3.0 L-Bar, New Mexico, Disposal Site

3.1 Compliance Summary

The L-Bar, New Mexico, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title II Disposal Site was inspected on August 18, 2015. The tailings impoundment was in excellent condition. Erosion and vegetation measurements to monitor the condition of the impoundment cover indicated that no erosion is occurring, and perennial vegetation foliar cover at the measurement plots increased substantially compared to previous years due to above-average precipitation for the year.

A short segment of the perimeter fence near the site entrance was realigned in spring 2015 because a gully was undermining the fence corner. Loose fence strands at another location were repaired during the inspection, and a section of fence needs to be realigned to avoid areas affected by deep gullies and sediment deposition. Inspectors identified no other maintenance needs or cause for a follow-up inspection.

Groundwater monitoring is required every 3 years. The next monitoring event will be in 2016.

3.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the *Long-Term Surveillance Plan for the U.S. Department of Energy L-Bar, New Mexico, (UMTRCA Title II) Disposal Site, Seboyeta, New Mexico* (DOE−LM/GJ709−2004, September 2004) and in procedures the U.S. Department of Energy (DOE) established to comply with the requirements of Title 10 *Code of Federal Regulations* Section 40.28 (10 CFR 40.28). Table 3-1 lists these requirements.

Table 3-1. License Requirements for the L-Bar, New Mexico, Disposal Site

Requirement	Long-Term Surveillance Plan	This Report
Annual Inspection and Report	Section 3.3 and 3.4	Section 3.4
Follow-up Inspections	Section 3.5	Section 3.5
Routine Maintenance and Emergency Measures	Section 3.6	Section 3.6
Environmental Monitoring	Section 3.7	Section 3.7

3.3 Institutional Controls

The 738-acre site (Figure 3-1) is owned by the United States of America and was accepted under the U.S. Nuclear Regulatory Commission (NRC) general license (10 CFR 40.28) in 2004. DOE is the licensee and, in accordance with the requirements for UMTRCA Title II sites, is responsible for the custody and long-term care of the site. Institutional controls at the site include federal ownership of the property and the following features that are inspected annually: a site marker, boundary monuments, and warning/no-trespassing signs.

3.4 Inspection Results

The site, located approximately 15 miles north of Laguna, New Mexico, was inspected on August 18, 2015. The inspection was conducted by R. Johnson, M. Widdop, M. Kastens, and D. Marshall of the DOE Legacy Management Support contractor. D. Barr (DOE Site Manager) attended the inspection.

The purposes of the inspection were to confirm the integrity of the visible features at the site, to identify changes in conditions that might affect site integrity, and to determine the need, if any, for maintenance or additional inspection and monitoring. Numbers in the left margin of this report refer to items summarized in Table ES-1 of the "Executive Summary."

3.4.1 Site Surveillance Features

The locations of site surveillance features are shown on Figure 3-1. 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 on Figure 3-1 by photograph location (PL) numbers.

3.4.1.1 Site Access and Interior Roads

Access to the L-Bar site is via a public gravel road (Cibola County Road 1). Approximately 300 feet of Cebolleta Land Grant property is crossed to enter the site, and access is provided for and described in the warranty and quitclaim deed for the site. The access road was in good condition.

Interior tertiary dirt roads and tracks are present to access DOE assets. Portions of the roads are susceptible to erosion and are repaired when they become impassable. Some of the monitoring well access roads were difficult to drive on because of erosion and dense stands of annual vegetation.

3.4.1.2 Signs and Boundary Monuments

The entrance sign is located on the main site access road near the site marker. It has several bullet holes but was legible (PL-1). Thirty-four warning or perimeter signs are attached to a barbed-wire fence that surrounds the disposal site structures. The perimeter signs were in good condition; however, the trefoil decal on some of the signs is peeling off and will need to be replaced in the near future.

Eight flush-mounted boundary monuments define the site boundary; some are set in concrete and some consist of aluminum caps on rebar driven into the ground. The boundary monuments observed during the inspection were in excellent condition.

3.4.1.3 Fence and Gates

A barbed-wire stock fence encompasses the tailings impoundment and associated drainage structures and is intended to prohibit trespassing and livestock intrusion on the tailings impoundment structures. The fence is located as much as 3,300 feet inside the property

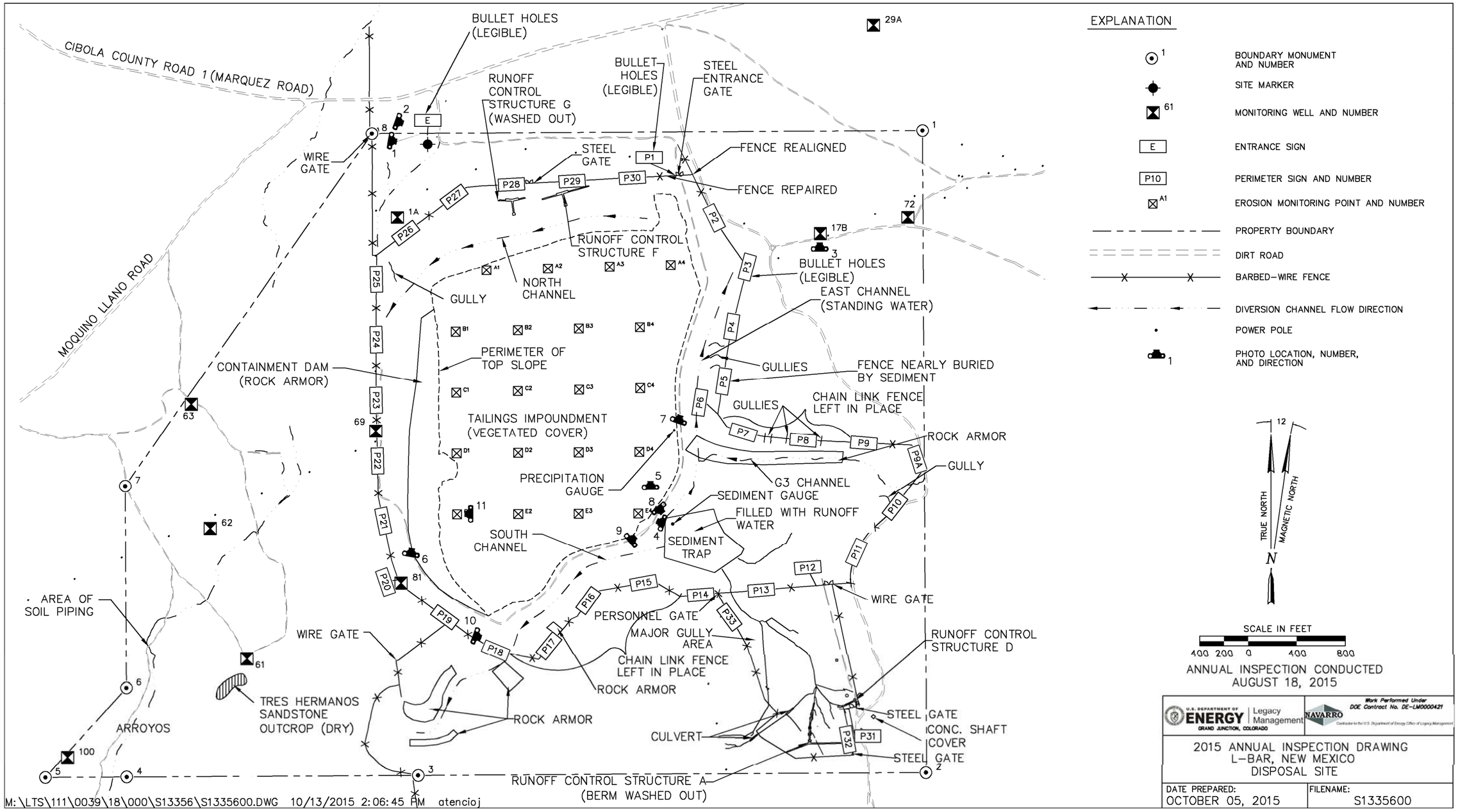

Figure 3-1. 2015 Annual Inspection Drawing for the L-Bar, New Mexico, Disposal Site

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boundary, and the area between the fence and the boundary is grazed in accordance with a DOE grazing license with the Cebolleta Land Grant that owns the surrounding property.

3A A short segment of fence east of the site entrance gate was realigned in spring 2015 because a gully was undermining the fence corner. Loose fence strands west of the entrance gate were repaired during the site inspection. The section of fence between perimeter signs P3 and P9 is affected by deep gullies and areas of sediment accumulation, potentially providing access points for livestock to enter the site. This section of fence is difficult to maintain because of continuing erosion and steep terrain, so DOE plans to bypass this area with a new fence realigned along the east site access road. The work is scheduled for 2016.

Four tubular steel gates with DOE locks allow vehicle access through the fence. The gates were in excellent condition.

3.4.1.4 Site Marker

A granite site marker is located north of the disposal cell adjacent to the site access road. The marker was in excellent condition (PL-2).

3.4.1.5 Monitoring Wells

The site groundwater-monitoring network consists of 10 wells. Nine of the wells are located on DOE property; monitoring well 29A is located outside the northeast corner of the site. Most of the wells were checked during the inspection and they were locked and in good condition (PL-3). Some well locations do not have established access roads or tracks but are accessible by 4-wheel drive vehicle if the ground is dry.

3.4.2 Inspection Areas

In accordance with the Long-Term Surveillance Plan (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 cover of the tailings impoundment; (2) the containment dam; (3) the diversion channels; and (4) the site perimeter, balance of the site, and outlying area.

Within each area, inspectors examined the specific site surveillance features. Inspectors also looked for evidence of erosion, settling, slumping, or other disturbances that might affect the site's integrity, protectiveness, or long-term performance.

3.4.2.1 Cover of the Tailings Impoundment

The soil-covered tailings impoundment, completed in 2000, occupies approximately 100 acres. Its surface is minimally sloped to the west toward the central portion of the containment dam to promote drainage and minimize runoff water velocities and the potential for erosion. Although the cover was not seeded because plant growth was not expected to be successful, revegetation is occurring naturally with native species (PL-4). The establishment and maturing of vegetation is expected to reduce wind and water erosion of the surface and help prevent precipitation from infiltrating into the tailings.

Cracks are usually present in the surface soil of the tailings impoundment cover (PL-5). They are confined to the upper couple of feet of the cover soil and appear to result from drying of the gypsum-rich soil after precipitation events. The cracks tend to heal as they fill with windblown sediment and as perennial vegetation continues to establish.

In accordance with the LTSP, erosion and vegetation are monitored on the impoundment cover. Sections 3.7.2.1 and 3.7.2.2 describe the monitoring program and present the results to date.

3.4.2.2 Containment Dam

The tailings impoundment was constructed by damming the head of a natural drainage basin. The face of the earthen containment dam has a 20 percent slope and is rock-armored to prevent erosion and degradation. Large-diameter rock was used to protect the central portion of the containment dam where runoff from the tailings impoundment surface would spill. Native vegetation is well established on the face, which is desirable for increasing the erosion protection of the surface (PL-6). There were no indications of erosion, settlement, rock degradation, seeps, or other modifying processes that might affect the integrity of the dam.

3.4.2.3 Diversion Channels

The surface water diversion system consists primarily of the east, north, and south channels that divert runoff water away from the impoundment. The system is designed to accommodate probable maximum flood discharges.

Runoff from an upgradient watershed east of the tailings impoundment is designed to be conveyed away from the site to a northeastward-flowing drainage via the east diversion channel. The east channel is separated from the impoundment by a dike. Gullies are present along the east slope of the east channel, but the erosion and sediment deposition are not impairing the function of the channel. Some of the gullies that pass under the adjacent perimeter fence are deep enough to potentially allow livestock access, and one gully threatens to undermine a fence corner near perimeter sign P6; this section of fence will be bypassed by the planned fence realignment. Standing water was present in the east channel due to recent rainfall events (PL-7).

A tributary channel, the G3 channel, was constructed to divert runoff from a smaller watershed into the east channel. Gullies have formed along the north slope of the G3 channel. The erosion is not impairing the function of the channel, but gullies are encroaching on the perimeter fence in that area. This section of fence will be bypassed by the planned fence realignment.

Some erosion was expected to occur in a watershed that encompasses the southeast portion of the site and adjacent property. Storm runoff from this watershed discharges into a sediment trap, where the sediment load is expected to settle out. If a runoff event overtops the sediment trap, the flow is diverted to the east channel. The sediment trap was nearly full of runoff water at the time of the inspection, and there was evidence that it had recently spilled into the east channel as designed (PL-8 and PL-9).

The sediment trap was designed to function for 600 years before accumulated sediment would need to be removed. However, multiple high-intensity storm events since the completion of site reclamation have caused deep gullies to form in the highly erodible soils and fill materials upgradient of the sediment trap, resulting in an apparent accelerated rate of sediment deposition

in the sediment trap. Construction of runoff control structures to reduce the rate of erosion in the area and prevent headward migration of gullies into adjoining private property was completed in January 2010. Runoff from a storm event in August and September 2011 overtopped an earthen runoff control berm and caused substantial damage to the berm. Repairs are not planned at this time because erosion from this area is not impacting the integrity of the tailings impoundment.

Runoff water from the area north of the tailings impoundment is captured by the north diversion channel. The water is diverted away from the site to the west. Deep gullies had formed in the weathered shale and alluvium along a portion of the north bank of the channel, and headward erosion was rapidly migrating to the north toward the site access road and property boundary. The eroded channel bank was restored to its original design configuration, and two runoff control structures were constructed to reduce erosion and sedimentation; construction was completed in January 2010. The east structure (Structure F) was in good condition at the time of the inspection. The west structure (Structure G), however, suffered severe erosion during runoff events in August and September 2011 and continues to erode. Repairs are not planned at this time because erosion from this area is not currently impairing the function of the diversion channel or the integrity of the tailings impoundment.

The south diversion channel diverts storm runoff from the higher terrain immediately south of the tailings impoundment toward the channel outlet to the west. Two riprap aprons are present on the north-facing slope (south bank) to inhibit erosion along natural drainage paths. Minor erosion is occurring on the unprotected slope surfaces, resulting in sediment accumulation in the channel (PL-10). The erosion and sediment deposition are not impairing the function of the channel.

3.4.2.4 Site Perimeter, Balance of the Site, and Outlying Area

The access track to monitoring well 100, located in the southwest corner of the site, is damaged by subsurface erosion (soil piping) near the head of an arroyo. The affected area has been mapped, metal fence posts have been installed next to soil collapse features, and the information is shown on the inspection and sampling maps to prevent injury or vehicle damage. Well 100 was not accessed during the inspection because excessive annual vegetation made it too difficult to see soil collapse features.

A Tres Hermanos sandstone unit of the Mancos Shale crops out in the southwest corner of the site. This unit is hydraulically connected to contaminated groundwater under the impoundment, and the outcrop is considered to be a potential evapotranspiration area. There was no indication of seepage or evaporation at the outcrop. This location will continue to be monitored for seepage and recommended for sampling if seep water is present.

Several legacy features, including concrete pads (a large pad covers the mine shaft) and abandoned sewer manholes, are near the southeast corner of the site. These features will be monitored to ensure that they remain in a safe condition.

The site is surrounded by open private land that is used primarily for grazing. Uranium exploration activities, mine reclamation activities, and associated access road construction are occurring on properties adjacent to the site. These activities do not appear to be detrimental to site security.

3.5 Follow-up Inspections

DOE 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) DOE 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 during the inspection.

3.6 Routine Maintenance and Emergency Measures

A section of the east perimeter fence is scheduled to be realigned in 2016 to bypass areas affected by deep gullies and soil deposition. No other maintenance needs were identified during the inspection.

Emergency measures are corrective actions that DOE will take in response to unusual damage or disruption that threatens or compromises site health and safety, security, integrity, or compliance with 40 CFR 192. No emergency measures were necessary.

3.7 Environmental Monitoring

3.7.1 Groundwater Monitoring

3B Groundwater monitoring is required every 3 years. The next monitoring event will be in 2016. The visible features of the monitoring wells that were inspected were in good condition and the wells were locked.

3.7.2 Erosion Monitoring Program

An erosion monitoring program (EMP) was developed to address potential erosion of the tailings impoundment cover over time and was incorporated as an LTSP requirement. Sohio Western Mining Company developed the plan at the request of the New Mexico Water Quality Control Commission as a condition for granting alternate abatement standards for groundwater at the site.

The cover of the impoundment consists of a 4.1-foot-thick (minimum) compacted layer of clay to function as a radon barrier, overlain by clay-rich soil materials. Total thickness of the cover
3C ranges from 6 to 10 feet. The EMP has two parts: (1) measuring erosion and (2) measuring the progress of revegetation. Measurements were made during the annual site inspection on August 18, 2015.

3.7.2.1 Erosion Monitoring

In accordance with the EMP, the former licensee installed a grid of 20 evenly spaced monitoring points on the cover in November 2003. These points are shown on Figure 3-1. The locations were initially measured in December 2003 to establish a baseline data set.

Each monitoring point consists of a 5-foot length of half-inch-diameter, epoxy-coated rebar surrounded by three metal t-posts that were installed to help locate the rebar and provide orientation for the measurements. The rebar was driven at each point such that approximately 1 foot remained above the cover surface. Each rebar has a metal tag indicating the point location

number. The t-posts are set approximately 6 feet from the rebar and form an equilateral triangle, with one point of the triangle due east of the rebar.

Erosion measurement is accomplished by placing a 4-foot-long level centered at the base of the rebar such that the east end of the level points to the eastern t-post. The height of the rebar is measured from the base of the level to the top of the rebar and is recorded to the nearest 1/16 inch, using the method established during baseline measurements in 2003.

In accordance with Appendix C of the LTSP, erosion measurements will be performed annually for 20 years (through 2024) and once every 10 years for the following 80 years. Erosion will be considered excessive when 2 feet of erosion is noted at more than half of the monitoring points. If this occurs, DOE will initiate discussions with NRC to assess likely remedial scenarios and develop an appropriate mitigation protocol, if required.

Results of the 2015 measurements are presented in Table 3-2. Baseline measurements are included for comparison. The surface elevation has increased at all of the monitoring points when compared to the baseline measurements. These results indicate that the surface of the disposal cell is accreting instead of eroding. Accretion is likely due to the increasing vegetation density on the cell cover, which in turn raises the surface elevation through underground root growth, organic matter accumulation in and on the surface soil, and sediment (derived from locations upwind of the tailings impoundment) deposition around the plants' foliage and stems.

Table 3-2. Surface Elevation Changes on the L-Bar, New Mexico, Tailings Impoundment Cover Between 2003 and 2015

Monitoring Point	Length of Rebar Above Surface (inches)				Change in Surface Elevation[a] Baseline to Present (decimal inches)
	2003 (Baseline)		2015		
	(fraction)	(decimal)	(fraction)	(decimal)	
A1	12 10/16	12.625	10 4/16	10.250	2.375
A2	12 7/16	12.438	11 5/16	11.313	1.125
A3	12 15/16	12.938	11 7/16	11.438	1.500
A4	12 6/16	12.375	11 5/16	11.313	1.062
B1	12 10/16	12.625	11 3/16	11.188	1.437
B2	12 8/16	12.500	11 3/16	11.188	1.312
B3	13 0/16	13.000	12 6/16	12.375	0.625
B4	12 15/16	12.938	11 4/16	11.250	1.688
C1	12 8/16	12.500	11 0/16	11.000	1.500
C2	13 1/16	13.063	11 7/16	11.438	1.625
C3	12 2/16	12.125	11 6/16	11.375	0.750
C4	12 6/16	12.375	11 8/16	11.500	0.875
D1	12 7/16	12.438	12 0/16	12.000	0.438
D2	12 12/16	12.750	11 3/16	11.188	1.562
D3	12 3/16	12.188	11 0/16	11.000	1.188
D4	12 12/16	12.750	12 6/16	12.375	0.375
E1	13 1/16	13.063	12 0/16	12.000	1.063
E2	12 14/16	12.875	11 9/16	11.563	1.312
E3	12 9/16	12.563	11 6/16	11.375	1.188
E4	12 15/16	12.938	12 6/16	12.375	0.563

[a] A positive change indicates that the surface elevation at that point increased; a negative change indicates that the surface elevation at that point decreased.

3.7.2.2 Vegetation Monitoring

DOE established 10 vegetation monitoring locations to measure the progress of revegetation over time. Plots were established at existing erosion monitoring points to streamline measurement activities at the site (monitoring points A1, A3, B2, B4, C1, C3, D2, D4, E1, and E3). At each location, three t-posts were used to form three corners of the plot; the fourth point was projected south of the three t-posts to form a parallelogram covering approximately 100 square feet (ft^2) (PL-11).

The primary requirement is to measure the percentage of the foliar cover (canopy) of all live perennial vegetation within the plot. Percent foliar cover represents the approximate total area under the maximum circumference of each of the live plants within the plot. In addition to estimating the cover of live plants, litter (organic detritus often consisting of dead annual plants), rock, bare ground, and plant species also were recorded.

The average foliar cover of live vegetation in the vicinity of the L-Bar disposal site, according to the U.S. Department of Agriculture and estimated from observation, is approximately 25 percent. The predominant vegetation in the area consists of perennial grasses, forbs, and shrubs. In accordance with the EMP, DOE will perform annual vegetation measurements until at least 20 percent foliar cover is achieved in at least 6 plots, and this criterion will be satisfied when more than half of the measurement plots exceed 20 percent cover. Because annual and biennial plants do not necessarily germinate each year, and their germination is highly dependent upon weather conditions, it is assumed that this criterion is based on perennial plant cover. Once the success criterion is met, annual monitoring will not be required unless a significant reduction in plant density is noted during an annual site inspection; then, the plots will be measured again. Annual vegetation monitoring will resume until the success criterion has again been satisfied.

Results of the 2015 measurements, compared with the 2012, 2013, and 2014 measurements, are presented in Table 3-3. Five of the 10 plots contained more than 20 percent perennial foliar cover in 2015 (only one location met the criterion in 2014). The increase of perennial plant cover on the vegetation plots is most likely due to the above-average precipitation for the year. The increasing plant cover is approaching the average foliar cover for the vicinity of the site and increasing protection against erosion of the impoundment surface. Annual vegetation monitoring will continue until six or more plots meet or exceed the 20-percent foliar cover requirement.

Table 3-3. Comparison of Perennial Plant Cover on the L-Bar, New Mexico, Tailings Impoundment Cover from 2012 Through 2015

Plot Location	Percent Perennial Plant Cover in 100-ft^2 Plots			
	2012	2013	2014	2015
A1	28	12	10	30
A3	12	7	8	12
B2	0	0	0	0
B4	23	13	8	21
C1	24	7	16	28
C3	2	2	1	2
D2	10	9	7	14
D4	5	1	3	14
E1	25	5	25	34
E3	12	6	5	25

3.8 Photographs

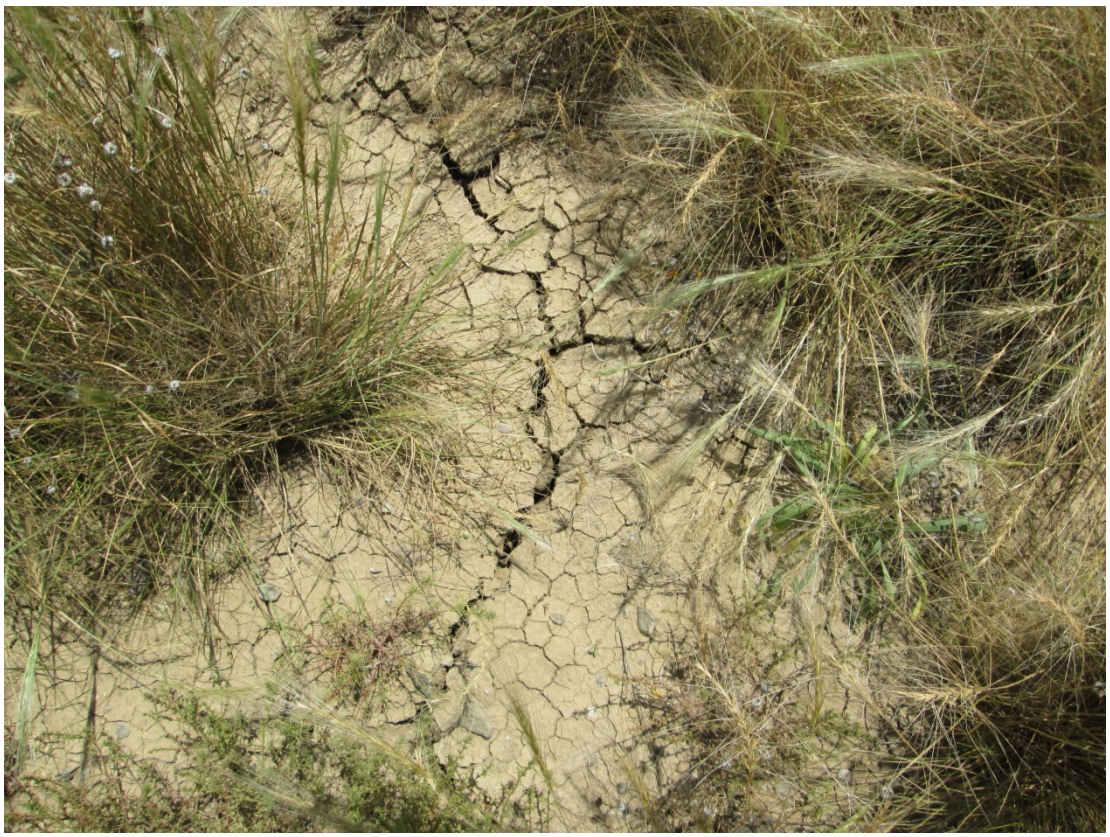
Photograph Location Number	Azimuth	Photograph Description
PL-1	100	Entrance sign and site marker.
PL-2	110	Site marker.
PL-3	0	Monitoring well 17B.
PL-4	290	Vegetation on tailings impoundment top slope.
PL-5	0	Desiccation cracks on the tailings impoundment top slope.
PL-6	10	Rock-armored slope of containment dam.
PL-7	20	Ponded water in east diversion channel.
PL-8	140	Ponded water in sediment trap.
PL-9	50	Area where ponded water in sediment trap spilled into east diversion channel.
PL-10	110	Slope erosion and sediment deposition in the south diversion channel.
PL-11	270	Erosion monitoring point and vegetation plot E1.

BAR 8/2015. PL–1. Entrance sign and site marker.

BAR 8/2015. PL–2. Site marker.

BAR 8/2015. PL–3. Monitoring well 17B.

BAR 8/2015. PL–4. Vegetation on tailings impoundment top slope.



BAR 8/2015. PL–5. Desiccation cracks on the tailings impoundment top slope.

BAR 8/2015. PL–6. Rock-armored slope of containment dam.

BAR 8/2015. PL–7. Ponded water in east diversion channel.

BAR 8/2015. PL–8. Ponded water in sediment trap.

BAR 8/2015. PL–9. Area where ponded water in sediment trap spilled into east diversion channel.

BAR 8/2015. PL–10. Slope erosion and sediment deposition in the south diversion channel.

BAR 8/2015. PL–11. Erosion monitoring point and vegetation plot E1.