14.0 Rifle, Colorado, Disposal Site

14.1 Compliance Summary

The Rifle, Colorado, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site was inspected on August 31, 2021. No changes were observed on the disposal cell or in the associated drainage features. Inspectors identified one minor maintenance need but found no cause for a follow-up inspection.

In April 2021, the site's vertical datum from National Geodetic Vertical Datum of 1929 was transformed to North American Vertical Datum of 1988. The transformation resulted in an increase of 2.55 feet (ft) in elevation measurements across the site. Both the original 1929 vertical datum elevations and the new 1988 vertical datum elevations are presented in this report side by side with the new datum shown followed by the older datum in parentheses (e.g., 6022.55 ft [6020 ft]).

14.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the site-specific Long-Term Surveillance Plan (DOE 1997) (LTSP) in accordance with procedures established to comply with the requirements of the U.S. Nuclear Regulatory Commission (NRC) general license at Title 10 *Code of Federal Regulations* Section 40.27 (10 CFR 40.27). Table 14-1 lists these requirements.

Table 14-1. License Requirements for the Rifle, Colorado, Disposal Site

Requirement	LTSP	This Report	10 CFR 40.27
Annual Inspection and Report	Section 3.0	Section 14.4	(b)(3)
Follow-Up Inspections	Section 3.4	Section 14.5	(b)(4)
Maintenance and Repairs	Section 4.0	Section 14.6	(b)(5)
Groundwater Monitoring	Section 2.6	Section 14.7	(b)(2)
Disposal Cell Pore-Water Level Monitoring	Appendix	Section 14.8	—
Corrective Action	Section 5.0	Section 14.9	—

14.3 Institutional Controls

The 205-acre site, identified by the property boundary shown in Figure 14-1, is owned by the United States and was accepted under the NRC general license in 1998. The U.S. Department of Energy (DOE) is the licensee and, in accordance with the requirements for UMTRCA Title I sites, the Office of Legacy Management (LM) is responsible for the custody and long-term care of the site. Institutional controls (ICs) at the site include federal ownership of the property, administrative controls, and the following physical ICs that are inspected annually: the disposal cell and associated drainage features, entrance gates and sign, stock fence, perimeter signs, site markers, survey and boundary monuments, standpipes, and evaporation pond.

14.4 Inspection Results

The site, 6 miles north of Rifle, Colorado, was inspected on August 31, 2021. The inspection was conducted by B. Mays and D. Holbrook of the Legacy Management Support (LMS) contractor. N. Keller, LM site manager, and M. Cosby, of 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 whether maintenance or additional inspection and monitoring are needed.

14.4.1 Site Surveillance Features

Figure 14-1 shows the locations of site features, including site surveillance features and inspection areas, in black and gray font. 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 2021 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 U.S. Bureau of Land Management (BLM) property provides access to the site. Entrance to the site is through two locked gates on the access road: an outer reinforced metal gate about 1700 ft south of the site (PL-1) and an inner metal gate at the stock fence. The entrance sign, which is next to the inner gate, 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 2021 inspection showed evidence of continued livestock grazing, discussed further in Section 14.4.2.3. Strands of the barbed-wire fence were repaired in June 2021, and no additional maintenance needs were identified during the 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.

There are 27 perimeter signs positioned along the perimeter. Perimeter signs P0 through P11 are attached to the stock fence, and signs P12 through P26 are attached to steel posts set in concrete and set back 5 ft from the boundary (PL-2). Perimeter signs P15 and P19 have bullet damage, but remain legible and do not need to be replaced at this time. Perimeter sign P18 has shown minor cracks and peeling but remains legible. No other maintenance needs were identified.

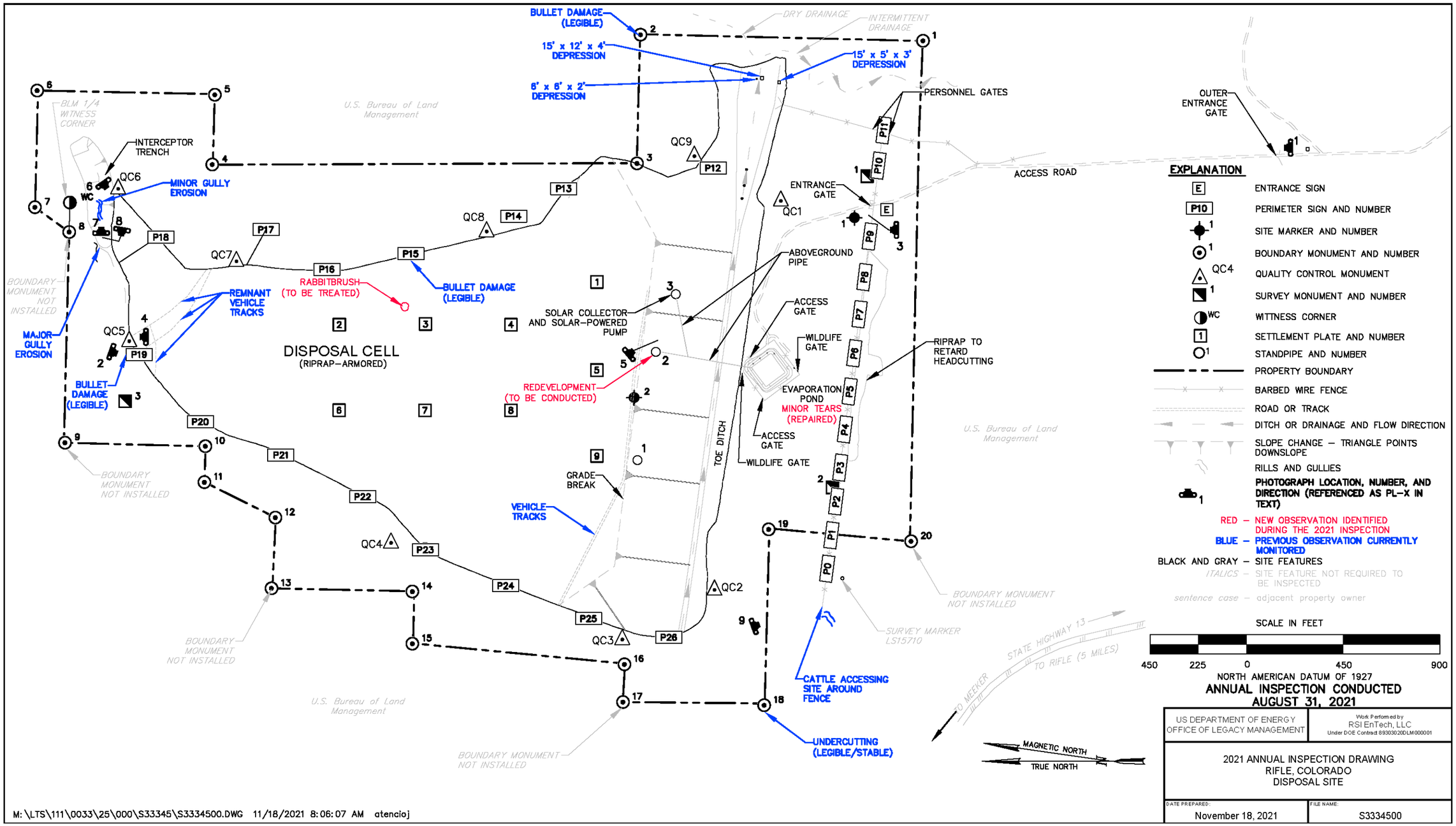

Figure 14-1. 2021 Annual Inspection Drawing for the Rifle, Colorado, Disposal Site

This page intentionally left blank

14.4.1.3 Site Markers

The site has two granite site markers. Site marker SMK-1 is just inside the inner entrance gate, and site marker SMK-2 is on the top slope of the disposal cell (PL-3). No maintenance needs were identified.

14.4.1.4 Survey and Boundary Monuments

Three survey monuments and 15 boundary monuments delineate the property boundary. The boundary monuments are set at the corners of the irregular site boundary. Although the site boundary has 20 corners, only 15 are marked by boundary monuments because 5 of the corners are on extremely steep terrain that is not safely accessible. Consequently, boundary monuments BM-8, BM-9, BM-13, BM-17, and BM-20 were never installed. GPS is used to identify and inspect existing boundary monuments that are installed in steep, hard-to-access areas. Boundary monument BM-2 has several bullet holes but remains intact. Boundary monument BM-18 has undercutting at the ground surface but remains legible and stable. No maintenance needs were identified.

14.4.1.5 Aerial Survey Quality Control Monuments

Nine aerial survey quality control monuments were inspected during the 2021 annual inspection. Inspectors noted minor sediment accumulation on quality control monuments QC-5 and QC-8 (PL-4). No maintenance needs were identified.

14.4.1.6 Standpipes

Three standpipes (SP-01, SP-02, and SP-03) on the south side slope of the disposal cell are used to monitor pore-water levels in the disposal cell (PL-5). At the time of the inspection, disposal cell pore water was being pumped from standpipes SP-02 and SP-03 (also known as monitoring wells 02 and 03, respectively) into the evaporation pond. Redevelopment of standpipe SP-02, consisting of mechanical and chemical cleaning to treat biofouling and debris removal, will be completed before the next inspection. No maintenance needs were identified.

14.4.1.7 Evaporation Pond

A lined evaporation pond was constructed adjacent to the disposal cell in 2001 to receive water pumped from standpipes SP-02 and SP-03. The pond contained water at the time of the inspection. Evaluation of the pond liner's integrity was completed in fall 2020 by a professional geosynthetic liner installation and inspection company. Two minor holes, approximately 2 inches in diameter, were identified at the top slope of the liner and repaired after the inspection. Evaluation of the liner by a testing laboratory indicated the liner is in good condition for its age. LM plans to replace the pond liner in fiscal year 2024 barring further damage that would necessitate earlier replacement. The security fence around the pond was intact and effectively preventing livestock from entering the area. The vehicular access gates on the north and west corners of the fence were closed and locked at the time of the inspection. A meteorological station alongside the pond was functioning normally. No other maintenance needs were identified.

14.4.2 Inspection Areas

In accordance with the LTSP, the site is divided into four areas to ensure a thorough and efficient inspection. The inspection areas are (1) the disposal cell and interceptor trench, (2) the toe ditch and toe ditch outlet, (3) onsite reclaimed areas, and (4) the outlying area. Inspectors examined specific site surveillance features within each area and looked for evidence of settlement, erosion, or other modifying processes that might affect the site's conformance with LTSP requirements.

14.4.2.1 Disposal Cell and Interceptor Trench

The disposal cell, completed in 1996, occupies 71 acres and is armored with riprap consisting of river cobbles and boulders to control erosion and deter animal and human intrusion. There was no evidence of erosion, settling, slumping, or other modifying processes that might affect the integrity of the disposal cell (PL-6). As in the past several inspections, inspectors noticed minor rock degradation on the disposal cell top slope, primarily in the form of cracking and spalling. Rock degradation does not present a concern at this time.

Remnant vehicle tracks, which formed on the cover during well decommissioning activities in 2002, remain evident in the 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 SP-02 and SP-03.

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.

One deep-rooted rabbitbrush plant was observed on the cell cover during the inspection. The plant will be treated before the 2022 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 at this time.

A vegetated interceptor trench was constructed at the top of the disposal cell to protect the disposal cell from stormwater and snowmelt runoff. The trench appeared to be functioning as designed, although minor gully erosion has been occurring in the lower portion of the trench. The gully did not appear to be increasing in depth or width (PL-7); the deepest downcut was approximately 18 inches deep and 24 inches wide. In the outfall area below the trench (down the steep-sided natural slope), stormwater runoff has formed a major gully to the north of the armoring riprap placed in this area in the early 2000s. The gully did not appear to be increasing in depth or width (PL-8) during the 2021 inspection. The outfall area will continue to be monitored to assess if additional riprap is needed on the slope to prevent upstream gully migration. No maintenance needs were identified.

14.4.2.2 Toe Ditch and Toe Ditch Outlet

A toe ditch runs along the downslope (south) edge of the disposal cell and is armored with the same rock that protects the disposal cell. The toe ditch diverts stormwater runoff from the disposal cell offsite to the east. The ditch was stable and functioning as designed.

Minor erosion, anticipated in the design, remains evident in the channel at the toe ditch outlet. Rock previously placed in the outlet to stabilize the erosion has dropped into and armored the eroded areas. Inspectors found two depressions in the rock during the 2017 annual inspection (one about 15 × 12 ft in area and 4 ft deep and one about 6 × 6 ft in area and 2 ft deep) and another depression during the 2018 annual inspection (about 15 × 5 ft in area and 3 ft deep). These depressions were formed after the underlying soil eroded away. They are not a concern at this time but will continue to be monitored. No maintenance needs were identified.

14.4.2.3 Onsite Reclaimed Areas

Disturbed areas around the edges and south of the disposal cell were reseeded in 1996 and, overall, have been successfully reclaimed. Before 2012, there was little evidence of grazing within the site boundaries. Since 2012, however, grazing by cattle has been regularly observed, and cattle trails have been identified meandering up the steep arroyos on the unfenced, southwest side of the site (PL-9). LM is evaluating additional fencing installation options on the southwest side of the site to prevent cattle access.

Three arroyos are present in the reclaimed area south of the disposal cell and outside the stock fence. A rock apron was placed between the stock fence and the headcuts in these arroyos to prevent headward migration toward the disposal cell. As erosion has migrated into the rock apron, the rock has naturally armored the arroyos and effectively stabilized them from further erosion. Inspectors will continue to monitor this area. No maintenance needs were identified.

14.4.2.4 Outlying Area

The area beyond the site boundary for a distance of 0.25 mile was visually observed for erosion, changes in land use, or other phenomena that might affect the long-term integrity of the site. The primary land uses in the area are grazing, hunting, recreation, and wildlife habitat. The Rifle Arch Trailhead is approximately 0.25 mile southwest of the site along Highway 13. The city of Rifle constructed two additional mountain bike trails in spring 2021 that follow the Rifle Arch Trail. Historically, trash has been dumped along the access road between Highway 13 and the outer entrance gate, and BLM has periodically removed it. No other changes to the outlying area were observed.

14.5 Follow-Up Inspections

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

14.6 Maintenance and Repairs

Two minor tears in the evaporation pond were repaired after the 2021 inspection. Inspectors documented the following maintenance items to be completed before the 2022 annual inspection:

- Redevelopment of standpipe SP-02
- Treatment of the rabbitbrush on top of the disposal cell

14.7 Groundwater Monitoring

Groundwater quality monitoring is not required by the LTSP (DOE 1997). Transient drainage from the disposal cell enters the Wasatch Formation, a 3800-foot-thick sequence of shales, siltstones, and fine-grained sandstones (DOE 1997). The Wasatch Formation separates the disposal cell from the uppermost useable aquifer (the Mesaverde Group). Groundwater in the Wasatch Formation is classified as limited use due to naturally occurring concentrations of total dissolved solids that exceed 10,000 milligrams per liter (DOE 1997). Additionally, this unit produces very little water and is not considered to be an aquifer. Ambient levels of barium, cadmium, chromium, lead, molybdenum, selenium, and combined radium-226 and radium-228 exceed maximum concentration limits. The Wasatch Formation does not represent a useable source of water, and no exposure pathways to site-related groundwater exist at the site. Further groundwater monitoring is not required (DOE 1997). All monitoring wells at the site were decommissioned by 2002.

14.8 Disposal Cell Pore-Water Level Monitoring

In accordance with the LTSP, LM monitors pore-water levels in the disposal cell at standpipes SP-02 and SP-03, which are installed at the downgradient end of the disposal cell on the south side slope (Figure 14-1). This monitoring is performed to ensure that pore water in the disposal cell does not rise above a high-density polyethylene (HDPE) liner that was installed in the toe of the disposal cell at an elevation of 6022.50 ft (6020 ft) during original construction. The bottom of standpipe SP-01 is at an elevation of 6023.95 ft (6021.4 ft); as such, it continues to be dry and does not require continuous monitoring.

The disposal cell dewatering system (pump) is activated when the interior pore-water elevation reaches 6018.55 ft (6016 ft). Circumstances other than pore water accumulation that triggers water accumulation includes (1) periods when solar-powered pumps are nonoperational (for recovery tests or maintenance) or (2) when temperatures are below freezing, preventing the pump from operating. Pore-water levels in standpipes SP-02 and SP-03 have remained below the geotextile liner at 6020 ft (6022.55 ft), preventing water from overtopping the disposal cell liner.

A contingency plan for control of pore-water levels at the toe of the disposal cell was appended to the LTSP. The plan included the installation of a dewatering system and a retention pond to use when water levels reach an elevation of 6016.55 ft (6014 ft) and the solar-powered dewatering pump is initiated at a water level elevation of 6018.55 ft (6016 ft). Both the dewatering system and the evaporation pond were constructed in 2001. Water pumped from the standpipes is discharged through an aboveground polyethylene pipe to the evaporation pond.

Despite the pumping efforts to dewater the cell since 2001, pore-water levels in the cell have not decreased as expected; instead, they have continued to increase to the recent maximum level of 6022.45 ft (6019.5 ft). While the 6018.55 ft (6016 ft) pump action level has been exceeded, pore-water levels in both standpipes SP-02 and SP-03 have been maintained below the top of the HDPE liner elevation. In compliance with requirements of the LTSP, pumping will continue until water levels in the standpipes stabilize at an elevation of 6016.55 ft (6014 ft) or lower. Studies are ongoing to determine (1) potential sources of pore water in the disposal cell other than tailings leachate and (2) potential pumping system upgrades to increase dewatering volumes. Table 14-2 lists total dewatering volumes.

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

Reporting Years	Annual Dewatering Volumes (gal)	Annual Dewatering (gal per day)	Cumulative Dewatering Volumes (gal)
2008	143,110	392.08	143,110
2009	389,618	1067.45	532,728
2010	215,569	590.60	748,297
2011	61,434	168.31	809,731
2012	155,189	425.18	964,920
2013	106,267	291.14	1,071,187
2014	138,574	379.65	1,209,761
2015	30,948	84.79	1,240,709
2016	168,555	461.79	1,409,263
2017	87,741	240.39	1,497,005
2018	160,191	438.88	1,657,196
2019	247,537	678.18	1,904,733
2020	194,788	533.66	2,099,521
2021*	266,065*	861.05*	2,365,586

Note:
* 2021 dewatering data through November 5, 2021.

Abbreviation:
gal = gallons

Real-time disposal cell water elevations collected in 2018 (using pressure transducers and dataloggers) continued to indicate that daily maximum or semistatic pore-water levels in standpipes SP-02 and SP-03 exceed the 6018.55 ft (6016 ft) pump action level (see Figure 14-2). In 2019, LM modified the seasonal pumping regimen for year-round pumping while a long-term solution is evaluated and implemented.

Data fluctuations for both standpipes observed from 2018 to 2021 are the result of partial overnight recharge due to well inefficiencies, and nonstatic levels have been filtered from the dataset shown in Figure 14-2. Downhole video taken in 2020 for both standpipes revealed fouling in the perforated interval. Redevelopment of standpipe SP-02 to remove mineral scale and biofouling was completed in December 2020. Initial testing results indicate an increase in production volume from standpipe SP-02 of approximately 22%. Downhole video in standpipe SP-03 also identified approximately 7.6 ft of 6- to 10-inch diameter rock riprap at the bottom of the standpipe. Potential methods to remove the rock and redevelop the standpipe are being considered to increase production.

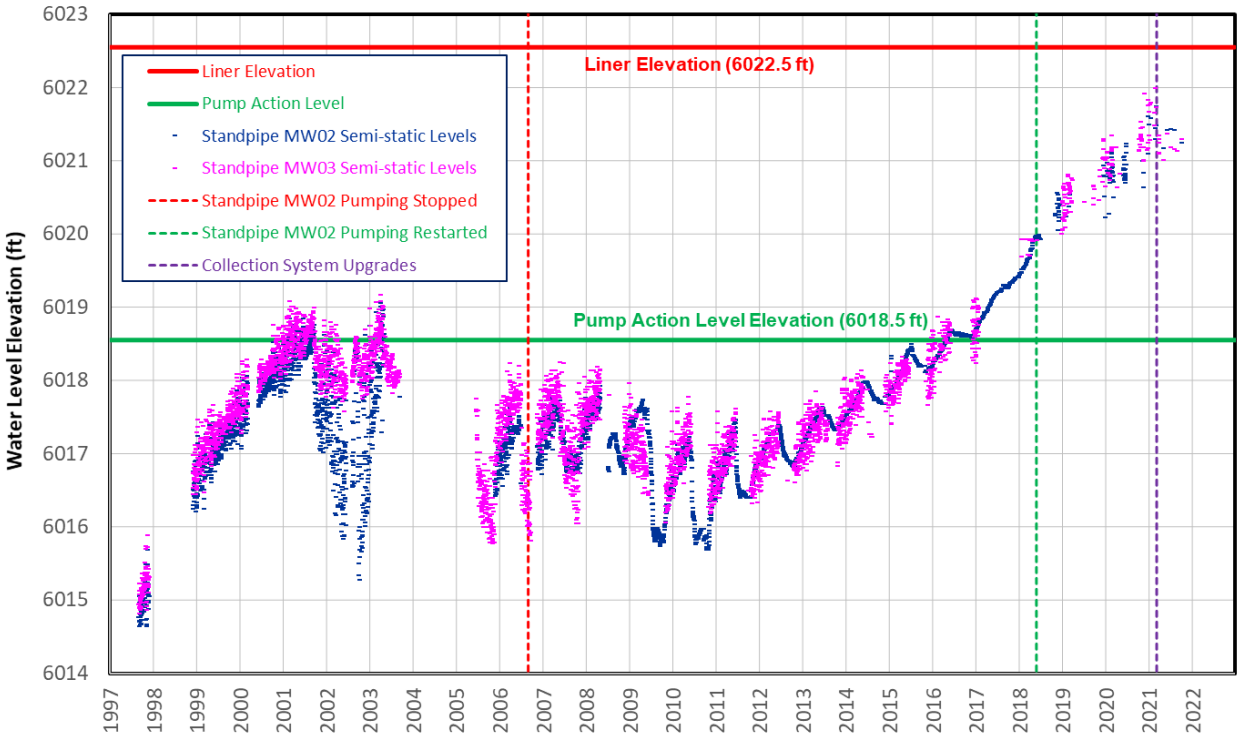

Figure 14-2. Disposal Cell Pore-Water Levels in Standpipes SP-02 and SP-03 at the Rifle, Colorado, Disposal Site

In March 2021, the solar-powered pumping system was upgraded to provide additional operation of the pumps by increasing electrical storage ability. By adding batteries to store solar-generated electricity, the pumps are able to operate throughout the night and on overcast days. This should yield a more consistent and lower pore-water elevation and increase annual dewatering volume. The pumping system will continue to have limited availability in winter because aboveground effluent lines are susceptible to freezing.

LM is organizing an ongoing collaborative initiative with the National Laboratory Network (NLN) to identify innovative approaches to perform pore-water source investigation and accumulation mitigation strategies for the site. LM included NRC in the LM and NLN collaborative process that began in fall 2021.

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	0	Outer Entrance Gate
PL-2	200	Perimeter Sign P19
PL-3	0	Site Marker SMK-1
PL-4	0	Quality Control Monument QC-5
PL-5	140	Standpipe SP-02 and Instrumentation
PL-6	235	Disposal Cell Cover
PL-7	90	(a) Gully Erosion in Interceptor Trench Outfall in 2021 (b) Gully Erosion in Interceptor Trench Outfall in 2016—Photo for Comparison
PL-8	280	(a) Gully Erosion in Interceptor Trench Outfall in 2021 (b) Gully Erosion in Interceptor Trench Outfall in 2016—Photo for Comparison
PL-9	160	Cattle Trail on Southwest Side of Site

PL-1. Outer Entrance Gate

PL-2. Perimeter Sign P19

PL-3. Site Marker SMK-1

PL-4. Quality Control Monument QC-5

PL-5. Standpipe SP-02 and Instrumentation

PL-6. Disposal Cell Cover

PL-7a. Gully Erosion in Interceptor Trench Outfall in 2021

PL-7b. Gully Erosion in Interceptor Trench Outfall in 2016—Photo for Comparison

PL-8a. Gully Erosion in Interceptor Trench Outfall in 2021

PL-8b. Gully Erosion in Interceptor Trench Outfall in 2016—Photo for Comparison

PL-9. Cattle Trail on Southwest Side of Site

This page intentionally left blank