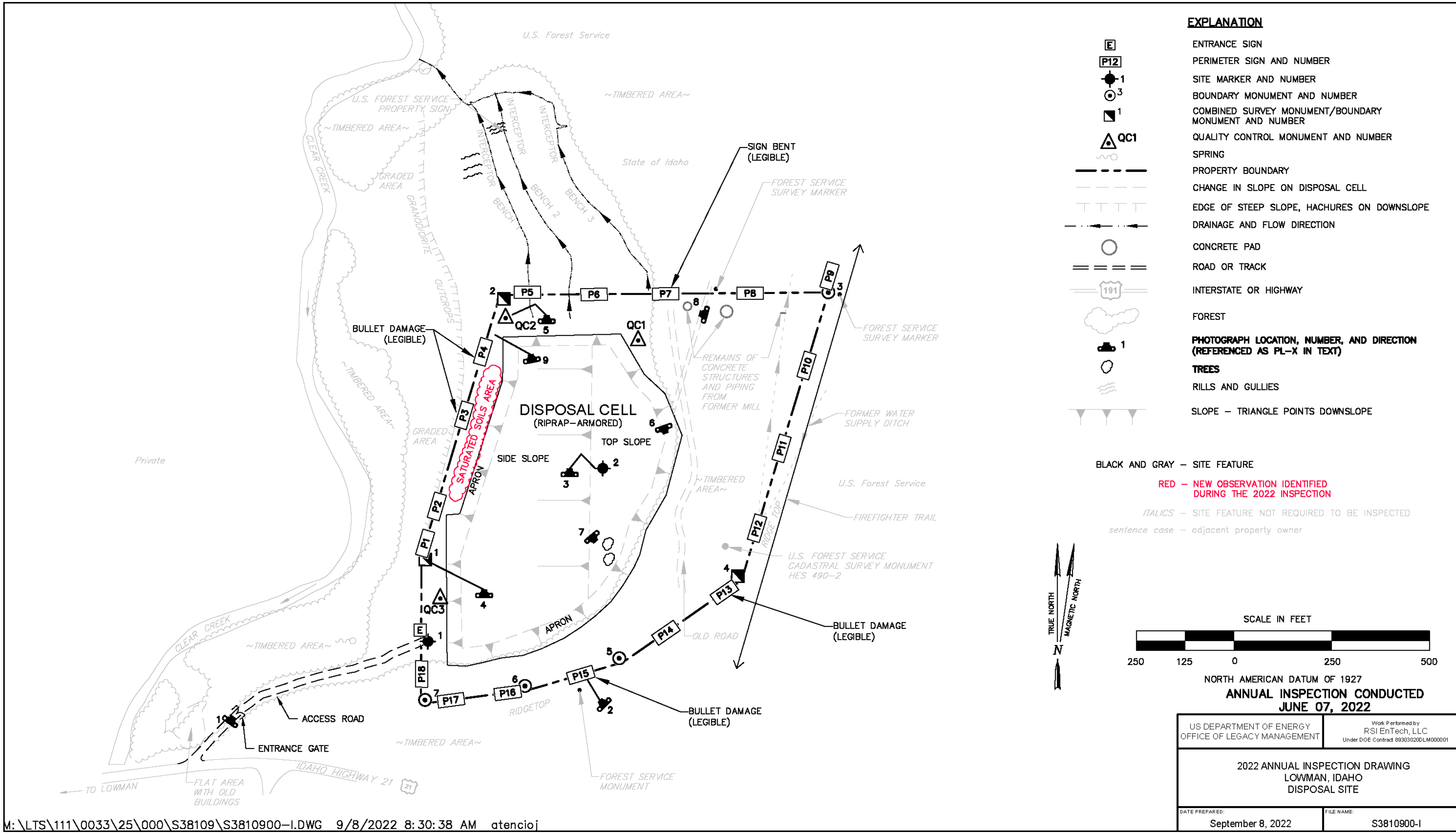


Figure 10-1. 2022 Annual Inspection Drawing for the Lowman, Idaho, Disposal Site

10.4.1.5 Aerial Survey Quality Control Monuments

Three aerial survey quality control monuments were inspected during the 2022 annual inspection (PL-5). The baseline aerial survey is scheduled to be flown in 2023. 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. An apron of larger riprap surrounds the disposal cell on all sides (PL-6). There was no evidence of erosion, settling, slumping, rock degradation, or other modifying processes that might affect the integrity of the disposal cell. An area of saturated soil was observed on the northwest side of the cell, confirming that the disposal cell is shedding precipitation appropriately.

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. Other plants growing on the disposal cell do not threaten the integrity of the disposal cell and are not controlled (PL-7). Numerous ponderosa pine trees were cut down and left in place in 2018. Additional ponderosa pine and Douglas fir trees have established since then and are large enough to require evaluation and potential control. 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 (PL-8). 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 2022. 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-9). Over the years, minor erosion has breached the benches in several locations, and LM has repaired this erosion. Rock armoring has been very successful in preventing further erosion, and vegetation has become well established. No 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

No 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 is in compliance 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

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	35	Site Entrance Gate
PL-2	315	Perimeter Sign P15 with Bullet Damage
PL-3	—	Site Marker SMK-2
PL-4	—	Combined Survey and Boundary Monument 1
PL-5	—	Quality Control Monument QC-2
PL-6	160	Disposal Cell Apron on Eastern Side
PL-7	140	Disposal Cell Top Slope
PL-8	285	Piping from Former Mill
PL-9	350	Interceptor Benches with Quality Control Monument QC-2 in Foreground

Note:
— = Photograph taken vertically from above.

PL-1. Site Entrance Gate

PL-2. Perimeter Sign P15 with Bullet Damage

PL-3. Site Marker SMK-2

PL-4. Combined Survey and Boundary Monument 1

PL-5. Quality Control Monument QC-2

PL-6. Disposal Cell Apron on Eastern Side

PL-7. Disposal Cell Top Slope

PL-8. Piping from Former Mill

PL-9. Interceptor Benches with Quality Control Monument QC-2 in Foreground

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 7, 2022. 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 7, 2022. The inspection was conducted by J. Cario and Z. Aldous of the Legacy Management Support (LMS) contractor. S. Woods (LM) and C. Murphy (LMS) 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 2022 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 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 the site marker and entrance sign. The second gate is between perimeter signs P3 and P4 in the northwest corner of the property. Both gates were locked and functional and had locks replaced for additional security. The entrance sign is near the entrance gate and is mounted on a T-post in the perimeter fence (PL-1). 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. Minor damage to the perimeter fence from animal contact periodically occurs. On July 27, 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 has been cut between perimeter sign P1 and the entrance gate (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 (P5, P6, P8, and P11) have bullet damage but remain legible. Perimeter sign P16 is faded (PL-3), and perimeter sign P26 was missing. Perimeter signs P16 and P26 were replaced following the inspection. No other maintenance needs were identified.

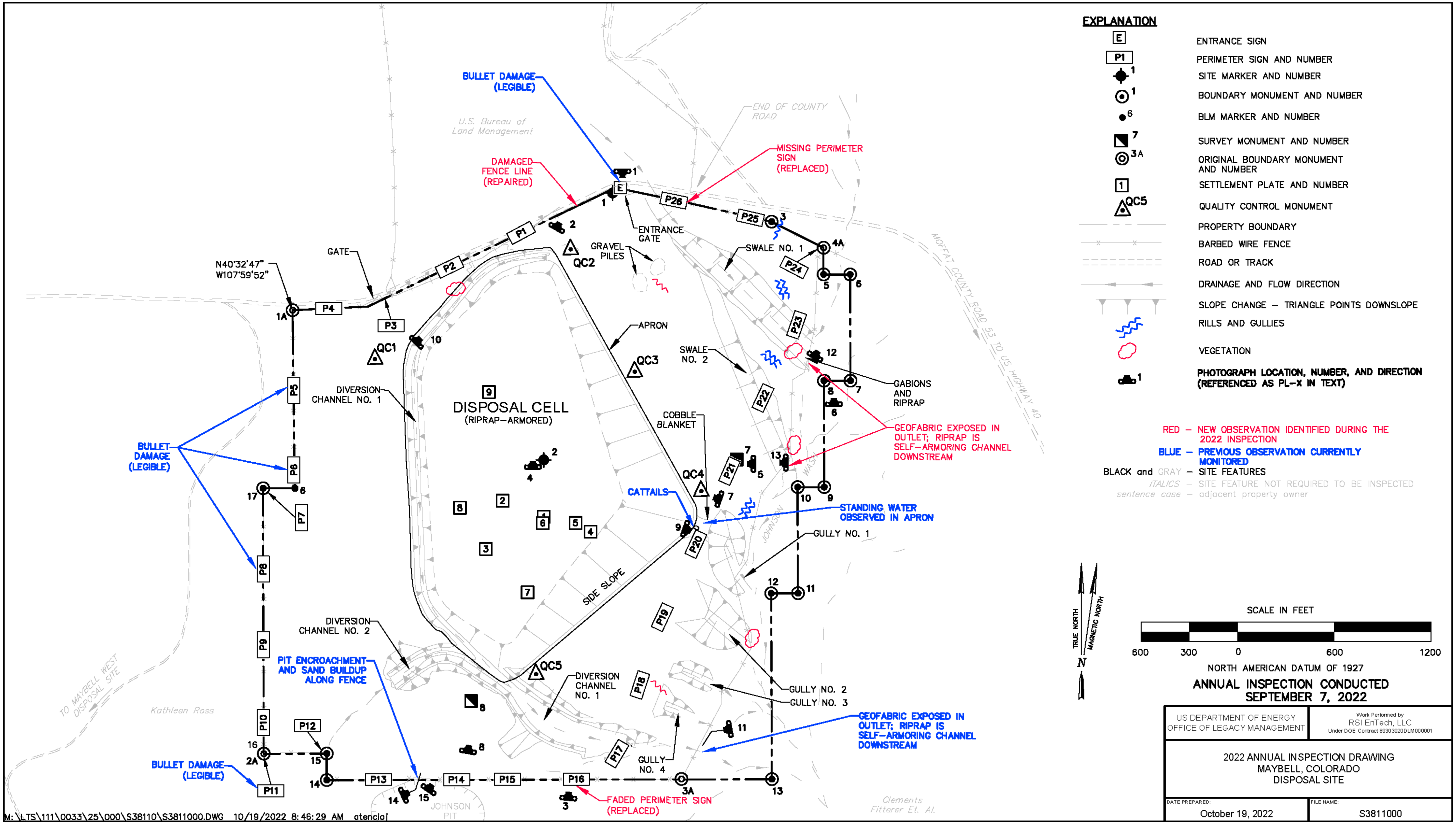


Figure 11-1. 2022 Annual Inspection Drawing for the Maybell, Colorado, Disposal Site

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 (PL-4). No maintenance needs were identified.

11.4.1.4 Survey and Boundary Monuments

The site has two survey monuments. Survey monument SM-7 (PL-5) 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 (PL-6). No maintenance needs were identified.

11.4.1.5 Aerial Survey Quality Control Monuments

Five aerial survey quality control monuments were inspected during the 2022 inspection (PL-7). 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-8). 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 at this location. Cattails are present in this area indicating regular pooling of water (PL-9). During the 2021 inspection, standing water was observed in the easternmost portion of the disposal cell toe slope apron upgradient of the cobble blanket. This area was dry during the 2022 inspection. No other 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-10), swales, and gullies are performing as designed. Noxious weeds were observed growing in the diversion and drainage channels and were treated after the inspection.

Erosion directly downgradient of the outlets of Diversion Channel No. 1 (PL-11) and Swale No. 1 (PL-12) has exposed the underlying geofabric, but that exposure has not changed significantly since the 2020 inspection. During the 2022 inspection, it was discovered that Swale No. 2 (PL-13) had erosion exposing the underlying geofabric. Riprap placed in the outlets continues to protect against headcutting. Minor rills adjacent to Swale No. 1, Swale No. 2, Gully No. 1, and Gully No. 4 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 other maintenance needs were identified.

11.4.2.3 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.

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 (PL-14). 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-15). 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 2022 inspection included:

- Treatment of noxious weeds in the drainage and diversion channels.
- Replacement of perimeter signs P16 and P26.
- Repair of fence between perimeter sign P1 and the entrance gate.

No other maintenance needs were identified.

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, and 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. No noxious weeds or deep-rooted vegetation were noted on the disposal cell during the inspection. Noxious weeds were observed in the drainage and diversion channels. 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 non-disturbed areas.

11.9 References

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, U.S. Department of Energy Office of Legacy Management, April.

Janosko, 2005. Gary S. 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 Michael 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	30	Damaged Fence near Perimeter Sign P1
PL-3	5	Faded Perimeter Sign P16 to Be Replaced
PL-4	—	Site Marker SMK-2 on Disposal Cell
PL-5	270	Survey Monument SM-7
PL-6	—	Boundary Monument BM-8
PL-7	290	Quality Control Monument QC-4
PL-8	10	Disposal Cell Overview
PL-9	110	Cattails Along Eastern Side Slope Apron
PL-10	45	Diversion Channel No. 1
PL-11	260	Exposed Geofabric in Diversion Channel No. 1
PL-12	30	Exposed Geofabric in Swale No. 1
PL-13	270	Exposed Geofabric in Swale No. 2
PL-14	65	Encroachment of Johnson Pit
PL-15	35	Sand Buildup Along Fence near Johnson Pit

Note:
— = Photograph taken vertically from above.

PL-1. Entrance Sign

PL-2. Damaged Fence near Perimeter Sign P1

PL-3. Faded Perimeter Sign P16 to Be Replaced

PL-4. Site Marker SMK-2 on Disposal Cell

PL-5. Survey Monument SM-7

PL-6. Boundary Monument BM-8

PL-7. Quality Control Monument QC-4

PL-8. Disposal Cell Overview

PL-9. Cattails Along Eastern Side Slope Apron

PL-10. Diversion Channel No. 1

PL-11. Exposed Geofabric in Diversion Channel No. 1

PL-12. Exposed Geofabric in Swale No. 1

PL-13. Exposed Geofabric in Swale No. 2

PL-14. Encroachment of Johnson Pit

PL-15. 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 August 23, 2022.

In response to the cell depressions identified in 2016, the U.S. Department of Energy (DOE) Office of Legacy Management (LM) continued investigations and performed geotechnical sampling and materials testing (GSMT) on the disposal cell side slope cover components in April 2019 (DOE 2019a). Data obtained through the 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).

The interim cover protection (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 can be assessed. The ICP project focused on the degradation associated with the lower portions of the northeast side slope.

No evidence of a breach through the radon barrier has been identified, and the site remains protective of human health and the environment. Collaborative efforts are in progress to evaluate other potential contributing causes of erosion.

During the annual inspection, LM also conducted annual observational seep monitoring. The results are described in Section 12.8. 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 disposal 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 (DE-FC04-85AL26731) 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, 1.5 miles south of the town of Mexican Hat, Utah, and 0.5-mile northeast of the Navajo community of Halchita, was inspected on August 23, 2022. The inspection was conducted by M. Franke, K. Lott, C. Mueller, and J. Manée of the Legacy Management Support (LMS) contractor. J. Dayvault (LM) and S. Cameron and P. Hazenberg (Florida International University) 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.

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 2022 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.

12.4.1.1 Site Access, Entrance Gate, and Entrance Sign

Access to the site is from a short, unmarked dirt road off U.S. Highway 163 that ends at a graded parking area. Minor erosion continues along the dirt access road, but the site remains accessible (PL-1). 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.

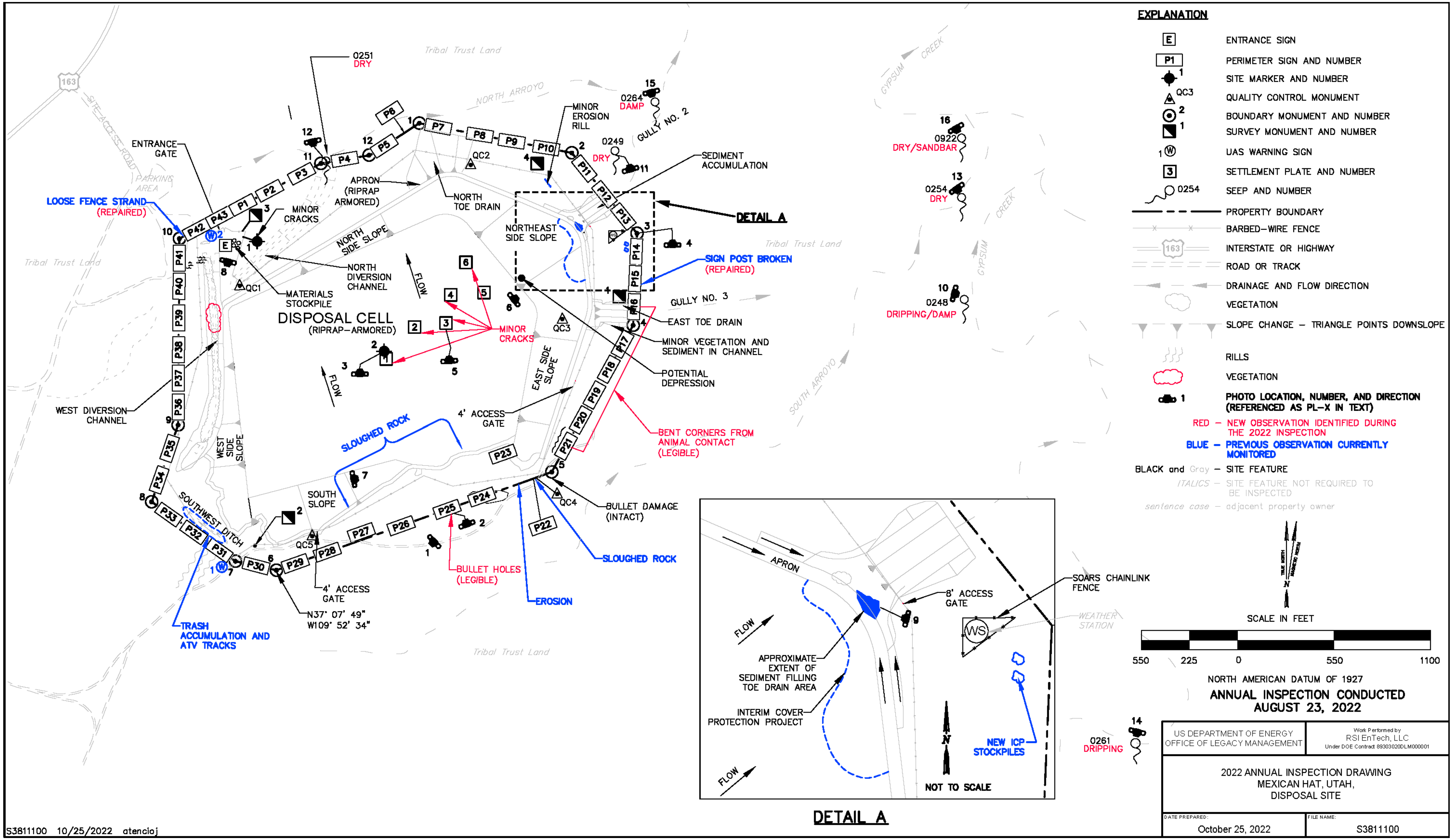


Figure 12-1. 2022 Annual Inspection Drawing for the Mexican Hat, Utah, Disposal Site

12.4.1.2 Fence and Perimeter Signs

A barbed-wire fence encloses the disposal cell. Damage to the fence by livestock, erosion, or vandalism noted during the 2021 inspection was repaired, including one loose fence strand identified on the northwest corner of the site near perimeter sign P42. 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.

A perimeter chainlink fence was installed in 2019 around the existing System Operation and Analysis at Remote Sites (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.

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. Perimeter signs are typically outside the fence that encloses the disposal cell, but some are affixed directly to the fence or immediately inside the fence. The signpost at perimeter sign P15 was repaired before the inspection. All remaining perimeter signs are in good condition. The corners of the lower southeastern perimeter signs (perimeter signs P16 through P21) are bent possibly from burro contact. Perimeter sign P25 has bullet holes but is legible (PL-2).

Two signs prohibiting unauthorized unmanned 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-5. No other maintenance needs were identified.

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, which have been noted during previous inspections. This does not compromise the integrity of the base, and repairs are unnecessary at this time. Site marker SMK-2 is on the top slope of the disposal cell (PL-3) 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 delineate the property boundary (PL-4). As noted previously, vandalism has resulted in bullet damage to boundary monument BM-5, but the monument remains legible and intact. No immediate maintenance needs were identified.

12.4.1.5 Aerial Survey Quality Control Monuments

Five aerial survey quality control monuments were inspected during the 2022 annual inspection. No maintenance needs were identified.

12.4.1.6 Settlement Plates

Six settlement plates were inspected during the 2022 annual inspection. Settlement plates SP-1, SP-2, SP-3, SP-4, and SP-6 have minor cracking in the concrete bases, but the integrity of the bases are not compromised (PL-5). No maintenance needs were identified.

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. No other erosion, settling, slumping, rock degradation, or other modifying processes that might affect the integrity of the disposal cell were evident on the top slope of the disposal cell.

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 every year since 2016 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.

One depression feature was observed near the top of the northeast side slope (PL-6). The feature will be verified with light detection and ranging (lidar) data from an aerial survey planned in October 2022.

There was no noticeable increase of sloughed rock or soil along the south apron of the disposal cell (PL-7). Because the apron is adjacent to the base of a steep exposure of Halgaito Shale, it is expected that occasional sloughing of rock and soil associated with this exposure will continue. The accumulated material is not affecting the function of the apron, and this area will continue to be monitored. No maintenance needs were identified.

12.4.2.2 Toe Drains and Diversion Channels

Erosion continues in upgradient offsite areas resulting in sediment being transported onto the site and into the west diversion channel. Sediment accumulation has promoted the growth of vegetation in the west diversion channel (PL-8).

Sediment accumulation has also been observed along the transition zone from the apron to the northeast toe drain. The origin of this material is being evaluated as part of the ongoing cover degradation assessment. Possible sources of this material include a windblown material that originates offsite and radon barrier material associated with the depression features on the northeast side slope of the disposal cell. Visual observations during the inspection did not identify any apparent increases in the sediment accumulation in this area compared to previous visual observations; however, increased vegetation growth was apparent in this drainage apron at the toe of the northeast side slope (PL-9). No immediate maintenance needs were identified.

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). The most noticeable accumulation of trash is in the southwest ditch, inside the barbed-wire fence; however, this trash is likely transported onto the site by wind. Inside the site boundary (outside the fence), evidence of vehicle and all-terrain vehicle tracks were observed in the same areas where trash accumulation is present.

As part of the 2019 ICP project, road repairs were performed along the dirt access road to provide site access to haul trucks, delivery trucks, and other vehicles. Road repairs included grading the entire access road. Two incised areas were stabilized by installing Geocell with standard U.S. Department of Transportation-specific rock types that allow proper drainage. The repaired areas were examined during the inspection and appeared to be performing as designed, with the exception of minor erosion on the downslope side. Inspectors will continue to monitor the area.

The revegetated material and equipment storage areas used during the ICP project were inspected in 2022. Minimal vegetation growth has occurred. The straw wattles installed to provide stormwater run-on and runoff protection were intact and performing as designed.

Old bedding material removed during the ICP project and excess new bedding material were stockpiled near the SOARS perimeter chainlink fence. 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 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 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. The lidar data from the October 2022 aerial survey will be used to verify the existence of the visually-observed depression on the northeast side slope. No other follow-up inspections, evaluations, or work are needed based on the inspection results.

12.6 Maintenance

The signpost at perimeter sign P15 and the loose fence strand near perimeter sign P42 were both repaired before the inspection. No maintenance needs were identified during the 2022 annual site inspection.

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 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.

The LTSP requires annual visual monitoring of the seven designated seeps through 2016, when an evaluation was to be conducted and a decision 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.

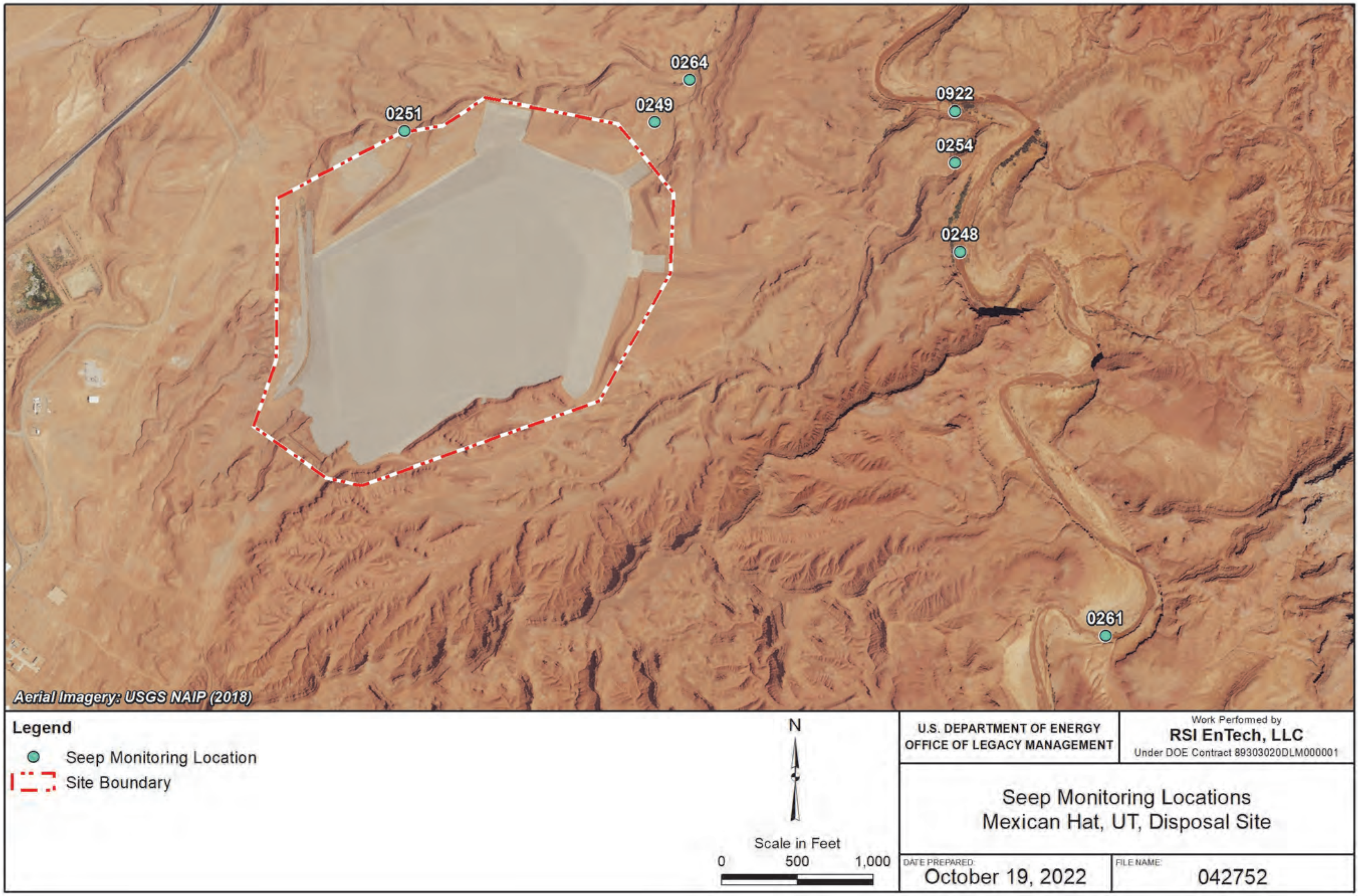


Figure 12-2. Seep Monitoring Locations at the Mexican Hat, Utah, Disposal Site

Observational documentation consists of photographing seeps (PL-10 through PL-16) and providing descriptions of the conditions observed at the seven designated seeps. Since 2010, groundwater discharge from seeps had been observed at cross-gradient seep 0248, which typically exhibits dripping conditions; during the 2022 inspection, seep 0248 was dripping and showed new vegetation growth (PL-10).

Upgradient (background) seep 0261 (PL-14), approximately 0.5 mile upstream of seep 0248 in Gypsum Creek, was observed to be dripping during the inspection. Seep 0264 was damp (PL-15), and ephemeral drainages along the perimeter of the site were dry.

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-10	Dripping (no flow rate measured). New vegetation growth was noted.
0249	Gully No. 2	Downgradient	PL-11	Dry conditions (no evaporites present); 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-12	Dry conditions (no evaporites present).
0254	South Arroyo	Downgradient	PL-13	Dry conditions (no evaporites present). Warning sign not posted at this location due to seasonal flash flood conditions in the ephemeral drainage.
0261	Gypsum Creek	Upgradient (background)	PL-14	Seep was dripping. This seep discharges directly into Gypsum Creek, which has standing water outside of the immediate seep discharge area. Warning sign not posted since this seep is a background location.
0264	North Arroyo	Downgradient	PL-15	Damp (no evaporites present in immediate area). Ephemeral wash near seep location was damp, with no evidence of evaporites in the areas observed during the inspection.
0922	Gypsum Creek	Downgradient	PL-16	Dry conditions (no evaporites present in immediate area). Seep is along the south side of Gypsum Creek, and the seep location is covered entirely by a sandbar that has formed along this section of Gypsum Creek.

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. Vegetation growth in the west diversion channel will continue to be monitored during annual inspections to ensure that it does not negatively affect the performance of this surface water diversion structure (PL-8). No maintenance needs were identified.

12.9 References

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	228	Access Road with Minor Erosion
PL-2	340	Perimeter Sign P25
PL-3	—	Site Marker SMK-2
PL-4	—	Boundary Monument BM-3
PL-5	356	Settlement Plate SP-3
PL-6	52	Depression Feature on the Northeast Side Slope
PL-7	79	Sloughing Rock Along the South Apron
PL-8	194	Vegetation Growth in the West Diversion Channel
PL-9	285	Vegetation in the Northeast Toe Drain
PL-10	105	Seep 0248 (Dripping)
PL-11	344	Seep 0249 (Dry)
PL-12	168	Seep 0251 (Dry)
PL-13	145	Seep 0254 (Dry)
PL-14	193	Seep 0261 (Dripping)
PL-15	166	Seep 0264 (Damp)
PL-16	150	Seep 0922 (Dry)

Note:
— = Photograph taken vertically from above.

PL-1. Access Road with Minor Erosion

PL-2. Perimeter Sign P25

PL-3. Site Marker SMK-2

PL-4. Boundary Monument BM-3

PL-5. Settlement Plate SP-3

PL-6. Depression Feature on the Northeast Side Slope

PL-7. Sloughing Rock Along the South Apron

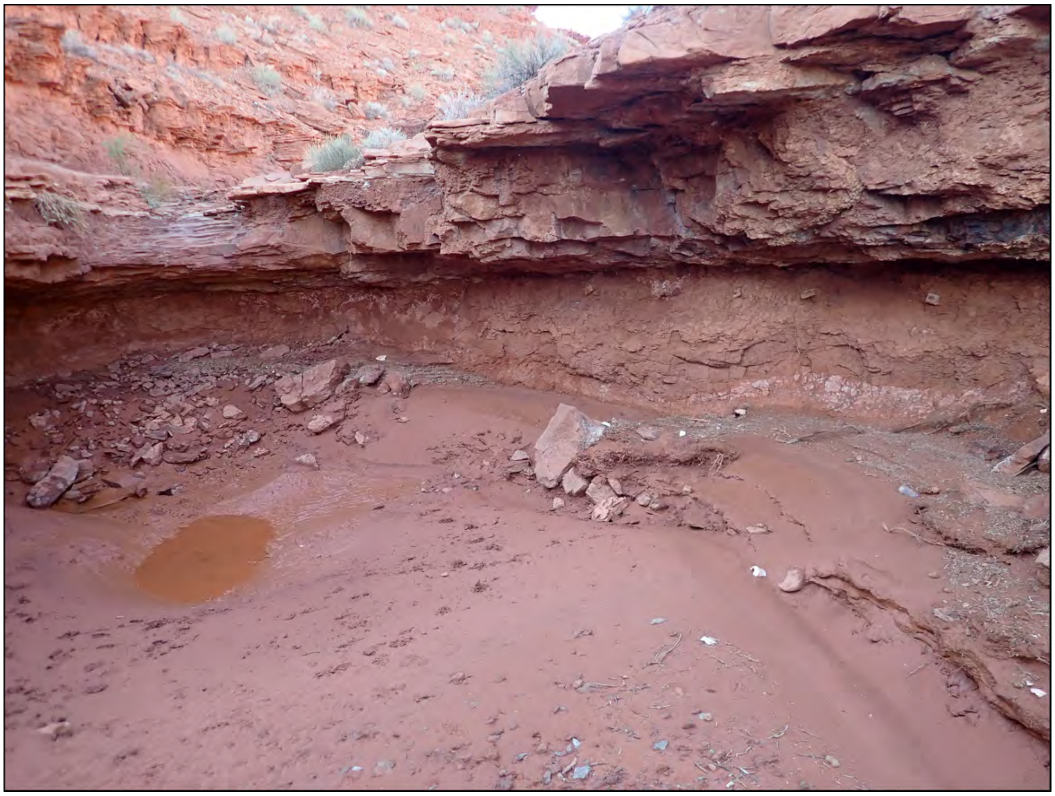
PL-8. Vegetation Growth in the West Diversion Channel

PL-9. Vegetation in the Northeast Toe Drain

PL-10. Seep 0248 (Dripping)

PL-11. Seep 0249 (Dry)

PL-12. Seep 0251 (Dry)



PL-13. Seep 0254 (Dry)

PL-14. Seep 0261 (Dripping)

PL-15. Seep 0264 (Damp)

PL-16. Seep 0922 (Dry)

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 4, 2022. No changes were observed on the disposal cell or in the associated drainage features. Inspectors identified several minor maintenance needs but found no cause for a follow-up inspection.

Groundwater monitoring is not required and was discontinued in 2014. The site-specific U.S. Department of Energy (DOE) *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 site-specific long-term surveillance and maintenance of the site are specified in the 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 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. DOE is the licensee and, in accordance with the requirements for UMTRCA Title I sites, 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.

13.4 Inspection Results

The site, 13 miles northwest of Naturita, Colorado, was inspected on May 4, 2022. The inspection was conducted by K. Meadows and D. Marshall of the Legacy Management Support (LMS) contractor. M. Hurt, the Office of Legacy Management (LM) site manager, and M. Cosby 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 2022 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 missing and was replaced following the inspection (PL-1). New locks were placed at the entrance gate and two pedestrian gates. No other 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 attached to steel posts set in concrete and set back 5 feet from the property line. Inspectors noticed vegetation growing in the fence line near perimeter sign P6. Removal of the vegetation was completed following the inspection. Erosion around the concrete base of perimeter sign P22 is continually present and will be monitored. 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. Boundary monuments BM-1 through BM-17 (PL-3) mark the property corners. Survey monuments SM-3, SM-4, and SM-11 are dual purpose monuments that represent boundary monuments BM-3, BM-4, and BM-11, respectively. No maintenance needs were identified.

13.4.1.5 Aerial Survey Quality Control Monuments

Four aerial survey quality control monuments utilized during aerial surveys for ground control were inspected. No maintenance needs were identified.

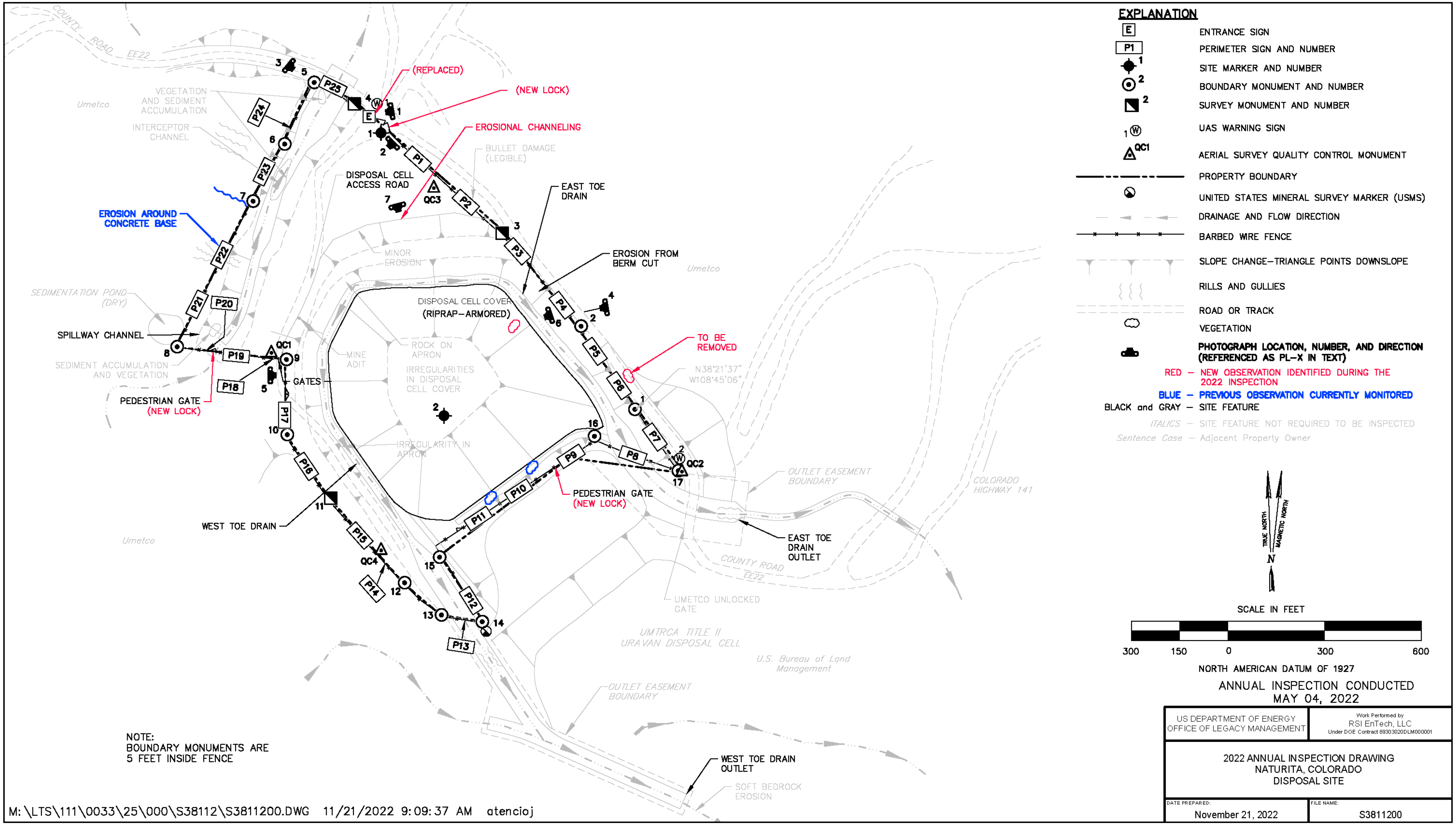


Figure 13-1. 2022 Annual Inspection Drawing for the Naturita, Colorado, Disposal Site

13.4.1.6 Monitoring Wells

Before the inspection, five groundwater monitoring wells installed at the time of the disposal cell construction were abandoned in place according to Colorado state regulations (PL-4). LM requested concurrence from NRC to terminate groundwater monitoring at the site in 2013, and NRC concurred in a letter dated April 15, 2014 (DOE 2019).

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 versus 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 appears to have not changed over time.

Vehicle tracks present 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 beginning to become established in this area (PL-6). 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. Vegetation continues to grow in the accumulating sediment just outside the culverts, potentially blocking stormwater flow. 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. Herbicide treatment of rabbitbrush plants is ongoing.

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 2022 inspection and will continue to monitor this area.

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.

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 noted small erosional channeling occurring along the cliff north of the disposal cell and flagged the area for safety reasons (PL-7). Inspectors will continue to monitor the area for further signs of erosion. No maintenance needs were identified.

13.4.2.3 Outlying Area

The surrounding 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. 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 is still present but does not appear to have grown since the last inspection. The gully originates on the hillside beyond the northern perimeter fence and is slowly growing toward the fence line. Inspectors will continue to monitor this area for ongoing erosion and resulting impacts. 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

The entrance sign was replaced following the inspection. The vegetation growing in the fence line near perimeter sign P6 will be treated or removed before the next inspection. 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.

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. The vegetation growing in the southern fence area does not require maintenance, but the vegetation growing in the fence line near P6 required treatment. No maintenance needs were identified.

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

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	260	Entrance Area with Missing Entrance Sign
PL-2	225	Site Marker SMK-1 near Entrance Gate
PL-3	—	Boundary Monument BM-5
PL-4	260	Previous Site of Monitoring Well BR95-1
PL-5	90	Disposal Cell
PL-6	85	Vegetation Growing in Accumulated Sediment Downslope from Culvert Break
PL-7	165	Erosional Channeling on Slope North of Disposal Cell

Note:
— = Photograph taken vertically from above.

PL-1. Entrance Area with Missing Entrance Sign

PL-2. Site Marker SMK-1 near Entrance Gate

PL-3. Boundary Monument BM-5

PL-4. Previous Site of Monitoring Well BR95-1

PL-5. Disposal Cell

PL-6. Vegetation Growing in Accumulated Sediment Downslope from Culvert Break

PL-7. Erosional Channeling on Slope North 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 August 11, 2022. Minor depressions or undulations were noted on the disposal cell cover, particularly on the western edge of the cell. These features will be verified with the light detection and ranging (lidar) data from the baseline aerial survey. No other changes were observed on the disposal cell. No changes were observed in the associated drainage features. Inspectors identified one minor maintenance need but found no cause for a follow-up inspection.

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. 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, stock fence, perimeter signs, site markers, survey and boundary monuments, standpipes, and evaporation pond.

14.4 Inspection Results

The site, 6 miles north of Rifle, Colorado, was inspected on August 11, 2022. The inspection was conducted by D. Miller, M. Franke, and E. Gaasche of the Legacy Management Support (LMS) contractor. M. Kautsky (LM), M. Cosby (Colorado Department of Public Health and Environment), and Linda Gersey (NRC) 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 2022 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 U.S. Bureau of Land Management (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 feet (ft) south of the site and an inner metal gate at the stock fence (PL-1). The entrance sign, which is next to the inner gate, was faded and had minor cracks but remained legible. No maintenance needs were identified.

14.4.1.2 Stock Fence and Perimeter Signs

A four-strand barbed-wire stock 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 evidence of continued livestock grazing, discussed further in Section 14.4.2.3. Two barbed-wire personnel gates are at the southeast corner of the site. The northern gate, which provides access to DOE property, was locked with a chain and padlock. The southern gate is left open to allow livestock that are on the adjacent BLM allotment to pass through the fence. No maintenance needs were identified.

There are 27 perimeter signs positioned along the site perimeter. Perimeter signs P0 through P11 are attached to the stock fence, and 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 P1, P3, P16, P18, P22, P24, and P26 have minor cracks and peeling but remain legible (PL-2). No maintenance needs were identified.

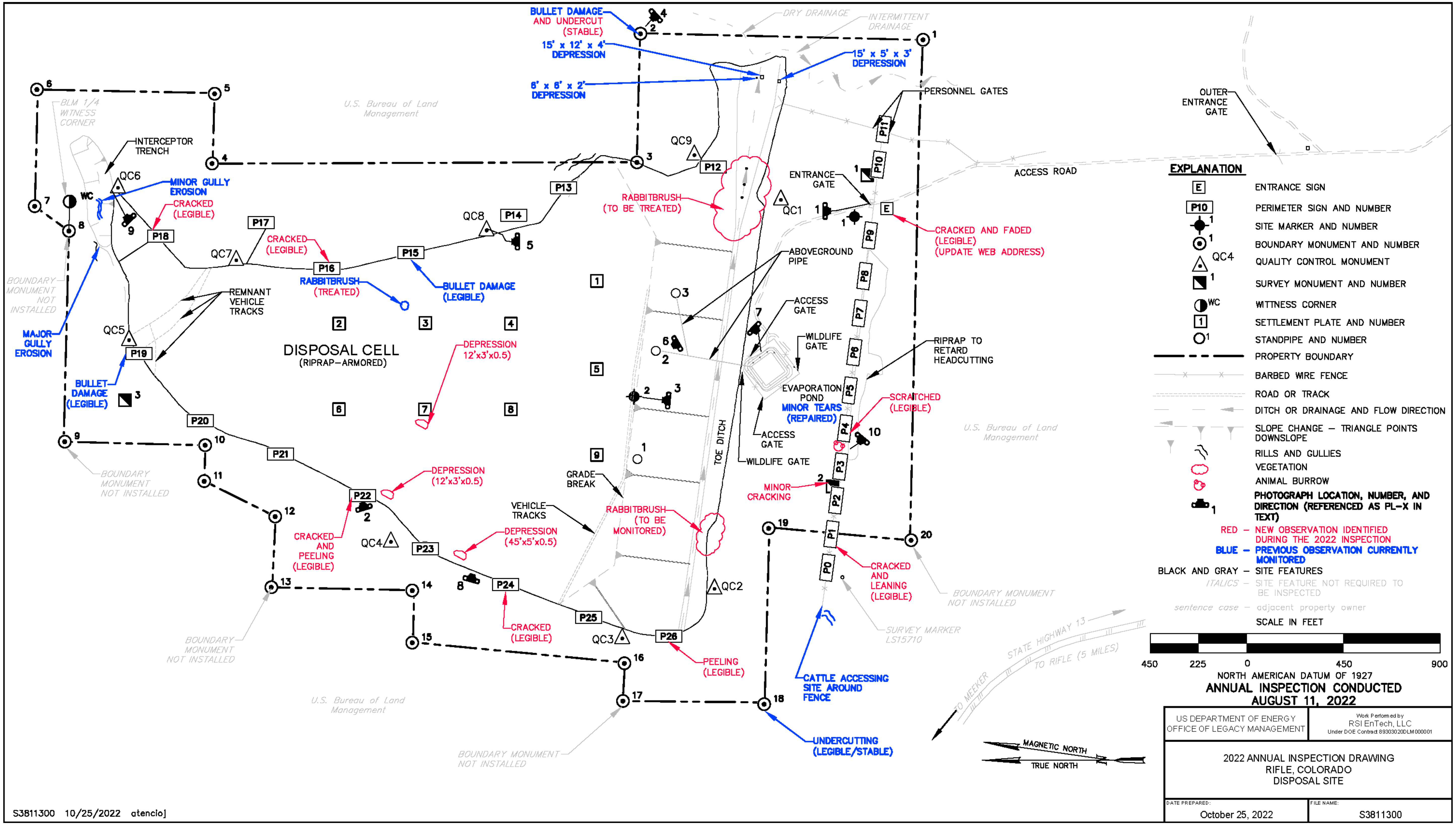


Figure 14-1. 2022 Annual Inspection Drawing for the Rifle, Colorado, Disposal Site

14.4.1.3 Site Markers

The site has two granite site markers. Site marker SMK-1 is just inside the inner entrance gate, and site marker SMK-2 is on the top slope of the disposal cell (PL-3). 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 and BM-18 have undercutting at the ground surface but remain stable (PL-4). 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 2022 annual inspection. Inspectors noted minor sediment accumulation on quality control monuments QC-5 and QC-8 (PL-5). An aerial survey collected lidar data in July 2022. No maintenance needs were identified.

14.4.1.6 Standpipes

Three standpipes (SP-01, SP-02, and SP-03) on the south side slope of the disposal cell are used to monitor pore-water levels in the disposal cell (PL-6). At the time of the inspection, disposal cell pore water was being pumped from standpipes SP-02 and SP-03 (also known as monitoring wells 02 and 03, respectively) into the evaporation pond. No other maintenance needs were identified.

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 SP-02 and SP-03. The pond contained water at the time of the inspection (PL-7). 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. Evaluation of the liner by a testing laboratory indicated that the liner is in good condition for its age. LM plans to replace the pond liner in fiscal year 2024, barring further damage that would necessitate earlier replacement. Inspectors will continue to monitor this before the planned liner preplacement.

The security fence around the pond was repaired, including replacing a bent gate, to prevent cattle entry in 2020. At the time of the 2022 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 at the time of the inspection. A meteorological station alongside the pond was functioning normally. No other maintenance needs were identified.

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.

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. Three possible depressions or undulations were noted, primarily on the west edge of the disposal cell. The largest of these features was approximately 45 feet long × 5 feet wide × 6 inches deep (PL-8). The aerial survey lidar data collected in July 2022 will be used to verify these observed features. There was no evidence of erosion, settling, slumping, or other modifying processes that might affect the integrity of the disposal cell. As in the past several inspections, inspectors noticed minor rock degradation on the disposal cell top slope, primarily in the form of cracking and spalling. Rock degradation does not present a concern at this time.

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, which are attributable to the installation of solar panels and pumps at standpipes SP-02 and SP-03.

Two to three deep-rooted, woody rabbitbrush plants were observed on the southeastern slope of the disposal cell and in the toe ditch during the inspection. Rabbitbrush and common mullein were observed on the southwestern edge of the cell but were not impeding onto the top slope of the cell at the time of the 2022 inspection. The rabbitbrush on the southeastern slope of the disposal cell near the toe ditch will be treated before the 2023 inspection. Small, isolated patches of other grasses also 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 the disposal cell from stormwater and snowmelt runoff (PL-9). 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 in depth or width; the deepest downcut was approximately 18 inches deep and 24 inches wide. 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 2022 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.

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 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, grazing by cattle has been regularly observed, and cattle trails have been identified meandering up the steep arroyos on the unfenced, southwest side of the site. LM is evaluating additional fencing installation options on the southwest side of the site to prevent cattle access. Animals are burrowing under the fence between perimeter signs P3 and P4 (PL-10). Inspectors will continue to monitor this area and conduct repairs when necessary.

Three arroyos are present in the reclaimed area south of the disposal cell and outside the stock fence. A rock apron was placed between the stock 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 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. 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 constructed two additional mountain biking trails in spring 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

Treatment of rabbitbrush growing on the top of the disposal cell was completed before the 2022 inspection. Inspectors identified the following maintenance items that will be completed before the next inspection:

- Update the website address on the entrance sign
- Treat the rabbitbrush growing on the southeastern slope of the disposal cell and toe drain area

14.7 Groundwater Monitoring

Groundwater quality monitoring is not required by the LTSP (DOE 1997). Transient drainage from the disposal cell enters the Wasatch Formation, a 3800-foot-thick sequence of shales, siltstones, and fine-grained sandstones (DOE 1997). The Wasatch Formation separates the disposal cell from the uppermost useable 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. Ambient levels of barium, cadmium, chromium, lead, molybdenum, selenium, and combined radium-226 and radium-228 exceed maximum concentration limits. The Wasatch Formation does not represent a useable source of water, and no exposure pathways to site-related groundwater exist at the site. Further groundwater monitoring is not required (DOE 1997). All monitoring wells at the site 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 SP-02 and SP-03, which are installed at the downgradient end of the disposal cell on the south side slope (Figure 14-1). The pore-water levels were monitored during monthly pump shutdown periods, which allowed the water level to equilibrate. 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 6022.50 ft during original construction. In 2022, monthly recovery tests have been paused for maintenance efforts and will resume in 2023. The bottom of standpipe SP-01 is at an elevation of 6023.95 ft; as such, it continues to be dry and does not require continuous monitoring.

The disposal cell dewatering system (pump) is activated when the interior pore-water elevation reaches 6018.55 ft. Circumstances other than pore-water accumulation that triggers the dewatering pump includes: (1) periods when solar-powered pumps are nonoperational (for recovery tests or maintenance) or (2) when temperatures are below freezing, preventing the pump from operating. Pore-water levels in standpipes SP-02 and SP-03 have remained below the geotextile liner at 6022.55 ft, preventing water from overtopping the disposal cell liner.

A contingency plan for control of pore-water levels at the toe of the disposal cell was included as an attachment to the LTSP. The plan included the installation of a dewatering system and a retention pond to use when water levels reach an elevation of 6016.55 ft and the solar-powered dewatering pump is initiated at a water level elevation of 6018.55 ft. Both the dewatering system and the evaporation pond were constructed in 2001. Water pumped from the standpipes is discharged through an aboveground polyethylene pipe to the evaporation pond.

Despite the pumping efforts to dewater the cell since 2001, pore-water levels in the cell have not decreased; instead, they have continued to increase to the recent maximum level of 6022.42 ft. While the 6018.55 ft pump action level has been exceeded, pore-water levels in both standpipes SP-02 and SP-03 have been maintained below the top of the HDPE liner elevation. In compliance with requirements of the LTSP, pumping will continue until water levels in the standpipes stabilize at an elevation of 6016.55 ft or lower.

Table 14-2 lists total dewatering volumes based on the flow meter at the evaporation pond.

Table 14-2. Total Dewatering Volumes at the Rifle, Colorado, Disposal Site

Reporting Years	Annual Dewatering Volumes (gal)**	Annual Dewatering (gal per day)**	Cumulative Dewatering Volumes (gal)**
2008	144,796	720.38	144,796
2009	407,455	1144.54	552,251
2010	217,775	672.15	770,026
2011	60,555	186.32	830,581
2012	153,941	428.80	984,522
2013	106,262	292.74	1,090,784
2014	135,123	374.30	1,225,907
2015	154,625	423.63	1,380,532
2016	167,466	458.81	1,547,998
2017	86,075	237.12	1,634,073
2018	121,523	438.88	1,755,596
2019	244,529	681.34	2,000,125
2020	194,751	533.66	2,194,876
2021	296,908	814.20	2,491,784
2022*	167,265*	702.79*	2,659,049*

Notes:
* 2022 dewatering data through August 26, 2022.
** Previously, Table 14-2 presented dewatering volumes based on the combined flow meter readings at standpipes SP-02 and SP-03. However, the flow meters at the standpipes are less accurate than the volumes reported by the pond flow meter. In general, the volumes reported by the pond flow meter are similar with the volumes reported by the flow meters at standpipes SP-02 and SP-03, except for the volumes reported in 2015, 2018, and 2021. One of the flow meters at standpipes SP-02 and SP-03 may have turned off and not accurately recorded the volumes pumped from one of the wells for a period of time during these years.

Abbreviation:
gal = gallons

Real-time disposal cell water elevations collected in 2018 (using pressure transducers and dataloggers) continued to indicate that daily maximum or semistatic pore-water levels in standpipes SP-02 and SP-03 exceed the 6018.55 ft pump action level (see Figure 14-2). In 2019, LM modified the seasonal pumping regimen for year-round pumping while a long-term solution is evaluated and implemented.

Data fluctuations for both standpipes observed from 2018 to 2022 are the result of partial overnight recharge due to well inefficiencies. The nonstatic levels have been removed from the dataset shown in Figure 14-2. Downhole video taken in 2020 for both standpipes revealed fouling in the perforated interval. Redevelopment of standpipe SP-02 to remove mineral scale and biofouling was last completed in December 2020. Testing results indicated an increase in production volume from standpipe SP-02 of approximately 22%. Downhole video in standpipe SP-03 also identified approximately 7.6 ft of 6- to 10-inch diameter rock riprap at the bottom of the standpipe.

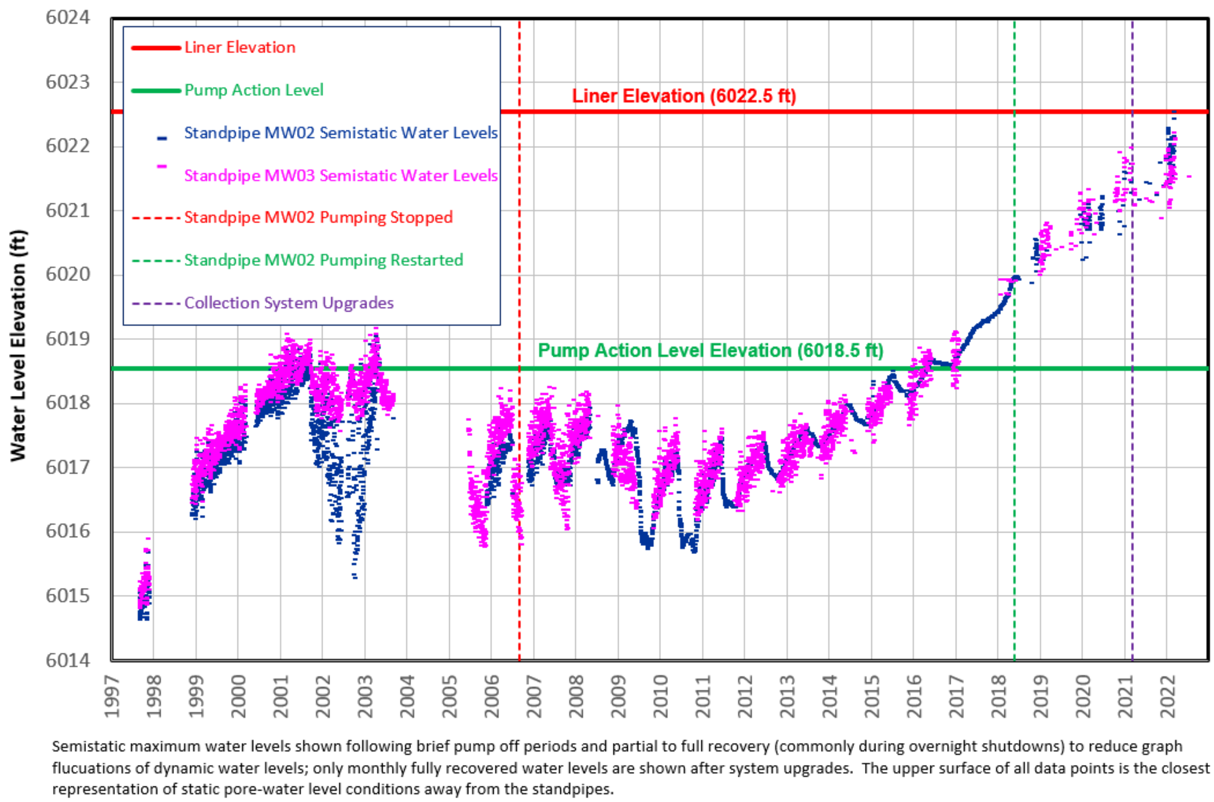


Figure 14-2. Disposal Cell Pore-Water Levels in Standpipes SP-02 and SP-03 at the Rifle, Colorado, Disposal Site

In March 2021, the solar-powered pumping system was upgraded to provide additional operation of the pumps by increasing electrical storage ability. By adding batteries to store solar-generated electricity, the pumps are able to operate throughout the night and on overcast days. This has yielded an increase in annual dewatering volume but does not appear to have decreased the pore-water level.

In July 2022, the leachate discharge pipes were replaced with 2-inch diameter pipes and insulated where the pipe crosses the toe ditch to protect against freezing and pipe bursting in the winter. These improvements should allow the pumping system to function at colder temperatures in the winter, increasing the annual dewatering volume.

LM completed a collaborative initiative with the National Laboratory Network (NLN) in March 2022 to identify innovative approaches to perform pore-water source investigation and accumulation mitigation strategies for the site. LM included NRC in the LM and NLN collaborative process. The recommendations are being compiled into a Recommendations Report and a Pore-Water Accumulation Work Plan.

14.9 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.

14.10 References

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.

14.11 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	180	Entrance Gate
PL-2	73	Perimeter Sign P22
PL-3	5	Site Marker SMK-2
PL-4	318	Boundary Monument BM-2
PL-5	—	Aerial Survey Quality Control Monument QC-8
PL-6	330	Standpipe SP-02 and Instrumentation
PL-7	224	Evaporation Pond
PL-8	106	Potential Depression on Edge of Disposal Cell
PL-9	47	Interceptor Trench
PL-10	310	Signs of Animal Burrowing Under Fence

Note:
— = Photograph taken vertically from above.

PL-1. Entrance Gate

PL-2. Perimeter Sign P22

PL-3. Site Marker SMK-2

PL-4. Boundary Monument BM-2

PL-5. Aerial Survey Quality Control Monument QC-8

PL-6. Standpipe SP-02 and Instrumentation

PL-7. Evaporation Pond

PL-8. Potential Depression on Edge of Disposal Cell

PL-9. Interceptor Trench

PL-10. Signs of Animal Burrowing Under Fence

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 19, 2022. No changes were observed on the disposal cell or in associated drainage features. Observations of rock-quality monitoring plots indicated no significant change from the previous year. Inspectors identified one routine maintenance need but found no cause for a follow-up inspection. Minor maintenance needs were identified and will be completed before the next inspection. 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 19, 2022. The inspection was conducted by D. Atkinson and T. Santonastaso of the Legacy Management Support (LMS) contractor. J. Nguyen (DOE) and C. Bishop (Utah Department of Environmental Quality) attended the inspection. S. Gurr and B. Stewart 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 2022 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 completely 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 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. Gates were locked and functional. The entrance sign is at Gate 61. No maintenance needs were identified.

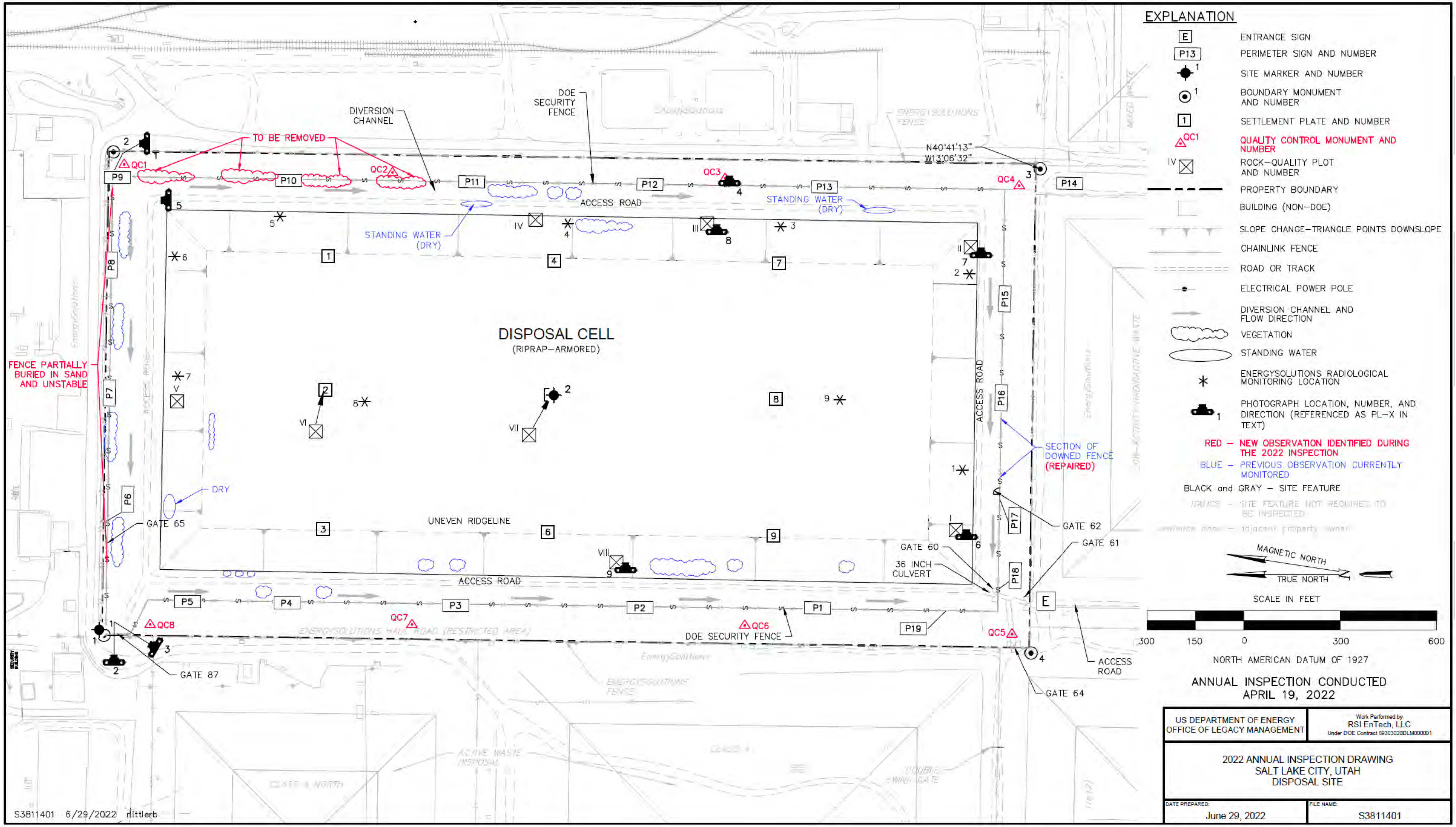


Figure 15-1. 2022 Annual Inspection Drawing for the Salt Lake City, Utah, Disposal Site

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 LM 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 (PL-1). Inspectors noted vegetation growing along the east fence line that will be addressed before the next annual site inspection. The EnergySolutions fence was partially buried in sand and pushed over in areas along the north side of the site. This non LM-owned asset does not require maintenance 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 (PL-2) is just inside Gate 87 in the northwest corner of the site. Site marker SMK-2 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 [PL-3] 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 (PL-4). 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 (PL-5). There were noticeable vehicle tracks on the east side slope of the disposal cell, but 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. Based on visual monitoring of the rock in the plots (PL-6 through PL-9), there have been no significant changes from the 2021 annual inspection. Comparisons to the initial 2010 rock-quality plot photographs indicate very little (if any) additional rock degradation since monitoring began (PL-6a through PL-9a). The extent of rock degradation observed to date has not reduced the effectiveness of the riprap cover. 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. Inadvertently, no photos were taken of rock-quality plots VI and VII during the 2022 inspection. The condition of these rock quality plots will be documented by photograph during a site visit later in the year to correct the oversight.

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.

Although areas of the disposal cell have continued to have minor perennial grass growth, no deep-rooted plants were present on the disposal cell. Standing water from stormwater runoff has been observed in the apron at the base of the east side slope of the disposal cell toe drainage in the past but no standing water was present on or near the cell during the 2022 inspection. No 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 was removed after the 2021 inspection and the road is in good condition. EnergySolutions will continue to remove vegetation along the road as needed.

The surface water diversion channels were functioning as designed. No ponded water was observed and vegetation growth in these diversion channels is not impeding stormwater runoff.

Radiological surveys are performed 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 2019 and radiological measurements were again conducted by EnergySolutions in 2022.

Dose rate measurements and wipe samples were collected at various locations around the base of the disposal cell, including on the disposal cell top slope during the 2022 annual inspection. Nine wipe samples were collected by the EnergySolutions radiological control technician at the specific radiological monitoring locations depicted in Figure 15-1.

Results from radiological surveys conducted at the site have been below applicable exposure limits established in the *Radiological Control Manual*. Therefore, both spillover and windblown radiological contamination from the surrounding radioactive waste disposal operation are not evident. All results from the 2022 wipe samples collected by EnergySolutions were below the minimum detectable activities (i.e., nondetect) for removable alpha and beta radiation contamination. The next radiological survey will occur during the 2024 annual site inspection.

EnergySolutions conducts periodic walkthroughs of the site to remove any windblown debris. The company reported no debris on the site in 2022. No maintenance needs were identified.

15.4.2.3 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.

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

Repairs to the chainlink fence on the south side of the site were performed, and aerial survey quality control monuments were installed before the 2022 inspection.

Inspectors documented the vegetation growing along the security fence on the east side of the cell that will be addressed before the next 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

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.

Radiological Control Manual, LMS/POL/S04322, continually updated, prepared by the LMS contractor for the U.S. Department of Energy Office of Legacy Management.

15.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	270	Perimeter Sign P9
PL-2	—	Site Marker SMK-1
PL-3	300	Boundary Monument BM-1 with Protective Cover and Nearby Bollards
PL-4	—	Quality Control Monument QC-3
PL-5	270	Northern Cell Side Slope
PL-6	—	(a) Rock Quality Plot No. I—2022 (b) Rock Quality Plot No. I—2010 Photo for Comparison
PL-7	—	(a) Rock Quality Plot No. II—2022 (b) Rock Quality Plot No. II—2010 Photo for Comparison
PL-8	—	(a) Rock Quality Plot No. III—2022 (b) Rock Quality Plot No. III—2010 Photo for Comparison
PL-9	—	(a) Rock Quality Plot No. VIII—2022 (b) Rock Quality Plot No. VIII—2010 Photo for Comparison

Note:
— = Photograph taken vertically from above.

PL-1. Perimeter Sign P9

PL-2. Site Marker SMK-1

PL-3. Boundary Monument BM-1 with Protective Cover and Nearby Bollards

PL-4. Quality Control Monument QC-3

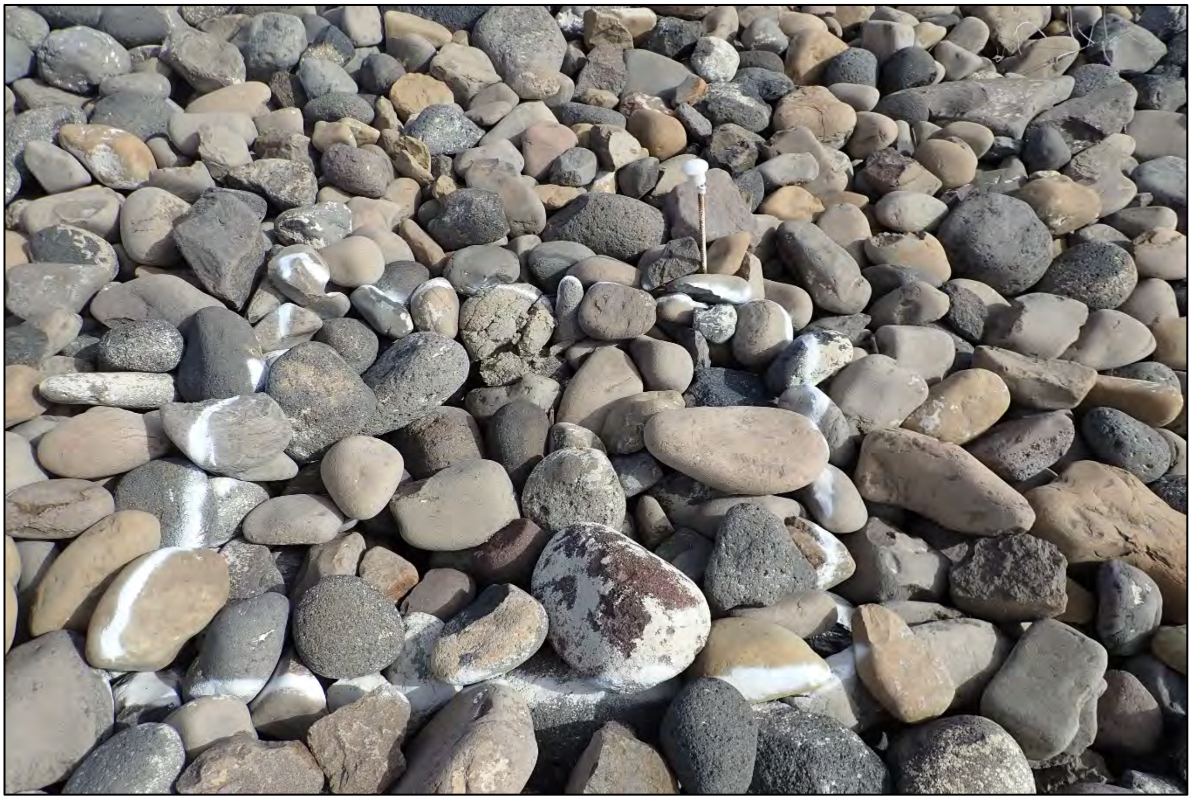
PL-5. Northern Cell Side Slope

PL-6a. Rock Quality Plot No. I—2022

PL-6b. Rock Quality Plot No. I—2010 Photo for Comparison

PL-7a. Rock Quality Plot No. II—2022

PL-7b. Rock Quality Plot No. II—2010 Photo for Comparison



PL-8a. Rock Quality Plot No. III—2022

PL-8b. Rock Quality Plot No. III—2010 Photo for Comparison

PL-9a. Rock Quality Plot No. VIII—2022

PL-9b. Rock Quality Plot No. VIII—2010 Photo for Comparison

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 22, 2022. 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 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 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.

16.4 Inspection Results

The site, 1 mile south of Shiprock, New Mexico, was inspected on June 22, 2022. The inspection was conducted by D. Marshall and J. Sullivan of the Legacy Management Support (LMS) contractor. J. Tallbull (LM) and G. Jay (LMS) 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 2022 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), the north gate (an auxiliary access gate), and the west gate (the former main entrance gate). Access to the main entrance gate is on the road to the 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 needs to be updated. No other 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 to keep the perimeter fence free of trash, tumbleweeds, and other debris is ongoing. 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-1). Perimeter sign P10 is beginning to crack and perimeter sign P14’s radiation symbol is faded. Cracked signs and signs with faded symbols will be replaced before the next inspection. No other maintenance needs were identified.

[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.

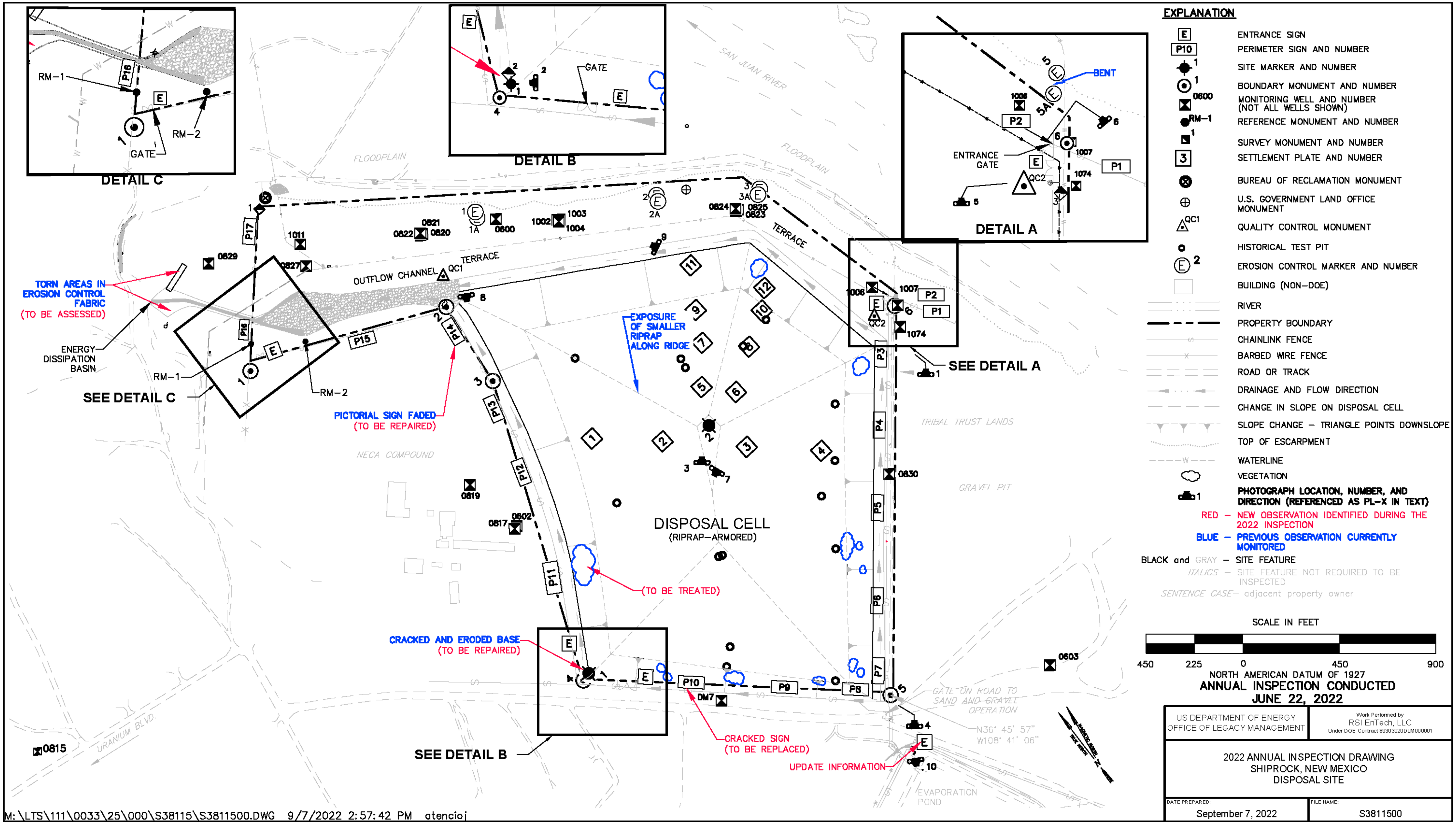


Figure 16-1. 2022 Annual Inspection Drawing for the Shiprock, New Mexico, Disposal Site

16.4.1.3 Site Markers

The site has two granite site markers. Site marker SMK-1 is just inside the west gate and contains minor cracks in its concrete base. Although the cracks were sealed in 2018, they are beginning to open and will be repaired before the next inspection (PL-2). Site marker SMK-2 is on the top slope of the disposal cell and is stable and legible (PL-3). No other 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 is cracked, and the sides eroded. This will be repaired before the next inspection. All survey and boundary monuments were observed to be clear of vegetation and were either visible or uncovered with a shovel (PL-4) during the 2022 inspection. No other maintenance needs were identified.

16.4.1.5 Aerial Survey Quality Control Monuments

Two aerial survey quality control monuments are present at the site and were inspected during the 2022 annual inspection (PL-5). No maintenance needs were identified.

16.4.1.6 Erosion Control Markers

The site has pairs of erosion control markers (1/1A, 2/2A, 3/3A, and 5/5A) (PL-6) along the edge of the terrace escarpment. Erosion control markers 4 and 4A are not inspected; they were installed on the terrace east of the site in the gravel pit. Erosion control marker 5A, 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 gravel pit southeast of the disposal cell. 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.

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 (PL-7). 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 in the cover. As reported in previous site inspection reports, the surface of the disposal cell has numerous ruts associated with past vehicle traffic. 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 2022. 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. In accordance with the LTSP, woody, deep-rooted shrubs are controlled. Several woody shrubs were found on the top and side slopes of the disposal cell and will be treated before the next inspection (PL-8).

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 (PL-9). 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 inspection in 2022. The LTSP states that the base of the terrace escarpment should be inspected for signs of seepage, and seeps were identified during early site inspections. However, this is no longer part of the annual inspection, as 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 miles 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 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 2022 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 pond liner leak test showed that the liner has five locations where liner performance has been compromised due to the age of the liner, resulting in breaches from pin sized holes to ½”. To mitigate seepage from the pond at these locations LM place five water-filled hydrologic barriers over the areas in question. The hydrologic barriers function as pressure patches to eliminate unplanned seepage. A quarterly pond liner inspection is conducted by a geotechnical engineer to identify any other potential issues that may arise. Water levels are monitored during the work week to determine whether any actions need to be taken (PL-10).

Inspectors noted that torn areas in the erosion control fabric on the banks of the lower outflow channel are still present. The tears will be assessed before the next annual inspection.

Fences and warning signs posted in Bob Lee Wash are maintained under the groundwater compliance program and were not examined during the 2022 annual inspection.

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 needs that were not completed because of prior travel restrictions but will be conducted before the next inspection:

- Replacing faded pictorial signs and updating information on perimeter signs
- Continuing to remove trash and debris (including tumbleweeds) along the perimeter fence
- Sealing the cracks and repairing erosion at the base of site marker SMK-1
- Treating deep-rooted woody shrubs on the top and side slopes of the disposal cell
- Assessing torn areas in the erosion control fabric on the northwest end of the outflow channel

Inspectors noted additional maintenance needs during the 2022 inspection that will be completed before the next inspection. These include the following:

- Replacing cracked and faded perimeter signs P10 and P14
- Updating contact information on the evaporation pond entrance sign

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 observed during the inspection were locked, and no maintenance needs were identified.

16.7.2 Vegetation Monitoring

In a 1999 letter to the Navajo Nation Abandoned Mine Lands (AML) Reclamation/Uranium Mill Tailings Remedial Action department (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, Navajo Nation AML, and LMS ecologists in 2019, LM recommended that it cease treatment of nonnoxious weeds on the cell and allow natural plant succession to progress. In 2019, LM wrote to Navajo Nation AML 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

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, M., 2019. Mark Kautsky, 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	340	Perimeter Sign P3
PL-2	180	Site Marker SMK–1
PL-3	15	Site Marker SMK–2 on Cell Top
PL-4	—	Boundary Monument BM-5
PL-5	200	Aerial Survey Quality Control Monument QC-2
PL-6	—	Erosion Control Marker ECM-5
PL-7	210	Top Slope of Disposal Cell
PL-8	170	West Side Slope of Disposal Cell
PL-9	295	Northwest Drainage Channel
PL-10	170	Evaporation Pond with hydrologic barriers

Note:
— = Photograph taken vertically from above.

PL-1. Perimeter Sign P3

PL-2. Site Marker SMK–1

PL-3. Site Marker SMK–2 on Cell Top

PL-4. Boundary Monument BM-5

PL-5. Aerial Survey Quality Control Monument QC-2

PL-6. Erosion Control Marker ECM-5

PL-7. Top Slope of Disposal Cell

PL-8. West Side Slope of Disposal Cell

PL-9. Northwest Drainage Channel

PL-10. Evaporation Pond with hydrologic barriers deployed to mitigate seepage

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 31, 2022. 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 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 17-1 lists these requirements.

Table 17-1. License Requirements for the Slick Rock, Colorado, Disposal Site

Requirement	LTSP	This Report	10 CFR 40.27
Annual Inspection and Report	Sections 3.0 and 6.2	Section 17.4	(b)(3)
Follow-Up Inspections	Section 3.4	Section 17.5	(b)(4)
Maintenance and Repairs	Section 4.0	Section 17.6	(b)(5)
Groundwater Monitoring	Section 2.5	Section 17.7	(b)(2)
Corrective Action	Section 5.0	Section 17.8	--

17.3 Institutional Controls

The 62-acre site, defined 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, and survey and boundary monuments.

17.4 Inspection Results

The site, 5 miles northeast of Slick Rock, Colorado, was inspected on May 31, 2022. The inspection was conducted by K. Meadows and D. Marshall of the Legacy Management Support contractor. M. Hurt from LM and M. Cosby from the 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.

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 2022 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 (PL-1). No maintenance needs were identified.

17.4.1.2 Perimeter Fence and Signs

A four-strand barbed-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.

Inspectors noticed rills and gullies expanding on the southwest side of the site from the apron area extending to the fence line between perimeter signs P30 and P32. The gullies and rills terminate into the culvert along San Miguel County Road T11. Consequently, the fence posts along that fence line are undercut by the erosion and are unstable. Stabilization of the fence posts will be completed before the next inspection, and if mitigation to the erosional features will be required, it will be completed in the future. No other maintenance needs were identified.

There are 32 perimeter signs, attached to steel posts set in concrete, positioned along the property boundary; they are set back 5 feet (ft) from the boundary and cut in at the southwest corner. The printed overlay is cracked on perimeter sign P27, but remains legible. The concrete bases on perimeter signs P14 and P15 are slightly undercut by erosion but remain stable. No maintenance needs were identified.

17.4.1.3 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 top of the disposal cell (PL-2). 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-3). No maintenance needs were identified.

17.4.1.1 Aerial Survey Quality Control Monuments

Inspectors inspected the five aerial survey quality control monuments installed in 2021. The baseline aerial survey was performed in May 2022. Animal burrows were detected around quality control monument QC-5. No maintenance needs were identified.

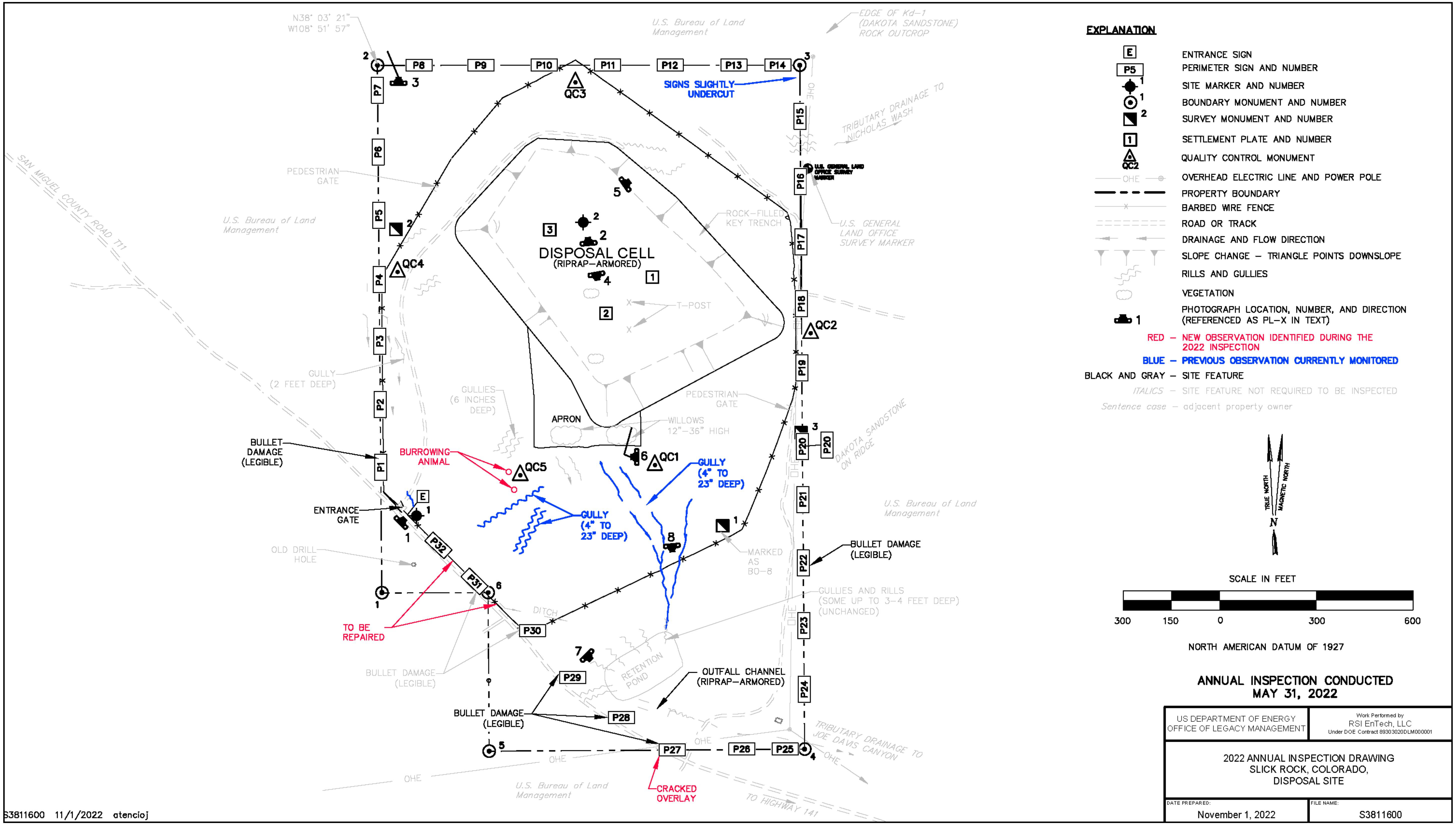


Figure 17-1. 2022 Annual Inspection Drawing for the Slick Rock, Colorado, Disposal Site

17.4.2 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, including 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 (PL-4). 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 bunches of grass are growing on the top of the disposal cell but do not require treatment at this time. No other maintenance needs were identified.

At the toe of the disposal cell side slopes is a key trench that encloses the disposal cell (PL-5). 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) are growing on a portion of the apron but are not considered detrimental to the integrity of the disposal cell (PL-6). 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 (PL-7). 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 dry at the time of inspection.

The site was originally graded for sheet flow from the apron to the retention pond. Rills have been developing since 1998 on the northwest side of the retention pond and now are 3 ft deep or deeper adjacent to the pond and shallower farther upslope. Most of the rills have stabilized or are stabilizing. Deeper gullies identified in the 2020 inspection have not grown significantly since the previous inspection and do not threaten the integrity of the disposal cell (PL-8). Erosional gullies on the southwest side of the apron area have grown to affect the fence posts along San Miguel County Road T11. This erosional area will be evaluated for mitigation but does not currently affect the integrity of the disposal cell. Inspectors will continue to monitor this area. No maintenance needs were identified.

Vegetation in the reclaimed areas were healthy. Noxious weeds are controlled regularly to comply with state and county requirements. No 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 north and northeast of the site 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

Stabilization of the fence posts between perimeter signs P30 to P32 will be completed before the next inspection. If determined to be necessary, the erosional features downslope from the cell and apron extending to San Miguel County Road T11 between perimeter signs P30 and P32 will be evaluated and possibly mitigated in the future. 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. All monitoring wells were abandoned in 2001, and the standpipes in the disposal cell were abandoned in 2002. The LTSP is being revised to reflect these changes.

17.8 Corrective Action

In accordance with the LTSP, corrective action is taken to correct conditions that threaten the integrity of the disposal cell in compliance with 40 CFR 192. No need for corrective action was identified.

17.9 References

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*.

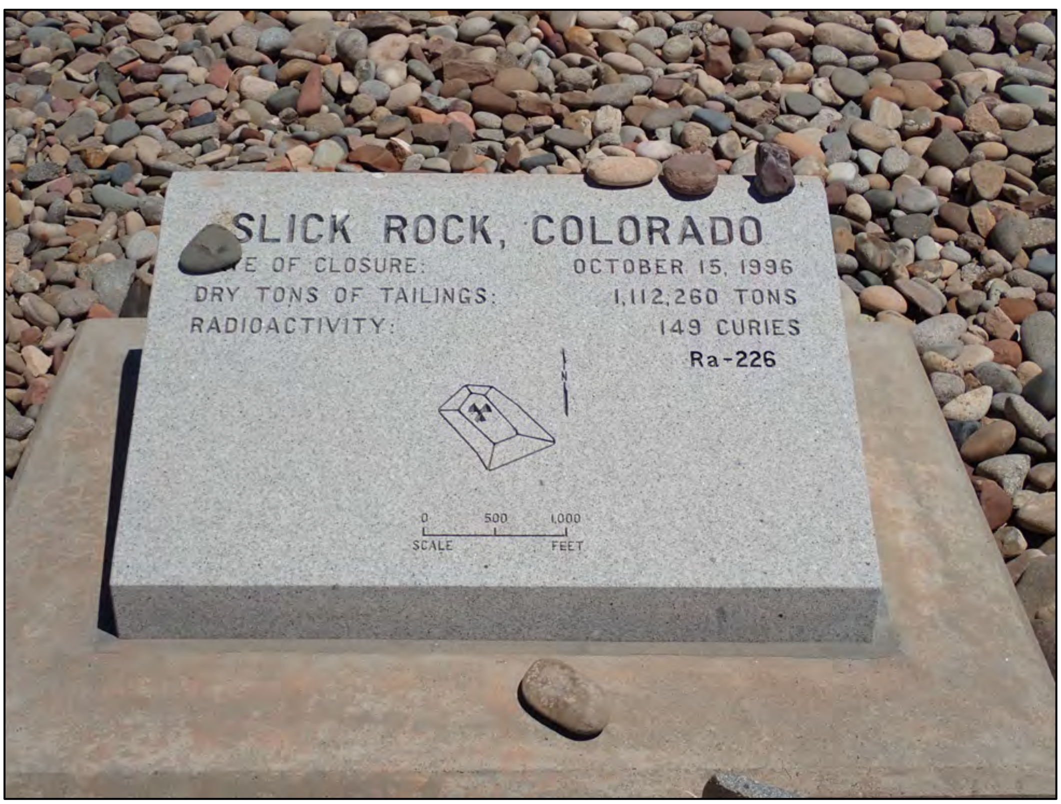
DOE (U.S. Department of Energy), 1998. *Long-Term Surveillance Plan for the Burro Canyon Disposal Cell Slick Rock, Colorado*, DOE/AL/62350-236, Rev. 0, Ver. 4, May.

17.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	45	Entrance Sign
PL-2	355	Site Marker SMK-2
PL-3	—	Boundary Monument BM-2
PL-4	170	Disposal Cell Top Slope
PL-5	55	Key Trench on East Side Slope
PL-6	270	Willows Growing in Apron
PL-7	135	Retention Pond
PL-8	175	Gullies on South Area Between Disposal Cell and Site Boundary

Note:
— = Photograph taken vertically from above.

PL-1. Entrance Sign



PL-2. Site Marker SMK-2

PL-3. Boundary Monument BM-2

PL-4. Disposal Cell Top Slope

PL-5. Key Trench on East Side Slope

PL-6. Willows Growing in Apron

PL-7. Retention Pond

PL-8. Gullies on South Area Between Disposal Cell and Site Boundary

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 19, 2022. No changes were observed on the land surface of the disposal cell or in the associated drainage features. 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	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 19, 2022. The inspection was conducted by J. Cario, J. Doebele, T. Santonastaso, and P. Schwarz of the Legacy Management Support contractor. C. Boger (LM site manager) 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.

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 2022 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. The entrance sign is mounted on a steel post set in concrete. No maintenance needs were identified.

18.4.1.2 Perimeter Signs

There are 10 perimeter signs (PL-1) attached to steel posts set in concrete and positioned around the site outside the unfenced property boundary. The 2021 inspection noted that perimeter sign P5 showed signs of weathering and was delaminating. The sign was replaced after the 2022 inspection. Perimeter sign P1 is plastic and warped but still legible. Soil around the concrete base of perimeter sign P3 is eroded but remains stable (PL-2). The phone numbers on perimeter signs P6 and P7 were updated during the inspection. 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 but is stable; there were no apparent changes from the previous year. Site marker SMK-2 is at the north side of the disposal cell (PL-3). No maintenance needs were identified.

18.4.1.4 Survey and Boundary Monuments

The site has three survey monuments and eight boundary monuments. Boundary monument BM-6 is bent and the base is eroded but stable (PL-4). The boundary monuments and a survey monument, as well as the perimeter signs are outside the property boundary. The owner of the surrounding property (Hornbuckle Ranch) is aware that the monuments are on his property, but he is not concerned. Therefore, the survey and boundary monuments and perimeter signs will remain at their current locations. No maintenance needs were identified.

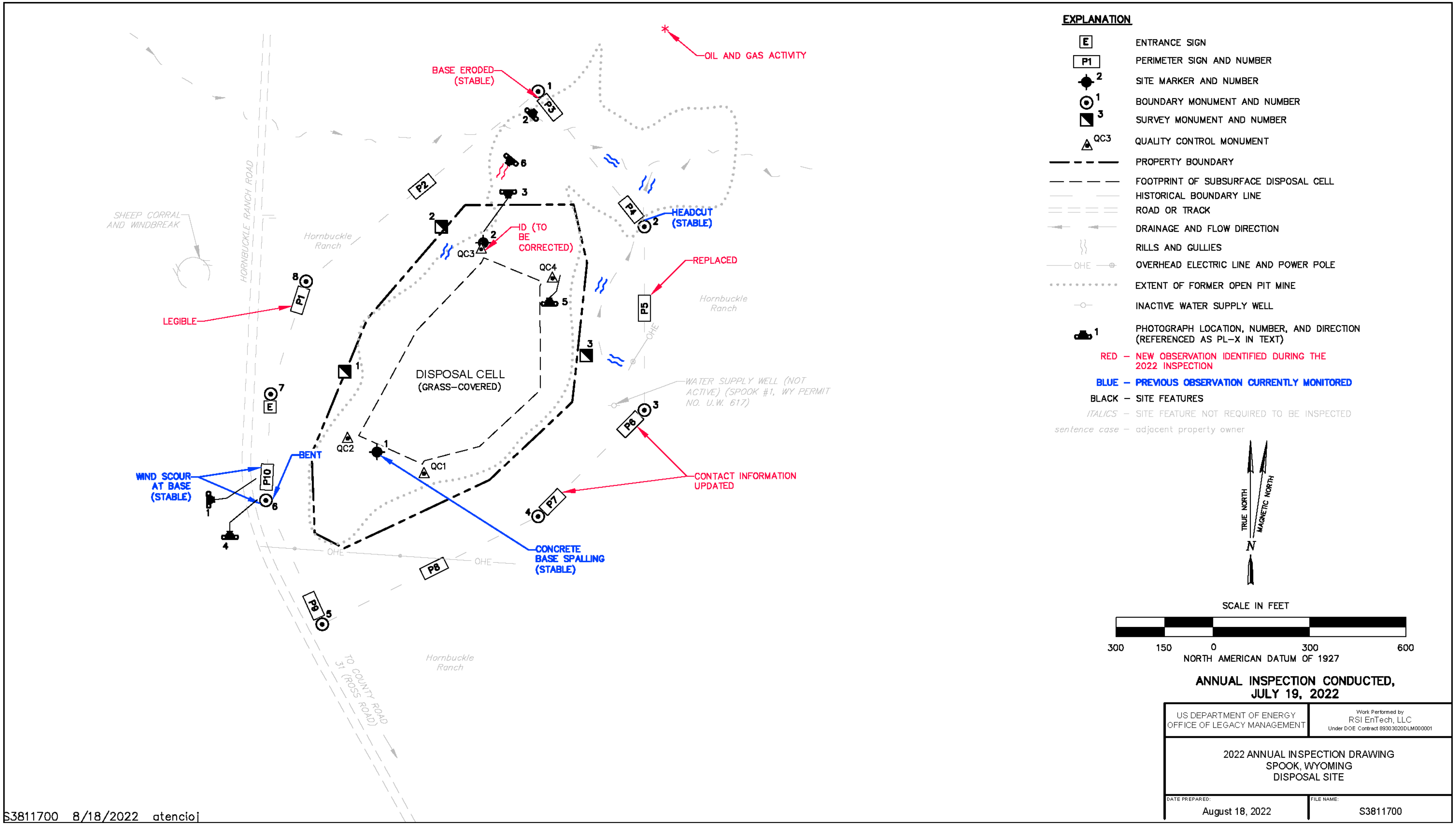


Figure 18-1. 2022 Annual Inspection Drawing for the Spook, Wyoming, Disposal Site

18.4.1.5 Aerial Survey Quality Control Monuments

Four aerial survey quality control (QC) monuments were inspected (PL-5). The cap for quality control monument QC-3 was stamped as QC-1. The cap will be renumbered before the next annual inspection. No other 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 in that the mill tailings were placed in 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. Several minor rills and gullies are near the site and appear to be stable. One minor gully was noted north of the disposal site, which was not identified in previous inspections (PL-6). This gully appeared to be stable and had established vegetation. None of the erosion areas are harming the function of the disposal cell cover or other site features and are not a concern at this time. Inspectors will continue to monitor these erosion areas.

The access road has frequent truck traffic to service and maintain oil wells in the area. Activity associated with construction of a new well pad was observed northeast of the site, between 0.25–0.5 mile away. Although oil field activity has greatly increased near the site, inspectors found no evidence of trespassing or vandalism onsite.

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 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

Inspectors updated the contact information listed on perimeter signs P6 and P7 during the inspection. Following the inspection, perimeter sign P5 was replaced. The label on quality control monument QC-3 will be corrected before the next inspection.

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. Therefore, groundwater monitoring is not required.

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

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	90	Perimeter Sign P10
PL-2	45	Erosion Around Base of Perimeter Sign P3
PL-3	180	Site Marker SMK-2
PL-4	—	Boundary Monument BM-6
PL-5	—	Quality Control Monument QC-4
PL-6	220	Erosional Gully, Previously Unreported

Note:
— = Photograph taken vertically from above.

PL-1. Perimeter Sign P10

PL-2. Erosion Around Base of Perimeter Sign P3

PL-3. Site Marker SMK-2

PL-4. Boundary Monument BM-6

PL-5. Quality Control Monument QC-4

PL-6. Erosional Gully, Previously Unreported

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 17, 2022. 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 in lieu 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 2022. The corresponding results are presented in Section 19.7.

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, identified 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.

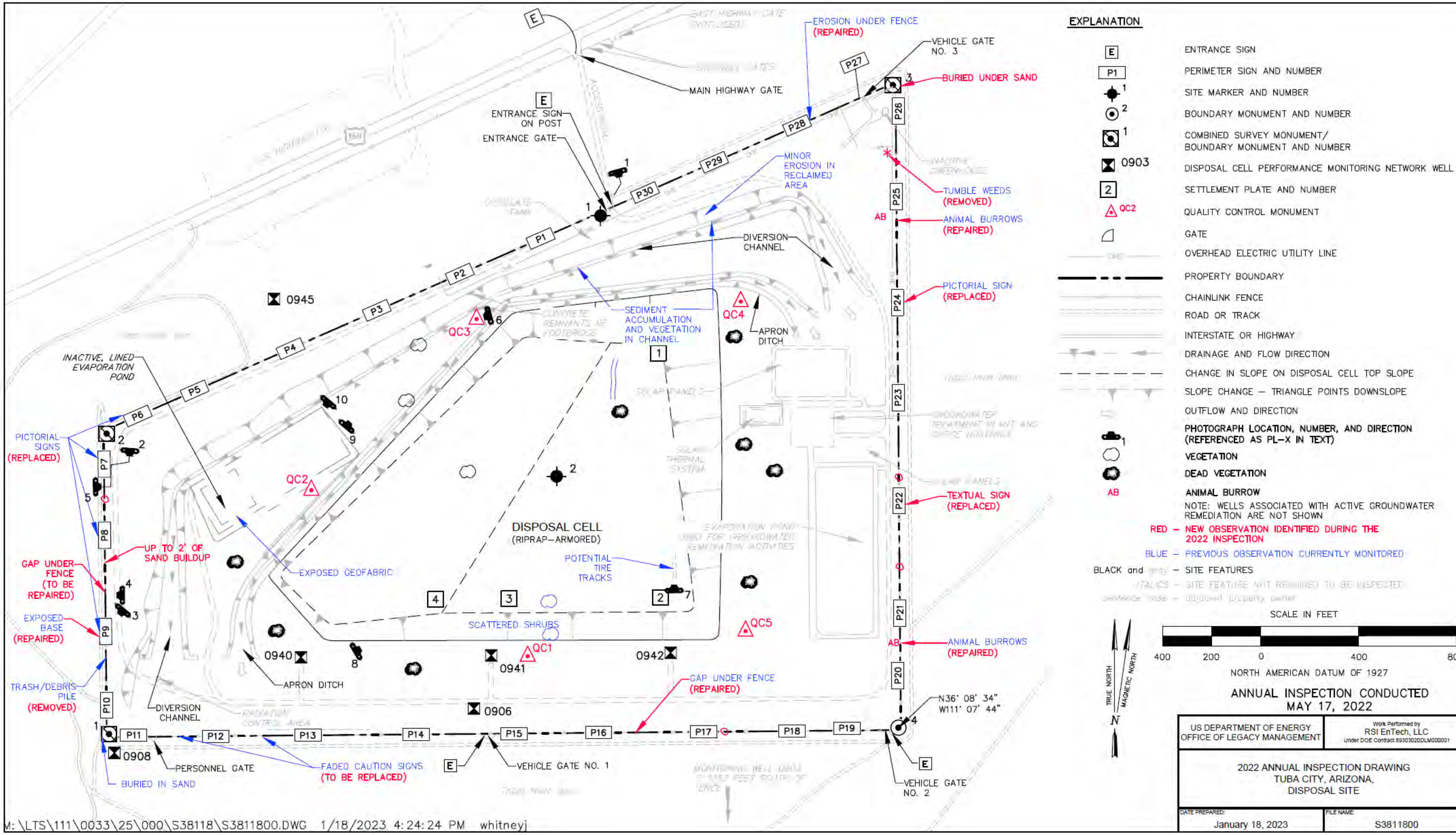


Figure 19-1. 2022 Annual Inspection Drawing for the Tuba City, Arizona, Disposal Site

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 gate and sign, 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 17, 2022. The inspection was conducted by L. Sheader and A. Smith of the Legacy Management Support contractor. J. Tallbull and G. Dayzie (both of Navajo Nation Abandoned Mine Lands/Uranium Mill Tailings Remedial Action) and N. Honie (Hopi Tribe Department of Natural Resources, Office of Mining and Mineral Resources) also attended and 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.

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 2022 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 (Figure 19-1) 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, near the entrance gate, and on two vehicle gates (No. 1 and No. 2). Vehicle Gate No. 3, in the northeast corner of the site, purposefully does not have a sign. An informational sign exists on the main entrance gate (PL-1). 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 and road (PL-2 and PL-3) resulting in several gaps under the fence (PL-4). These areas will be repaired before the next inspection. Trash and debris have accumulated around perimeter sign P9 and were removed following the inspection.

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. Pictorial signs P6, P7 (PL-5), P8, P9, and P24 and textual sign P22 were damaged and were replaced following the inspection. In previous years, perimeter sign P9 was reported to be undercut by wind erosion and was repaired following the inspection. Two faded signs warning of high voltage near perimeter sign P12 need to be replaced. No other 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. 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 (QC) monuments were installed before the 2022 inspection as identified in Figure 19-1. All were located and in good condition (PL-6). No maintenance needs were identified.

19.4.1.6 Monitoring Wells

Seven monitoring 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 (with the exception of wells 0903 and 0945, which are offsite). All were found to be undamaged and locked except well 0941, which was unlocked. No other 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 (PL-7) reported in previous annual reports. This area will continue to be monitored. There was no evidence of erosion, settling, slumping, or other modifying processes on the disposal cell.

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-8). This area will continue to be monitored. No other maintenance needs were identified.

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 and located 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. No evidence of recent or past water flows was observed in the apron ditch or the diversion channel.

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 near the northeast corner of the diversion channel, however, and erosion control repairs are performed as needed.

Inspectors noted that much of the woody vegetation, in reclaimed areas around the disposal cell, was dead. These areas were of concern to tribal officials (Mr. Honie) as they could present a potential fire hazard. Inspectors will evaluate multiple habitat enhancements to address the dead vegetation and reduce potential fire hazards at the site.

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. Perennial vegetation is establishing in these areas (PL-9).

The remaining historical evaporation pond, containing windblown sand and evaporites (PL-10), 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. The plastic geofabric that stabilizes the south-facing slope of the pond remains exposed. No repairs of the geofabric are needed at this time, as it remains mostly buried and continues to stabilize the slope. Inspectors will continue to monitor this area. No other maintenance needs were identified.

There are many 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, 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 hydrologic constraints on extraction and GWTP maintenance challenges. The structures associated with the GWTP remain onsite and include a control building; a shop and laboratory building; an ion exchange building, external tanks, and distillation skid; a solar water-heating system; two photovoltaic panel arrays for utility power generation; evaporation ponds; a network of extraction, injection, and monitoring wells; and a treated water infiltration trench.

19.4.2.3 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 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

Several maintenance items identified in the 2020 and 2021 inspections and reported previously were completed this year. These items include:

- Removal of tumbleweeds along the fence near perimeter sign P26.
- Repair of the gap beneath the fence near perimeter signs P16 and P28.
- Repair of the eroding base and removal of trash and debris at perimeter sign P9.
- Repair of animal burrows under the fence line near perimeter signs P20 and P25.
- Replacement of the P6, P7, P8, P9, and P24 pictorial perimeter signs and P22 textual sign.
- Treatment of vegetation growing on the side slopes of the disposal cell.

Five aerial survey quality control monuments were installed before the 2022 inspection. Inspectors noted the following maintenance items that will be completed before the next inspection:

- Treatment of the vegetation on the side slopes of the disposal cell
- Replacement of two caution signs near perimeter sign P12
- Repair of the gap in the fence near perimeter sign P9
- Implementation of habitat enhancements to reduce potential fire hazards at the site

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).

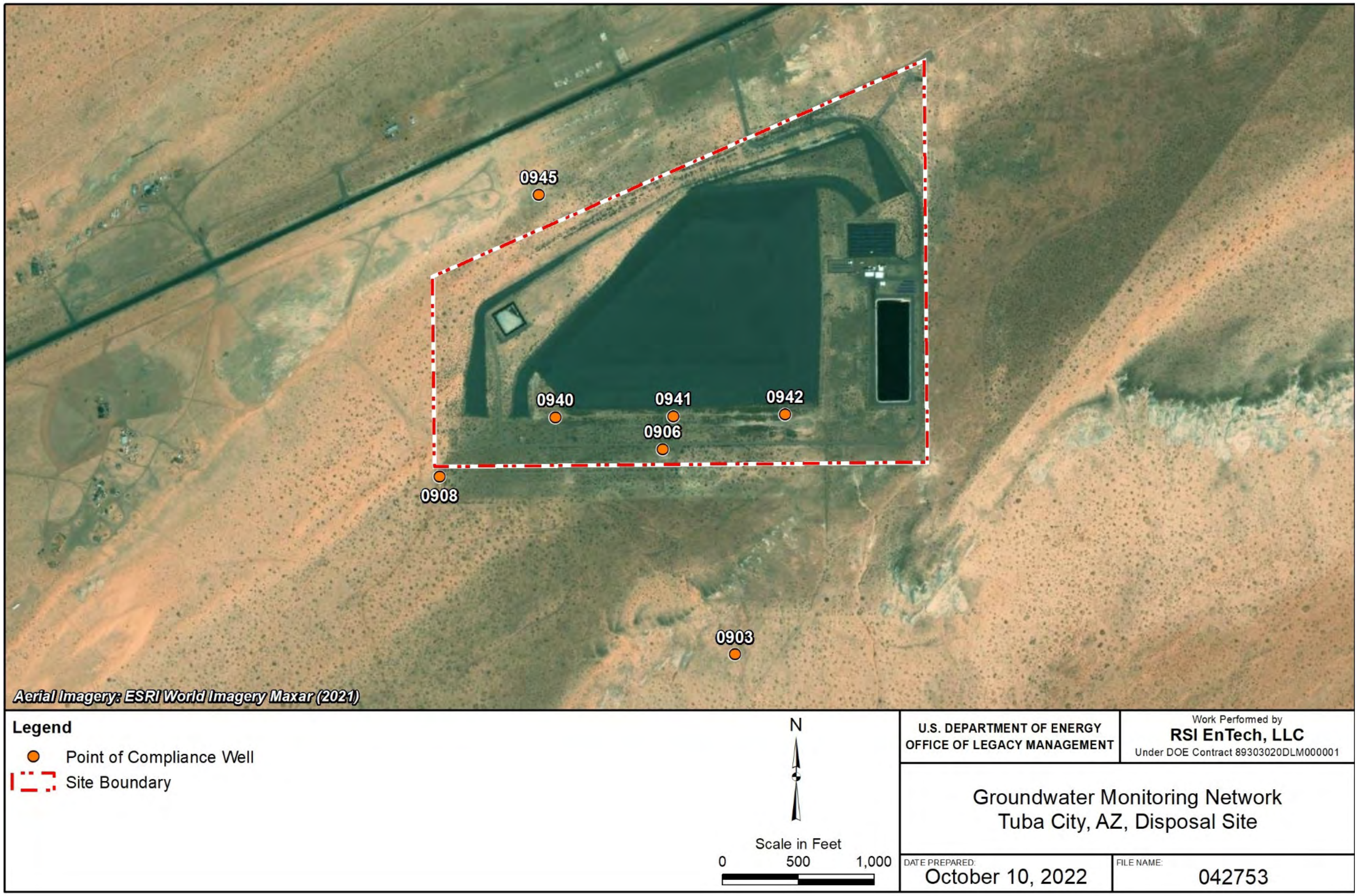
19.7.1 Groundwater Monitoring Program

In lieu 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 February and August 2022.

The progress of groundwater remediation is evaluated and reported annually, separate from this compliance reporting. Groundwater remediation is being conducted by an active treatment system that includes the operation of extraction wells and the transport of extracted (contaminated) groundwater to the onsite evaporation pond. Extraction wells are installed in areas and depths of greatest contamination in order to maximize source mass removal. Annual extraction volume is constrained to 5 million gallons due to evaporation pond capacity and the average annual evaporation rate of the pond. The contaminant plume is monitored, and additional mitigative actions will be defined and implemented if monitoring reveals unacceptable migration of the plume.

Pumping tests were performed in 2017 to determine groundwater drawdown and recovery rates and to characterize variations in hydraulic conductivity. Results were reported in the *Interim Treatment System Evaluation Report, Tuba City, Arizona, Disposal Site* (DOE 2018). Since 2018, the remediation system has operated in 4-month-long high-volume intensity, short-duration campaigns that begin in July and end in October.

Seven wells (Figure 19-2 and Table 19-2) identified in the LTSP are monitored for four hazardous constituents: molybdenum, nitrate, selenium, and uranium (Table 19-2) (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 Groundwater 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.



Note: Well 0942 was converted from a monitoring well to an extraction well in 2015.

Figure 19-2. Groundwater Monitoring Network at the Tuba City, Arizona, Disposal Site

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	Semiannually
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, therefore, has not been sampled since then.

Table 19-3. Provisional Upper Baseline Limits 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 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.” Establishing baseline conditions at wells 0906 and 0908 were conducted 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.

From September 2014 to April 2018, contaminated groundwater was pumped from one to three extraction wells in the higher-concentration portions of the plume. Since June 2018, the remediation system has operated in high-volume, short-duration campaigns during periods of highest potential for evaporative flux that generally begin in July and end in October. As many as 11 extraction wells are operating during this period to expand the capture zone area to capture more of the contaminant plume footprint, relative to the capture zone resulting from approximately three wells operating continuously between 2014 and 2018 (DOE 2020).

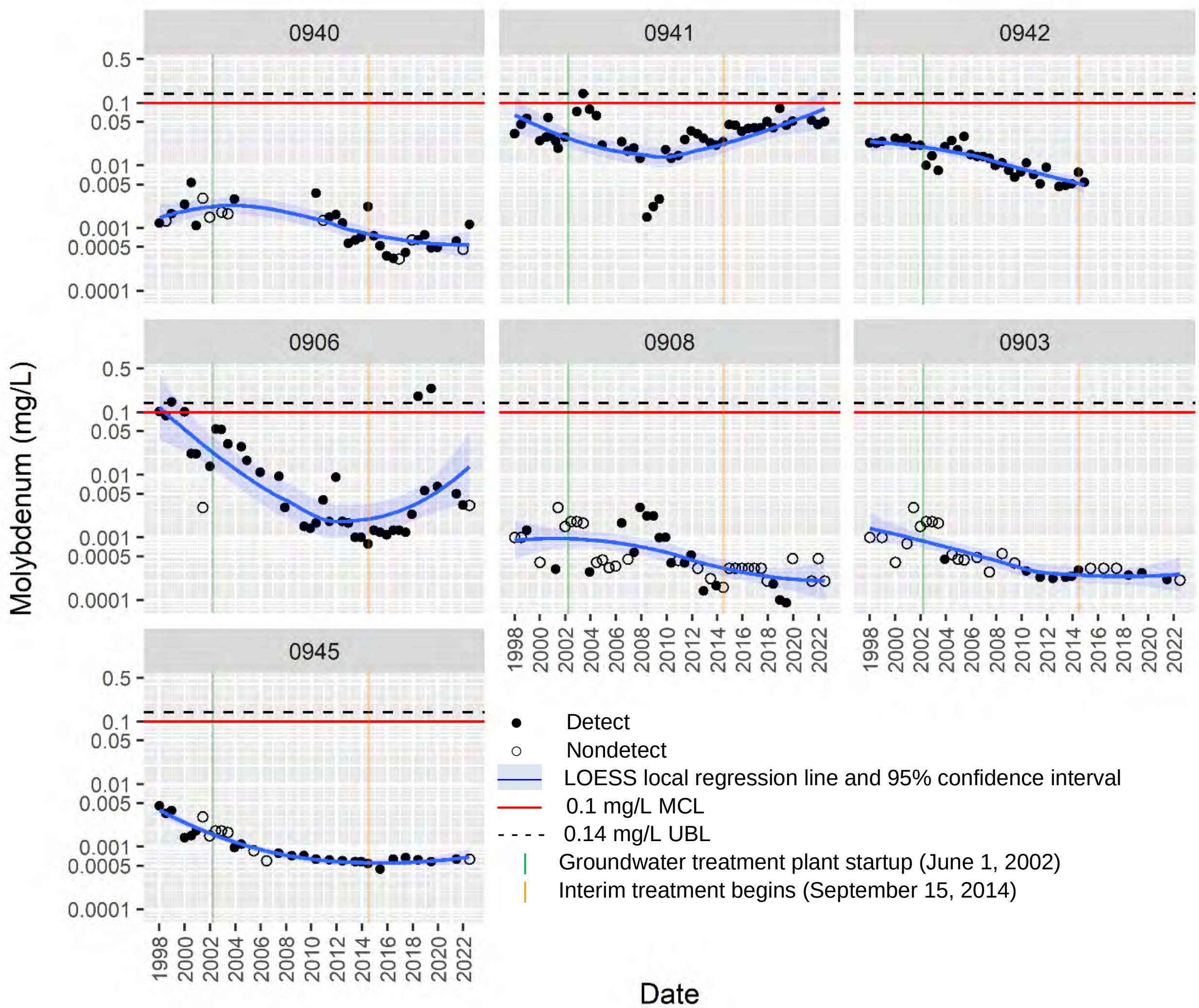
19.7.2 Groundwater Monitoring Results

Figure 19-3 through Figure 19-6 show time-concentration plots for the four target analytes, along with corresponding UBLs and MCLs. In these figures, data are plotted from 1998 to the present, consistent with the time frame evaluated in previous annual reports (DOE 2022a). 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/#site=TUB).[1] In this section, 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.

Since 2004, molybdenum concentrations have been below both the 0.10 milligram per liter (mg/L) MCL and the 0.14 mg/L UBL in all LTSP evaluative monitoring wells except well 0906 in August 2019 (Figure 19-3). Overall, molybdenum concentrations have been highest in well 0941, averaging about 0.04 mg/L. Concentrations in this well have increased since 2015 but are still below the UBL (most recent result of 0.05 mg/L). Molybdenum concentrations in wells 0940, 0908, and 0903 have been comparable to concentrations in background well 0945. In August 2019, the molybdenum concentration in well 0906 (0.18 mg/L) exceeded the UBL for the

[1] The August 2020 and February 2021 semiannual sampling events were cancelled due to travel restrictions imposed in response to the coronavirus disease 2019 pandemic, thus the data gap for this period in the time-concentration plots.

first time since 1999. Concentrations declined the following February but then exceeded the UBL again in August 2019 (0.24 mg/L). Both UBL exceedances coincided with the pumping campaigns. Molybdenum concentrations in well 0906 have since declined to levels well below both the MCL and the UBL (≤0.007 mg/L). The most recent (August 2022) was below the detection limit value (<0.003 mg/L).

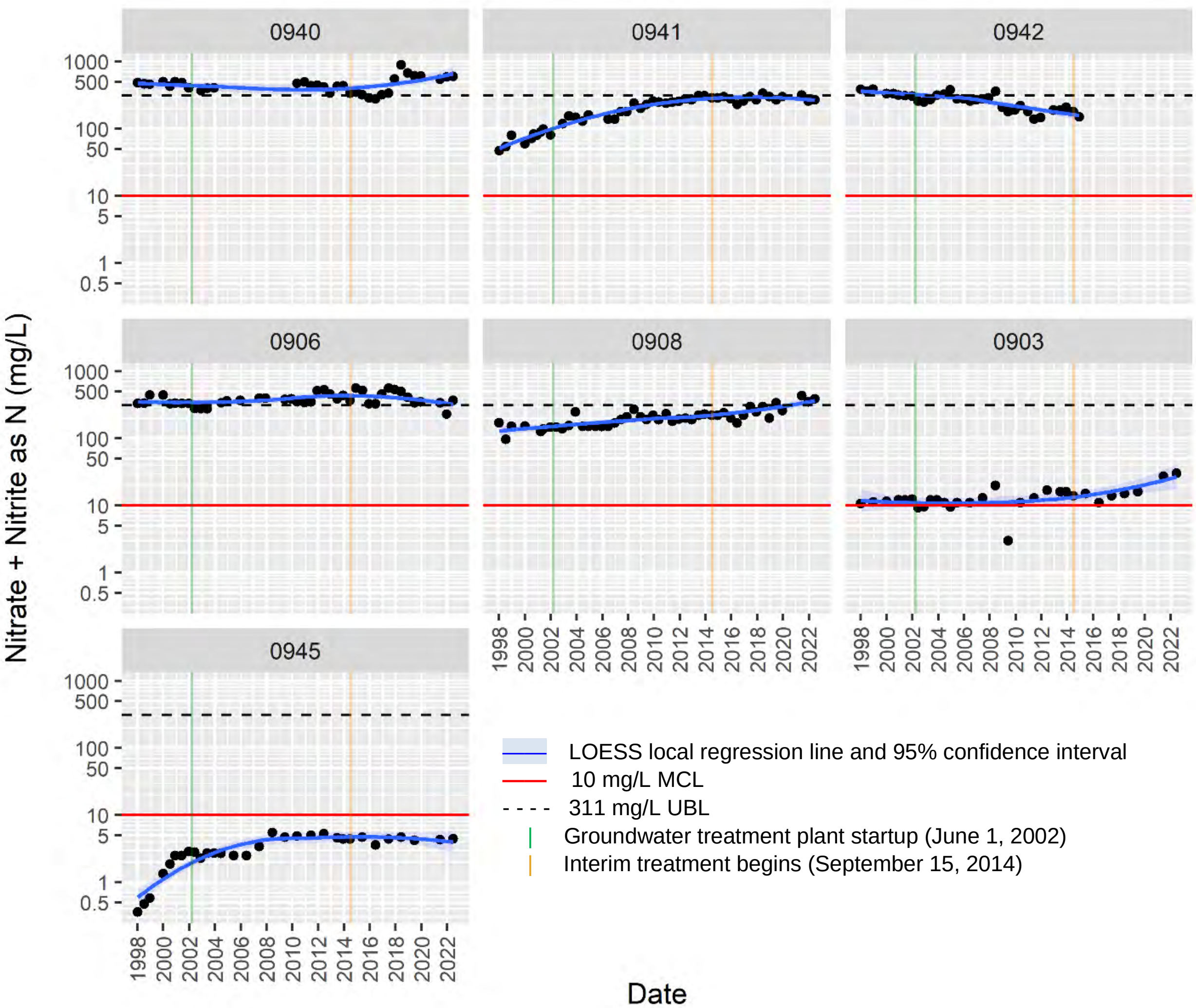


Note: Downgradient wells (from Table 19-2) are ordered in general direction of groundwater flow or distance from the disposal cell (Figure 19-2). Data for the upgradient background well are plotted last.
Abbreviation: LOESS = locally estimated scatterplot smoothing

Figure 19-3. Time-Concentration Plots of Molybdenum in Groundwater at the Tuba City, Arizona, Disposal Site

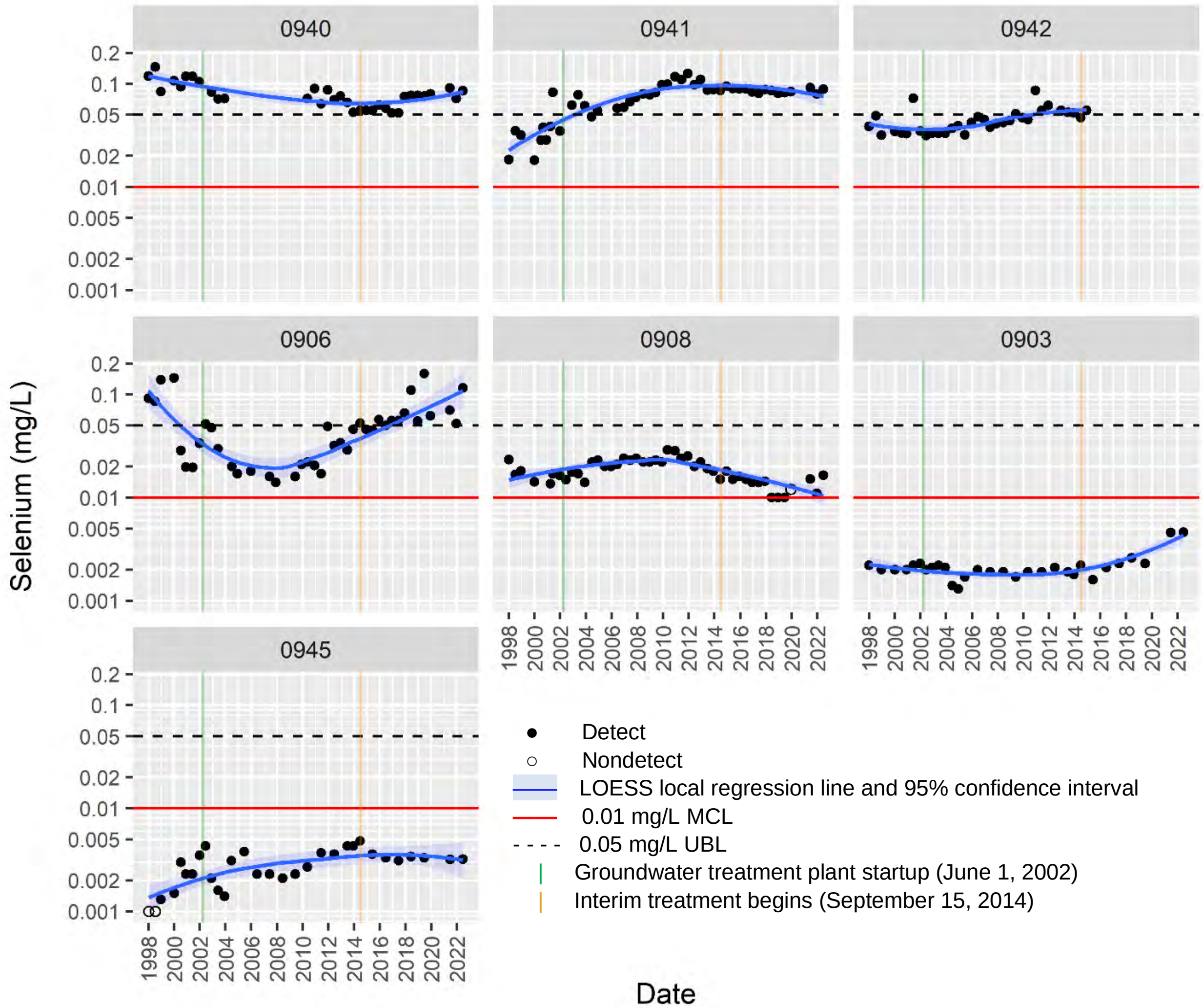
Nitrate (+ nitrite as nitrogen [N]) concentrations have historically exceeded the 10 mg/L MCL in all LTSP evaluative wells except background well 0945 (Figure 19-4). The 311 mg/L UBL has been exceeded in all downgradient evaluative monitoring wells except southernmost well 0903, approximately 1250 feet south of the site perimeter. The UBL has been exceeded consistently in wells 0940 and 0906, but only recently (in the last several years) in wells 0941 and 0908. Nitrate concentrations in well 0941 exceeded the UBL twice, first in August 2018 (340 mg/L) and again (slightly) in August 2021 (318 mg/L); the most recent (August 2022) result was 270 mg/L.

In westernmost well 0908, nitrate exceeded the 311 mg/L UBL for the first time in August 2019. Levels have remained elevated since August 2021, when the maximum concentration of 434 mg/L was detected. Nitrate concentrations in southernmost downgradient well 0903, although regularly exceeding the MCL since 2004, have remained below the UBL. However, results have slightly increased since about 2014, with the maximum result (30.1 mg/L) detected in August 2022. In summary, in 2022, the UBL was exceeded in three compliance monitoring wells: 0940 (590–605 mg/L), 0906 (370 mg/L), and 0908 (350–391 mg/L).



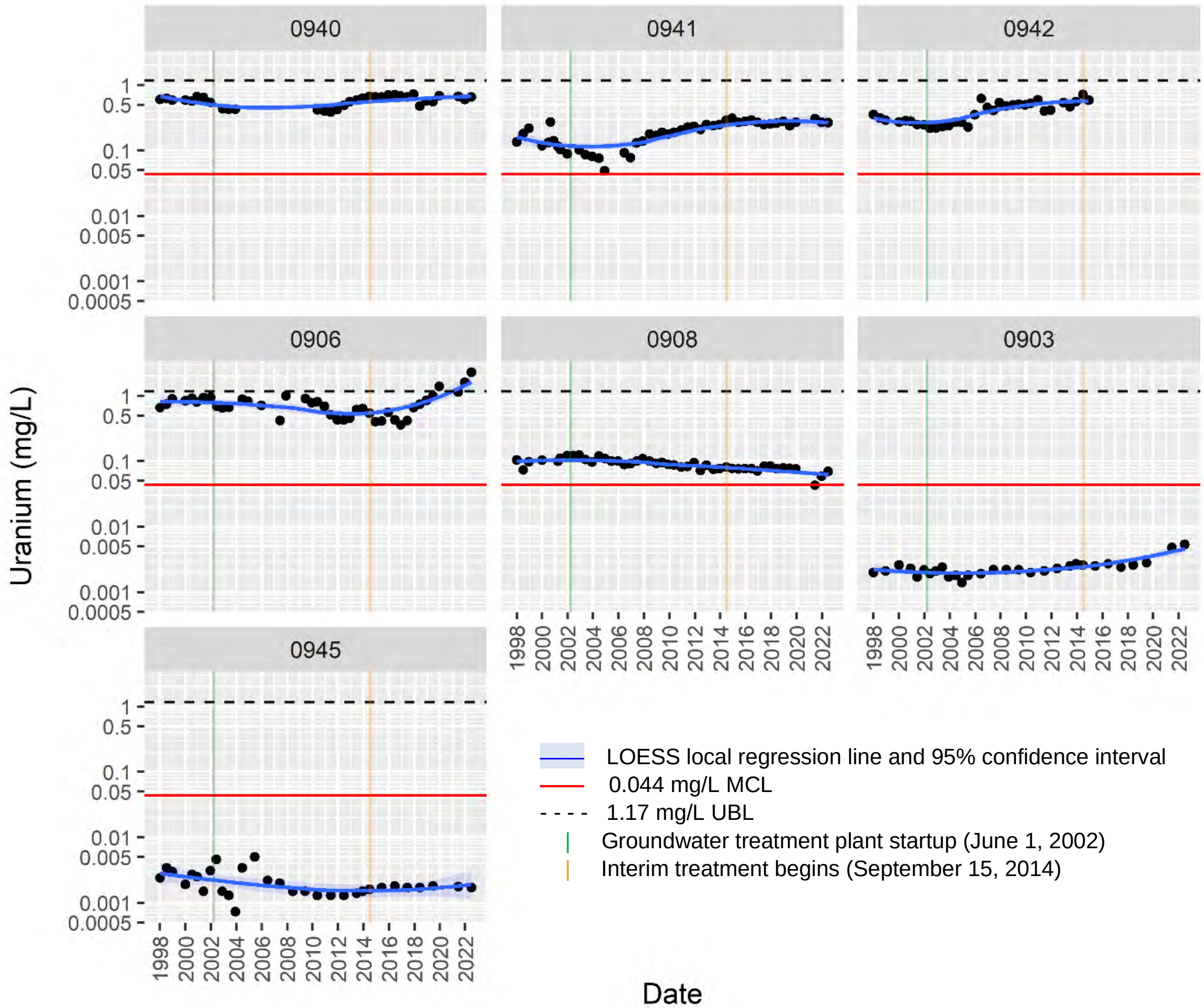
Note: Downgradient wells (from Table 19-2) are ordered in general direction of groundwater flow or distance from the disposal cell (Figure 19-2). Data for the upgradient background well are plotted last.
Abbreviation: LOESS = locally estimated scatterplot smoothing

Figure 19-4. Time-Concentration Plots of Nitrate in Groundwater at the Tuba City, Arizona, Disposal Site



Note: Downgradient wells (from Table 19-2) are ordered in general direction of groundwater flow or distance from the disposal cell (Figure 19-2). Data for the upgradient background well are plotted last.
Abbreviation: LOESS = locally estimated scatterplot smoothing

Figure 19-5. Time-Concentration Plots of Selenium in Groundwater at the Tuba City, Arizona, Disposal Site



Note: Downgradient wells (from Table 19-2) are ordered in general direction of groundwater flow or distance from the disposal cell (Figure 19-2). Data for the upgradient background well are plotted last.
Abbreviation: LOESS = locally estimated scatterplot smoothing

Figure 19-6. Time-Concentration Plots of Uranium in Groundwater at the Tuba City, Arizona, Disposal Site

Selenium concentrations have historically exceeded the 0.01 mg/L MCL in all LTSP evaluative wells except background well 0945 and distal well 0903 (Figure 19-5). The 0.05 mg/L UBL has been exceeded consistently in wells 0940 and 0941, immediately downgradient of the disposal cell, since 1998 and 2005, respectively. Selenium concentrations in both wells have been stable, however, averaging about 0.07 mg/L and 0.09 mg/L (respectively) since 2010; the most recent results were 0.085 and 0.089 mg/L. Since 2018, the highest selenium concentrations have been measured in well 0906. After declining from 0.15 mg/L in 2000 to 0.014 mg/L in 2008, concentrations have since increased; the most recent result was 0.12 mg/L (Figure 19-5). The increase in selenium concentrations in well 0906 since 2009 correlates with the time that average annual cumulative extraction rates dropped from 80 to 35 gallons per minute (gpm) due to intermittent shutdowns of the groundwater treatment plant for maintenance (DOE 2020).

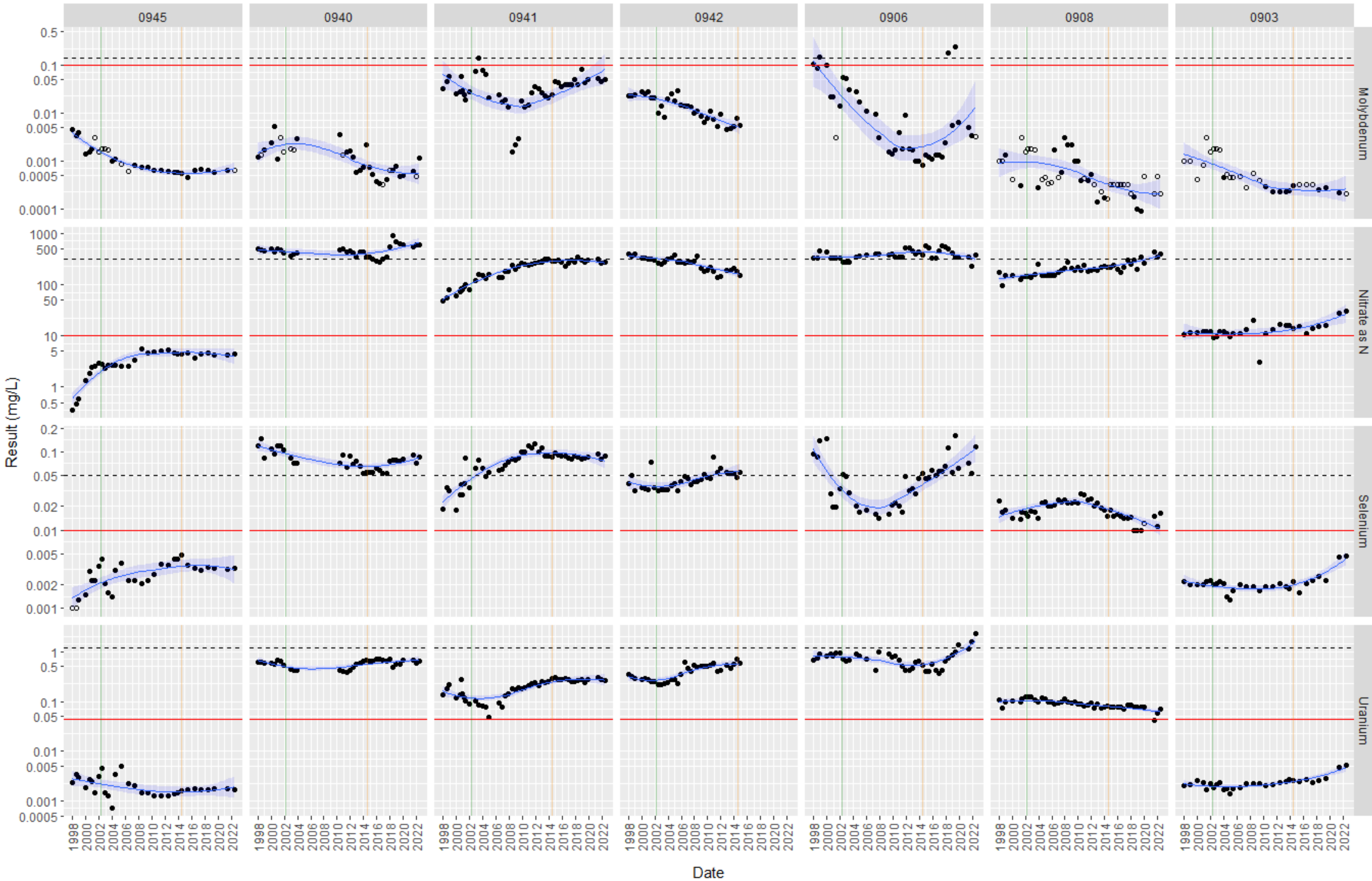
Selenium concentrations in well 0908 have been consistently at or above the 0.01 mg/L MCL but remain below the 0.05 mg/L UBL since 1998 (the most recent result was 0.017 mg/L). Selenium concentrations in southernmost downgradient well 0903 have consistently been below both the UBL and the MCL. Concentrations have increased slightly in recent years, however, from 0.0016 mg/L in 2015 to 0.0046 mg/L in August of 2021 and 2022.

Uranium concentrations have historically exceeded the 0.044 mg/L MCL in all downgradient compliance wells except for distal downgradient well 0903 and a single (August 2021) measurement in well 0908 (Figure 19-6). The 1.17 mg/L UBL has not been exceeded except for recent measurements in well 0906. Uranium concentrations in this well increased from 0.36 mg/L in February 2017 to 1.4 mg/L in February 2020. Following a slight decline in August 2021, concentrations increased again, to 1.6 mg/L in February 2022 and (a historical maximum) 2.3 mg/L in August 2022. Uranium concentrations in well 0908 exhibit a slight decreasing trend, with the most recent results (0.07–0.08 mg/L) just slightly exceeding the 0.044 mg/L MCL. In contrast, increasing uranium concentration trends are apparent in wells 0906 and 0903 (refer to DOE 2022b for a detailed evaluation). Although below both the MCL and the UBL, the most recent uranium concentration in well 0903 is the highest result on record for this well at 0.0054 mg/L.

In summary, analytical results from the 2022 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, that are comparable to background. Apart from a few historical results for well 0906, molybdenum concentrations in all downgradient wells have been below the corresponding MCL of 0.1 mg/L. Nitrate concentrations have recently increased in several site wells, with the 311 mg/L UBL currently exceeded in wells 0940, 0906, and 0908. Selenium concentrations currently exceed the 0.05 mg/L UBL in wells 0940, 0941, and 0906 and have increased significantly in well 0906 since 2008. Except for recent measurements in well 0906, uranium concentrations have been below the 1.17 mg/L UBL in all evaluative monitoring wells. Increases in uranium and molybdenum concentrations in well 0906 starting around 2014 correlate with the timing of the groundwater treatment plant 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 2020; DOE 2022b).

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

| Groundwater treatment plant startup (June 1, 2002); | Interim treatment begins (September 15, 2014)

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.

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

Figure 19-7. Summary of Historical Evaluative Monitoring Results at the Tuba City, Arizona, Disposal Site (1998–2022)

19.9 References

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), 2020. *Tuba City, Arizona, Disposal Site Groundwater Remedy Performance Report, 2002 Through 2018,* LMS/TUB/S28108, Office of Legacy Management, June.

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DOE (U.S. Department of Energy), 2022b. *Draft Tuba City, Arizona, Disposal Site Groundwater Remedy Performance Update, 2019 Through 2021*, LMS/TUB/S33713, Office of Legacy Management, February

EPA (U.S. Environmental Protection Agency), 1989. *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities-Interim Final Guidance*, EPA/530-SW-89-026, Office of Solid Waste, Waste Management Division, Washington, D.C., February.

19.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	165	Entrance Sign
PL-2	185	West Perimeter Fence with Sand Deposition
PL-3	220	Vegetation and Debris on Fence near Perimeter Sign P9
PL-4	270	Gap Under Perimeter Fence near Perimeter Sign P9
PL-5	90	Perimeter Sign P7; Pictorial Sign Damaged
PL-6	—	Quality Control Monument QC-3
PL-7	0	Parallel Tracks Visible on Top of Disposal Cell
PL-8	60	Vegetation on South Slope of Disposal Cell
PL-9	40	Revegetated Area of Former Evaporation Ponds
PL-10	220	Inactive Evaporation Pond

Note:
— = Photograph taken vertically from above.

PL-1. Entrance Sign

PL-2. West Perimeter Fence with Sand Deposition

PL-3. Vegetation and Debris on Fence near Perimeter Sign P9

PL-4. Gap Under Perimeter Fence near Perimeter Sign P9

PL-5. Perimeter Sign P7; Pictorial Sign Damaged

PL-6. Quality Control Monument QC-3

PL-7. Parallel Tracks Visible on Top of Disposal Cell

PL-8. Vegetation on South Slope of Disposal Cell

PL-9. Revegetated Area of Former Evaporation Ponds

PL-10. Inactive Evaporation Pond