

9.0 Lakeview, Oregon, Disposal Site

9.1 Compliance Summary

The Lakeview, Oregon, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site was inspected June 28, 2022. No changes were observed on the disposal cell or in the associated drainage features. Inspectors identified minor maintenance needs but found no cause for a follow-up or contingency inspection.

Disposal cell riprap gradation monitoring has been performed annually since 1997 at random locations on the west side slope due to concerns over premature rock degradation. With the approval of the U.S. Nuclear Regulatory Commission (NRC) in 2019 to discontinue rock gradation monitoring at the site (Mandeville 2019), rock gradation monitoring was not performed in 2022. The 2022 annual inspection found no evidence of settling, slumping, erosion, or any other modifying process on the disposal cell side slopes that might affect the integrity of the cell.

The U.S. Department of Energy (DOE) Office of Legacy Management (LM) conducts groundwater monitoring every 5 years to demonstrate compliance with established groundwater quality protection standards. The most recent sampling event occurred in June 2019. Groundwater monitoring results were below the U.S. Environmental Protection Agency (EPA) designated maximum concentration limits (MCLs) in all monitoring wells.

9.2 Compliance Requirements

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

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

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

9.3 Institutional Controls

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

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

9.4 Inspection Results

The site, approximately 7 miles northwest of Lakeview, Oregon, was inspected on June 28, 2022. The inspection was conducted by C. Wentz and Z. Aldous of the Legacy Management Support (LMS) contractor. T. Sicilia (Oregon Department of Energy) and A. Denny (LM) participated in the inspection. The purposes of the inspection were to confirm the integrity of visible features at the site, identify changes in conditions that might affect conformance with the LTSP, and evaluate whether maintenance or a follow-up inspection and monitoring are needed.

9.4.1 Site Surveillance Features

Figure 9-1 shows the locations of site features, including site surveillance features and inspection areas, in black and gray font. Some site features that are present but not required to be inspected are shown in italic font. Observations from previous inspections that are currently monitored are shown in blue, and new observations identified during the 2022 annual inspection are shown in red. Inspection results and recommended maintenance activities associated with site surveillance features are described in the following subsections. Photographs to support specific observations are noted in the text and in Figure 9-1 by photograph location (PL) numbers. The photographs and photograph log are presented in Section 9.10.

9.4.1.1 Access Road, Entrance Gate, and Entrance Sign

Access to the site is from a gravel road that heads west from Lake County Road 2-16B. DOE was granted a perpetual easement on the approximately 1.2-mile access road between the county road and property boundary. A lockable gate across the access road on the adjacent privately owned land limits access to the site. The entrance gate to the site is in the southeast corner of the perimeter fence. The entrance gate was locked and undamaged. The entrance sign is attached to a steel post set in concrete along the access road and was undamaged (PL-1). A pedestrian gate in the northwest corner of the site was locked and undamaged (PL-2). The locks on the entrance gate and the pedestrian gate were replaced during the 2022 inspection. No maintenance needs were identified.

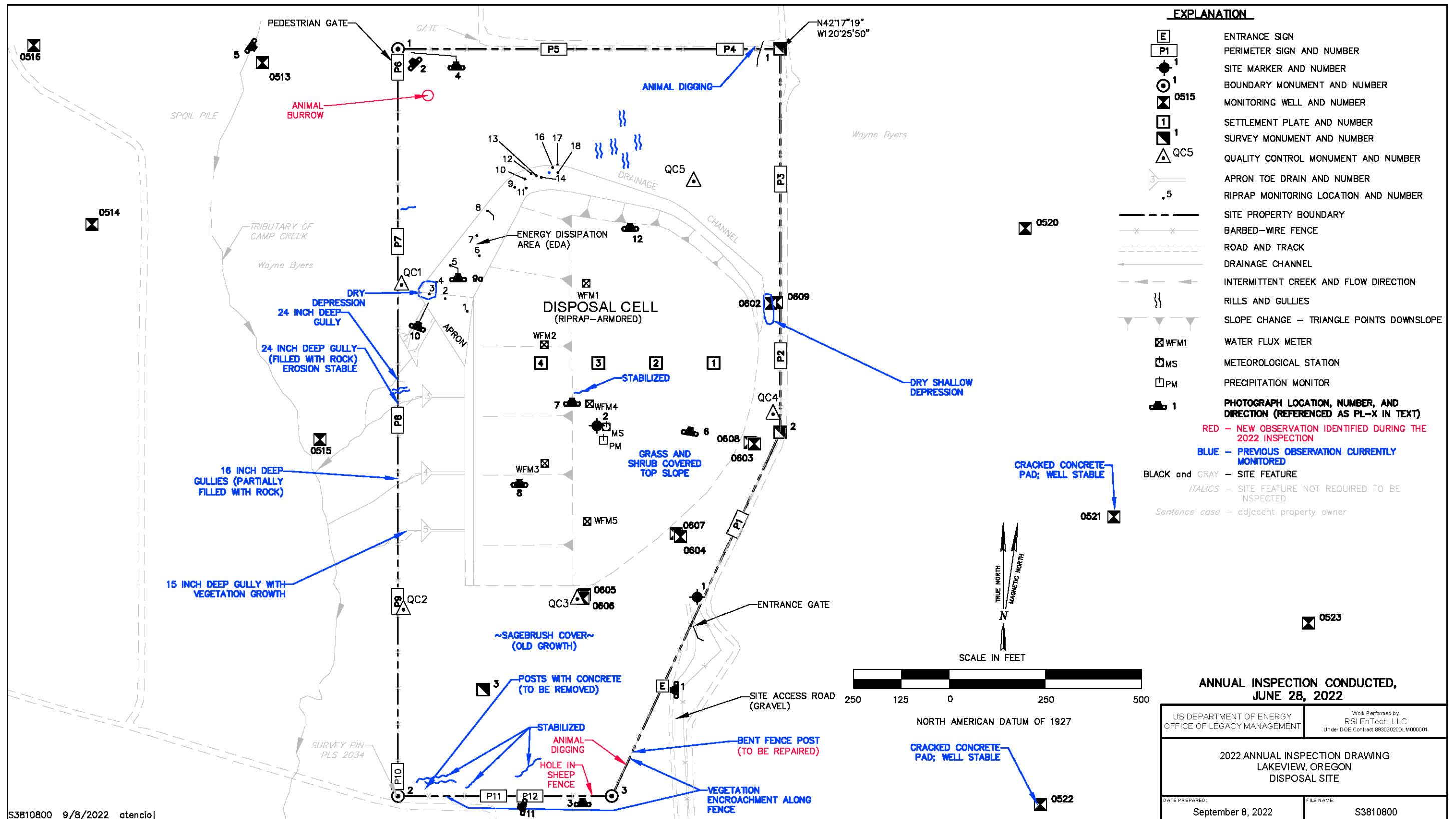


Figure 9-1. 2022 Annual Inspection Drawing for the Lakeview, Oregon, Disposal Site

9.4.1.2 Perimeter Fence and Signs

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

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

9.4.1.3 Site Markers

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

9.4.1.4 Survey and Boundary Monuments

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

9.4.1.5 Aerial Survey Quality Control Monuments

There are five permanent aerial survey quality control monuments installed at the site to provide control during aerial surveys of the disposal cell. A baseline aerial survey was performed in October 2021. The quality control monuments were inspected in 2022. No maintenance needs were identified.

9.4.1.6 Monitoring Wells

The site has 12 downgradient groundwater monitoring wells with four wells offsite to the east. Four upgradient wells are offsite to the west (PL-5). Wells 0522 and 0521 have concrete bases that are cracked, but the wellhead protectors remain stable. A dry, shallow depression remains near well 0602, as noted in previous inspections. The wellhead protectors were locked and undamaged. No maintenance needs were identified.

9.4.2 Inspection Areas

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

9.4.2.1 Top of Disposal Cell

The disposal cell, completed in 1988, occupies 16 acres. At the time of disposal cell construction, the entire top slope of the disposal cell was covered in 12 inches of type B-size riprap. In 1989, at the request of the State of Oregon, 4 inches of soil was added over the riprap to allow a vegetative cover to be established and help minimize the visual impact of the disposal cell. The design for the top of the disposal cell has created conditions that favor the growth of deep-rooted plants. The growth of shrubs on the disposal cell top slope is favored by movement of precipitation through the topsoil, riprap, and bedding layers; the compacted soil (radon barrier) inhibits root growth from reaching the tailings. Grasses and forbs growing on the top slope have gradually increased over the years, but some areas remain sparsely vegetated. This plant growth pattern is consistent with surrounding offsite areas (PL-6). Riprap was observed through the soil on the top slope in several small areas during the inspection. These areas are sporadic across the top slope and are likely caused by the soil infilling the riprap-void spaces. No structural or disposal cell performance concerns are associated with the riprap becoming visible on the top slope.

The incipient development of checkerboard soil erosion patterns was observed in some of the more sparsely vegetated areas on the top slope (consistent with similar areas offsite). A previously identified shallow rill on the top slope could not be found and was assumed to have stabilized from natural weathering processes. No additional changes were noted during the inspection. No structural or disposal cell performance concerns are associated with this condition because the riprap rock cover is continuous beneath the top slope soil cover, slope crests, and side slopes. Inspectors will continue to monitor this condition.

The contact boundary between the disposal cell top and side slopes was inspected and generally appears stable and uniform (PL-7). No erosion was observed during the inspection at the crest of the west side slope and the disposal cell top slope, and both appear to be stable. Inspectors will continue to monitor the transition zone between the disposal cell top slope and the west side slope for erosion development. There was no evidence of settling, slumping, erosion, or any other modifying process on the top of the disposal cell that might affect the integrity of the disposal cell.

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

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

Deterioration of the basalt riprap that armors the disposal cell side slopes is a result of physical and chemical weathering processes. Deterioration monitoring at the site consists of rock gradation monitoring on the west side slope and photographic monitoring in the energy dissipation area (EDA) in accordance with the LTSP. Addendums to the LTSP commit LM to annually assess the mean diameter (D_{50}) value of the riprap on the west side slope through

gradation monitoring to ensure the riprap remains large enough to protect the disposal cell from erosion during a major precipitation event, as designed. The thickness of the riprap on the west side slope was doubled during construction due to concerns over rock quality.

In 2015, LM proposed to replace annual gradation monitoring with rill inspections. The rills may form along the interface between the vegetated soil and rock top slope and the rock-covered west side slope (Dayvault 2015). Focusing on these areas allows LM to assess conditions that may indicate the development of potential failure points along the side slope. In 2019, NRC concurred with the discontinuation of rock gradation monitoring (Mandeville 2019); therefore, it was not performed in 2022. DOE is updating the LTSP to reflect this change. No rills or erosional features were observed along the side slope (PL-8) and the interface between the vegetated soil and rock top slope during the inspection.

Annual photographic monitoring of the 18 locations for long-term rock monitoring was conducted during the 2022 inspection (PL-9a). Minor rock degradation has been observed in the EDA since monitoring began at the original 10 photograph locations established in 1997 and at the 8 additional locations established in 2000 (PL-9b). No significant degradation of the EDA rock has been observed since monitoring began.

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

Small amounts of vegetation (primarily grass) have encroached on the riprap on the side slopes, on the upper (eastern) portion of the stormwater drainage channel (i.e., diversion channel), and on the west side slope's apron. The relatively sparse plant growth in these features will not affect their performance (i.e., channels were designed to control stormwater runoff from affecting encapsulated materials within the disposal cell). There are a few small shrubs in the upper (eastern) portion of the drainage channel, but they will not obstruct water flow. An area of dense, tall grass near Toe Drains 1 and 3 suggests that conditions are periodically wetter in this area because stormwater runoff is channeled there by control features. No ponded water was observed during the inspection. Minor erosion was observed near the fence line near Toe Drain 3 but appears to be stable. There was no evidence of settling, slumping, erosion, or any other modifying process on the disposal cell side slopes that might affect the integrity of the disposal cell. No other maintenance needs were identified.

9.4.2.3 Site Perimeter and Outlying Area

The area beyond the site boundary for a distance of 0.25 mile was visually observed for erosion, changes in land use, or other phenomena that might affect the long-term integrity of the site. This includes the seeded grass area extending from the disposal cell to the site boundary and perimeter fence. No such impacts were observed. An active animal burrow was observed in the northwest corner of the site near the pedestrian gate but does not pose a threat to any site features.

In September and October 2021, the Cougar Peak Wildfire burned approximately 91,000 acres to the west of the site mostly within the Fremont-Winema National Forest. The fire perimeter was within 2 miles of the site and the burn scar can be clearly seen from the site (PL-11).

Gullies that formed in seeded areas extending west of Toe Drains 1 through 5 were filled with rock in 2000. Although the rock has generally arrested the headcutting that was advancing eastward from the adjacent private property onto DOE property, some minor headcutting is still evident. Several small gullies have been observed on the private property directly west of the site in the heavily grazed areas downslope of the perimeter fence line. Several rills and shallow gullies were also observed onsite on the slope north of the disposal cell where grass reestablishment has been limited (PL-12), in a drainage area on the site north of perimeter sign P7, north of perimeter sign P8, and in the southwest corner of the site. These gullies and rills were identified during previous annual inspections but appear to have stabilized, as no significant changes were observed in 2022. The gullies do not pose a threat to disposal cell integrity, and inspectors will continue to monitor these areas. In previous years, inspectors have observed a pile of cut telephone poles and signposts with concrete bases in the southwest corner of the site. The cut telephone poles were removed in June 2019; however, the fence posts with cement bases were too heavy to remove by hand. Though this remaining debris does not affect site integrity, it will be removed in the future. No other maintenance needs were identified.

9.5 Follow-Up or Contingency Inspections

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

9.6 Maintenance and Repairs

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

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

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

No other maintenance needs were identified.

9.7 Groundwater Monitoring

In accordance with the LTSP, LM conducts groundwater monitoring every 5 years to demonstrate compliance with established groundwater quality protections standards. The most recent sampling event occurred on June 13, 2019, and the next event will occur in 2024.

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

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

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

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

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

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

Note:

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

Abbreviation:

mg/L = milligrams per liter

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

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

9.8 Corrective Action

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

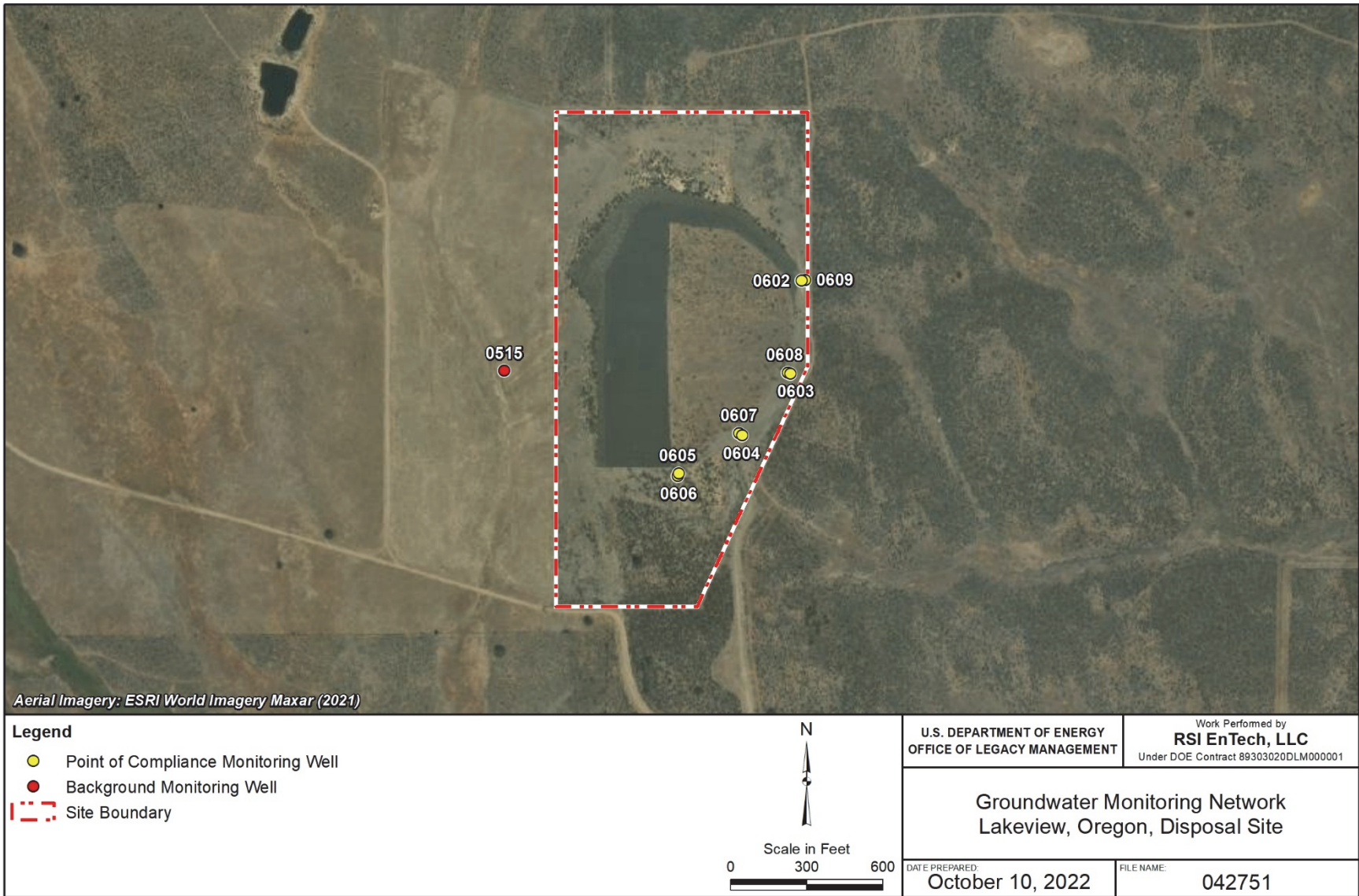


Figure 9-2. Groundwater Monitoring Network, Lakeview, Oregon, Disposal Site

9.9 References

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

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

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

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

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

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

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

9.10 Photographs

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

Note:

— = Photograph taken vertically from above.



PL-1. Site Entrance Sign



PL-2. Pedestrian Gate



PL-3. Hole in Sheep Fence



PL-4. Boundary Monument BM-1



PL-5. Monitoring Well 0513



PL-6. Vegetation on Top Slope of Disposal Cell



PL-7. West Side of Disposal Cell



PL-8. West Side Slope of Disposal Cell



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



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



PL-10. Dry Depression in EDA



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



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