

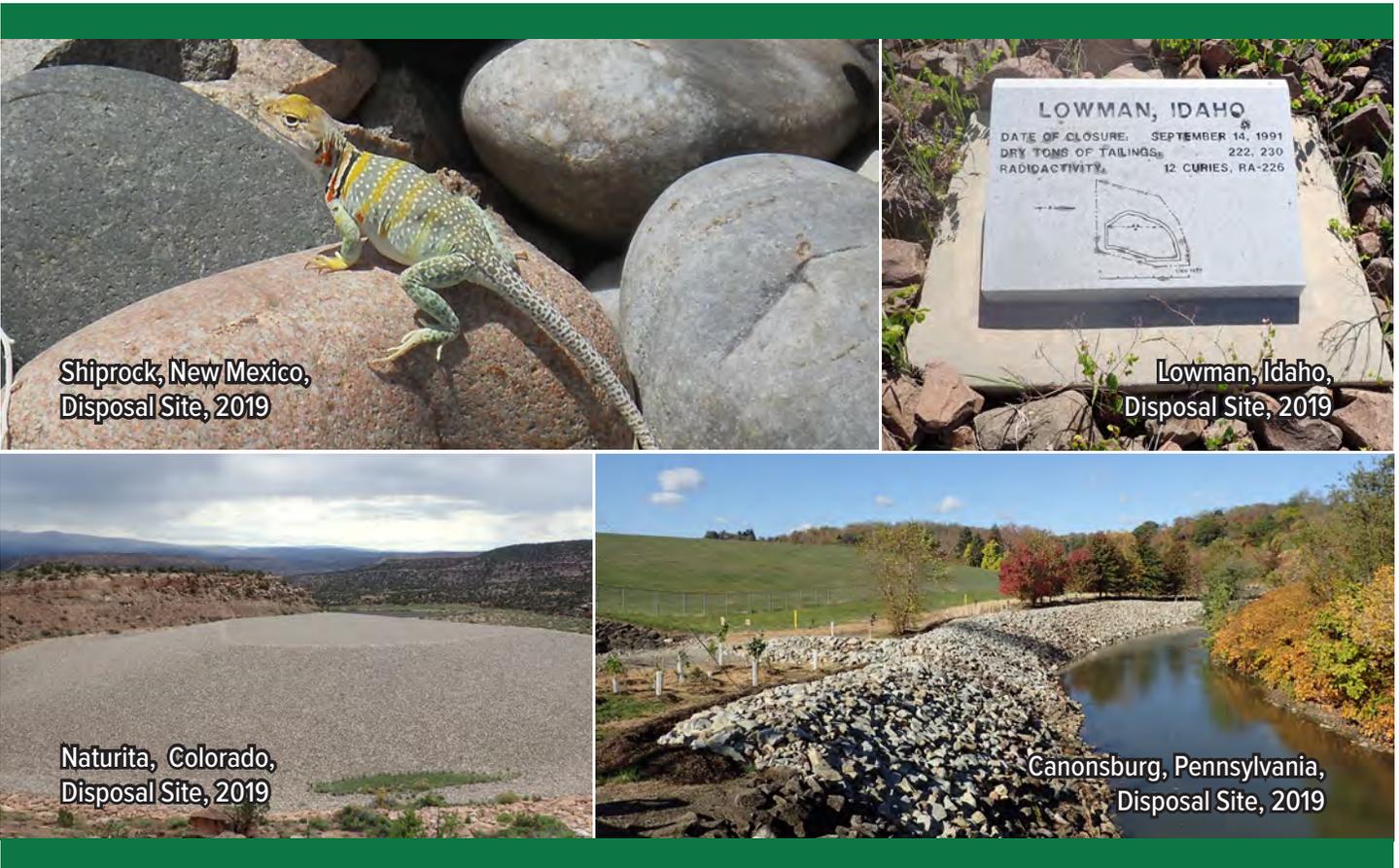


U.S. DEPARTMENT OF
ENERGY

Legacy
Management

2019 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites

March 2020



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Contents

	Page
Abbreviations	iii
Executive Summary	v
1.0 Ambrosia Lake, New Mexico, Disposal Site	1-1
2.0 Burrell, Pennsylvania, Disposal Site	2-1
3.0 Canonsburg, Pennsylvania, Disposal Site	3-1
4.0 Durango, Colorado, Disposal Site	4-1
5.0 Falls City, Texas, Disposal Site	5-1
6.0 Grand Junction, Colorado, Disposal Site	6-1
7.0 Green River, Utah, Disposal Site	7-1
8.0 Gunnison, Colorado, Disposal Site	8-1
9.0 Lakeview, Oregon, Disposal Site	9-1
10.0 Lowman, Idaho, Disposal Site	10-1
11.0 Maybell, Colorado, Disposal Site	11-1
12.0 Mexican Hat, Utah, Disposal Site	12-1
13.0 Naturita, Colorado, Disposal Site	13-1
14.0 Rifle, Colorado, Disposal Site	14-1
15.0 Salt Lake City, Utah, Disposal Site	15-1
16.0 Shiprock, New Mexico, Disposal Site	16-1
17.0 Slick Rock, Colorado, Disposal Site	17-1
18.0 Spook, Wyoming, Disposal Site	18-1
19.0 Tuba City, Arizona, Disposal Site	19-1

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Abbreviations

ACL	alternate concentration limit
AML	Abandoned Mine Lands
BLM	U.S. Bureau of Land Management
BMP	best management practice
BOR	U.S. Bureau of Reclamation
CFR	<i>Code of Federal Regulations</i>
CPW	Colorado Parks and Wildlife
D ₅₀	mean diameter
DOE	U.S. Department of Energy
EDA	energy dissipation area
EPA	U.S. Environmental Protection Agency
ft	feet
FY	fiscal year
GCAP	groundwater compliance action plan
GSMT	geotechnical sampling and materials testing
IC	institutional control
ICP	interim cover protection
IRBP	interim radon barrier protection
LIDAR	light detection and ranging
LM	Office of Legacy Management
LMS	Legacy Management Support
LTSP	Long-Term Surveillance Plan
MCL	maximum concentration limit
mg/L	milligrams per liter
µrem/h	microrem per hour
NECA	Navajo Engineering and Construction Authority
NMED	New Mexico Environment Department
NRC	U.S. Nuclear Regulatory Commission
PL	photograph location
POC	point of compliance
RAI	request for additional information
RCT	radiation control technician

SOARS	System Operation and Analysis at Remote Sites
TCEQ	Texas Commission on Environmental Quality
UBL	upper baseline limit
UMTRCA	Uranium Mill Tailings Radiation Control Act of 1978
USDA	U.S. Department of Agriculture

Executive Summary

This report, in fulfillment of a 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 2019. Activities occurred at the 19 uranium mill tailings disposal sites established under Title I of the Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA).¹ These activities verified that the UMTRCA Title I disposal sites remain in compliance with license requirements. Long-Term Surveillance Plans (LTSPs) and site compliance reports 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 the U.S. Nuclear Regulatory Commission (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. In accordance with Public Law 104-259, “An Act to Extend the Authorization of the Uranium Mill Tailings Radiation Control Act of 1978, and for Other Purposes,” the open portion will be closed either when the capacity has been reached or in 2023, whichever comes first. Reauthorization of Public Law 104-259 is expected, with an extension of the closure date through 2048.

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 LTSPs² 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, if any, for maintenance, follow-up inspections, or corrective action in accordance with the LTSP.

All sites require some degree of routine monitoring and maintenance, which may include groundwater and surface water monitoring, minor erosion control, vegetation control, fence and gate repairs, sign replacement, and minor trash removal. The following nonroutine activities³ occurred in 2019:

- **Multiple sites:** Permanent quality control monuments were installed at several sites in preparation for baseline aerial surveys of the disposal cells. The monuments consist of steel survey markers surrounded by 3-by-3-foot concrete slabs. Permanent quality control monuments were installed at the Rifle, Colorado; Canonsburg and Burrell, Pennsylvania; Ambrosia Lake, New Mexico; Lakeview, Oregon; and Spook, Wyoming, sites.

¹ Congress directed that the Moab, Utah, Processing Site be remediated under Title I of UMTRCA. This site eventually will become the 20th Title I disposal site.

² The Grand Junction Disposal Site is inspected in accordance with an interim LTSP.

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

- **Canonsburg, Pennsylvania, Disposal Site:** Engineered repairs to the riprap-armored embankment of Chartiers Creek north of the disposal cell were completed. A riparian forest buffer was planted above and along the embankment to further stabilize the area against future stream flooding events and to reduce erosion upgradient of the riprap embankment. Disturbed areas were seeded with a pollinator-friendly native grass and wildflower mix.
- **Mexican Hat, Utah, Disposal Site:** The interim cover protection project was performed as a temporary measure to restore the depressional features identified in 2016 to original design specifications. A series of test pits and one test strip were mechanically excavated and supplemented with a moisture-conditioned, bentonite-amended granular material to reconstruct the areas where radon barrier material had been eroded. All test areas were systematically screened for gamma radiation, and no elevated readings were observed. Geotechnical sampling and materials testing (GSMT) were performed on the disposal cell side slope cover components in 2019. Information obtained through the GSMT will be used to identify possible causes for the cover degradation features that have been observed at the site.

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

Table ES-1. 2019 Summary of UMTRCA Title I Site Actions and Issues

Site	Chapter	Page	Actions and Issues
Ambrosia Lake, New Mexico	1	1-2	Replaced several perimeter and mining restriction signs.
		1-7	Conducted best management groundwater monitoring.
Burrell, Pennsylvania	2	2-2	Replaced information sign and perimeter signs.
		2-7	Removed dying trees and brush.
		2-10	Conducted vegetation management.
Canonsburg, Pennsylvania	3	3-7	Conducted stabilization of riprap embankment at Chartiers Creek.
		3-7	Planted riparian forest buffer.
		3-9	Conducted vegetation management.
Durango, Colorado	4	4-2	Replaced entrance sign.
		4-5	Removed vegetation from around perimeter sign and boundary monument.
		4-5	Treated woody vegetation on disposal cell.
		4-8	Conducted groundwater monitoring.
Falls City, Texas	5	4-12	Conducted vegetation management.
		5-7	Conducted minor fence repair.
Grand Junction, Colorado	6	5-8	Conducted groundwater monitoring.
		6-2	Installed new entrance gate.
Green River, Utah	7	6-7	Conducted groundwater monitoring.
		7-2	Repaired minor erosion under perimeter fence.
Gunnison, Colorado	8	7-7	Conducted groundwater monitoring.
		8-2	Repaired broken fence strands.
		8-6	No groundwater monitoring required.

Table ES-1. 2019 Summary of UMTRCA Title I Site Actions and Issues (continued)

Site	Chapter	Page	Actions and Issues
Lakeview, Oregon	9	9-5	Performed minor fence repair.
		9-6	Conducted riprap gradation monitoring.
		9-10	Conducted groundwater monitoring.
Lowman, Idaho	10	10-5	Treated tree seedlings.
		10-6	No groundwater monitoring required.
Maybell, Colorado	11	11-2	Repaired perimeter fence.
		11-7	No groundwater monitoring required.
		11-7	Conducted vegetation monitoring.
Mexican Hat, Utah	12	12-1	Performed geotechnical sampling and materials testing (on disposal cell side slope cover components).
		12-1	Conducted interim cover protection field activity.
		12-5	Performed minor fence repair.
		12-9	No groundwater monitoring required.
		12-9	Conducted observational seep monitoring.
Naturita, Colorado	13	13-2	Conducted minor fence repair.
		13-2	Replaced perimeter signs.
		13-2	Installed pedestrian access gates.
		13-6	Observed erosion from County Road EE22 berm cut.
		13-6	Montrose County repaired road berm cut.
		13-7	No groundwater monitoring required.
Rifle, Colorado	14	14-2	Removed graffiti from entrance gate cover.
		14-5	Added perimeter signs.
		14-8	Installed quality control monuments.
		14-8	Conducted disposal cell pore-water monitoring.
Salt Lake City, Utah	15	15-5	Conducted visual riprap degradation monitoring on disposal cell.
		15-7	No groundwater monitoring required.
Shiprock, New Mexico	16	16-2	Replaced pictorial signs.
		16-2	Repaired gaps under perimeter fence.
		16-2	Conducted minor fence repair.
		16-7	Repaired degraded erosion control fabric on energy dissipation basin.
		16-8	No disposal cell performance monitoring required.
		16-8	Conducted vegetation monitoring.
Slick Rock, Colorado	17	17-2	Removed vegetation from fence line.
		17-6	No groundwater monitoring required.
Spook, Wyoming	18	18-5	Installed quality control monuments.
		18-6	No groundwater monitoring required.
Tuba City, Arizona	19	19-5	Updated entrance signs.
		19-8	Conducted groundwater monitoring.

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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 (site) was inspected on March 20, 2019. 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 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 at three wells as a best management practice at the request of the New Mexico Environment Department (NMED). The most recent groundwater sampling event occurred in November 2019. All monitoring results were within the range of historical monitoring results, with the exception of molybdenum levels in well 0678, which were lower than previous monitoring results.

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 (LTSP) (DOE 1996) in accordance with procedures established to comply with the requirements of the U.S. Nuclear Regulatory Commission (NRC) general license at Title 10 *Code of Federal Regulations* Section 40.27 (10 CFR 40.27). Table 1-1 lists these requirements.

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

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

1.3 Institutional Controls

The 288-acre site, identified by the property boundary shown in Figure 1-1, is owned by the United States and was accepted under the NRC general license in 1998. DOE is the licensee and, in accordance with the requirements for UMTRCA Title I sites, 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

The site, 25 miles north of Grants, New Mexico, was inspected on March 20, 2019. The inspection was conducted by A. Kuhlman, R. Johnson, and D. Traub of the Legacy Management

Support contractor. B. Tsosie (LM site manager); E. Holland (LM FIMS program manager); A. Rheubottom (NMED); and R. Evans and S. Anderson (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 the need, if any, for maintenance or additional inspection and monitoring.

1.4.1 Site Surveillance Features

Figure 1-1 shows the locations of site features, including site surveillance features and inspection areas, in black. 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 text, and new observations identified during the 2019 annual inspection are shown in red. Inspection results and recommended maintenance activities associated with site surveillance features are included in the following subsections. Photographs to support specific observations are identified 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 for 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). The text on the entrance sign was cracked but remained legible. Following the inspection, LM replaced the entrance sign. No other maintenance needs were identified.

1.4.1.2 Perimeter Signs

There are 70 perimeter signs, attached to steel posts set in concrete, positioned along the unfenced property boundary. Posts for perimeter signs P1 through P15 include additional warning signs about mining restrictions; several were bent by cattle but remained legible. The text on perimeter signs P1 through P15 was cracked but remained legible (PL-2). Following the annual inspection, LM replaced perimeter signs P1 through P15 and the mining restriction signs. No other 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-3). No maintenance needs were identified.

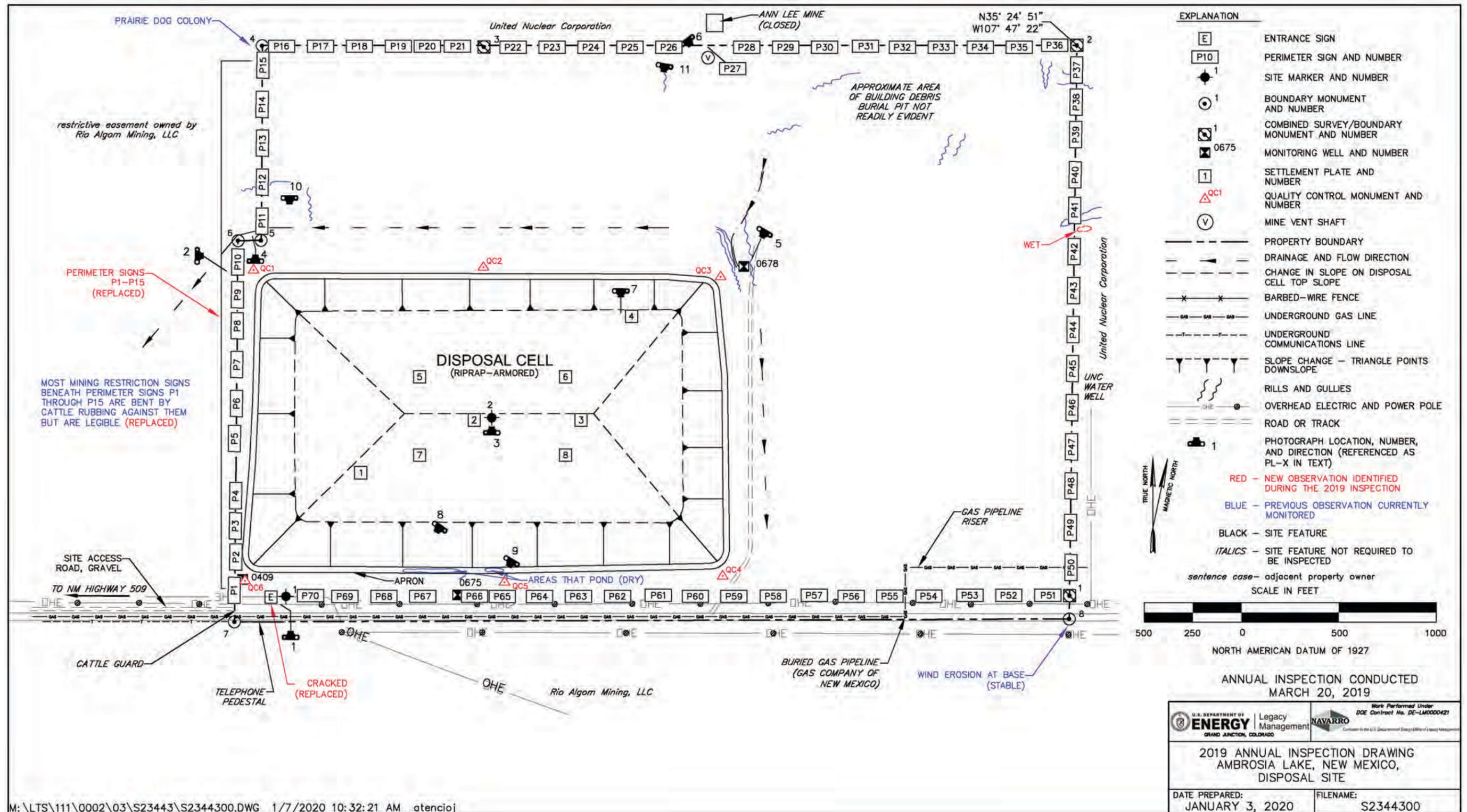


Figure 1-1. 2019 Annual Inspection Drawing for the Ambrosia Lake, New Mexico, Disposal Site

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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-4). Steel T-posts were installed next to boundary monuments to help inspectors locate the monuments. Erosion has occurred around the base of boundary monument BM-8, but the monument is stable. No maintenance needs were identified.

1.4.1.5 Monitoring Wells

The site has three monitoring wells. A gully formation adjacent to well 0678 appears to be stable, and the well is not affected by the erosion (PL-5). All wellhead protectors observed during the inspection were undamaged, locked, and properly labeled. No maintenance needs were identified.

1.4.1.6 Mine Vent

A mine vent shaft associated with an abandoned underground mine is within the site boundary in the northern portion of the site. 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 (PL-6). Inspectors will continue to monitor the condition of the vent to ensure that the closure remains secure. 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. Visual observations during the 2017 annual inspection indicated that very minor settlement may have occurred since the depression was repaired. The area was inspected during the 2019 annual inspection, and although the area was observed to be slightly depressed, settlement was shallow enough that the depth or the extent could not be definitively assessed (PL-7). Inspectors will continue to monitor this area.

Scattered annual weeds and perennial grasses and forbs are growing on the disposal cell top. 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 (PL-8). This location is the topographic low spot along the base of the disposal cell, and rainfall runoff collects in this area. No significant changes in the potential desiccation crack and small rills at the base of the disposal cell were observed (PL-9). 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 (PL-10). Because the site is not fenced, livestock occasionally enter it. Inspectors did not observe cattle near the disposal cell, but there was evidence of recent grazing on the site. Occasional grazing will not affect the disposal cell protectiveness or long-term performance, because livestock 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. While no new rills and gullies were observed during the 2019 annual inspection, existing rills and gullies continued to develop (PL-11). These erosional features do not threaten the disposal cell's performance or integrity, because headward erosion is progressing away from the disposal cell, and there is no significant sedimentation near the disposal cell. Inspectors will continue to monitor these features to confirm that they do not impact site features. No maintenance needs were identified.

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 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

Inspectors documented the following minor maintenance and repair needs that were completed after the inspection:

- Replacing the cracked entrance sign
- Replaced perimeter signs P1 through P15 and associated mining restriction signs

In June 2019, six permanent quality-control monuments were installed at the site in preparation for a baseline aerial survey of the disposal cell. The quality control monument locations are shown in Figure 1-1.

No other maintenance needs were identified.

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 three 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 was returned to a triennial schedule. The most recent sampling event occurred in November 2019.

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 Unit C of the Tres Hermanos member of the Mancos Shale Formation. The well is dry, which suggests that groundwater is not leaving the southwest portion of the site via alluvium.

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



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

Figure 1-3 through Figure 1-7 depict time concentration plots for molybdenum, nitrate, selenium, sulfate, and uranium in wells 0675 and 0678. Molybdenum levels in well 0675 had relative highs of 3.96 milligrams per liter (mg/L) in 2001 and 3.3 mg/L in 2015. Molybdenum has since decreased from 3.3 mg/L to 0.6 mg/L in 2019. By comparison, molybdenum levels have been consistently low in well 0678 since 1989.

Nitrate as nitrogen (N) levels in well 0678 were at a maximum of 520 mg/L as N in 2004 and decreased steadily to 170 mg/L 2019. Well 0675 in 2019 had a nitrate as N concentration of 34 mg/L, which was consistent with historical levels at well 0675.

Selenium in well 0678 decreased from 0.7 mg/L in 1992 to background levels in 2019. Selenium concentration in well 0675 was 0.7 mg/L in 2019 and has fluctuated between 1.3 mg/L and 0.17 mg/L since 1991. No apparent historical trend in selenium concentration is present in well 0675.

Sulfate levels have increased steadily in well 0678 from 6240 mg/L in 1989 to 8900 mg/L in 2019. Sulfate in well 0675 has been relatively consistent around the 4000 mg/L concentration value since 1989.

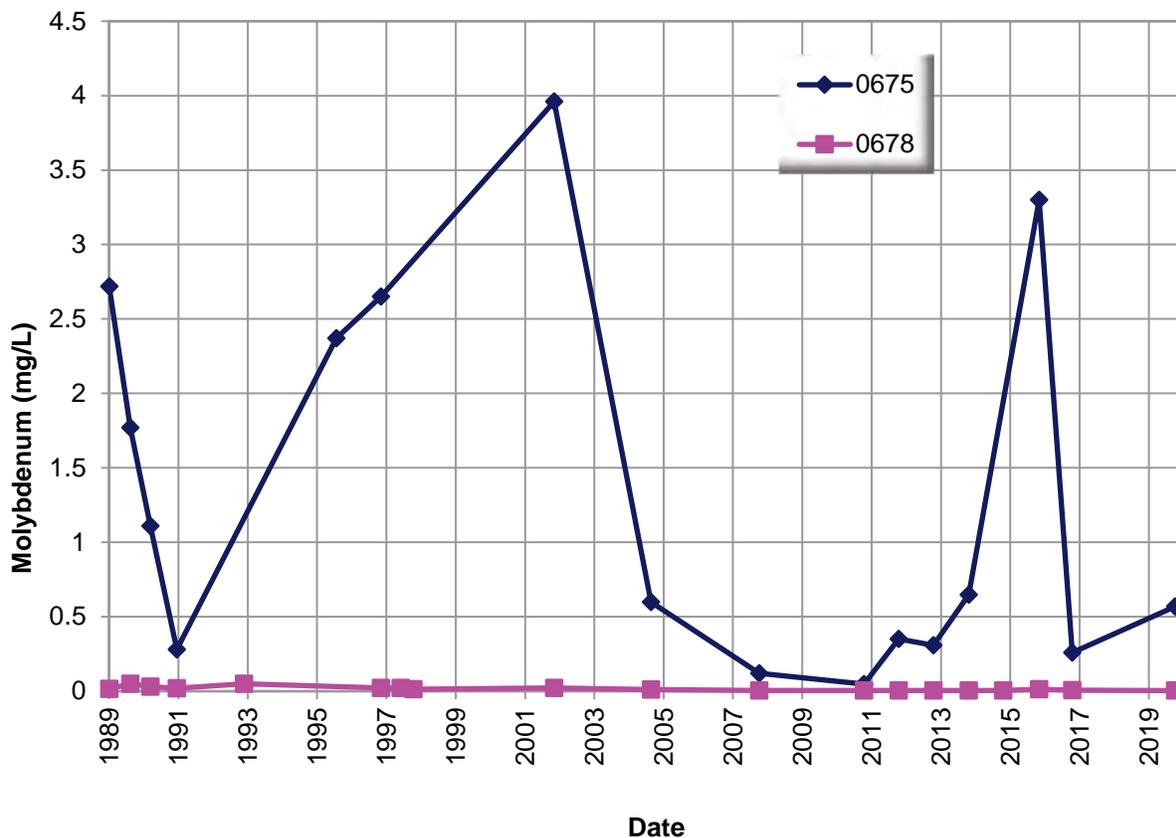


Figure 1-3. Molybdenum in Groundwater at the Ambrosia Lake, New Mexico, Disposal Site

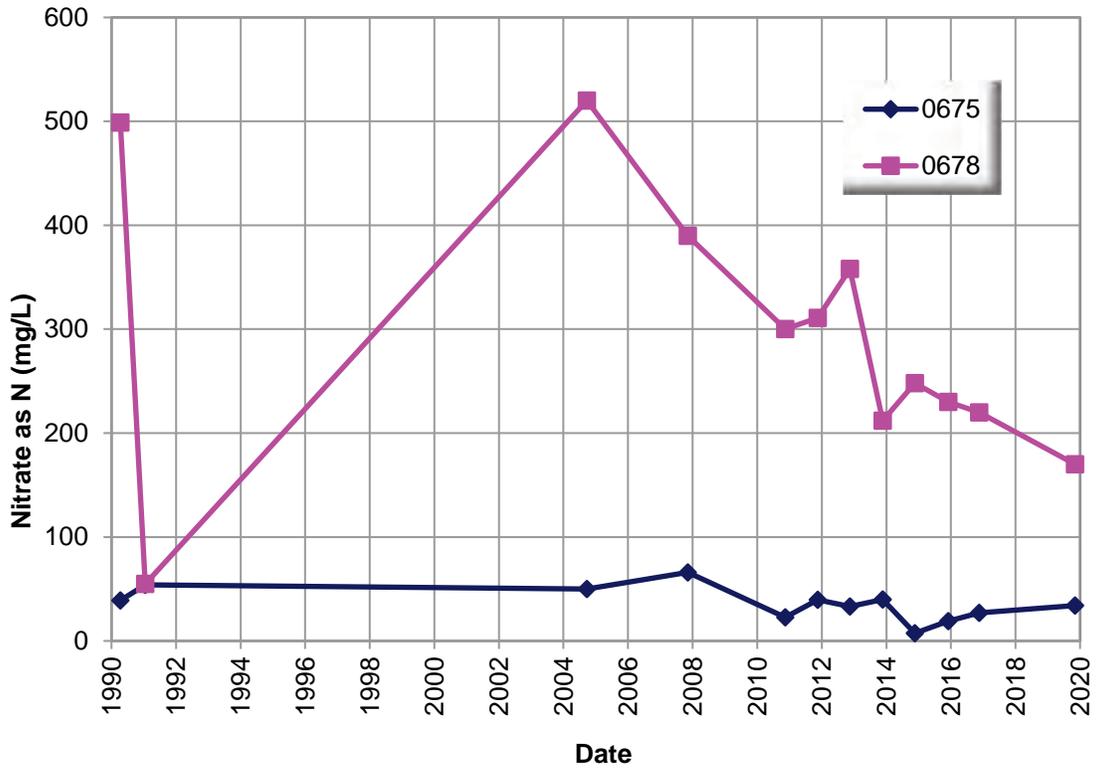


Figure 1-4. Nitrate in Groundwater at the Ambrosia Lake, New Mexico, Disposal Site

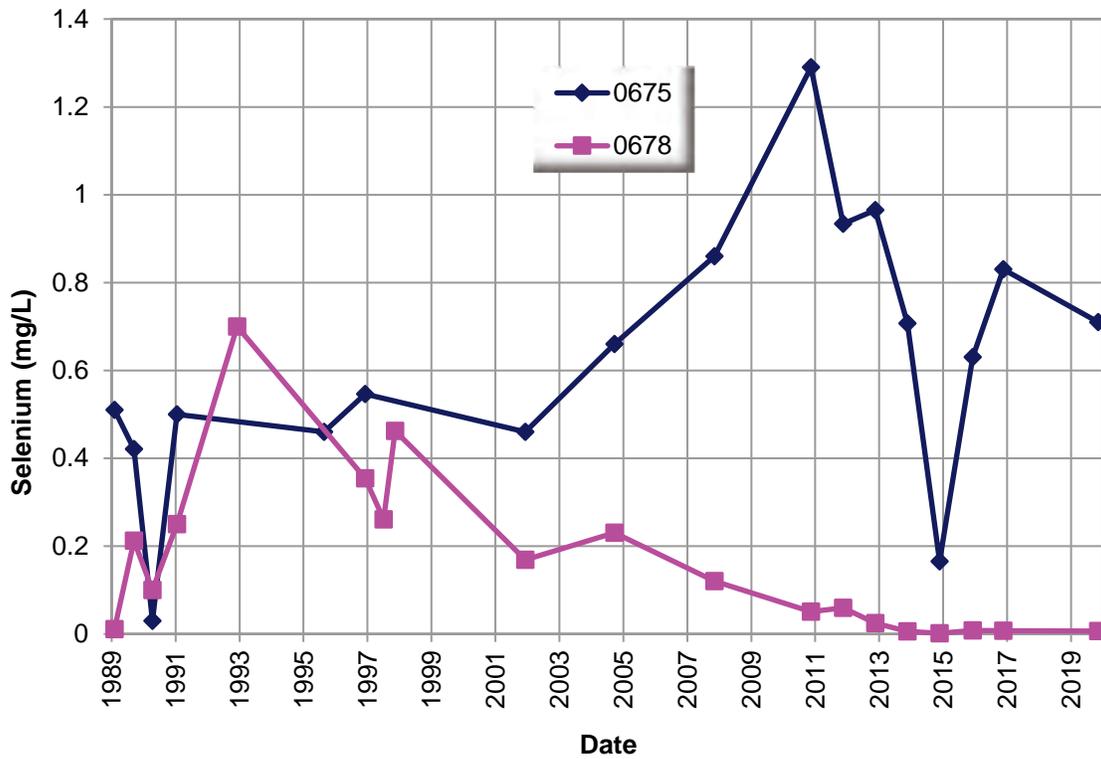


Figure 1-5. Selenium in Groundwater at the Ambrosia Lake, New Mexico, Disposal Site

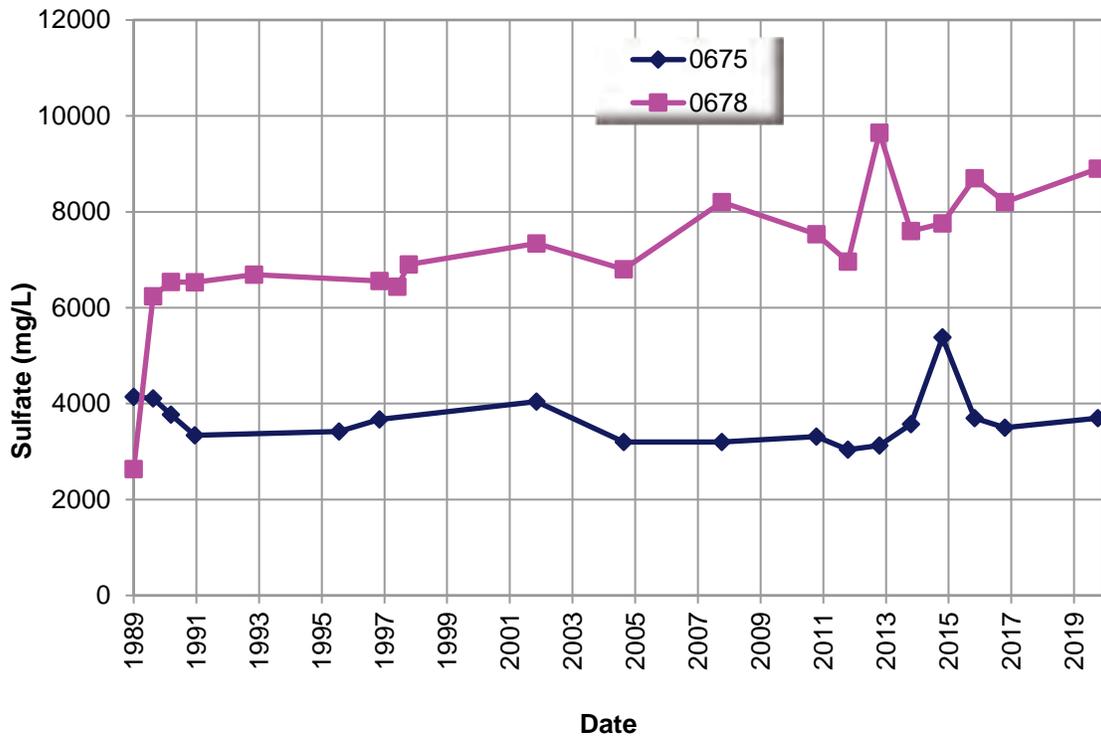


Figure 1-6. Sulfate in Groundwater at the Ambrosia Lake, New Mexico, Disposal Site

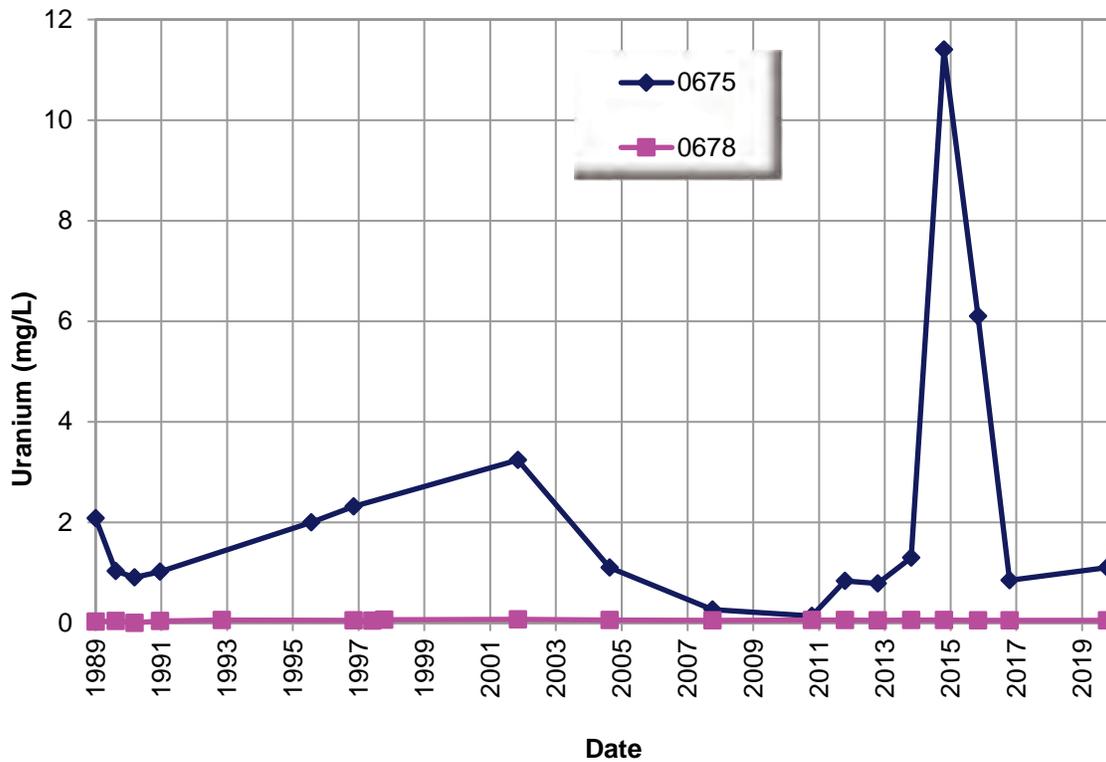


Figure 1-7. Uranium in Groundwater at the Ambrosia Lake, New Mexico, Disposal Site

In 2019, uranium in well 0678 was 0.052 mg/L, which was consistent with historical levels. Well 0675 had an anomalously high uranium concentration of 11.4 mg/L in 2014; uranium levels have since decreased to 1.1 mg/L in 2019.

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

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 UMRCA 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 Site Marker SMK-1
PL-2	90	Perimeter Sign P10 and Mining Restriction Sign (Replaced Following Inspection)
PL-3	0	Site Marker SMK-2
PL-4	—	Boundary Monument BM-5
PL-5	210	Monitoring Well 0678 with Disposal Cell in Background
PL-6	185	Mine Vent Shaft
PL-7	180	Minor Settlement near Settlement Plate SP-4
PL-8	215	South Side Slope of Disposal Cell and Area That Ponds (Dry)
PL-9	210	Rills at Southern Base of Disposal Cell
PL-10	180	Bare Spot North of Disposal Cell with Minor Rills
PL-11	190	Erosion North of Disposal Cell

Note:

— = Photograph taken vertically from above.



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



PL-2. Perimeter Sign P10 and Mining Restriction Sign (Replaced Following Inspection)



PL-3. Site Marker SMK-2



PL-4. Boundary Monument BM-5



PL-5. Monitoring Well 0678 with Disposal Cell in Background



PL-6. Mine Vent Shaft



PL-7. Minor Settlement near Settlement Plate SP-4



PL-8. South Side Slope of Disposal Cell and Area That Ponds (Dry)



PL-9. Rills at Southern Base of Disposal Cell



PL-10. Bare Spot North of Disposal Cell with Minor Rills



PL-11. Erosion North of Disposal Cell

2.0 Burrell, Pennsylvania, Disposal Site

2.1 Compliance Summary

The Burrell, Pennsylvania, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site (site) was inspected on October 22, 2019. No changes were observed on the disposal cell or in the associated drainage features. Inspectors identified minor maintenance needs but found no cause for a follow-up inspection.

The U.S. Department of Energy (DOE) Office of Legacy Management (LM) conducts groundwater monitoring every 5 years as a best management practice to aid evaluation of the disposal cell's performance. The most recent groundwater sampling event occurred in November 2018, and results were reported in the 2018 site inspection report.

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 (LTSP) (DOE 2000) 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 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, security fence, perimeter signs, site marker, survey and boundary monuments, erosion control markers, and wellhead protectors.

2.4 Inspection Results

The site, 1 mile east of Blairsville, Pennsylvania, was inspected on October 22, 2019. The inspection was conducted by K. Broberg and J. Homer of the Legacy Management Support (LMS) contractor. C. Carpenter (LM site manager); D. Shearer and J. Timcik (Pennsylvania Department of Environmental Protection); M. Dombrowski (LMS contractor); 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 the need, if any, for maintenance or additional inspection and monitoring.

2.4.1 Site Surveillance Features

Figure 2-1 shows the locations of site features in black, including site surveillance features and inspection areas. 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 text, and new observations identified during the 2019 annual inspection are shown in red. Inspection results and recommended maintenance activities associated with site surveillance features are included in the following subsections. Photographs to support specific observations are identified 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 in 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 practice, and riding all-terrain vehicles. 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 found to be locked and functional. The site entrance sign on the entrance gate was legible (PL-1). No maintenance needs were identified.

2.4.1.2 Security Fence and Perimeter Signs

A chainlink security fence encloses the disposal cell and drainage features. The site herbicide subcontractor keeps the fence line clear of vegetation, which should prolong the life of the security fence (PL-2). Tree limbs growing toward, or hanging over, the security fence tagged during the 2018 inspection were removed in 2019 before the inspection. An information sign that was posted on the personnel gate at the west end of the site was identified as missing during the 2018 inspection and was replaced in 2019 before the inspection.

There are 16 perimeter signs attached to the outside of the security fence. All 16 perimeter signs were present. All perimeter signs noted as missing or faded in the 2018 inspection were replaced before the 2019 inspection. Perimeter signs P9 and P12 are faded and will be replaced in 2020. No other maintenance needs were identified.

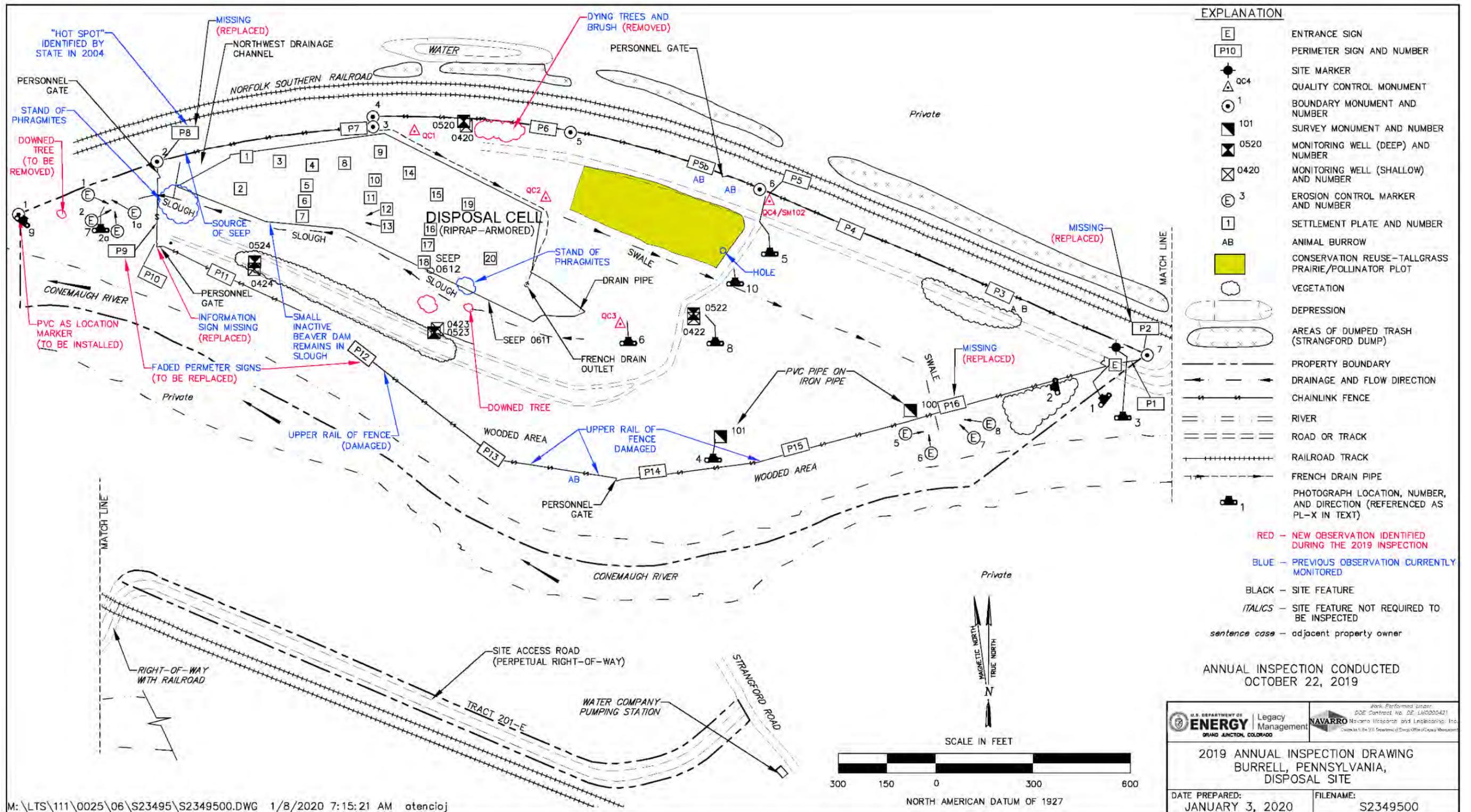


Figure 2-1. 2019 Annual Inspection Drawing for the Burrell, Pennsylvania, Disposal Site

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2.4.1.3 Site Marker

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

2.4.1.4 Survey, Boundary Monuments

The site has three survey monuments (PL-4) and seven boundary monuments (PL-5). Survey monument SM-102 was noted as missing in the 2017 and 2018 inspections. In 2019, before the annual inspection, four new baseline aerial survey quality control monuments were installed at the site (PL-6). Quality control monument QC-4 will serve as a replacement for survey monument SM-102.

Boundary monument BM-1 is difficult to locate because it is buried by dirt, and a downed tree was blocking the path to the expected location. DOE plans to install a 4-foot-tall, 4-inch PVC pipe around and over boundary monument BM-1 in 2020 to aid in locating the monument and removing the tree to clear the path. No other maintenance needs were identified.

2.4.1.5 Erosion Control Markers

The site has eight erosion control markers (PL-7). No maintenance needs were identified.

2.4.1.6 Monitoring Wells

The site has eight monitoring wells that were last sampled and inspected in November 2018. 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 conditions prevented the installation of concrete well pads at monitoring wells 0424 and 0524 in 2018, but these will be installed in the future. All wellhead protectors that were observed during the annual inspection were locked and undamaged (PL-8). No immediate 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. There was no evidence of erosion, settling, slumping, or any other modifying process that might affect the integrity of the disposal cell (PL-9).

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 and whether it interferes with the ability of inspectors to assess disposal cell cover stability. The 2017 inspection report (DOE 2018) noted that LM was planning to conduct a follow-up assessment in fiscal year 2019. LM delayed the assessment to further consult with NRC on the scope of the study. Currently, NRC and LM are working on joint research to analyze disposal cell cover performance and pedogenesis at other UMTRCA sites that will support development of the scope for the Burrell site study.

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 is effective at limiting the spread of noxious weeds. Other woody species continue to establish but are controlled. No other maintenance needs were identified.

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 inspections. Water was not ponded anywhere along the French drain, and no wetland vegetation was observed, which indicates it is operating properly. Inspectors will continue to monitor the French drain area to verify that it continues to operate as designed.

A large tree fell in the slough south of the disposal cell in 2019. Given the way the tree fell, and its location on a steep slope, it may not be necessary to remove it at this time. In 2020, DOE will ensure that this downed tree does not interfere 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 2019, 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.

2.4.2.3 Site Perimeter

An active seep near the north security fence, about 60 feet east of perimeter sign P8 and west of the disposal cell, was observed to be flowing during this year's inspection. The seep does not pose a threat to the integrity of the disposal cell. Inspectors will continue to monitor this area. Conceivably, the seep could destabilize the nearby railroad embankment. The water for the seep along the fence line appears to be coming from the bluffs north of the railroad tracks.

An area of dying trees and brush that was observed east of monitoring wells 0420 and 0520 was successfully cleared in 2019 to facilitate seasonal mowing operations. No other 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. The dumping of trash is not a threat to the disposal site but indicates the overall level of activity near the disposal site and may be a predictor of vandalism. Inspectors will continue to note any dumping activity.

In 2004, a representative from the Pennsylvania Department of Environmental Protection showed inspectors a “hot spot” (an area having 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 Uranium Mill Tailings Remedial Action project property completion report. 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. 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.

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

Minor maintenance needs identified by the inspectors during the 2018 annual inspection and completed in 2019, include:

- Information sign replacement
- Removal of dying trees and brush
- Replacement of perimeter signs P2, P8, and P16
- Regular maintenance to treat or remove woody vegetation and noxious weeds

During the 2019 inspection, inspectors documented maintenance needs that will be addressed in 2020, including:

- Installing 4-inch PVC pipe over boundary monument BM-1 for easier identification
- Removing a downed tree across the path leading to boundary monument BM-1
- Replacing faded and worn perimeter signs P9 and P12

In 2019, four permanent quality-control monuments were installed at the site in preparation for a baseline aerial survey of the disposal cell. The quality control monument locations are shown in Figure 2.1. As a best management practice, concrete pads surrounding monitoring wells 0424 and 0524 will be installed in the future. No other maintenance needs were identified.

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.

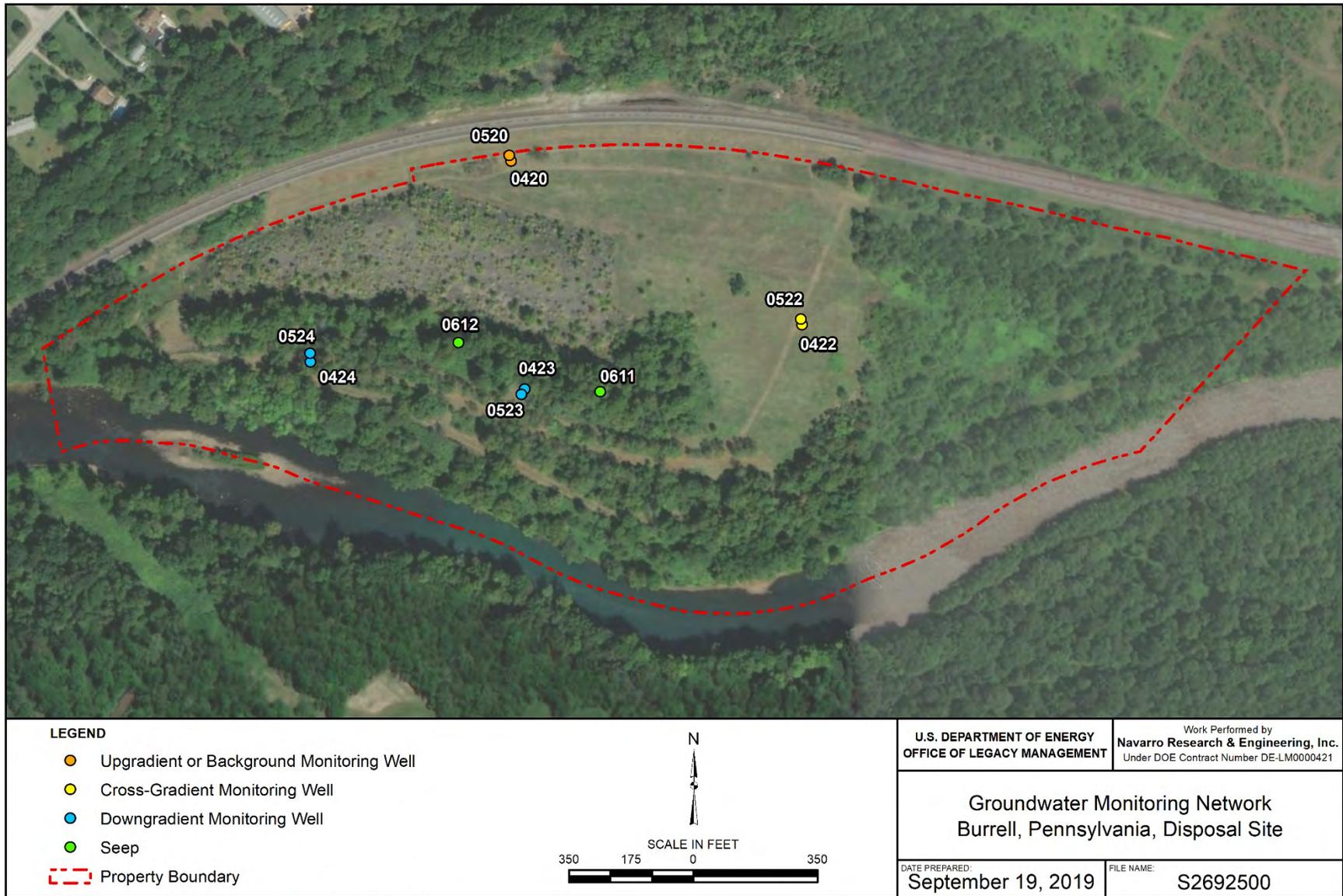
2.8 Environmental Monitoring

2.8.1 Groundwater Monitoring

In accordance with the LTSP, LM conducts groundwater monitoring every 5 years as a best management practice to aid evaluation of the disposal cell's performance. The most recent sampling event occurred in October 2018. 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 four analytes: lead, molybdenum, selenium, and uranium. The maximum concentration limits (MCLs) for these 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



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

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

All groundwater monitoring results for the site are reported and published on the LM Geospatial Environmental Mapping System website (<http://gems.lm.doe.gov/#site=BUR>). The *2018 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites* (DOE 2019) reports the most recent monitoring results. The four analytes monitored (lead, molybdenum, selenium, and uranium) continue to remain below the MCLs identified in 40 CFR 192 Table 1 Subpart A, but all four analytes increased in concentration in one or both of the downgradient monitoring wells. The increases for three of the target analytes (lead, selenium, and uranium) in regard to their respective MCLs are considered insignificant in that the concentrations would not exceed the MCL for some time if the trend continues. This will allow LM time to investigate the cause and assess if the increase is the result of cell performance. The increase in molybdenum identified in one of the downgradient wells is considered potentially significant in that it may exceed the MCL before the next regularly scheduled sampling event in 2023. Consequently, LM will resample in fall of 2020, 3 years ahead of the required 5-year sampling frequency.

2.8.2 Vegetation Management

In accordance with the Vegetation Management Plan, mowing and spot herbicide application continues. Vegetation management activities include ensuring the fence line and access paths remain clear of Japanese knotweed (an invasive species), 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, poison hemlock, and multiflora rose were not observed in 2019, except for sporadic resprouts following mowing. Additional invasive species that were identified in 2018 have been addressed as well, including teasel and tree of heaven. Several other invasive plants persist, including Japanese knotweed and common reed. A stand of common reed that was identified during previous inspections appears to have expanded at the west end of the disposal cell. This stand is very difficult to access because of the presence of standing water and its location adjacent to the perimeter fence. Wooded areas remained heavily vegetated with Japanese knotweed. Privet is an invasive shrub that was observed in several areas. 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. Several seeded wildflowers were observed during the 2019 inspection, and the prairie plot appeared to be progressing as planned after 1 year of growth (PL-10). Prairie grasses and wildflowers are long-lived perennials that take their first couple of growing seasons to establish roots. A diverse flowering community is not expected for several years. Following the 2019 inspection, field personnel broadcast Indian grass to augment the 2018 seeding effort.

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, January.

DOE (U.S. Department of Energy), 2018. *2017 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites*, LMS/S17252, 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, March.

2.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	310	Sign at Entrance Gate
PL-2	260	Southeast Fence Line
PL-3	—	Site Marker
PL-4	—	Survey Monument SM-101
PL-5	—	Boundary Monument BM-6
PL-6	—	Quality Control Monument QC-3
PL-7	—	Erosion Control Marker ECM-2a
PL-8	—	Monitoring Well 0422
PL-9	35	South Slope of Disposal Cell with Vegetative Cover
PL-10	0	East Side of Test Prairie

Note:

— = Photograph taken vertically from above.



PL-1. Sign at Entrance Gate



PL-2. Southeast Fence Line



PL-3. Site Marker



PL-4. Survey Monument SM-101



PL-5. Boundary Monument BM-6



PL-6. Quality Control Monument QC3



PL-7. Erosion Control Marker ECM-2a



PL-8. Monitoring Well 0422



PL-9. South Slope of Disposal Cell with Vegetative Cover



PL-10. East Side of Test Prairie

3.0 Canonsburg, Pennsylvania, Disposal Site

3.1 Compliance Summary

The Canonsburg, Pennsylvania, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site (site) was inspected on October 23, 2019. No changes were observed on the disposal cell or in the associated drainage features. Inspectors identified several minor maintenance needs.

Engineered repairs were completed to the riprap-armored embankment of Chartiers Creek north of the disposal cell just before the 2019 inspection. A riparian forest buffer was also 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 area against future stream flooding events and to reduce erosion upgradient of the riprap embankment. The Commonwealth of Pennsylvania has a goal to establish 95,000 acres of forest riparian buffer by 2025. The Commonwealth was notified of the streambank project so the newly planted acreage could be counted toward its goal.

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 (LTSP) (DOE 2013) 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, 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, 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, which are southeast of Strabane Avenue. Area C (3.1 acres) was sold and transferred in 2005, and the east portion of Tract 117 (0.431 acre) was sold and transferred in 2009 to the same private owner. 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 establish restrictions to limit excavation, prohibit the disturbance of the streambank, maintain 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 23, 2019. The inspection was conducted by K. Broberg and J. Homer of the Legacy Management Support (LMS) contractor. C. Carpenter (LM site manager), D. Shearer (Pennsylvania Department of Environmental Protection), C. Shrontz (representing 48th District Representative Tim O’Neal), M. Dombrowski (LMS contractor), and T. Biller (site herbicide contractor 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 may affect conformance with the LTSP, and evaluate the need, if any, for maintenance or additional inspection and monitoring.

3.4.1 Site Surveillance Features

Figure 3-1 shows the locations of site features in black, including site surveillance features and inspection areas. 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 text, and new observations identified during the 2019 annual inspection are shown in red. Inspection results and recommended maintenance activities associated with site surveillance features are included in the following subsections. Photographs to support specific observations are identified in the text and in Figure 3-1 by photograph location (PL) numbers. The photographs and photograph log are presented in Section 3.10.

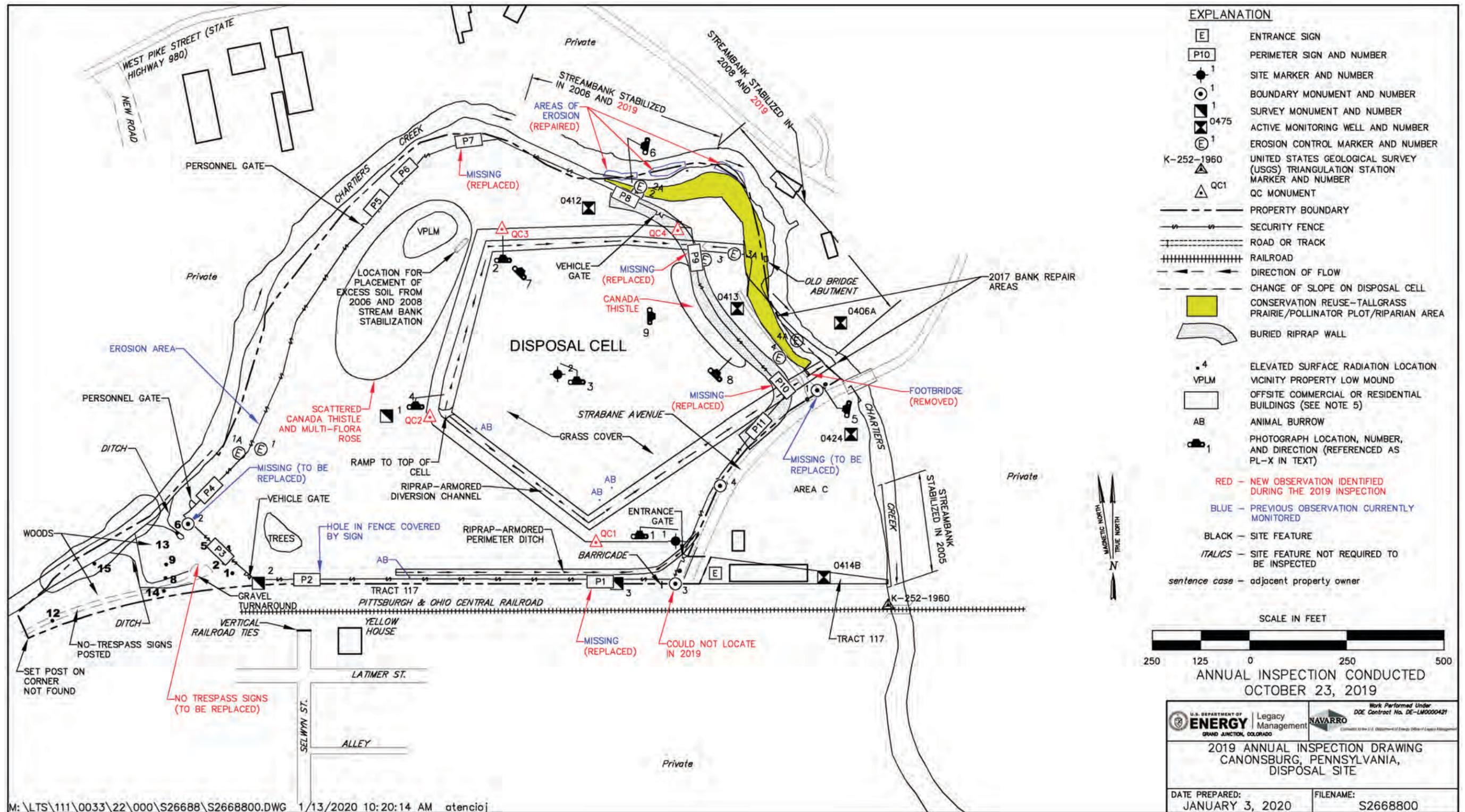


Figure 3-1. 2019 Annual Inspection Drawing for the Canonsburg, Pennsylvania, Disposal Site

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3.4.1.1 Site Access, Entrance Gates, and Entrance Sign

Main access to the site is from Strabane Avenue. There are three vehicle gates: the main entrance gate at the southeast corner of the site along Strabane Avenue, a vehicle access gate at the southwest corner of the site, and a vehicle access gate north of the disposal cell between perimeter signs P8 and P9. There are also two personnel access gates. All gates were locked and functional. The entrance sign is posted on the main entrance gate. No maintenance needs were identified.

3.4.1.2 Security Fence and Perimeter Signs

A chainlink security fence encloses most of the site. A vegetation-free buffer zone is maintained around the entire security fence. An area of erosion under the west security fence remains. The area appears to be stable and has not grown in several years. For added security, slats were installed in 2016 across the area beneath the fence to help fill in the gap.

There are 11 perimeter signs attached to the security fence. Perimeter signs P1, P7, P9, and P10 were replaced following the 2018 inspection. All perimeter signs were accounted for and legible in 2019. No maintenance needs were identified.

3.4.1.3 Site Markers

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

3.4.1.4 Survey, Boundary Monuments

The site has three survey monuments, four boundary monuments, and four baseline aerial survey quality control monuments (PL-2). Boundary monuments BM-1 and BM-2 (noted as missing during the 2017 inspection) were not located and are scheduled to be replaced in 2020. Boundary monument BM-3 was not located in 2019. A metal detector will be used to try to locate it in 2020. No other maintenance needs were identified.

3.4.1.5 Erosion Control Markers

The site has four pairs of erosion control markers along the bank of Chartiers Creek. No maintenance needs were identified.

3.4.1.6 Monitoring Wells

The site has five groundwater monitoring wells that are inspected when they are sampled. Monitoring wells were last sampled and inspected in October 2018. All wellhead protectors that were observed during the inspection were undamaged and locked. No 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-3). 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. Inspectors will continue to monitor the location and the significance of burrows. No new significant burrows were noted on the disposal cell during the inspection. 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, with seeded fescues and crown vetch being prevalent. 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.

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-4). Periodic physical removal and spot herbicide applications have been effective at reducing woody vegetation and will continue to be conducted as needed.

A pedestrian footbridge was installed northeast of the disposal cell in 2010. It was removed in 2019 as part of the erosion repair project along the streambank. Removal of the bridge better fits the long-term plans for the area by discouraging the public from accessing and disturbing the newly planted riparian forest buffer. 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. Two of these signs are worn and will be replaced in 2020. No evidence of recent trespassing was observed during the 2019 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. An access agreement was established in 2017 with the plastics company for continued use of the turnaround. No changes to the size of the turnaround were observed in 2019. No maintenance needs were identified.

3.4.2.5 Outlying Area

Chartiers Creek Bank: Chartiers Creek is an active, meandering waterway west, north, and east of the disposal site. Bedrock outcrops and mature trees on the streambank west of the site indicate that the bank of that creek is stable after numerous stabilization projects completed over the past 2 decades.

Between 2001 and 2008, several streambank-stabilization projects were conducted north and east of the site. The projects consisted of installing riprap armoring along the streambanks. Age 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. The work consisted of minor grading, replacing geotextile filter fabric, and importing and placing 2-foot-thick R6 riprap slopes (PL-5 and PL-6).

A conservation reuse initiative was included as part of the streambank stabilization repair project. A riparian forest buffer was planted following the riprap slope repair; it consisted of 525 new native trees and shrubs within a 1.7-acre corridor adjacent to Chartiers Creek. Disturbed areas were then seeded with a pollinator-friendly native grass and wildflower mix (PL-7 and PL-8). This corridor will further protect the Chartiers Creek streambank and help prevent erosion above the riprap embankment. The riparian forest buffer is recognized as a means to improve stream quality. The Commonwealth of Pennsylvania has a 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.

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 put in place to address land use and site access requirements (PL-9). There was no evidence that any of the ICs in place for Area C and Tract 117 had been violated.

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

The Chartiers Creek project, executed in 2019, included engineered repairs to the riprap-armored embankment north of the disposal cell and areas of erosion identified in the 2018 inspection. A riparian forest buffer was planted above and along the embankment to help stabilize the bank. Additional minor maintenance needs identified by the inspectors during the 2018 annual inspection and completed in 2019 include:

- Replacing of perimeter signs P1, P7, P9, P10
- Regular maintenance to treat or remove woody vegetation and noxious weeds
- Removing the footbridge over the riprap-armored diversion ditch

Inspectors documented minor maintenance needs that will be addressed in 2020, including:

- Replacing two “no trespassing” signs in the southwest corner of the site
- Locating boundary monument BM-3
- Replacing boundary monuments BM-1 and BM-2

In 2019, four permanent quality-control monuments were installed at the site in preparation for a baseline aerial survey of the disposal cell. The quality-control monument locations are shown in Figure 3-1. No other maintenance needs were identified.

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) to demonstrate that concentrations of uranium at point-of-compliance (POC) wells are decreasing as predicted and that the system remains in compliance with the Groundwater Compliance Action Plan; and (3) to ensure that remedial actions at the disposal site and Area C continue to protect human health, safety, and the environment. The most recent sampling event occurred in October 2018.

The groundwater monitoring network consists of five monitoring wells, including 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 1.0 milligram per liter (mg/L) 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	Point of compliance
0413	Downgradient	Point of compliance
0414B	Cross-gradient	Point of compliance
0424	Downgradient	Best management practice

All groundwater monitoring results for the site are reported and published on the LM Geospatial Environmental Mapping System website (<http://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.

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 location, 0602, is the point-of-exposure (POE) location for Chartiers Creek and is sampled and analyzed for uranium. The 2018 uranium concentration of 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. Additionally, all monitoring results for the site are reported and published on the LM Geospatial Environmental Mapping System website (<http://gems.lm.doe.gov/#site=CAN>).

3.7.3 Vegetation Management

Vegetation management activities continue to be conducted at the site in accordance with the LTSP; they include spot-treating tree of heaven (an invasive species), physical removal, spot-application of herbicides to target woody vegetation in diversion channels and perimeter ditches, and the spray-and-mow approach. These activities are mostly successful. Noxious weeds within the fenced area are limited to resprouting seedlings, which were observed in portions of mowed areas. No changes to the current vegetation management approach are recommended.



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

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

3.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	—	Site Marker SMK-1
PL-2	—	Quality Control Monument QC3
PL-3	0	North Side of Disposal Cell
PL-4	0	West Section of Riprap-Armored Diversion Ditch
PL-5	280	Newly Repaired Riprap Embankment
PL-6	280	West End of Riprap Embankment
PL-7	45	Newly Planted Riparian Area
PL-8	45	Newly Planted Riparian Area
PL-9	90	Area C from Disposal Cell

Note:

— = Photograph taken vertically from above.



PL-1. Site Marker SMK-1



PL-2. Quality Control Monument QC3



PL-3. North Side of Disposal Cell



PL-4. West Section of Riprap-Armored Diversion Ditch



PL-5. Newly Repaired Riprap Embankment



PL-6. West End of Riprap Embankment



PL-7. Newly Planted Riparian Area



PL-8. Newly Planted Riparian Area



PL-9. Area C from Disposal Cell

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 (site) annual inspection on May 13, 2019, and the annual groundwater monitoring event in May 2018. No cause for a follow-up inspection was identified.

Monitoring of the linear depression on the toe of the northeast side slope continues; inspectors noted that there may have been some movement of rocks in the interior of the depression (rotated inward). However, no change in depth or length of the feature was observable. Monitoring of the linear depression will continue to understand its cause and address issues. No changes were observed on the top of the disposal cell or in the associated drainage features. Inspectors identified several minor maintenance needs that have been addressed.

LM conducts annual groundwater sampling and analysis to monitor potential contaminant migration downgradient from the disposal cell. The most recent annual sampling event occurred in May 2019. Concentrations in the three point-of-compliance (POC) wells are below site-specific thresholds. In addition, LM monitors one background well and three best management practice (BMP) wells or noncompliance wells. BMP well 0618 is monitored more frequently in response to variable uranium concentrations that are typically above site-specific thresholds. Increased monitoring of BMP well 0618 will continue to assess any influence from the holding pond removal and transient drainage system closure.

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 (LTSP) (DOE 2015) 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, 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 May 13, 2019. The inspection was conducted by M. Kastens and D. Atkinson of the Legacy Management Support (LMS) contractor. J. Dayvault (LM site manager); M. Cosby (Colorado Department of Public Health and Environment); and D. Miller, D. Holbrook, C. Jarchow, and A. Blackford (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 the need, if any, for maintenance or additional inspection and monitoring.

4.4.1 Site Surveillance Features

Figure 4-1 shows the locations of site features in black, including site surveillance features and inspection areas. Site features that are present but not required by the LTSP to be inspected are shown in italic font. Observations from previous inspections that are currently monitored are shown in blue text, and new observations identified during the 2019 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 identified 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. Entrance to the site is through the locked steel entrance gate along County Road 212 and an older, original entrance gate. Both gates were locked and functional. The entrance sign is at the original entrance gate within the property boundary. The entrance sign showed outdated information and was replaced following the inspection. No other maintenance needs were identified.

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 they are functioning. 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 recent additions act as surrogates for perimeter signs P40–P43 because perimeter signs P40–P43 are on a steep, densely wooded hillside. Perimeter signs P40–P43 are not routinely inspected unless the dense vegetation recedes.

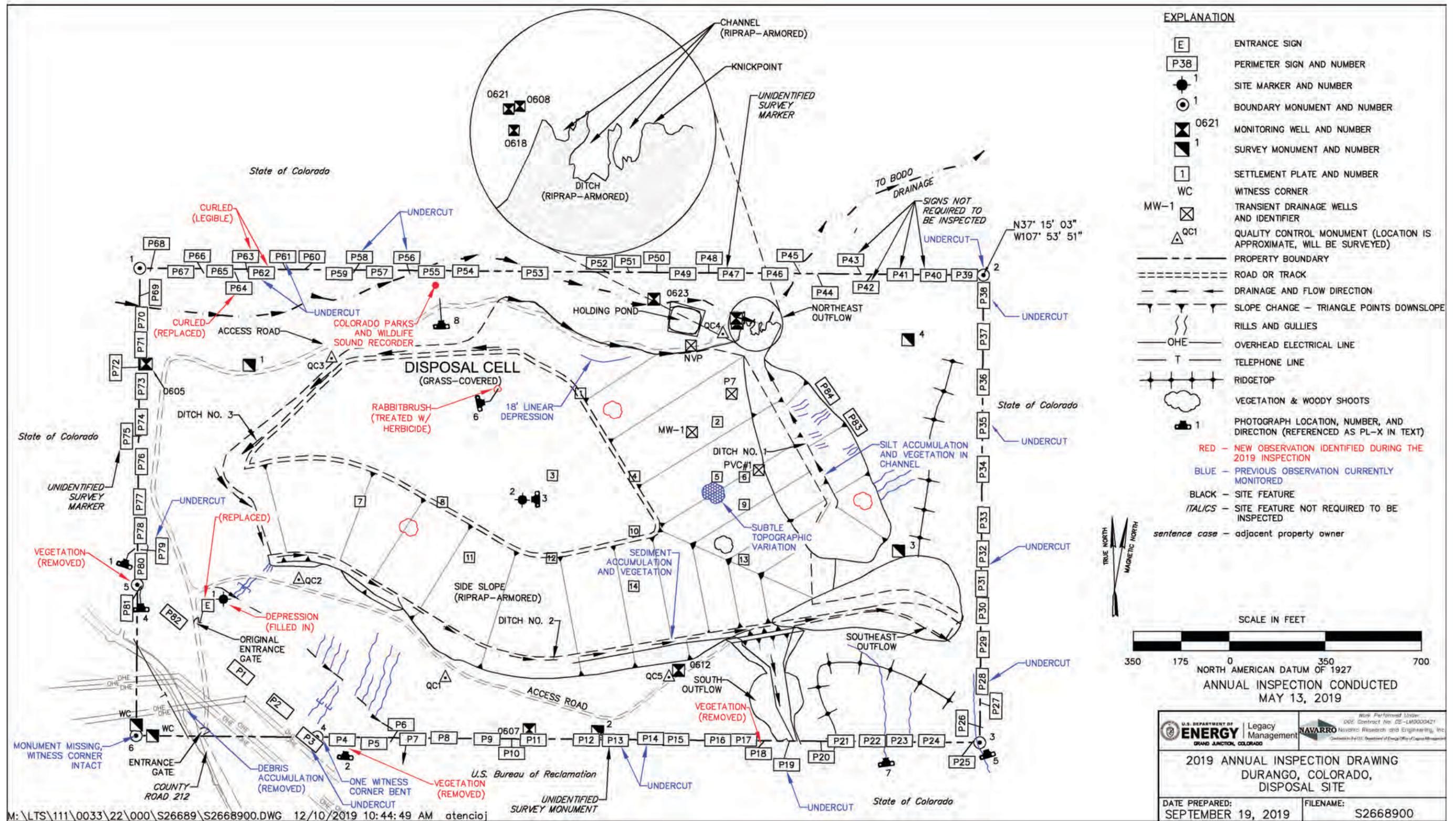


Figure 4-1. 2019 Annual Inspection Drawing for the Durango, Colorado, Disposal Site

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The concrete bases of several perimeter signs have been and continue to be undercut, but the positions of the signs remain uncompromised (PL-1). Following the 2018 inspection, perimeter sign P45 was moved approximately 25 feet (ft) to the east, a location less prone to erosion. Vegetation was encroaching on perimeter sign P4 (PL-2) and P18 and was removed in 2019 following the inspection. Perimeter sign P64 was a plastic sign and had faded and curled and was replaced in 2019 following the inspection. Perimeter signs P62 and P63 are also plastic and somewhat curled but still legible at this time. No other maintenance needs were identified.

4.4.1.3 Site Markers

The site has two site markers. Site marker SMK-1 is just inside the original entrance gate; a deep depression to the side of SMK-1 was filled in after the inspection. Site marker SMK-2 is on the top slope of the disposal cell; minor cracking and spalling along the concrete base edges was repaired in 2018 (PL-3). No other 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 (BOR) pipeline was installed, bringing the current number of boundary monuments to five. However, both witness corners to boundary monument BM-6 were present. Replacement of boundary monument BM-6 is not warranted at this time. Boundary monument BM-5 (PL-4) and one of its witness corners was covered with vegetation, which was removed following the inspection. The north witness corner of boundary monument BM-3 was reinforced and stabilized as identified in the 2018 annual inspection (PL-5). No other maintenance needs were identified.

4.4.1.5 Monitoring Wells

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

4.4.2 Inspection Areas

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

4.4.2.1 Top of Disposal Cell

The disposal cell, completed in 1990, occupies 60 acres. It has a vegetated cover consisting primarily of perennial grasses and broadleaf plants. There was no evidence of erosion, settling, slumping, or other modifying processes on top of the disposal cell. In the past, inspectors have observed small animal burrows in several areas throughout the top; however, none were

observed in 2019. A single volunteer rabbitbrush shoot (a woody species) (PL-6) was observed growing on the disposal cell top and was treated with herbicide in 2019. No other 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. Along the north toe of the disposal cell, rock has moved, resulting in a linear depression approximately 18 ft long that first was observed in 2015. Inspectors did not observe any significant changes to the depression. Inspectors will continue to monitor this area.

A subtle topographic variation in the surface of the northeast side slope, first observed during the 2018 annual inspection, was observed again in 2019. The variation does not pose a concern for disposal cell integrity at this time as no evidence of significant erosion was found during the 2019 inspection. Inspectors will continue to monitor the variation. No maintenance needs were identified.

4.4.2.3 Drainage Ditches

Rock-armored drainage ditches are constructed beneath the toe of the side slope on the east (Ditch No. 1), south (Ditch No. 2), and northwest and west (Ditch No. 3) sides of the disposal cell. Storm water is directed into these ditches and conveyed away from the site into natural drainages (PL-7). The ditches have sufficient depth and rock protection to carry 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 process creates locales that favor plant establishment and enhance wildlife habitat. Sediment accumulation and associated vegetation have not adversely affected the performance of the channel.

The riprap-covered outflows of the drainage ditches were designed to self-armor. The outflows and drainage ditches below them are monitored annually. The uplands above the northeast outflow are steadily eroding over time. Erosion of the uplands does not affect the stability or effectiveness of the outflow area. No maintenance needs were identified.

4.4.2.4 Holding Pond

The holding pond and fence associated with the site's transient drainage system in the northeast corner of the site was removed in 2017. Inspectors in 2019 noted that the former holding pond area was revegetated; 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 (property 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, with the exception of a Colorado Parks and Wildlife (CPW) sound recording device placed near the road along the north side of the disposal cell (PL-8). The device was placed onsite without the

knowledge of LM or LMS personnel. LM discussed the issue with CPW. 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 other 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 such impacts were identified. CPW manages land to the north, west, and east of the site, and BOR manages land to the south. The primary land uses are wildlife habitat and recreation. Mountain bikers and other recreationists commonly use 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

Inspectors documented minor maintenance needs that were addressed following the inspection, including:

- Removing vegetation from around perimeter signs P4 and P18 and boundary monument BM-5
- Replacing plastic perimeter sign P64, which had curled
- Filling in and stabilizing the soil around site marker SMK-1
- Treating woody species on the side and top slopes of the disposal cell
- Replacing the entrance sign, which showed outdated information
- Removing vegetation from around boundary monument BM-5 and one of its witness corners

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

In accordance with the LTSP, LM conducts annual groundwater sampling and analysis to monitor disposal cell performance. Several BMP monitoring wells, such as BMP well 0618, are sampled more frequently to evaluate variable uranium concentrations. The most recent annual sampling event occurred at the site in May 2019. 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) underlying the site. A background well is also completed in the uppermost aquifer.

Three additional monitoring wells are completed in the alluvium and monitored as a BMP. The LTSP describes the Cliff House/Menefee aquifer as the uppermost aquifer because of the limited area of the alluvial system saturation under natural conditions beneath the disposal cell.

Table 4-2 and Figure 4-2 show the current groundwater monitoring network at the site.

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

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

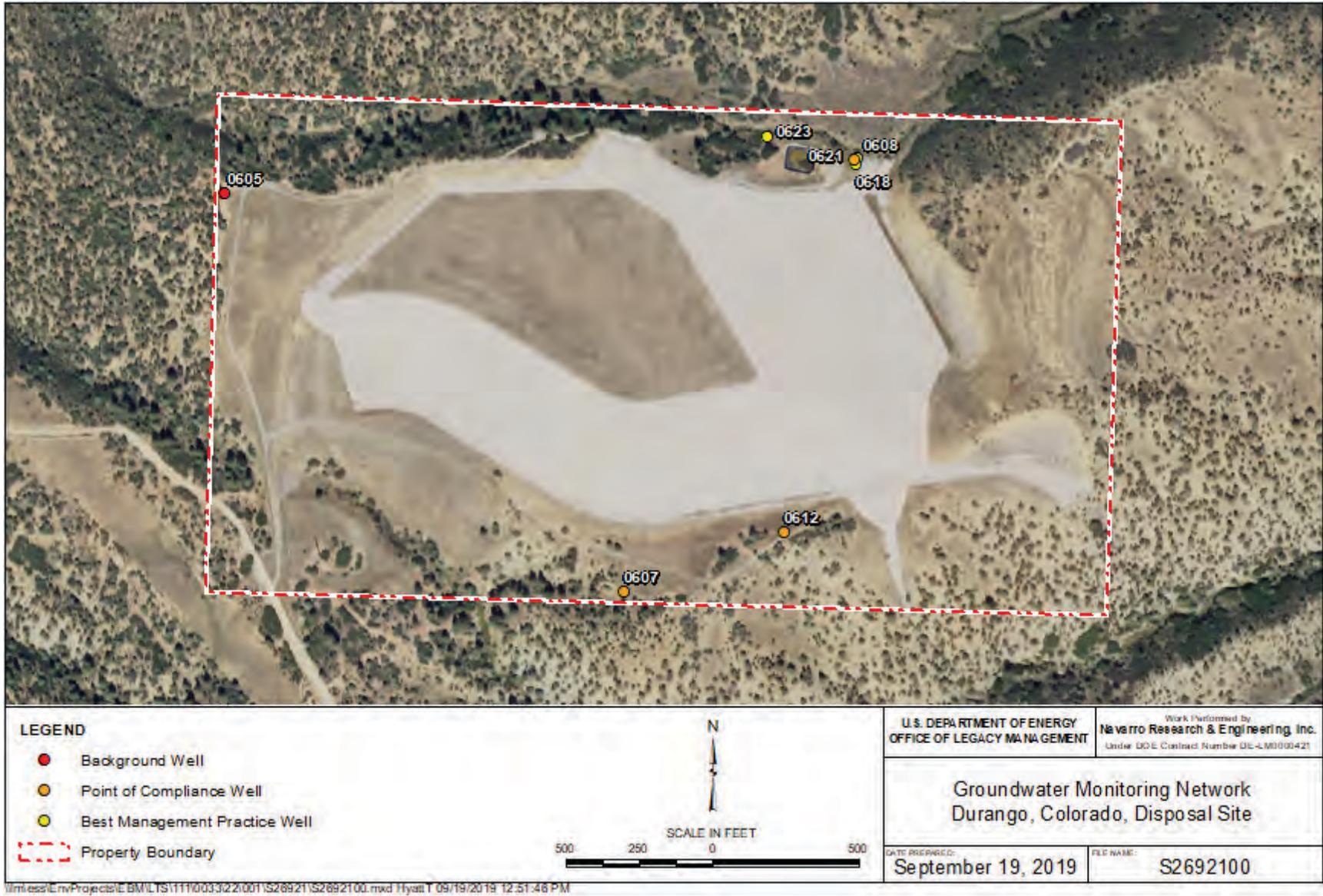


Figure 4-2. Groundwater Monitoring Network for the Durango, Colorado, Disposal Site

Groundwater is sampled annually for three indicator parameters: molybdenum, selenium, and uranium. The site-specific standards used for the three indicator parameters are the respective maximum observed background concentrations reported in groundwater samples collected from wells completed in the bedrock aquifer, as identified in Table 2-3 of the LTSP. These site-specific standards are provided in Table 4-3. Figure 4-3 through Figure 4-5 show the time-concentration plots for the three indicator parameters, along with corresponding site-specific standards. All groundwater monitoring results for the site are reported and published on the LM Geospatial Environmental Mapping System website (<http://gems.lm.doe.gov/#site=DUD>).

Molybdenum, selenium, and uranium concentrations in POC wells (0607, 0612, and 0621) in the uppermost aquifer are below their respective standards.

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

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

Abbreviation:
mg/L = milligrams per liter

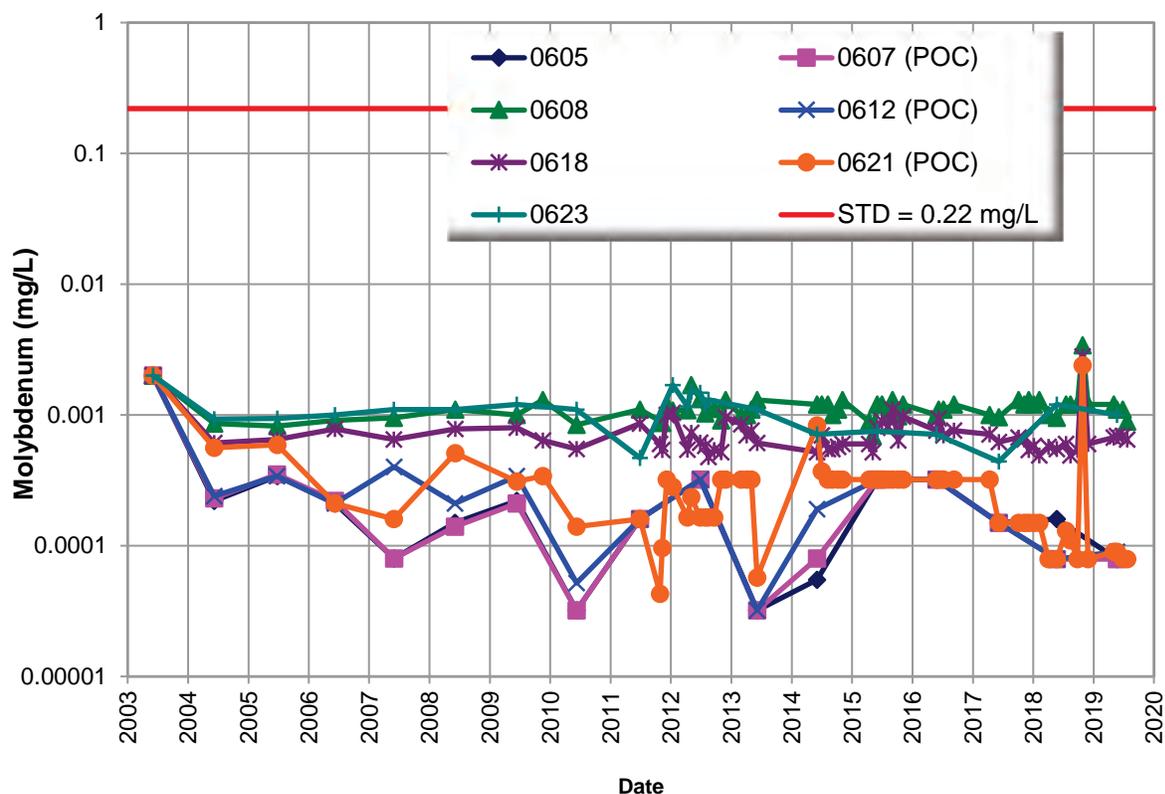


Figure 4-3. Molybdenum in Groundwater at the Durango, Colorado, Disposal Site

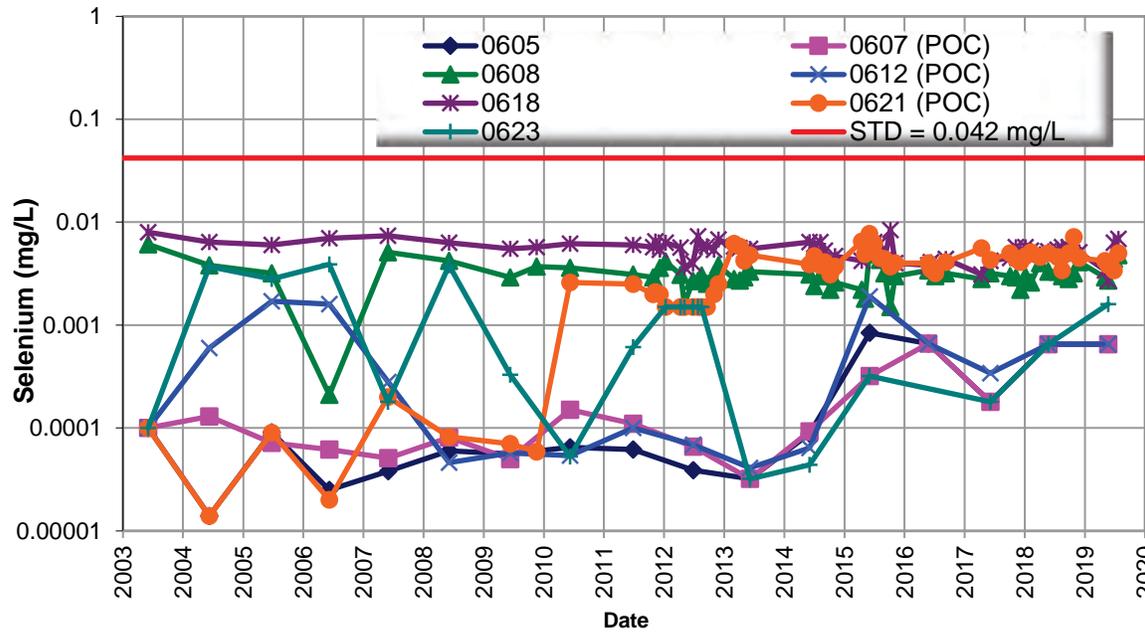


Figure 4-4. Selenium in Groundwater at the Durango, Colorado, Disposal Site

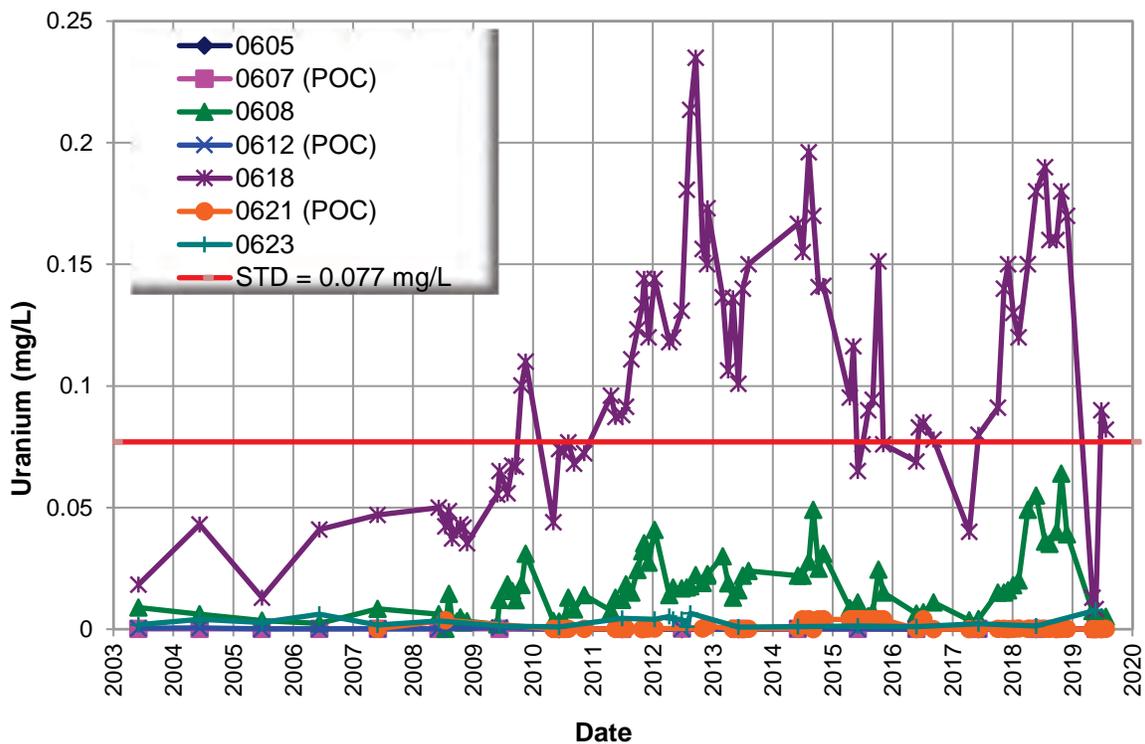


Figure 4-5. Uranium in Groundwater at the Durango, Colorado, Disposal Site

Wells completed in the alluvium are sampled as a BMP. Uranium concentrations in well 0618 have consistently been higher than concentrations in the other wells onsite. To monitor and

compare the elevated and variable uranium concentrations observed in this well, wells 0608, 0618, and 0621 are sampled monthly as weather permits. Figure 4-5 shows variable uranium concentrations between 0.04 milligrams per liter (mg/L) and 0.24 mg/L in well 0618 beginning in 2009 and continuing to the present. In 2019, uranium concentrations in well 0618 decreased from 0.18 mg/L to 0.02 mg/L—a value slightly below the minimum measured concentration—and then increased to 0.09 mg/L, which is within the range of measured historical concentrations. Investigating the cause of this variability at well 0618 continues.

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 to be removed by either selective spraying or mechanical removal when their shoot height equals or exceeds 3.5 ft. Although the aboveground height of dryland alfalfa will never exceed the height criterion, it is known to be a deep-rooted plant; therefore, this species is also controlled on the disposal cell cover. Several shoots of woody species were found on the side slopes and were removed following the site inspection.

4.9 Corrective Action

In accordance with the LTSP, implementation of a corrective action program will be taken within 18 months of verification of an established exceedance of a concentration limit for one or more constituents in a POC well. 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), 2015. *Long-Term Surveillance Plan for the Durango, Colorado, Disposal Site*, LMS/DUD/S06297, April.

4.11 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	20	Concrete Base of Perimeter Sign P79 (Undercut by Erosion)
PL-2	5	Vegetation Blocking Perimeter Sign P4 (Removed Following Inspection)
PL-3	270	2018 Repairs to Base of Site Marker SMK-2
PL-4	—	Vegetation Blocking Boundary Monument BM-5
PL-5	325	Boundary Monument BM-3
PL-6	80	Rabbitbrush on Disposal Cell Top
PL-7	355	Water Flowing in Natural Drainage Near Perimeter Sign P23
PL-8	—	Colorado Parks and Wildlife Sound Recorder Near Small Pull-out in Road

Note:

— = Photograph taken vertically from above.



PL-1. Concrete Base of Perimeter Sign P79 (Undercut by Erosion)



PL-2. Vegetation Blocking Perimeter Sign P4 (Removed Following Inspection)



PL-3. 2018 Repairs to Base of Site Marker SMK-2



PL-4. Vegetation Blocking Boundary Monument BM-5



PL-5. Boundary Monument BM-3



PL-6. Rabbitbrush on Disposal Cell Top



PL-7. Water Flowing in Natural Drainage Near Perimeter Sign P23



PL-8. Colorado Parks and Wildlife Sound Recorder near Small Pull-out in Road

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 (site) was inspected on March 6, 2019. No changes were observed in the disposal cell or associated drainage features, and inspectors 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 (BMP). The most recent sampling event occurred in February 2019. The compliance strategy for groundwater protection at the site, which is designated as limited use, is no further remediation and application of supplemental standards due to widespread ambient contamination that is not due to milling and is not reasonably treatable. Therefore, no concentration limits or points of compliance have been established. 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.

5.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the site-specific LM Long-Term Surveillance Plan (LTSP) (DOE 2008) 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 5-1 lists these requirements.

Table 5-1. License Requirements for the Falls City 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, 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 to not 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 impact groundwater quality or interfere with UMTRCA groundwater remediation activities. Permission must be obtained from the Texas Commission on Environmental Quality (TCEQ) 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 have agreed to seek approval from LM and the State for any future construction.

5.4 Inspection Results

The site, 8 miles southwest of Falls City, Texas, was inspected on March 6, 2019. The inspection was conducted by M. Widdop and C. Boger of the Legacy Management Support contractor. T. Jasso (LM site manager); R. Thomas, M. Kawasmi, F. Abbaszadea, K. Tu, and A. Ozain-Poterie (TCEQ); and R. Lyssy (site 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 LTSP, and evaluate the need, if any, for maintenance or additional inspection and monitoring.

5.4.1 Site Surveillance Features

Figure 5-1 shows the locations of site features in black, including site surveillance features and inspection areas. 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 text, and new observations identified during the 2019 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.

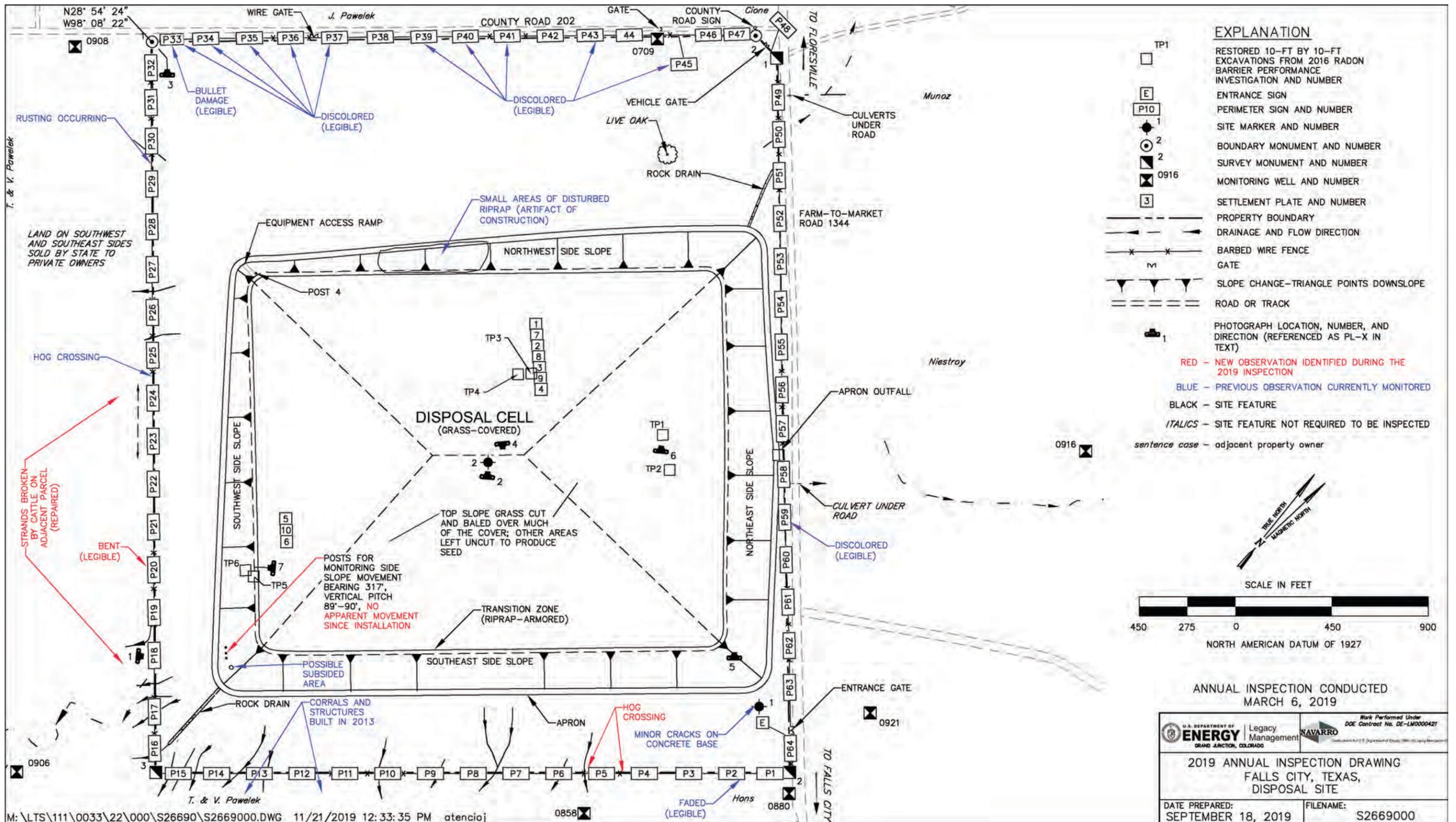


Figure 5-1. 2019 Annual Inspection Drawing for the Falls City, Texas, Disposal Site

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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. Broken strands along the southwest side were identified during the inspection and were repaired by the maintenance subcontractor following the inspection.

There are 64 perimeter signs, attached to steel posts set in concrete, positioned along the property boundary and set back 5 feet (ft). Perimeter sign P33 has bullet damage but remains legible. Additional perimeter signs are fading but remain legible (PL-1). Perimeter sign P20 was bent but remains legible. No other maintenance needs were identified.

5.4.1.3 Site Markers

The site has two site markers. Site marker SMK-1 is just inside the entrance gate. The corners of the concrete base around the marker are cracked. The cracks appear to be unchanged from last year, and repairs are not needed at this time. Site marker SMK-2 is on the top slope of the disposal cell (PL-2). 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-3). 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 2019 sampling event, and wellhead protectors were undamaged and locked. No maintenance needs were identified.

5.4.2 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 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-4). The site, including the disposal cell, is managed for hay production, which ensures that turf vitality is maintained. The site maintenance subcontractor can take as many as three cuttings of hay each year from the site. The maintenance subcontractor will spot-spray woody vegetation that inspectors found distributed sporadically in the uncut grass. At the time of the inspection, hay bales were present on the property.

There was no evidence of erosion, settling, slumping, or other modifying processes that might affect the integrity of the disposal cell. This year, as in past inspections, the surface of the soil on top of the disposal cell had small desiccation cracks, which are especially common in clayey or loamy soils when soil conditions are dry. No areas of ponded water or areas of settlement were observed on top of the disposal cell during the 2019 inspection.

The disposal cell side slopes and a transition zone where the top slope meets the side slopes are armored with riprap (PL-5). 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. LM periodically takes photos of riprap at the base of T-post 4 on the west corner of the disposal cell. On the basis of a qualitative evaluation of the photos in 2018, there is no indication that the riprap is degrading, but its durability will continue to be monitored. Because of the stable condition of the riprap indicated by these photos, no photo was taken in 2019, but photos should continue to be taken periodically. If the number of fractured rocks appears to be increasing, LM will establish a more quantitative monitoring program.

In 2007, inspectors noted possible subsidence in the riprap at the toe of the south corner of the side slope. In 2008, three T-posts were installed in a straight line running at an orientation of 317 degrees to monitor side slope movement. Each post was installed at a vertical pitch of 90 degrees. These three posts provide reference points to assess whether the area is undergoing movement: If a post moves out of line with the other two posts or the pitch of an individual post changes, it indicates possible movement. The three posts remain in the same straight line in which they were installed and are at the same vertical pitch.

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 2008 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.

There were no issues with the vegetation management on top of the disposal cell and on 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. In 2019, vegetation was well established at all test pit (TP) locations (PL-6). Locations TP5 and TP6 are on the southwest side slope of the disposal cell within the riprap (PL-7). 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 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 site runoff during storms and to reduce soil erosion. Vegetation in the apron outfall, midway along the northeast side slope, was cut back before the 2019 inspection. 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 one to three times annually, depending on precipitation. It is usually left uncut along the fence, along rock drains, and around some surveillance features such as survey monuments that cannot be accessed with conventional farming equipment.

Wild hogs burrow along the perimeter fence line in some areas. Their burrows are filled in by the site maintenance contractor, as they can potentially compromise the integrity of the perimeter fence or damage haying equipment. Two new areas where hogs enter the site were found along the southeast fence line during the 2019 inspection, and hogs continue to enter the site along the northwest side. No resultant perimeter fence damage was observed, and the areas will continue to be monitored. 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. The remainder of the adjacent former processing site is used for occasional livestock grazing. The owners have removed some of the brush 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

Broken fence strands were identified during the inspection and repaired by the maintenance subcontractor following the inspection. 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 LTSP, annual groundwater monitoring is conducted as a BMP. 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). The most recent sampling event occurred in February 2019.

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 sandstone units of the Deweesville Sandstone and Conquista Clay of the Whitsett Formation. The deeper unit is in the Dilworth Sandstone of the Whitsett Formation. The Dilworth Sandstone is underlain by the Manning Clay, a 300-foot-thick aquitard that isolates the uppermost aquifer from better-quality groundwater in deeper aquifers. Samples are collected from both 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
Disposal cell performance monitoring	0709, 0858, 0880, 0906, 0908, 0916, and 0921
Groundwater compliance monitoring	0862, 0886, 0891, 0924, and 0963

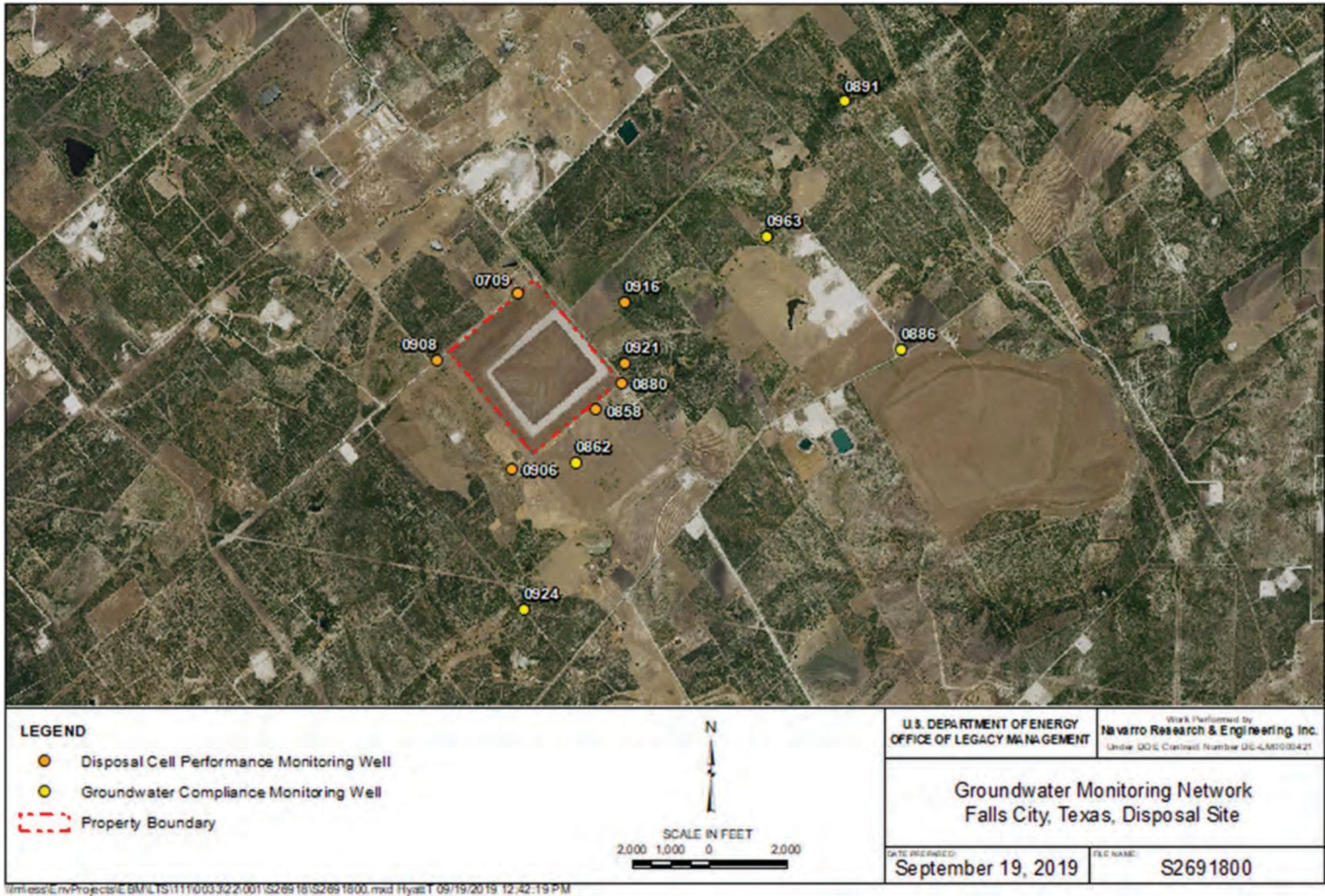


Figure 5-2. Groundwater Monitoring Well Network at the Falls City, Texas, Disposal Site

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 level. The LTSP identifies low pH levels in groundwater as an indicator of the extent and movement of the legacy groundwater plumes. Because tailings pore fluids were lower in pH than background groundwater, changes in geochemical conditions might also indicate leachate movement from the disposal cell into the uppermost aquifer. However, because pH levels and other signature contaminants in tailings pore fluids are essentially indistinguishable from processing-related contamination, it is difficult to assess whether contamination comes from the disposal cell or from legacy processing activities.

LM has concluded that pH and uranium concentrations do not correlate (DOE 2008). This is an indication that other factors, such as natural redistribution of uranium in this active ore-forming environment or buffering of low-pH groundwater, contribute to uranium distribution in the uppermost aquifer. Therefore, increasing uranium levels at a monitoring well without an attendant drop in pH might still indicate movement of processing-related contamination. Groundwater chemistry at monitoring wells near the formation subcrop can also be influenced by residence time as a response to precipitation or by changes in the oxidation state within the formation.

Because narrative supplemental standards apply to the uppermost aquifer at the site, no concentration limits or points of compliance 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 cleaned up using methods reasonably employed by public water supply systems (40 CFR 192.11[e]).

Background groundwater quality in the uppermost aquifer varies by orders of magnitude in the area because it is in contact with naturally occurring uranium mineralization. Figure 5-3 and Figure 5-4 show the water level measurements over time at both the disposal cell performance monitoring wells and the groundwater compliance monitoring wells. Figure 5-5 through Figure 5-8 show the time-concentration plots for pH and uranium at both disposal cell performance monitoring wells and groundwater compliance monitoring wells. All groundwater monitoring results for the site are reported and published on the LM Geospatial Environmental Mapping System website (<http://gems.lm.doe.gov/#site=FCT>).

5.8.2 Groundwater Level Monitoring Results

Since 1996, groundwater levels in the disposal cell performance monitoring wells have decreased overall, with decreases ranging from approximately 3 to 12 ft (Figure 5-3). In 2019, water levels in monitoring wells 0709, 0880, and 0906 increased at a steeper rate of change than has occurred in recent years (Figure 5-3), while water levels in monitoring wells 0858 and 0921 increased less abruptly. The water level in monitoring well 0906 has fluctuated more than water levels in the other monitoring wells, showing other short-term increases while decreasing over the longer period. The reason why 0906 fluctuates more than other wells is unknown. The general decrease in water levels across the entire disposal cell performance monitoring network might reflect (1) the dissipation of the processing site-related groundwater mound beneath the disposal cell or (2) the reduction of transient drainage from the disposal cell. Monitoring wells 0908 and 0916 are not shown in Figure 5-3 nor subsequent time concentration plots

(Figure 5-5 through Figure 5-8), because vicinity groundwater levels dropped below the bottom of the screens in 1996, rendering the wells dry.

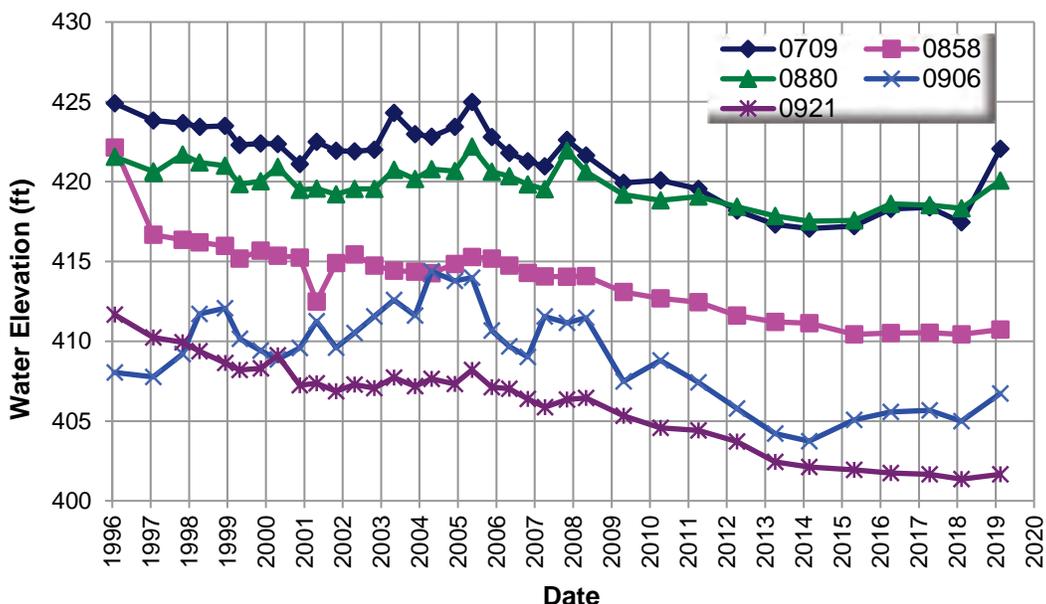


Figure 5-3. Water-Level Measurements at Disposal Cell Performance Monitoring Wells at the Falls City, Texas, Disposal Site

Mann-Kendall testing indicates water level trends are generally increasing in the groundwater compliance monitoring wells 0862, 0886, 0891, and 0963 (Figure 5-4). Overall, these water levels have increased about 4 ft since 1996. Mann-Kendall testing indicates no trend in water levels at monitoring well 0924.

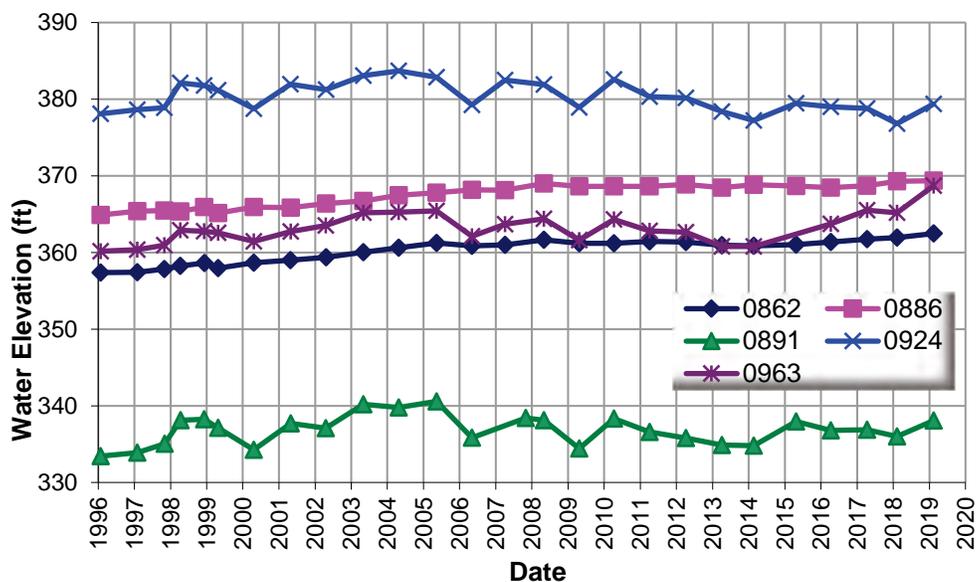


Figure 5-4. Water-Level Measurements at Groundwater Compliance Monitoring Wells at the Falls City, Texas, Disposal Site

5.8.3 Groundwater Quality Monitoring Results

pH: At the disposal cell performance monitoring wells, pH levels have historically been greater than the pH in tailings pore fluids (pH level of 2.93), with no significant upward or downward trends. Mann-Kendall testing indicates no trend in pH values at monitoring wells 0709 and 0906, an increasing trend at monitoring wells 0858 and 0921, and a decreasing trend at monitoring well 0880. In 2019, the pH levels in monitoring wells 0709, 0880, and 0921 decreased slightly, while the pH levels for monitoring well 0858 and 0906 increased slightly. The 2019 pH levels were within the range of historical values for all disposal cell performance monitoring wells (Figure 5-5).

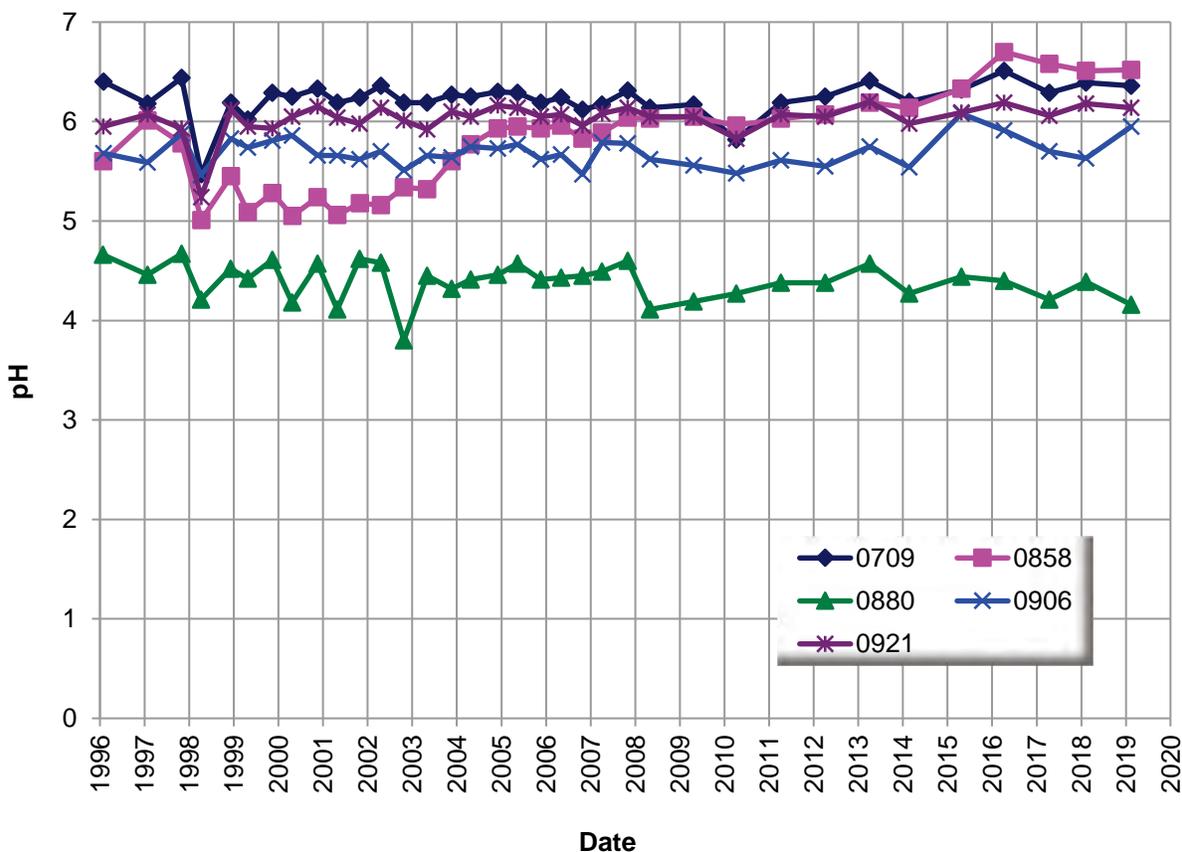


Figure 5-5. pH at Disposal Cell Performance Monitoring Wells at the Falls City, Texas, Disposal Site

At the groundwater compliance monitoring wells, pH levels have historically been greater than the pH in groundwater contaminated by processing activities, with no significant upward or downward trends. Mann-Kendall testing indicates no trend in pH values at monitoring wells 0862, 0886, and 0963 and an increasing trend at monitoring wells 0891 and 0924. In 2019, the pH levels for monitoring wells 0886 and 0963 increased, while the pH levels for monitoring wells 0862, 0891, and 0924 slightly decreased (Figure 5-6). The 2019 pH levels were within the range of historical values for all groundwater compliance monitoring wells except monitoring well 0963, where the pH has increased above the historical maximum. The pH in monitoring

well 0963 historically has been lower than at the other locations, and in 2019 it remains similar to the pH in the tailings pore fluids.

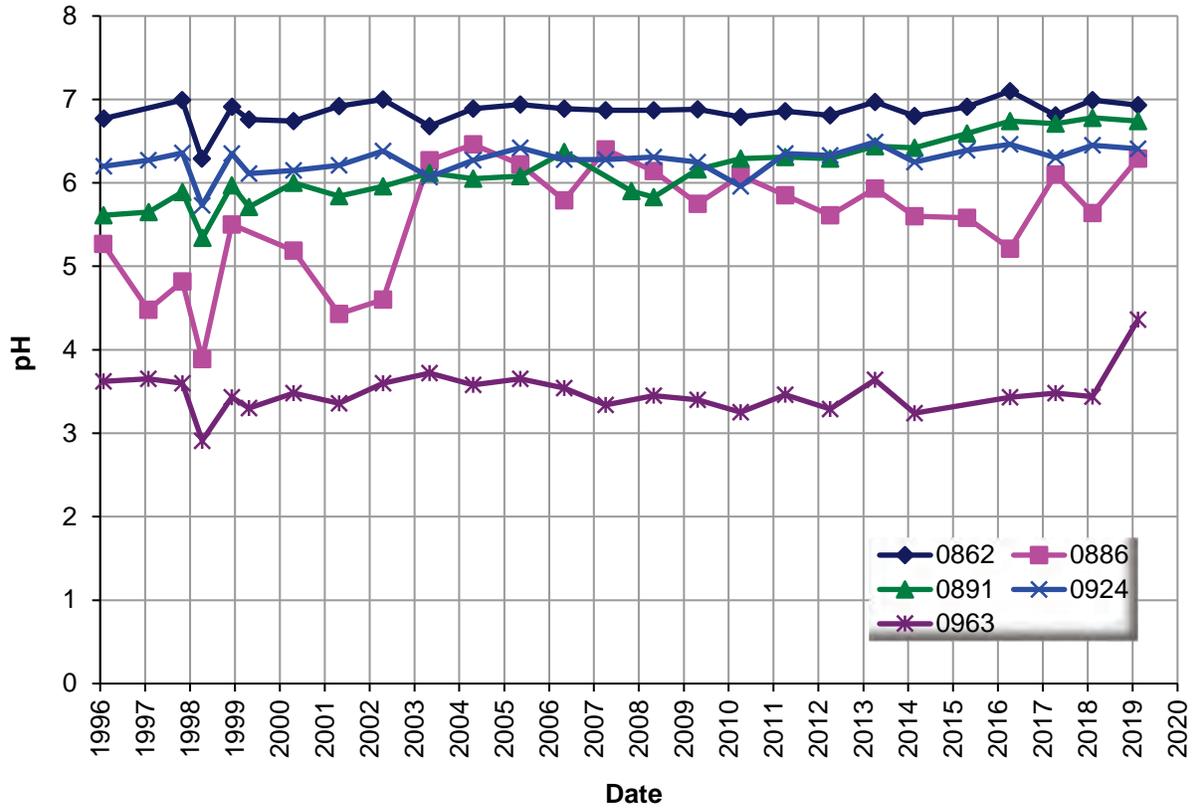


Figure 5-6. pH at Groundwater Compliance Monitoring Wells at the Falls City, Texas, Disposal Site

Uranium: The 2019 uranium concentrations for disposal cell performance monitoring wells were within the range of historical values for all groundwater compliance monitoring wells (Figure 5-7). In 2019, the uranium concentrations for monitoring wells 0709, 0906, and 0858 remained generally constant when compared with previous results. The uranium concentration in monitoring well 0921 increased slightly, maintaining a generally increasing trend. The concentration in monitoring well 0880 increased from 7.6 milligrams per liter (mg/L) to 8.7 mg/L. Uranium concentrations in monitoring well 0880 show considerable variation, ranging from a low of 1.38 mg/L in 2008 to a high of 14 mg/L in 2004, and the 2019 uranium concentration is within the range of historical concentrations.

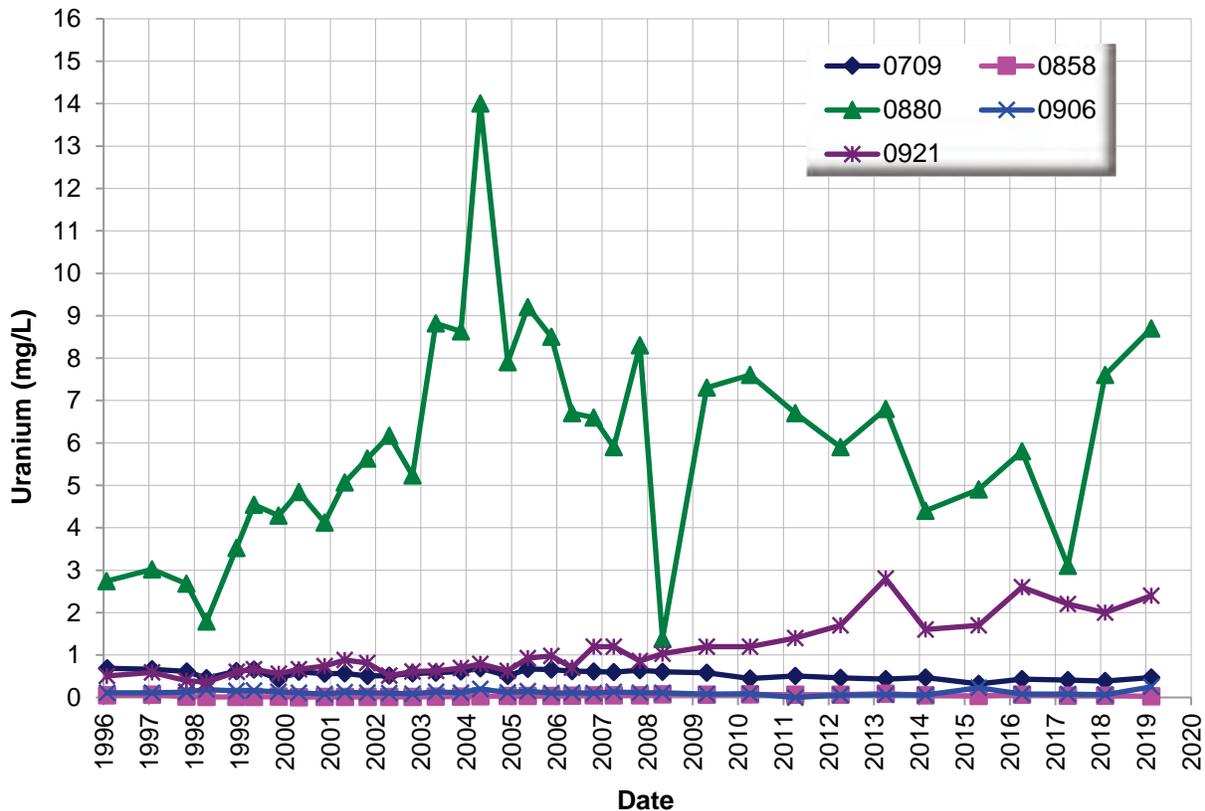


Figure 5-7. Uranium Concentrations at Disposal Cell Performance Monitoring Wells at the Falls City, Texas, Disposal Site

The 2019 uranium concentrations for groundwater compliance monitoring wells were within the range of historical values for all groundwater compliance monitoring wells (Figure 5-8). The uranium concentration at monitoring wells 0862, 0886, and 0963 remains less than 0.2 mg/L. The uranium concentration at monitoring well 0924 has been relatively stable since 2004, fluctuating between 0.4 mg/L and 0.6 mg/L. Since 2008, the uranium concentrations measured at monitoring well 0891 have been greater than at other monitoring wells and are currently elevated when compared to the historical range for the well but not for the historical range of the aquifer (DOE 2010). The 2019 uranium result (1.5 mg/L) at monitoring well 0891 is slightly greater than the 2018 result at this location (1.2 mg/L) but remains significantly less than the 2016 uranium result of 3.7 mg/L and less than the uranium concentration value used for groundwater in the Dilworth aquifer in the *Baseline Risk Assessment of Ground Water*

Contamination at the Uranium Mill Tailings Site Near Falls City, Texas (3.04 mg/L) (DOE 1995). This suggests that a slug of groundwater with elevated uranium has flowed past this location.

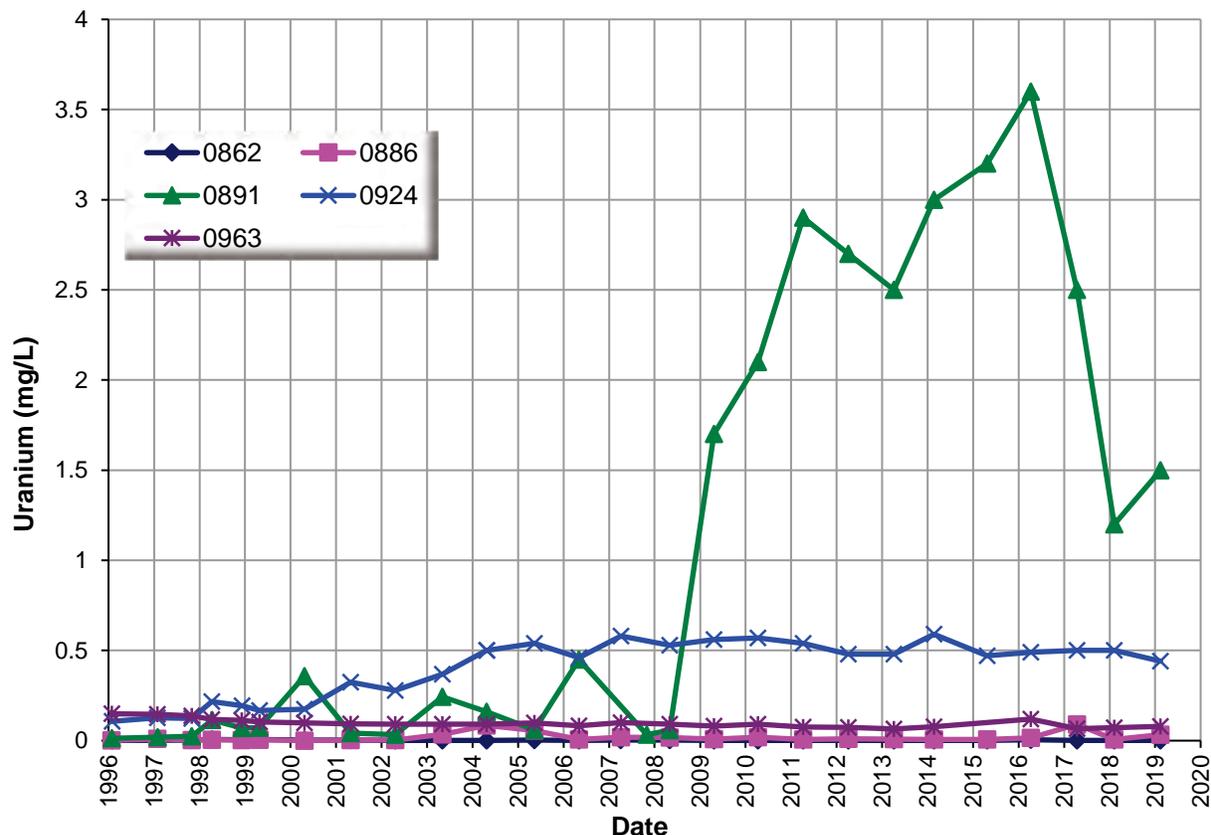


Figure 5-8. Uranium Concentrations in Groundwater Compliance Monitoring Wells at the Falls City, Texas, Disposal Site

5.8.4 Evaluation of Groundwater Monitoring

Uranium concentrations in disposal cell performance monitoring well 0880 have varied considerably since 1996, ranging from 1.38 mg/L in 2008 to 14 mg/L in 2004 (Figure 5-7). The uranium concentration was 8.7 mg/L in 2019. The pH at this location is less than at other disposal cell performance monitoring wells. Water levels at all the cell performance monitoring wells trended lower from 2007 until 2016, then increased in recent years (Figure 5-3). Because the uranium concentrations at some of the cell performance monitoring wells have been steady and concentrations vary at other locations, local conditions are likely influencing uranium concentrations. This is reasonable because (1) the disposal cell is located on tailings that were placed in existing open pit mines, (2) subeconomic ore remains in unmined areas, (3) the uppermost aquifer beneath the cell is oxidized and near the aquifer recharge area, and (4) uranium mineralization processes, which involve redistributing and concentrating uranium in the formation materials, are ongoing. Given the local conditions listed above, it is difficult to assess whether elevated uranium concentrations in the uppermost aquifer are a result of disposal cell performance or existing background conditions.

The high uranium concentrations in groundwater compliance well 0891 since 2008, have been trending downward since 2015, likely reflects the passage of a slug of groundwater with elevated uranium flowing from the direction of the former processing site. Historical data from upgradient monitoring wells that were abandoned in 2001 show a uranium anomaly moved past them (Figure 5-9) (DOE forthcoming). LM defined the groundwater flow directions in the Deweesville and the Dilworth aquifers and identified areas of low pH where tailings-derived fluids have consumed all of the natural buffering capacity (DOE 2008, Figures 2-7 and 2-8). Monitoring well 0891 is completed in the Dilworth aquifer. Monitoring well 0963 (completed in the Deweesville Sandstone) is in a zone of low pH where groundwater in the Deweesville aquifer flows into the underlying Dilworth aquifer. Monitoring well 0966 is the next downgradient Dilworth aquifer well.

Figure 5-9 shows uranium concentration spikes in both wells (0963 and 0966) in 1992, with slowly declining uranium concentrations in 0963 over time (data for monitoring well 0966 are limited). This is likely due to an initial release of uranium and low pH tailings fluids during tailings deposition and subsequent acid leaching, with tailings removal by 1994 (DOE forthcoming). Monitoring well 0891 is the next Dilworth well directly downgradient of the low pH zone. Additionally, the elevated uranium at monitoring well 0891 is accompanied by elevated alkalinity and chloride, which also supports the conclusion that the elevated uranium is the result of passage of a slug of groundwater containing processing-related constituents.

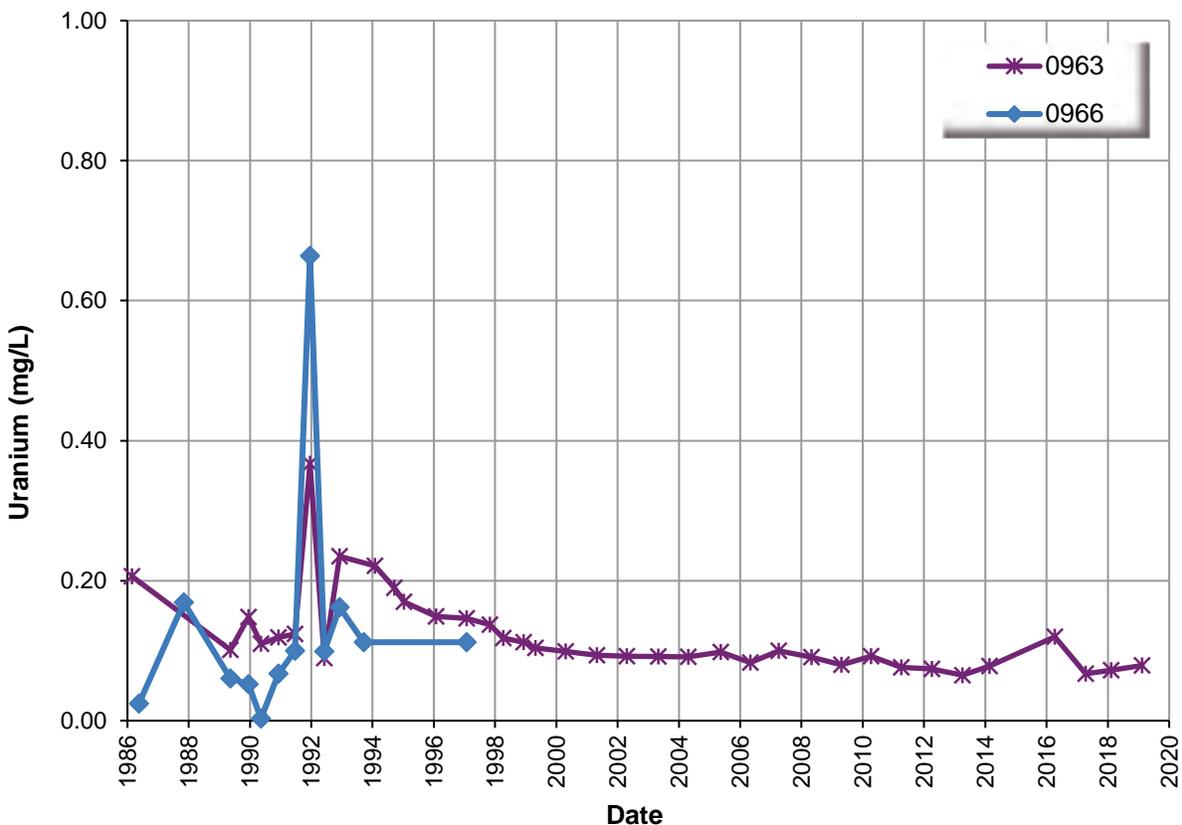


Figure 5-9. Uranium Concentrations in Monitoring Wells 0963 (in the Deweesville Aquifer) and 0966 (in the Dilworth Aquifer)

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 better-quality groundwater in deeper aquifers.

LM evaluated the groundwater monitoring program at the site in 2010 as required by the LTSP (DOE 2010). Groundwater monitoring data collected from 2006 through 2010 were compared to previous data (1996 through 2005). The comparison showed that contaminant concentrations continued to fluctuate in the uppermost aquifer, but the fluctuations were within the historical range reported for the aquifer near the site. The comparison also showed no unexpected water level changes. The 2010 evaluation recommended that, after the collection of samples in 2011, groundwater monitoring activities at the site be discontinued. Recommendations made in the 2010 evaluation continue to undergo NRC review. In 2016, NRC received comments on the 2010 report from TCEQ, which concurred that monitoring could be halted at all Falls City wells except (1) monitoring well 0891 until a horizontal or decreasing trend is observed (this condition has been met, as shown in Figure 5-8) and (2) monitoring wells 0880 and 0886, which are completed in the Deweesville Sandstone and should be retained until the groundwater remedy for the downgradient Conquista site is established.

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*.

DOE (U.S. Department of Energy), 1995. *Baseline Risk Assessment of Ground Water Contamination at the Uranium Mill Tailings Site Near Falls City, Texas*, DOE/AL/62350-64, Rev. 1, Environmental Restoration Division, Albuquerque, New Mexico, September.

DOE (U.S. Department of Energy), 2008. *Long-Term Surveillance Plan for the U.S. Department of Energy Falls City Uranium Mill Tailings Disposal Site, Falls City, Texas*, DOE-LM/1602-2008, March.

DOE (U.S. Department of Energy), 2010. *Groundwater Monitoring Assessment, Falls City, Texas, Disposal Site*, LMS/FCT/S07069, December.

DOE (U.S. Department of Energy), forthcoming. *Groundwater Monitoring Assessment and Chronology of Groundwater Compliance Activities at the Falls City, Texas, UMTRCA Title I Disposal Site*, LMS/FCT/s25289, Office of Legacy Management, to be published.

5.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	50	Perimeter Sign P18
PL-2	320	Site Marker SMK-2
PL-3	320	Boundary Monument BM-1
PL-4	130	Looking East Across Disposal Cell Top Slope
PL-5	270	Northeast Side Slope
PL-6	320	Restored Excavation Test Pit TP1 from 2016 Radon Barrier Performance Investigation
PL-7	230	Restored Excavation Test Pit TP6 from 2016 Radon Barrier Performance Investigation



PL-1. Perimeter Sign P18



PL-2. Site Marker SMK-2



PL-3. Boundary Monument BM-1



PL-4. Looking East Across Disposal Cell Top Slope



PL-5. Northeast Side Slope



PL-6. Restored Excavation Test Pit TP1 from 2016 Radon Barrier Performance Investigation



PL-7. Restored Excavation Test Pit TP6 from 2016 Radon Barrier Performance Investigation

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 (site) was inspected on December 12, 2019. No changes were observed on the disposal cell or in the associated drainage features. Inspectors did not identify any immediate maintenance needs or find cause for a follow-up inspection.

A portion of the disposal cell remains open to receive low-level radioactive materials from various 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 lysimeter facilities adjacent to the north and east sides of the disposal cell, are also not inspected. This annual inspection includes the completed 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 as a best management practice. Three monitoring wells are sampled to verify that groundwater in onsite paleochannels is not affected by seepage (transient drainage) from the disposal cell. Groundwater monitoring was last completed in August 2019. Groundwater monitoring results confirm that groundwater in the paleochannels continues to be unaffected by potential transient drainage from the disposal cell.

6.2 Compliance Requirements

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

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-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. Under legislation authorizing LM's operation of the site (PL 104-259), the cell is scheduled to stop receiving

radioactive waste in September 2023. Congress is considering legislation to keep the disposal cell open until 2031. Once the disposal cell is closed, it will be accepted under the NRC general license. 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, boundary monuments, and wellhead protectors.

6.4 Inspection Results

The site, 18 miles southeast of Grand Junction, Colorado, was inspected on December 12, 2019. The inspection was conducted by S. Woods, K. Roemer, and P. Wetherstein of the Legacy Management Support contractor. B. Frazier (LM site manager) and J. Doebele (Colorado Department of Public Health and Environment) 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 the need, if any, for maintenance or additional inspection and monitoring.

6.4.1 Site Surveillance Features

Figure 6-1 shows in black the locations of site features, including site surveillance features and inspection areas. 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 text, and new observations identified during the 2019 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 identified 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 Sign

Access to the site is from U.S. Highway 50. A steel double-swing access gate, secured by a locking device, in the highway right-of-way fence provides access to a right-of-way and an access road. LM is one of several parties with access to the locking device. A right-of-way grant on federal land, administered by the U.S. Bureau of Land Management (BLM), extends approximately 1.7 miles between Highway 50 and the entrance gate. LM maintains this right-of-way, including a two-lane asphalt access road. The double-swing chainlink entrance gate was replaced in 2019 before the inspection with a solar-powered chainlink gate as part of a green initiative (PL-1); the gate's solar-powered system includes battery storage. The entrance gate was locked and functional. The entrance sign is next to the entrance gate. No maintenance needs were identified.

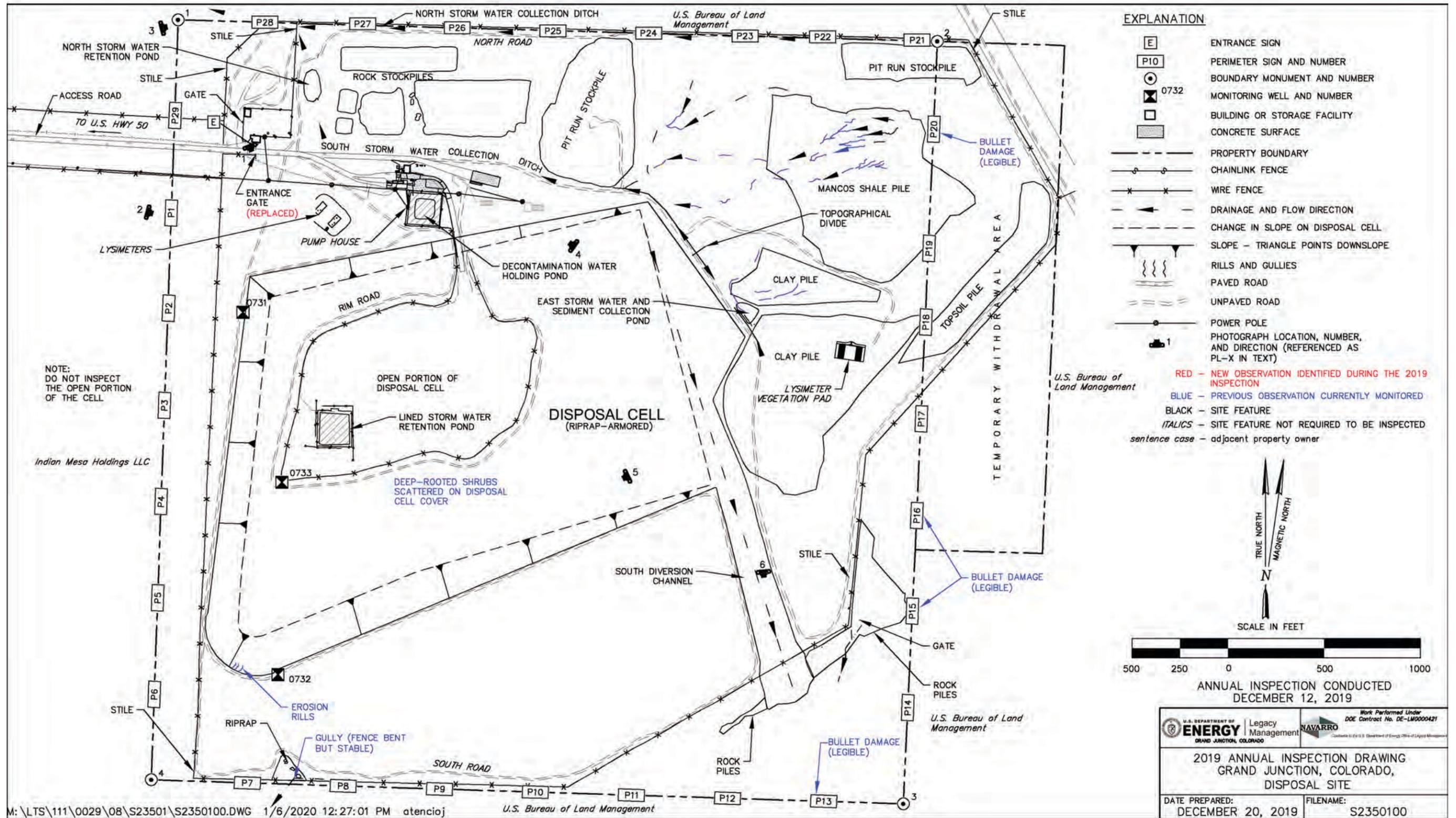


Figure 6-1. 2019 Annual Inspection Drawing for the Grand Junction, Colorado, Disposal Site

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6.4.1.2 Perimeter Fence and Signs

A perimeter fence encloses the disposal cell features and operations areas. It consists of a standard four-strand barbed-wire fence in some areas and a woven wire fence topped with barbed wire in others. There are 29 perimeter signs, attached to steel posts set in concrete, positioned at regular intervals along the property boundary (PL-2). Perimeter signs P13, P16, and P20 have bullet damage but remain legible. All three signs will be replaced in the future.

6.4.1.3 Site Markers

Granite site markers similar to those at other UMTRCA sites will not be installed until the disposal cell is closed.

6.4.1.4 Boundary Monuments

Four boundary monuments delineate the corners of the property boundary (PL-3). No maintenance needs were identified.

6.4.1.5 Monitoring Wells

The groundwater monitoring network consists of three monitoring wells (0731, 0732, and 0733). All wellhead protectors were locked and undamaged. No 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 site boundary, and (4) the outlying area. Inspectors examined specific site surveillance features in each area and looked for evidence of erosion, settling, slumping, or other modifying processes that might affect 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-4). The rock showed no significant weathering. There was no evidence of erosion, settling, slumping, rock degradation, or other modifying processes that might affect the integrity of the disposal cell.

Grasses and weeds were growing on most of the disposal cell cover (PL-5). Historically, deep-rooted shrubs have been treated with herbicide on the disposal cell top slope. Although treatment is not required by the interim LTSP, LM plans to continue controlling the deep-rooted shrubs as needed until more is known about the potential effects of vegetation on the disposal cell cover.

During the 2014 annual inspection, several small erosion channels were noted in soils at the base of the disposal cell's southwestern corner. The channels do not threaten the integrity of the disposal cell, and no significant changes were noted in 2019. 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 runoff from the disposal cell, and conveys the water into a natural drainage that flows away from the site to the southwest (PL-6). Grasses, weeds, and shrubs grow within the diversion channel, but this vegetation is not expected to degrade the channel's performance. The discharge area of the channel is armored with large-diameter basalt riprap.

Other drainage features at the site include north and south storm water collection ditches, the north storm water retention pond, and the east storm water and sediment collection pond. These small drainage features control storm water runoff primarily from the various stockpiles of cover materials. The storm water collection ditches also capture storm water run-on from offsite locations. The diversion channel, ditches, and ponds were functioning as designed. No maintenance needs were identified.

6.4.2.3 Area Between the Disposal Cell and the Site Boundary

There are 11 discrete stockpiles of rock and soil between the disposal cell and the perimeter fence on the north and east sides of the site. Most of these materials eventually will be used to cover and close the open disposal cell. Vegetation and surface rocks generally protect the stockpiles from significant erosion.

Most of the flat areas between the disposal cell and the site (property) boundary are vegetated with native shrubs, scant perennial grasses, and annual weeds. Some localized erosion has occurred along the perimeter road near the east storm water and sediment collection pond. No areas of significant erosion were present that could threaten the integrity of the disposal cell or site features. Erosion rills on the west side of the perimeter road will continue to be monitored, and maintenance will be performed as necessary.

In addition to the perimeter signs, the perimeter fence also has warning signs ("no trespassing" and "controlled area" signs). No immediate maintenance needs were identified.

6.4.2.4 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 changes were identified. Most of the land surrounding the site is rangeland administered by BLM and private property on the west side used primarily for cattle grazing. No land use changes were evident in this area. Outside the site's eastern boundary is a 40-acre temporary federal land withdrawal area. Some of the withdrawal area is included within the perimeter fence and contains materials stockpiles. This area is not included in the interim LTSP but is inspected as an offsite area.

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

A green initiative was undertaken in 2019 before the inspection to replace the double-swing chainlink entrance gate with a solar-powered electric chainlink gate secured by an electronic keypad and a backup battery. No immediate 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, a designation given to groundwater that is not a current or potential source of drinking water. The disposal cell is underlain by 5 to 40 feet (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) 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 (transient drainage) from the disposal cell. The most recent sampling event occurred in August 2019.

Monitoring wells 0731 and 0732 are screened across the alluvial paleochannels adjacent to the disposal cell and extend 5 to 7.5 ft into weathered Mancos Shale. The wells are in two separate paleochannel systems, each 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 website (<http://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 (Figure 6-3). Water levels in disposal cell monitoring well 0733 increased approximately 4 ft since 1998 and has remained lower than the adjacent water levels in the two paleochannel monitoring wells. Groundwater levels in wells 0731 and 0732 remained relatively constant with the same apparent trend in variability, suggesting the two paleochannel systems are influenced by the same upgradient recharge mechanisms.

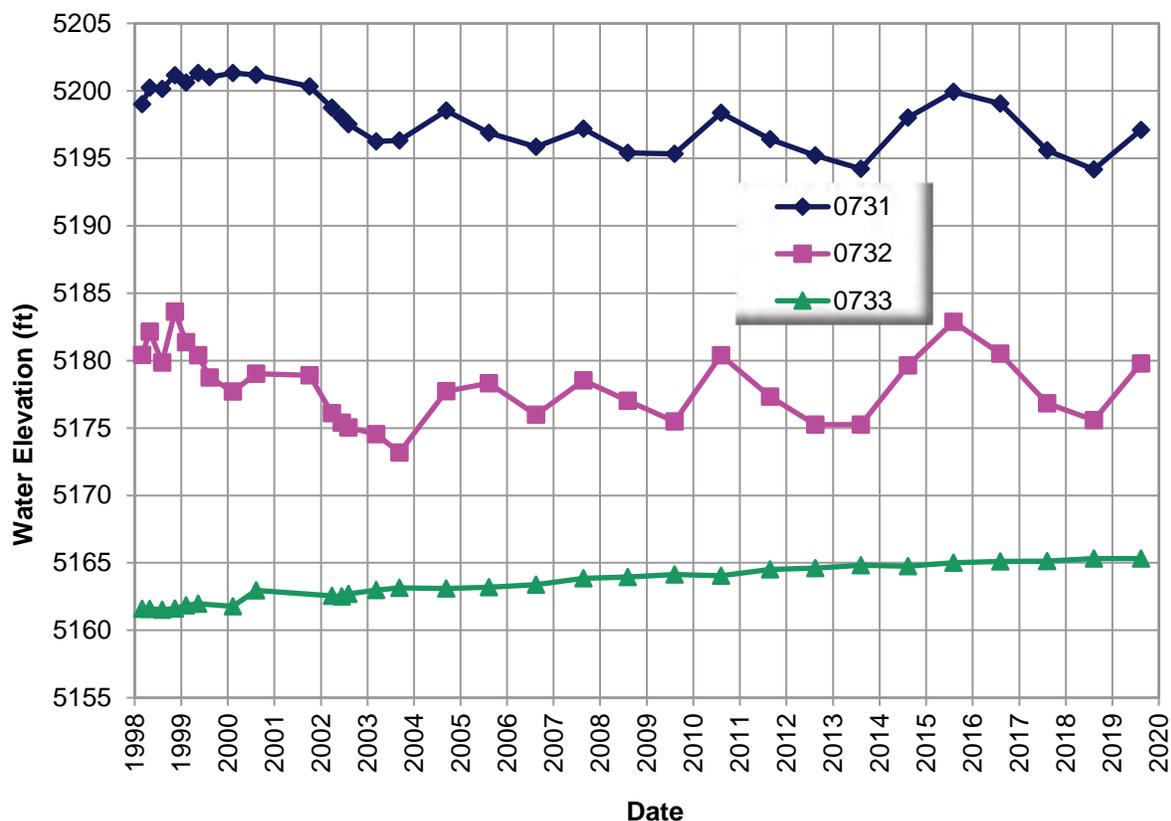


Figure 6-3. Water Level Measurements at the Grand Junction, Colorado, Disposal Site

6.8.2 Groundwater Quality Monitoring

Annual groundwater samples are analyzed for standard field parameters and the following indicator analytes: molybdenum, nitrate, polychlorinated biphenyls, selenium, sulfate, TDS, uranium, and vanadium. Key indicator analytes are molybdenum, nitrate, selenium, and uranium. The U.S. Environmental Protection Agency has established maximum concentration limits (MCLs) for these analytes in groundwater (Table 6-3) (40 CFR 192 Table 1 Subpart A). Monitoring results are compared to the MCLs for evaluation only and not for compliance purposes.

Table 6-3. Maximum Concentration Limits for Groundwater at the Grand Junction, Colorado, Disposal Site

Constituent	MCL ^a (mg/L)
Molybdenum	0.1
Nitrate (as nitrogen)	10
Selenium	0.01
Uranium	0.044

Note:

^a MCLs as listed in 40 CFR 192 Table 1 Subpart A.

Molybdenum concentrations in all three monitoring wells have remained steady since 1998; 2019 concentrations were less than or equal to 0.003 mg/L. Time-concentration plots from 1998 through 2019 for the other key indicator analytes—nitrate (as nitrogen [N]), selenium, and uranium—are shown in Figure 6-4 through Figure 6-6.

Since 1999, nitrate (as N) concentrations in disposal cell monitoring well 0733 continued to decline, reaching a low of 0.74 mg/L in 2019 (Figure 6-4). Nitrate concentrations continued to exceed the MCL of 10 mg/L in the paleochannel monitoring wells 0731 and 0732. Mann-Kendall trend tests for nitrate concentrations in monitoring well 0732 showed a statistically significant increasing trend from 2003 to 2019 and a historic high value in 2018.

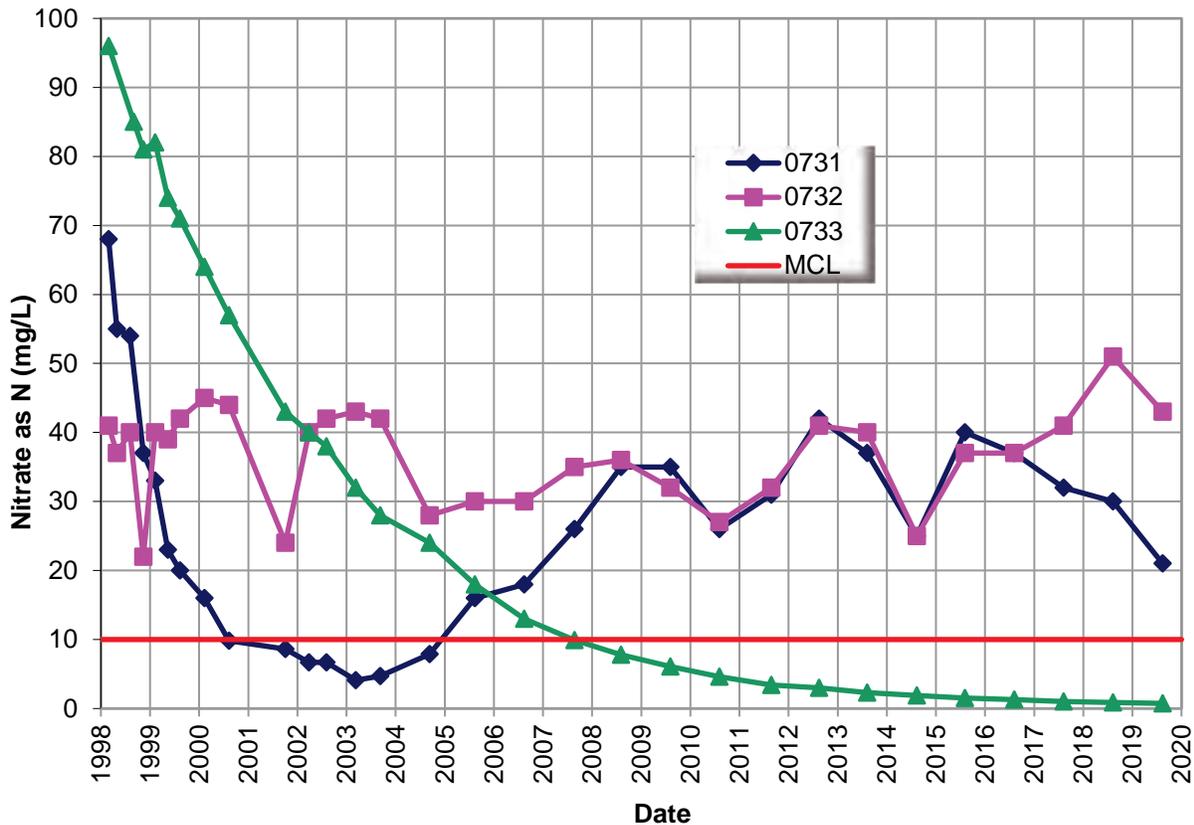


Figure 6-4. Nitrate (as N) in Groundwater at the Grand Junction, Colorado, Disposal Site

Selenium concentrations continued to exceed the MCL of 0.01 mg/L in the paleochannel monitoring wells 0731 and 0732, with no apparent trend in either well since 2001 (Figure 6-5). Selenium occurs naturally in the Mancos Shale deposits that underlie the disposal cell at concentrations slightly greater than the MCL of 0.01 mg/L. Paleochannel monitoring wells 0731 and 0732 are screened at the contact of the Mancos Shale unconsolidated soil and the alluvium. Background groundwater quality in these wells is brackish, with elevated TDS levels ranging from 870 to 7010 mg/L; this supports the theory that the shale is the source of the elevated selenium concentrations in both paleochannel monitoring wells. Disposal cell monitoring well 0733 is not screened in the weathered Mancos Shale, and selenium concentrations remain below the MCL.

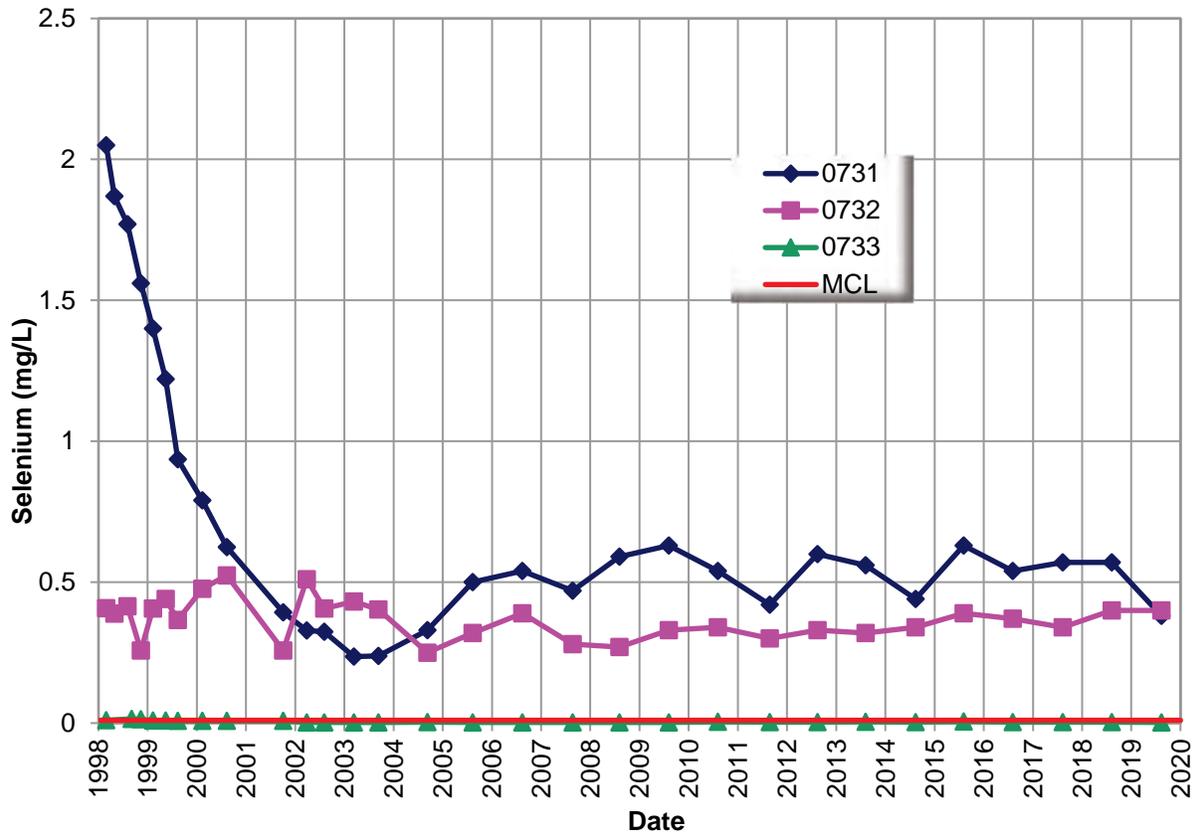


Figure 6-5. Selenium in Groundwater at the Grand Junction, Colorado, Disposal Site

Uranium concentrations in groundwater slightly exceeded the MCL of 0.044 mg/L in both paleochannel monitoring wells in 2018 and remained near the MCL in 2019. Mann-Kendall trend tests for uranium concentrations show a statistically increasing trend for all three wells from 2010 to 2019. Wells 0732 and 0733 also had statistically increasing trends since 2003, according to Mann-Kendall (Figure 6-6). Uranium concentrations in disposal cell monitoring well 0733 have increased from 0.02 mg/L in 2002 to 0.22 mg/L in 2019. Increasing uranium beneath the disposal cell is coinciding with the addition of residual radioactive material to the open cell. 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.

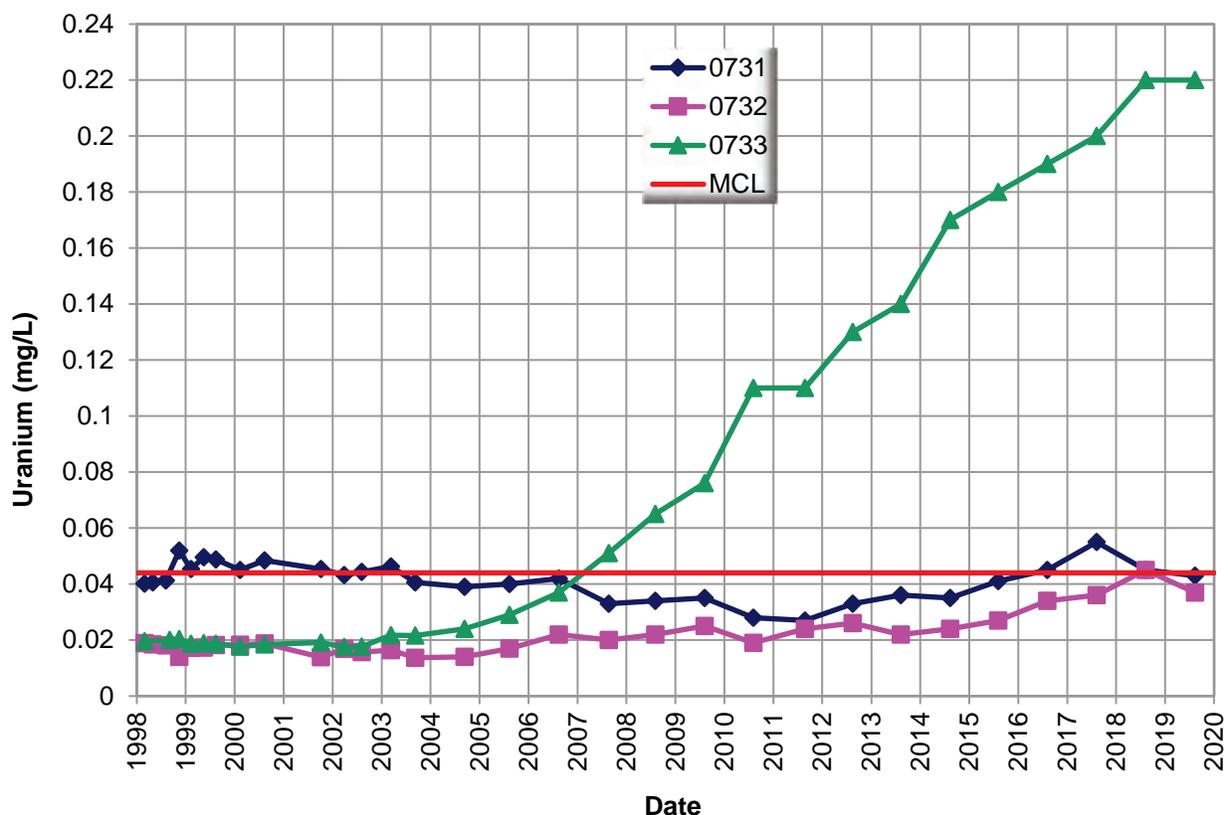


Figure 6-6. Uranium in Groundwater at the Grand Junction, Colorado, Disposal Site

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), 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, Albuquerque, New Mexico, April.

PL 104-259. “An Act to Extend the Authorization of the Uranium Mill Tailings Radiation Control Act of 1978, and for Other Purposes,” Public Law.

6.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	160	Solar-Powered Entrance Gate
PL-2	105	Perimeter Sign P1
PL-3	—	Boundary Monument BM-1
PL-4	305	Disposal Cell–North Side Slope; Operations Area Facilities in Background
PL-5	245	Top of Disposal Cell–South
PL-6	175	South Diversion Channel

Note:

— = Photograph taken vertically from above.



PL-1. Solar-Powered Entrance Gate



PL-2. Perimeter Sign P1



PL-3. Boundary Monument BM-1



PL-4. Disposal Cell–North Side Slope; Operations Area Facilities in Background



PL-5. Top of Disposal Cell–South



PL-6. 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 (site) was inspected on March 19, 2019. No changes were observed on the disposal cell or in the associated drainage features. Inspectors did not identify any maintenance items 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 LM Long-Term Surveillance Plan (LTSP) (DOE 1998). Groundwater monitoring was last completed in June 2019. The UMTRCA maximum concentration limits (MCLs), which the LTSP specified as the groundwater standards for the site, were exceeded at multiple point-of-compliance (POC) wells. In 2011, LM developed a draft Groundwater Compliance Action Plan (GCAP) to update the groundwater monitoring requirements (DOE 2011) as specified in the LTSP. The draft GCAP has been approved by the State of Utah but has not been accepted (to date) by the U.S. Nuclear Regulatory Commission (NRC). LM has received a request for additional information (RAI) from the NRC and is addressing the NRC comments. Groundwater analytical results are evaluated with respect to LTSP requirements until a GCAP is finalized.

7.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the LTSP and 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, 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, site markers, survey and boundary monuments, and wellhead protectors.

7.4 Inspection Results

The site, one mile southeast of Green River, Utah, was inspected on March 19, 2019. The inspection was conducted by J. Price, C. Wentz, and K. Lott of the Legacy Management Support contractor. A. Denny (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 the need, if any, for maintenance or additional inspection and monitoring.

7.4.1 Site Surveillance Features

Figure 7-1 shows the locations of site features in black, including site surveillance features and inspection areas. 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 2019 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 identified in the text and in Figure 7-1 by photograph location (PL) numbers. The photographs and photograph log are presented in Section 7.10.

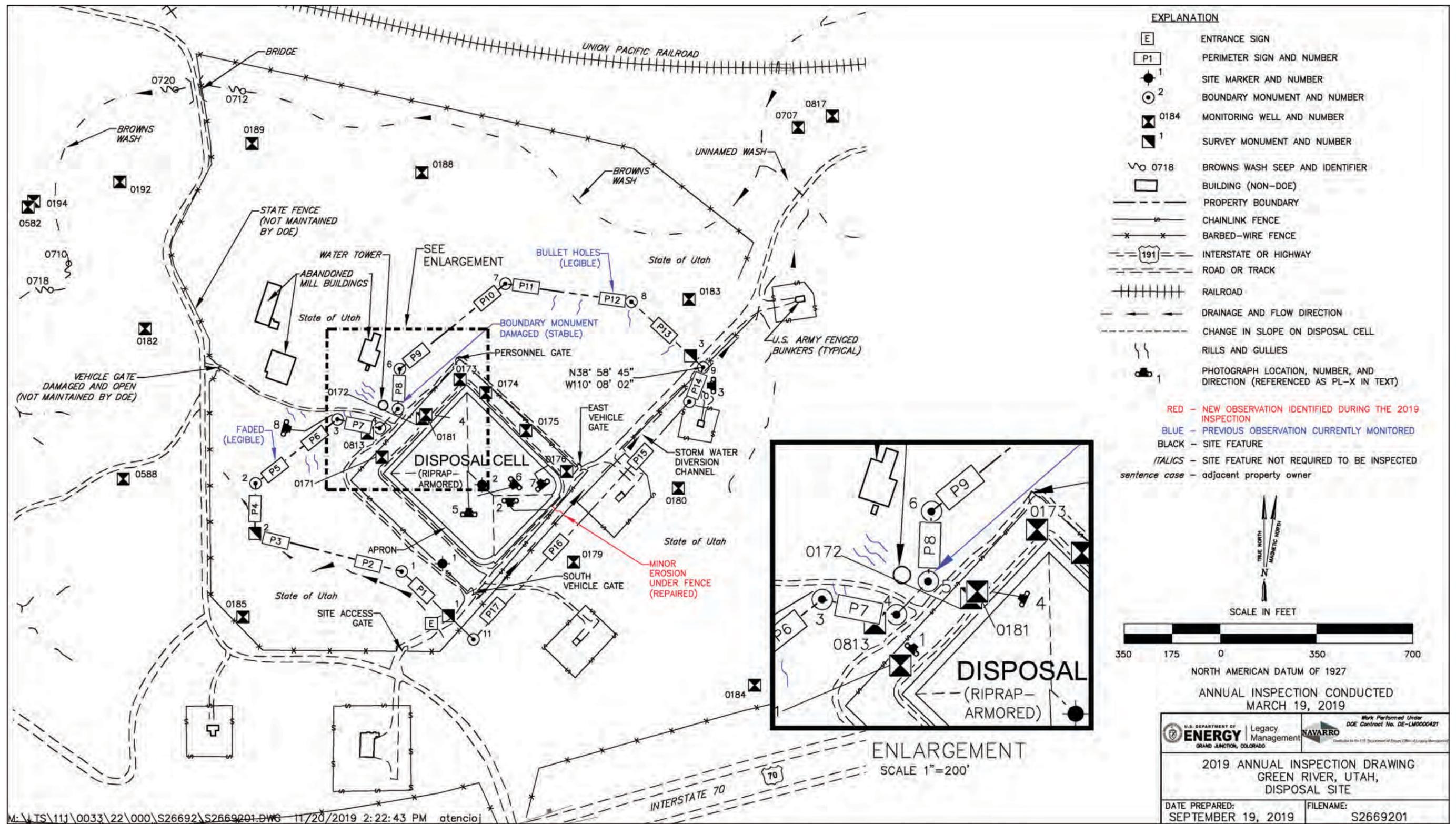
7.4.1.1 Access Road, Entrance Gate, and Entrance Sign

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 Street 1600 East. The paved access road crosses property owned by the State of Utah and the U.S. Army. Access has been 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 at the security fence, with one branch entering 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. No maintenance needs were identified.

7.4.1.2 Security Fence and Perimeter Signs

A chainlink security fence encloses the portion of the site that contains the disposal cell. Two vehicle gates are at the south and east corners of the security fence line, and a personnel gate is at the north corner of the security fence line. The security fence (PL-1) was intact, and the gates were locked. Minor erosion was identified under the southeast fence line (PL-2), but it does not compromise the integrity of the fence at this time. The erosion was repaired at the time of the inspection.

There are 17 perimeter signs (PL-3), attached to steel posts set in concrete, positioned along the unfenced property boundary. Perimeter sign P5 was faded but remains legible. No other maintenance needs were identified.



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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. Its concrete base has several minor cracks, but they do not compromise the integrity of the base, and repairs are not necessary at this time. Site marker SMK-2 is on the crest of the disposal cell. No maintenance needs were identified.

7.4.1.4 Survey and Boundary Monuments

Eleven boundary monuments and three survey monuments delineate the property boundary. Boundary monument BM-5 is damaged (it is bent from being hit by a vehicle), but its condition does not require repair. No maintenance needs were identified.

7.4.1.5 Monitoring Wells

There are 22 monitoring wells on or near the site. Monitoring wells were inspected during the June 2019 sampling event. All wellhead protectors observed during the inspection were undamaged and locked (PL-4). Some of the concrete monitoring well collars are cracked, but the wellhead protectors are stable and repairs are not necessary. No 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 (PL-5). A small percentage of the rock, including basalt and sedimentary rock, has degraded, but the riprap cover is functioning as designed (PL-6). There was no evidence of settling, slumping, erosion, or any other modifying process that might affect the integrity of the disposal cell.

A boulder-filled trench, known as an apron, surrounds the disposal cell (PL-7). The apron was intact and stable, with no observed erosion along the base of the side slopes. Small erosion rills are present along portions of the outside edge of the apron. The rills form as storm water runoff along the disposal cell perimeter road drains into the disposal cell apron. This occurrence is not a concern because the erosion is minor and sedimentation in the apron has not adversely affected the performance of the apron (the sediment has not filled the apron or become visible in the apron). Inspectors will continue to monitor the area.

The area between the disposal cell and the security fence consists of the disposal cell perimeter dirt road, several monitoring wells, and sparsely vegetated open space. The road was passable,

and there was no indication of erosion or trespassing in the open space. No maintenance needs were identified.

7.4.2.2 Perimeter Area In-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 storm water diversion channel, and a monitoring well. The site (property) boundary is not fenced, and trespassing occurs on the site from several access points through State of Utah land. Unauthorized access to the site is primarily from the west through a former mill access gate that has 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 north and east of the site. The site will continue to be monitored for adverse public use typically indicated by trash, tire ruts, and vandalism. Inspectors did not find any indication of vandalism.

Signs of erosion are present in multiple areas in the site perimeter. Erosional rills are present on the west side of the site but are not impacting any site surveillance features. Rills and gullies are also present along the escarpment northeast of the disposal cell in the area 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. A portion of the storm water 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 the integrity of the disposal cell. Inspectors will continue to monitor the erosional 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. 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 was minor, but it will continue to be monitored, and debris will be removed as it accumulates.

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 (PL-8). Evidence of continued erosion in these areas was apparent but currently 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

Minor erosion was identified under the southeast fence line and repaired at the time of 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 that was approved by the State of Utah. As a best management practice, LM implemented the draft GCAP to expand the groundwater monitoring requirements (i.e., additional monitoring wells and analytes), and propose a groundwater compliance strategy. The most recent sampling event occurred in June 2019 and the results are presented below.

The LTSP establishes four POC wells at the site for postclosure groundwater monitoring. 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, which is at the hydrologic downgradient limit of the disposal cell. The LTSP included monitoring well 0172, but its construction integrity was suspect and the well was replaced with monitoring well 0181 in 2001. It has been monitored as the replacement POC well since 2001. Table 7-2 and Figure 7-2 show the current groundwater monitoring network at the site.

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, sulfate, and uranium. Groundwater monitoring results are reported and published on the LM Geospatial Environmental Mapping System website (<http://gems.lm.doe.gov/#site=GRN>).



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

7.7.1 Water Level Monitoring

Water levels have been manually measured annually in the POC wells since 1991.

Water levels in the POC wells decreased slightly from 2017 to 2018 (Figure 7-3). Historically, the groundwater levels in these wells decreased approximately 3 ft overall from 1998 through 2004 and then increased approximately 8 ft between 2004 and 2007. Water level decreases ranged from 4 to 5 ft from 2007 through 2014. From 2014 to 2019, the water levels increased to elevations near the 2007 levels.

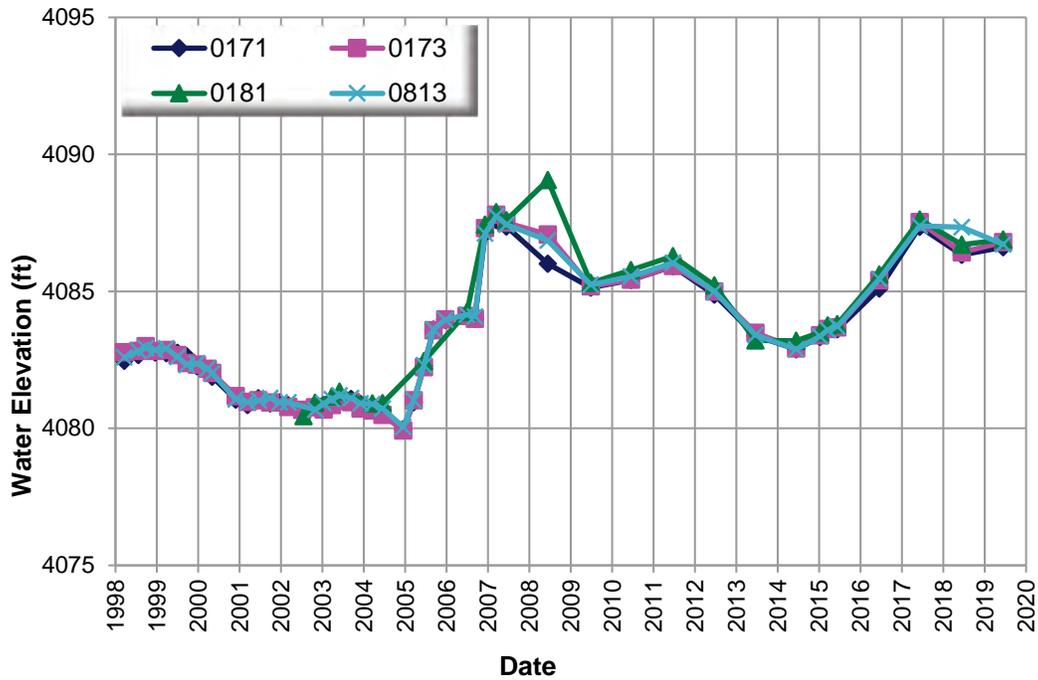


Figure 7-3. Groundwater Elevations at the Green River, Utah, Disposal Site

7.7.2 Disposal Cell Performance Monitoring

Table 7-3 presents the concentration limits for POC wells established in the LTSP. The concentration limits chosen for uranium and nitrate were the higher value from either the U.S. Environmental Protection Agency 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 TDS and concentrations of sulfate that exceed national primary and secondary drinking water regulations (DOE 1998). In accordance with the LTSP, sulfate results are compared to well-specific background concentration limits (Table 7-3). ACLs are proposed as a component of the compliance strategy in the draft GCAP after it became clear that groundwater concentrations were unlikely to meet the levels specified in the LTSP (DOE 2002). ACLs are proposed for nitrate (1000 milligrams per liter [mg/L]) and uranium (4.4 mg/L) in the draft GCAP.

Table 7-4 provides the analytical results at the POC wells for the June 2019 sampling event. Figure 7-4 through Figure 7-6 show the time-concentration plots for nitrate, sulfate, and uranium along with corresponding MCLs.

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

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

Note:

^a MCL (40 CFR 192 Table 1 Subpart A)

Table 7-4. 2019 Analytical Results for Point of Compliance Wells at the Green River, Utah, Disposal Site

Monitoring Well	Nitrate ^a (mg/L)	Sulfate (mg/L)	Uranium (mg/L)
0171	40	3900	0.1
0173	140	8100	0.039
0181	38	6500	0.019
0813	0.003	3600	0.03

Notes:

Red = equal to or exceeding LTSP-driven concentration limit

^a Nitrate = nitrate plus nitrite as nitrogen.

Nitrate concentrations continue to exceed the MCL in POC wells 0171 and 0173. The 2019 nitrate concentrations were within the range of historical values for all POC wells (Figure 7-4).

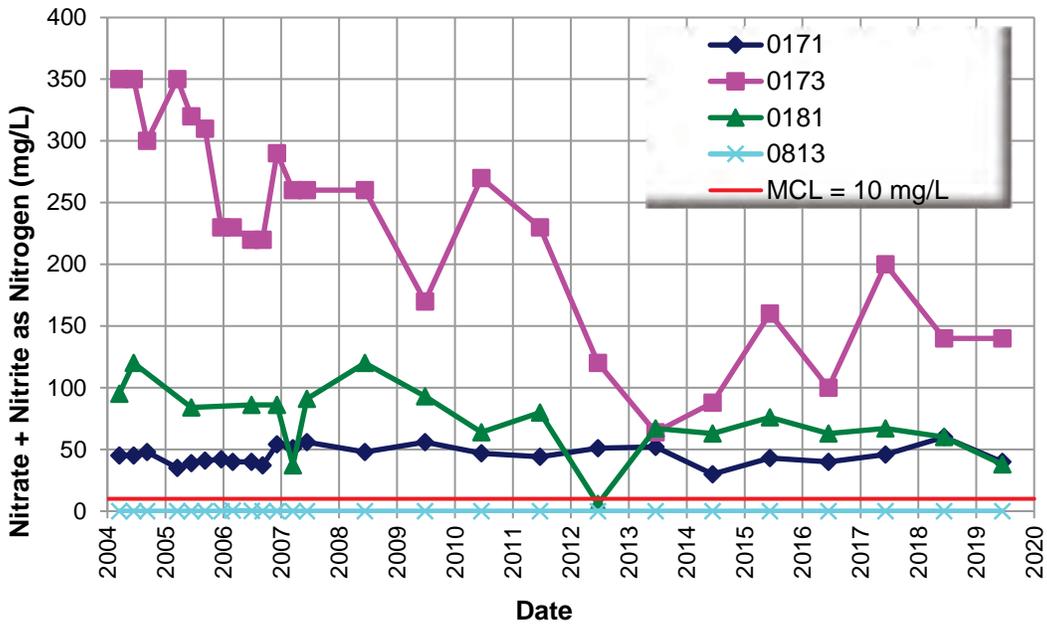


Figure 7-4. Nitrate at Point of Compliance Wells at the Green River, Utah, Disposal Site

Sulfate concentrations exceeded the LTSP background concentrations in all POC wells (Table 7-3) except POC well 0813. The 2019 sulfate concentrations were within the range of historical values for all POC wells (Figure 7-5).

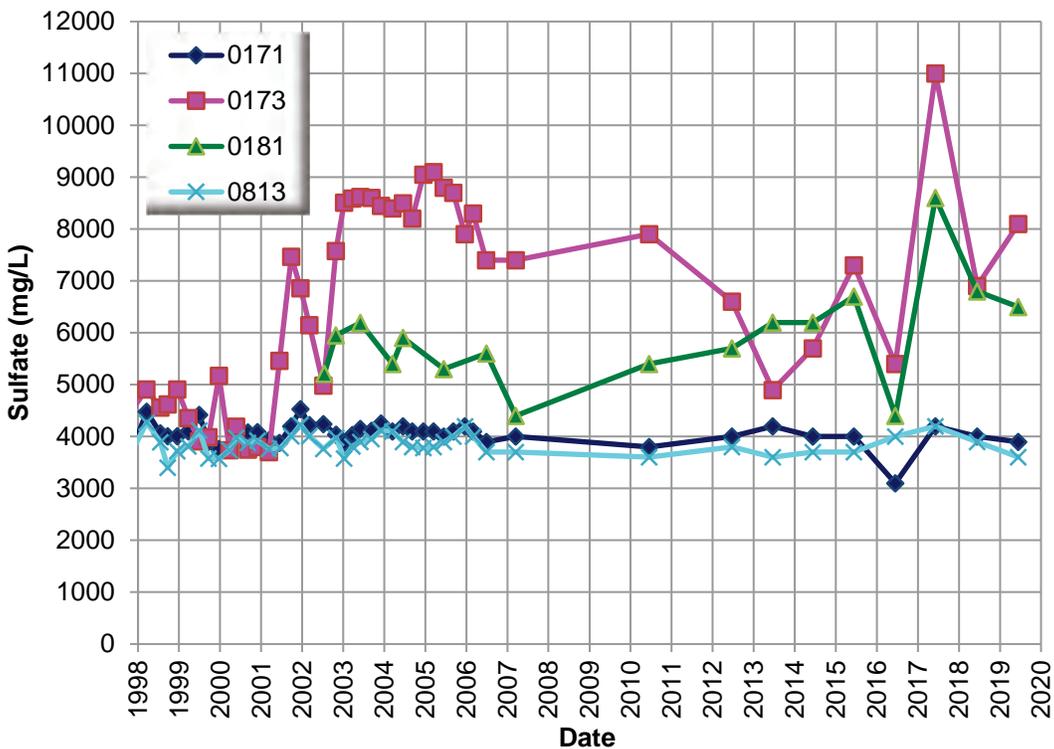


Figure 7-5. Sulfate at Point of Compliance Wells at the Green River, Utah, Disposal Site

Uranium concentrations in POC well 0171 routinely exceed the UMTRCA and LTSP concentration limits, while the other POCs remain mostly below the MCL. Well 0173 exceeded 0.044mg/L once in 2018 (Figure 7-6). Uranium concentrations at POC well 0171 have varied considerably, ranging from a low of 0.0184 mg/L in 1999 to a high of 0.14 mg/L in 2016. The 2019 uranium concentrations were within the range of historical values for all POC wells.

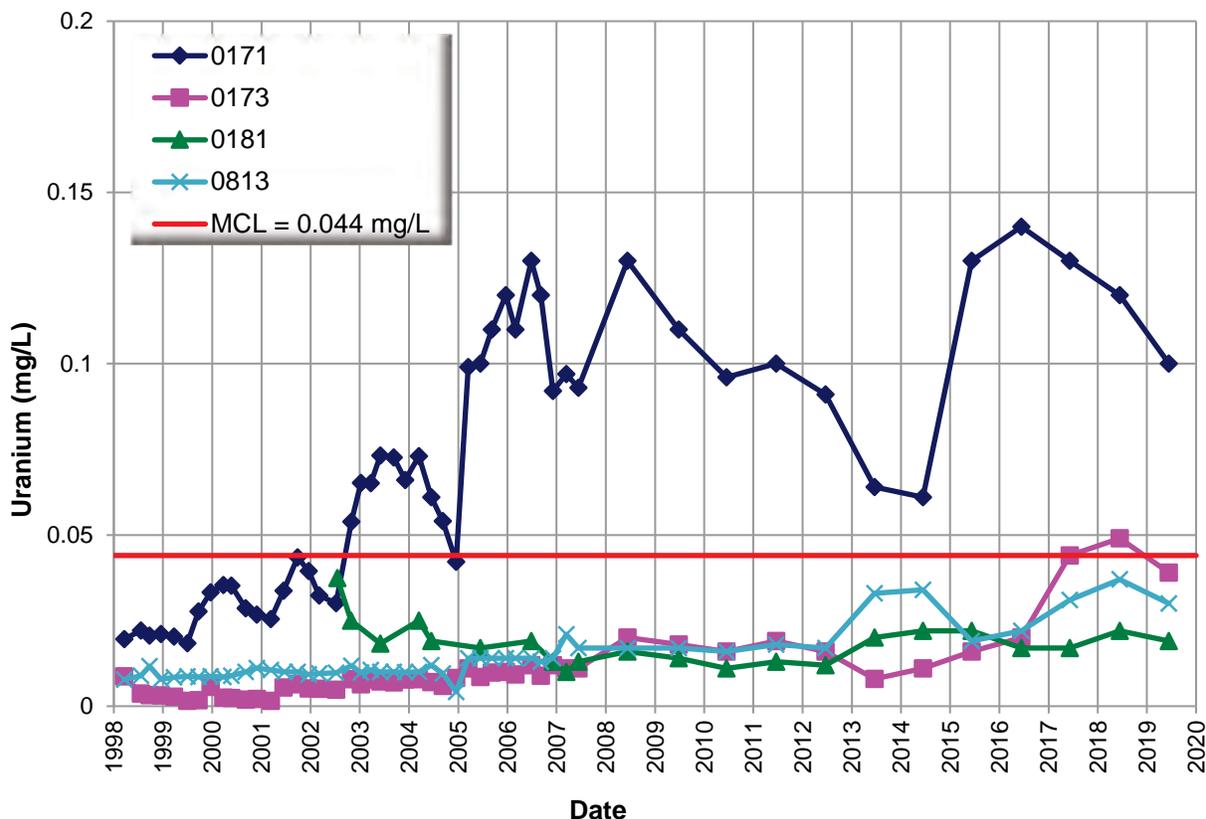


Figure 7-6. Uranium at Point of Compliance Wells at the Green River, Utah, Disposal Site

In summary, groundwater monitoring results were within the range of historical values at all POC wells with the exception of nitrate in well 0171. Groundwater monitoring and disposal cell performance evaluation will continue at the site under the requirements set forth in the LTSP until the 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), 2002. *Final Site Observational Work Plan for the Green River, Utah, UMTRA Project Site*, GJO-2002-356-TAC, Grand Junction, Colorado, September.

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

7.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	40	Northwest Security Fence Line
PL-2	180	Minor Erosion Under Southeast Security Fence Line (Repaired)
PL-3	270	Perimeter Sign P14 (Disposal Cell in Background)
PL-4	295	Monitoring Well 0181 (Abandoned Mill Buildings in Background)
PL-5	—	North Corner of Disposal Cell
PL-6	225	Southwest Side Slope of the Disposal Cell
PL-7	320	Apron Along Northeast Side of Disposal Cell
PL-8	105	Gullies Near Water Tower and Boundary Monument BM-3

Note:

— = Photograph taken vertically from above.



PL-1. Northwest Security Fence Line



PL-2. Minor Erosion Under Southeast Security Fence Line (Repaired)



PL-3. Perimeter Sign P14 (Disposal Cell in Background)



PL-4. Monitoring Well 0181 (Abandoned Mill Buildings in Background)



PL-5. North Corner of Disposal Cell



PL-6. Southwest Side Slope of the Disposal Cell



PL-7. Apron Along Northeast Side of Disposal Cell



PL-8. Gullies Near Water Tower and Boundary Monument BM-3

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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 (site) inspection on September 4, 2019. 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 needs and addressed most during the site inspection.

The most recent sampling event occurred in July 2016. The next scheduled monitoring event will occur in 2020. Groundwater monitoring results were below the site-specific uranium action level in all 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 (LTSP) (DOE 1997) in accordance with procedures established to comply with the requirements of the U.S. Nuclear Regulatory Commission 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 general license in 1997. 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 diversion channel, 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 4, 2019. The inspection was conducted by J. Lobato and D. Atkinson of the Legacy Management Support

contractor. J. Dayvault (LM site manager) and M. Cosby (Colorado Department of Public Health and Environment) 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 the need, if any, for maintenance or additional inspection and monitoring. The results of the inspection are reported in the remainder of Section 8.4.

8.4.1 Site Surveillance Features

Figure 8-1 shows the locations of site features in black, including site surveillance features and inspection areas. 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 text, and new observations identified during the 2019 annual inspection are shown in red. Inspection results and recommended maintenance activities associated with site surveillance features are included in the following subsections. Photographs to support specific observations are identified 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. The entrance sign is bolted to a perimeter fence post next to the entrance gate. The entrance sign has bullet damage but remains legible. A sticker with the new UMTRCA web address will be placed on the entrance sign during the next inspection. No maintenance needs were identified.

8.4.1.2 Perimeter Fence and Signs

A three-strand barbed-wire perimeter fence encloses the site; most of it is set along the property boundary (PL-1). The perimeter fence was intact except for one location along the north fence line (near boundary sign P24) with a broken strand that was repaired during the inspection.

Two barbed-wire gates—one on the east fence line and the other on the north fence line—provide egress from the site to offsite monitoring wells; both gates were locked.

There are 45 perimeter signs bolted to the perimeter fence posts. Several perimeter signs have bullet damage but remain legible. Perimeter signs P36, P37, P39, and P42 are constructed of plastic and should be replaced with metal signs. Perimeter signs P4–P13 along the west perimeter fence line are becoming illegible due to fading. Perimeter signs that are damaged and showing wear will be replaced over the next 2 years. No other maintenance needs were identified.

8.4.1.3 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. The base of SMK-2 has a small, insignificant crack and remains stable (PL-3). No maintenance needs were identified.

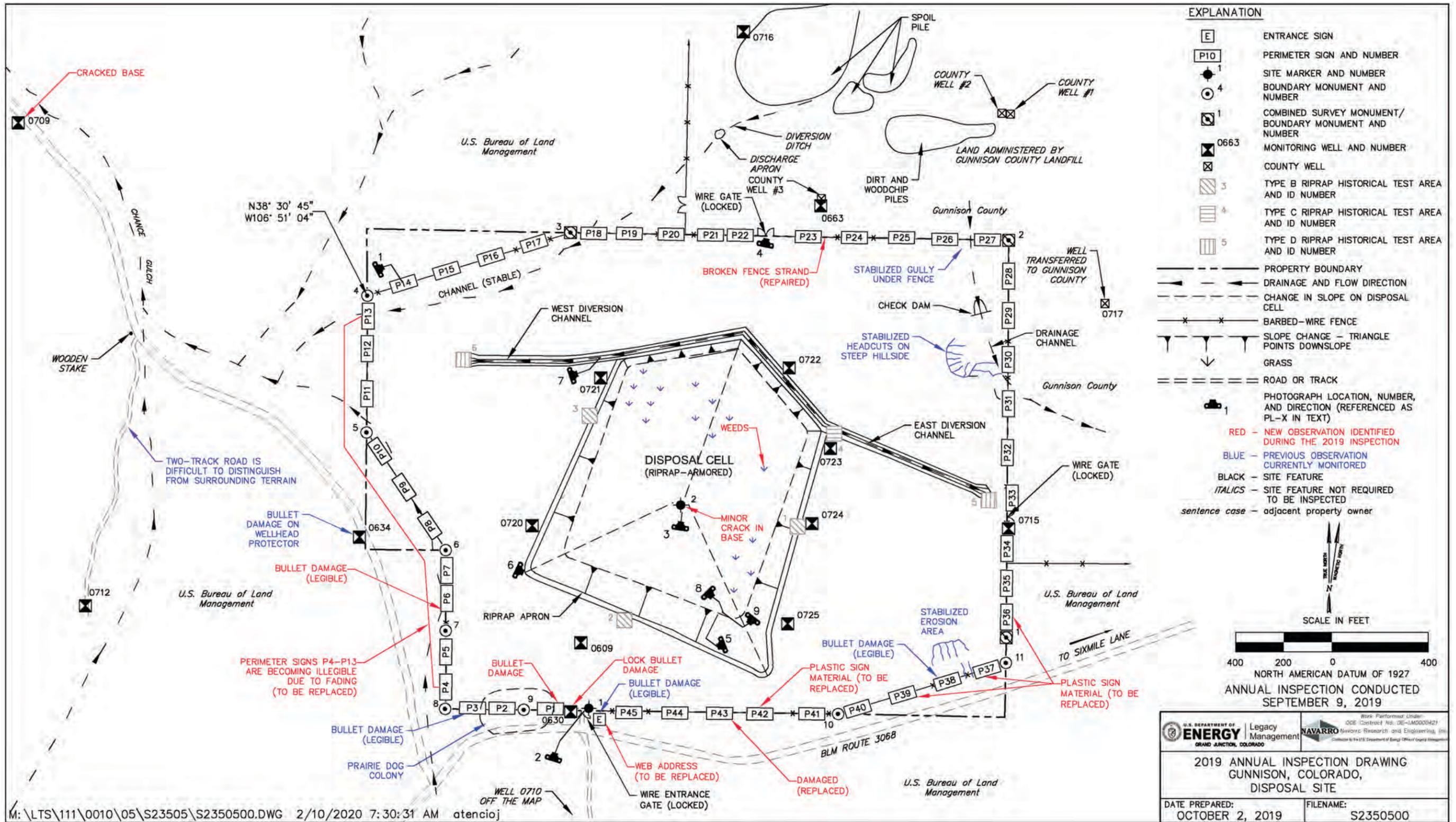


Figure 8-1. 2019 Annual Inspection Drawing for the Gunnison, Colorado, Disposal Site

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8.4.1.4 Survey and Boundary Monuments

Three combined survey and boundary monuments and eight additional boundary monuments delineate the property boundary. 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. Bullet damage is present on the lock of monitoring well 0630 and on the wellhead protector of monitoring well 0634. However, both wells are secure, and no maintenance is required. Gunnison County landfill operators have placed concrete barriers to protect monitoring well 0716, which is on landfill property, from landfill activities. The edge of an adjacent spoil pile (PL-4), although close to the concrete barriers, does not impair access to monitoring well 0716. The base of monitoring well 709 is cracked but remains stable. Inspectors will continue to monitor these features. 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

The disposal cell, completed in 1995, occupies 29 acres and is armored with basalt riprap to control erosion. 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. No maintenance needs were identified.

8.4.2.2 Disposal Cell Side Slopes, Apron, and Diversion Channels

Basalt riprap armors the disposal cell side slopes (PL-5), an apron to collect and divert precipitation runoff from the disposal cell (PL-6), and two diversion channels to protect the disposal cell from precipitation run-on (PL-7). 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; monitoring is no longer required in accordance with the LTSP because no rock degradation had been observed.

Precipitation runoff from the disposal cell occasionally ponds in a low-lying area at the southeast corner of the disposal cell; standing water was not present at the time of the inspection (PL-8). The riparian-type vegetation that has become established there indicates that the area retains moisture. Water collection in this area does not pose a problem because the disposal cell surfaces

are designed to drain to the southeast, and any water that ponds there is below the elevation of tailings placed under the engineered cover. No maintenance needs were identified.

8.4.2.3 Area Between the Disposal Cell and the Site Boundary

Reclaimed and undisturbed areas comprise the area between the disposal cell and the site boundary (PL-9). 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 continue to be stable and are naturally revegetating with native plant species. 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. Gunnison County owns the land that adjoins 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 (PL-4). Although landfill activities do not impact 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). With regard to groundwater flow, the landfill operations are upgradient from the disposal cell. The proximity of the spoil pile to monitoring well 0716 (see Figure 8-1) is the only current concern for activities that could impact a site asset. Inspectors will continue to monitor this area.

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

A broken fence strand along the north fence line (near boundary sign P24) was identified and repaired during the inspection. Perimeter signs P42, P39, P37, and P36 are constructed of plastic and will be replaced with metal signs at the next inspection. Perimeter signs P4–P13 along the west fence line are becoming illegible due to fading and will be replaced within the next couple of years. No other maintenance needs were identified.

8.7 Groundwater Monitoring

In accordance with the LTSP, 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 through 2001. Following

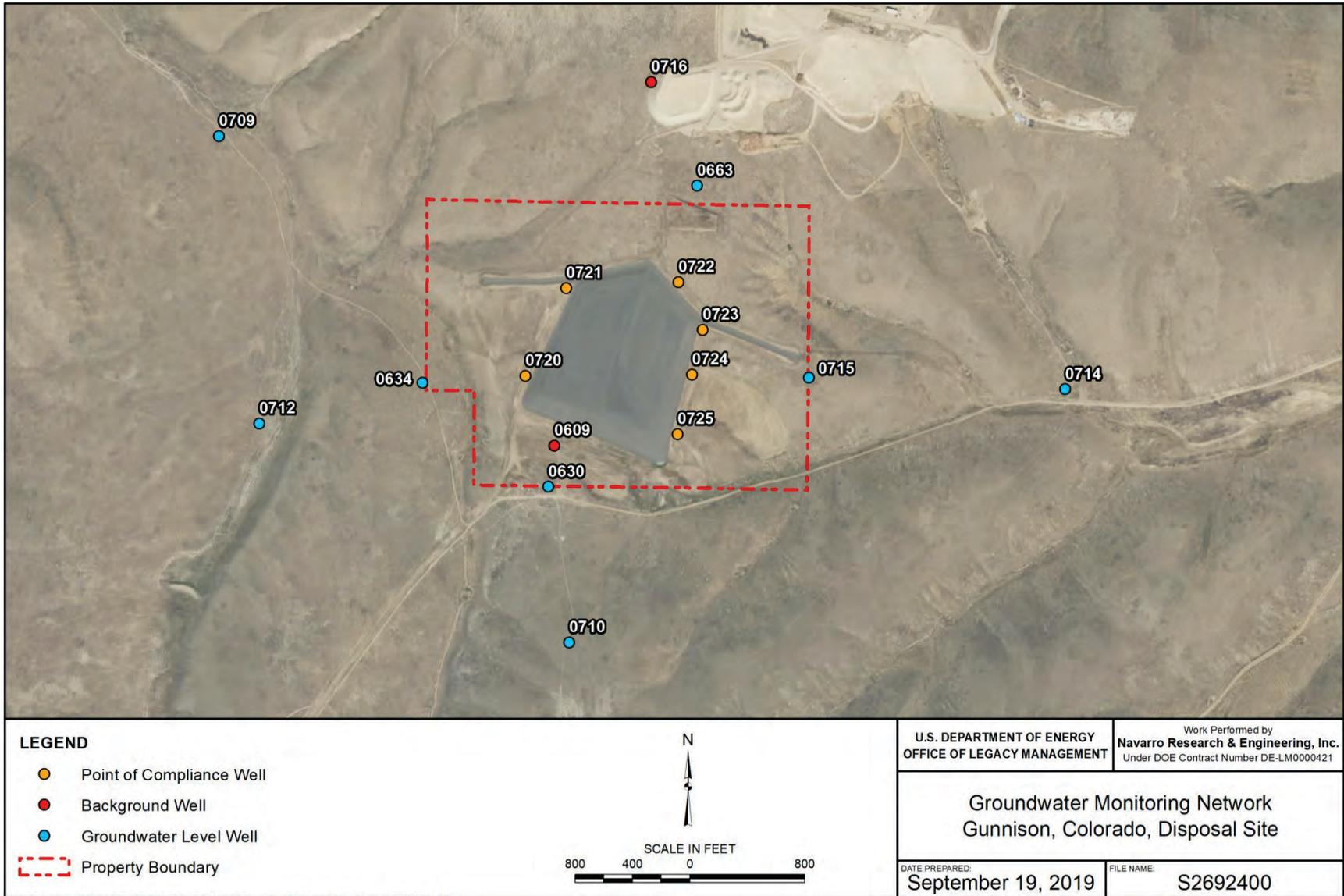
the 2001 sampling event, the monitoring frequency changed to once every 5 years. The most recent sampling event occurred in July 2016.

The groundwater monitoring network consists of 16 monitoring wells. That total includes six POC wells, two monitoring wells to monitor background groundwater quality, and eight wells to monitor groundwater levels (Table 8-2 and Figure 8-2). The indicator analyte for disposal cell performance is uranium, which was selected because of its presence in tailings pore fluid, its relatively high mobility in groundwater, and its low concentration in upgradient (background) groundwater. 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).

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

All groundwater monitoring results for the site are reported and published on the LM Geospatial Environmental Mapping System website (<http://gems.lm.doe.gov/#site=GUD>). The *2016 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites* (DOE 2016) shows the most recent monitoring results. The report shows uranium concentration was below the action level (0.013 mg/L) in all POC wells and indicates continued groundwater compliance at the Gunnison disposal site.



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

8.8 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 192.04. No need for corrective action was identified.

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.

DOE (U.S. Department of Energy), 2016. *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.

8.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	60	North Fence Line
PL-2	20	Site Marker SMK-1
PL-3	10	Small Crack in Base of Site Marker SMK-2
PL-4	10	Gunnison County Landfill Operations
PL-5	250	South Side Slope of Disposal Cell
PL-6	115	South Riprap Apron
PL-7	70	West Diversion Channel
PL-8	140	Southeast Corner of Disposal Cell
PL-9	220	Reclaimed Area Along South Fence Line



PL-1. North Fence Line



PL-2. Site Marker SMK-1



PL-3. Small Crack in Base of Site Marker SMK-2



PL-4. Gunnison County Landfill Operations



PL-5. South Side Slope of Disposal Cell



PL-6. South Riprap Apron



PL-7. West Diversion Channel



PL-8. Southeast Corner of Disposal Cell



PL-9. Reclaimed Area Along South Fence Line

9.0 Lakeview, Oregon, Disposal Site

9.1 Compliance Summary

The Lakeview, Oregon, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site (site) was inspected June 24 and June 25, 2019. No changes were observed on the disposal cell or in the associated drainage features. Inspectors identified no immediate maintenance needs or 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. The disposal cell design called for placement of specifically sized rock (riprap) to ensure continued long-term protection of the disposal cell from erosion during a severe precipitation event. The riprap gradation monitoring is performed to assess if the mean diameter (D_{50}) value of the riprap on the west side slope meets design specifications. The D_{50} value measured during the 2019 gradation monitoring is 2.56 inches, which is below the D_{50} design size range of 2.7–3.9 inches for the Type B-size side slope riprap but within the historical range of measured values. In 23 years of monitoring, the measured D_{50} value has varied above and below design specifications. During the 2019 annual inspection, 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 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 May 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 (LTSP) (DOE 1994) 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 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, 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 24 and June 25, 2019. The inspection was conducted by C. Wentz, C. Goodknight, and S. Hall of the Legacy Management Support (LMS) contractor. J. Nguyen (LM site manager), C. Mueller (LMS), G. Smith (Geo-Smith Engineering LLC), and T. Sicilia (Oregon Department of Energy), 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 the need, if any, for maintenance or additional inspection and monitoring.

9.4.1 Site Surveillance Features

Figure 9-1 shows the locations of site features in black, including site surveillance features and inspection areas. 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 text, and new observations identified during the 2019 annual inspection are shown in red. Inspection results and recommended maintenance activities associated with site surveillance features are included in the following subsections. Photographs that support specific observations are identified in the text and in Figure 9-1 by photograph location (PL) numbers. The photographs and photograph log are presented in Section 9.10.

9.4.1.1 Access Road, Entrance Gate, and Entrance Sign

Access to the site is from a gravel road that heads west from Lake County Road 2-16B. DOE was granted a perpetual easement on the approximately 1.2-mile access road between the county road and the property boundary. A lockable gate across the access road on the adjacent privately owned land limits access to the site. The entrance gate to the site is in the southeast corner of the perimeter fence (PL-1). 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-2). A pedestrian gate in the northwest corner of the site was locked and undamaged (PL-3). No maintenance needs were identified.

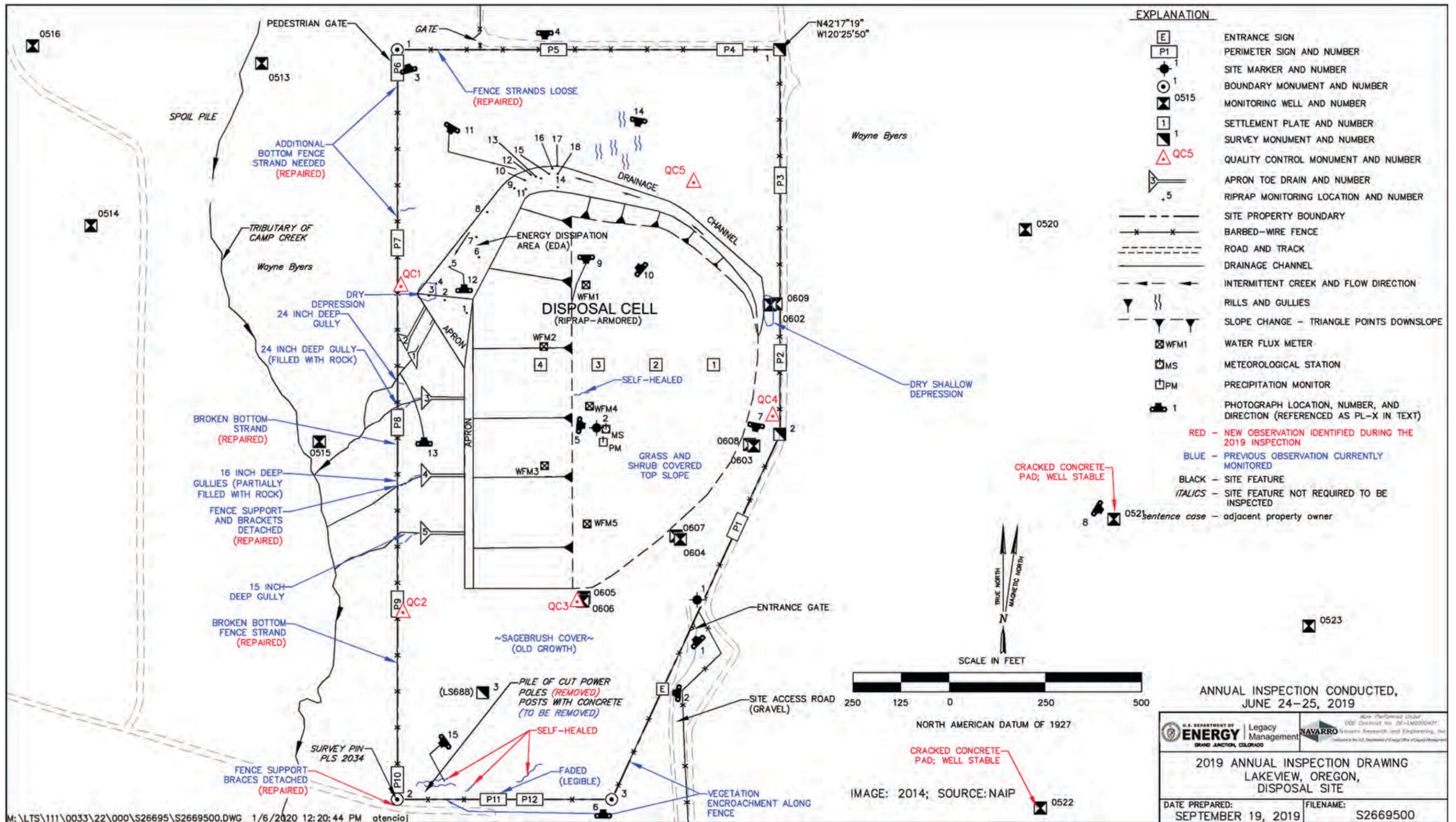


Figure 9-1. 2019 Annual Inspection Drawing for the Lakeview, Oregon, Disposal Site

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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. Repairs to the perimeter fence identified in the 2018 annual inspection were made in June 2019. During the 2019 annual inspection, inspectors confirmed the necessary repairs were made. Some vegetation is growing near, and entangled in, the perimeter fence line, but the fence appeared stable and remains functional.

There are 12 perimeter signs, attached to steel posts set in concrete, positioned along the property boundary (PL-4). Perimeter sign P11 was faded but remains legible. No 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 (PL-5) is on the top slope of the disposal cell. No maintenance needs were identified.

9.4.1.4 Survey and Boundary Monuments

Two survey monuments and three boundary monuments delineate the property boundary (PL-6). No maintenance needs were identified.

9.4.1.5 Monitoring Wells

The site has 12 downgradient groundwater monitoring wells (PL-7) and four upgradient groundwater monitoring wells offsite to the west of the site. A few of the concrete bases were cracked but the wellhead protectors remain stable (PL-8). 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 and adjacent drainage channel, aprons, and trench drains; 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, consistent with surrounding offsite areas. Riprap was observed through the soil on the top slope in several small areas during the inspection. These areas are sporadic across the top slope and are likely caused by the soil infilling the 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 be self-healed from natural weather processes. No additional changes were noted during the inspection. This minor erosion pattern is likely a natural process but could also indicate that water on the top slope is beginning to channelize, or it could be due to soil settling into the riprap voids. 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 except at the northwest corner of the disposal cell, where erosion has been observed along the top slope. No structural or disposal cell performance concerns are associated with this minor erosion because the riprap rock cover is continuous beneath the top slope soil cover, slope crests, and side slopes. No erosion was observed during the inspection at the crest of the west side slope and the disposal cell top slope, which appears to be stable (PL-9). 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 (PL-10). Inspectors will monitor the restored locations to confirm that no settlement is occurring, positive drainage is preserved, and vegetation reestablishes. 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 armoring 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 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 it was designed to do. The thickness of the riprap on the west side slope was doubled during construction due to concerns over the quality of the rock.

The riprap gradation monitoring has inherent limitations and has produced variable and uncertain sampling results. This monitoring method measures the number of rocks retained according to sieve size. Riprap measurement locations are randomly selected across the entire west side slope before each monitoring event. Particle (i.e., riprap) size distribution by rock count was collected at 20 locations, with approximately 25 rocks measured at each location. The standard method for determining D_{50} in the laboratory is by weight, not by rock gradation measurement. Also, only the upper portion of the 12-inch riprap layer is measured at each location, as the method requires that the first rock directly below the grid point is measured. The more exposed surface rocks may be more susceptible to accelerated weathering, thus conservatively skewing the data (i.e., providing a smaller D_{50} result). Furthermore, this riprap gradation determination method measures the minimum rock dimension in sieve analysis, which also conservatively skews the data.

In 2015, LM proposed to replace the annual gradation monitoring with more rigorous and focused inspection of all rills that 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 will enable LM to more proactively assess and mitigate vulnerability of potential failure points along the side slope. This proposal is currently being reviewed by NRC.

In 2019, riprap gradation monitoring was performed for the 23rd consecutive year. An evaluation of the 2019 rock size (gradation) measurement data indicates that the west side slope riprap D_{50} is 2.56 inches with a 95% confidence interval between 2.32 and 2.82 inches. The 2019 D_{50} value of 2.56 inches is within the range of D_{50} values (2.26–2.88 inches) previously measured on the side slope during the 23 years of monitoring. The D_{50} design size range is 2.7–3.9 inches for the Type B-size side slope riprap.

Figure 9-2 is a graph that shows the results of the gradation monitoring since 1997. During the 2015 annual inspection, the rock monitoring approach deviated from the normal procedure, at NRC's request, by using a preestablished monitoring grid in a subset area of the west side slope. This changed the measurement approach from random to biased, thus potentially compromising data comparability. Therefore, the 2015 data were not included on the graph of historical riprap gradation monitoring D_{50} values.

A statistical trend analysis of the D_{50} values was completed using EPA's ProUCL 5.1 statistical software (last updated June 20, 2016) (<https://www.epa.gov/land-research/proucl-software>). Both Mann-Kendall and Theil-Sen trend tests were performed to evaluate if a significant trend in rock size was present. At the 95% confidence level, no trend was observed. While the lack of a significant trend does not indicate a static D_{50} value, it does indicate that the D_{50} value has not significantly decreased in 23 years of observation.

Minor rock degradation has been observed in the EDA (PL-11) since monitoring began at the original 10 photograph locations established in 1997 and at the eight additional locations established in 2000. Annual photographic monitoring of the 18 locations for long-term rock monitoring was conducted during the 2019 inspection. In 2018, it was observed that some of the numbered rocks had faded labels, and they were repainted before the 2019 annual inspection. Location 15 was missed and will be repainted next year. The rock at photo monitoring location 5 is shown in PL-12. No significant degradation of the EDA rock has been observed since monitoring began.

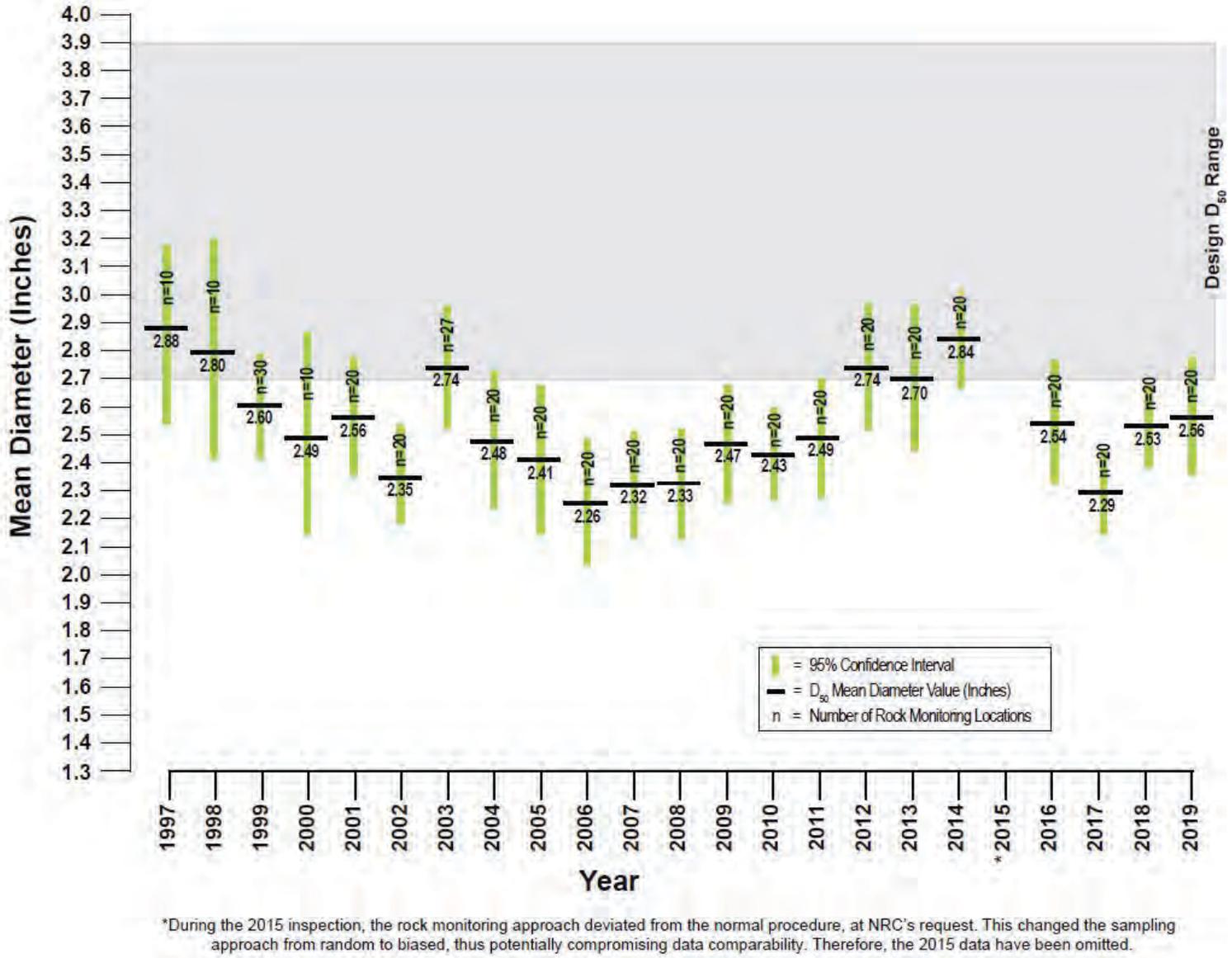


Figure 9-2. Riprap Gradation Monitoring D_{50} Values (1997–2019)

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, although the rock used in the EDA is apparently not as susceptible to this process as other rock types present on the disposal cell. Dry conditions were observed in the EDA depression during the inspection.

Small amounts of vegetation (primarily grass) have encroached on the riprap on the side slopes, on the upper (eastern) portion of the surface water 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 surface water runoff from impacting 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. Should flow obstruction become a concern in the future, maintenance will be performed. There is an area of dense, tall grass near Toe Drains 1 and 3, which suggests that conditions are periodically wetter in this area because surface water runoff is channeled there by control features. No ponded water was observed during the inspection. Increased erosion was observed near the fence line near Toe Drain 3 (PL-13). 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 the site perimeter fence. No such impacts were observed.

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-14), in a drainage area on the site north of perimeter sign P7, and in the southwest corner of the site. These gullies and rills were identified during previous annual inspections but appear to be self-healed as no significant changes were observed in 2019. The gullies do not pose a threat to disposal cell integrity, and inspectors will continue to monitor these areas. In previous years inspectors also 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 signposts with cement bases were too heavy to remove by hand (PL-15). This remaining debris does not impact site integrity; however, 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

Before the inspection, several maintenance items identified in the *2018 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites* (DOE 2019) were completed including:

- Repairing loose fence strands
- Repairing detached fence brackets and braces
- Removing cut telephone poles

Inspectors documented minor maintenance to be addressed in the future, including:

- Repainting the rock monitoring label at location number 15
- Removing the signposts with concrete bases from the southwest corner of the site

In August 2019, following the inspection, eight permanent quality control monuments were installed at the site in preparation for a baseline aerial survey of the disposal cell. The quality control monument locations are shown in Figure 9-1. 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 9-3). 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 (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 hazardous 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

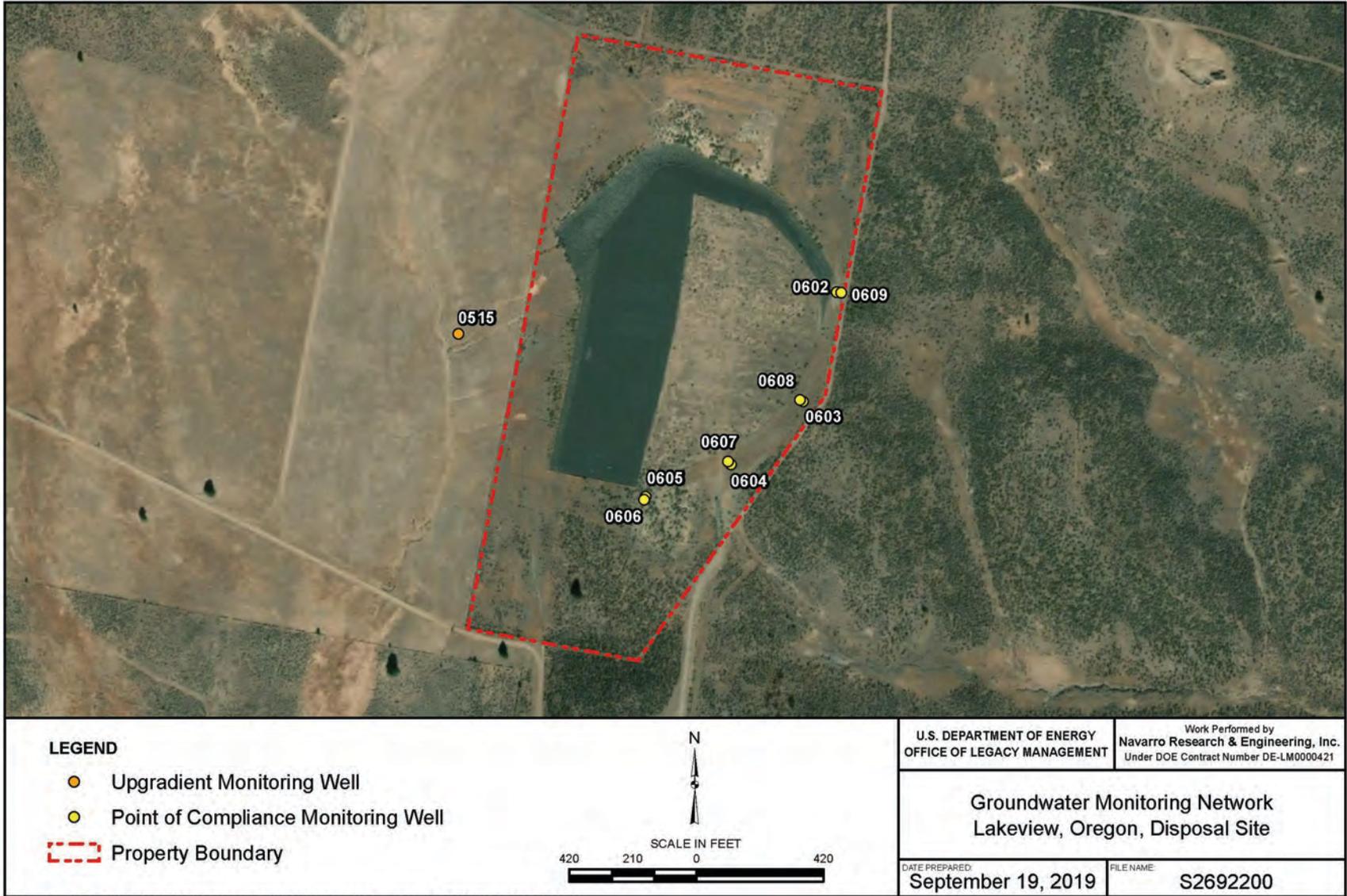


Figure 9-3. Groundwater Monitoring Network Lakeview, Oregon, Disposal Site

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 prior 2014 results (Figure 9-4), all cadmium concentration results were below the laboratory detection limit of 0.000083 mg/L, and uranium concentrations remained stable or have slightly increased (Figure 9-5). The next disposal cell performance monitoring is scheduled for 2024.

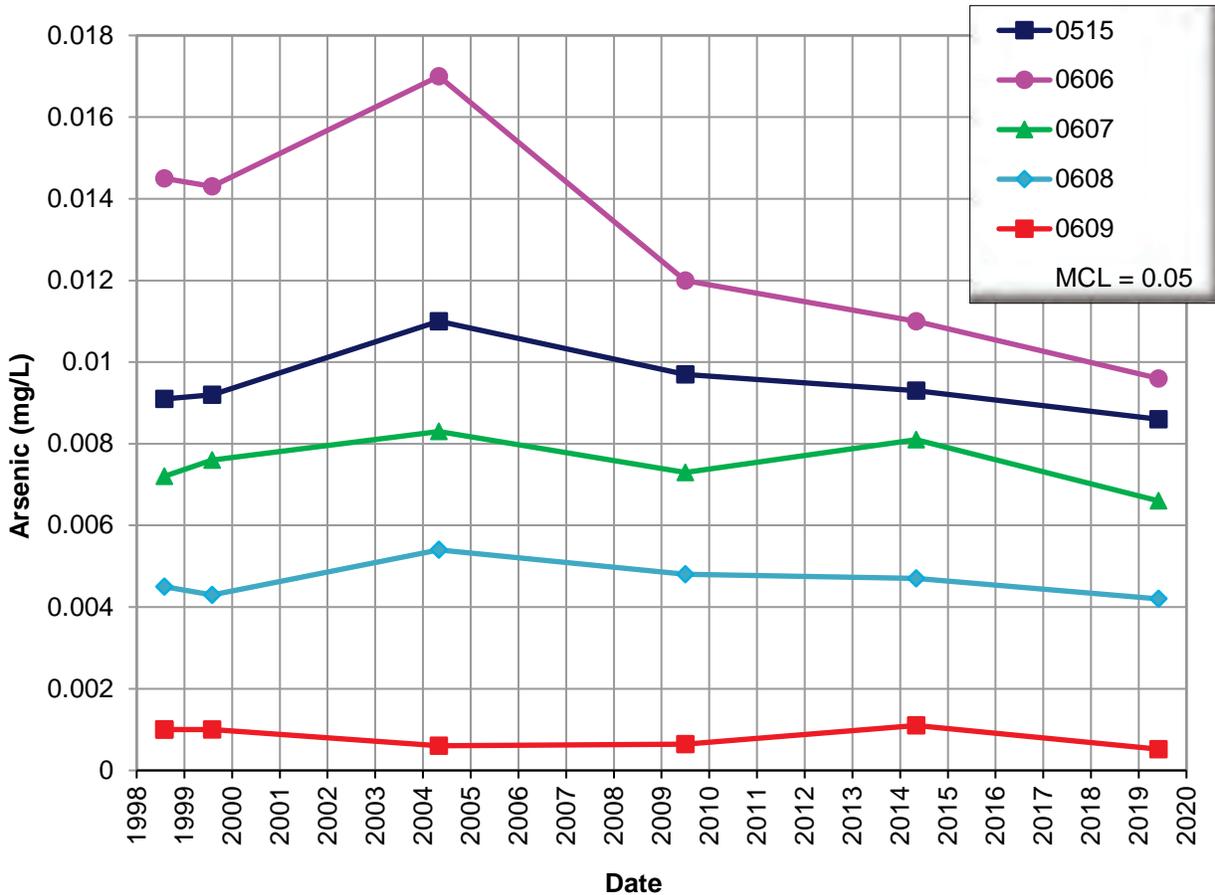


Figure 9-4. Arsenic in Groundwater at the Lakeview Disposal Site
(Arsenic MCL is not Shown Because the MCL is Significantly Higher Than Groundwater Monitoring Concentrations)

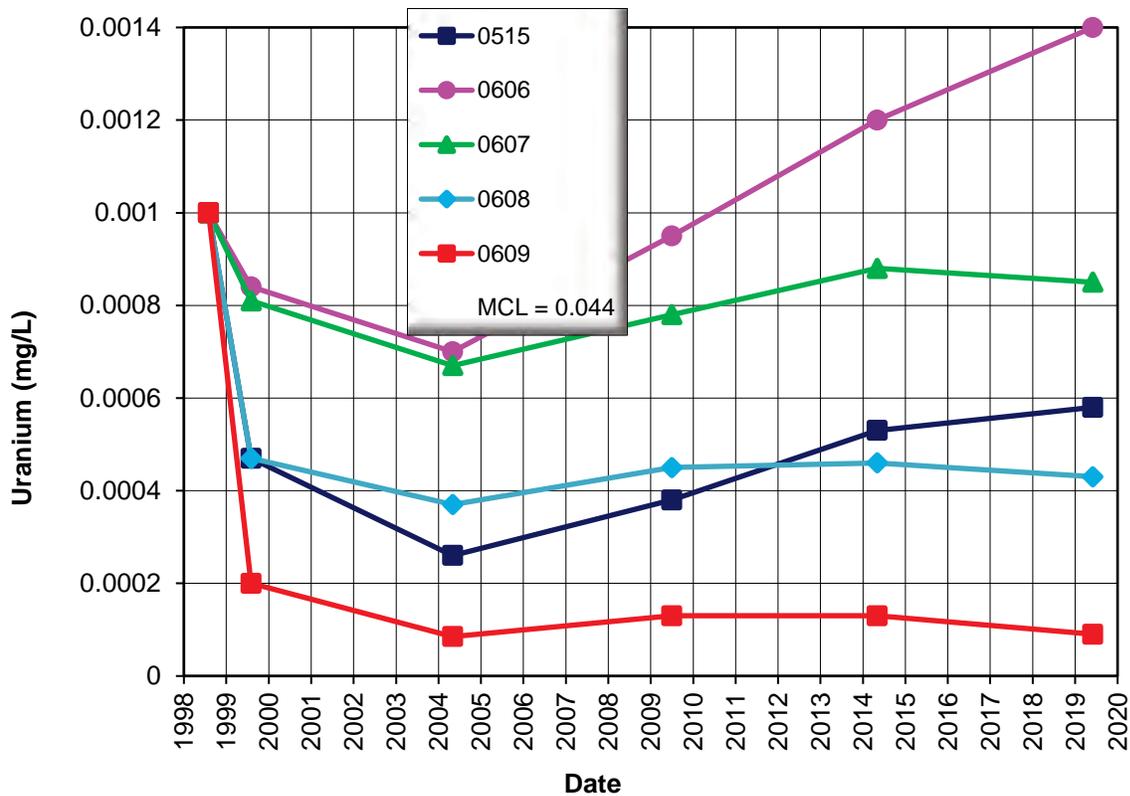


Figure 9-5. Uranium in Groundwater at the Lakeview Disposal Site
 (Uranium MCL is not Shown Because the MCL is Significantly Higher Than Groundwater Monitoring Concentrations)

All groundwater monitoring results for the site are reported and published on the LM Geospatial Environmental Mapping System (GEMS) website (<http://gems.lm.doe.gov/#site=LKD>). The monitoring results at the site for arsenic, cadmium, and uranium continue to remain below their respective MCLs. 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.

9.8 Corrective Action

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

9.9 References

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

9.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	315	Entrance Gate
PL-2	275	Entrance Sign
PL-3	345	Boundary Monument BM-1 and Pedestrian Gate
PL-4	180	Perimeter Sign P5 with Disposal Cell in Background
PL-5	95	Site Marker SMK-2 with Meteorological Station in Background
PL-6	—	Boundary Monument BM-3
PL-7	190	Monitoring Wells 0603 and 0608
PL-8	120	Monitoring Well 0521 with Cracked Concrete Base
PL-9	180	Top Edge of West Side Slope
PL-10	310	Reclaimed Cover Study Test Plot
PL-11	210	Energy Dissipation Area Downstream of Drainage Channel North of Disposal Cell
PL-12	—	(a) Riprap Monitoring Location Number 5 in Energy Dissipation Area—2019 (b) Riprap Monitoring Location Number 5 in Energy Dissipation Area—2004 Photo for Comparison
PL-13	—	Gully Downgradient of Toe Drain 3
PL-14	190	Erosion Rills North of Disposal Cell
PL-15	235	Abandoned Metal Signposts with Concrete Bases

Note:

— = Photograph taken vertically from above.



PL-1. Entrance Gate



PL-2. Entrance Sign



PL-3. Boundary Monument BM-1 and Pedestrian Gate



PL-4. Perimeter Sign P5 with Disposal Cell in the Background



PL-5. Site Marker SMK-2 with Meteorological Station in Background



PL-6. Boundary Monument BM-3



PL-7. Monitoring Wells 0603 and 0608



PL-8. Monitoring Well 0521 with Cracked Concrete Base



PL-9. Top Edge of West Side Slope



PL-10. Reclaimed Cover Study Test Plot



PL-11. Energy Dissipation Area Downstream of Drainage Channel North of Disposal Cell

Photos continue on the next page.



PL-12. (a) Riprap Monitoring Location Number 5 in Energy Dissipation Area—2019



PL-12. (b) Riprap Monitoring Location Number 5 in Energy Dissipation Area—2004 Photo for Comparison



PL-13. Gully Downgradient of Toe Drain 3



PL-14. Erosion Rills North of Disposal Cell



PL-15. Abandoned Metal Signposts with Concrete Bases

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10.0 Lowman, Idaho, Disposal Site

10.1 Compliance Summary

The Lowman, Idaho, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site (site) was inspected on June 13, 2019. No changes were observed on the disposal cell or in the associated drainage features. Inspectors identified a minor maintenance need but found no cause for a follow-up inspection. Groundwater monitoring is not required and was discontinued in 2004.

10.2 Compliance Requirements

Requirements for long-term surveillance and maintenance of the site are specified in the site-specific Long-Term Surveillance Plan (LTSP) (DOE 2005) 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)
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, 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 signs, site markers, and survey and boundary monuments.

10.4 Inspection Results

The site, 0.5 mile east of Lowman, Idaho, was inspected on June 13, 2019. The inspection was conducted by C. Boger, D. Johnson, and D. Marshall of the Office of Legacy Management (LM) Support contractor. T. Jasso (LM site manager), D. Nygard (Idaho Department of Environmental Quality), and P. Rekow (vegetation control subcontractor) attended the inspection. The purposes of the inspection were to confirm the integrity of visible features at the site, identify changes in conditions that might affect conformance with the LTSP, and evaluate the need, if any, for maintenance or additional inspection and monitoring.

10.4.1 Site Surveillance Features

Figure 10-1 shows the locations of site features in black, including site surveillance features and inspection areas. Site features that are present but not required to be inspected are shown in italic font, and new observations identified during the 2019 annual inspection are shown in red. Observations from previous inspections that are currently monitored are shown in blue text. There were no new observations in 2019. Inspection results and recommended maintenance activities associated with site surveillance features are described in the following subsections. Photographs to support specific observations are identified 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

Access to the site is at the end of a gravel road about 650 feet (ft) north of Idaho Highway 21. Entrance to the site is through a locked steel gate on the site access road about 150 ft from the highway. The site is not fenced, but the topography and forest vegetation prevent vehicle access around the entrance gate and along the property boundary. The entrance gate was locked and functional, the access road was passable, and the entrance sign was present and legible (PL-1). 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 (P2, P3, P4, P13, and P15) have bullet damage but remain legible. Perimeter sign P3 is rotated about 90 degrees from its original position, but it continues to be legible and noticeable. Perimeter sign P7 is slightly bent from tree fall 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-2) is on the top slope of the disposal cell. Lichen is growing on the surface of both site markers, but it is easily removable by hand and does not detract from the legibility of the markers. No maintenance needs were identified.

10.4.1.4 Survey and Boundary Monuments

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

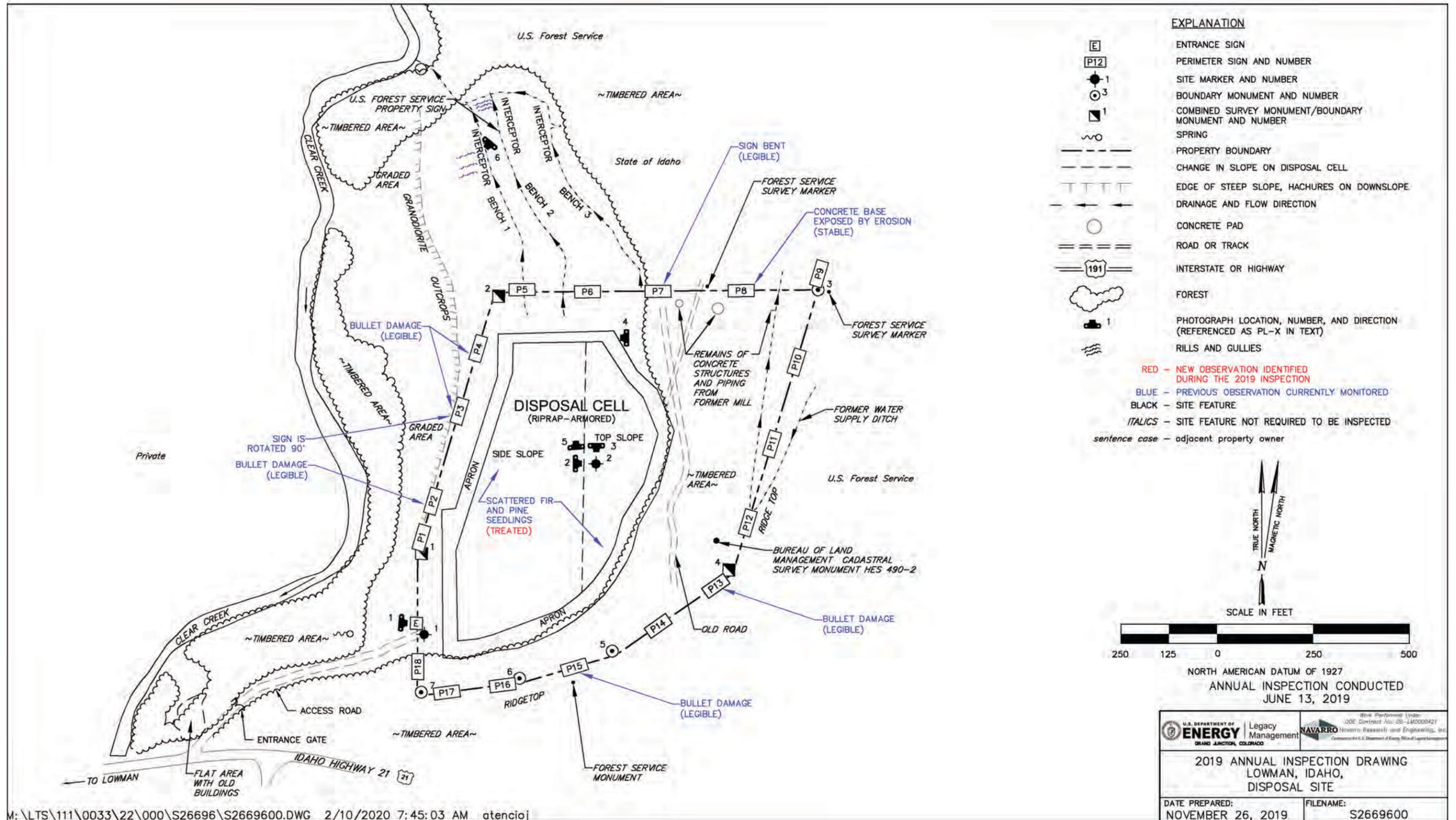


Figure 10-1. 2019 Annual Inspection Drawing for the Lowman, Idaho, Disposal Site

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10.4.2 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 top and side slope 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 Slope of the Disposal Cell

The disposal cell, completed in 1991, occupies 8.29 acres. The disposal cell top and side slope are armored with basalt riprap to control erosion (PL-3). An apron of larger riprap surrounds the disposal cell on all sides (PL-4). There was no evidence of erosion, settling, slumping, rock degradation, or other modifying processes that might affect the integrity of the disposal cell.

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—would be a best management practice. Unlike the shrubs and other vegetation growing on the disposal cell, mature conifers could potentially become uprooted during windstorms and damage the surface of the disposal cell. Numerous ponderosa pine trees were observed on the disposal cell top and side slopes and were cut down and left in place in September 2018 following the inspection (PL-5). Other plants growing on the disposal cell were not removed, as they do not present a physical threat to the integrity of the disposal cell. Additional ponderosa pine seedlings that were not eradicated in 2018 were identified during the inspection and treated in 2019 following the inspection. 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 ponderosa pines, shrubs, and grasses. Several features from the historical mining operations remain on the steep hillside east of the disposal cell, including a water-supply ditch and the remains of a water piping system. 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 changes were observed in the area across Clear Creek to the west, where there are several summer cabins and campsites. The U.S. Forest Service, an office of USDA, manages the areas east and south of the site, and those areas remain visually unchanged from previous inspections. The area along Highway 21 east of the site does not show evidence of new development.

The reclaimed area north of the disposal cell and outside the site boundary is owned by the State of Idaho. The area is steep and was once highly eroded; today it is slowly becoming

revegetated. LM installed three interceptor benches across the steep slope in this area in 1998 to intercept runoff, collect it in an armored collection ditch, and route it offsite into Clear Creek. Over the years, minor erosion has breached the benches in several locations, and LM has conducted repairs on numerous occasions, most recently in October 2016. The three interceptor benches (PL-6) and a collection ditch are inspected annually to ensure that erosion in this area does not affect overall site stability. In 2019, inspection of the 2016 repairs showed they remain intact, and LM will continue to inspect as the vegetation continues to establish.

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

Ponderosa pine seedlings on the disposal cell that were not eradicated by 2018 treatment were retreated in 2019 during routine noxious weed treatment activities following the annual inspection. No other maintenance needs were identified.

10.7 Emergency Response

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

10.8 Environmental Monitoring

In accordance with the LTSP, groundwater monitoring is not required and was discontinued in 2004. Groundwater monitoring is not required because (1) the disposal cell is performing as designed, and (2) the groundwater monitoring program demonstrated that the site is in compliance with groundwater protection standards and that 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*, DOE-LM/GJ771-2005, Rev. 2, January.

10.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	95	Entrance Sign
PL-2	—	Site Marker SMK-2
PL-3	180	Disposal Cell Top Slope, View South
PL-4	270	North Apron of Disposal Cell
PL-5	355	Treated and Fallen Ponderosa Pine
PL-6	220	Bench 1 Erosion

Note:

— = Photograph taken vertically from above.



PL-1. Entrance Sign



PL-2. Site Marker SMK-2



PL-3. Disposal Cell Top Slope, View South



PL-4. North Apron of Disposal Cell



PL-5. Treated and Fallen Ponderosa Pine



PL-6. Bench 1 Erosion

11.0 Maybell, Colorado, Disposal Site

11.1 Compliance Summary

The Maybell, Colorado, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site (site) was inspected on September 4, 2019. 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.

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 (LTSP) (DOE 2008) 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, 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 4, 2019. The inspection was conducted by J. Cario and S. Hall, of the Office of Legacy Management (LM) Support contractor. J. Nguyen (LM site manager), J. Doebele (Colorado Department of Public Health and Environment), and R. Evans (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 the need, if any, for maintenance or additional inspection and monitoring.

11.4.1 Site Surveillance Features

Figure 11-1 shows the locations of site features in black, including site surveillance features and inspection areas. 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 text, and new observations identified during the 2019 annual inspection are shown in red. Inspection results and recommended maintenance activities associated with site surveillance features are included in the following subsections. Photographs to support specific observations are identified 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 (and beyond, 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 (PL-1). The second gate is between perimeter signs P3 and P4 in the northwest corner of the property. Both gates were locked and functional. The entrance sign is near the entrance gate and is mounted on a T-post in the perimeter fence. The entrance sign has bullet damage but remains legible. No maintenance needs were identified.

11.4.1.2 Perimeter Fence and Signs

To facilitate land management by LM, 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. As a result, minor damage to the perimeter fence periodically occurs. Perimeter fence strands were twisted in one location (PL-2) and were repaired following the inspection.

There are 26 perimeter signs. On the north, west, and south sides of the site, perimeter signs are attached to T-posts in the perimeter fence. On the east 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 (PL-3). Several of the perimeter signs along the dirt road north and west of the site (P5, P6, P8, P11, P25, and P26) have bullet damage but remain legible. No other maintenance needs were identified.

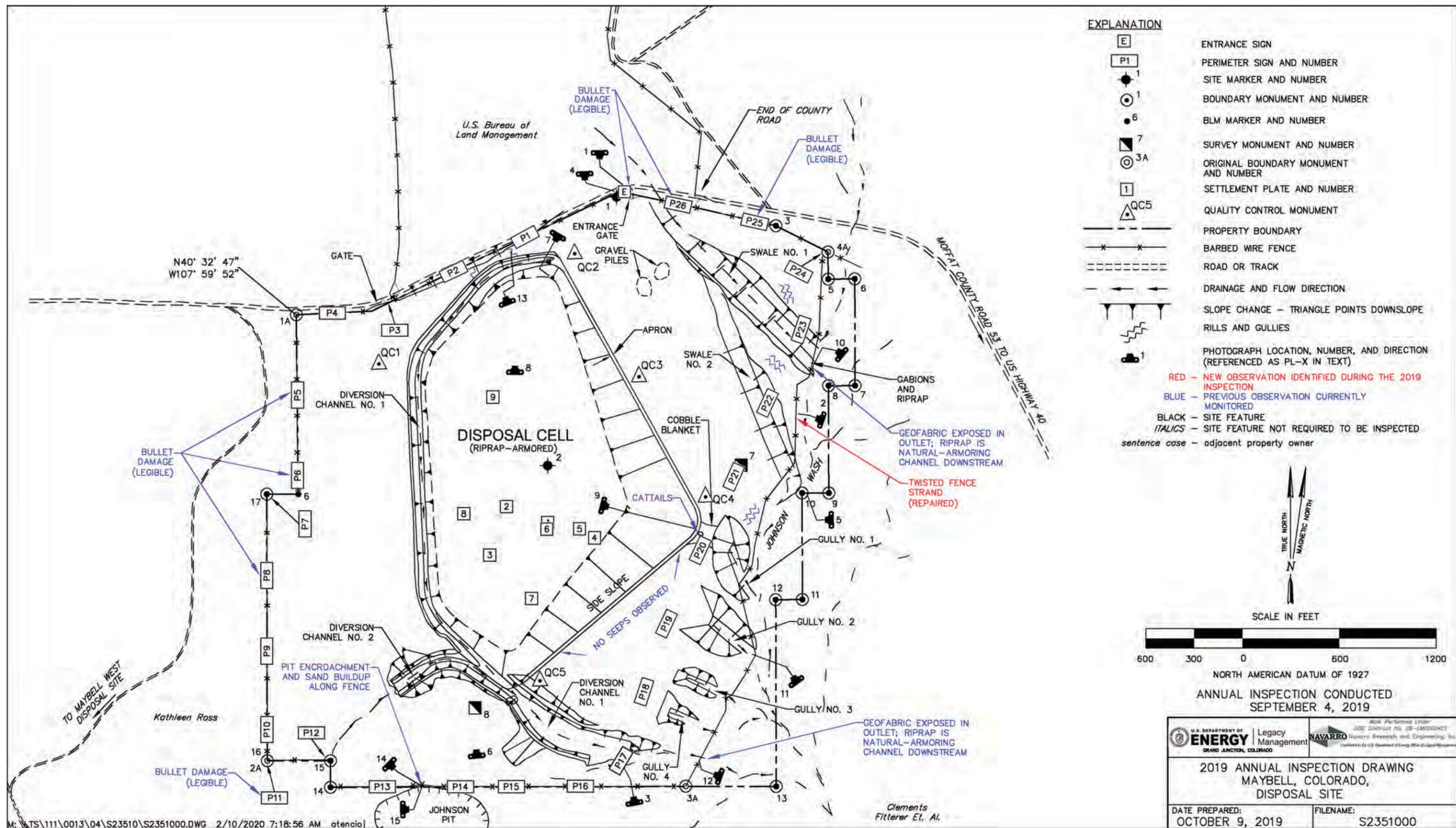


Figure 11-1. 2019 Annual Inspection Drawing for the Maybell, Colorado, Disposal Site

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11.4.1.3 Site Markers

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

11.4.1.4 Survey and Boundary Monuments

The site has two survey monuments. Survey monument SM-7 is on the bench above Johnson Wash just north of perimeter sign P21, and survey monument SM-8 is south of the disposal cell on the bench above Diversion Channel No. 2. The two survey monuments were not inspected during the inspection but were confirmed to be present and intact during a subsequent site visit. Seventeen boundary monuments delineate the property boundary (PL-5). 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. The disposal cell is armored with riprap to control erosion and deter animal and human intrusion (PL-6 and PL-7). There was no evidence of erosion, settling, slumping, rock degradation, or other modifying processes that might affect the integrity of the disposal cell. Scattered shallow-rooted plants continue to establish on the disposal cell top and side slopes (PL-8); these plants do not affect the integrity of the cell. Deep-rooted plants and noxious weeds are controlled as required by the LTSP.

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. Cattails continue to grow at the toe of the east corner of the disposal cell, indicating the presence of moisture (PL-9). Surface runoff from the disposal cell discharges at this location, and standing water has been observed in this area during past inspections; no standing water was noted during the 2019 inspection. A 2003 laboratory analysis of evaporite minerals from this location confirmed that no constituents attributable to the disposal cell contents were present. No other maintenance needs were identified.

11.4.2.2 Other Areas Inside the Site Boundary

The 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, swales, and gullies are performing as designed (PL-10 and PL-11). Erosion directly downgradient of the

outlets of Diversion Channel No. 1 and Swale No. 1 that has exposed the underlying geofabric had not changed significantly (PL-12 and PL-10). Riprap placed within the outlets continues to provide protection against headcutting. Minor rills adjacent to Swale No. 1 and Gully No. 1 continue to stabilize due to 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 (PL-13). These occurrences of erosion do not threaten the disposal cell, and there was no evidence of sediment moving offsite into Johnson Wash. No maintenance needs were identified.

11.4.2.3 Outlying Area

The area 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 referred to as the Johnson Pit (PL-14). Over time, slumping of the pit wall resulted in the pit encroaching several feet onto what is now DOE property. This encroachment presents no threat to the integrity of the disposal cell and occurred before reclamation and transfer of the site to DOE for long-term surveillance and maintenance. This encroachment is visually monitored annually; it is periodically documented with photographs to assess whether there is any further slumping of the pit wall and to verify the integrity and functionality of the perimeter fence. There was no evidence of any additional encroachment of the pit onto the site at the time of the inspection. 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

Inspectors documented minor maintenance needs that were completed following the inspection, including:

- Spraying noxious weeds and deep-rooted plants on the disposal cell
- Minor repairs to the perimeter fence (twisted fence strand)

No other immediate 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 reasonably 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 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, annual visual inspections are conducted to verify the continued health of the onsite vegetation and to ensure that undesirable plant species (deep-rooted plants on the disposal cell cover and noxious weeds) do not proliferate on the site. Minor occurrences of noxious weeds and deep-rooted plants were noted on the disposal cell during the inspection. Annual noxious weed treatment will continue. 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 continued increases in diversity and density.

11.9 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*.

DOE (U.S. Department of Energy), 2008. *Long-Term Surveillance Plan for the Maybell, Colorado (UMTRCA Title I) Disposal Site, Moffat County, Colorado*, DOE-LM/1605-2008, Revision 4, April.

Janosko, G.S., 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, U.S. Department of Energy Grand Junction Office, January 5.

11.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	180	Entrance Gate and Sign with Disposal Cell in Background
PL-2	290	Twisted Perimeter Fence Strands (Repaired)
PL-3	350	Perimeter Sign P17
PL-4	—	Site Marker SMK-1
PL-5	270	Boundary Monument BM-10 with Outlet to Swale No. 2 and Disposal Cell in Background
PL-6	355	Disposal Cell with Diversion Channel No. 1 in Foreground
PL-7	210	Top Slope of Disposal Cell
PL-8	—	Milkweed Plant on Top Slope of Disposal Cell
PL-9	105	Southeast Side Slope of Disposal Cell Side with Cobble Blanket in Background
PL-10	310	Exposed Geotextile at Outlet to Swale No. 1
PL-11	325	Outlet to Gully No. 2
PL-12	290	Perimeter Fence near Outlet to Diversion Channel No. 1
PL-13	340	Minor Erosion Along Northern Perimeter Fence
PL-14	135	East Portion of Johnson Pit
PL-15	90	Sand Buildup Around Perimeter Fence near Johnson Pit

Note:

— = Photograph taken vertically from above.



PL-1. Entrance Gate and Sign with Disposal Cell in Background



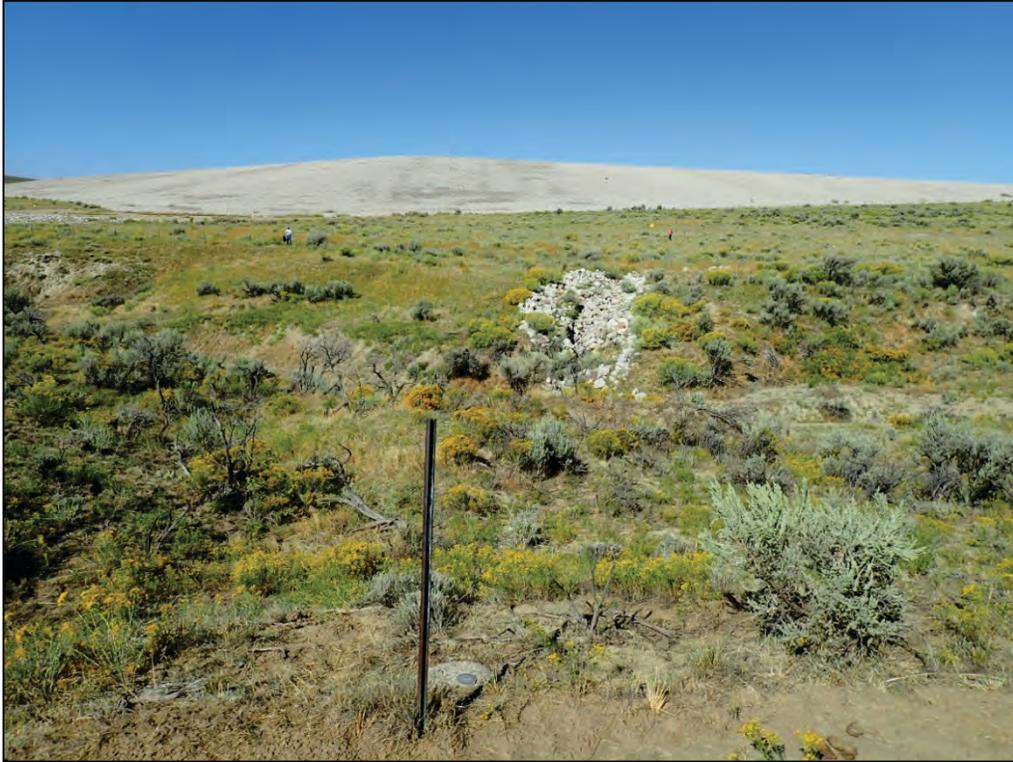
PL-2. Twisted Perimeter Fence Strands (Repaired)



PL-3. Perimeter Sign P17



PL-4. Site Marker SMK-1



PL-5. Boundary Monument BM-10 with Outlet to Swale No. 2 and Disposal Cell in Background



PL-6. Disposal Cell with Diversion Channel No. 1 in Foreground



PL-7. Top Slope of Disposal Cell



PL-8. Milkweed Plant on Top Slope of Disposal Cell



PL-9. Southeast Side Slope of Disposal Cell Side with Cobble Blanket in Background



PL-10. Exposed Geotextile at Outlet to Swale No. 1



PL-11. Outlet to Gully No. 2



PL-12. Perimeter Fence near Outlet to Diversion Channel No. 1



PL-13. Minor Erosion Along Northern Perimeter Fence



PL-14. East Portion of Johnson Pit



PL-15. Sand Buildup Around Perimeter 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 (site) was inspected on April 30, 2019. Depressions in the riprap cover identified during the 2016 annual site inspection continue to be observed along lower portions of the disposal cell's northeast side slope and north side slope (as identified in 2018 inspections). Inspectors identified several minor maintenance needs and conducted follow-up inspections.

In response to the observed depressions, the U.S. Department of Energy (DOE) Office of Legacy Management (LM) has continued investigations and performed geotechnical sampling and materials testing (GSMT) on the disposal cell side slope cover components in April 2019. Data obtained through the GSMT will be used to identify possible causes for the cover degradation features that have been observed at the site. Additionally, interim radon barrier protection (IRBP) was implemented at GSMT sampling areas that had radon barrier degradation. A series of test pits and one test strip were mechanically excavated and supplemented with a moisture-conditioned, bentonite-amended granular material to reconstruct the areas where radon barrier material had been eroded. All test areas were systematically screened for gamma radiation, and no elevated readings were observed.

No evidence of a breach through the radon barrier has been identified, and the site remains protective of human health and the environment. Efforts to evaluate the cause(s) of the erosional features are in progress, and an interim cover protection (ICP) action was completed in September 2019.

LM conducted annual observational monitoring consisting of photographic documentation and observational description of seven designated seeps during the annual inspection. Seeps 0251 and 0264 were damp, and Seep 0248 exhibited typical conditions and was dripping. Upgradient (background) Seep 0261 was flowing; the remaining seeps were dry. Ephemeral drainages along the perimeter of the site were wet. Gypsum Creek had some areas of flowing surface water and contained evaporites throughout dry areas within and leading to its flow path. 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 (LTSP) (DOE 2007) 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 the 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, 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 April 30, 2019. The inspection was conducted by S. Hall, K. Lott, J. Manée, and D. Miller of the Legacy Management Support (LMS) contractor. A. Denny (LM site manager), and J. Tallbull (Navajo Nation Abandoned Mine Lands/Uranium Mill Tailings Remedial Action) 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 the need, if any, for maintenance or additional inspection and monitoring.

12.4.1 Site Surveillance Features

Figure 12-1 shows the locations of site features in black, including site surveillance features and inspection areas. Site features that are present but not required to be inspected are shown in italics. Observations from previous inspections that are currently monitored are shown in blue text, and new observations identified during the 2019 annual inspection are shown in red. Inspection results and recommended maintenance activities associated with site surveillance features are included in the following subsections. Photographs to support specific observations are identified in the text and in Figure 12-1 by photograph location (PL) numbers. The photographs and photograph log are presented in Section 12.10.

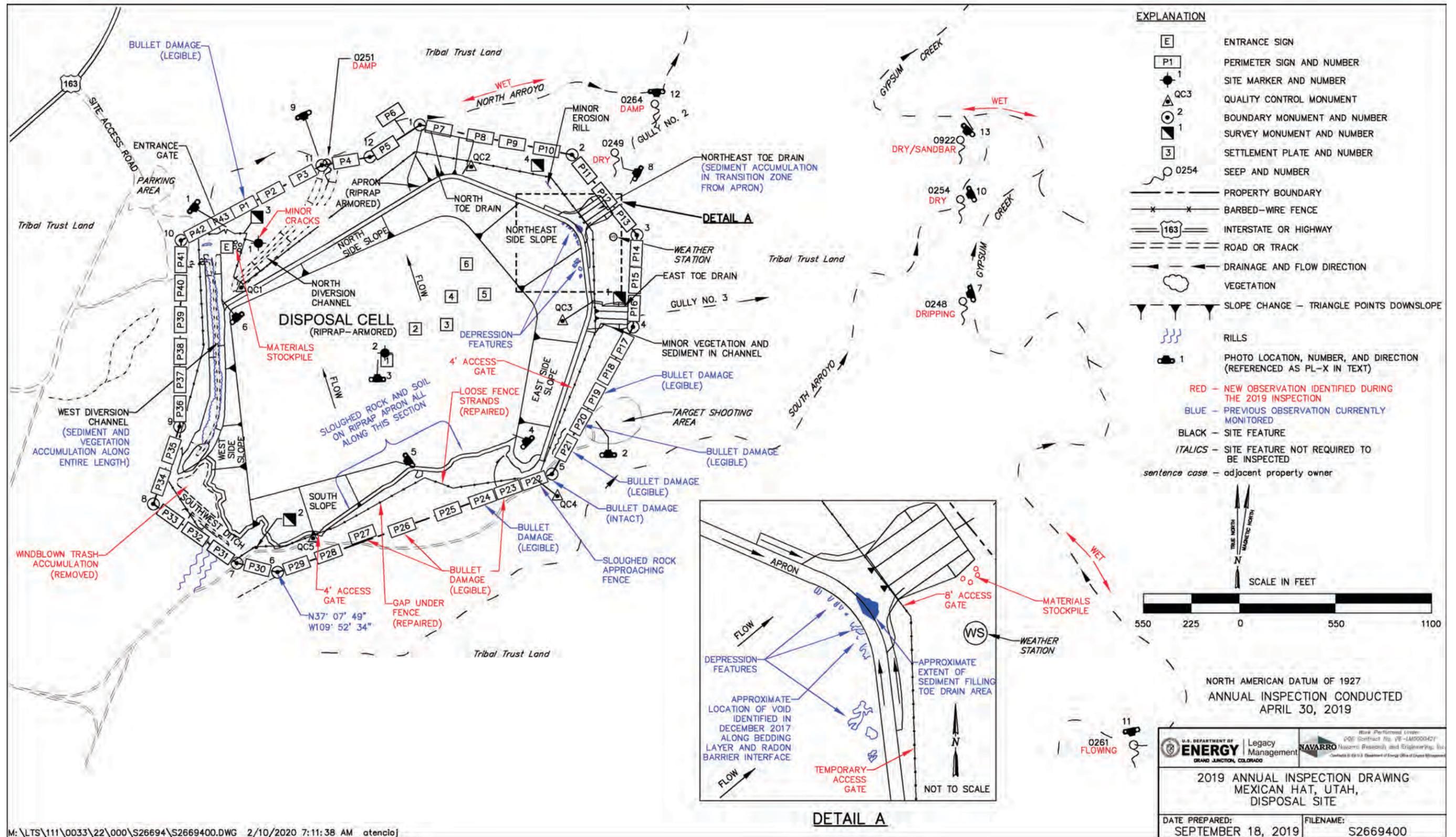


Figure 12-1. 2019 Annual Inspection Drawing for the Mexican Hat, Utah, Disposal Site

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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 to occur along the dirt access road, but the site remains accessible. Entrance to the site is through a locked steel entrance gate at the northwest corner of the site (PL-1). The entrance gate was locked and functional. The entrance sign is affixed to a steel post immediately behind the entrance gate (PL-1). Before the inspection, two 4-foot access gates and one 8-foot access gate were permanently installed in the perimeter barbed-wire fence to support ongoing disposal cell cover evaluations and maintenance activities, including one temporary access gate within the fence line. No maintenance needs were identified.

12.4.1.2 Fence and Perimeter Signs

A barbed-wire fence encloses the disposal cell. Periodically, the fence is damaged by livestock, erosion, or vandalism and requires repair. Loose fence strands were identified at a few locations across the site. Two small areas of fence line had loose fence strands and were repaired following the inspection.

There are 43 pairs of perimeter signs, designated P1 through P43 (each pair consisting of a higher 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 (PL-2), but some are affixed directly to the fence or immediately inside the fence. Several perimeter signs (P19, P20, P21, P23, P24, P26, and P27) have bullet damage but remain legible. Additionally, several perimeter signs are bent (presumably from animal contact) or are becoming faded and cracked (P14, P15, P19, P21, P27, P33, P34, P37, and P42) but do not require replacement. A gap was evident under the southern boundary fence and was fixed following the inspection. 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 (PL-3); its concrete base has several minor cracks, but they do not compromise the integrity of the base, and repairs are not necessary at this time. Site marker SMK-2 is on the top slope of the disposal cell. No immediate maintenance needs were identified.

12.4.1.4 Survey and Boundary Monuments

Four survey monuments were installed during construction of the disposal cell for survey control. Twelve boundary monuments delineate the property boundary. Bullet damage remains at boundary monument BM-5, but repairs are not necessary at this time, as the boundary monument remains legible and intact. No immediate 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. The disposal cell is armored with riprap to control erosion. No 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 (PL-4).

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 in 2016 and are detailed in the *Mexican Hat UMRCA Disposal Cell Side Slope Cover Depressions Evaluation Report Mexican Hat, Utah* (DOE 2019b), also known as the Depressions Evaluation Report.

There was no noticeable increase of sloughed red rock and soil along the south apron of the disposal cell (PL-5). Because the apron is adjacent to the base of a steep, rocky cliff, it is expected that sediment and rock from the cliff will continue to fall onto the apron. The accumulated material is not currently affecting the function of the apron, and this area will continue to be monitored.

12.4.2.2 Toe Drains and Diversion Channels

Upgradient offsite areas continue to erode, resulting in the transport of sediment onto the site and into the west diversion channel. Sediment accumulation has promoted the growth of vegetation, including perennial grasses and annual weeds, in the west diversion channel (PL-6). However, sediment accumulation and associated vegetation growth have not adversely affected the performance of the west diversion channel.

Sediment accumulation has also been observed along the transition zone from the apron to the northeast toe drain. The origin of this material has not been evaluated but may be a result of the observed radon barrier erosion associated with the depression features in this area. Visual observations during the inspection did not identify any apparent increases in the sediment accumulation in this area compared to previous visual observations. Inspectors will continue to monitor this area concurrently with the observed depression features on the northeast side slope. Conversely, no sediment accumulation has been observed below the north side slope where depressions and radon barrier erosion have been identified. No 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 brittle and subject to weathering. Inspectors will continue to monitor erosion in these areas, but erosion is not a concern unless it

damages the fence or affects the performance of site drainage and diversion features such as the west diversion channel.

Sloughed rock from an overhanging shelf continues to be observed along the southern perimeter of the site. Although no visual changes were evident, and this material currently appears to be stable, this 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 accumulations of trash are along the access road and in the parking area, the areas on the site outside of the fence between perimeter signs P31 and P42, and the southern portion of the site between perimeter signs P22 and P27. Trespassing just inside the site boundary (outside the fence), as evidenced by vehicle and all-terrain vehicle tracks, occurs in the same areas where trash accumulations are present. One smaller area starting to accumulate trash is inside the barbed-wire fence, between perimeter signs P31 and P35; however, this trash is likely being transported onto the site by wind. The trash was removed as part of regular maintenance following the inspection.

Minor vandalism continues to occur, as indicated by bullet damage in several perimeter signs (P19, P20, P21, P23, P24, P26, and P27), but this is expected to be an ongoing problem because of the site's remote location and because access to these areas cannot be restricted. Damaged perimeter signs are replaced when they become illegible. No other 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. Several follow-up inspections have been performed to further evaluate the depression features since they were first identified in 2016. LM has provided NRC with a series of updates and details associated with follow-up inspections. Follow-up inspections performed through January 2018 are detailed in the Depressions Evaluation Report (DOE 2019b). Follow-up inspections, evaluations, and work performed and completed in 2019 will be detailed in a subsequent report.

12.6 Maintenance

In April 2019, before the annual inspection, LM performed the following maintenance items:

- GSMT on the disposal cell side slope cover components. Data obtained through the GSMT will be used to identify possible causes for the cover degradation features that have been observed at the site. Additionally, an IRBP was implemented in GSMT sampling areas that had radon barrier degradation as detailed in the *Geotechnical Sampling and Materials Testing Work Plan for the Mexican Hat, Utah, UMTRCA Title I Disposal Site* (DOE 2019a). A series of test pits and one test strip were mechanically excavated and supplemented with a moisture-conditioned, bentonite-amended granular material to reconstruct the areas where radon barrier material had been eroded. All test areas were systematically screened for gamma radiation, and no elevated readings were observed.
- A new perimeter chainlink fence was installed 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.

Two 4-foot access gates, and one 8-foot access gate were permanently installed in the perimeter barbed-wire fence to support ongoing disposal cell cover evaluations and maintenance activities, including one temporary access gate within the fence line (Figure 12-1).

During the annual inspection, inspectors documented several minor maintenance needs that were addressed following the inspection, including:

- Repairing loose fence strands
- Repairing a gap under the fence on the south side of the site
- Removing accumulated trash

The ICP project was performed in late summer 2019 as a temporary measure to replace and restore the depressional features back to the original design specifications until a long-term solution can be assessed. The entire ICP work area was systematically screened for gamma radiation, and no elevated readings were observed.

- As part of the ICP project, front-end road repairs were performed along the dirt access road to allow for safe transportation of haul trucks and delivery trucks. Road repairs included grading the entire access road, and two areas damaged from rain events were corrected by installing geocell with standard U.S. Department of Transportation–specific rock type to stabilize these areas, which will also allow for proper drainage from rain events.

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 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 2006). 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. The majority of seeps have exhibited dry conditions over the past 11 years of observational monitoring.

The LTSP required annual visual monitoring of the seven designated seep locations through 2016, at which time an evaluation was to be conducted whether to continue or discontinue visual seep monitoring; this report is in development. In the interim, observational seep monitoring has been performed in accordance with the LTSP during annual site inspections.

Since 2010, groundwater discharge from seeps had only been observed at cross-gradient Seep 0248, which typically exhibits dripping conditions. During the inspection, Seep 0248 was observed dripping; since the seep was only dripping and did not exhibit steady flow, an estimated flow rate was not evaluated. Additionally, Seeps 0251 and 0264 were damp, and upgradient (background) Seep 0261 was observed to be flowing during the inspection. Seep 0261 is approximately 0.50 mile upstream of Seep 0248 in Gypsum Creek.

The remaining seeps on the annual monitoring plan exhibited dry conditions during the inspection. Table 12-2 documents the conditions of each monitored seep that was observed during the inspection, including the respective drainage in which each seep occurs and a reference to photographic documentation.

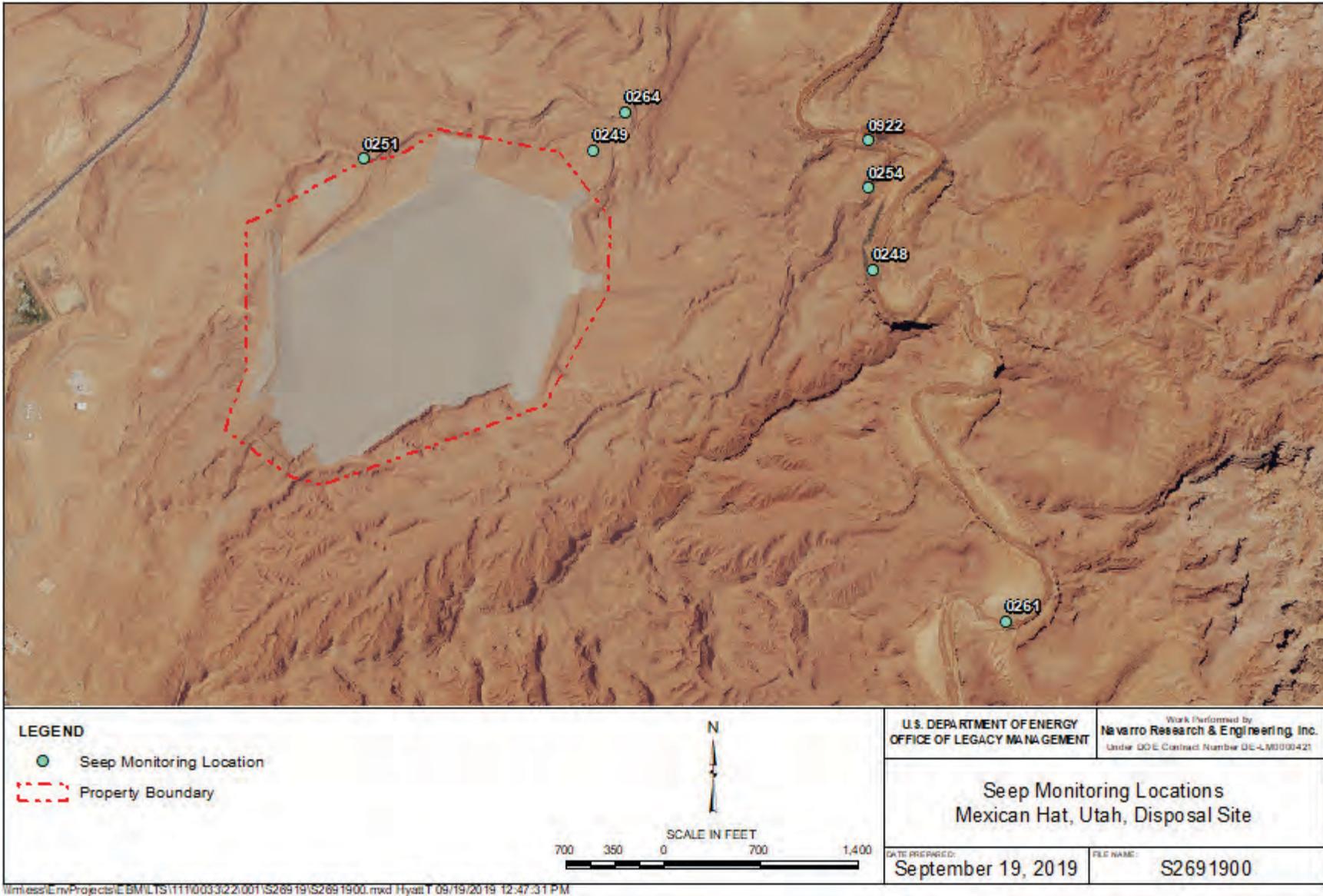


Figure 12-2. Seep Monitoring Locations at the Mexican Hat, Utah, Disposal Site

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-7	Seep was dripping at a much slower rate compared to previous visual observations (no flow rate measured).
0249	Gully No. 2	Downgradient	PL-8	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-9	Damp conditions (no evaporites present).
0254	South Arroyo	Downgradient	PL-10	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-11	Flowing conditions. This seep discharges directly into Gypsum Creek, which had surface water flow during the inspection. Warning sign not posted at this location since this seep is a background location.
0264	North Arroyo	Downgradient	PL-12	Damp conditions. Ephemeral wash near seep location was wet with no evidence of evaporites in the areas observed during the inspection.
0922	Gypsum Creek	Downgradient	PL-13	Dry conditions (no evaporites present in immediate area). Seep is along the south side of Gypsum Creek, and the seep location is still covered entirely by a sandbar that has formed along this section of Gypsum Creek.

Gypsum Creek had areas of flowing surface water during the inspection, including the North Arroyo.

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. With the exception of 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. 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), 2006. *Resolution of Seep and Ground Water Monitoring at the Mexican Hat, Utah, UMTRCA Title I Disposal Site*, DOE-LM/GJ1139-2006, March.

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.

12.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	130	Entrance Gate; Entrance Sign and Disposal Cell in Background
PL-2	—	Perimeter Sign P20
PL-3	—	Site Marker SMK-1
PL-4	315	Central Portion of Top Slope of Disposal Cell
PL-5	235	Sloughed Rock on South Apron of Disposal Cell
PL-6	320	West Diversion Channel
PL-7	255	Seep 0248 (Limited Dripping)
PL-8	300	Seep 0249 (Dry)
PL-9	155	Seep 0251 (Damp)
PL-10	245	Seep 0254 (Dry)
PL-11	170	Background Seep 0261 (Flowing)
PL-12	180	Seep 0264 (Damp)
PL-13	225	Seep 0922 (Dry/Sandbar)

Note:

— = Photograph taken vertically from above.



PL-1. Entrance Gate; Entrance Sign and Disposal Cell in Background



PL-2. Perimeter Sign P20



PL-3. Site Marker SMK-1



PL-4. Central Portion of Top Slope of Disposal Cell



PL-5. Sloughed Rock on South Apron of Disposal Cell



PL-6. West Diversion Channel



PL-7. Seep 0248 (Limited Dripping)



PL-8. Seep 0249 (Dry)



PL-9. Seep 0251 (Damp)



PL-10. Seep 0254 (Dry)



PL-11. Background Seep 0261 (Flowing)



PL-12. Seep 0264 (Damp)



PL-13. Seep 0922 (Dry/Sandbar)

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13.0 Naturita, Colorado, Disposal Site

13.1 Compliance Summary

The Naturita, Colorado, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site (site) was inspected on June 17, 2019. 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 (LTSP) (DOE 2019b) was revised to exclude the groundwater monitoring requirement. The revised LTSP was sent to the U.S. Nuclear Regulatory Commission (NRC) in September 2019 and finalized in December 2019.

13.2 Compliance Requirements

Requirements for the 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 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 3.0 and 6.2	Section 13.4	(b)(3)
Follow-Up Inspections	Section 3.4	Section 13.5	(b)(4)
Maintenance and Repair	Section 4.0	Section 13.6	(b)(5)
Groundwater Monitoring	Section 2.6	Section 13.7	(b)(2)
Corrective Action	Section 5.0	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 June 17, 2019. The inspection was conducted by A. Kuhlman and C. Wentz of the Office of Legacy Management Support (LMS) contractor. A. Denny (Office of Legacy Management [LM] site manager), J. Doebele (Colorado Department of Public Health and Environment), K. Meadows (LMS), K. Speights and A. Renteria (both of LM) 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 the need, if any, for maintenance or additional inspection and monitoring.

13.4.1 Site Surveillance Features

Figure 13-1 shows the locations of site features in black, including site surveillance features and inspection areas. 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 text, and new observations identified during the 2019 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 identified 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. Entrance to the site is through a locked steel gate directly off County Road EE22. The entrance gate was locked and functional. The entrance sign, next to the entrance gate, has bullet damage but remains legible. The website listed on the entrance sign has faded and was replaced following the inspection. No other maintenance needs were identified.

13.4.1.2 Perimeter Fence and Signs

A barbed-wire perimeter fence encloses the site. Three aging wooden stiles identified in the 2018 inspection (DOE 2019a) were replaced with two pedestrian gates following the 2019 inspection (PL-1). A large bush growing in the western perimeter fence line was removed to prevent damage to the fence (PL-2). Inspectors identified a loose fence strand and a detached fence bracket; both were repaired following the inspection.

There are 25 perimeter signs positioned along the perimeter fence attached to steel posts set in concrete and set back 5 feet (PL-3). Several perimeter signs identified with “Uravan” as the site name were replaced with “Naturita” following the inspection. Perimeter sign P2 has bullet damage but remains legible. Erosion is occurring around the base of perimeter sign P22, but the perimeter sign is stable. Perimeter sign P18 was facing away from the disposal cell access road and was turned to face the road following the inspection. No other maintenance needs were identified.

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13.4.1.3 Site Markers

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

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 mark the property corners. Survey monuments SM-3, SM-4, and SM-11 represent boundary monuments BM-3, BM-4, and BM-11, respectively (PL-5). Boundary monument BM-9 was obstructed by woody vegetation, which was removed following the inspection. No other maintenance needs were identified.

13.4.1.5 Monitoring Wells

The site has five groundwater monitoring wells. The wellhead protectors were undamaged and locked (PL-6). Monitoring well CM93-1 remains completely surrounded by woody vegetation. Monitoring of the wells is not required, and the vegetation will be removed upon well abandonment. No immediate maintenance needs were identified.

13.4.2 Inspection Areas

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

13.4.2.1 Disposal Cell

The disposal cell, completed in 1998, occupies 10 acres (PL-7). The disposal cell is armored with riprap to control erosion. The riprap is rounded, with larger diameter rock on the side slopes than on the top slope. There was no evidence of settling, slumping, erosion, rock degradation, or other modifying processes that might affect the integrity of the disposal cell.

Irregularities in the riprap on the top slope of the disposal cell continue to be observed. The irregularities consist of slightly darker rock at differing angles than the rest of the top slope. The irregularities are not lower than surrounding areas and have not changed over time. They are believed to be a construction artifact. Another irregularity exists in the apron area on the west side of the disposal cell (PL-8) appearing to be old vehicle tracks. The irregularity does not present a hazard to the disposal cell or surrounding area. Inspectors will continue to monitor this area. A large boulder was observed on the northeast side of the disposal cell apron, a presumed result of erosion on the steep cliff above the disposal cell (PL-9). The apron around the boulder remains intact, and the boulder does not currently pose a hazard to the disposal cell. Inspectors will continue to monitor for potential impacts. A rabbitbrush plant (a deep-rooted woody species) growing at the base of the north side slope identified during the previous inspection was successfully treated with herbicide and was not apparent during the 2019 inspection. Additional

rabbitbrush plants growing on the south apron of the disposal cell were treated with herbicide in June before the inspection. Herbicide treatment of the rabbitbrush plants will continue. No other 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 Montrose County Road EE22. Vegetation continues to grow in the accumulating sediment just outside of the culverts, potentially blocking storm water flow through the culverts (PL-10). The vegetation will be removed before the 2020 annual inspection. 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 storm water and snowmelt runoff to the northeast under County Road EE22. Some sediment has eroded from the offsite area upslope from perimeter signs P22 and P23 and is deposited in the channel. Sediment accumulation and associated vegetation have not adversely affected the performance of the interceptor channel. No new erosion was noted during the inspection.

An area south of monitoring well CM93-2 next to a large boulder upgradient of the disposal cell is beginning to show signs of erosion (PL-11). Rills leading in the boulder's direction are becoming apparent. The erosion does not present a hazard to the disposal cell or to any site features, so repairs are not warranted. Inspectors will continue to monitor this area for ongoing erosion.

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 and monitoring wells on the west side of the site. Minor new rockfall was observed on the disposal cell access road. The access road remains passable. Inspectors will continue to monitor this area for ongoing erosion. No other maintenance needs were identified.

A cut in the berm and resulting erosion alongside County Road EE22 (between perimeter signs P3 and P4) has been observed since 2017 and appeared to have increased in size and depth (PL-12). Erosion in the steep cliff below the berm cut was observed (PL-13), but does not pose a current threat to the integrity of the disposal cell or site features. Following the inspection, the Montrose County maintenance crew repaired the berm cut (PL-14). Inspectors will continue to monitor this area for ongoing erosion. No other maintenance needs were identified.

13.4.2.3 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. The area has been highly disturbed by mining, quarrying, reclamation, and road building.

Headcutting erosion was identified within the spillway channel below the sedimentation pond on the outlying area northwest of the site (PL-15). Inspectors will continue to monitor this area for ongoing erosion.

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

Several maintenance items identified in the 2018 annual inspection (DOE 2019a) were completed in 2019, including:

- Removal of three pedestrian wooden stiles and installation of two pedestrian gates
- Repair of the berm cut by Montrose County

Inspectors documented minor maintenance needs that were completed in 2019 following the inspection, including:

- Repairs to the perimeter fence (tightened loose fence strand and repaired detached fence bracket)
- Treatment of vegetation growing in the disposal cell apron
- Replacing “Uravan” perimeter signs with “Naturita”
- Turning perimeter sign P18 to face the disposal cell access road
- Removal of the bush in the fence line between perimeter signs P16 and P17
- Replacing the entrance sign

Inspectors also documented minor maintenance needs that have not been addressed but will be before the 2020 inspection, including:

- Removing sedimentation or vegetation blocking the culverts

No other immediate maintenance needs were identified.

13.7 Groundwater Monitoring

Groundwater monitoring was discontinued in 2014 because (1) the groundwater monitoring program demonstrated that transient drainage from the disposal cell is not impacting the uppermost aquifer and (2) site geology prevents impact to the uppermost aquifer. NRC concurrence with the change (discontinuation) of groundwater monitoring is documented in an April 15, 2014, letter from NRC to LM (Orlando 2014). The LTSP was revised to exclude the groundwater monitoring requirement and submitted to NRC for acceptance in 2018. The revised LTSP was finalized in December 2019 (DOE 2019b).

13.8 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.

13.9 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), 2019a. *2018 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites*, LMS/S22053, March.

DOE (U.S. Department of Energy), 2019b. *Long-Term Surveillance Plan for the Naturita, Colorado Disposal site*, LMS/NAD/S13227, December.

Orlando, 2014. Dominick A. Orlando, Senior Project Manager, Materials Decommissioning Branch, U.S. Nuclear Regulatory Commission, letter (about U.S. Department of Energy proposal to terminate groundwater monitoring at the Naturita, Colorado, site) to Mark Kautsky, Office of Legacy Management, U.S. Department of Energy, April 15.

13.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	315	New Pedestrian Gate on Disposal Cell
PL-2	150	Vegetation Growing in Fence Line
PL-3	110	Perimeter Sign P21
PL-4	325	Site Marker SMK-1
PL-5	—	Survey Monument SM-11
PL-6	160	Monitoring Well CM93-2
PL-7	90	Disposal Cell
PL-8	30	Area of Irregularity on Disposal Cell Apron and Interface with Disposal Cell Access Road
PL-9	150	Boulder on Disposal Cell Apron
PL-10	85	Culvert Inlet Partially Blocked by Sediment
PL-11	70	Erosion Along Cliff Edge Above Disposal Cell
PL-12	189	Berm Cut off County Road EE22 (Repaired Following Inspection)
PL-13	40	Erosion Along Cliff from Cut in County Road EE22 Berm
PL-14	142	Berm Cut Repaired by Montrose County
PL-15	270	Sedimentation Pond Spillway Area

Note:

— = Photograph taken vertically from above.



PL-1. New Pedestrian Gate on Disposal Cell



PL-2. Vegetation Growing in Fence Line



PL-3. Perimeter Sign P21



PL-4. Site Marker SMK-1



PL-5. Survey Monument SM-11



PL-6. Monitoring Well CM93-2



PL-7. Disposal Cell



PL-8. Area of Irregularity on Disposal Cell Apron and Interface with Disposal Cell Access Road



PL-9. Boulder on Disposal Cell Apron



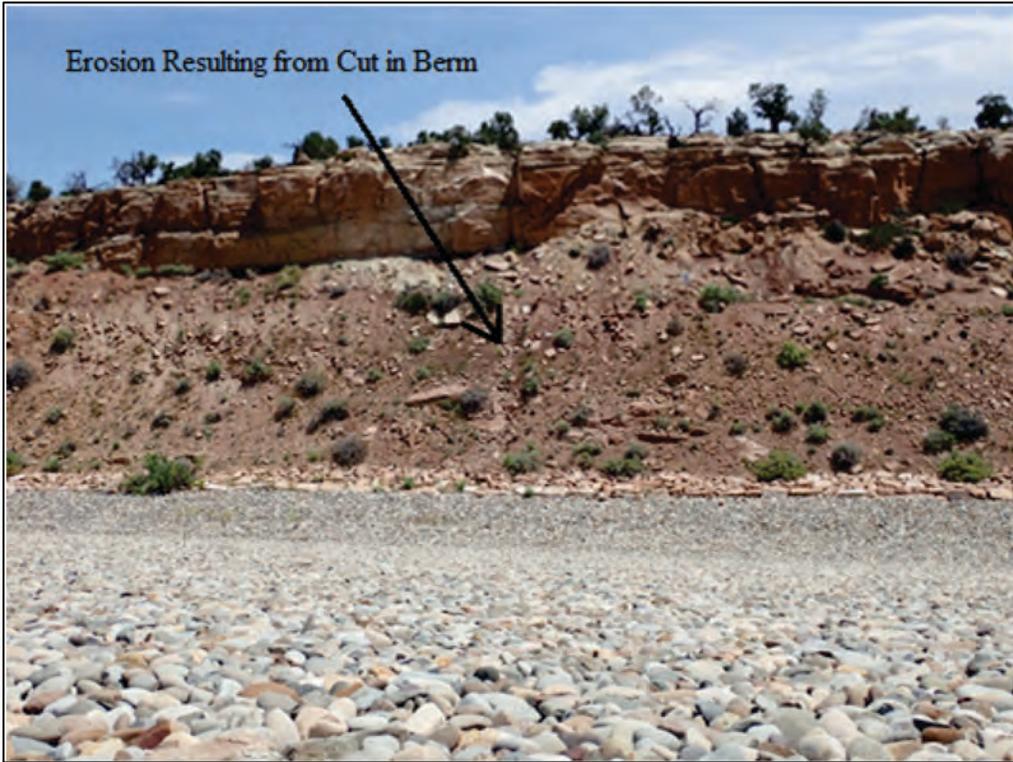
PL-10. Culvert Inlet Partially Blocked by Sediment



PL-11. Erosion Along Cliff Edge Above Disposal Cell



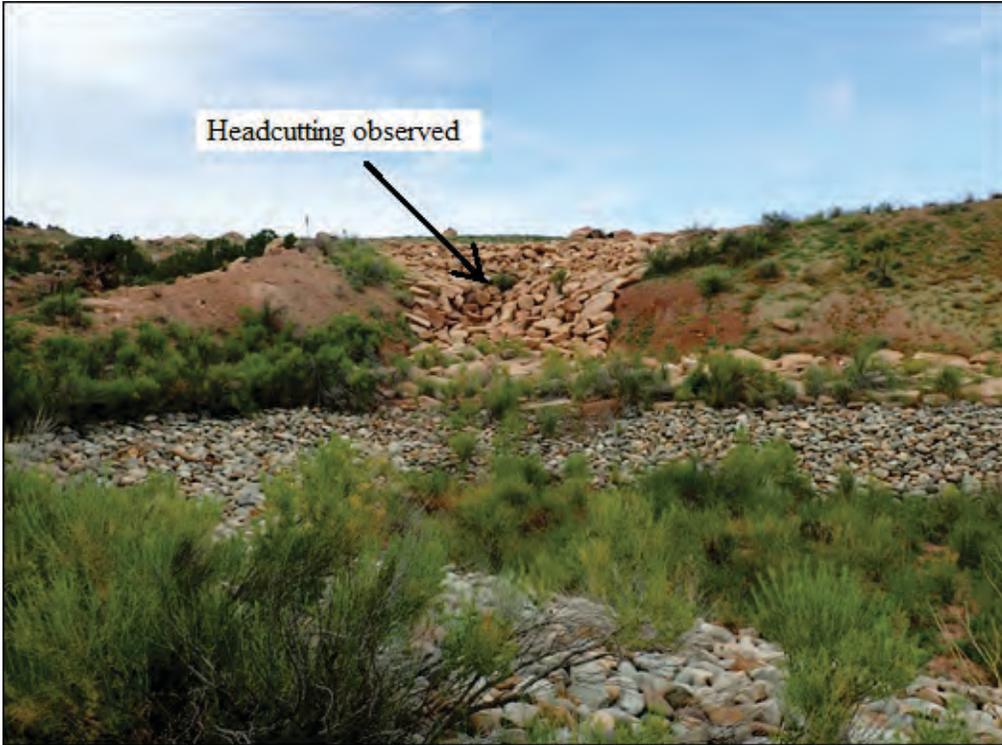
PL-12. Berm Cut off County Road EE22 (Repaired Following Inspection)



PL-13. Erosion Along Cliff from Cut in County Road EE22 Berm



PL-14. Berm Cut Repaired by Montrose County



PL-15. Sedimentation Pond Spillway Area

14.0 Rifle, Colorado, Disposal Site

14.1 Compliance Summary

The Rifle, Colorado, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site (site) was inspected on August 20, 2019. 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.

The disposal cell dewatering system is activated when the interior water elevation reaches 6016 feet (ft); this is called the pump trigger level. This level has been exceeded during (1) nonoperational conditions of solar-powered pumps (night and insufficient sunlight); (2) below-freezing temperatures; and (3) periods of maintenance. However, pore-water levels in standpipes 2 and 3 have remained below the geotextile liner at 6020 ft, preventing water from overtopping the disposal cell liner. Groundwater quality monitoring is not required.

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 (LTSP) (DOE 1997) 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 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, 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 20, 2019. The inspection was conducted by M. Kastens, K. Lott, and D. Holbrook of the Office of Legacy Management Support (LMS) contractor. T. Jasso (Office of Legacy Management [LM] site manager), C. Spalding (City of Rifle), I. Pittman (U.S. Bureau of Land Management [BLM]), and M. Cosby (Colorado Department of Public Health and Environment) 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 the need, if any, for maintenance or additional inspection and monitoring.

14.4.1 Site Surveillance Features

Figure 14-1 shows the locations of site features in black, including site surveillance features and inspection areas. 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 text, and new observations identified during the 2019 annual inspection are shown in red. Inspection results and recommended maintenance activities associated with site surveillance features are identified in the following subsections. Photographs to support specific observations are identified in the text and in Figure 14-1 by photograph location (PL) numbers. The photographs and photograph log are presented in Section 14.11.

14.4.1.1 Access Road, Entrance Gates, and Entrance Sign

Access to the site is from an improved gravel road northeast of Colorado Highway 13. A perpetual right-of-way across BLM property provides access to the site. Entrance to the site is through two locked gates on the access road: an outer reinforced metal gate about 1700 ft south of the site that limits public access to the site and an inner metal gate at the stock fence. While both gates were locked and functional, graffiti (PL-1) and bullet holes (PL-2) were found on the outer gate cover. The graffiti was removed following the inspection. The entrance sign is next to the inner gate. The entrance sign had minor cracks but remained legible. No other maintenance needs were identified.

14.4.1.2 Stock Fence and Perimeter Signs

A four-strand barbed-wire stock fence at the south 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 onsite vegetation. Results from the 2019 inspection showed vegetation regrowth in the livestock trails that were identified in the 2018 inspection (PL-3). One T-post near survey monument SM-1 was broken at the base of the ground surface; however, it is unclear if this was caused by livestock. The T-post was repaired following the 2019 inspection. 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 on the adjacent BLM allotment to pass through the fence.

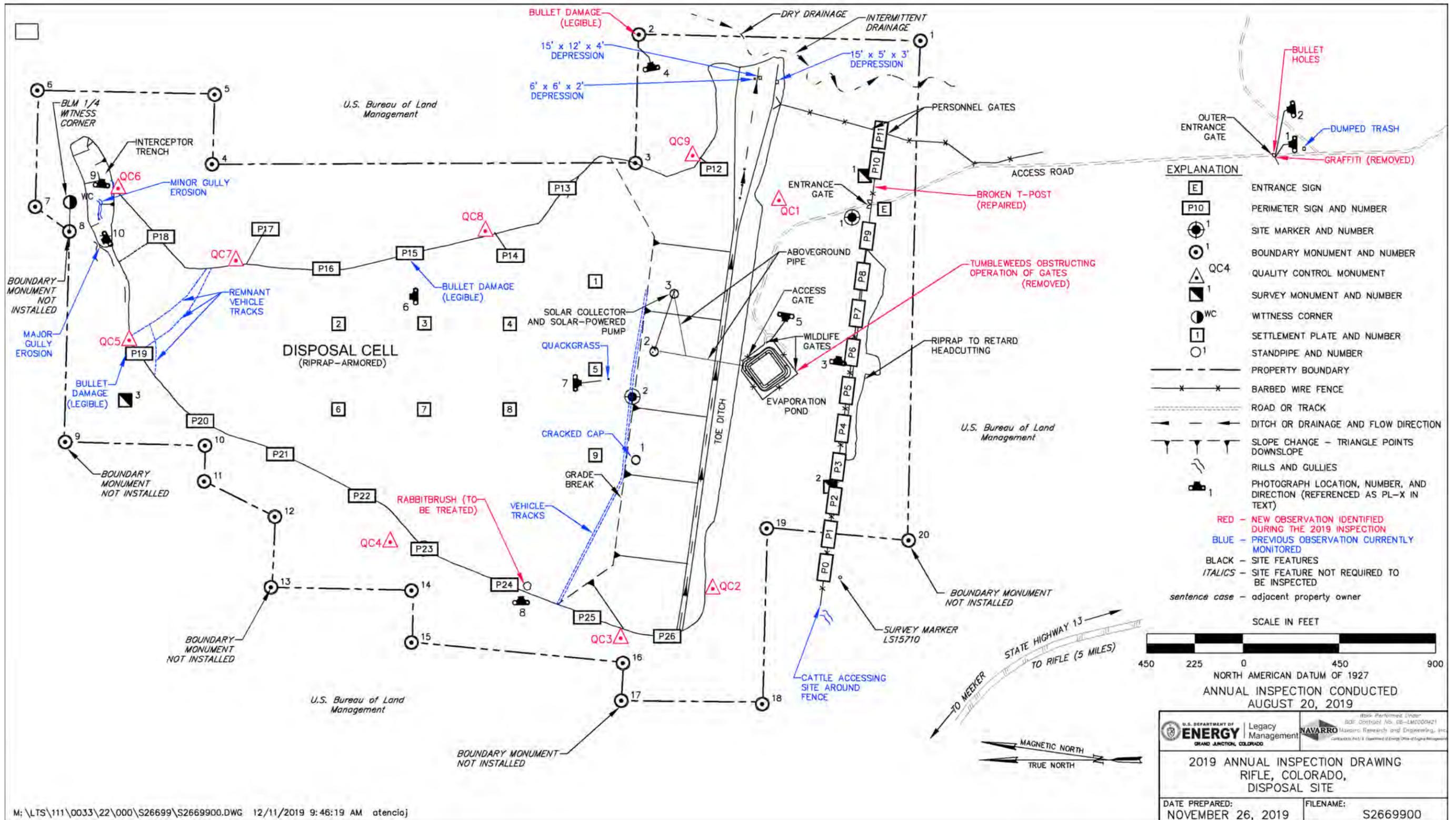


Figure 14-1. 2019 Annual Inspection Drawing for the Rifle, Colorado, Disposal Site

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There are 25 perimeter signs positioned along the perimeter fence, attached to steel posts set in concrete and set back 5 ft. Signs are numbered from P0 through P7 and P10 through P26. Following the inspection, perimeter signs P8 and P9 were added to complete the consecutive ordering. Inspectors noted that perimeter signs P15 and P19 had bullet damage, but they remain legible and do not need to be replaced at this time. No other maintenance needs were identified.

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. 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. Several of the existing boundary monuments are difficult to locate because they are installed in steep, hard-to-access areas. Inspectors located all boundary monuments with a GPS unit with the exception of boundary monument BM-18, which is on steep terrain. Inspectors plan to confirm the location of boundary monument BM-18 during the 2020 annual inspection. Boundary monument BM-2 has several bullet holes but remains intact (PL-4). No maintenance needs were identified.

14.4.1.5 Standpipes

Three standpipes (1–3) on the south side slope of the disposal cell are used to monitor pore-water levels in the disposal cell. At the time of the inspection, disposal cell pore water was being pumped from standpipes 2 and 3 (also known as monitoring wells MW02 and MW03, respectively) into the evaporation pond. No maintenance needs were identified.

14.4.1.6 Evaporation Pond

A lined evaporation pond was constructed adjacent to the disposal cell in 2001 to receive water pumped from standpipes 2 and 3. It contained water at the time of the inspection. The chainlink security fence around the pond was intact and effectively prevents livestock from entering the area. The vehicular access gate on the north corner of the fence was closed and locked at the time of the inspection. Inspectors noted that tumbleweeds obstructed the proper functioning of the two wildlife gates on the south and east corners of the fence (PL-5). These were removed following 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. 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 (PL-6). This phenomenon is not a significant concern, as less than 0.01% of the surface rocks have been affected by breakage.

Remnant vehicle tracks, which formed on the cover during well decommissioning activities in 2002, remain evident in the north portion of the disposal cell. Additional vehicle tracks continue to be visible in the south portion of the disposal cell; these were made during installation of solar panels and pumps at standpipes 2 and 3.

In the early 2000s, inspectors became concerned that the steep slopes of the disposal cell cover, particularly in the north portion, could lead to slope instability. In response, LM conducted annual three-dimensional surveys of the rock cover between 2006 and 2011. The surveys confirmed that the rock cover was stable.

Inspectors examined the infestation of quackgrass (a state-listed noxious weed) that had been discovered on the cell top last year and noticed that it had been treated recently with herbicide (PL-7). A single deep-rooted plant, rubber rabbitbrush, was found on the cell top (PL-8). The plant will be treated with herbicide before the 2020 inspection. Small, isolated patches of other grasses and annual weeds also were present on the disposal cell cover and side slope, but they do not present a concern.

A vegetated interceptor trench was constructed at the top of the disposal cell to protect the disposal cell from storm water and snowmelt runoff. The trench appeared to be functioning as designed, although minor gully erosion has been occurring in the lower portion of the trench. The gully did not appear to be increasing in depth or width (PL-9); 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), runoff has formed a gully to the north of the armoring riprap placed in this area in the early 2000s. The gully did not appear to be increasing in depth or width (PL-10). The outfall area will continue to be monitored to assess if additional riprap will need to be placed 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 (south) edge of the disposal cell and is armored with the same rock that protects the disposal cell. The toe ditch diverts surface 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 cattle or sheep grazing within the site boundaries. Since 2012, however, heavy grazing by cattle has been observed regularly. Because the site was deemed unsuitable for livestock grazing, LM contacted BLM in 2018 to address this issue. The 2019 inspection showed less impact from livestock trespass and grazing. However, because 2019 was an above-average precipitation year, evidence of livestock trespass and resultant heavy grazing should continue to be monitored. LM plans to continue communications with BLM and also has offered to meet with the grazing lessee.

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. Historically, trash has been dumped along the access road between Highway 13 and the outer entrance gate, and BLM has periodically removed it. During the 2019 inspection, a new pile of trash was observed near the outer entrance gate. 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

Inspectors documented minor maintenance and repair needs that were completed following the inspection:

- Removal of graffiti from the outer access gate cover
- Repair of a broken T-post near survey monument SM-1

- Addition of perimeter signs P8 and P9
- Removal of tumbleweeds from wildlife gates on evaporation pond fencing

In August 2019, nine permanent quality control monuments were installed at the site in preparation for a baseline aerial survey of the disposal cell. The quality control monument locations are shown in Figure 14-1. The rabbitbrush on top of disposal cell will be treated with herbicide before the next inspection in 2020. No other maintenance needs were identified.

14.7 Groundwater Monitoring

Groundwater quality monitoring is not required by the LTSP. Transient drainage from the disposal cell enters the Wasatch Formation, a 3800-foot-thick sequence of shales, siltstones, and fine-grained sandstones. The Wasatch 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. 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. All monitoring wells at the site were decommissioned in 2002.

14.8 Disposal Cell Pore-Water Level Monitoring

In accordance with the LTSP, LM monitors pore-water levels from transient drainage in the disposal cell at standpipes 2 and 3, installed at the downgradient end of the disposal cell on the south side slope (Figure 14-1). This monitoring is performed to ensure that water in the disposal cell does not rise above a geotextile liner that was installed in the toe of the disposal cell at an elevation of 6020 ft. The bottom of standpipe 1 is at an elevation of 6021.4 ft; as such, it continues to be dry and does not require continuous monitoring.

A contingency plan for control of water levels at the toe of the disposal cell was appended to the LTSP. The plan required installation of a dewatering system and evaporation pond when the water level reached an elevation of 6014 ft and initiation of dewatering at an elevation of 6016 ft. The 6014 ft action level was reached in 2001, and the 6016 ft action level was reached in 2003. As required by the contingency plan, the evaporation pond was constructed in 2001. Pumping water from standpipes 2 and 3 to the evaporation pond began in 2003 and continued until September 2006, when it was concluded that standpipe 2 could not sustain prolonged pumping due to consistent lack of sufficient recharge. Although pumping at standpipe 2 was discontinued at that time, the datalogger remained, and water-level monitoring continued at this standpipe. Pumping at standpipe 2 was restarted in June 2018, with the objective of more effectively dewatering the disposal cell toe. Water pumped from the standpipes was discharged through an aboveground plastic line to the evaporation pond.

Pore-water levels in standpipes 2 and 3 have shown a rising trend since 2011 but remained below the 6016 ft pump trigger level until 2016 for standpipe 3 and 2017 for standpipe 2 (Figure 14-2). While the 6016 ft pump trigger level has been exceeded, pore-water levels in both standpipes 2 and 3 have been reduced by pumping to remain below the geotextile liner at 6020 ft, preventing

water from overtopping the disposal cell liner. In compliance with requirements of the LTSP, pumping will continue until water levels in the standpipes stabilize at an elevation of 6014 ft or lower.

Due to insufficient recharge, water levels in standpipe 2 did not reach the pump trigger level until 2018. Real-time disposal cell water elevations collected in 2018 (using pressure transducers and dataloggers) continued to indicate that pore-water levels in standpipes 2 and 3 exceed the 6016 ft pump trigger level (Figure 14-2). In 2019, LM modified the seasonal pumping regimen to pump year-round while a long-term solution is evaluated and implemented.

Data fluctuations in standpipe 2 observed in 2018 and 2019 are due to the restart of pumping and various equipment and instrumentation maintenance repairs. Downhole video in both standpipes revealed significant fouling in the screened interval. Redevelopment of the standpipe 2 to remove mineral scale and biogrowth is planned for 2020. LM will investigate the cause of the rising trend and will develop mitigation actions as appropriate.

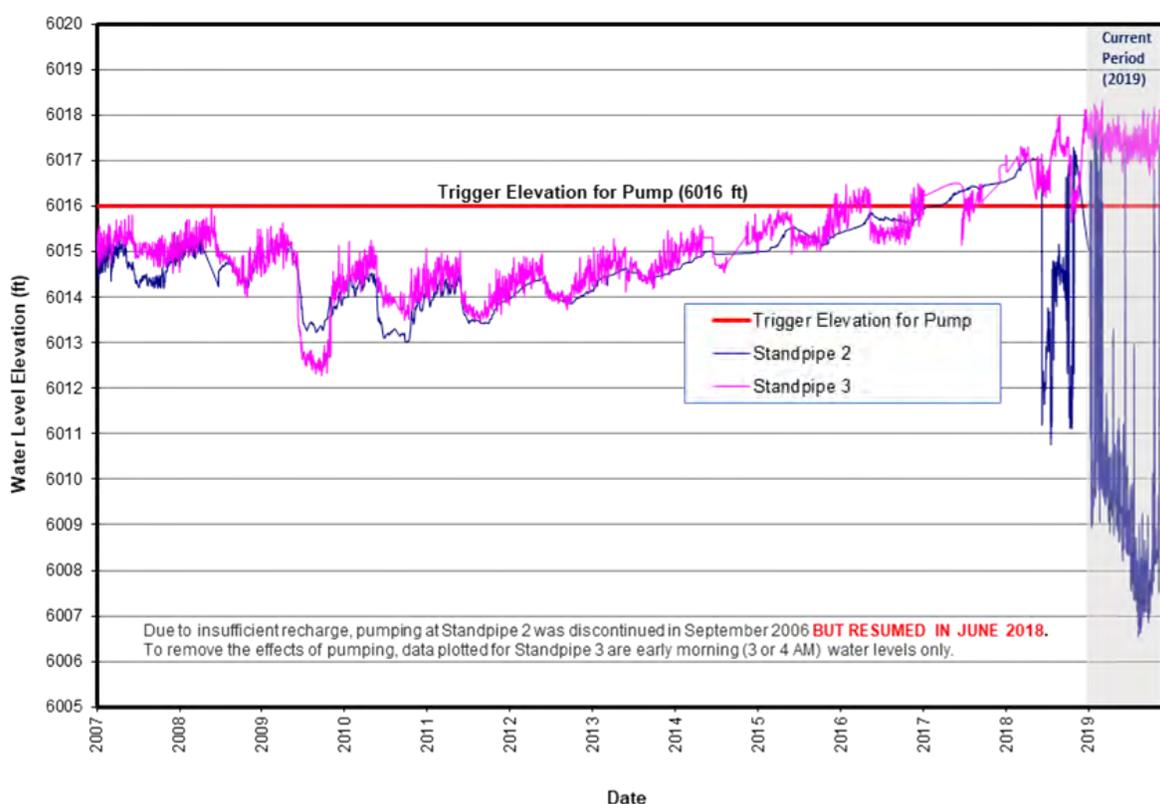


Figure 14-2. Disposal Cell Pore-Water Levels in Standpipes 2 and 3 at the Rifle, Colorado, Disposal Site

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	—	Recent Graffiti on Gate Cover at Outer Entrance Gate (Text Blurred Due to Nature of Content) (Removed)
PL-2	355	Bullet Holes in Gate Cover at Outer Entrance Gate
PL-3	100	Regrowth on Last Year’s Livestock Trails on Both Sides of Fence East of Reclaimed Area
PL-4	90	Bullet Damage (Legible) in Boundary Monument BM-2
PL-5	280	Tumbleweed Buildup in Wildlife Gates (Removed Following Inspection)
PL-6	—	Fractured Rock on Disposal Cell Top
PL-7	180	Treated Quackgrass, a State-Listed Noxious Weed
PL-8	90	One Deep-Rooted Woody Plant—Rubber Rabbitbrush—on Disposal Cell Top Slope
PL-9	95	Upslope of Interceptor Trench Erosion
PL-10	330	(a) Erosion in Interceptor Trench Outfall Channel—2019 (b) Erosion in Interceptor Trench Outfall Channel—2016 Photo for Comparison

Note:

— = Photograph taken vertically from above.



*PL-1. Recent Graffiti on Gate Cover at Outer Entrance Gate
(Text Blurred Due to Nature of Content) (Removed)*



PL-2. Bullet Holes in Gate Cover at Outer Entrance Gate



PL-3. Regrowth on Last Year's Livestock Trails on Both Sides of Fence East of Reclaimed Area



PL-4. Bullet Damage (Legible) in Boundary Monument BM-2



PL-5. Tumbleweed Buildup in Wildlife Gates (Removed Following Inspection)



PL-6. Fractured Rock on Disposal Cell Top



PL-7. Treated Quackgrass, a State-Listed Noxious Weed



PL-8. One Deep-Rooted Woody Plant—Rubber Rabbitbrush—on Disposal Cell Top Slope



PL-9. Upslope of Interceptor Trench Erosion

Photos continue on the next page.



PL-10. (a) Erosion in Interceptor Trench Outfall Channel—2019



PL-10. (b) Erosion in Interceptor Trench Outfall Channel—2016 Photo for Comparison

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 (site) was inspected on April 30, 2019. 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 two routine maintenance needs but found no cause for a follow-up 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 (LTSP) (DOE 1997) 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, 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 30, 2019. The inspection was conducted by J. Lobato and D. Traub of the Office of Legacy Management Support (LMS) contractor. J. Nguyen (Office of Legacy Management [LM] site manager) and C. Bishop (Utah Department of Environmental Quality) attended the inspection. T. Orton (EnergySolutions) escorted the inspection group, and S. Stanley (EnergySolutions) provided support as a radiation control technician (RCT). 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 the need, if any, for maintenance or additional inspection and monitoring.

15.4.1 Site Surveillance Features

Figure 15-1 shows the locations of site features in black, including site surveillance features and inspection areas. 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 text, and new observations identified during the 2019 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 identified 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 an active radioactive waste disposal facility operated by EnergySolutions. A perpetual right-of-way easement ensures that LM and its representatives have continued access across the EnergySolutions property to the site. LM 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 a *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 personal contamination monitor.

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 (Gate 61 and Gate 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 Gate 60 and Gate 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. The gates were locked and functional. The entrance sign is on Gate 61 at the southwest corner of the site. No maintenance needs were identified.

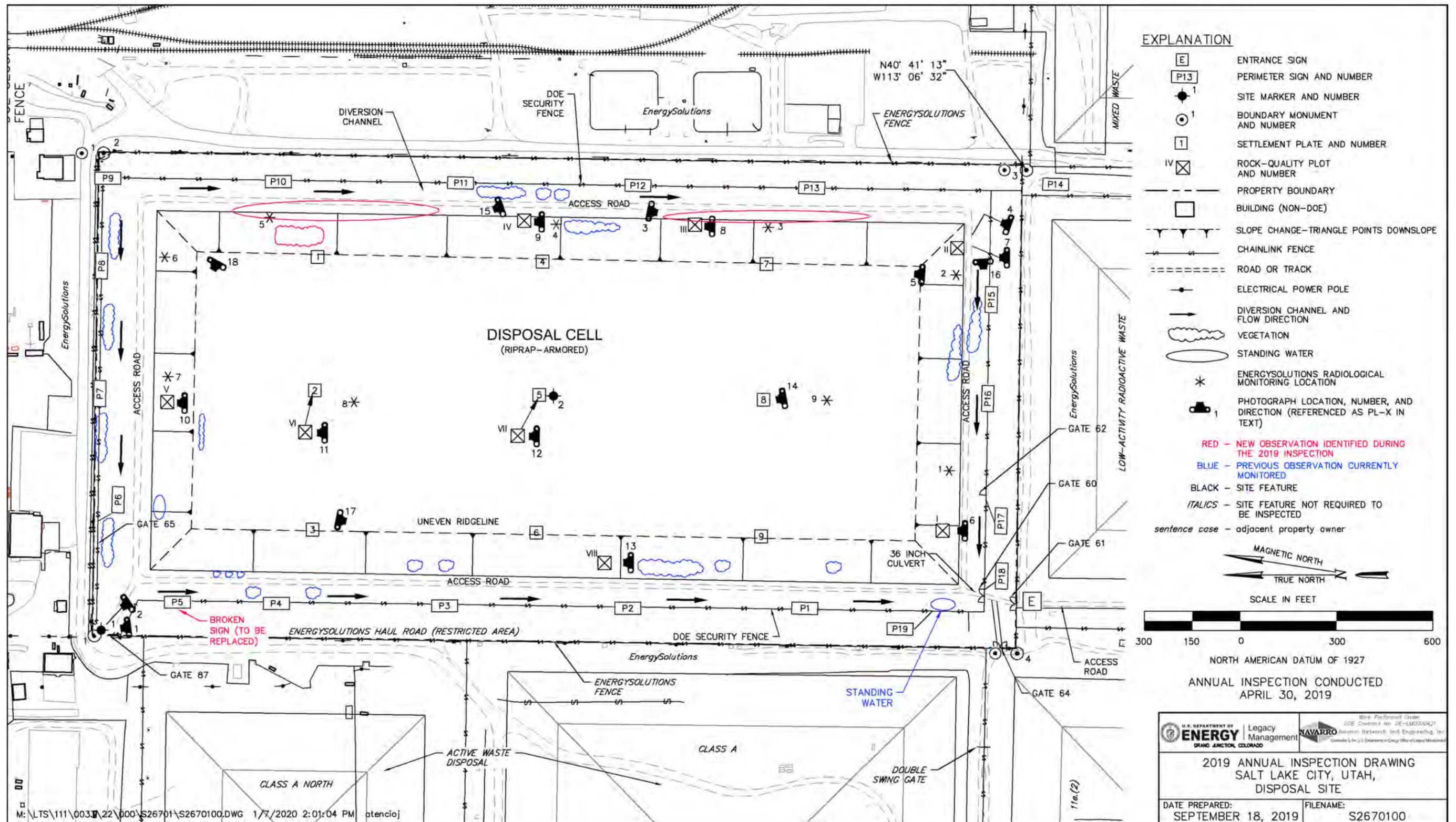


Figure 15-1. 2019 Annual Inspection Drawing for the Salt Lake City, Utah, Disposal Site

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15.4.1.2 Fences and Perimeter Signs

There are two chainlink fences at the site: 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. Perimeter sign P5 was observed to be damaged and broken and will be replaced during the 2020 annual inspection.

15.4.1.3 Site Markers

The site has two granite site markers. Site marker SMK-1 is just inside Gate 87 in the northwest corner of the site (PL-1). 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 to BM-4). Protective casings that EnergySolutions installed over each boundary monument continue to protect the boundary monuments from damage by surrounding earthmoving activities (PL-2). 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. 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 (PL-3, PL-4, and PL-5).

One of several types of rock used for the disposal cell erosion-protection riprap layer has exhibited minor degradation since the disposal cell was constructed. As a result, 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 rock type exhibiting degradation constitutes approximately 1%–10% of the riprap material; degradation of this less competent rock is thought to result from freeze-thaw weathering. Rock-quality monitoring plots are visually monitored and documented annually with photographs.

Approximately 1%–10% of the rock in the plots exhibited signs of weathering during the 2019 annual inspection (PL-6 through PL-13), with no significant changes from the 2018 annual inspection. Comparisons to the initial 2010 rock-quality plot photographs indicate very little (if any) additional rock degradation since monitoring began. The minimal 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.

There are nine settlement plates on the top slope of the disposal cell (PL-14); 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, including this disposal cell; these LIDAR survey results are available on request.

Although areas of the disposal cell have continued to have minor perennial grass growth, no deep-rooted plants were growing on the disposal cell. Standing water from precipitation runoff was observed in the apron at the base of the east side slope of the disposal cell toe drainage (PL-15); no adverse impacts to the disposal cell were noted or expected as a result of this water. No maintenance needs were identified.

15.4.2.2 Area Between Disposal Cell and Site Perimeter

The 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 continues to encroach along the access road (PL-16), but the road remains functional, and no maintenance is currently required.

The surface water diversion channels were functioning as designed. Although minor areas of ponded water were observed, vegetation growth in these diversion channels is not impeding surface water runoff.

Radiological surveys are performed every 2 years on the site by EnergySolutions personnel to confirm the absence of spillover or windblown radioactive contamination from surrounding radioactive waste disposal operations. Survey measurements include taking dose rate measurements at random locations across the site and collecting wipe samples that are analyzed for gross alpha and beta radiation contamination.

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 2019 annual inspection. Nine wipe samples were collected by the EnergySolutions RCT at the specific radiological monitoring locations depicted in Figure 15-1. The RCT also collected dose rate measurements at random locations throughout the duration of the inspection using a handheld meter capable of detecting radiation doses greater than 20 microrem per hour ($\mu\text{rem/h}$).

Results from the radiological surveys conducted at the site to date have been below the applicable exposure limits established in LM's *Radiological Control Manual* (LMS/POL/S04322). Therefore, both spillover and windblown radiological contamination from the surrounding radioactive waste disposal operation are not evident. All results from the 2019 wipe samples collected by EnergySolutions were below the minimum detectable activities (i.e., nondetect) for removable alpha and beta radiation contamination. Additionally, no dose rate measurements exceeding the detection limit of 20 $\mu\text{rem/h}$ were detected during the inspection. The next radiological survey will occur during the 2021 annual site inspection.

EnergySolutions conducts periodic walkthroughs of the site to remove any windblown debris, and the company reported no debris on the site in 2019. 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 (PL-17). 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 radioactive waste disposal cell, to the southwest is a waste disposal cell containing Atomic Energy Act Section 11e.(2) byproduct material, 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 (PL-18). 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

Inspectors documented minor maintenance needs that have not been addressed but will be during the 2020 inspection, including:

- Replacing broken perimeter sign P5

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 the 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*.

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 Navarro Research and Engineering, Inc., for the U.S. Department of Energy Office of Legacy Management.

15.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	350	Site Marker SMK-1
PL-2	325	Boundary Monument BM-1
PL-3	190	Tracks Observed on East Side Slope of Disposal Cell
PL-4	20	Southeast Corner of Disposal Cell and Apron
PL-5	5	View North from Southeast Corner of Disposal Cell
PL-6	—	(a) Rock Quality Plot No. I—2019 (b) Rock Quality Plot No. I—2010 Photo for Comparison
PL-7	—	(a) Rock Quality Plot No. II—2019 (b) Rock Quality Plot No. II—2010 Photo for Comparison
PL-8	—	(a) Rock Quality Plot No. III—2019 (b) Rock Quality Plot No. III—2010 Photo for Comparison
PL-9	—	(a) Rock Quality Plot No. IV—2019 (b) Rock Quality Plot No. IV—2010 Photo for Comparison
PL-10	—	(a) Rock Quality Plot No. V—2019 (b) Rock Quality Plot No. V—2010 Photo for Comparison
PL-11	—	(a) Rock Quality Plot No. VI—2019 (b) Rock Quality Plot No. VI—2010 Photo for Comparison
PL-12	—	(a) Rock Quality Plot No. VII—2019 (b) Rock Quality Plot No. VII—2010 Photo for Comparison
PL-13	—	(a) Rock Quality Plot No. VIII—2019 (b) Rock Quality Plot No. VIII—2010 Photo for Comparison
PL-14	350	Settlement Plate 8
PL-15	340	Standing Water in Disposal Cell Toe Drainage
PL-16	270	Saltbush Growing on Disposal Cell Access Road
PL-17	190	Intersection of Disposal Cell Top with West Side Slope of Disposal Cell; EnergySolutions Disposal Cell in Background
PL-18	300	EnergySolutions Facility on North Side of Cell

Note:

— = Photograph taken vertically from above.



PL-1. Site Marker SMK-1



PL-2. Boundary Monument BM-1



PL-3. Tracks Observed on East Side Slope of Disposal Cell



PL-4. Southeast Corner of Disposal Cell and Apron



PL-5. View North from Southeast Corner of Disposal Cell

Photographs continue on next page.



PL-6. (a) Rock Quality Plot No. 1—2019



PL-6. (b) Rock Quality Plot No. 1—2010 Photo for Comparison



PL-7. (a) Rock Quality Plot No. II—2019



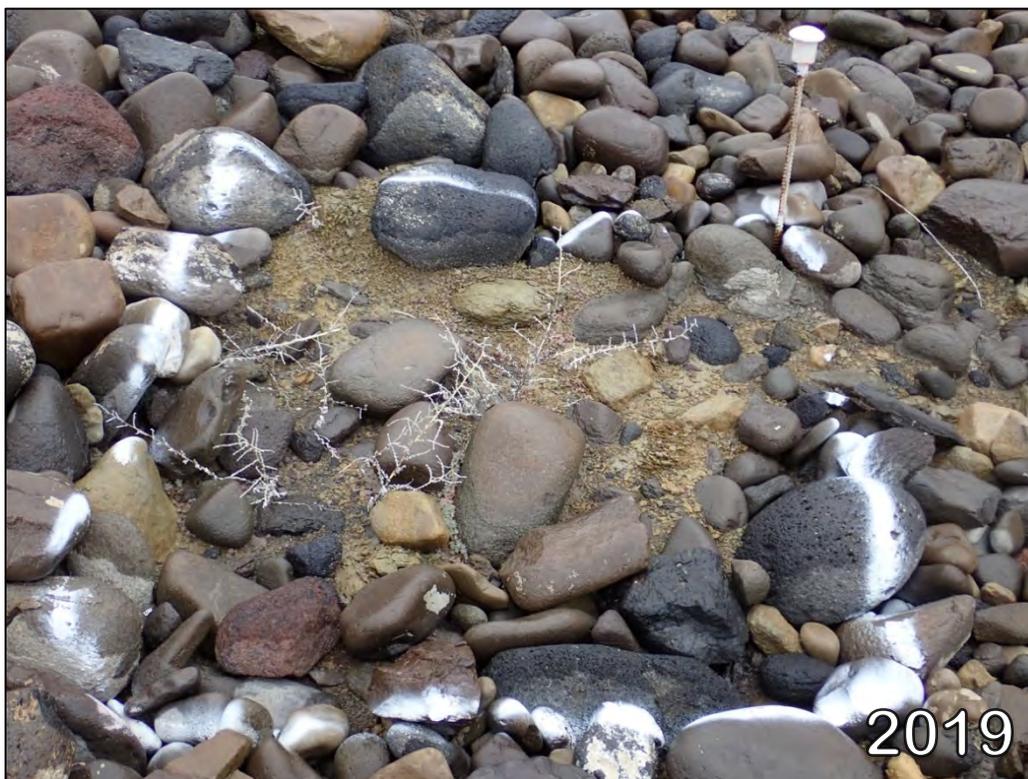
PL-7. (b) Rock Quality Plot No. II—2010 Photo for Comparison



PL-8. (a) Rock Quality Plot No. III—2019



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



PL-9. (a) Rock Quality Plot No. IV—2019



PL-9. (b) Rock Quality Plot No. IV—2010 Photo for Comparison



PL-10. (a) Rock Quality Plot No. V—2019



PL-10. (b) Rock Quality Plot No. V—2010 Photo for Comparison



PL-11. (a) Rock Quality Plot No. VI—2019



PL-11. (b) Rock Quality Plot No. VI—2010 Photo for Comparison



PL-12. (a) Rock Quality Plot No. VII—2019



PL-12. (b) Rock Quality Plot No. VII—2010 Photo for Comparison



PL-13. (a) Rock Quality Plot No. VIII—2019



PL-13. (b) Rock Quality Plot No. VIII—2010 Photo for Comparison



PL-14. Settlement Plate 8



PL-15. Standing Water in Disposal Cell Toe Drainage



PL-16. Saltbush Growing on Disposal Cell Access Road



*PL-17. Intersection of Disposal Cell Top with West Side Slope of Disposal Cell;
EnergySolutions Disposal Cell in Background*



PL-18. EnergySolutions Facility on North Side of Cell

16.0 Shiprock, New Mexico, Disposal Site

16.1 Compliance Summary

The Shiprock, New Mexico, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site (site) was inspected on June 12, 2019. 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 (LTSP) (DOE 1994) and 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 general license. 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 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, 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 12, 2019. The inspection was conducted by M. Kastens, K. Whysner, D. Miller, and J. Bailey of the Office of Legacy Management Support (LMS) contractor. M. Kautsky (Office of Legacy Management [LM] site manager), M. Poston-Brown (NRC), G. Jay (LMS), and J. Tallbull (Navajo Nation Abandoned Mine Lands [AML] Program) attended the inspection. The purposes of the inspection were to confirm the integrity of the visible features at the site, identify changes in conditions that might affect conformance with the LTSP, and evaluate the need, if any, for maintenance or additional inspection and monitoring.

16.4.1 Site Surveillance Features

Figure 16-1 shows the locations of site features in black, including site surveillance features and inspection areas. 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 text, and new observations identified during the 2019 annual inspection are shown in red. Inspection results and recommended maintenance activities associated with site surveillance features are included in the following subsections. Photographs to support specific observations are identified 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 through a 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. The pictorial sign next to the entrance sign was faded and replaced after the inspection. 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. A gap was observed under the fence near perimeter sign P3. The 8-inch gap under the perimeter fence identified in 2018 was still present near perimeter sign P15. Maintenance to repair both gaps was completed in 2019 following the inspection. One perimeter fence post near perimeter sign P15 was disconnected, and a barbed-wire stanchion was damaged. These items were repaired following the inspection in 2019. Near perimeter sign P15, construction materials were again observed leaning against the perimeter fence in several locations on the Navajo Engineering and Construction Authority (NECA) side (PL-1). Dirt accumulation against the perimeter fence has bent the fence fabric between perimeter signs P11 and P12 (PL-2). NECA management was contacted following the inspection and requested to address both these maintenance needs.

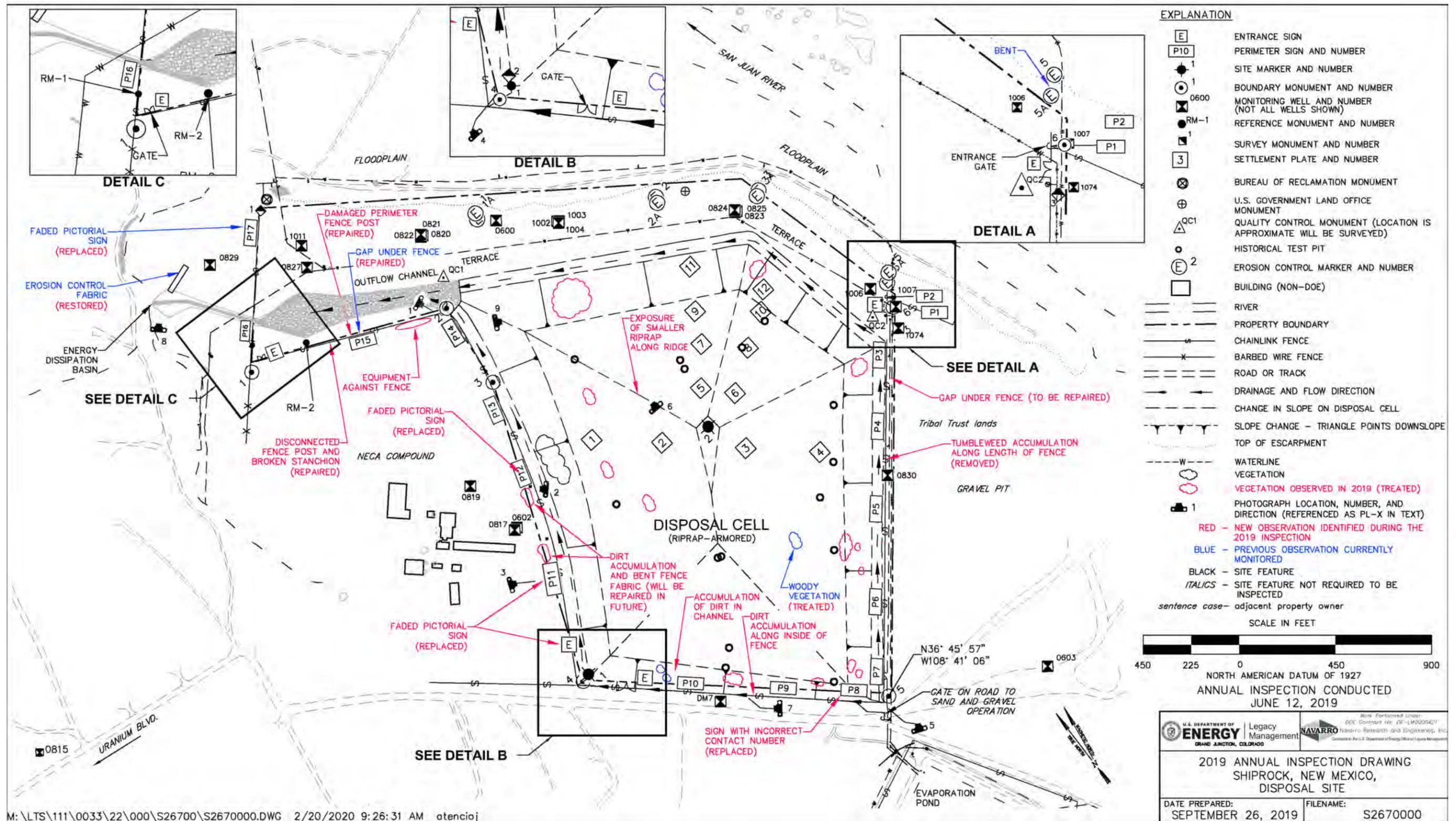


Figure 16-1. 2019 Annual Inspection Drawing for the Shiprock, New Mexico, Disposal Site

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Dirt accumulation was also observed along the inside of the perimeter fence between perimeter signs P9 and P10. No maintenance is needed at this time. Inspectors will continue to monitor these areas. Regular maintenance continues to mitigate the accumulation of trash and tumbleweeds along the fence, although some minor tumbleweed accumulation was observed along the southeastern perimeter fence between perimeter signs P3 and P7. Maintenance to keep the perimeter fence lines free of debris will continue.

There are 17 pairs of perimeter signs, designated P1 through P17 (each pair consisting of one pictorial and one textual sign), positioned along the perimeter fence.¹ The pictorial signs near the southwestern entrance sign and perimeter signs P11, P12, and P17 were faded (PL-3) and were replaced following the inspection. The phone number on perimeter sign P8 was updated following the inspection. No other maintenance needs were identified.

16.4.1.3 Site Markers

The site has two granite site markers. Site marker SMK-1 is just inside the west gate; minor cracks in its concrete base were resealed in 2018 (PL-4). Site marker SMK-2 is on the top slope of the disposal cell. No maintenance needs were identified.

16.4.1.4 Survey and Boundary Monuments

Three survey monuments and six boundary monuments delineate the property boundary. Two additional boundary monuments are offsite; monitoring of these monuments was discontinued in 1999 and 2003. Steel T-posts were installed next to all boundary monuments to help inspectors locate the monuments. The site map was updated with the more recent coordinates for boundary marker BM-6, as resurveyed in 2018. Boundary marker BM-1 was identified within the NECA yard, and the location was added to the site map following the inspection. The GPS coordinates were resurveyed in 2019 following the inspection. The concrete at survey monument SM-1 is cracked, but the crack does not threaten the integrity of the marker. All boundary monuments were observed to be clear of vegetation and visible during the inspection. No maintenance needs were identified.

16.4.1.5 Erosion Control Markers

The site has four pairs of erosion control markers along the edge of the terrace escarpment (1/1A; 2/2A; 3/3A; and 5/5A). 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, near the east entrance gate, was previously bent by a vehicle, but it is still 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

¹ Plate 1 of the LTSP shows six sets of perimeter signs on fence fabric along the terrace escarpment. These were never installed because a fence was never installed in this area. As the escarpment itself prohibits access to the site, a fence was not needed.

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 (PL-5). There was no evidence of erosion, settling, slumping, rock degradation, or other modifying processes that might affect the integrity of the disposal cell. Piezocones associated with a research project were installed on the disposal cell cover in the past and 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 contains numerous ruts associated with past vehicle traffic. An area where smaller riprap has been exposed was identified along the northern ridge of the disposal cell (PL-6). This area will be monitored for further changes that might indicate erosion or degradation of the cover. 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. Numerous woody shrubs were growing on the top and side slopes of the disposal cell; these were treated in 2019 following the inspection.

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 (PL-7). It is possible that the sediment was generated from the maintenance of the road adjacent to the perimeter fence and has settled in the bottom of the channel. These shrubs do not adversely affect the performance of the diversion channel at this time and are not a concern, but they will continue to be monitored. Nonwoody plants were growing within the outflow channel, and woody vegetation was growing on the banks of the channel. 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 in 2019. 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 annual inspection procedures because the seeps are now being monitored as part of the groundwater compliance strategy for the site. No maintenance needs were identified.

16.4.2.3 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 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.

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 strategy. Both the security fence and pond were intact and functional at the time of the inspection. Inspectors noted that the offsite portion of the outflow channel was functional and clear of debris. The degraded portion of the erosion control fabric on the south-facing bank of the energy dissipation basin identified during the 2018 inspection has been repaired and is functioning as intended (PL-8).

Fences and warning signs posted in Bob Lee Wash are maintained under the groundwater compliance strategy and are not examined during the annual inspection. No other maintenance needs were identified.

16.5 Follow-Up or Contingency Inspections

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

16.6 Maintenance and Repairs

Minor maintenance needs identified by the inspectors during the 2018 annual inspection and completed in 2019, include the following:

- Replacing the pictorial perimeter sign P17
- Repairing the gap under the perimeter fence near perimeter sign P15
- Treating woody vegetation on the disposal cell top and side slopes
- Repairing the degraded portion of the erosion control fabric on the south-facing bank of the energy dissipation basin

Inspectors documented minor maintenance needs that were addressed following the inspection, including the following:

- Replacing the faded pictorial sign next to the entrance sign
- Repairing a fence post and stanchion near perimeter sign P15
- Contacting NECA management to request removal of construction material leaning against the perimeter fence near perimeter sign P15, repair of the fence fabric between perimeter signs P11 and P12, and assistance in fence repairs along the common fence
- Removing accumulating tumbleweeds on the southeast side of the perimeter fence
- Replacing the pictorial signs next to the southwest entrance sign and perimeter signs P11 and P12
- Treating new woody vegetation on the disposal cell top and side slopes

Ongoing maintenance conducted at the site includes removal of trash and debris (including tumbleweeds) along the perimeter fence.

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 (along the terrace and at offsite locations) are not included in the annual inspection process. All wells encountered during the inspection were locked, and no maintenance needs were observed.

16.7.2 Vegetation Monitoring

In a 1999 letter to the Navajo AML Reclamation/Uranium Mill Tailings Remedial Action Department (Bergman-Tabbert 1999), LM committed to spraying annual weeds on the disposal cell top slope. During the inspection, annual weeds were observed growing on less than 1% of the top slope. After discussion among LM, Navajo AML, and LMS ecologists, LM recommended that it cease treatment of nonnoxious weeds on the cell and allow natural plant succession to progress. LM wrote a new letter to Navajo AML outlining its proposed vegetation management plan. Under the plan, LM would continue to treat State of New Mexico– and Navajo Nation–listed noxious weeds (primarily *Halogeton glomeratus*) in accordance with applicable laws and deep-rooted woody species in accordance with the LTSP (Kautsky 2019). Vegetation will continue to be monitored to inform future management decisions (PL-9).

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, U.S. Department of Energy Office of Legacy Management, letter (about Shiprock Uranium Mill Tailings Remedial Action site) to M. Roanhorse, Division of Natural Resources, Navajo Uranium Mill Tailings Remedial Action Program, 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, U.S. Department of Energy Office of Legacy Management, letter (on Proposed Revision to Vegetation Control on the Shiprock Disposal Cell) to Madeline Roanhorse, Director Navajo Nation UMTRA Program Division of Natural Resources, October 10, 2019.

16.10 Photographs

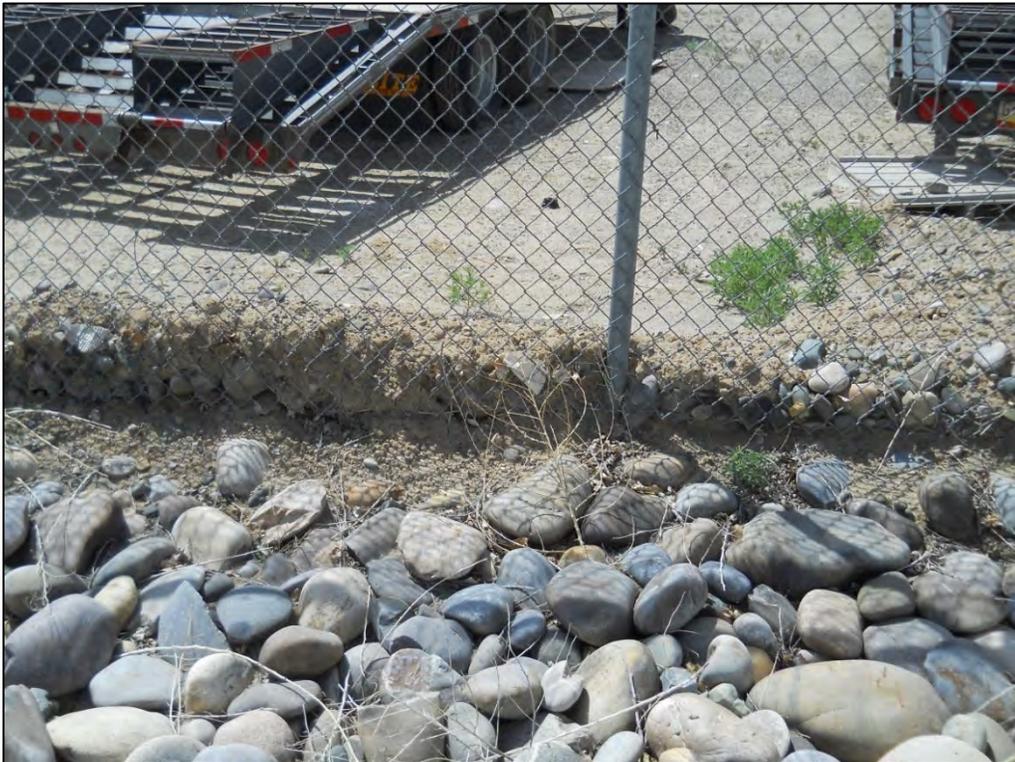
Photograph Location Number	Azimuth	Photograph Description
PL-1	160	NECA Equipment Against Perimeter Fence Between Perimeter Signs P14 and P15
PL-2	315	Dirt Accumulation Against Perimeter Fence Between Perimeter Signs P11 and P12
PL-3	115	Faded Pictorial Perimeter Sign P11 at NECA Yard
PL-4	—	Site Marker SMK-1
PL-5	25	Perimeter Fence and Southern Corner of Disposal Cell
PL-6	—	Exposure of Smaller Cobbles and Gravels Along Ridge of Disposal Cell
PL-7	310	Sediment Accumulation in Diversion Channel Along Southwest Slope of Disposal Cell
PL-8	45	Revegetated Slopes at Energy Dissipation Basin
PL-9	120	Vegetation on Northeast Side Slope of Disposal Cell (Treated)

Note:

— = Photograph taken vertically from above.



PL-1. NECA Equipment Against Perimeter Fence Between Perimeter Signs P14 and P15



PL-2. Dirt Accumulation Against Perimeter Fence Between Perimeter Signs P11 and P12



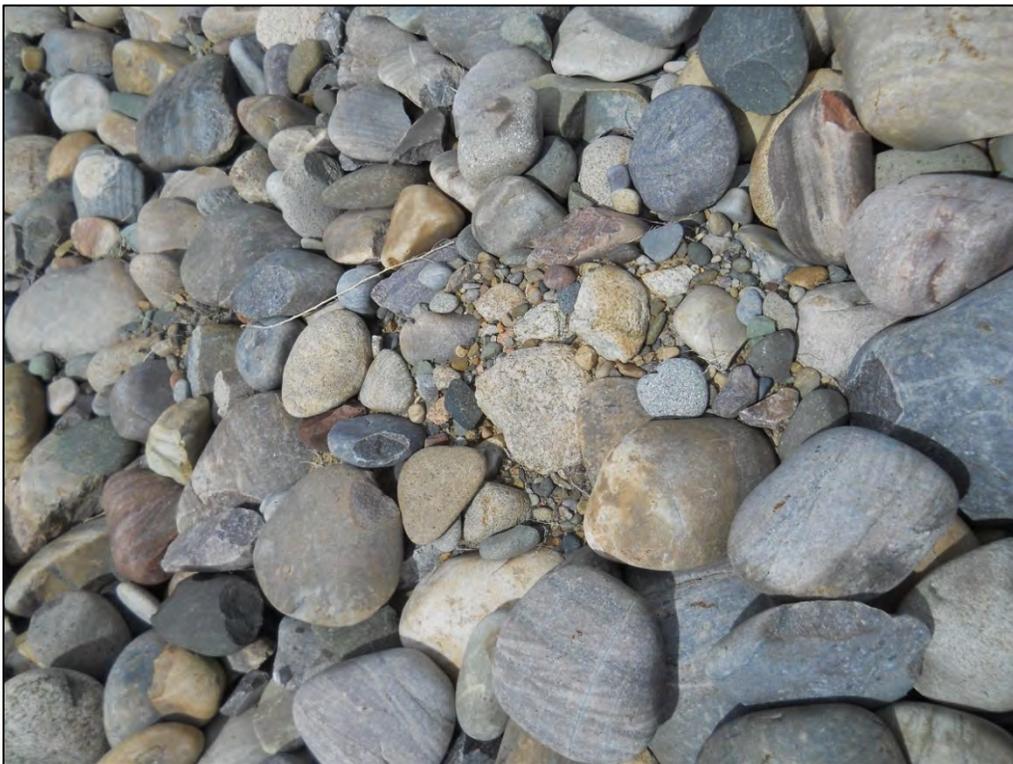
PL-3. Faded Pictorial Perimeter Sign P11 at NECA Yard



PL-4. Site Marker SMK-1



PL-5. Perimeter Fence and Southern Corner of Disposal Cell



PL-6. Exposure of Smaller Cobbles and Gravels Along Ridge of Disposal Cell



PL-7. Sediment Accumulation in Diversion Channel Along Southwest Slope of Disposal Cell



PL-8. Revegetated Slopes at Energy Dissipation Basin



PL-9. Vegetation on Northeast Side Slope of Disposal Cell (Treated)

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 (site) was inspected on May 29, 2019. No changes were observed on the disposal cell or in the associated drainage features. Inspectors identified several 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 long-term surveillance and maintenance of the site are specified in the site-specific Long-Term Surveillance Plan (LTSP) (DOE 1998) in accordance with procedures established to comply with the requirements of the U.S. Nuclear Regulatory Commission (NRC) general license at Title 10 *Code of Federal Regulations* Section 40.27 (10 CFR 40.27). Table 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, 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 29, 2019. The inspection was conducted by D. Traub and D. Marshall of the Office of Legacy Management Support (LMS) contractor. J. Nguyen (Office of Legacy Management [LM] site manager), M. Cosby (Colorado Department of Public Health and Environment), L. Gersey and A. Roberts (NRC), and K. Whysner and K. Meadows (both of 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 the need, if any, for maintenance or additional inspection and monitoring.

17.4.1 Site Surveillance Features

Figure 17-1 shows the locations of site features in black, including site surveillance features and inspection areas. 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 text, and new observations identified during the 2019 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 identified 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 wire entrance gate was locked and is worn but remains functional. The entrance sign is next to the gate. No maintenance needs were identified.

17.4.1.2 Perimeter Fence and Signs

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. A T-post along the northeast perimeter fence was broken and will be repaired before the next inspection. Woody vegetation was growing in the perimeter fence, including a rabbitbrush near the entrance sign (PL-7). Following the inspection, the rabbitbrush was removed and the vegetation sprayed with herbicide.

There are 32 perimeter signs, attached to steel posts set in concrete, positioned along the property boundary; they are set back 5 feet (ft) and cut in at the southwest corner. Some cracking of the printed overlay is beginning to appear on several signs, and several signs have bullet damage, but all remain legible (PL-1). The concrete bases on two perimeter signs (P14 and P15) are slightly undercut by erosion but remain stable. No other 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 the top slope of the disposal cell. Erosion near site marker SMK-1 is being monitored and will be repaired if it threatens the integrity of the marker. No immediate maintenance needs were identified.

17.4.1.4 Survey and Boundary Monuments

The site has three survey monuments. Survey monument SM-2 was set in a low area and is frequently covered by several inches of soil. A T-post and rocks have been placed next to the monument to assist in locating this feature. Six boundary monuments delineate the corners of the site boundary (PL-2). No maintenance needs were identified.

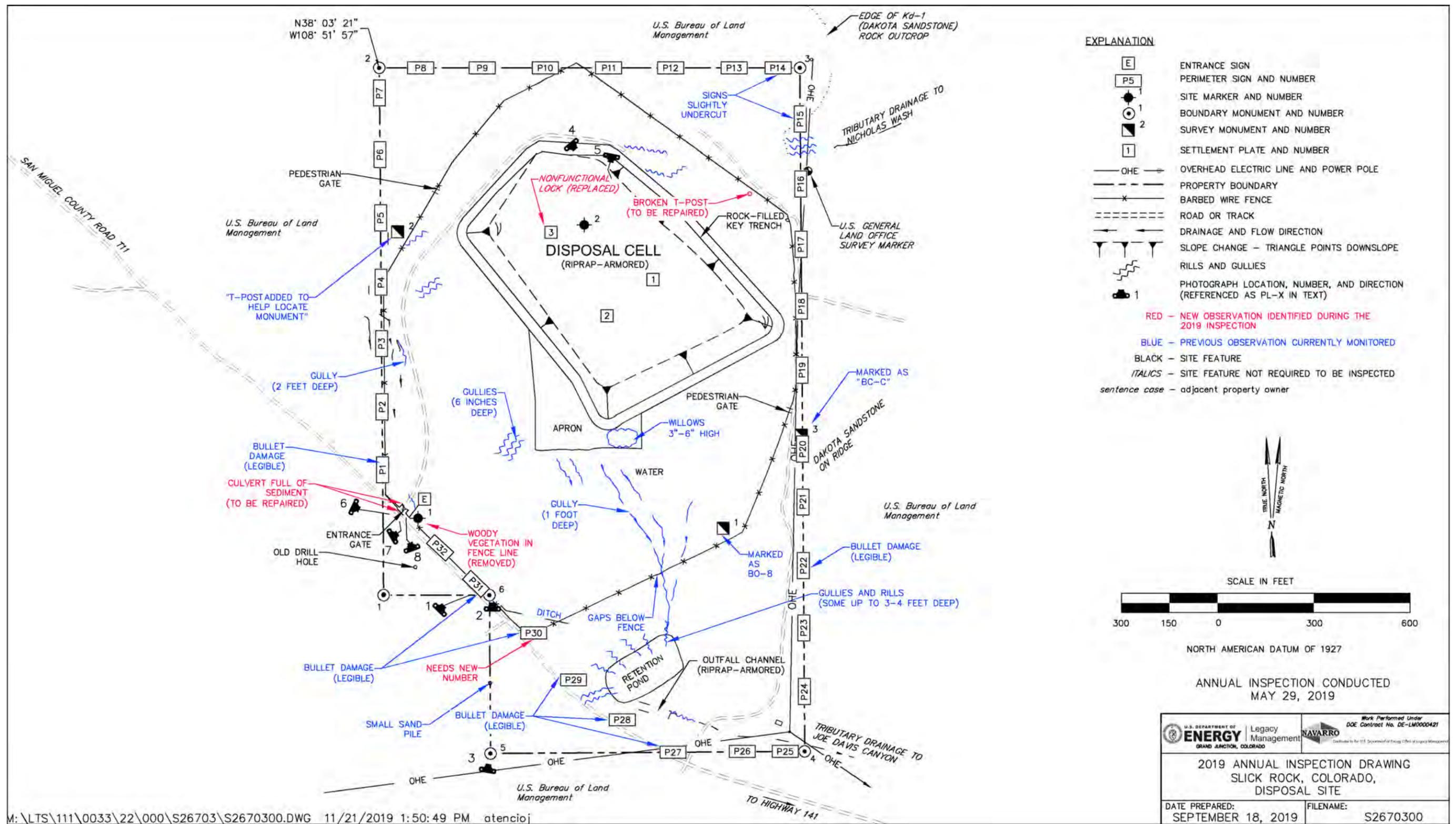


Figure 17-1. 2019 Annual Inspection Drawing for the Slick Rock, Colorado, Disposal Site

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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-3 and 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. During the 2016 annual inspection, inspectors observed a small area below the grade break with the top slope where the rock surface appears lower than the surrounding rock. This was inspected in 2017, 2018, and 2019 and could not be located. Inspectors will continue to monitor the area.

At the toe of the disposal cell side slopes is a key trench that encloses the disposal cell. The key trench, designed to convey runoff water away from the disposal cell, is as much as 5 ft deep and 20 ft wide and filled with rock. Runoff water 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. Willow brush (a deep-rooted species) is growing on a portion of the apron but is not considered to be detrimental to the integrity of the disposal cell. The settlement plate SP-3 lock was not functional and was replaced during the inspection. No other maintenance needs were identified.

17.4.2.2 Area Between the Disposal Cell and the Site Boundary

The area around the disposal cell includes the retention pond. Surface drainage from the disposal cell flows south from the apron into the retention pond, which is constructed in a channel tributary 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 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 as much as 3 ft deep adjacent to the pond and shallower farther upslope. The rills are stabilizing. Abundant rock is naturally present in the soil, and additional rock was added to the deeper rills to arrest or slow erosion. Beneficial vegetation is also establishing in the bottoms of the rills. The erosion does not present a hazard to the disposal cell or to any site features, so repairs are not warranted. Instead, the rills should be allowed to further stabilize. Inspectors will continue to monitor these erosional features.

Erosion rills and gullies are present in several other areas of the site but do not affect the disposal cell or any site features. They appear to be stabilizing with the establishment of vegetation but will continue to be monitored. Vegetation in the reclaimed areas was healthy. Noxious weeds are controlled to comply with State of Colorado and San Miguel County requirements.

Two culverts are present (1) beneath the site access road outside of the entrance gate and (2) beneath the access road inside the entrance gate. Both culverts are approximately 80% to 90% full of sediment (PL-5 and PL-6). Vegetation growing in the drainage channel has stabilized the sediment. Before the next inspection, maintenance will be conducted to clear established vegetation from the drainage channel and clear the culverts so they perform as designed. No other maintenance needs were identified.

17.4.2.3 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. 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 firewood cutting and recreation, such as hunting and off-road use by all-terrain vehicles.

17.5 Follow-Up Inspections

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

17.6 Maintenance and Repairs

Inspectors documented minor maintenance needs that were completed in 2019 following the inspection. They include:

- Removal of rabbitbrush growing at the fence post near the entrance sign
- Herbicide spraying of woody vegetation growing at fence T-posts
- Replacement of the lock on settlement plate SP-3

Remaining site maintenance will be completed before the next inspection in 2020, which includes:

- Clearing accumulated sediment from culverts near the site entrance
- Minor fence repair to replace a broken T-post along the northeast boundary of the site

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. Groundwater in the uppermost aquifer is designated as limited use because of low yield. The aquifer does not yield a large enough quantity of water to be used for beneficial purposes; with no complete exposure pathways at the site, monitoring is not required. All monitoring wells were abandoned in 2001, and the standpipes in the disposal cell were abandoned in 2002.

17.8 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.

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	Perimeter Sign P31
PL-2	—	Boundary Monument BM-5
PL-3	140	View Southeast to Eastern Corner of Disposal Cell
PL-4	250	View to Southwest Along East Edge of Disposal Cell
PL-5	190	North Roadside Culvert
PL-6	60	South Roadside Culvert
PL-7	340	Woody Vegetation Next to Fence Post with Culvert at Gate Entrance

Note:

— = Photograph taken vertically from above.



PL-1. Perimeter Sign P31



PL-2. Boundary Monument BM-5



PL-3. View Southeast to Eastern Corner of Disposal Cell



PL-4. View to Southwest Along East Edge of Disposal Cell



PL-5. North Roadside Culvert



PL-6. South Roadside Culvert



PL-7. Woody Vegetation Next to Fence Post with Culvert at Gate Entrance

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18.0 Spook, Wyoming, Disposal Site

18.1 Compliance Summary

The Spook, Wyoming, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site (site) was inspected on July 17, 2019. No changes were observed on the land surface of the disposal cell. Inspectors identified no maintenance needs and found no cause for a follow-up or contingency inspection. 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 (LTSP) (DOE 1993) 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, 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 17, 2019. The inspection was conducted by C. Boger, R. Johnson, B. Mays, and N. Keller of the Office of Legacy Management Support contractor. T. Jasso (Office of Legacy Management [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 the need, if any, for maintenance or additional inspection and monitoring.

18.4.1 Site Surveillance Features

Figure 18-1 shows the locations of site features in black, including site surveillance features and inspection areas. 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 text. There were no new observations in 2019. Inspection results and recommended maintenance activities associated with site surveillance features are included in the following subsections. Photographs to support specific observations are identified 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 the Hornbuckle Ranch Road. Site access is maintained through perpetual easements across the Hornbuckle ranch. The road to the site is graded and hard packed and is maintained by the ranch. The entrance sign is mounted on a steel post set in concrete (PL-1). No maintenance needs were identified.

18.4.1.2 Perimeter Signs

There are 10 perimeter signs, attached to steel posts set in concrete, positioned around the site outside the unfenced property boundary (PL-2). The DOE 24-hour telephone number was updated on perimeter sign P10 during the inspection. No 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 (PL-4). Boundary monument BM-6 is bent but stable. 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 they are on his property but is not concerned. Therefore, the survey and boundary monuments and perimeter signs will remain at their current locations.

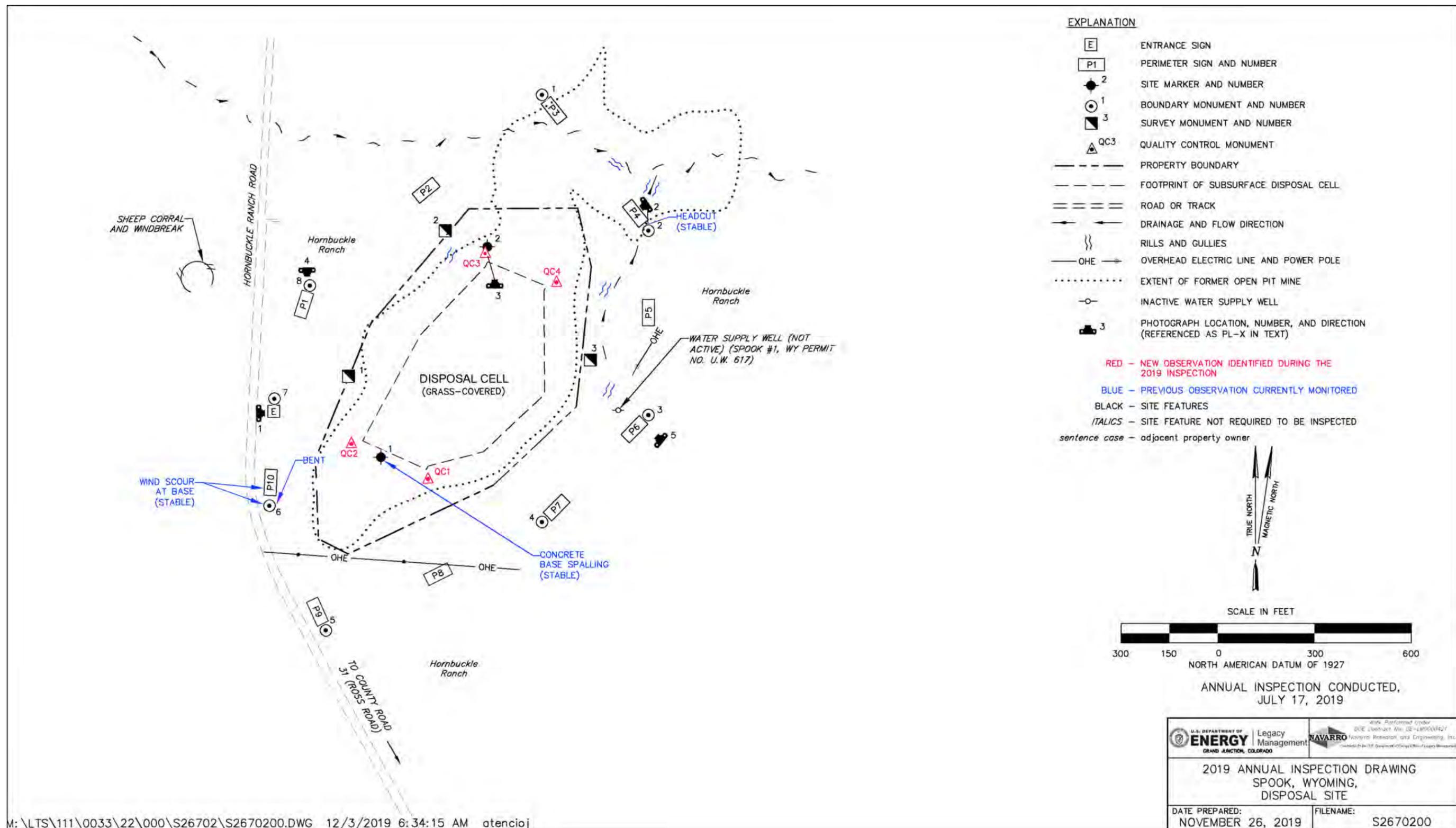


Figure 18-1. 2019 Annual Inspection Drawing for the Spook, Wyoming, Disposal Site

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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 LTSP requirements.

18.4.2.1 Disposal Cell

The site is unique among Title I sites in that 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 (PL-5). 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 they appeared to be stable. The erosion is not harming the function of the disposal cell cover or other site features, and it is not a concern at this time. Inspectors will continue to monitor this area.

The access road has frequent truck traffic to service and maintain oil wells in the area. Even though oil field activity has greatly increased near the site, inspectors found no evidence of trespassing or vandalism on the site.

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

In July 2019, following the inspection, four permanent quality control monuments were installed at the site in preparation for a baseline aerial survey of the disposal cell. The quality control monument locations are shown in Figure 18-1. No maintenance needs were identified.

18.7 Groundwater Monitoring

In accordance with the LTSP, groundwater monitoring is not required due to the application of supplemental standards. Groundwater at the site qualifies for supplemental standards because it is designated as limited use, 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 contamination from widespread, naturally occurring uranium mineralization and is of limited yield. Therefore, monitoring of the groundwater 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	Entrance Sign Before Update
PL-2	235	Perimeter Sign P4
PL-3	—	Site Marker SMK-2
PL-4	—	Boundary Monument BM-8
PL-5	310	View Northwest of Perimeter Sign P6 and Vegetated Ground Surface

Note:

— = Photograph taken vertically from above.



PL-1. Entrance Sign Before Update



PL-2. Perimeter Sign P4



PL-3. Site Marker SMK-2



PL-4. Boundary Monument BM-8



PL-5. View Northwest of Perimeter Sign P6 and Vegetated Ground Surface

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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 (site) was inspected on April 9, 2019. No changes were observed on the disposal cell or in the associated drainage features. Inspectors identified several 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 to compare current conditions to baseline postconstruction groundwater quality at the site. 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. Evaluative groundwater results from monitoring conducted in February and August 2019 indicate that groundwater quality immediately downgradient of the former mill site is still degraded relative to concentrations of molybdenum, nitrate, selenium, and uranium in the background well. Periodically throughout the year, contaminated groundwater is extracted and placed in the onsite evaporation pond to help prevent further downgradient movement of the contaminants. The progress of groundwater remediation is evaluated and reported annually, separately from this compliance evaluation.

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 (LTSP) (DOE 1996) 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 disposal 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 and the Navajo Nation executed a Custodial Access Agreement that conveys to the federal government

title to the residual radioactive materials stabilized at the disposal 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, 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, 5 miles northeast of Tuba City, Arizona, was inspected on April 9, 2019. The inspection was conducted by M. Kastens and P. Lemke of the Legacy Management Support contractor. J. Tallbull (Navajo Abandoned Mine Lands/Uranium Mill Tailings Remedial Action) and N. Honie and L. Leslie (Hopi Tribe's Office of Mining and Mineral Resources) 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 the need, if any, for maintenance or additional inspection and monitoring.

19.4.1 Site Surveillance Features

Figure 19-1 shows the locations of site features, including site surveillance features and inspection areas, in black. 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 text, and new observations identified during the 2019 annual inspection are shown in red. Inspection results and recommended maintenance activities associated with site surveillance features are included in the following subsections. Photographs to support specific observations are identified in the text and in Figure 19-1 by photograph location (PL) numbers. The photographs and photograph log are presented in Section 19.10.

Many structures and features at the site are associated with the former groundwater treatment system. Beginning in 2002, contaminated groundwater was extracted from the affected aquifer, circulated through ion exchange and distillation units, and then reinjected into the affected aquifer upgradient of the disposal cell. This system was shut down in September 2014. Since that time, contaminated groundwater has continued to be extracted from the aquifer periodically throughout the year but has been placed in the onsite evaporation pond instead of being actively treated. The structures associated with the original treatment system remain onsite and include a control building; a shop and laboratory building; a water-treatment plant that includes an ion exchange building, external tanks, and a distillation skid; a solar water-heating (thermal) system; solar panels; evaporation ponds; an extensive network of extraction, injection, and monitoring wells; and a treated water infiltration system. The purpose of groundwater treatments has been to mitigate contamination that resulted from past uranium-ore processing at the site. Groundwater remediation activities are not addressed in the LTSP, because they are not related to the long-term disposal and stabilization of encapsulated contaminated materials. Therefore, the features associated with groundwater treatment are not included in the annual inspection and are only addressed in this report as they relate to site integrity or safety concerns.

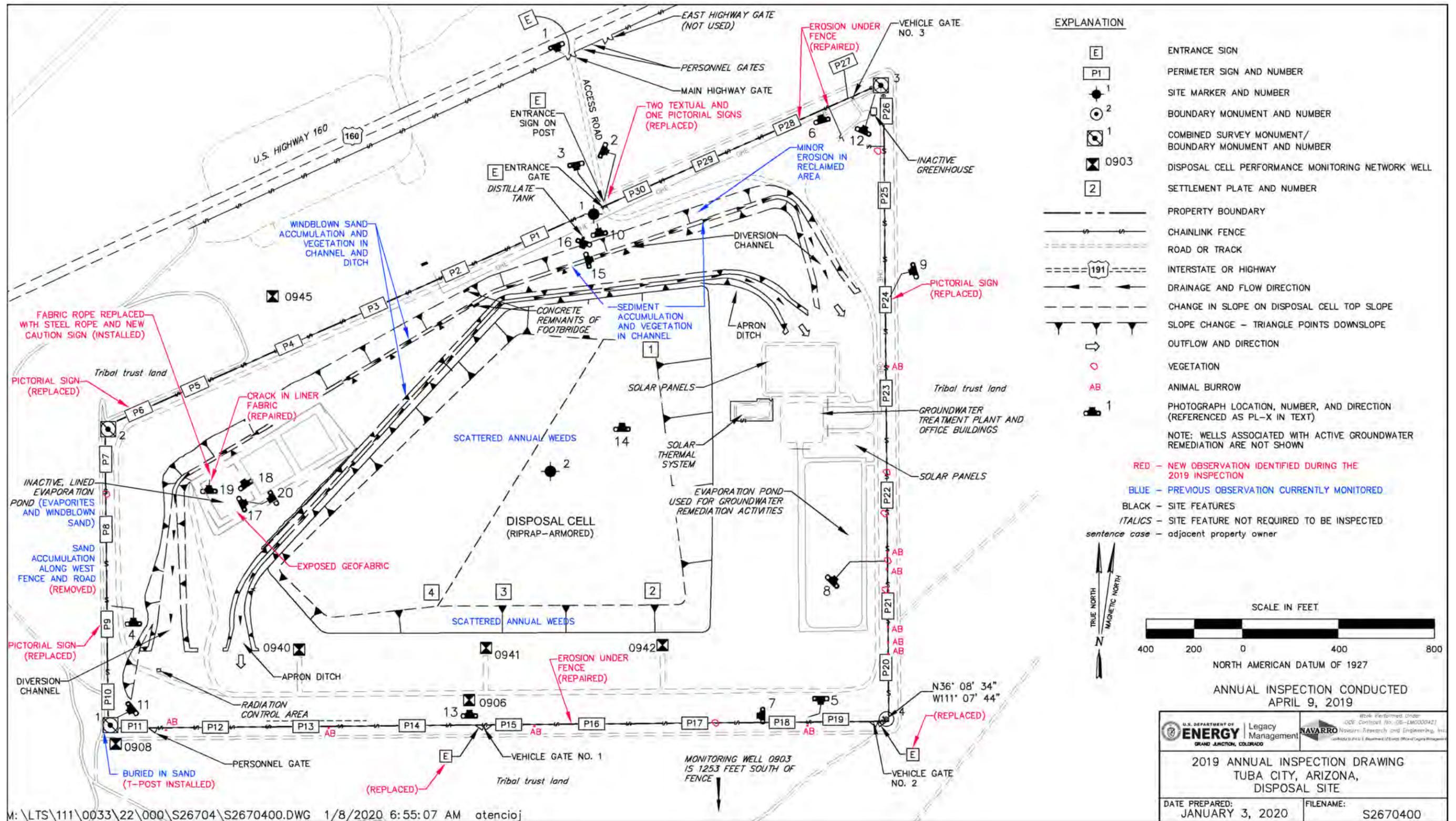


Figure 19-1. 2019 Annual Inspection Drawing for the Tuba City, Arizona, Disposal Site

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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 highway right-of-way (“main highway gate” in 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 open at the time of the inspection because of ongoing site activities. Vehicle gates are also present in the northeast corner of the site (to allow access to Diné College’s greenhouse) and along the southern fence line to facilitate access for offsite activities.

Entrance signs are posted on the main highway gate (PL-1) and vehicle entrance gates No.1 and No. 2. The phone number for the Hopi Tribe on the two textual signs at the entrance gate (PL-2) was outdated, and the textual sign on the entrance gate was cracked and missing the Navajo Nation phone number. A pictorial sign on the entrance gate is cracked and peeling (PL-3); all three signs at the entrance gate were replaced following the inspection. Additional entrance signs are attached to vehicle gate No. 1 and vehicle gate No. 2 along the southern fence line; these signs have bullet damage and were replaced following the inspection. Vehicle gate No. 3, in the northeast corner of the site, purposefully does not have a sign. No other maintenance needs were identified.

19.4.1.2 Perimeter Fence and Signs

A chainlink perimeter fence encloses the site. Windblown sand continues to accumulate along the western perimeter fence, the associated road (PL-4), and in a few areas along the western end of the north perimeter fence. In one area, sand accumulation is so high that people or animals could step or jump over the fence. Inspectors found numerous animal burrows (PL-5) and several areas of erosion beneath the fence (PL-6). Woody vegetation continues to grow along portions of the fence (PL-7 and PL-8) and may eventually affect its function. As a result of these observations, fence maintenance was completed in 2019: Sand was removed from accumulated areas and from the western perimeter road, gaps beneath the fence were filled with rock, accumulated tumbleweeds were cleared from the fence, and woody vegetation was removed from the fence fabric (and their remnant stumps treated with herbicide).

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. All were legible and stable, with the exception of three pictorial signs becoming faded at the P6, P9, and P24 locations (PL-9); these signs were replaced following the inspection. No other maintenance needs were identified.

19.4.1.3 Site Markers

The site has two granite site markers. Site marker SMK-1 (PL-10) 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 were found in this condition during the inspection. Survey and boundary monument SM/BM-1 could not be found with a shovel (PL-11) but finally was located and a T-post was installed to mark its location permanently. Survey and boundary monument SM/BM-3, marked with a steel T-post, was uncovered during the inspection (PL-12). No other maintenance needs were identified.

19.4.1.5 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 distal downgradient well 0903, which is offsite), and all were found to be undamaged and locked, with one exception: The wellhead protector for well 0906 was removed because an electronic datalogger was collecting data from the well at the time of the inspection (PL-13). Monitoring wells are also inspected during semiannual groundwater sampling events; their condition and maintenance needs, if any, are reported. No maintenance needs were identified.

19.4.2 Inspection Areas

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

19.4.2.1 Disposal Cell

The disposal cell, completed in 1989, occupies 50 acres. The disposal cell is armored with riprap to control erosion and deter animal and human intrusion. 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. 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 the cell top or side slopes during the inspection. Scattered patches of annual weeds grow on the disposal cell top and side slopes (PL-14), but these shallow-rooted plants are not a concern. Windblown sand and dirt continue to accumulate on the rock-covered surfaces, providing a favorable environment for plant growth. No maintenance needs were identified.

19.4.2.2 Area Between the Disposal Cell and the Site Boundary

The disposal cell is protected from surface water runoff by a disposal cell apron ditch and a diversion channel, both 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 (PL-15) along the north and northwest sides of the disposal cell. This 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, consisting of noncohesive sandy soil, is subject to erosion from storm runoff. Erosion repair conducted in this area in 2013 was successful in reducing the rate of erosion and subsequent soil deposition in the channel. Some erosion and deposition continue (PL-16), however, and erosion control repairs are performed as needed. No repairs are necessary at this time.

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 in 2007 and again in 2013. Because the area is often scoured by wind, perennial vegetation is establishing extremely slowly (PL-17), and most of the plants are early successional annual species.

The remaining evaporation pond, filled minimally with windblown sand and evaporites, is retained as a backup for the main evaporation pond on the east side of the site. Inspectors noted several maintenance needs associated with the pond. First, the fabric safety rope and caution signs surrounding the pond were deteriorated and found on the ground, (PL-18) likely due to consistent high winds. The fabric rope was replaced with a steel rope, and new caution signs were hung. Secondly, the high-density polyethylene (HDPE) liner contained a small crack on the surface (PL-19) and was repaired. Lastly, the plastic geofabric that stabilizes the south-facing slope of the pond was exposed (PL-20), probably due to wind erosion. 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.

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 such impacts were identified.

19.5 Follow-Up Inspections

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

19.6 Maintenance and Repairs

Inspectors observed and reported numerous maintenance and repair items that were completed following the 2019 inspection, including:

- Replacement of two textual and one pictorial sign on the entrance gate
- Updating phone numbers for the Hopi Tribe Department of Natural Resources on two textual signs
- Replacement of entrance signs on vehicle gate No. 1 and vehicle gate No. 2

- Removal of accumulated sand from the western perimeter fence, perimeter road, and along the northern perimeter fence
- Repair of gaps beneath the fence created by animals and soil erosion
- Replacement of three pictorial perimeter signs at the P6, P9, and P24 locations
- Location of survey and boundary monument SM/BM-1, with installation of a steel T-post to permanently mark its location
- Replacement of the evaporation pond fabric safety rope with steel rope
- Installation of new caution signs surrounding the northwestern evaporation pond
- Repair of the surficial crack in the HDPE liner of the northwestern evaporation pond
- Removal and treatment of vegetation

No other maintenance needs were identified.

19.7 Environmental Monitoring

In accordance with the LTSP, semiannual groundwater monitoring is conducted to compare current conditions to baseline postconstruction groundwater quality at the site. 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 and limits the effectiveness of normal POC groundwater monitoring as a reliable indicator of disposal cell performance (40 CFR 192 Subpart A). 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. The purpose of this evaluative monitoring is to (1) assess trends in groundwater quality in the uppermost aquifer, (2) monitor the downgradient extent of contamination in groundwater, and (3) analyze the impacts of transient drainage and surface runoff on groundwater quality. Evaluative groundwater monitoring was conducted twice in 2019, in February and August. The progress of groundwater remediation is evaluated and reported annually, separately from this compliance evaluation.

Seven wells (Figure 19-2 and Table 19-2) as identified in the LTSP, are monitored for four target analytes: molybdenum, nitrate, selenium, and uranium (DOE 1996). Evaluative monitoring is considered indicative of disposal cell performance because these analytes: are present in tailings fluid; are present in the contaminant plume at higher than background concentrations; and are mobile in the aquifer. As a baseline for cell performance evaluation, provisional upper baseline limits (UBLs) for the target analytes were calculated in accordance with *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities—Interim Final Guidance* (EPA 1989) and documented in the LTSP (Table 19-3). 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. Exceedance of UBLs in more than 5% 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 area of the mill ponds (not covered by the disposal cell). Elevated concentrations attributed to transient drainage or infiltration would not be indicative of substandard performance for the cell.



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

Table 19-2. 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 accounts for 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.

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	10
Selenium	0.05	0.01
Uranium	1.17	0.044

Notes:

^a As documented in the 1996 LTSP.

^b MCLs as listed in 40 CFR 192 Table 1 Subpart A.

Abbreviation:

mg/L = milligrams per liter

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 groundwater remediation ongoing. However, the LTSP also noted that POC sampling and analysis protocol to monitor cell performance could not be established until groundwater restoration was complete, and that the LTSP would be revised at that time.

As noted in the definition of UBLs above, 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 (2000–2014) and interim treatment (2015 to present) the conditions near the LTSP evaluative wells have constantly been affected and exceedance of UBLs cannot be attributed to disposal cell performance. Recent operation of the interim treatment system, potentially affecting concentrations of target analytes in the LTSP-specified evaluative monitoring wells, is described in the following paragraphs.

Throughout the period of interim treatment (2015 to present) active remediation has been performed by pumping contaminated groundwater directly to the onsite evaporation pond (DOE 2015). The volume of contaminated groundwater that can be extracted is limited to the pond’s evaporation rate, at approximately 5 million gallons annually. From 2015 through 2017

groundwater extraction was operated year-round and the extraction flow rate was adjusted seasonally, operating at a relatively high rate in warm weather and at a lower rate in cold weather. In these years, three extraction wells were typically operated at flow rates ranging from 5 gallons per minute (gpm) to 30 gpm, dependent on seasonal changes in evaporation. The wells were used because of their consistent productivity and for maximum contaminant mass removal.

In 2018 and 2019 extraction pumping was conducted in high-intensity/short-duration campaigns, with the objective of evaluating the effects on plume capture and maximum groundwater drawdown achievable under the interim treatment regime. In 2018, the high-intensity/short-duration pumping campaign used 11 extraction wells operating at a cumulative flow rate of 44 gpm for 76 days. In 2019, the pumping campaign used 9 extraction wells at a cumulative pumping rate of 33 gpm for 99 days. Groundwater levels were constantly measured in a surrounding network of monitoring wells. Results and evaluation of the recent pumping campaigns will be reported in a groundwater performance report.

Figure 19-3 through Figure 19-6 show time-concentration plots for the four target analytes, along with corresponding UBLs and MCLs. All groundwater monitoring results for the site are reported and published on the LM Geospatial Environmental Mapping System website (<http://gems.lm.doe.gov/#site=TUB>). MCLs are presented as information only. The LTSP requirement related to disposal cell performance is for evaluative monitoring over time, in comparison with UBLs.

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 wells except well 0906 in August 2019 (Figure 19-3). Molybdenum concentrations in the westernmost downgradient well 0908 and in distal downgradient well 0903 (approximately 1250 feet south of the site perimeter) continue to be comparable to concentrations in background well 0945. Well 0906 exceeded the UBL for molybdenum in August 2019 for the first time since 1999. The UBL exceedance in well 906 was measured during the 2019 pumping campaign.

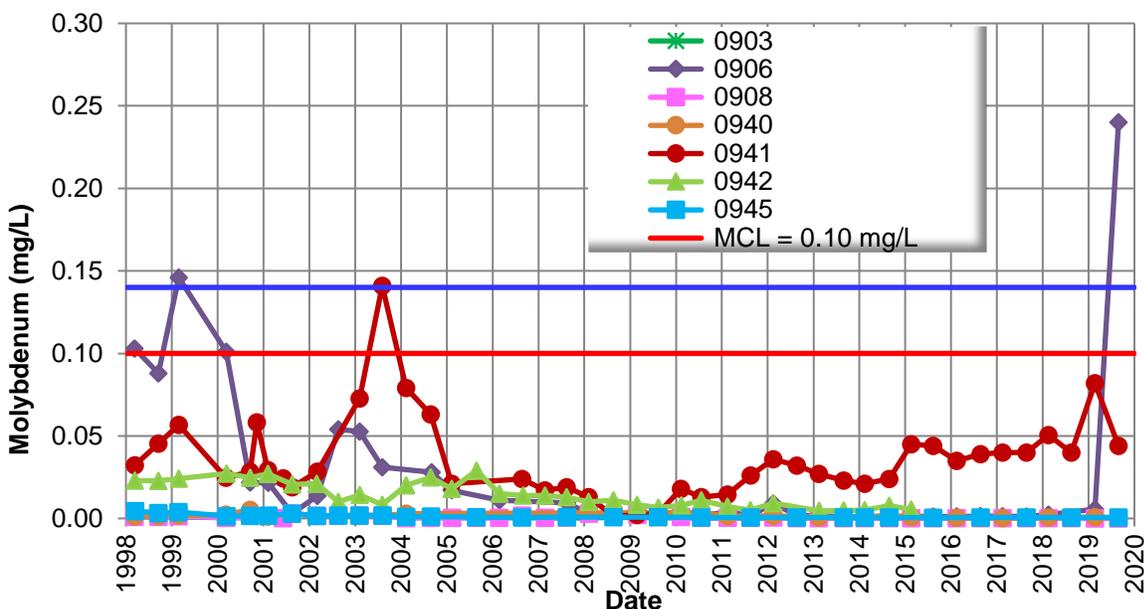


Figure 19-3. Molybdenum in Groundwater at the Tuba City, Arizona, Disposal Site

Nitrate concentrations have historically exceeded the 10 mg/L MCL in all LTSP evaluative wells, except background well 0945 (Figure 19-4). Exceedances of the 311 mg/L UBL were observed at compliance wells 0906 (340 mg/L), 0908 (340 mg/L), and 0940 (620 mg/L) in August 2019, during high-intensity pumping. This was the first historical exceedance in well 0908. LTSP evaluative well 0941 dropped below the UBL in February 2019 after exceeding it for the first time in August 2018. Nitrate concentrations in distal downgradient well 0903 regularly exceeded the MCL since 2004 but remain below the UBL.

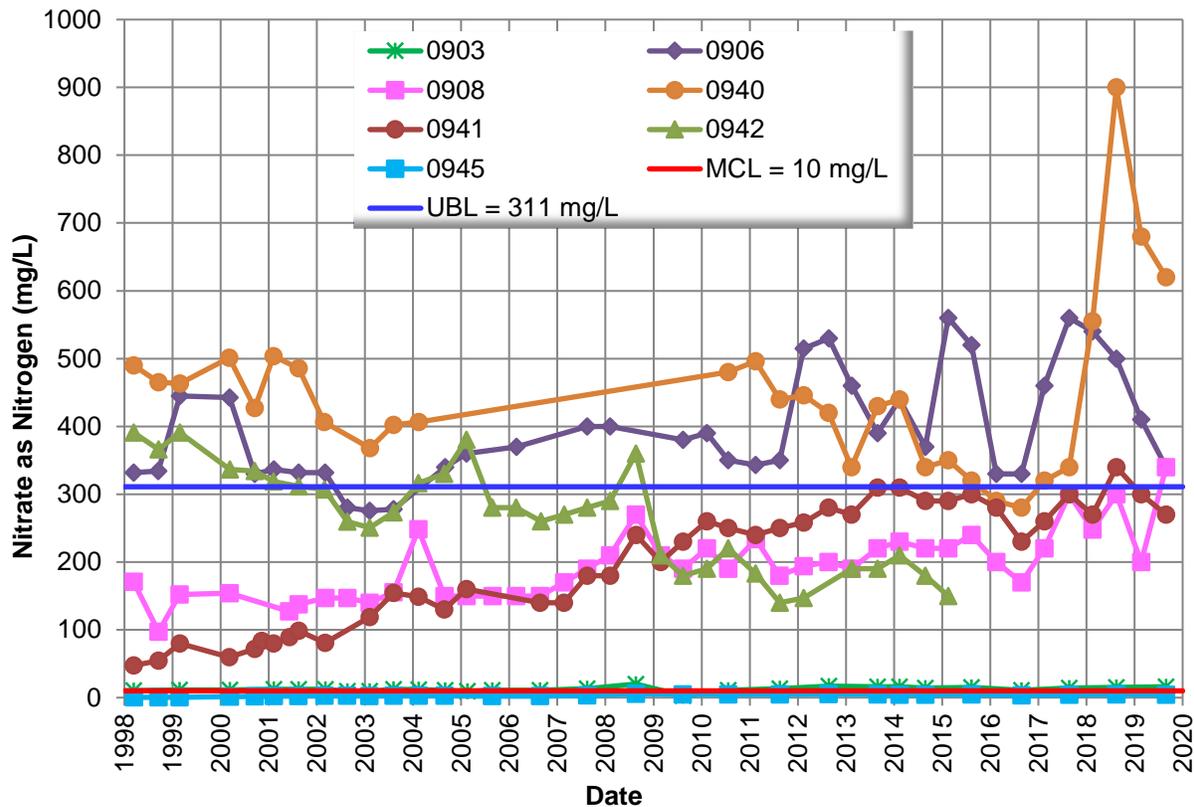


Figure 19-4. Nitrate in Groundwater at the Tuba City, Arizona, Disposal Site

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). Concentrations in well 0908 exceeded the UBL for selenium in 1997 and have since remained at the 0.01 mg/L MCL since August 2018. Selenium concentrations in well 0942 exceeded the UBL in February 2015, and that well has not been sampled since. Concentrations continued to exceed the 0.05 mg/L UBL in wells 0906, 0940, and 0941, all of which are immediately downgradient of the disposal cell. Selenium increased in well 0906 to 0.16 mg/L during the high-intensity pumping campaign in August 2019, the highest level since 1997. Selenium concentrations have increased in well 0941 from 0.018 mg/L in 1998 to 0.08 mg/L in 2019. Selenium concentrations in distal downgradient well 0903 have consistently been below both the UBL and the MCL and, since late 2004, below levels measured in background well 0945.

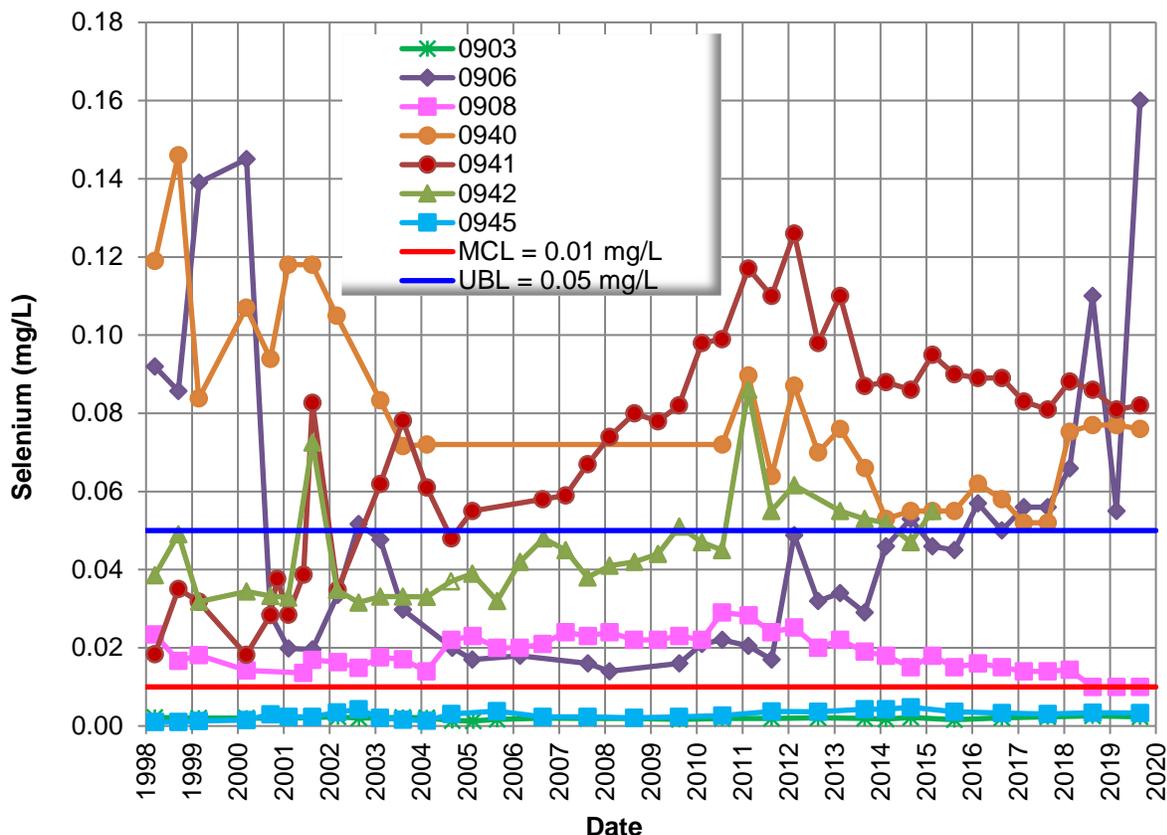


Figure 19-5. Selenium in Groundwater at the Tuba City, Arizona, Disposal Site

Uranium concentrations have historically exceeded the 0.044 mg/L MCL but remained below the 1.17 mg/L UBL in all compliance wells except for distal downgradient well 0903 and background well 0945, both of which have always been below the MCL (Figure 19-6).

Uranium concentrations in central downgradient well 0941 gradually increased since 2005 from 0.05 mg/L to 0.24 mg/L. Concentrations in well 0906 more recently increased from 0.36 mg/L in February 2017 to 1.0 mg/L in August 2019.

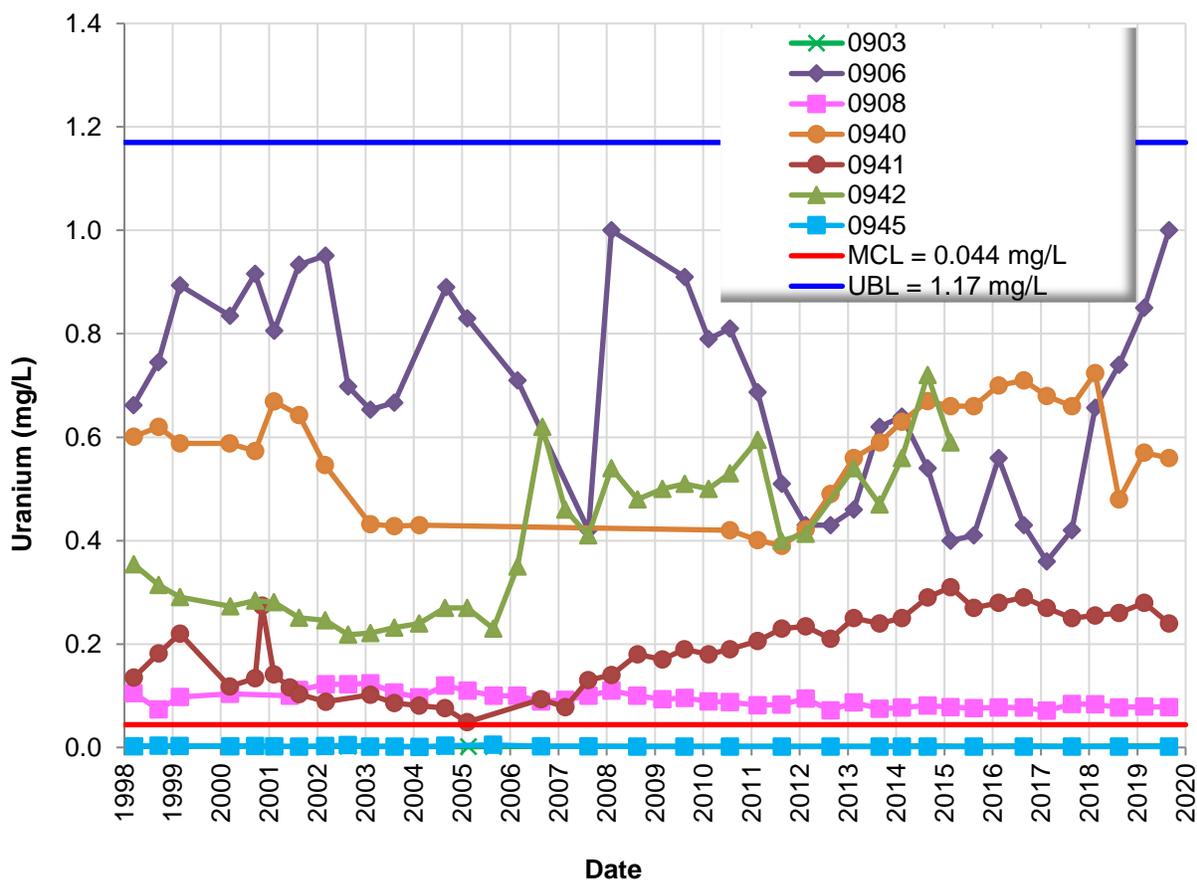


Figure 19-6. Uranium in Groundwater at the Tuba City, Arizona, Disposal Site

Sample results from the 2019 evaluative monitoring indicate that groundwater quality immediately downgradient of the former mill site (in wells 0906, 0908, 0940, 0941, and 0942) is still degraded relative to concentrations of molybdenum, nitrate, selenium, and uranium in background well 0945. Concentrations of all four analytes in distal downgradient well 0903 are comparable with those measured in background well 0945 and below corresponding UBLs, although nitrate concentrations continue to be slightly above the MCL. Analysis of water quality trending and progress of the groundwater remedy are reported in the site-specific annual groundwater report for the Tuba City site. No concerns about disposal cell performance are identified in the evaluative monitoring results.

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.

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*.

40 CFR 192 Subpart B. U.S. Environmental Protection Agency, “Standards for Cleanup of Land and Buildings Contaminated with Residual Radioactive Materials from Inactive Uranium Processing Sites,” *Code of Federal Regulations*.

DOE (U.S. Department of Energy), 1984. *Cooperative Agreement Between the United States Department of Energy, the Navajo Tribe of Indians and the Hopi Tribe of Indians*, DE-FC04-85AL26731, December.

DOE (U.S. Department of Energy), 1996. *Long-Term Surveillance Plan for the Tuba City, Arizona, Disposal Site*, DOE/AL/62350-182, Rev. 0, Office of Legacy Management, October.

DOE (U.S. Department of Energy), 2015. *Plan for Interim Treatment During Distillation Shutdown for the Tuba City, Arizona, Disposal Site*, LMS/TUB/S12431.

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.

19.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	160	Entrance Sign at Main Highway Gate
PL-2	115	Entrance Sign on Post at Entrance Gate (Replaced Following Inspection)
PL-3	170	Pictorial Entrance Sign on Entrance Gate (Replaced Following Inspection)
PL-4	0	Sand Accumulation Along Western Perimeter Fence and Road (Removed Following Inspection)
PL-5	180	Animal Burrow Under Perimeter Fence (Repaired Following Inspection)
PL-6	345	Soil Erosion Under Perimeter Fence Between Perimeter Signs P27 and P28 (Repaired Following Inspection)
PL-7	270	Dense Shrub Growth on Perimeter Fence (Removed Following Inspection)
PL-8	45	Shrubs Growing in Perimeter Fence Fabric (Removed Following Inspection)
PL-9	255	Perimeter Sign P24; Pictorial Sign Faded (Replaced Following Inspection)
PL-10	350	Site Marker SMK-1
PL-11	230	Survey and Boundary Monument SM/BM-1 Buried in Sand (Found Following Inspection and Permanent T-Post Installed)
PL-12	25	Survey and Boundary Monument SM/BM-3
PL-13	—	Datalogger in Monitoring Well 0906
PL-14	0	Annual Weeds on Disposal Cell Cover
PL-15	75	Sediment Accumulation and Vegetation in Diversion Channel
PL-16	200	Soil Erosion in Reclaimed Area
PL-17	65	Reclaimed Evaporation Pond Area
PL-18	325	Downed Safety Rope and Caution Sign (Replaced with Steel Rope and New Caution Sign Following Inspection)
PL-19	—	Crack in Evaporation Pond Liner (Repaired)
PL-20	240	Exposed Geofabric

Note:

— = Photograph taken vertically from above.



PL-1. Entrance Sign at Main Highway Gate



PL-2. Entrance Sign on Post at Entrance Gate (Replaced Following Inspection)



PL-3. Pictorial Entrance Sign on Entrance Gate (Replaced Following Inspection)



PL-4. Sand Accumulation Along Western Perimeter Fence and Road (Removed Following Inspection)



PL-5. Animal Burrow Under Perimeter Fence (Repaired Following Inspection)



PL-6. Soil Erosion Under Perimeter Fence Between Perimeter Signs P27 and P28 (Repaired Following Inspection)



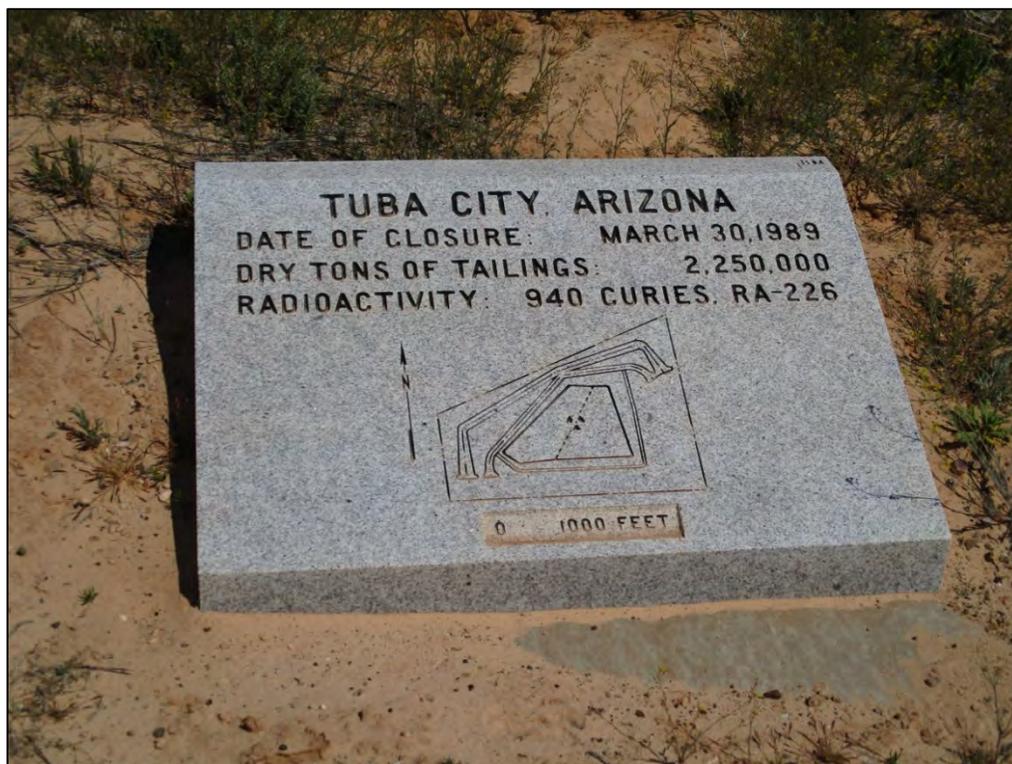
PL-7. Dense Shrub Growth on Perimeter Fence (Removed Following Inspection)



PL-8. Shrubs Growing in Perimeter Fence Fabric (Removed Following Inspection)



PL-9. Perimeter Sign P24; Pictorial Sign Faded (Replaced Following Inspection)



PL-10. Site Marker SMK-1



*PL-11. Survey and Boundary Monument SM/BM-1 Buried in Sand
(Found Following Inspection and Permanent T-Post Installed)*



PL-12. Survey and Boundary Monument SM/BM-3



PL-13. Datalogger in Monitoring Well 0906



PL-14. Annual Weeds on Disposal Cell Cover



PL-15. Sediment Accumulation and Vegetation in Diversion Channel



PL-16. Soil Erosion in Reclaimed Area



PL-17. Reclaimed Evaporation Pond Area



*PL-18. Downed Safety Rope and Caution Sign
(Replaced with Steel Rope and New Caution Sign Following Inspection)*



PL-19. Crack in Evaporation Pond Liner (Repaired)



PL-20. Exposed Geofabric