6.0 Grand Junction, Colorado, Disposal Site

6.1 Compliance Summary

The Grand Junction, Colorado, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site was inspected on December 7, 2021. No changes were observed on the disposal cell or in the associated drainage features. Inspectors identified minor maintenance needs that will be handled during the next routine maintenance event, but no cause for a follow-up inspection was identified.

A portion of the disposal cell remains open to receive low-activity radioactive materials from 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 cover studies on top of the disposal cell and on lysimeter facilities adjacent to the north and east sides of the disposal cell, are 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 at the site as a best management practice. Two monitoring wells are sampled to verify that groundwater in onsite paleochannels are not affected by potential seepage from the disposal cell. A third monitoring well is within the disposal cell. Groundwater monitoring of all three wells was completed July 29, 2021.

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 (DOE 1998) (LTSP) in accordance with procedures LM established to comply with the requirements of the U.S. Nuclear Regulatory Commission (NRC) general license at Title 10 *Code of Federal Regulations* Section 40.27 (10 CFR 40.27). Table 6-1 lists these requirements.

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

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

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

6.3 Institutional Controls

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

6.4 Inspection Results

The site, 18 miles southeast of Grand Junction, Colorado, was inspected on December 7, 2021. The inspection was conducted by J. Lobato, D. Atkinson, H. Petrie, and C. Garcia of the Legacy Management Support (LMS) contractor. S. Woods and N. Olin from LM also attended the inspection. The purposes of the inspection were to confirm the integrity of visible features at the site, identify changes in conditions that might affect conformance with the Interim LTSP, and evaluate whether maintenance or additional inspection and monitoring are needed.

6.4.1 Site Surveillance Features

Figure 6-1 shows the locations of site features, including site surveillance features and inspection areas, in black and gray font. 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 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 Signs

Access to the site is from U.S. Highway 50 by a right-of-way grant on federal land that is administered by the U.S. Bureau of Land Management (BLM). A steel double-swing access gate along the highway right-of-way fence provides access within the BLM-administered right-of-way. The access gate is secured by a locking device that was locked and functional at the time of the inspection. LM is one of several parties with access to the locking device.

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

The site entrance gate was locked and functional, and site entrance signs on and next to the entrance gate were in good condition (PL-1). No maintenance needs were identified.

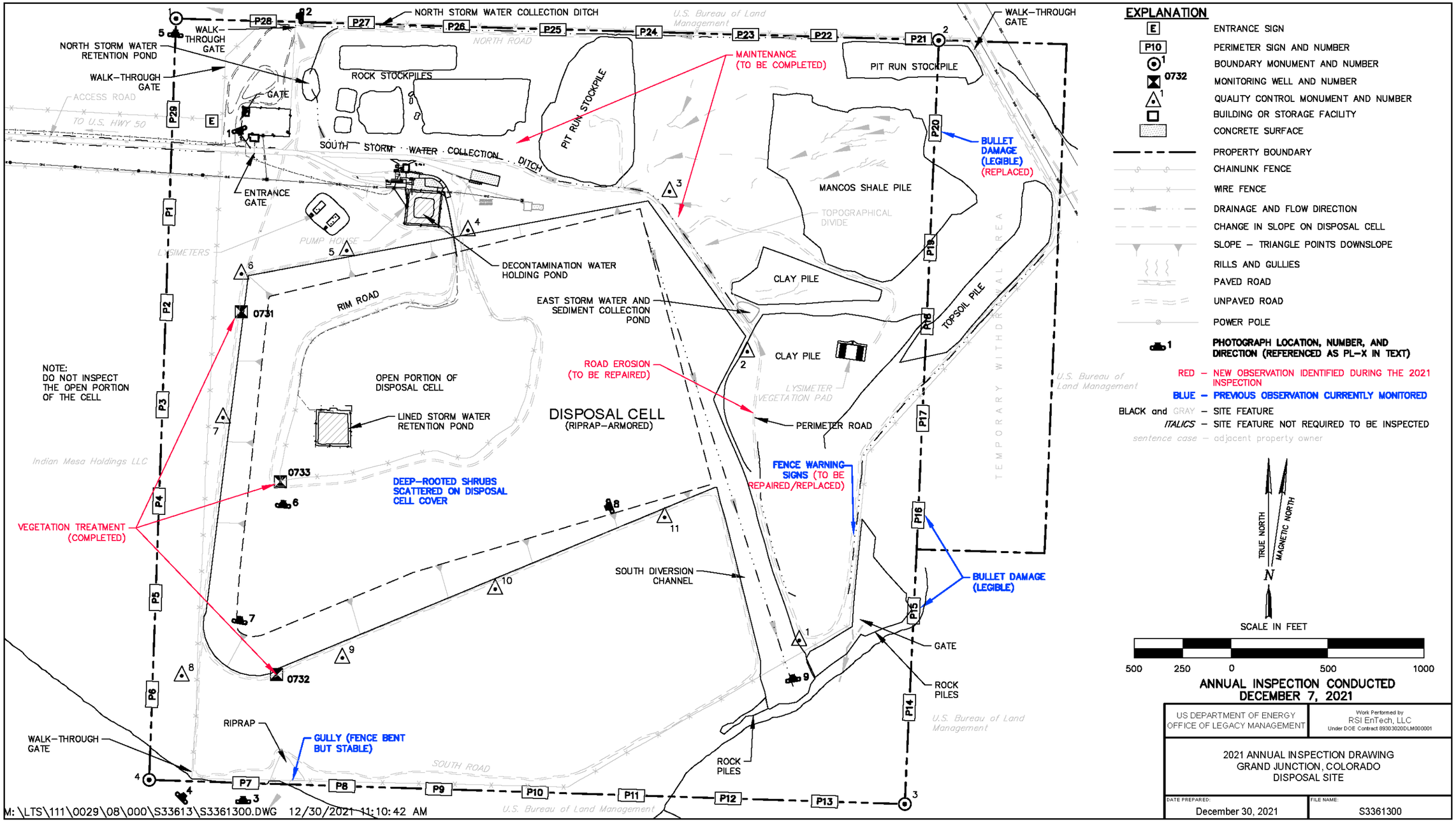

Figure 6-1. 2021 Annual Inspection Drawing for the Grand Junction, Colorado, Disposal Site

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6.4.1.2 Perimeter Fence and Signs

A perimeter fence encloses the disposal cell features and operations areas (PL-2). It consists of a standard four-strand, barbed-wire fence in some areas and a woven wire fence topped with barbed wire in others. The perimeter fence does not match the property boundary in several areas. There are 29 perimeter signs attached to steel posts set in concrete positioned at regular intervals along the property boundary (PL-3). Several perimeter signs along the south property boundary are faded or peeling but remain legible. Perimeter signs P15 and P16 have bullet damage but remain legible. Perimeter sign P20, previously reported with bullet damage, was replaced. In addition to the perimeter signs, the perimeter fence also has warning signs ("No Trespassing" and "Controlled Area" signs). Several warning signs on the southeast perimeter fences reported in 2020 as damaged or detached will be repaired or replaced before the next inspection (PL-4). No other maintenance needs were identified.

6.4.1.3 Site Markers

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

6.4.1.4 Boundary Monuments

Four boundary monuments delineate the corners of the property boundary (PL-5). All were present and in good condition during the inspection. No maintenance needs were identified.

6.4.1.5 Aerial Survey Quality Control Monuments

Eleven aerial survey quality control monuments installed in December 2020 were inspected during the 2021 inspection. No maintenance needs were identified.

6.4.1.6 Monitoring Wells

The groundwater monitoring network consists of three monitoring wells (0731, 0732, and 0733) (PL-6). Vegetation treatment was completed in a large radius around each wellhead. All wellhead protectors were locked and undamaged. Roots were found in monitoring wells 0731 and 0732; they will be removed and the wells redeveloped before the next inspection. No other maintenance needs were identified.

6.4.2 Inspection Areas

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

6.4.2.1 Closed Portion of the Disposal Cell

The closed portion of the disposal cell is armored with basalt riprap to control erosion (PL-7). 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-8). Historically, deep-rooted shrubs on top of the disposal cell have been treated with herbicide. Although treatment is not required by the Interim LTSP, LM plans to continue controlling the deep-rooted shrubs as needed. No maintenance needs were identified.

6.4.2.2 Diversion Structures and Drainage Channels

The south diversion channel is a large, riprap-armored structure that intercepts run-on water from offsite and onsite, as well as stormwater runoff from the disposal cell, and conveys the water into a natural drainage that flows away from the site to the southwest (PL-9). Grasses, weeds, and shrubs growing within the diversion channel is not expected to affect 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 stormwater collection ditches, the north stormwater retention pond, and the east stormwater and sediment collection pond. These small drainage features control stormwater runoff primarily from the various stockpiles of disposal cell cover materials. The stormwater collection ditches also capture stormwater run-on from offsite locations. Maintenance (cleaning out) of several parts of the site stormwater collection ditches is ongoing and is expected to continue into 2022. The diversion channel, ditches, and ponds were functioning as designed. No other maintenance needs were identified.

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

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

Most of the flat areas between the disposal cell and the site (property) boundary are vegetated with native shrubs, scant perennial grasses, and annual weeds. Localized erosion is present at two locations on the perimeter road adjacent to the east side of the disposal cell (Figure 6-1). Repairs to these areas will be completed with the ongoing maintenance of site stormwater collection ditches (Section 6.4.2.2). No other maintenance needs were identified.

6.4.2.4 Outlying Area

The area beyond the site boundary for 0.25 mile was visually observed for erosion, changes in land use, or other phenomena that might affect the long-term integrity of the site. No such changes were identified. Most of the land surrounding the site is rangeland administered by BLM, and private property on the west side is used primarily for cattle grazing. No land use changes were evident in that area. Outside the site's eastern boundary is a 40-acre temporary

withdrawal area that was issued by BLM to DOE for stockpiled materials. Some of the withdrawal area is included within the site perimeter fence and contains stockpiled materials. This area is not included in the Interim LTSP 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

Vegetation was treated around wells 0731, 0732, and 0733, and perimeter sign P20 was replaced before the annual inspection. Inspectors identified maintenance items that will be addressed before the next inspection. These include:

- Replacement or repair of warning signs on the southeast perimeter fences
- Maintenance to the site stormwater collection ditches
- Repairs to the two eroded areas on the site perimeter road adjacent to the east side of the disposal cell
- Root removal and well redevelopment for monitoring wells 0731 and 0732

No other 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 with no numerical concentration limits for hazardous constituents identified at the site (DOE 1998); this 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 (i.e., transient drainage) from the disposal cell. The most recent sampling event occurred on July 29, 2021.

Monitoring wells 0731 and 0732 are screened within the alluvial paleochannels adjacent to the disposal cell and extend 5 to 7.5 ft into weathered Mancos Shale. These wells are in two separate paleochannel systems downgradient from the disposal cell (DOE 1998). Monitoring well 0733 is screened below the paleochannel monitoring wells in the lower tailings in the disposal cell (Table 6-2 and Figure 6-2). Disposal cell construction was initiated by excavating Mancos Shale, which resulted in the base of the disposal cell being below the weathered Mancos Shale horizon. Monitoring well 0733 is primarily used to measure water levels within the disposal cell. All groundwater monitoring results for the site are reported and published on the LM Geospatial Environmental Mapping System (GEMS) website (https://gems.lm.doe.gov/#site=GRJ).

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

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

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

6.8.1 Groundwater-Level Monitoring

Static water level measurements are obtained from each monitoring well before water quality samples are collected (Figure 6-3). Water levels in disposal cell monitoring well 0733 generally increased approximately 4 ft since 1998 and have 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. The 2020 sampling occurred in late May, whereas every previous sampling since 2003 occurred in August or early September. Consequently, water level measurements in 2020 may have a seasonal influence in relation to the historical data. 2021 groundwater levels in wells 0731 and 0732 are not reported, as both wells were filled with roots.

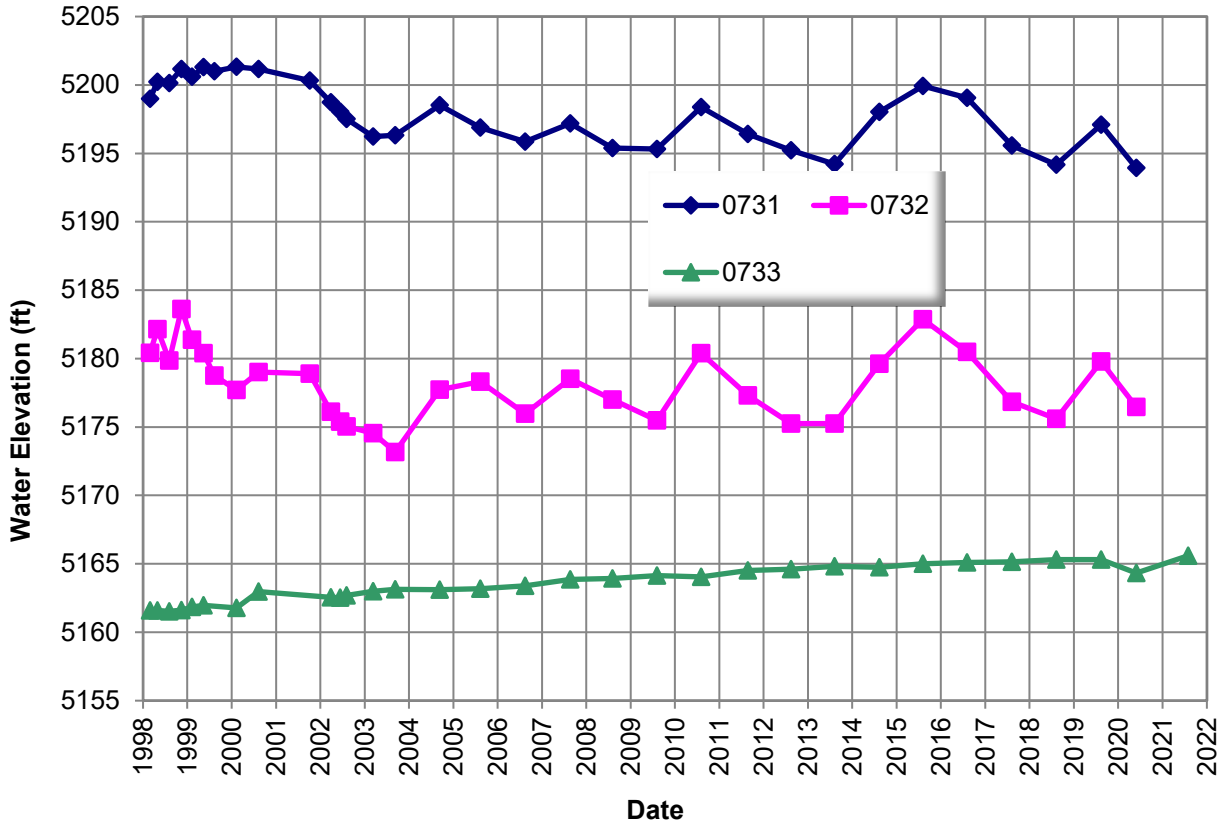


Figure 6-3. Water Level Measurements at the Grand Junction, Colorado, Disposal Site

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 key indicator analytes are compared to U.S. Environmental Protection Agency established maximum concentration limits (MCLs) (40 CFR 192 Table 1 Subpart A), background groundwater concentrations from the alluvial groundwater, and background groundwater concentration from Mancos Shale groundwater (Table 6-3). Monitoring well concentration data

are compared to the highest of the three values in Table 6-3 as a best management practice to determine if there is any potential seepage from the disposal cell. MCLs are listed for comparison evaluation only and not for compliance purposes.

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

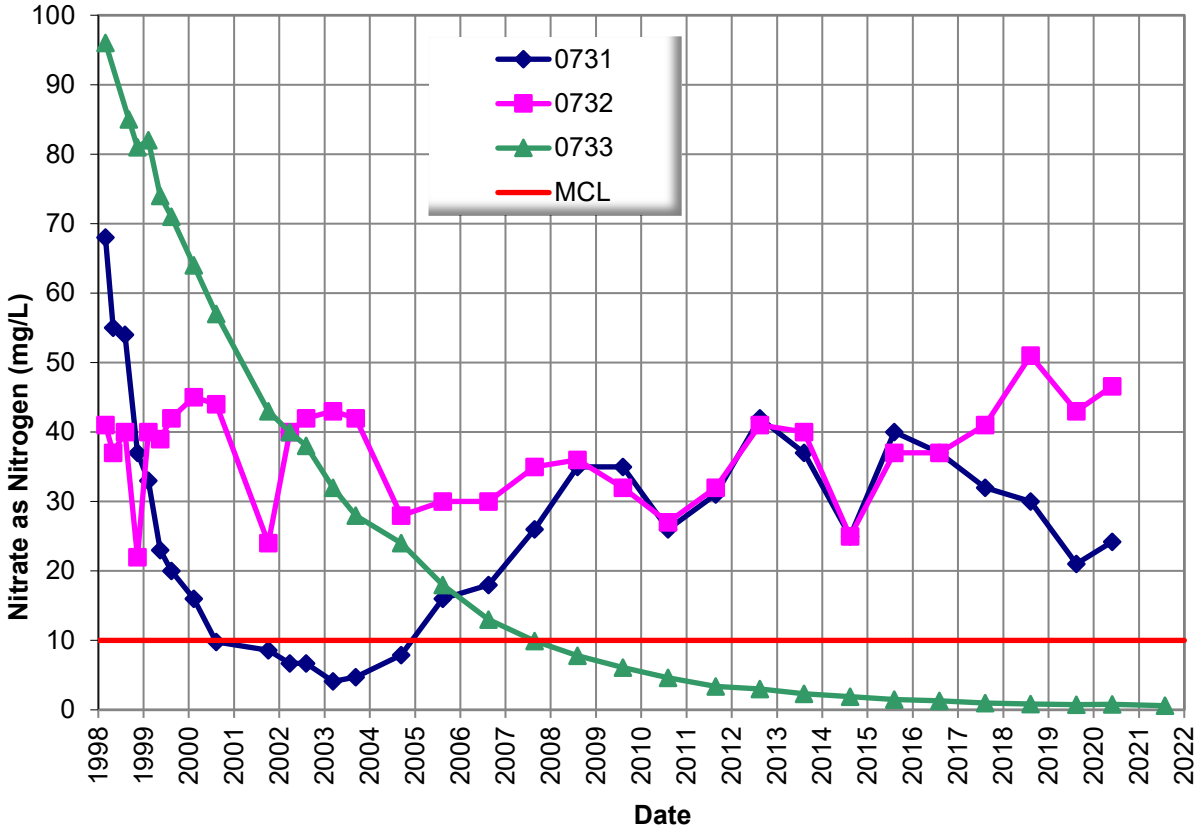
Constituent	MCL[a] in mg/L	Maximum Concentration in Background Alluvial Groundwater (mg/L)	Maximum Concentration in Background Mancos Shale Groundwater (mg/L)
Molybdenum	0.1	0.070	0.12
Nitrate (as nitrogen)	10	1.1	0.80
Selenium	0.01	0.019	0.11
Uranium	0.044	0.074	0.011

Notes:
[a] MCLs as listed in 40 CFR 192 Table 1 Subpart A.
Data are from Table 3.34 for background alluvial groundwater and Table 3.37 for Mancos Shale Groundwater in Attachment 3 of DOE 1991.

Wells 0731 and 0732 were sampled in 2021, but both wells were filled with roots, causing the field and laboratory results to be outliers. All field and lab results for 0731 and 0732 were rejected and are not acceptable to be reported. For that reason, only results from 0733 are shown for the 2021 sampling event. Data for wells 0731 and 0732 from the 2020 sampling event are presented here and are identical to the ones reported in the 2020 report (DOE 2021). Both wells 0731 and 0732 will be redeveloped before the next sampling event which will include root removal.

Molybdenum concentrations in all three monitoring wells have remained steady since 1998; 2021 concentrations were less than or equal to the MCL of 0.1 mg/L and thus less than the background molybdenum concentration in the Mancos Shale of 0.12 mg/L. Time-concentration plots from 1998 through 2021 for the other key indicator analytes—nitrate (as nitrogen), selenium, and uranium—are shown in Figure 6-4 through Figure 6-6.

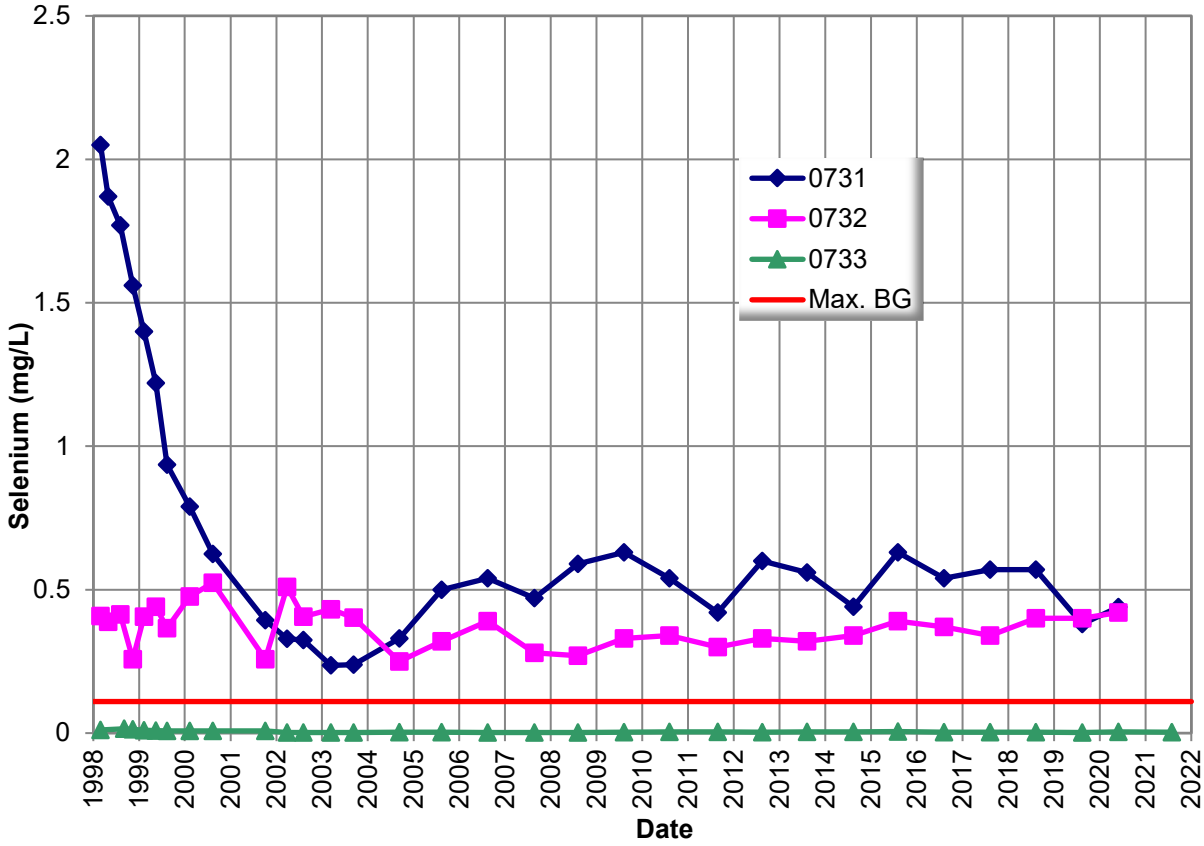
Nitrate (as nitrogen) concentrations in disposal cell monitoring well 0733 continued to decline from 96 mg/L in 1998 to 0.6 mg/L in 2021; the 2021 numbers are significantly below the MCL of 10 mg/L (Figure 6-4). This is possibly due to increased reducing conditions (less oxygen) over time at the bottom of the disposal cell, creating denitrification (conversion of nitrate to nitrogen gas). Past concentrations of elevated nitrate (as nitrogen) in paleochannel monitoring wells 0731 and 0732 (compared to background nitrate concentrations up to 1.1 mg/L) may be the result of these wells adding oxygen to the Mancos Shale within the well screen and releasing nitrate.



Note: Well 0733 is screened in the disposal cell tailings.

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

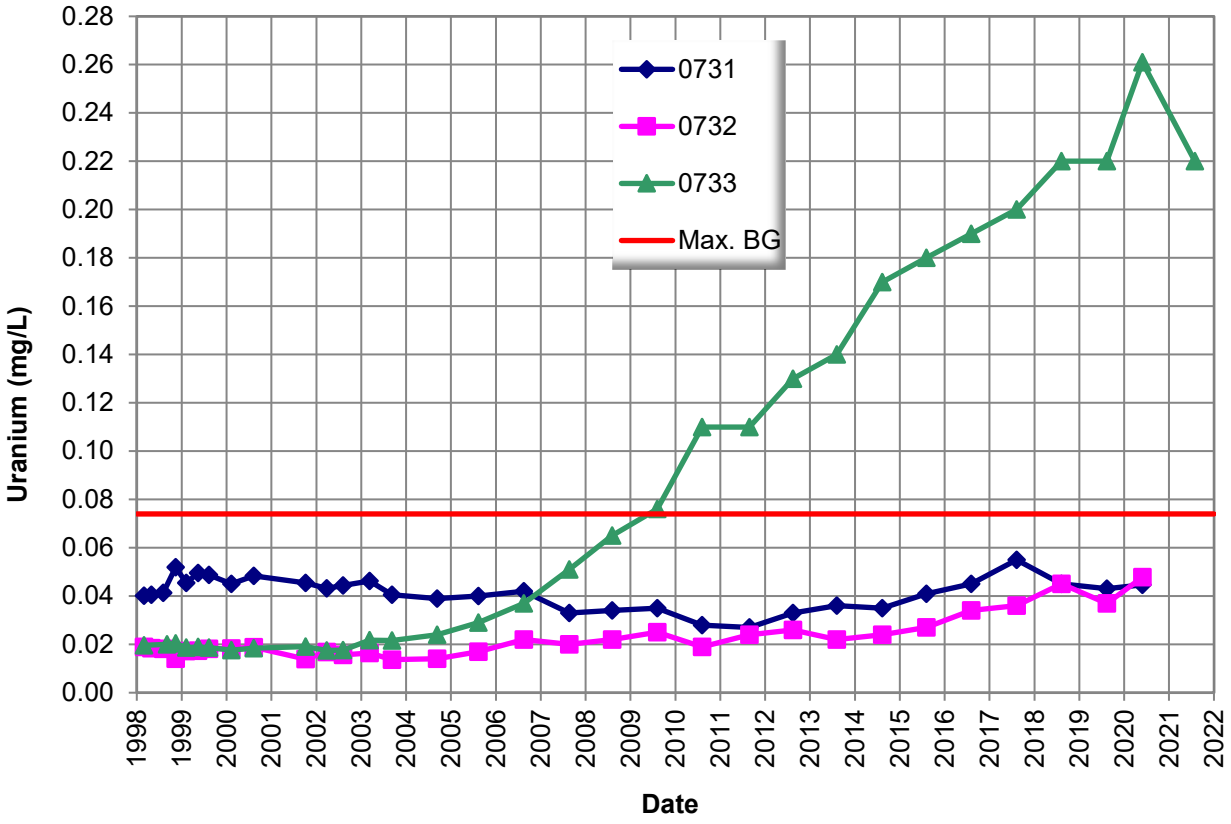
Selenium occurs naturally in the Mancos Shale deposits that underlie the disposal cell (DOE 1991). Background groundwater concentrations in the Mancos Shale are at 0.11 mg/L, which exceeds the MCL of 0.01 mg/L (Table 6-3). As with nitrate, the addition of oxygen into the Mancos Shale because of the installation of these monitoring wells may contribute to the release of selenium from the Mancos Shale. Disposal cell monitoring well 0733 is not screened in the weathered Mancos Shale, and selenium concentrations remain below maximum background concentrations (Figure 6-5).



Note: Well 0733 is screened in the disposal cell tailings. "Max. BG" stands for maximum background concentration. Results include validated data only; results below the detection limit are presented at the laboratory reported value.

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

Uranium concentrations in wells 0731 and 0732 have shown an apparent, gradually increasing trend since 2011 (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 2021. 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.



Note: Well 0733 is screened in the disposal cell tailings. "Max. BG" stands for maximum background concentration. Results include validated data only; results below the detection limit are presented at the laboratory reported value.

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

Wells 0731 and 0732 will not be sampled again until 2022 to ensure that any disturbances after root removal have passed. In 2022, the slightly increasing trends in uranium (albeit below maximum background concentrations) will be reevaluated. To assist in the determination of a Mancos Shale influence on nitrate and selenium in these two wells, duplicate samples will be collected 2 ft below the top of the water table in addition to the current sampling depth. Sampling just below the top of the water table will ensure that samples are from the alluvial groundwater only, resulting in less potential interference from reactions occurring within the top of the Mancos Shale that might release nitrate and selenium.

6.9 References

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

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

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

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

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

DOE (U.S. Department of Energy), 2021. *2020 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites*, LMS/S30146, March.

6.10 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	160	Solar-Powered Site Entrance Gate
PL-2	275	North Perimeter Fence
PL-3	0	Perimeter Sign P7
PL-4	45	Unsecured Perimeter Fence Sign
PL-5	5	Boundary Monument BM-1
PL-6	5	Monitoring Well 0733
PL-7	10	West Side Slope Disposal Cell
PL-8	250	Disposal Cell Top and Side Slope
PL-9	350	South Diversion Channel

PL-1. Solar-Powered Site Entrance Gate

PL-2. North Perimeter Fence

PL-3. Perimeter Sign P7

PL-4. Unsecured Perimeter Fence Sign

PL-5. Boundary Monument BM-1

PL-6. Monitoring Well 0733

PL-7. West Side Slope Disposal Cell

PL-8. Disposal Cell Top and Side Slope

PL-9. South Diversion Channel