Department of Energy
Office of Legacy Management

NOV 2 3 2010

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Deputy Director
Mail Stop T8F5
Washington, DC 20555-0001

Subject: 2010 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title II Disposal Sites

To Whom It May Concern:

Enclosed are four copies of the *2010 Annual Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title II Disposal Sites*. The report covers the annual inspections of the 6 Title II disposal sites managed by the U.S. Department of Energy.

This report is submitted in compliance with the reporting requirements set forth in 10 CFR 40.28, and each inspection was conducted in accordance with the inspection and monitoring requirements contained in the Long-Term Surveillance Plan for each site.

Please call me at 970-248-6197 if you have comments or questions.

Sincerely,

Tracy Plessinger
Acting Team Leader

Enclosures

cc w/o enclosures:
P. Brandt, NRC
J. Buckley, NRC
K. Conway, NRC
D. Orlando, NRC
R. Bush, DOE-LM (e)
D. Johnson, Stoller (e)
File: ADM 535.10(A)

FSME20

2597 B 3/4 Road, Grand Junction, CO 81503 ☐ 99 Research Park Road, Morgantown, WV 26505
1000 Independence Ave., S.W., Washington, DC 20585 ☐ 11025 Dover St., Suite 1000, Westminster, CO 80021
10995 Hamilton-Cleves Highway, Harrison, OH 45030 ☐ 955 Mound Road, Miamisburg, OH 45342
232 Energy Way, N. Las Vegas, NV 89030 ☐
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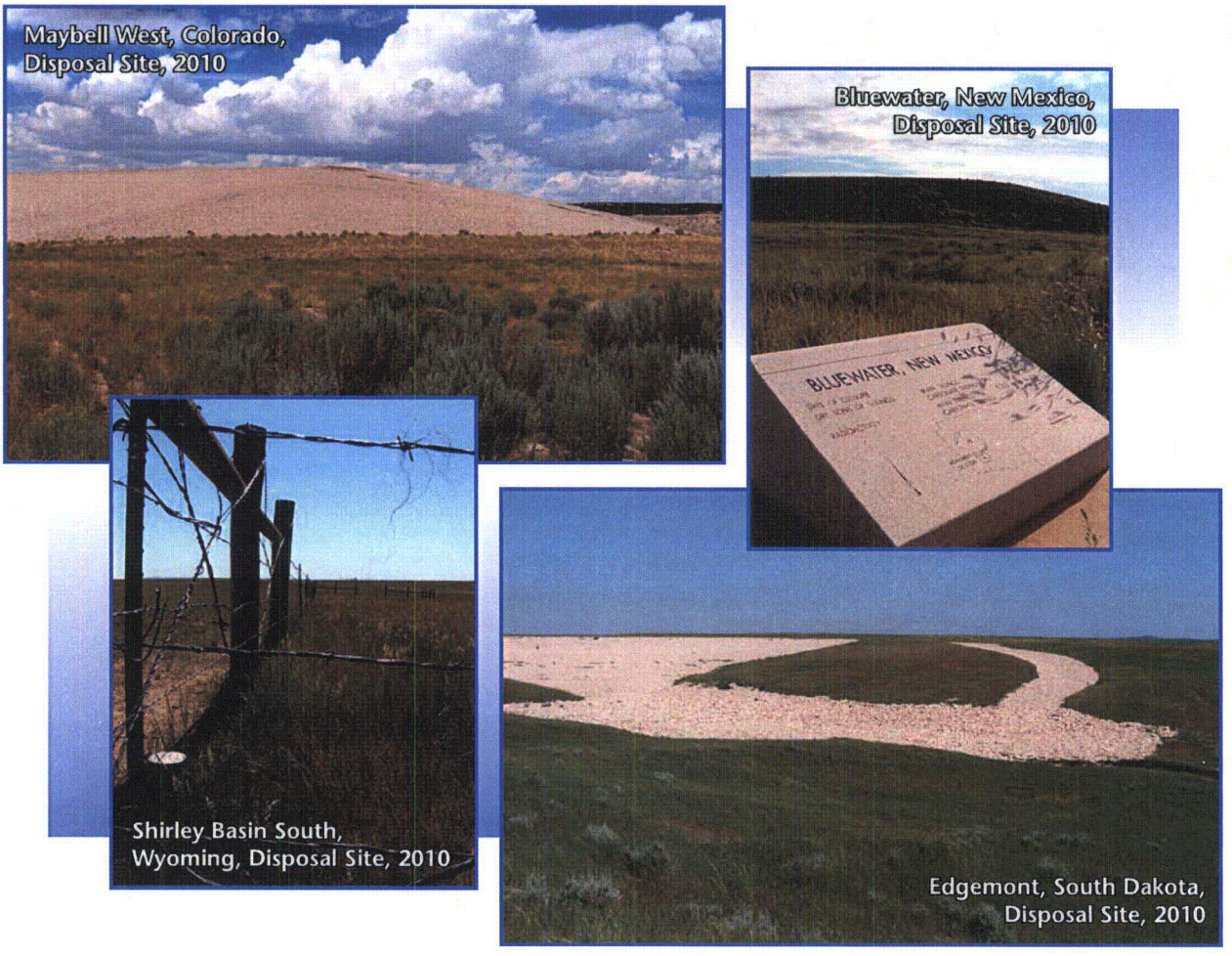
U.S. DEPARTMENT OF ENERGY

Legacy Management

2010 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title II Disposal Sites

November 2010



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2010 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title II Disposal Sites

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Abbreviations

AAS	alternate abatement standard
ACL	alternate concentration limit
BIA	U.S. Bureau of Indian Affairs
BLM	U.S. Bureau of Land Management
CFR	*Code of Federal Regulations*
DOE	U.S. Department of Energy
EMP	erosion monitoring program
LM	Office of Legacy Management
LTSP	long-term surveillance plan
mg/L	milligram(s) per liter
NMED	New Mexico Environment Department
NRC	U.S. Nuclear Regulatory Commission
PCB	polychlorinated biphenyl
pCi/L	picocurie(s) per liter
PL	photo location
PMF	probable maximum flood
POC	point of compliance
POE	point of exposure
TDS	total dissolved solids
UMTRCA	Uranium Mill Tailings Radiation Control Act of 1978 (88 USC 7901, et seq.)
WDEQ	Wyoming Department of Environmental Quality

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Executive Summary

This report, in fulfillment of a license requirement, presents the results of long-term surveillance and maintenance activities conducted by the U.S. Department of Energy (DOE) Office of Legacy Management in 2010 at six uranium mill tailings disposal sites reclaimed under Title II of the Uranium Mill Tailings Radiation Control Act (UMTRCA) of 1978. These activities verified that the UMTRCA Title II disposal sites remain in compliance with license requirements.

DOE manages six UMTRCA Title II disposal sites under a general license granted by the U.S. Nuclear Regulatory Commission (NRC) established at Title 10 *Code of Federal Regulations* Part 40.28. Reclamation and site transition activities continue at other sites, and DOE ultimately expects to manage approximately 27 Title II disposal sites.

Long-term surveillance and maintenance activities and services for these disposal sites include inspecting and maintaining the sites; monitoring environmental media and institutional controls; conducting any necessary corrective action; and performing administrative, records, stakeholder services, and other regulatory functions.

Annual site inspections and monitoring are conducted in accordance with site-specific long-term surveillance plans (LTSPs) and procedures established by DOE to comply with license requirements. Each site inspection is performed to verify the integrity of visible features at the site; to identify changes or new conditions that may affect the long-term performance of the site; and to determine the need, if any, for maintenance, follow-up or contingency inspections, or corrective action. LTSPs and site compliance reports are available online at http://www.LM.doe.gov.

The sites required routine monitoring and maintenance activities in 2010, including groundwater monitoring, erosion and vegetation monitoring, vegetation and noxious weed control, and fence repairs. The following non-routine activities[1] occurred in 2010:

- L-Bar, New Mexico—Construction of new runoff control structures at the site was completed in January 2010.

- Shirley Basin South, Wyoming—The groundwater alternate concentration limits for radium-226 and radium-228 continue to be exceeded. The cause is being evaluated.

Results of the annual site inspection, maintenance, and monitoring activities are reported in the site-specific chapters that follow. Significant actions and issues at each site are summarized in Table ES–1, which includes an index number for each item, which can be found in the left margin next to the corresponding text in the respective site chapter.

[1]Non-routine activities are activities implemented in response to changes in site conditions, the regulatory setting, or the management structure following an extraordinary event or regulatory compliance review.

Table ES–1. 2010 Summary of UMTRCA Title II Site Issues and Actions

Site	Chapter	Page	Index No.	Issues and Actions
Bluewater, New Mexico	1	1–2	1A	Removed drifted sand blocking the entrance gate and modified the fence.
		1–2	1B	Replaced a missing perimeter sign.
		1–5	1C	Cut and sprayed tree saplings growing on the disposal cell.
		1–6	1D	Removed drifted sand overtopping the perimeter fence and modified the fence.
		1–6	1E	Repaired washed-out portions of the site perimeter road.
		1–7	1F	Conducted groundwater compliance monitoring.
Edgemont, South Dakota	2	2–2	2A	Installed perimeter signs at two new locations to deter trespassing.
		2–6	2B	Conducted vegetation monitoring.
L-Bar, New Mexico	3	3–2	3A	Replaced stolen gate.
		3–6	3B	Completed construction of erosion control structures.
		3–6	3C	Completed construction of erosion control structures.
		3–7	3D	Conducted groundwater compliance monitoring.
		3–8	3E	Measured cell cover erosion and vegetation.
Maybell West, Colorado	4	4–1	4A	Site transitioned to DOE in March 2010; conducted first annual inspection in August 2010.
		4–5	4B	Cut and sprayed deep-rooted plants growing on the disposal cell.
Sherwood, Washington	5	5–2	5A	Replaced damaged perimeter sign.
		5–6	5B	Conducted dam safety inspection.
		5–7	5C	Conducted groundwater best management practice monitoring.
Shirley Basin South, Wyoming	6	6–6	6A	Conducted groundwater compliance monitoring.
		6–8	6B	Continued to exceed the groundwater alternate concentration limit for radium-228.
		6–8	6C	Continued to exceed the groundwater alternate concentration limit for radium-226.

1.0 Bluewater, New Mexico, Disposal Site

1.1 Compliance Summary

The Bluewater, New Mexico, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title II disposal site was inspected on August 24, 2010. A missing perimeter sign was replaced. Portions of the site perimeter road were washed out and subsequently repaired. Drifted sand along portions of the perimeter fence was removed to avoid blocking the entrance gate and to prevent cattle from crossing the fence at those locations. Tree saplings on the main tailings disposal cell cover were cut and treated with herbicide. Several shallow depressions on the main tailings disposal cell cover had standing water at the time of the inspection, and the cover will be evaluated to determine if additional monitoring or corrective action is necessary.

Groundwater monitoring results indicate that all compliance requirements continue to be met; however, the uranium concentration in an alluvium well downgradient of the disposal cells is increasing and approaching the alternate concentration limit (ACL). The U.S. Department of Energy (DOE) is cooperating with the State of New Mexico regarding the investigation of regional groundwater contamination associated with historical Grants Mineral Belt uranium activities. An evaluation of the groundwater conditions at the Bluewater site is part of that investigation.

1.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the Bluewater site are specified in the *Long-Term Surveillance Plan for the DOE Bluewater (UMTRCA Title II) Disposal Site Near Grants, New Mexico* (DOE, Grand Junction, Colorado, July 1997) and in procedures established by DOE to comply with requirements of Title 10 *Code of Federal Regulations* Part 40.28 (10 CFR 40.28). Table 1–1 lists license requirements for this site.

Table 1–1. License Requirements for the Bluewater, New Mexico, Disposal Site

Requirement	Long-Term Surveillance Plan	This Report
Annual Inspection and Report	Sections 3.3 and 3.4	Section 1.3.1
Follow-up Inspections	Section 3.5	Section 1.3.2
Routine Maintenance and Emergency Measures	Section 3.6	Section 1.3.3
Environmental Monitoring	Section 3.7	Section 1.3.4

Institutional Controls—The 3,300-acre site 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 1997. 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, as defined by DOE Policy 454.1, consist of federal ownership of the property, a site perimeter fence, warning/no-trespassing signs placed along the perimeter fence and around the disposal cells, and a locked gate at the site entrance. Verification of these institutional controls is part of the annual inspection. No off-site institutional controls are needed because contaminated groundwater is contained within the federal land boundary.

1.3 Compliance Review

1.3.1 Annual Inspection and Report

The site, located approximately 9 miles northwest of Grants, New Mexico, was inspected on August 24, 2010. Results of the inspection are described below. Features and photograph locations (PLs) mentioned in this report are shown on Figures 1–1 (south area) and 1–2 (north area). Numbers in the left margin of this report refer to items summarized in the "Executive Summary" table (Table ES–1).

1.3.1.1 Specific Site Surveillance Features

Entrance Gate, Access Road, Site Access Gate, and Signs—Access to the site is directly off a Cibola County gravel road; no private property is crossed to gain site access. The entrance gate is a tubular steel, double-swing gate. The gate is secured by a chain and locks belonging to DOE and the various utility companies that have rights-of-way across the site. The access road leads from the entrance gate to the main site access gate, which is a steel stock gate. The gates were in good condition. Windblown sand tends to accumulate near the entrance gate and had buried the boundary monuments and portions of the perimeter fence. The access road is surfaced with crushed basalt and extends northward along a narrow strip of DOE property for approximately 1,700 feet from the entrance gate to the main site access gate. The access road was deeply rutted from a recent storm. The sand was removed and the road was repaired in fall 2010. To reduce
1A continued accumulations at the entrance gate, the fence was modified to avoid catching tumbleweeds that cause the sand to accumulate.

Fifty-five warning signs are mounted on steel posts at access points along right-of-way intersections within the site boundary and around the main and carbonate tailings disposal cells.
1B Perimeter sign P9A, missing at the time of the 2009 inspection, was replaced. Perimeter signs P1, P3, and P10 have gunshot damage but are still legible. All other signs were in good condition.

Site Marker and Boundary Monuments—A granite site marker is between the southwest corner of the main tailings disposal cell and the northwest corner of the carbonate tailings disposal cell. The marker was in excellent condition (PL–1).

Twenty-four boundary monuments define the site boundary. These monuments are typically inside the perimeter fence and several feet inside the true corner or boundary line. Not all of the boundary monuments were verified during the 2010 inspection, but the monuments observed were in good condition. Some monuments tend to get covered by drifting sand, and metal t-posts have been driven at those locations to help inspectors find them.

Monitoring Wells—The groundwater-monitoring network consists of nine monitoring wells that are all inside the site boundary. Five wells are screened in Rio San Jose alluvium underlying basalt lava flows and are identified as E(M), F(M), T(M), X(M), and Y2(M). The other four wells are screened in the San Andres Limestone-Glorieta Sandstone, which is the uppermost bedrock aquifer at the site. The bedrock wells are L(SG), OBS–3, S(SG), and I(SG). Animal burrows under the concrete collar of well T(M) were filled with bentonite clay in fall 2009 to prevent surface water from percolating downward along the well casing. The wells encountered during the inspection were in excellent condition.

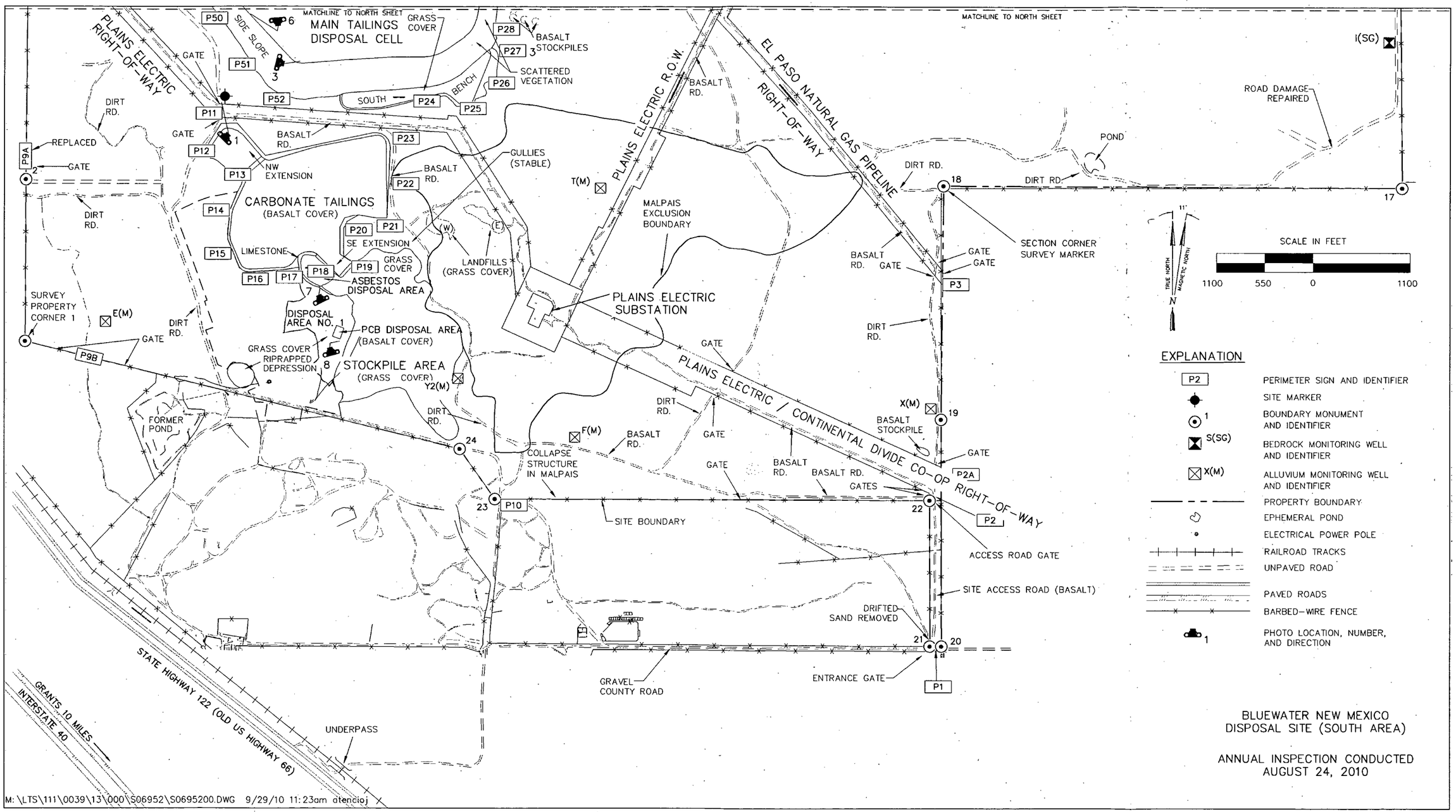


Figure 1–1. 2010 Annual Compliance Drawing for the Bluewater, New Mexico, Disposal Site (South Area)

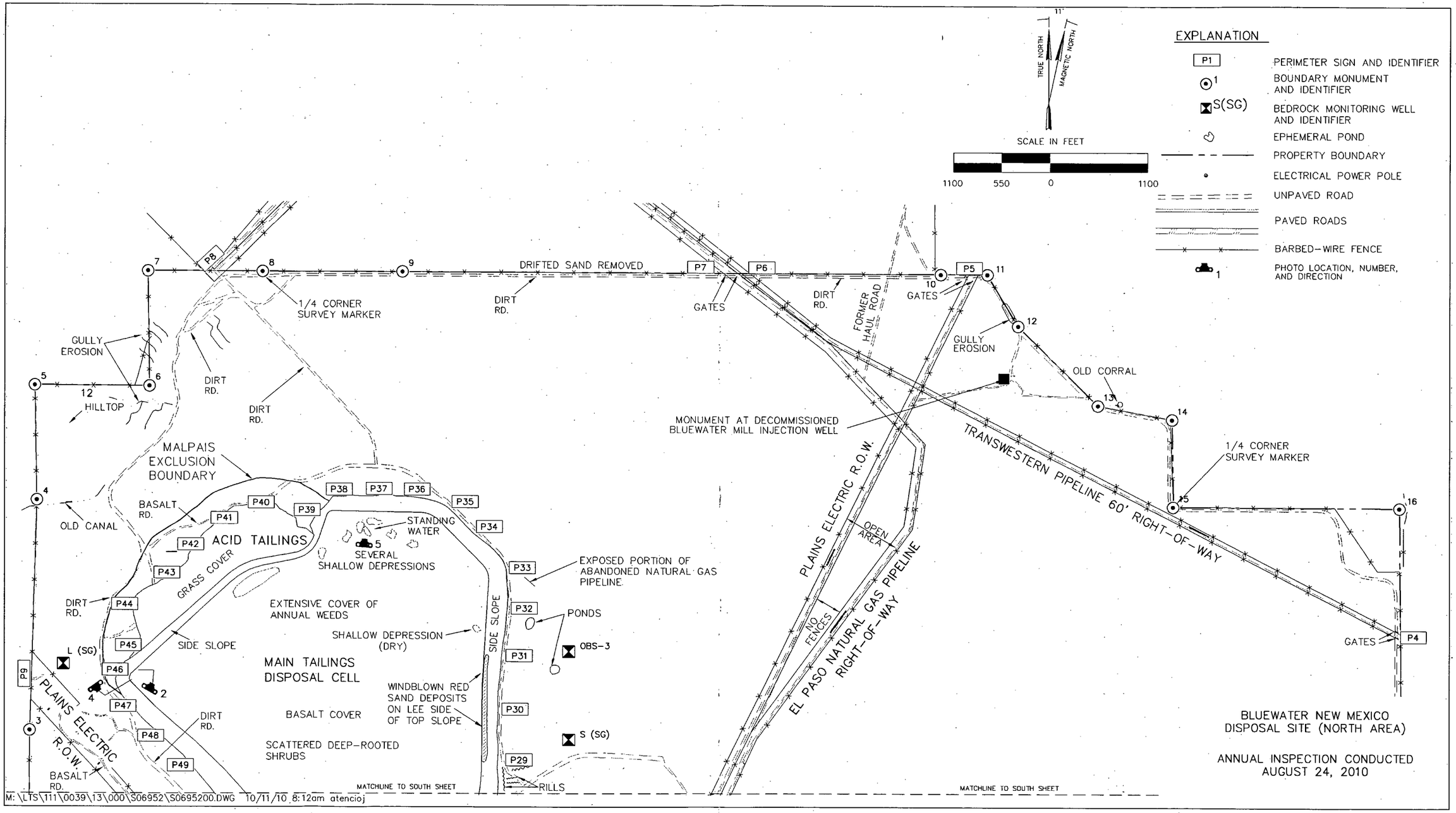


Figure 1–2. 2010 Annual Compliance Drawing for the Bluewater, New Mexico, Disposal Site (North Area)

1.3.1.2 Transects

In accordance with the Long-Term Surveillance Plan (LTSP), the site is divided into four transects to ensure a thorough and efficient inspection: (1) the main tailings disposal cell, including the acid tailings disposal area and the south bench; (2) the carbonate tailings disposal cell, including the asbestos disposal area, the polychlorinated biphenyl (PCB) disposal area, and associated landfills; (3) the region between the disposal structures and the site perimeter; and (4) the site perimeter and outlying area.

Within each transect, inspectors examined specific site surveillance features, such as monitoring wells, boundary monuments, and signs. Inspectors examined each transect for evidence of erosion, settling, slumping, or other disturbances that might affect the site's integrity, protectiveness, or long-term performance.

Main Tailings Disposal Cell, the Acid Tailings Disposal Area, and the South Bench Disposal Area—These three disposal areas are contiguous, and together they constitute one large disposal area of approximately 354 acres. The main tailings disposal cell is covered with basalt riprap and slopes northward. The top slope grade is 3 to 4 percent at the south end and decreases to less than 0.5 percent at the north end. The top slopes of the acid tailings (PL–2) and the south bench (PL–3) disposal areas are essentially flat and covered by healthy grass. Basalt riprap protects the side slopes of the three disposal areas (PL–4). The riprap was in excellent condition.

Fine-grained windblown sand continues to accumulate along the top of the east side slope on the main tailings disposal cell. Sand accumulation is expected to continue but is not expected to degrade the protectiveness of the riprap cover. Plant encroachment (annual weeds and scattered perennial shrubs) continues on the cell cover and side slopes. Several saplings of Siberian elm were present on the cell cover and east side slope and subsequently were cut and treated with herbicide. 1C

Several shallow depressions exist on the relatively flat north end of the top slope of the main tailings disposal cell and along the east and northwest edges of the cover. Standing water from a recent rainfall event was present in several of the depressions at the time of the inspection (PL–5). Given that evaporation greatly exceeds precipitation in this area, ponding is believed to be infrequent and brief and, therefore, has not been considered to be a concern. However, the cell cover in the area of the depressions will be evaluated to determine if additional monitoring or corrective action is necessary.

Carbonate Tailings Disposal Cell, Asbestos and PCB Disposal Areas, and Landfills—Basalt riprap covers the top and side slopes of the 54-acre carbonate tailings disposal cell (PL–6). The top, for the most part, slopes gently eastward. The small northwest and southeast extensions slope in their respective directions. Annual weeds and scattered perennial shrubs were present on the cell and its extensions. The carbonate tailings disposal cell was in excellent condition.

The 2-acre asbestos disposal area is a bowl-like feature just south of the carbonate pile (PL–7). The north, west, and south side slopes of this feature are covered by limestone riprap; the bottom of the bowl (the asbestos cell cover) is grass-covered. The asbestos disposal area was in excellent condition.

The 11-acre grass-covered disposal area south of the asbestos disposal area was in excellent condition, as was the small riprap-covered PCB disposal area located within the disposal area (PL–8). The two grass-covered landfills east of the carbonate tailings disposal cell, totaling about 2 acres, were in excellent condition. The stockpile area, another grass-covered landfill (southeast of the carbonate tailings disposal cell), was also in excellent condition.

Area Between the Disposal Cells and the Site Perimeter—Other areas inside the site were inspected by driving the site perimeter road and other roads and tracks. Much of the southern and western portions of the site are inaccessible by vehicle because they are covered by basalt flows.

Small ponds often form in an area along the east side of the disposal cell and in other low spots following storm events and were present at the time of the inspection. These ponds provide water for wildlife and wild burros that inhabit or travel through the site. The areas of ponding are far enough from the cell to not impact it.

A monument consisting of a steel well casing set in concrete is located at the decommissioned ARCO Bluewater mill injection well near the northeast corner of the site. Information pertaining to the well is welded onto the monument.

Several utility companies have rights-of-way that cross the site. These rights-of-way are enclosed by stock fences with gates where the rights-of-way intersect one another, cross the site boundary, or cross the perimeter road. Roads along the rights-of-way typically are covered with crushed basalt to provide the utility companies with all-weather access.

An electric power substation is enclosed by a security fence near the center of the site along the Plains Electric Company right-of-way. The substation is inspected frequently by the utility company.

Site Perimeter and Outlying Areas—A local subcontractor has been retained to repair the fencing and periodically check for unauthorized livestock use or trespassing on site property. Minor fence repairs occurred throughout the year. Grazing is not part of the current management plan for this site and, if livestock are discovered on the site, the subcontractor is authorized to remove the animals.

Windblown sand had accumulated along the perimeter fence along portions of the north property boundary. Livestock have crossed the fence and entered the site where accumulations approached the top of the fence. The sand was removed from the fence in fall 2010. To reduce
1D continued accumulations in these areas, the fence was modified to avoid catching tumbleweeds that cause the sand to accumulate.

The perimeter road consists of a dirt track covered at places with crushed basalt. The road runs along the site boundary in much of the southern and most of the northern and eastern parts of the site. Portions of the road are susceptible to erosion, and the road is repaired when it becomes
1E unusable. Runoff from recent rain storms had caused significant erosion along portions of the road; these portions were repaired in fall 2010.

Surrounding land is used for livestock grazing and wildlife habitat. The area outside the site boundary for 0.25 mile was visually inspected for erosion, development, changes in land use, or other phenomena that might affect the long-term integrity of the site. No such impacts were observed.

1.3.2 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 follow-up inspections were required in 2010.

1.3.3 Routine Maintenance and Emergency Measures

Windblown sand was removed from portions of the perimeter fence, eroded portions of site access roads were repaired, tree saplings were removed from the main tailings disposal cell cover, and minor fence repairs were conducted in 2010.

Emergency measures are corrective actions that DOE will take in response to unusual damage or disruption that threaten or compromise site health and safety, security, integrity, or compliance with 40 CFR 192. No emergency measures were required in 2010.

1.3.4 Environmental Monitoring

Groundwater monitoring is required at the Bluewater site. In accordance with the LTSP, the
1F alluvium aquifer background and point-of-compliance (POC) wells are sampled annually for polychlorinated biphenyls (PCBs) and every 3 years for molybdenum, selenium, and uranium (Table 1–2). The San Andres-Glorieta (bedrock) aquifer background and POC wells are sampled every 3 years for selenium and uranium. The LTSP stipulates that alluvium aquifer well MW–X(M) and bedrock aquifer well MW–I(SG)—point-of-exposure (POE) wells located along the east property boundary—will be sampled only if specified ACLs are exceeded (Table 1–3).

Table 1–2. Groundwater Monitoring Network for the Bluewater, New Mexico, Disposal Site

Monitoring Well	Network Application	Analytes
MW–E(M)	Alluvium background well	Mo, Se, U, and PCBs
MW–F(M)	Alluvium POC well	Mo, Se, U, and PCBs
MW–T(M)	Alluvium POC well	Mo, Se, U, and PCBs
MW–Y2(M)	Alluvium POC well	PCBs
MW–X(M)	Alluvium POE well	Mo, Se, U, and PCBs
MW–L(SG)	Bedrock background well	Se and U
MW–OBS–3	Bedrock POC well	Se and U
MW–S(SG)	Bedrock POC well	Se and U
MW–I(SG)	Bedrock POE well	Se and U

Key: Mo = molybdenum; PCB = polychlorinated biphenyl; POC = point-of-compliance; POE = point-of-exposure; Se = selenium; U = uranium

Table 1–3. Groundwater Alternate Concentration Limits for the Bluewater, New Mexico, Disposal Site

POC Well	Analyte	ACL (mg/L)
Alluvium MW–F(M) and MW–T(M)	Molybdenum Selenium Uranium	0.10 0.05 0.44
Bedrock MW–OBS–3 and MW–S(SG)	Selenium Uranium	0.05 2.15

Key: ACL = alternate concentration limit; mg/L = milligrams per liter; POC = point-of-compliance

The New Mexico Environment Department (NMED) requested DOE's assistance in investigating and evaluating regional groundwater contamination associated with the former Grants Mineral Belt uranium industry. NMED suspects that contaminants from the Bluewater site are migrating off site and contaminating the regional groundwater. In response to NMED's concerns, DOE re-initiated annual sampling at all of the site wells in fall 2008 and conducted follow-up sampling at several wells in May 2009. DOE also began evaluating the hydrogeology and groundwater quality at the site in 2009. Several new monitoring wells are planned for installation, including a replacement of alluvium POE well MW–X(M), which is dry (DOE has never been able to obtain a sample from this well).

Analytical results from the most recent sampling event in November 2009 are provided in Table 1–4. Alluvium well X(M) was not sampled because it continues to be dry. All concentrations were less than the specified ACL for each constituent. The uranium concentration in alluvium well MW–T(M) has trended upward since DOE began monitoring the well in 1999, and is approaching the ACL of 0.44 milligrams per liter (Figure 1–3). NRC was notified of the increasing uranium concentrations is this well, and the reason for this trend is under investigation. Concentrations for the other analytes in all of the wells remain within historical levels. PCBs have never been detected in any of the wells at the site.

Table 1–4. November 2009 Groundwater Monitoring Analytical Results for the Bluewater, New Mexico, Disposal Site

Analyte	Alluvium Wells				Bedrock Wells			
	E(M)	F(M)	T(M)	Y2(M)	I(SG)	L(SG)	OBS–3	S(SG)
Molybdenum (mg/L)	ND	0.004	0.030	0.003	0.0013	0.016	ND	ND
Selenium (mg/L)	0.00039	0.0010	0.0041	0.00064	ND	ND	ND	ND
Uranium (mg/L)	0.00009	0.0093	0.410	0.0053	0.0013	ND	0.00022	ND

Key: mg/L = milligrams per liter; ND = not detected (below method detection limit)

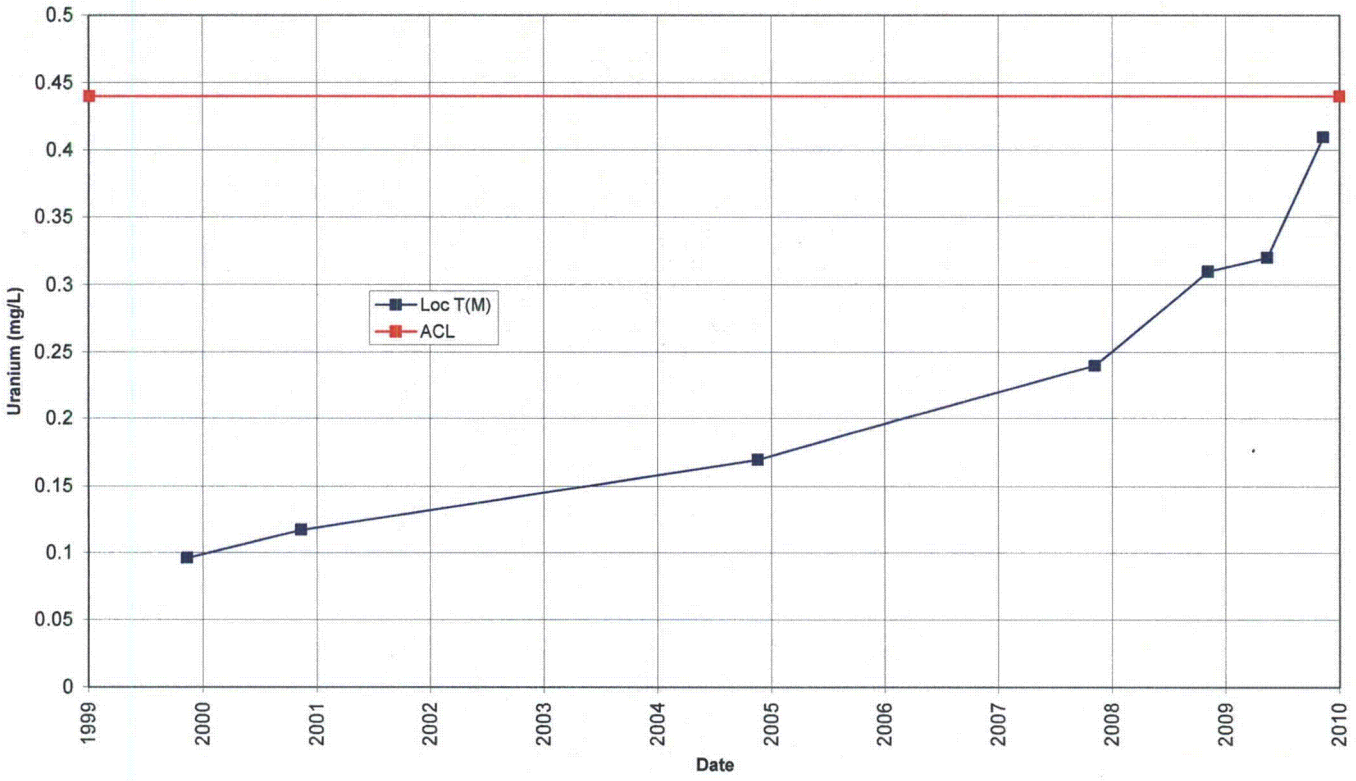
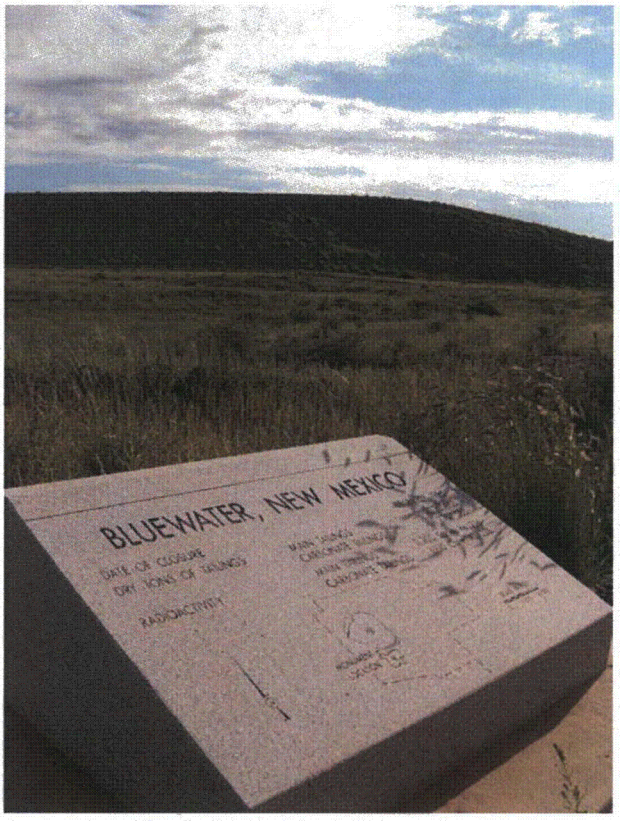


Figure 1–3. Uranium Concentration in Alluvium Well MW–T(M)

1.3.5 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL–1	45	Site marker.
PL–2	30	Acid tailings cell along the northwest side of the main tailings cell.
PL–3	105	South bench of the main tailings cell.
PL–4	145	Southwest side slope of the main tailings cell.
PL–5	5	Standing water in shallow depressions on the main tailings cell.
PL–6	175	Carbonate tailings cell viewed from the main tailings cell.
PL–7	335	Asbestos disposal area.
PL–8	345	Rock cover over PCB disposal area.

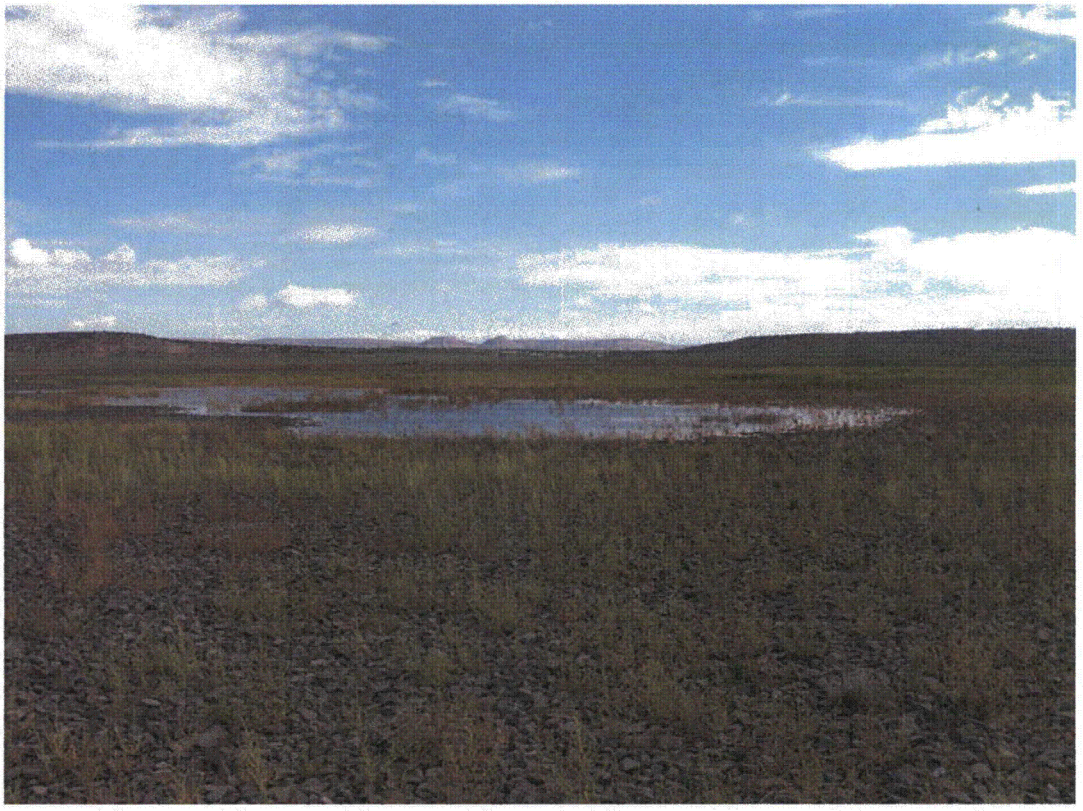


BLU 8/2010. PL–1. Site marker.

BLU 8/2010. PL–2. Acid tailings cell along the northwest side of the main tailings cell.

BLU 8/2010. PL–3. South bench of the main tailings cell.

BLU 8/2010. PL–4. Southwest side slope of the main tailings cell.



BLU 8/2010. PL–5. Standing water in shallow depressions on the main tailings cell.

BLU 8/2010. PL–6. Carbonate tailings cell viewed from the main tailings cell.

BLU 8/2010. PL–7. Asbestos disposal area.

BLU 8/2010. PL–8. Rock cover over PCB disposal area.

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2.0 Edgemont, South Dakota, Disposal Site

2.1 Compliance Summary

The Edgemont, South Dakota, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title II disposal site was inspected on June 22, 2010, and was in excellent condition. Chains and locks were added to remote wire gates, and perimeter signs were installed at those locations to deter trespassing. Cattle continue to graze on site under an agreement with a local rancher. However, the presence of cattle may be affecting range conditions on and around the cell, and may be causing minor erosion features in the southeast portion of the site. Annual vegetation monitoring is being conducted to evaluate the effect of grazing. Data will be evaluated to manage the grazing as needed to maintain healthy ecological conditions at the site. No cause for a follow-up inspection was identified.

2.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the Edgemont site are specified in the *Long-Term Surveillance Plan for the DOE Tennessee Valley Authority (UMTRCA Title II) Disposal Site, Edgemont, South Dakota,* (U.S. Department of Energy [DOE], Grand Junction, Colorado, June 1996) and procedures established by DOE to comply with the requirements of Title 10 *Code of Federal Regulations* Part 40.28 (10 CFR 40.28). Table 2–1 lists license requirements for this site.

Table 2–1. License Requirements for the Edgemont, South Dakota, Disposal Site

Requirement	Long-Term Surveillance Plan	This Report
Annual Inspection and Report	Sections 3.3 and 3.4	Section 2.3.1
Follow-up Inspections	Section 3.5	Section 2.3.2
Routine Maintenance and Emergency Measures	Section 3.6	Section 2.3.3
Environmental Monitoring	Section 3.7	Section 2.3.4

Institutional Controls—The 360-acre site is owned by the United States of America and was accepted under the U.S. Nuclear Regulatory Commission general license (10 CFR 40.28) in 1996. 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, as defined by DOE Policy 454.1, consist of federal ownership of the property, a site perimeter fence, locked gates, and warning/no-trespassing signs placed at the site gates. Verification of these institutional controls is part of the annual inspection.

2.3 Compliance Review

2.3.1 Annual Inspection and Report

The site, located approximately 2 miles south of the town of Edgemont in Fall River County near the southwestern corner of South Dakota, was inspected on June 22, 2010. Results of the inspection are described below. Features and photograph locations (PLs) mentioned in this report are shown on Figure 2–1. Numbers in the left margin of this report refer to items summarized in the "Executive Summary" table (Table ES–1).

2.3.1.1 Specific Site Surveillance Features

Site Access, Gates, Sign, and Fence—Access to the Edgemont site is immediately off County Road 6N. No private property is crossed to gain access.

A tubular metal entrance gate is secured by a locked chain and was in excellent condition. Two wire gates are also present along the perimeter fence: one at the northwest corner of the property on the north perimeter fence line and one approximately 700 feet north of the southeast corner of the property on the east perimeter fence line. Both were in good condition. Chains with locks were added to the gates to discourage trespassing.

2A The entrance sign was in excellent condition. Two new perimeter signs were installed on the west and east fence lines near the wire gates. Trespassers had accessed the site through the gates in fall 2009.

A four-strand barbed-wire fence was installed in spring 1999 along the site perimeter to demarcate DOE property and to control grazing on the property. The fence truncates the southeast corner to allow livestock access to a preexisting stock pond. A grazing license granted by DOE allows a local rancher's cattle to graze on the site; in return, the rancher monitors site security and maintains the perimeter fence. The fence was in excellent condition.

Site Marker and Monuments—One unpolished granite site marker identifying the site is just inside the entrance gate and was in excellent condition (PL–1). Four boundary monuments, one at each corner of the property, were in excellent condition.

2.3.1.2 Transects

In accordance with the Long-Term Surveillance Plan (LTSP), the site is divided into four transects to ensure a thorough and efficient inspection: (1) the grass-covered disposal cell top; (2) the riprap-covered embankment face and associated drainage and diversion channels; (3) the region between the disposal cell and the site perimeter; and (4) the outlying area.

Within each transect, inspectors examined specific site surveillance features, such as boundary monuments. Each transect was inspected for evidence of erosion, settling, slumping, or other disturbance that might affect site integrity or the long-term performance of the cell.

Top of the Disposal Cell—The 100-acre top of the disposal cell, completed in 1989, is grass-covered and in good condition. Although numerous cattle trails are present on the cell, no signs of erosion, settling, or other modifying processes that might affect the integrity of the cell were noted. The grass cover, which DOE manages through controlled grazing, was healthy due to substantial spring precipitation (PL–2).

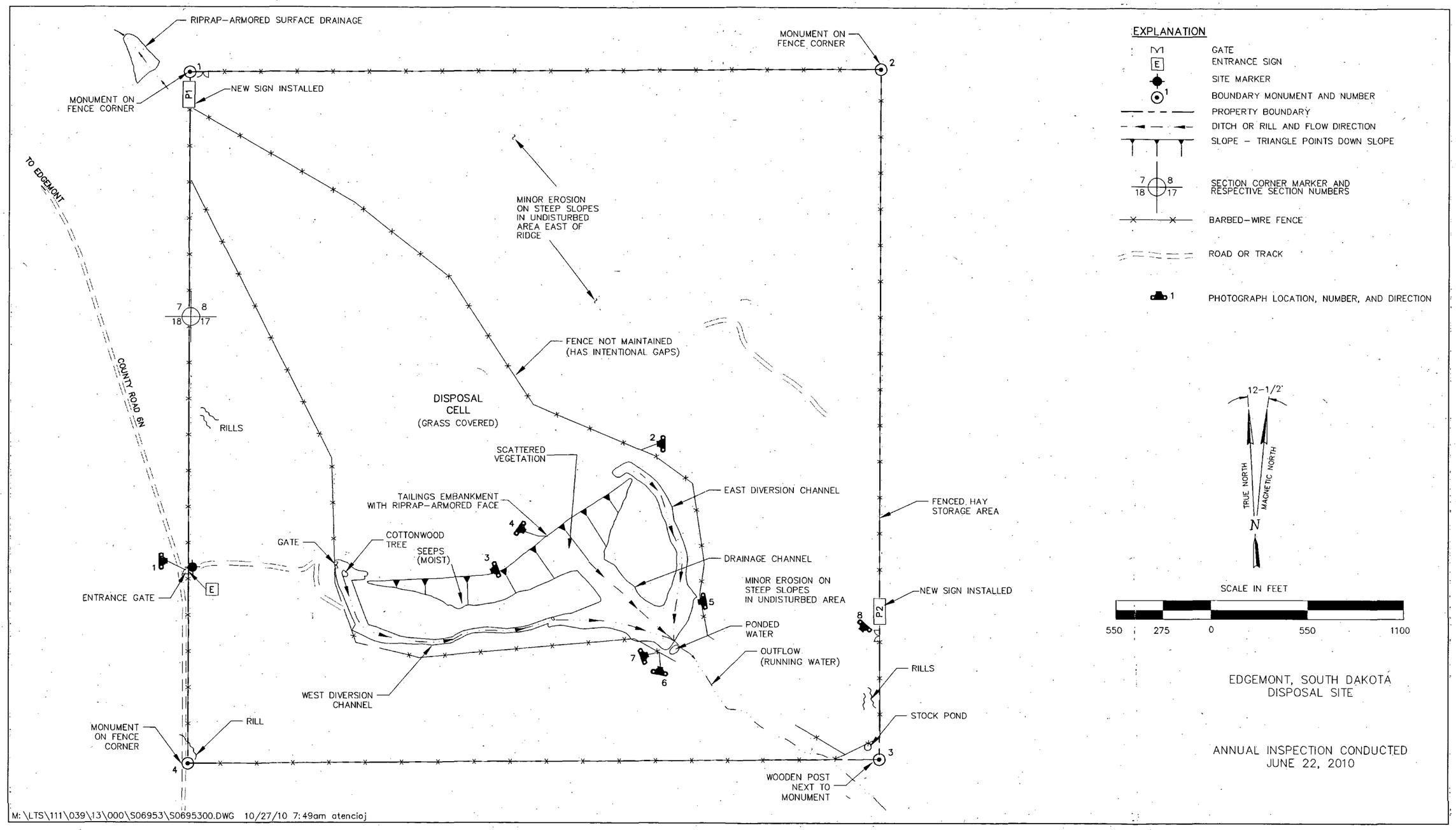

Figure 2–1. 2010 Annual Compliance Drawing for the Edgemont, South Dakota, Disposal Site

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Embankment Face and Drainage and Diversion Channels—The embankment face, the steepest manmade slope on site, is covered with riprap. The slope is stable, and the riprap showed no signs of degradation (PL–3). Scattered plants, mostly grass and annual weeds, grow in the riprap. These plants do not threaten the stability or function of the embankment face.

Diversion and drainage channels are grass-covered on their upslope portions (these are gentle swales on each side of the disposal cell) and riprap-armored on their downslope portions and on steeper slopes (PL–4, PL–5, and PL–6). Grass in the vegetated portions of the channels upgradient of the tailings embankment is dense and healthy, and there was no evidence of erosion. Minor amounts of vegetation are present in the riprap. The vegetation helps to stabilize these areas and does not impair the function of the channels. Water pooling and wetland vegetation occurs at the base of the diversion channels (PL–7). The riprap-armored surface drainage channel just outside the northwest corner of the property, designed to prevent headward erosion onto the site, was also stable and in good condition.

Region Between the Disposal Cell and the Site Perimeter—The area between the disposal cell and the site perimeter consists of undisturbed areas covered with native shrubs, grasses, and forbs, and formerly disturbed areas covered primarily with seeded grasses and annual weeds.

Cattle were grazing the site at the time of the inspection (PL–8). Cattle trails are common on the site and in a few places have concentrated storm runoff and created rills and gullies. The most significant erosion features, in the southeast portion of the site, do not have the potential to affect the disposal cell. Although minor natural erosion is occurring on the steep shale slopes in the east and northeast portions of the site, this undisturbed region of the site remains in good condition.

Outlying Area—The site is surrounded by private land used primarily for grazing and wildlife habitat. The area approximately 0.25 mile beyond the site boundary was inspected from within the boundary fence. The town of Edgemont operates a municipal landfill north-northwest of the site, and minor amounts of windblown trash have been observed on site or along the fences; however, landfill trash was insignificant at the site this year. There was no evidence of activity or changes in land use that could affect the site.

2.3.2 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 follow-up inspections were required in 2010.

2.3.3 Routine Maintenance and Emergency Measures

Chains and locks were added to remote gates, perimeter signs were installed next to the gates, and noxious weeds (Canada thistle) were sprayed with herbicide in 2010.

Emergency measures are corrective actions that DOE will take in response to unusual damage or disruption that threaten or compromise site health and safety, security, integrity, or compliance with 40 CFR 192. No emergency measures were required in 2010.

2.3.4 Environmental Monitoring

Groundwater monitoring is not required at this site, as stipulated in the LTSP, due to the presence of a 300- to 700-foot-thick layer of competent unweathered shale bedrock lying between the disposed tailings and the uppermost confined aquifer. Additionally, clay liners were constructed to isolate the tailings from the shallower unconfined perched groundwater present as a result of local precipitation. There is no evidence of any direct hydraulic connection between the perched groundwater and the underlying confined bedrock aquifer.

2B Vegetation monitoring is required in the LTSP as an annual visual inspection. In 2008 it was noted that a significant percentage of the plant cover was composed of non-noxious weedy species. It was not known whether the range condition has improved, deteriorated, or stayed about the same since cattle began grazing on site. A vegetation monitoring program began in 2009 to monitor the effects of grazing. Annual monitoring data will be evaluated to manage the grazing as needed to maintain healthy ecological conditions at the site.

2.3.5 Photographs

Photograph Location Number	Azimuth	Description
PL–1	90	Site marker.
PL–2	270	Grass-covered disposal cell cover.
PL–3	250	West end of the tailings embankment.
PL–4	125	Riprap-armored drainage channel below the tailings embankment.
PL–5	260	Drainage channel and west diversion channel.
PL–6	10	Drainage channel and east diversion channel.
PL–7	70	Wetland vegetation at the base of the drainage channel.
PL–8	220	Cattle on site.

EDG 6/2010. PL–1. Site marker.

EDG 6/2010. PL–2. Grass-covered disposal cell cover.

EDG 6/2010. PL–3. West end of the tailings embankment.

EDG 6/2010. PL–4. Riprap-armored drainage channel below the tailings embankment.

EDG 6/2010. PL–5. Drainage channel and west diversion channel.

EDG 6/2010. PL–6. Drainage channel and east diversion channel.

EDG 6/2010. PL–7 Wetland vegetation at the base of the drainage channel.

EDG 6/2010. PL–8. Cattle on site.

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 25, 2010. Erosion has been excessive in several areas of the site, and construction of several runoff control structures to prevent an impact on the integrity and function of the tailings impoundment and diversion structures was completed in January 2010. Erosion and vegetation measurements to monitor the condition of the impoundment cover indicate that no erosion is occurring and the foliar cover of the vegetation is increasing at the monitoring locations. No cause for a follow-up inspection was identified.

3.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the L-Bar 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 established by the U.S. Department of Energy (DOE) to comply with requirements of Title 10 *Code of Federal Regulations* Part 40.28 (10 CFR 40.28). Table 3–1 lists license requirements for this site.

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 3.3.1
Follow-up Inspections	Section 3.5	Section 3.3.2
Routine Maintenance and Emergency Measures	Section 3.6	Section 3.3.3
Environmental Monitoring	Section 3.7	Section 3.3.4

Institutional Controls—The 738-acre site 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 disposal site, as defined by DOE Policy 454.1, consist of federal ownership of the property, a perimeter fence around the impoundment and associated structures, warning/no-trespassing signs placed along the perimeter fence, and a locked gate at the site entrance. Verification of these institutional controls is part of the annual inspection. No off-site institutional controls are needed because contaminated groundwater is contained within the federal land boundary.

3.3 Compliance Review

3.3.1 Annual Inspection and Report

The site, located approximately 15 miles north of Laguna, New Mexico, and 2 miles east of Seboyeta, New Mexico, was inspected on August 25, 2010. Results of the inspection are described below. Features and photograph locations (PLs) mentioned in this report are shown on Figure 3–1. Numbers in the left margin of this report refer to items summarized in the "Executive Summary" table (Table ES–1).

3.3.1.1 Specific Site Surveillance Features

Access, Gates, Fences, and Perimeter Signs—Access to the site is via a public gravel road (Cibola County Road 1). Approximately 300 feet of Cebolleta Land Grant (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. Portions of the site are accessed via dirt roads.

The site entrance gate is a tubular metal stock gate located along a barbed-wire perimeter fence.
3A The entrance gate was locked and in excellent condition. A tubular metal access gate near the southeast corner of the site was stolen and subsequently replaced by a wire gate.

A barbed-wire stock fence encompasses the tailings impoundment and associated drainage structures, and is intended to prohibit trespassing and livestock use on the tailings impoundment structures. The fence is located as much as 3,300 feet inside the property boundary, and the area between the fence and the boundary is grazed in accordance with a DOE grazing license with the Land Grant that owns the surrounding property. The fence was in excellent condition.

Entrance signs installed on metal posts are located at three access points to the site. Entrance sign E2 has several bullet holes but is legible. Thirty-four perimeter warning/no trespassing signs are attached to the barbed-wire fence. The perimeter signs were in excellent condition.

Site Markers and Boundary Monuments—The granite site marker, located north of the disposal cell adjacent to the site access road, was in excellent condition. Metal t-posts were installed after the 2005 inspection to help inspectors find the eight flush-mounted boundary monuments.

Monitoring Wells—The site groundwater-monitoring network consists of ten wells (PL–1). Nine of the wells are located on DOE property; monitoring well MW–29A is located outside the northeast corner of the site. Some well locations do not have established access roads or tracks but are accessible by 4-wheel drive vehicle as long as the ground is dry.

3.3.1.2 Transects

In accordance with the Long-Term Surveillance Plan (LTSP), the site is divided into four transects to ensure a thorough and efficient inspection: (1) the cover of the tailings impoundment; (2) the containment dam; (3) the diversion channels; and (4) the site perimeter, outlying areas, and balance of the site.

Within each transect, inspectors examined specific site surveillance features, such as monitoring wells, boundary monuments, and signs. Each transect was inspected for evidence of erosion, settling, slumping, or other disturbances that might affect the site's integrity, protectiveness, or long-term performance.

Cover of the Tailings Impoundment—The tailings impoundment, completed in 2000, occupies approximately 100 acres. The cover consists of a compacted clay layer overlain by clay-rich soil and ranges from 6 to 10 feet thick. 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. The cover was not seeded; revegetation is occurring naturally with native species and is progressing well (PL–2). A 9.5-acre portion of the cover that has minimal perennial vegetation was ripped and seeded with a native vegetation seed mix in fall 2009. The establishment and maturing of vegetation is expected to reduce wind and water erosion of the surface and mitigate precipitation and runoff infiltration to the radon barrier.

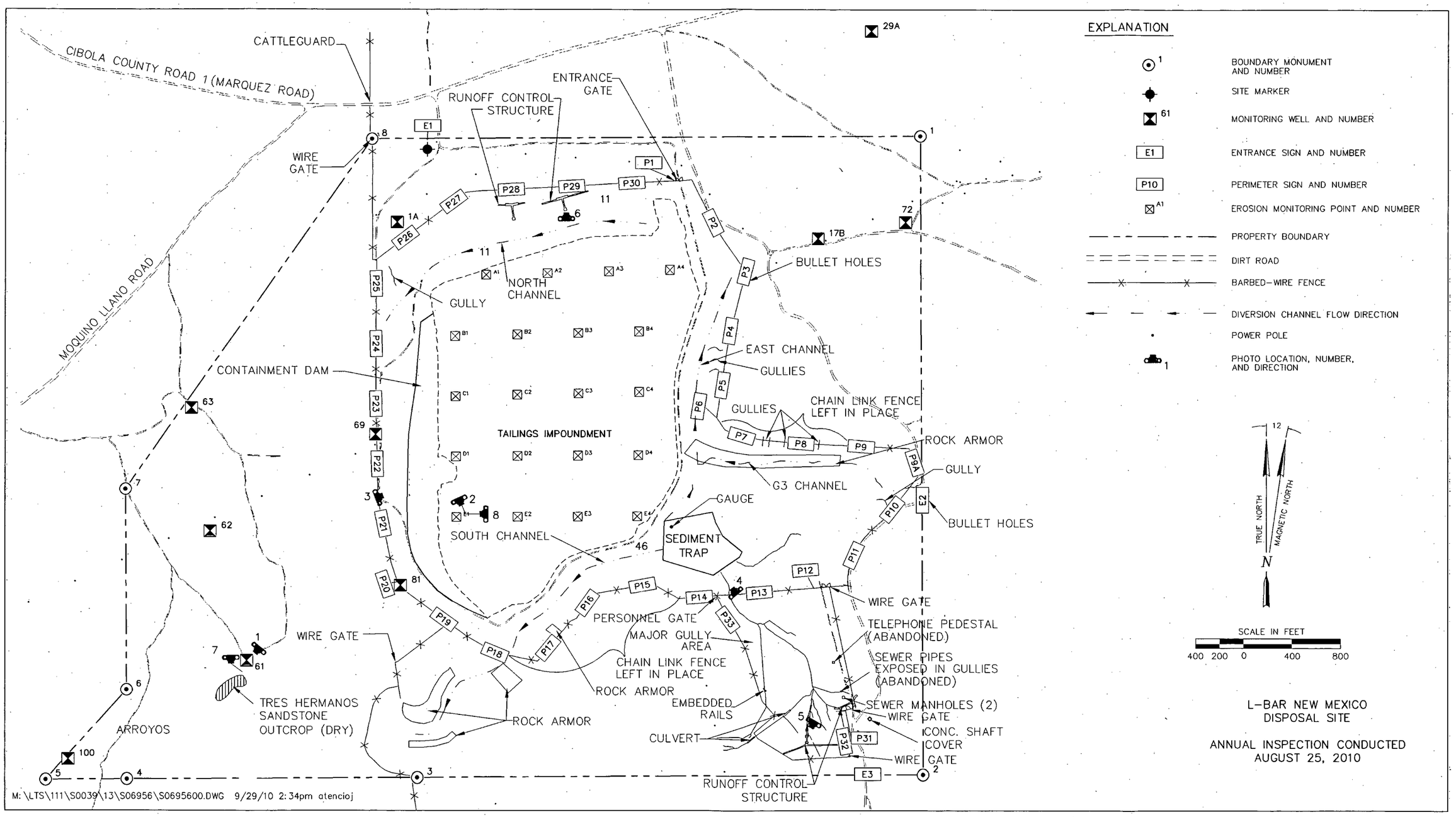

Figure 3–1. 2010 Annual Compliance Drawing for the L-Bar, New Mexico, Disposal Site

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Several low areas on the surface tend to accumulate runoff after storm events; however, there was no standing water at the time of the inspection. The low areas, which are no more than a couple of inches below the surrounding grade, most likely resulted from wind erosion, minor settling shortly after the impoundment cover was completed, or both. Elongate mounds of windblown sand, silt, and clay formed immediately downwind of sunflower stalks and kochia plants shortly after the impoundment cover was completed. The mounds are stable, and vegetation continues to establish on them. The ephemeral pools of water and windblown deposits do not impair the function of the cover materials.

Cracks are often present in the surface soil of the tailings impoundment cover. They are confined to the cover soil and do not extend into the radon barrier. The cracks appear to be the result of drying of the gypsum-rich cover soil after being saturated during rainfall events. They tend to fill with windblown sediment and heal as perennial vegetation continues to establish; however, surface cracking will be monitored to ensure that the underlying radon barrier is not compromised.

In accordance with the LTSP, erosion and vegetation are monitored on the impoundment cover. Section 3.3.4.2 describes the monitoring program and presents the results to date.

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 (PL–3). Native vegetation is well established on the face, which is desirable for increasing the erosion protection of the surface. There were no indications of erosion, settlement, seeps, or other modifying processes that might affect the integrity of the dam.

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 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 is not impairing the function of the channel.

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 area will be monitored and repairs will be made as needed to ensure the integrity of the fence.

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 (PL–4). If a runoff event overtops the sediment trap, the flow is diverted to the east channel; the sediment trap has not overtopped yet. Although the sediment trap sometimes has standing water for months at a time, it was dry at the time of the inspection because there had been no significant rainfall events since September 2009.

The sediment trap was designed to function for 600 years before accumulated sediment would need to be removed. However, multiple storm events have caused deep gullies to form in the soft soils and fill materials upgradient of the sediment trap, resulting in a substantial amount 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 (PL–5).

3B

A gauge was installed in the northwest corner of the sediment trap (runoff discharges into the southeast portion of the trap) in May 2009 to measure the rate of sediment deposition in the trap. Based on the gauge measurement taken during the inspection, the depth of sediment has increased 0.475 feet at the gauge location since May 2009. Sediment depth will be monitored to evaluate the results of erosion control measures and to predict when the sediment trap will need to be excavated.

Runoff water from the area north of the tailings impoundment is captured by the north 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 slope of the channel, and headward erosion was rapidly occurring to the north toward the site access road and property boundary. Sediment deposition in the diversion channel eventually would impair the function of the channel and potentially lead to erosion of the tailings impoundment. Consequently, the channel slope was restored to its original design configuration and two runoff control structures were constructed to reduce erosion and sedimentation (PL–6); construction was completed in January 2010.

3C

The south 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 to inhibit erosion along natural drainage paths (PL–2). Minor erosion is occurring on the unprotected slope surfaces but is not degrading the function of the channel or affecting the integrity of the tailings impoundment.

Site Perimeter, Outlying Areas, and Balance of the Site—Open private land, used primarily for grazing, surrounds the site. The original grazing license between DOE and the Land Grant allowed grazing on DOE property outside the former mill site chain-link fence. The area accessible to grazing increased with the removal of that fence; consequently, the license was amended in 2007 to allow grazing on DOE property outside the barbed-wire fence.

Due to vandalism and trespassing issues at the site, a local contractor has been retained to check site security periodically, remove trespassing livestock, and repair fences. 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.

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 (PL–7). This location will continue to be monitored for seepage and recommended for sampling if seep water is present.

A monitoring well access road had washed out since the last inspection. The damaged portion was graded and water bars were installed to divert runoff away from the road.

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 secure.

3.3.2 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 follow-up inspections were required in 2010.

3.3.3 Routine Maintenance and Emergency Measures

Maintenance activities in 2010 included completion of runoff control structures, repairing a washed-out section of a monitoring well access road, replacing a stolen access gate, and treating infestations of the noxious shrub tamarisk with herbicide.

Emergency measures are corrective actions that DOE will take in response to unusual damage or disruption that threaten or compromise site health and safety, security, integrity, or compliance with 40 CFR 192. No emergency measures were required in 2010.

3.3.4 Environmental Monitoring

3.3.4.1 Groundwater Monitoring

Groundwater monitoring is required at the L-Bar site. The monitoring network consists of ten
3D DOE wells on or adjacent to the site, and two Moquino Water Users Association wells approximately 2 miles west of the site in the village of Moquino. Table 3–2 lists the wells that are in the monitoring network. Samples are analyzed for chloride, nitrate (nitrate + nitrite as nitrogen), selenium, sulfate, total dissolved solids, and uranium. Analytical results will be compared to the alternate concentration limits (ACLs) and alternate abatement standards (AASs) provided in Table 3–3.

Table 3–2. Groundwater Monitoring Network for the L-Bar, New Mexico, Disposal Site

Monitoring Well	Network Application
MW–1A	POC source zone well
MW–17B	POC source zone well
MW–29A	Background well
MW–61	Seepage indicator well
MW–62	Seepage affected area indicator well
MW–63	POE seepage indicator well
MW–69	POC source zone well
MW–72	POE well on east property boundary
MW–81	POC source zone well
MW–100	POE well on west property boundary
Moquino Well (new)	Water users supply well in Moquino
Moquino Well (old)	Backup supply well in Moquino

Key: POC = point-of-compliance; POE = point-of-exposure

Table 3–3. Groundwater Alternate Concentration Limits and Alternate Abatement Standards for the L-Bar, New Mexico, Disposal Site

Analyte	New Mexico Standard	ACL (MW–1A, 17B, 69, 81)	AAS Source Zone (MW–1A, 17B, 69, 81)	AAS Affected Area (MW–62)
Chloride (mg/L)	250	N/A	1,127	N/A
Nitrate (mg/L)	10.0	N/A	1,180	N/A
Selenium (mg/L)	0.05	2.0	2.0	N/A
Sulfate (mg/L)	4,000[a]	N/A	13,110	5,185
TDS (mg/L)	5,880[a]	N/A	20,165	7,846
Uranium (mg/L)	5.0	13.0	13.0	N/A

[a]Background value.
Key: AAS = alternate abatement standard; ACL = alternate concentration limit; mg/L = milligrams per liter; N/A = not applicable; TDS = total dissolved solids

If an ACL or AAS is exceeded in the specified well (Table 3–3), DOE will inform NRC of the exceedance and conduct confirmatory sampling. If confirmatory sampling verifies the exceedance, DOE will develop an evaluative monitoring work plan and submit that plan to NRC for review prior to initiating the evaluative monitoring program. Results of the evaluative monitoring program will be used, in consultation with NRC, to determine if corrective action is necessary.

As stipulated in the LTSP, the requirements for annual groundwater monitoring were met in 2007. Consequently, sampling will occur every 3 years beginning in fall 2010 in accordance with the LTSP. Groundwater monitoring will continue as long as a New Mexico Standard (Table 3–3) is exceeded in any well. At least one New Mexico standard was exceeded in six of the DOE wells during the most recent sampling event in 2007.

3.3.4.2 Erosion Monitoring Program

As required by the LTSP, an erosion monitoring program (EMP) was developed to address
3E potential erosion of the tailings impoundment cover over time. SOHIO Western Mining Company developed the plan at the request of the New Mexico Water Quality Control Commission as a condition for granting AASs for groundwater at the L-Bar 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 ranges from 6 to 10 feet. The cover, completed in 2000, was not seeded, so revegetation is occurring naturally with locally occurring annual and perennial plant species. Vegetation is expected to help mitigate wind and water erosion.

The EMP consists of two parts: (1) measuring erosion and (2) measuring the progress of revegetation. Measurements were made during the annual site inspection on August 25, 2010.

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 measured in December 2003 to establish a baseline data set.

Each monitoring point consists of a reinforcing bar (rebar) surrounded by three metal t-posts that were installed to help locate the rebar and provide orientation for the measurements. A 5-foot-long piece of half-inch-diameter epoxy-coated 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. As an additional identification aid, the t-posts have been sprayed with orange anti-rust enamel paint.

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 easternmost t-post (PL–8). 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, in accordance with 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 2010 measurements are presented in Table 3–4. Baseline measurements are included for comparison. As indicated in Table 3–4, the surface elevation has remained the same at one location and increased at all of the other monitoring points when compared to the baseline measurements. These results indicate that the surface of the disposal cell is accreting instead of eroding. The amount of vegetation on the cover has increased substantially since 2003, which may be raising the surface elevation through root growth, the accumulation of organic materials in the surface soil, or the trapping of windblown sediment derived from locations upwind of the tailings impoundment.

Table 3–4. Erosion Monitoring Measurements on the L-Bar, New Mexico, Tailings Impoundment Cover

Monitoring Point	Length of Rebar Above Surface (inches)				Change in Surface Elevation[a] Baseline to Present (decimal inches)
	2003 (Baseline)		2010		
	(fraction)	(decimal)	(fraction)	(decimal)	
A1	12 10/16	12.625	10 12/16	10.750	1.875
A2	12 7/16	12.438	12 2/16	12.125	0.313
A3	12 15/16	12.938	11 10/16	11.625	1.313
A4	12 6/16	12.375	11 7/16	11.438	0.937
B1	12 10/16	12.625	11 7/16	11.438	1.187
B2	12 8/16	12.500	12 1/16	12.063	0.437
B3	13 0/16	13.000	12 6/16	12.375	0.625
B4	12 15/16	12.938	11 14/16	11.875	1.063
C1	12 8/16	12.500	11 4/16	11.250	1.250
C2	13 1/16	13.063	13 0/16	13.000	0.063
C3	12 2/16	12.125	11 7/16	11.438	0.687
C4	12 6/16	12.375	11 15/16	11.938	0.437
D1	12 7/16	12.438	11 9/16	11.563	0.875
D2	12 12/16	12.750	12 6/16	12.375	0.375
D3	12 3/16	12.188	11 3/16	11.188	1.000
D4	12 12/16	12.750	12 12/16	12.750	0.000
E1	13 1/16	13.063	12 2/16	12.125	0.938
E2	12 14/16	12.875	12 1/16	12.063	0.812
E3	12 9/16	12.563	11 6/16	11.375	1.188
E4	12 15/16	12.938	11 15/16	11.938	1.000

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

Vegetation Monitoring—Ten vegetation monitoring locations were established in accordance with the EMP. Plots were established at erosion monitoring points A1, A3, B2, B4, C1, C3, D2, D4, E1, and E3. At each location, the three t-posts were used to form three corners of the plot; the fourth point was projected south of the easternmost t-post to form a parallelogram covering approximately 100 square feet.

The primary requirement is to measure the percentage of the foliar cover (canopy) of all live vegetation (annual and perennial plants together) within the plot. Percent foliar cover represents the approximate total area under the maximum circumference of each of the live plants within the plot.

The average foliar cover of live vegetation in the vicinity of the L-Bar site, according to the U.S. Department of Agriculture, 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, 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 because their germination depends heavily on weather conditions, it is assumed that this criterion is based on perennial foliar cover. If a significant reduction in plant density is noted during an annual site inspection, then the plots will be measured again. If the plant coverage is less than 20 percent, annual vegetation monitoring will be reinstated until the termination criterion has again been satisfied.

Vegetation types, percentage of foliar cover, litter (organic detritus often consisting of dead annual plants), rock, and bare ground were recorded at each monitoring location. Annual or biennial plant species noted at the plots included kochia, Russian thistle, annual sunflower, and curly-cup gumweed. Perennial plant species included Nelson's globemallow, silverleaf nightshade, bottlebrush squirreltail, sand dropseed, galleta grass, Indian ricegrass, broom snakeweed, rubber rabbitbrush, and four-wing saltbush.

Table 3–5 compares perennial plant foliar cover between 2005 and 2010. Only three of the ten vegetation monitoring plots had 20 percent or greater foliar cover in 2005, and three had 20 percent or greater in 2010 as well. Overall, perennial plant foliar cover has increased in eight of the ten plots from 2005 to 2010. Most of the plots containing little or no perennial vegetation are in areas that seasonally become ponded. Monitoring will continue until at least six (more than half) of the plots meet or exceed the 20 percent foliar cover requirement based on perennial plant measurements.

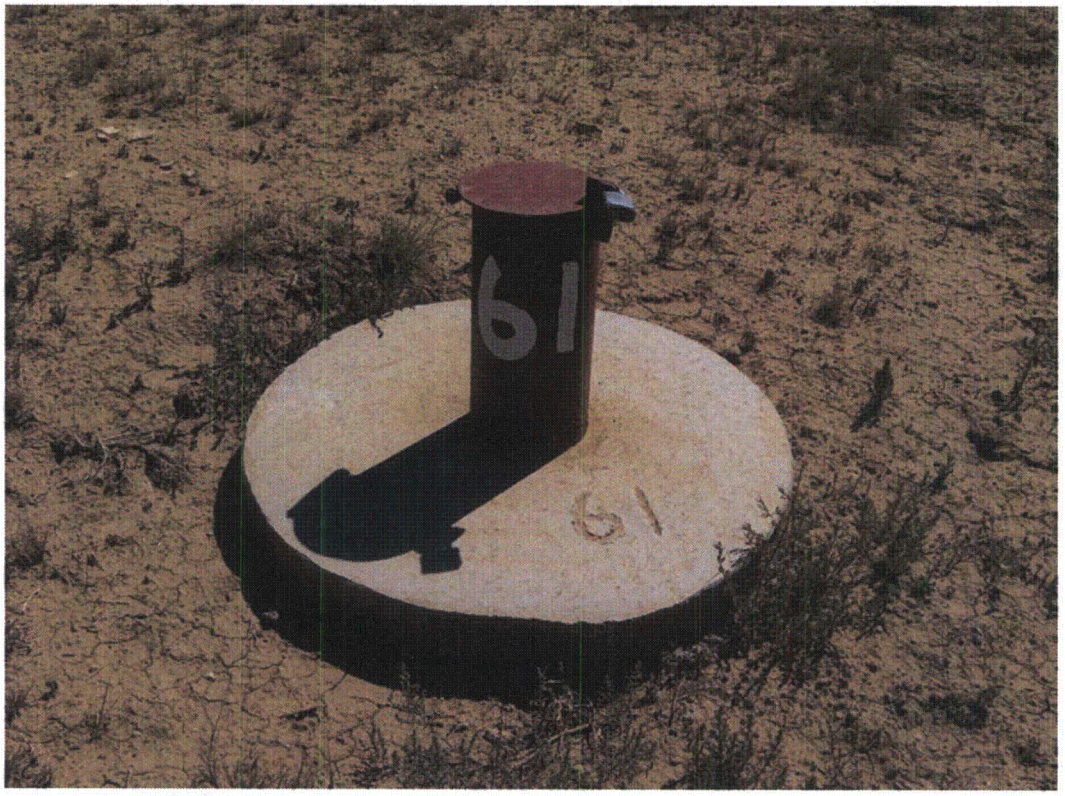
Table 3–5. Comparison of Perennial Plant Cover on the L-Bar, New Mexico, Tailings Impoundment Cover Between 2005 and 2010

Plot Location	Percent Perennial Plant Cover in 100-ft^2 Plots	
	2005	2010
A1	57	68
A3	11	12
B2	0	0
B4	20	38
C1	22	25
C3	0	3
D2	2	12
D4	0	0
E1	2	17
E3	8	14

Key: ft^2 = square foot

3.3.5 Photographs

Photograph Location Number	Azimuth	Description
PL–1	220	Monitoring well MW–61 with new concrete collar.
PL–2	155	Vegetation on the impoundment cover; rock-armored drainages along the south channel in the background.
PL–3	70	Spillway on the containment dam.
PL–4	320	Sediment trap.
PL–5	210	Gabion drop structures in the southeast drainage area.
PL–6	0	Gabion spillway of the east runoff control structure along the north diversion channel.
PL–7	180	Tres Hermanos outcrop area; no seeps present.
PL–8	270	Erosion monitoring point and vegetation plot E1.

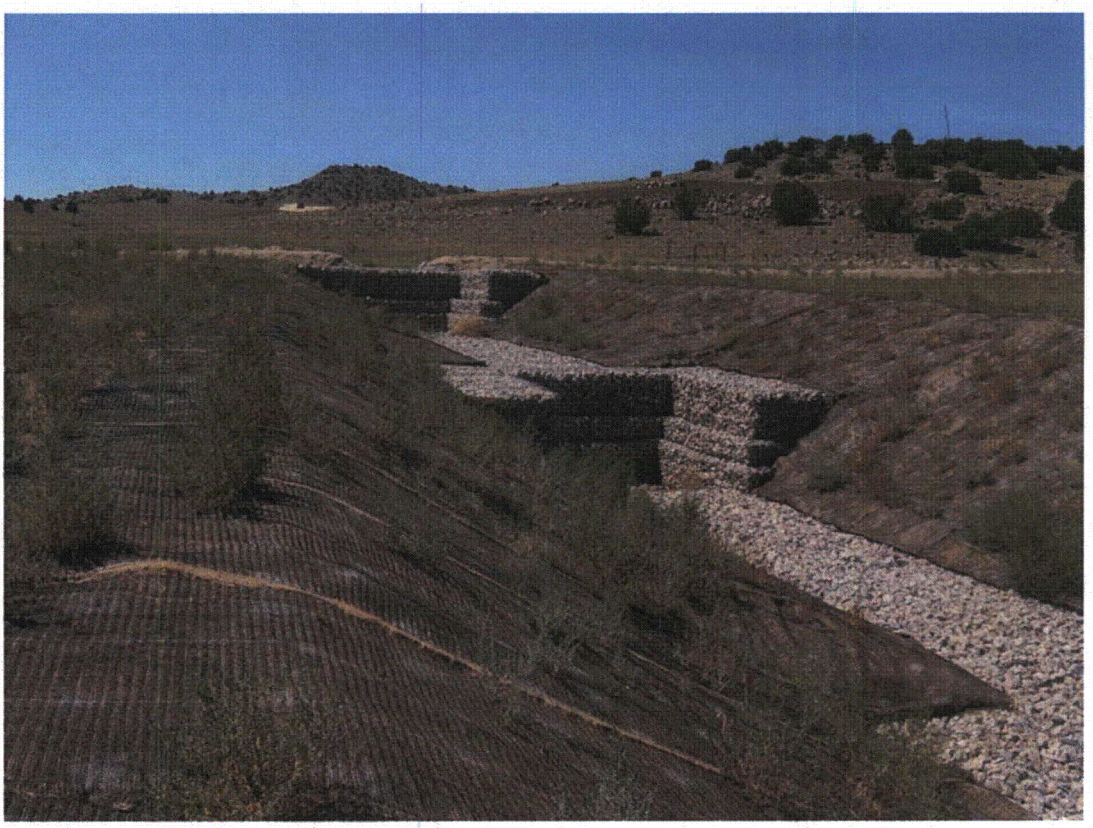


BAR 8/2010. PL–1. Monitoring well MW–61 with new concrete collar.

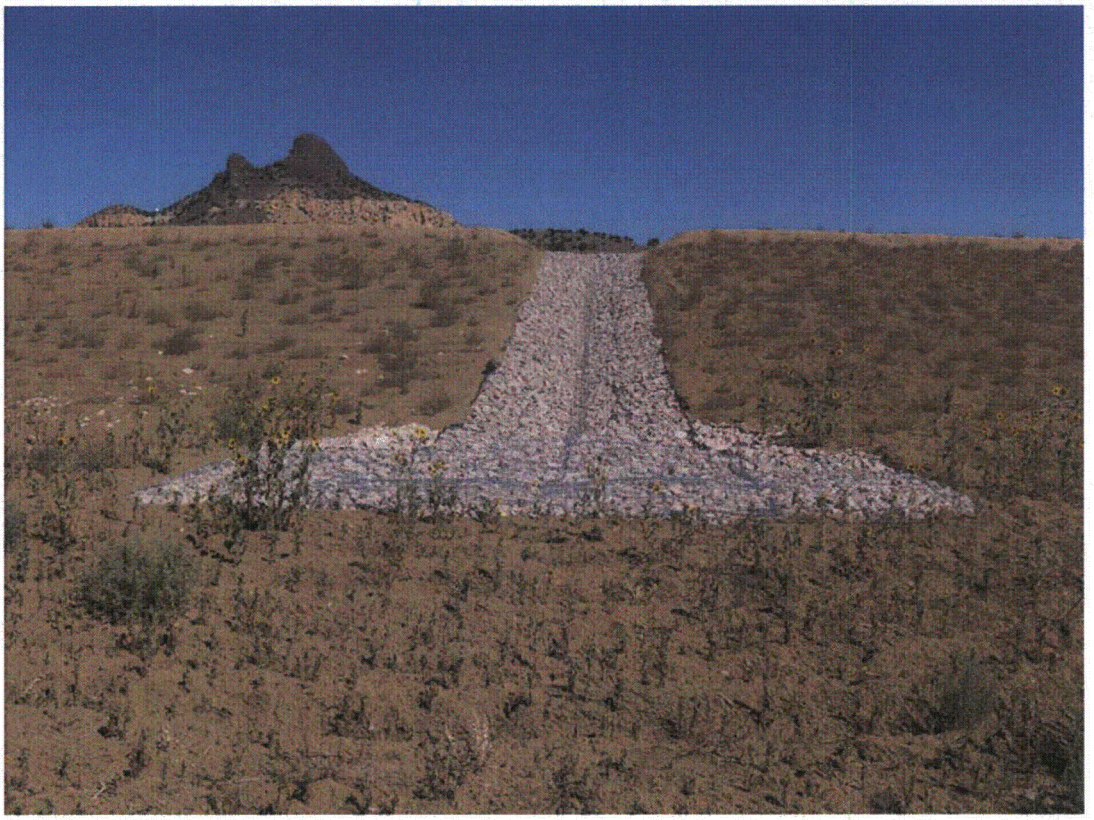
BAR 8/2010. PL–2. Vegetation on the impoundment cover; rock-armored drainages along the south channel in the background.

BAR 8/2010. PL–3. Spillway on the containment dam.

BAR 8/2010. PL–4. Sediment trap.



BAR 8/2010. PL–5. Gabion drop structures in the southeast drainage area.



BAR 8/2010. PL–6. Gabion spillway of the east runoff control structure along the north diversion channel.

BAR 8/2010. PL–7. Tres Hermanos outcrop area; no seeps present.

BAR 8/2010. PL–8. Erosion monitoring point and vegetation plot E1.

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4.0 Maybell West, Colorado, Disposal Site

4.1 Compliance Summary

The Maybell West, Colorado, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title II
4A disposal site was transitioned to the federal government for custody and long-term care in March 2010. The first annual inspection was conducted on August 18, 2010. The disposal cell, ancillary cell, and all associated surface water diversion and drainage structures were in good condition and functioning as designed. A shallow depression is present on the top of the disposal cell but does not threaten the integrity of the cell; the depression will be visually monitored to determine if settlement is occurring. Two perimeter warning signs were missing and will be replaced, and loose strands of the perimeter fence will be repaired. Deep-rooted plants growing on the disposal cell were cut and treated with herbicide. No cause for a follow-up inspection was identified.

4.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the Maybell West site are specified in the *Long-Term Surveillance Plan for the Maybell West (UMTRCA Title II) Disposal Site, Moffat County, Colorado,* (LMS/MAW/S01879, U.S. Department of Energy [DOE] Office of Legacy Management, February 2010) and procedures established by DOE to comply with the requirements of Title 10 *Code of Federal Regulations* Part 40.28 (10 CFR 40.28). Table 4–1 lists license requirements for this site.

Table 4–1. License Requirements for the Maybell West, Colorado, Disposal Site

Requirement	Long-Term Surveillance Plan	This Report
Annual Inspection and Report	Sections 3.3 and 3.4	Section 4.3.1
Follow-up Inspections	Section 3.5	Section 4.3.2
Routine Maintenance and Emergency Measures	Section 3.6	Section 4.3.3
Environmental Monitoring	Section 3.7	Section 4.3.4

Institutional Controls—The 180-acre site is owned by the United States of America and was accepted under the U.S. Nuclear Regulatory Commission general license (10 CFR 40.28) in 2010. 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, as defined by DOE Policy 454.1, consist of federal ownership of the property, a site perimeter fence, and a locked gate at the site entrance. Verification of these institutional controls is part of the annual inspection.

4.3 Compliance Review

4.3.1 Annual Inspection and Report

The site, located approximately 4 miles north-northeast of the town of Maybell in Moffat County in northwestern Colorado, was inspected on August 18, 2010. Results of the inspection are described below. Features and photograph locations (PLs) mentioned in this report are shown on Figure 4–1. Numbers in the left margin of this report refer to items summarized in the "Executive Summary" table (Table ES–1).

4.3.1.1 Specific Site Surveillance Features

Access Road—Access to the site is provided via County Road 53 that runs north off U.S. Highway 40 approximately 8 miles east of Maybell, Colorado. The county road is graveled, hard packed, and in good condition. County Road 53 ends at an unlocked gate near the northeast corner of the Maybell UMTRCA Title I disposal site (approximately 3 miles from U.S. Highway 40). From that point the access road continues west as a dirt two-track on U.S. Bureau of Land Management (BLM) property and through a second unlocked gate. Just past the second gate the access road turns south and continues past an abandoned open pit mine known as the Rob Pit for approximately 0.5 mile where it meets a former haul road. The access road continues north on the former haul road for approximately 0.25 mile to the Maybell West UMTRCA Title II disposal site. The access road to the site was in good condition.

Because the portion of the access road to the Maybell UMTRCA Title I disposal site is a county road, maintenance up to that point is performed by Moffat County. Beyond that point (identified by an "End of County Road" sign, which was lying on the ground), DOE is responsible for maintenance of the access road under a BLM right-of-way permit.

Fence and Entrance Gate—A standard four-strand barbed-wire stock fence surrounds the disposal cell, the ancillary cell, and the drainage structures. The site is located in wintering grounds frequented by big game animals (primarily antelope, deer, and elk) and is also surrounded by open range land used for grazing by cattle. Consequently, periodic damage to the perimeter fence is expected. Overall, the fence was in good condition; however, the top strand of the perimeter fence was loose at a few locations and a post needs to be reset.

The entrance gate, a standard tubular metal stock gate, is located near the southeast corner of the site. The gate was locked and in good condition (PL–1). There are no other gates at the site.

Entrance and Perimeter Signs—The entrance sign, mounted on a perimeter fence metal t-post directly south of the entrance gate, was in good condition.

Ten perimeter signs are mounted on perimeter fence metal t-posts around the site. Two signs—P10 at the southeast corner and P8 at the southwest corner of the site—were missing at the time of the inspection. These signs will be replaced during the next inspection. The other perimeter signs were in good condition.

Site Marker—One standard granite site marker is located on the site just south of the entrance gate (PL–2). The site marker was in good condition.

Boundary Monuments—Eight surveyed boundary monuments are located on site. Four of the monuments are at the property corners, and the others define a slight offset that occurs along both the north and south boundaries where the fee land adjoins the BLM withdrawal area on the western portion of the site. All boundary monuments encountered during the inspection were in good condition.

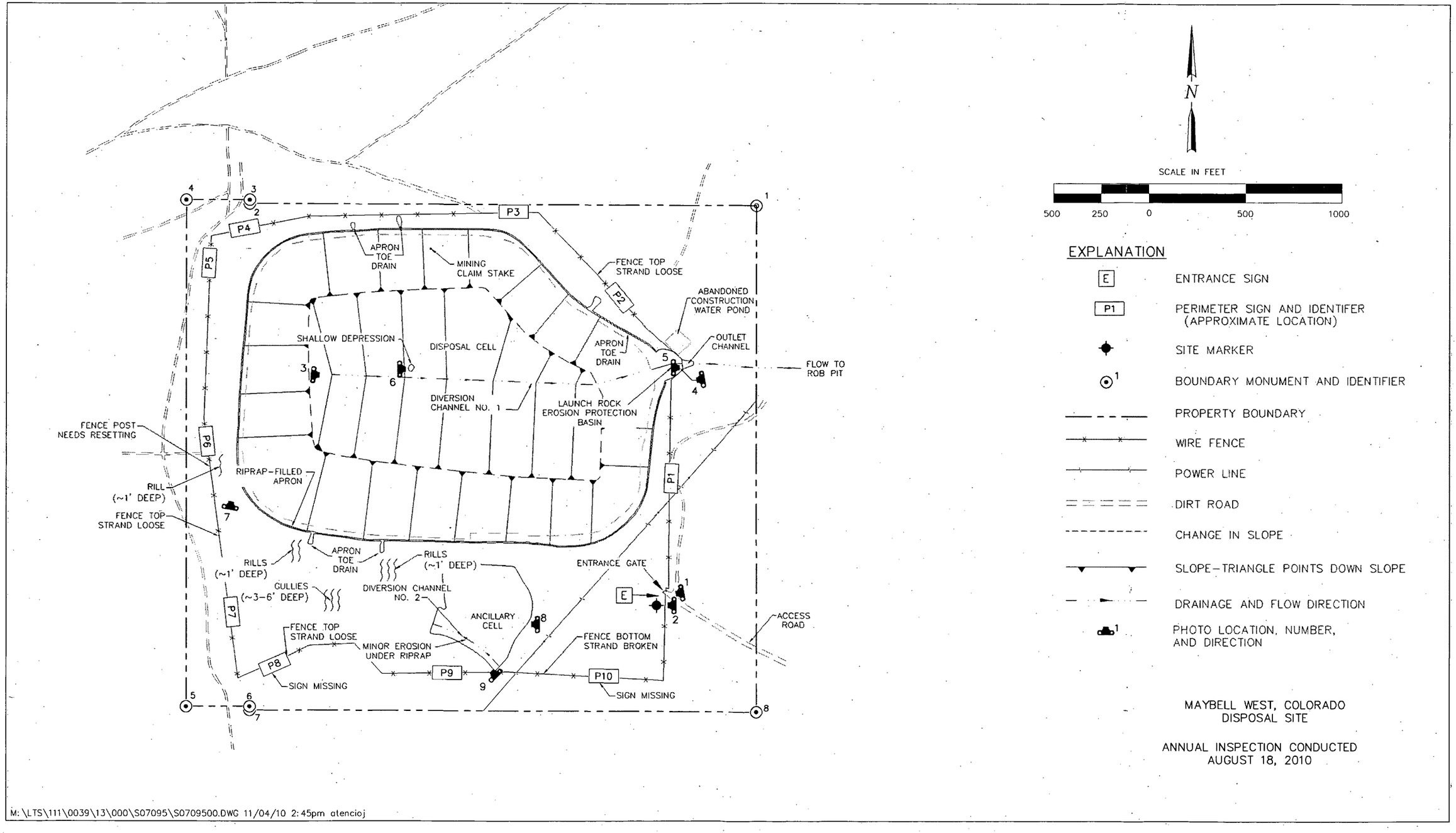

Figure 4–1. 2010 Annual Compliance Drawing for the Maybell West, Colorado, Disposal Site

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4.3.1.2 Transects

In accordance with the Long-Term Surveillance Plan (LTSP), the site is divided into five transects to ensure a thorough and efficient inspection: (1) the top slope of the disposal cell; (2) the side slopes of the disposal cell; (3) the ancillary cell; (4) the diversion/drainage channels; and (5) the site perimeter and balance of the site.

Within each transect, inspectors examined specific site surveillance features, such as signs and boundary monuments. Each transect was inspected for evidence of erosion, settling, slumping, or other disturbance that might affect site integrity or the long-term performance of the cells.

Top Slope of Disposal Cell—The disposal cell, a reclaimed former heap leach area that occupies about 60 acres of the site, was in good condition. It rises to a maximum height of approximately 75 feet (ft) above the surrounding landscape and is capped with an approximate 7-ft-thick multiple-component cover. The cover consists of a 1.5-ft-thick radon/infiltration barrier, a 4-ft-thick compacted soil layer for protection from freeze-thaw cycles, a 0.5-ft-thick bedding layer to promote drainage, and a 1-ft-thick layer of riprap to prevent erosion of the underlying materials.

The top slope of the cell was designed to drain surface water runoff to the center and into riprap-armored Diversion Channel No. 1, which is graded toward and then down the east side slope of the cell (PL–3). Surface water runoff ultimately discharges into a former open pit uranium mine (known as the Rob Pit) located directly east of the site. An erosion protection structure, referred to as the launch rock basin, was constructed at the outfall of Diversion Channel No. 1 to protect the disposal cell from any head-cutting that may occur from the deep channel that runs into Rob Pit (PL–4 and PL–5).

No evidence of slumping, erosion, or rock degradation was observed. A small shallow depression, however, is present just north of Diversion Channel No. 1 (PL–6). This depression, approximately 15 ft in diameter and 1 ft deep in the center, appears to be the result of settlement of the underlying materials since completion of the cell. Continued visual monitoring of this area will be performed during annual inspections to determine if settlement of the disposal cell is continuing. The depression currently does not threaten the integrity of the cell.

4B Some shallow-rooted grasses and weeds, along with a few deep-rooted woody plants, were on the cell top. The deep-rooted plants were cut and treated with herbicide.

Side Slopes of Disposal Cell—The side slopes of the disposal cell, constructed with a 20 percent slope grade and covered with a 1-ft-thick layer of riprap, were in good condition (PL–7). Deep-rooted plants present on the side slopes at the time of the inspection were cut and treated with herbicide at a later date.

Surface water runoff from the side slopes of the disposal cell is conveyed by an apron at the toe of the cell to several appropriately spaced toe drains that lie perpendicular to, and slope away from, the apron. The apron and toe drains are constructed channels with a minimum depth of 2 ft and filled with riprap that has a minimum 12-inch-diameter rock size. The disposal cell was designed to control surface water runoff resulting from the probable maximum flood event. The upgradient catchment area for the site is less than 40 acres, and no major surface water drainages are adjacent to the encapsulated waste materials.

A mining claim stake found on north side slope of the disposal cell is considered a "nuisance" claim; regulatory protections from surface or subsurface activities are provided under the NRC general license at 10 CFR 40.28. The portion of the site where the claim stake was found is part of the permanent withdrawal issued by BLM.

Ancillary Cell—The ancillary cell was in good condition (PL–8). It was constructed to contain all waste materials associated with the reclaimed evaporation pond area. An existing heap drainage storage pond that was constructed below grade and adjacent to the heap leach repository was used as the footprint for this cell. At the close of reclamation activities for the main disposal cell, the synthetic pond liner material, evaporation pond material, and other contaminated debris remaining on the site were compacted in the ancillary cell. The ancillary cell was then covered with a minimum of 5.5 ft of cover material, including radon barrier clay, random fill, and riprap for erosion protection. The ancillary cell slopes gently toward the southwest. A rock berm wraps around the eastern and northern sides of the ancillary cell to provide protection from surface water runoff. Diversion Channel No. 2 runs along the south side of the ancillary cell to convey surface water runoff away from the cell (PL–9).

Various types of shallow-rooted plants were present on the cell top. Deep-rooted plants that are found on the ancillary cell will be cut and treated with herbicide.

Diversion/Drainage Channels—Final surface conditions at the site are a combination of rock armoring and contouring to achieve the necessary surface water drainage control and erosion protection necessary to satisfy the design longevity requirements. The diversion channels and outlet channel of the launch rock basin were in good condition.

The rock berm that runs along the northern edge of the ancillary cell continues west across the slope directly south of the main disposal cell to provide protection against erosion. Several gullies and rills have developed along this slope but do not threaten the integrity of the disposal cell; however, they will continue to be monitored and repaired as needed. This erosion is expected to stabilize over time as site revegetation improves. The rock berm appears to be effective at controlling head-cutting from these gullies and providing protection to the cell.

Site Perimeter and Balance of Site—The balance of the site and the site perimeter were in good condition. Revegetated surfaces at the site have been planted with a mix of native and adaptive grasses to provide soil stability. Site revegetation is progressing; noxious weeds found onsite will be controlled.

The area outside the site boundary for 0.25 mile was visually inspected. There was no evidence of development, change in land use, or other activities that might affect the long-term performance or stability of the site.

4.3.2 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 follow-up inspections were required in 2010.

4.3.3 Routine Maintenance and Emergency Measures

Noxious weeds and deep-rooted shrubs on the disposal cell were treated with herbicide in 2010.

Emergency measures are corrective actions that DOE will take in response to unusual damage or disruption that threaten or compromise site health and safety, security, integrity, or compliance with 40 CFR 192. No emergency measures were required in 2010.

4.3.4 Environmental Monitoring

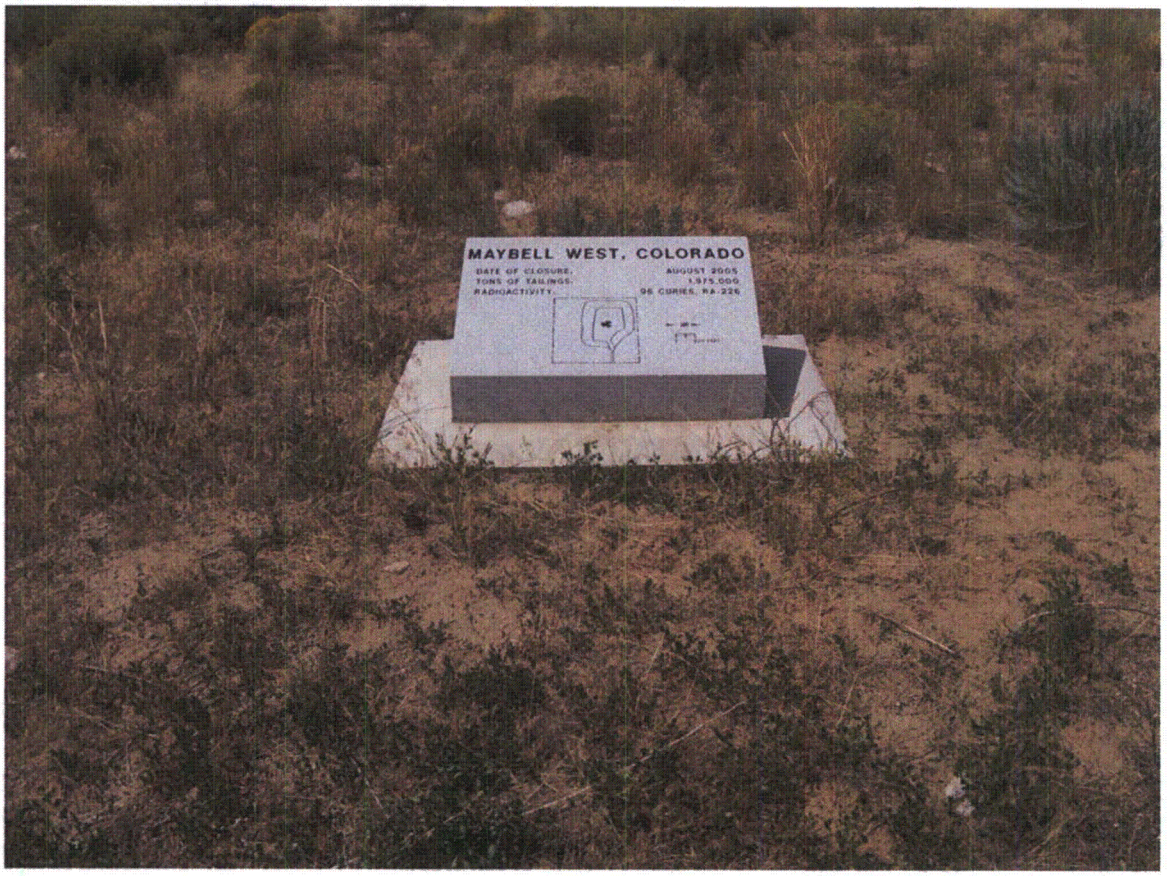
Groundwater monitoring is not required at the site because 30 years of historical monitoring performed at the site by the former licensee indicated that groundwater has not been contaminated by site-related activities.

During each site inspection, DOE will monitor land use in the area surrounding the site to ensure that changes in land or water use do not affect site protectiveness. For example, a resurgence of interest in uranium mining and processing or oil and gas exploration could lead to increased activity in the vicinity of the site and an increased potential for site disturbance. There was no evidence of such activities that might affect the long-term performance or stability of the site.

4.3.5 Photographs

Photograph Location Number	Azimuth	Description
PL–1	260	Site entrance gate and site marker.
PL–2	270	Site marker.
PL–3	95	Diversion Channel No. 1 on the disposal cell top.
PL–4	260	Launch rock basin at the base of Diversion Channel No. 1.
PL–5	90	Discharge point of the launch rock basin; Rob Pit in background.
PL–6	90	Shallow depression on the disposal cell top.
PL–7	10	West side slope of the disposal cell.
PL–8	270	Central portion of the ancillary cell.
PL–9	315	Downgradient view of Diversion Channel No. 2.

MAW 8/2010. PL–1. Site entrance gate and site marker.



MAW 8/2010. PL–2. Site marker.

MAW 8/2010. PL–3. Diversion Channel No. 1 on the disposal cell top.

MAW 8/2010. PL–4. Launch rock basin at the base of Diversion Channel No. 1.

MAW 8/2010. PL–5. Discharge point of the launch rock basin; Rob Pit in background.

MAW 8/2010. PL–6. Shallow depression on the disposal cell top.

MAW 8/2010. PL–7. West side slope of the disposal cell.

MAW 8/2010. PL–8. Central portion of the ancillary cell.

MAW 8/2010. PL–9. Downgradient view of Diversion Channel No. 2.

5.0 Sherwood, Washington, Disposal Site

5.1 Compliance Summary

The Sherwood, Washington, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title II disposal site was inspected on July 20, 2010. The tailings impoundment, dam, and diversion channel were in good condition. The dam inspection and associated piezometer water level measurements verified that the tailings embankment is functioning as designed. Groundwater monitoring, performed as a best management practice, verified that constituent concentrations continue to be significantly less than State of Washington water quality criteria. No cause for a follow-up inspection was identified.

5.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the Sherwood site are specified in the *Long-Term Surveillance Plan for the DOE Sherwood Project (UMTRCA Title II) Reclamation Cell, Wellpinit, Washington* (U.S. Department of Energy [DOE], Grand Junction, Colorado, February 2001) and in procedures established by DOE to comply with requirements of Title 10 *Code of Federal Regulations* Part 40.28 (10 CFR 40.28). Table 5–1 lists license requirements for this site.

Table 5–1. License Requirements for the Sherwood, Washington, Disposal Site

Requirement	Long-Term Surveillance Plan	This Report
Annual Inspection and Report	Sections 3.3 and 3.4	Section 5.3.1
Follow-up Inspections	Section 3.5	Section 5.3.2
Routine Maintenance and Emergency Measures	Section 3.6	Section 5.3.3
Environmental Monitoring	Section 3.7	Section 5.3.4

Institutional Controls—The United States of America, in trust for the Spokane Tribe of Indians, owns the 380-acre site. The site was accepted under the U.S. Nuclear Regulatory Commission (NRC) general license (10 CFR 40.28) in 2001. Because the site is on the Spokane Indian Reservation, no agreement of transfer was necessary for conveying the property rights to DOE. However, an agreement for permanent right-of-access and long-term surveillance and maintenance, which lets DOE fulfill its custodial responsibilities required for UMTRCA Title II sites, was executed between the tribe and DOE. The agreement does not prohibit the future use of the site for activities related to uranium mining and milling.

Institutional controls at the site, as defined by DOE Policy 454.1, consist of federal ownership of the property and warning/no-trespassing signs placed along the property boundary. Verification of these institutional controls is part of the annual inspection.

5.3 Compliance Review

5.3.1 Annual Inspection and Report

The site, located near Wellpinit, Washington, was inspected on July 20, 2010. Features and photograph locations (PLs) mentioned in this report are shown on Figure 5–1. Results of the inspection are described below. Numbers in the left margin of this report refer to items summarized in the "Executive Summary" table (Table ES–1).

5.3.1.1 Specific Site Surveillance Features

Access, Gates, and Signs—The site and adjacent lands are part of the Spokane Indian Reservation. The U.S. Bureau of Indian Affairs (BIA) maintains Elijah Road, the all-weather site road over which DOE has permanent right-of-access. Two double-swing steel gates across the road control access to the disposal site and the nearby Sherwood mine area and tribe-owned facilities. Because of trespassing and vandalism concerns, BIA installed new locks and plans to keep the gates locked. DOE locks were added to the gates at the time of the inspection.

Six perimeter or warning signs, designated P1 through P6, are located at likely access points around the site. The signs are attached at a height of about 5 feet above ground to steel posts set in concrete. Perimeter sign P2, located in a remote area near the southeast corner of the site, was
5A missing; logging operations had occurred in that area. Perimeter sign P6, heavily damaged with numerous bullet holes, was replaced during the inspection (PL–1).

Site Marker and Boundary Monuments—One inscribed granite site marker is present on the southwest side of the site where the access road lies closest to the site boundary (PL–2). The marker was in excellent condition.

Six boundary monuments, designated BM–1, BM–2, BM–3, BM–3A, BM–4, and BM–5, define the site boundary. Boundary monument BM–3A is bent but does not need to be repaired. Because surrounding vegetation had made it difficult to locate some of the monuments, metal t-posts have been installed at each monument location.

Monitoring Wells—Three monitoring wells are located on the site and are designated MW–2B, MW–4, and MW–10. The wells were secure and in good condition.

Four piezometers, designated PZ–1 through PZ–4, were installed in November 2000 along the crest of the tailings dam to a depth equivalent to the base of the dam, as part of the dam safety inspection program. All piezometers were secure and in good condition (PL–3).

5.3.1.2 Transects

In accordance with the Long-Term Surveillance Plan (LTSP), the site is divided into three transects to ensure a thorough and efficient inspection: (1) the cover of the tailings impoundment; (2) the diversion channel and impoundment dam face; and (3) the area between the diversion channel and site boundary, and the outlying area.

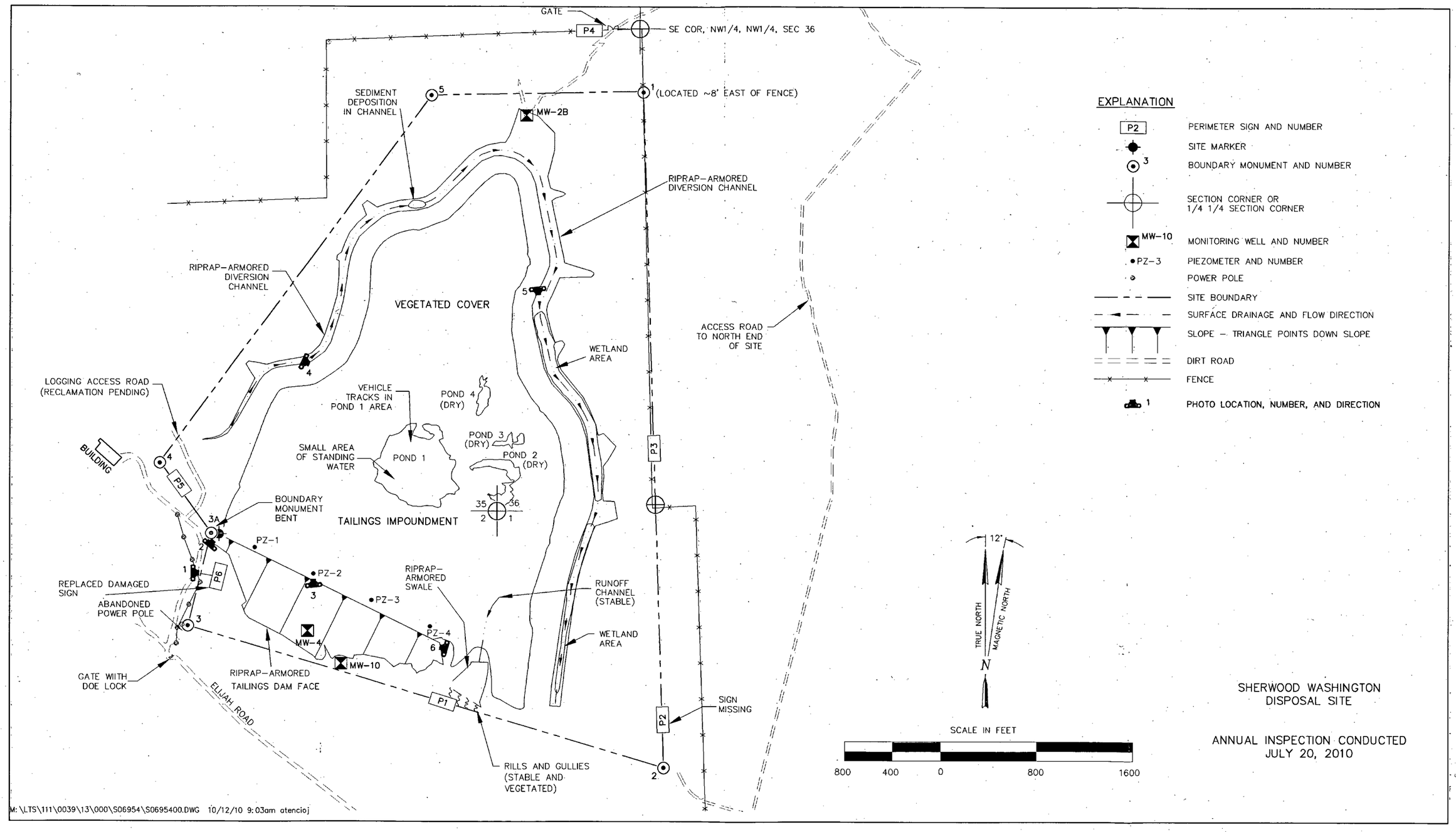


Figure 5–1. 2010 Annual Compliance Drawing for the Sherwood, Washington, Disposal Site

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Within each transect, inspectors examined specific site surveillance features, such as monitoring wells, boundary monuments, and signs. Inspectors examined each transect for evidence of erosion, settling, slumping, or other disturbances that might affect the site's integrity or long-term performance.

Tailings Impoundment Cover—The cover of the 100-acre tailings impoundment, completed in 1996, consists of 12 to 20 feet of uncompacted soils. During site reclamation, surface soils were seeded and planted with native shrubs, forbs, grasses, and trees. A healthy vegetative cover is needed to provide erosion protection and evapotranspiration of the cover in order to limit infiltration of meteoric water into the impoundment. Reclamation has been successful, as a healthy stand of vegetation has established on the impoundment cover and surrounding features.

A small, shallow channel developed by runoff from the cell top is present near the southeast corner of the cell. The channel discharges into a riprap-armored swale east of the tailings dam. The channel is not over an area containing tailings and is stable (it has scoured down to quartz monzonite bedrock).

Designers of the cell predicted that some settlement would continue after the uncompacted cover was put in place, and that the settlement would be self-healing with regard to impacts from freezing and thawing, biointrusion, and settlement (LTSP, page 2-14). The largest area of settlement is referred to as Pond 1. Some standing water was present in Pond 1 at the time of the inspection, and the plant species present indicate that there is year-round moisture below the surface of the pond area. Other minor depressions, designated as Ponds 2, 3, and 4, did not contain standing water. The shallow ponds are considered to be favorable features on the impoundment cover, but DOE will continue to monitor the surface for unusual settlement features, such as sinkholes or differential displacement, to verify the cover's integrity and ensure that the impoundment is performing as designed.

Vegetation in the area of Pond 1 is composed primarily of native wetland species; the other pond areas contain primarily riparian vegetation. The ponds provide habitat for small mammals, birds, amphibians, and reptiles and provide an important water source for larger mammals such as wild horses, deer, elk, bears, coyotes, and buffalo. Horses and buffalo were present on the tailings impoundment at the time of the inspection (PL–4).

Trespassing continues to occur on the disposal cell. Recent tire ruts were observed in and around Pond 1, and were attributed to an activity called "mud bogging." Trespassing activities may be reduced by keeping the gates on Elijah Road locked.

Diversion Channel and Impoundment Dam Face—Inspectors observed the length of the riprap-armored diversion channel. The condition of the riprap cover was good. Volunteer plant intrusion within the diversion channel, including trees, is evident in most areas of the channel. The channel was designed to allow trees to grow and stabilize the surfaces, and their presence in the channel is not expected to hinder the channel's ability to convey designed flows. Sediment deposition is evident in places on the west side of the diversion channel but does not interfere with the channel's design function; upslope areas that have contributed to the sedimentation have stabilized with vegetation. Two permanent wetland areas have formed along the bottom of the east side of the channel due to seeps that are present in those areas (PL–5). They provide habitat for a variety of small mammals and birds.

5B The tailings embankment on this site is classified as a dam because of the saturated condition of the impoundment, so an annual dam safety inspection is required (by the LTSP) to ensure continued compliance with the Federal Dam Safety Act. The tailings dam face was inspected in accordance with the Dam Inspection Checklist included at the end of the chapter. No evidence of seepage, slumping, erosion, or instability was observed. The rock cover, consisting primarily of highly durable quartz monzonite, was in excellent condition.

Water level measurements in the four piezometers were taken at the time of the annual groundwater sampling on July 14, 2010. These annual measurements, collected since the piezometers were installed in 2000, provide a direct means of determining moisture conditions in the dam. Significant increases would trigger an investigation of the performance of the dam. Piezometers PZ–1 and PZ–3 continue to be dry. PZ–2, normally containing 1 to 3 feet of water, had 2.28 feet of water in 2010. The minor amount of water in PZ–2 is the result of a small, perched lens of water that exists because of localized differences in permeability. The lateral extent of the lens is unknown, but there is more than 200 feet of unsaturated material beneath the perched zone. Piezometer PZ–4 had 0.41 foot of water that is likely attributed to water collecting in the end cap attached to the bottom of the piezometer. It may represent the presence of perched water after significant precipitation that occurred since the previous measurement. Steadily increasing water levels in any of the piezometers could indicate a potential problem with the performance of the dam. On the basis of 2010 measurements, the tailings dam is considered to be in an unsaturated condition.

The tailings dam face was designed to allow a vegetative cover, including mature trees, to establish and stabilize the surface and prevent erosion. Consequently, the presence of this vegetation does not harm the function of the dam, and the dam will not be compromised if the rock cover eventually degrades. The dam face has successfully revegetated (PL–6).

Adjacent to the eastern end of the tailings dam is a steep slope underlain by rock and covered with soil. Rills and gullies noted during previous annual inspections were inspected on this slope at the base of the riprap-armored swale. No new rills were identified at this location, and the existing rills and gullies are stable. Although these erosion features do not threaten site integrity, they will be inspected annually to ensure that the slope remains stable and that sediment is not transported off site.

Area Between the Diversion Channel and Site Boundary, and Outlying Area—Ponderosa pine forest constitutes most of the area outside of the diversion channel. The surrounding lands are part of the Spokane Indian Reservation and are used for timber harvesting and wildlife habitat. No residences are located within 0.25 mile of the site boundary.

During the summer of 2005, the BIA proposed to construct a portion of an access road across the southwest corner of the property. The road would follow a reclaimed former mining road and not encroach upon the tailings impoundment, and would be used only for logging operations planned for fall 2005. DOE agreed with the proposal and stipulated requirements for BIA to reclaim the road and any other areas on the site damaged by logging operations. Intermittent logging operations and burning of slash piles have continued adjacent to the site and the access road has not been reclaimed.

5.3.2 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 follow-up inspections were required in 2010.

5.3.3 Routine Maintenance and Emergency Measures

A damaged perimeter sign was replaced and several small patches of the noxious weed Canada thistle were treated with herbicide. No other maintenance or repairs were required in 2010.

Emergency measures are corrective actions that DOE will take in response to unusual damage or disruption that threaten or compromise site health and safety, security, integrity, or compliance with 40 CFR 192. No emergency measures were required in 2010.

5.3.4 Environmental Monitoring

5C Groundwater compliance monitoring is not required at the Sherwood site. However, as a best management practice stipulated in the LTSP, DOE conducts limited groundwater monitoring for designated indicator parameters. Samples are collected annually from one background well north of the tailings impoundment, identified as MW–2B, and two downgradient wells near the base of the tailings dam, identified as MW–4 and MW–10. Samples are analyzed for sulfate, chloride, and total dissolved solids. Sulfate and chloride are the primary indicator parameters.

Monitoring results are evaluated for evidence of groundwater impact from the reclamation cell. Should the concentration of sulfate or chloride exceed the State of Washington water quality criteria values of 250 milligrams per liter for either parameter, DOE will conduct confirmatory sampling of the downgradient wells. If the confirmatory sampling verifies the exceedance, DOE will develop an evaluative monitoring work plan, in consultation with the Tribe and BIA, and submit that plan to NRC for review prior to initiating the evaluative monitoring program. Results of an evaluative monitoring program would be used to determine if corrective action is necessary.

Groundwater sampling was conducted on July 14, 2010, and the results are presented in Table 5–2. Groundwater constituent concentrations were consistent with previous years and continue to be significantly less than the action levels for confirmatory sampling.

Table 5–2. 2010 Groundwater Quality Results for the Sherwood, Washington, Disposal Site

Constituent	Water Quality Criterion	Background Well MW–2B	Downgradient Well MW–4	Downgradient Well MW–10
Chloride, mg/L	250	0.56	0.51	1.2
Sulfate, mg/L	250	7.8	7.4	32
TDS, mg/L	N/A	200	330	640

Key: mg/L = milligrams per liter; N/A = not applicable; TDS = total dissolved solids
Note: State of Washington water quality criteria used as action levels.

5.3.5 Photographs

Photograph Location Number	Azimuth	Description
PL–1	90	New perimeter sign P6.
PL–2	40	Site marker.
PL–3	355	Piezometer PZ–2.
PL–4	115	Buffalo and wild horses on the tailings impoundment cover.
PL–5	175	Wetland vegetation in the diversion channel.
PL–6	285	Vegetation on the tailings dam face.

SHE 7/2010. PL–1. New perimeter sign P6.

SHE 7/2010. PL–2. Site marker.

SHE 7/2010. PL–3. Piezometer PZ–2.

SHE 7/2010. PL–4. Buffalo and wild horses on the tailings impoundment cover.

SHE 7/2010. PL–5. Wetland vegetation in the diversion channel.

SHE 7/2010. PL–6. Vegetation on the tailings dam face.

Dam Inspection Checklist
Sherwood, Washington, UMTRCA Title II Disposal Site

Date of Inspection: July 20, 2010

Inspector	Organization
R. K. Johnson	S.M. Stoller Corp.

Piezometer PZ-1 current year water depth: (Previous year depth: dry)	Dry
Piezometer PZ-2 current year water depth: (Previous year depth: 1.55 ft)	2.28 ft
Piezometer PZ-3 current year water depth: (Previous year depth: dry)	Dry
Piezometer PZ-4 current year water depth: (Previous year depth: dry)	0.41 ft
Was evidence of significant seepage observed on the dam face? If yes discuss in report.	No
Was evidence of significant slumping observed on the dam? If yes discuss in report.	No
Was evidence of significant erosion observed on the dam? If yes discuss in report.	No
Was vegetative growth that could compromise dam stability observed? If yes discuss in report.	No
Was any condition that presents an imminent hazard to human health and safety or to the environment observed? If yes immediately contact the following:	No

DOE Project Manager (970) 248-6073
NRC Operations Center (301) 951-0550
Spokane Tribal Police/Sheriff (509) 258-4400
State Department of Ecology—Dam Safety (360) 407-6625

Note: Piezometer water levels measured during sampling trip on July 14, 2010.

Inspector Signature:  Date: 8/13/10

6.0 Shirley Basin South, Wyoming, Disposal Site

6.1 Compliance Summary

The Shirley Basin South, Wyoming, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title II disposal site was in excellent condition when it was inspected on June 24, 2010. No maintenance needs were identified. Groundwater monitoring indicated that radium-228 concentrations continue to exceed the alternate concentration limit (ACL) at two wells but are within historical ranges. The radium-226 ACL continues to be exceeded in a new well next to the site boundary. These elevated concentrations are considered to be due to natural causes as aquifers recover from dewatering that occurred during mining and groundwater remediation activities, but evaluation continues. No cause for a follow-up inspection was identified.

6.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the Shirley Basin South site are specified in the *Long-Term Surveillance Plan for the U.S. Department of Energy Shirley Basin South (UMTRCA Title II) Disposal Site, Carbon County, Wyoming* (DOE–LM/GJ766–2004, December 2004) and in procedures established by the U.S. Department of Energy (DOE) to comply with requirements of Title 10 *Code of Federal Regulations* Part 40.28 (10 CFR 40.28). Table 6–1 lists license requirements for this site.

Table 6–1. License Requirements for the Shirley Basin South, Wyoming, Disposal Site

Requirement	Long-Term Surveillance Plan	This Report
Annual Inspection and Report	Section 3.3 and 3.4	Section 6.3.1
Follow-up Inspections	Section 3.5	Section 6.3.2
Routine Maintenance and Emergency Measures	Section 3.6	Section 6.3.3
Environmental Monitoring	Section 3.7	Section 6.3.4

Institutional Controls—The 1,512-acre site 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 2005. 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, as defined by DOE Policy 454.1, consist of federal ownership of the property, a site perimeter fence, warning/no-trespassing signs placed along the property boundary, and a locked gate at the site entrance. Verification of these institutional controls is part of the annual inspection. No off-site institutional controls are needed because contaminated groundwater is contained within the federal land boundary.

6.3 Compliance Review

6.3.1 Annual Inspection and Report

The site, located approximately 35 miles south of Casper, Wyoming, was inspected on June 24, 2010. Results of the inspection are described below. Features and photograph locations (PLs) mentioned in this report are shown on Figure 5–1. Numbers in the left margin of this report refer to items summarized in the "Executive Summary" table (Table ES–1).

6.3.1.1 Specific Site Surveillance Features

Access, Gates, Fences, and Perimeter Signs—Access to the Shirley Basin South site is immediately off of Carbon County Road 2 and is unimpaired; no private property is crossed to gain access. A wire entrance gate is secured by a locked chain and was in excellent condition.

A four-strand barbed-wire perimeter fence encompasses the site. The perimeter fence was inspected with the use of an all-terrain vehicle and, except for a damaged portion crossing the north end of Pit 4, was in excellent condition. The damaged portion will be difficult to maintain because of steep slopes and recurring snow damage. The grazing licensee (see Section 6.3.1.2), in cooperation with the adjacent property owner (Pathfinder Mines Corporation [Pathfinder]), erected a solar-powered electric fence around the north rim of Pit 4 in 2007 to bypass the damaged section and to give cattle access to each side of the pit. Sections along the north perimeter are secured with a temporary wire fence. Pathfinder uses these sections to reach a topsoil stockpile area on the DOE site. Section 6.3.1.2 provides additional information regarding this activity.

Perimeter signs (warning and property-ownership signs) are positioned around the disposal cell at 25 locations, and another nine signs are along the site perimeter at potential points of access (PL–1). Other than perimeter signs P1 and P2, which have bullet holes in them, the signs are in excellent condition.

Site Marker and Boundary Monuments—The granite site marker, at the site entrance, was in excellent condition (PL–2). All 26 boundary monuments delineating DOE property were located and were in excellent condition.

Monitoring Wells—The site groundwater monitoring network consists of 14 wells; six of these wells were installed downgradient of the disposal cell during fall 2008. Each well was inspected and was in excellent condition and secured with a DOE lock. Areas with surface damage caused by drilling activities were reclaimed and reseeded with a native seed mixture. New plant growth is establishing at the disturbed locations (PL–3).

6.3.1.2 Transects

In accordance with the Long-Term Surveillance Plan (LTSP), the site is divided into three transects to ensure a thorough and efficient inspection: (1) the cover of the tailings impoundment; (2) the containment dam and diversion channels; and (3) the balance of the site and the site perimeter.

Within each transect, inspectors examined specific site surveillance features. Each transect was inspected for evidence of erosion, settling, slumping, or other disturbances that might affect the site's integrity or the long-term performance of the cell.

Cover of the Tailings Impoundment—The tailings impoundment, completed in 2000, occupies approximately 142 acres and has a grass cover (PL–4). The cell surface is constructed at two elevations separated by a riprap-armored slope (PL–5). The slope was in excellent condition.

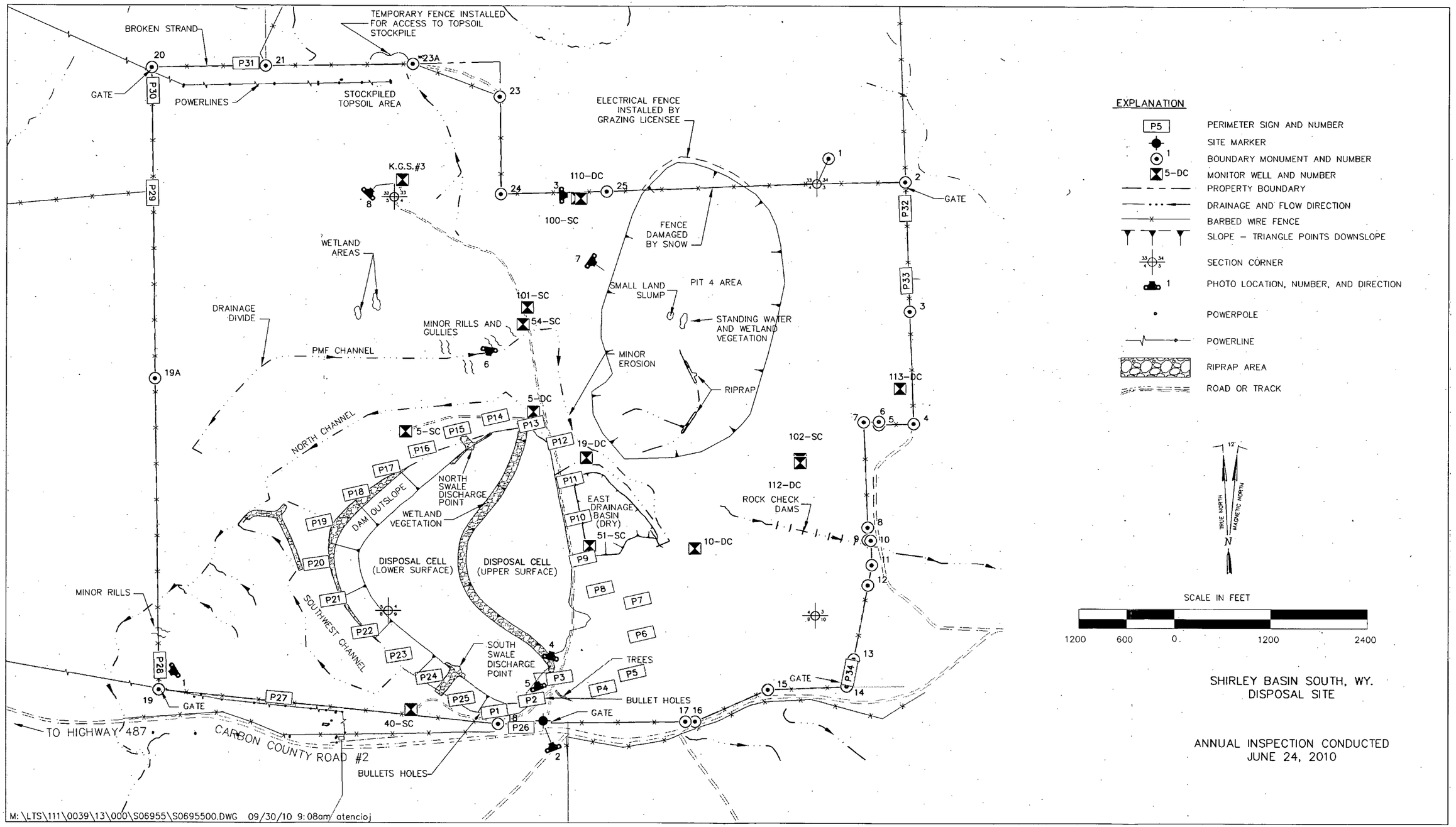

Figure 6–1. 2010 Annual Compliance Drawing for the Shirley Basin South, Wyoming, Disposal Site

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Windblown sediment is accumulating on the slope, and vegetation continues to encroach there, enhancing the slope's stability. Wetland vegetation is establishing in areas at the toe of the slope that are wet due to precipitation and snowmelt runoff. The surface of these areas tends to dry out later in the summer.

The eastern (upper) surface is contoured to drain into a basin east of the cell and west over the riprap-protected slope to the western (lower) surface. The lower surface drains to the north and south at riprap-armored discharge points (PL–6).

The grass cover on the cell is well established and was in excellent condition. There were no indications of erosion, settlement, or other modifying processes that might affect the integrity of the cell.

Containment Dam and Diversion Channels—The tailings pile was reclaimed in place and was contained behind a horseshoe-shaped earthen dam. The containment dam is predominantly grass-covered, with the north and south swale discharge points and the steeper sections (5:1 slope) of the dam protected by riprap. There were no indications of erosion, settlement, or other modifying processes that might affect the integrity of the dam. Vegetation is encroaching on the riprap surfaces, which enhances the stability of the slopes.

The surface-water diversion system consists of a combination of diversion channels, drainage basins, and contoured surfaces. Riprap armor was placed on the steeper slopes and flow concentration points where design flow velocities could erode surfaces and impact the tailings dam and impoundment. A probable maximum flood (PMF) channel was constructed north of the tailings impoundment. Part of the PMF channel drains to the southwest and discharges to a small closed basin. The portion of the PMF channel that flows eastward and discharges into the east drainage basin captures a larger drainage area. These closed drainage basins are large enough to accommodate the PMF water volumes. The diversion channels were in excellent condition, and no active erosion was indicated in the channels. Minor erosion is occurring at locations on the uphill and downhill slopes along the PMF channel but is not affecting the function of the channel.

Balance of the Site and the Site Perimeter—The other major feature on the site is reclaimed Pit 4, in the northeast portion of the site. Reclamation activities included rounding the side slopes, partially backfilling the pit to an elevation above the local water table, revegetating the surfaces, and protecting potential erosion areas with riprap. Vegetation is well established, and a wetland area is forming at the bottom of the pit where standing water from runoff often is present (PL–7); the surface of this area tends to dry out later in the summer. Minor slumps and displacement features are present on the west side slope of the pit. Otherwise, the pit was in excellent condition.

DOE established a grazing license with a local rancher in 2007. The license allows the rancher's livestock to graze the site and allows the rancher to cut the grass on the disposal cell for hay and use water from well MW–K.G.S. #3 (PL–8) for stock-watering purposes (at the request of DOE, the State of Wyoming changed the permitted use of the well from monitoring only to monitoring and stock water use). Well MW–K.G.S. #3 is completed in the lower sand aquifer of the Wind River Formation and is hydraulically isolated from the upper contaminated aquifers. The licensee installed a solar-powered pump in well MW–K.G.S. #3 in December 2007 and plans to install a

storage tank and stock-watering tank near the well. With DOE's approval, the rancher also plans to subdivide the site with solar-powered electric fences to facilitate a rotational grazing operation. In exchange for these uses of the site, the rancher is responsible for maintaining the perimeter fence and notifying DOE of observed trespassing, vandalism, erosion, or other problems at the site.

Private property and public land administered by the U.S. Bureau of Land Management surround the site. Land on three sides is used primarily for livestock grazing. Pathfinder is the property owner north of the site and is in the process of reclaiming the UMTRCA Title II Shirley Basin North disposal site. Pathfinder's access to and use of stockpiled topsoil on the DOE site is in accordance with an agreement between Petrotomics Company, the former licensee of the Shirley Basin South site, and Pathfinder. In accordance with the agreement, DOE is the successor to Petrotomics, and the terms of the agreement remain in effect. The Wyoming Department of Environmental Quality (WDEQ) extended Pathfinder's mine area permit to include the soil stockpile area and requires that Pathfinder reclaim the disturbed area, including fence replacement, when they have finished removing topsoil from the stockpile. This activity is not harming the security of the site, and no evidence of recent topsoil removal was observed.

6.3.2 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 follow-up inspections were required in 2010.

6.3.3 Routine Maintenance and Emergency Measures

Infestations of noxious weeds (Canada thistle), present over much of the site, were sprayed with herbicide. No other maintenance or repairs were required in 2010.

Emergency measures are corrective actions that DOE will take in response to unusual damage or disruption that threaten or compromise site health and safety, security, integrity, or compliance with 40 CFR 192. No emergency measures were required in 2010.

6.3.4 Environmental Monitoring

Groundwater monitoring is required at the Shirley Basin South site. The monitoring network, as
6A described in the LTSP, consisted of eight DOE wells completed in aquifers of the Wind River Formation. As agreed to by DOE and NRC, DOE installed six additional monitoring wells in fall 2008 to provide a better understanding of the groundwater chemistry and flow directions of the two aquifers of concern. The LTSP will be revised to address the new well-monitoring network and recommendations regarding monitoring requirements. A first draft of the revision was submitted to NRC for concurrence in January 2009, but returned to DOE for additional evaluation of constituents exceeding ACLs; this evaluation is continuing as additional sampling results are obtained. The existing monitoring network is described in Table 6–2.

Table 6–2. Groundwater Monitoring Network at the Shirley Basin South, Wyoming, Disposal Site

Monitoring well	Network Application
5–SC	POC well; upper sand aquifer
40–SC	Upgradient well; upper sand aquifer
51–SC	POC well; upper sand aquifer
54–SC	Downgradient well; upper/main sand aquifer
100–SC	Downgradient well; upper sand aquifer
101–SC	Downgradient well; upper sand aquifer
102–SC	Downgradient well; upper sand aquifer
5–DC	POC well; main sand aquifer
10–DC	Downgradient well; main sand aquifer
19–DC	POC well; main sand aquifer
110–DC	Downgradient well; main sand aquifer
112–DC	Downgradient well; main sand aquifer
113–DC	Downgradient well; main sand aquifer
K.G.S. #3	Lower sand aquifer

Key: POC = point-of-compliance

Water level, pH, and electrical conductivity are measured at the time of sampling, and the samples are analyzed for uranium, radium-226, radium-228, thorium-230, cadmium, chromium, lead, nickel, selenium, chloride, nitrate, sulfate, and total dissolved solids (TDS). Analytical results are compared to the ACLs and Wyoming Class III groundwater protection standards provided in Table 6–3. There are no applicable limits or standards for nitrate at this site. However, it is included as an analyte because it may be an indicator of contaminant migration. Water level elevations are measured at the wells to evaluate flow direction as the upper aquifers recover from mining and reclamation activities.

The intent of the annual groundwater quality monitoring is to verify that the ACLs are not exceeded at point-of-compliance (POC) wells and to verify continued compliance with the pertinent groundwater protection standards. If an ACL is exceeded at a POC well, or if trends indicate that a groundwater protection standard may be exceeded at the site boundary, DOE will inform NRC and WDEQ of the results and conduct confirmatory sampling. If the confirmatory sampling verifies the exceedance or threat of exceedance, DOE will develop an evaluative monitoring work plan and submit that plan to NRC for review prior to initiating the evaluative monitoring program. Results of the evaluative monitoring program will be used, in consultation with NRC, to determine if corrective action is necessary.

The results for cadmium in POC well MW–5–SC and radium-228 in POC well MW–5–DC for DOE's initial sampling in July 2005 exceeded their respective ACLs. The 2005 radium-228 concentration in non-POC well MW–54–SC also was substantially above the ACL. Therefore, confirmatory sampling and analysis for cadmium and radium-228 at the three wells were conducted in November 2005, and the results confirmed the initial findings. When compared with historical results provided by the previous site owner, the results for cadmium in well MW–5–SC were within the range of historical measurements. The 2005 results for radium-228 in well MW–5–DC were within the range of historical measurements, and data indicate that radium-228 has equaled or exceeded the ACL on all but four semiannual sampling events beginning in 1995. This analytical information was sent to NRC and WDEQ with a recommendation to continue annual monitoring and perform an evaluation after 5 years of results to determine if corrective action is necessary. To provide a better understanding of the site groundwater characteristics, DOE installed six additional monitoring wells in fall 2008.

Table 6–3. Alternate Concentration Limits and Groundwater Protection Standards for the Shirley Basin South, Wyoming, Disposal Site

Analyte	ACL	Groundwater Protection Standard[a]
Uranium (mg/L)	9.2	N/A
Radium-226 (pCi/L)	91.3	N/A
Radium-228 (pCi/L)	25.7	N/A
Thorium-230 (pCi/L)	2,409	N/A
Cadmium (mg/L)	0.079	N/A
Chromium (mg/L)	1.83	N/A
Lead (mg/L)	0.05	N/A
Nickel (mg/L)	6.15	N/A
Selenium (mg/L)	0.12	N/A
Chloride (mg/L)	N/A	2,000
Sulfate (mg/L)	N/A	3,000
TDS (mg/L)	N/A	5,000

[a]Wyoming Class III Groundwater Protection Standards for livestock use are applicable to this site.
Key: ACL = alternate concentration limit; mg/L = milligrams per liter; N/A = not applicable; pCi/L = picocuries per liter; TDS = total dissolved solids

The second sampling event after installing the new wells was conducted in July 2009 and indicated that radium-226 exceeded the ACL in new well MW–110–DC. NRC and WDEQ were notified of the exceedence, and confirmatory sampling conducted in November 2009 verified the exceedence. It was due to these results that NRC returned the draft revision of the LTSP for further evaluation.

Analytical results for the June 2010 sampling event are provided in Table 6–4 (upper sand aquifer) and Table 6–5 (main sand aquifer). Samples could not be collected in wells MW–51–SC and MW–101–SC because they continue to be dry.

6B 6C The concentration for cadmium in MW–5–SC remained below the ACL and has since 2005. However, radium-228 continued to exceed the ACL in both MW–5–DC and MW–54–SC (Figure 6–2). Additionally, the ACL for radium-226 continues to be exceeded in well MW–110–DC (Figure 6–3).

Although radium-228 concentrations are elevated in two of the wells, they are less than the peak concentrations that occurred in these wells in the early 1990s during site groundwater remediation activities. Radium-228 is a decay product of thorium-232, which is highly immobile. Because the half-life of radium-228 is very short, the thorium-232 source must be near the wells of concern. Both of the aquifers at the site were dewatered during mining and remediation, and are still in the process of recovering. Therefore, as the sand units are resaturating, groundwater may be coming back into contact with thorium and other minerals in the ore body, and the quality is returning to preremediation concentrations. Evaluation of these elevated concentrations will continue as additional sampling results are obtained.

The elevated radium-226 concentration in well MW–110–DC, located near the site boundary downgradient from the disposal cell, is also likely attributed to natural sources in the ore-bearing main sand unit instead of plume migration from the disposal cell. The aquifer was dewatered at this location during mining activities and is still in the process of recovering; therefore, its

quality may be returning to pre-mining concentrations. Also, the radium-226 concentrations in POC wells MW–5–DC and MW–19–DC, located immediately downgradient of the disposal cell, have been significantly below the ACL since 1995 and have never approached the concentrations seen in MW–110–DC. Evaluation of the elevated radium-226 will continue as additional sampling results are obtained.

Table 6–4. 2010 Groundwater Monitoring Results in the Upper Sand Aquifer Wells at the Shirley Basin South, Wyoming, Disposal Site

Analyte (Limit or Standard)	5–SC (POC)	40–SC	51–SC (POC)	54–SC	100–SC	101–SC	102–SC
Cadmium (0.079 mg/L)	0.039	0.00022	NS	0.0017	0.00013	NS	0.00034
Chloride (2,000 mg/L)	300	42	NS	340	120	NS	260
Chromium (1.83 mg/L)	0.26	ND	NS	0.19	ND	NS	ND
Lead (0.05 mg/L)	ND	0.000068	NS	0.00062	0.00012	NS	0.000053
Nickel (6.15 mg/L)	2.5	0.0082	NS	2.5	ND	NS	ND
Nitrate/Nitrite as N (mg/L)[a]	ND	1.5	NS	0.02	ND	NS	1.2
Radium-226 (91.3 pCi/L)	5.09	0.414	NS	16.7	3.37	NS	3.87
Radium-228 (25.7 pCi/L)	3.4	1.03	NS	**107**[b]	4.25	NS	3.32
Selenium (0.12 mg/L)	0.073	0.007	NS	0.047	0.00015	NS	0.0007
Sulfate (3,000 mg/L)	*14,000*[c]	1,700	NS	*8,400*[c]	1,000	NS	520
Thorium-230 (2,409 pCi/L)	421	ND	NS	5.21	ND	NS	ND
TDS (5,000 mg/L)	*18,000*[c]	2,600	NS	*12,000*[c]	1,800	NS	1,300
Uranium (9.2 mg/L)	3.4	0.00026	NS	0.045	0.0038	NS	0.0054

[a]No designated limit or standard.
[b]Result exceeded an ACL.
[c]Result exceeded a Wyoming Class III groundwater protection standard.
Key: mg/L = milligrams per liter; ND = not detected (below method detection limit); NS = no sample collected (dry well); pCi/L = picocuries per liter; POC = point-of-compliance; TDS = total dissolved solids

Table 6–5. 2010 Groundwater Monitoring Results in the Main Sand Aquifer Wells at the Shirley Basin South, Wyoming, Disposal Site

Analyte (Limit or Standard)	5–DC (POC)	10–DC	19–DC (POC)	110–DC	112–DC	113–DC
Cadmium (0.079 mg/L)	ND	0.000039	0.00063	ND	0.000034	ND
Chloride (2,000 mg/L)	170	55	82	220	53	8
Chromium (1.83 mg/L)	ND	ND	ND	ND	ND	ND
Lead (0.05 mg/L)	0.00028	0.00039	ND	0.0033	0.00028	0.000092
Nickel (6.15 mg/L)	0.9	ND	0.11	ND	ND	ND
Nitrate/Nitrite as N (mg/L)[a]	0.027	ND	ND	ND	ND	0.063
Radium-226 (91.3 pCi/L)	9.68	13.5	6.51	**134**[b]	14.9	2.65
Radium-228 (25.7 pCi/L)	**43.3**[b]	4.19	6.34	6.40	4.43	2.98
Selenium (0.12 mg/L)	0.02	ND	0.00016	ND	ND	ND
Sulfate (3,000 mg/L)	*6,300*[c]	1,100	3,000	1,900	1,200	640
Thorium-230 (2,409 pCi/L)	ND	0.71	ND	ND	ND	ND
TDS (5,000 mg/L)	*9,400*[c]	1,800	4,600	3,600	2,000	1,100
Uranium (9.2 mg/L)	0.045	0.013	0.00018	0.0087	0.043	0.0012

[a]No designated limit or standard.
[b]Result exceeded an ACL.
[c]Result exceeded a Wyoming Class III groundwater protection standard.
Key: mg/L = milligrams per liter; ND = not detected (below method detection limit); pCi/L = picocuries per liter; POC = point-of-compliance; TDS = total dissolved solids

Wyoming Class III groundwater protection standards (applicable only to chloride, sulfate, and TDS) apply to water quality at the site boundary. The standards were met at the site boundary wells (MW–100–SC, MW–102–SC, MW–110–DC, MW–112–DC, and MW–113–DC). The standards were exceeded for sulfate and TDS in wells MW–5–SC, MW–54–SC, and MW–5–DC. The 2010 results were within the range of historical measurements for these wells. Chloride concentrations were well below the standard in all wells.

Analytical results from well MW–K.G.S. #3 confirm that the lower sand aquifer is hydraulically isolated from the overlying main sand aquifer. This conclusion is based on substantially lower concentrations of sulfate (270 milligrams per liter [mg/L]), TDS (450 mg/L), and uranium (0.000033 mg/L) in the lower sand aquifer when compared with the main sand aquifer.

Figure 6–2. Radium-228 Concentrations in Wells MW–5–DC and MW–54–SC Since Completion of the Disposal Cell

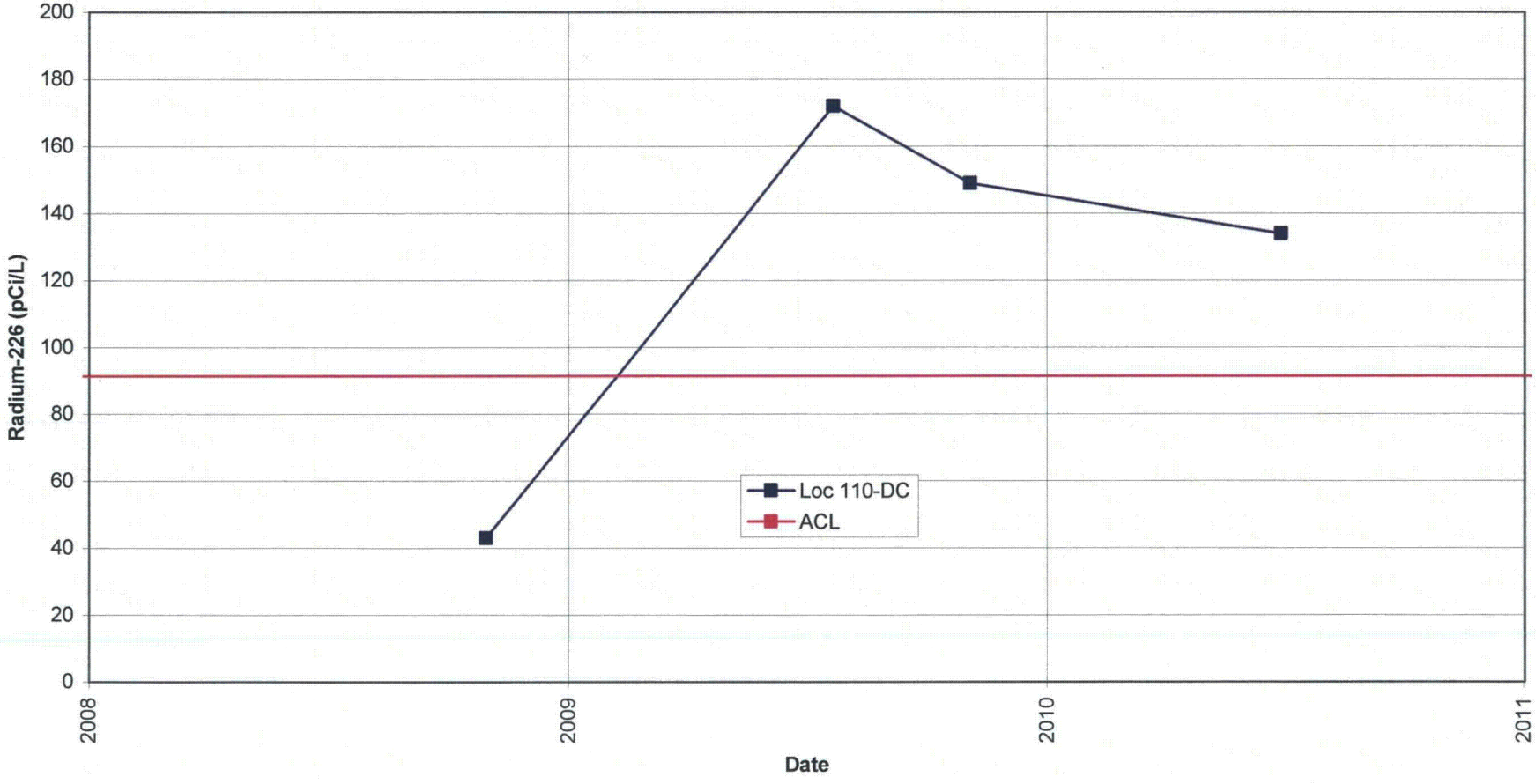


Figure 6–3. Radium-226 Concentrations in Well MW–110–DC

The LTSP specifies that this report provide iso-concentration maps for uranium and sulfate in each aquifer. However, the well network does not provide sufficient data points to develop contour maps of the contaminant plumes. Instead, 2010 concentrations for uranium in the two aquifers are shown on Figures 6–4 and 6–5, and concentrations for sulfate are shown on Figures 6–6 and 6–7. There were no significant changes in the concentrations for these analytes from 2009 to 2010; uranium concentrations in MW–5–SC indicate a slight downward trend, and sulfate concentrations in MW–5–DC indicate a slight upward trend.

The LTSP also specifies that this report provide groundwater contour maps. However, the well network does not provide sufficient data points to develop contour maps. Regional groundwater flows reportedly were to the north-northeast for the upper sand aquifer and to the east for the main sand aquifer prior to mining activities. The upper sand unit and the main sand unit coalesced and formed the main ore body at the Pit 4 location. Pit 4 was partially backfilled with overburden materials during reclamation, with the bottom of the pit being raised to an elevation above the projected recovered surface of the upper sand aquifer. The backfill material does not represent the hydrogeologic characteristics of the original formation, and the aquifers are no longer confined at Pit 4. It is likely that the bottom of Pit 4 is a groundwater recharge area during periods of rainfall and snowmelt, and may an evaporation area during dry periods. Both recharge and evaporation would tend to alter groundwater chemistry. Therefore, mining and reclamation activities permanently altered the local groundwater conditions for the upper and main sand aquifers at the site.

Water level elevations for the upper sand aquifer are shown on Figure 6–8. Water levels in the new perimeter wells are increasing, whereas the levels in the wells near the disposal cell are remaining steady or are decreasing. The apparent flow direction is to the northeast, toward Pit 4. The dry wells (MW–51–SC and MW–101–SC) indicate that the upper sand aquifer has not recovered in the vicinity of Pit 4. Because the aquifer is no longer confined at the Pit 4 location, it may never recover to its pre-mining elevations.

Main sand aquifer water elevations, shown on Figure 6–9, have been gradually rising at all wells since 2000, with an average rate of approximately ¾ foot per year since DOE began monitoring water levels in 2005. The rising levels indicate a gradual recovery of the aquifer. However, recovery appears to be greatly influenced by Pit 4 and may not attain pre-mining elevations. Flow direction cannot be determined at this time because water level measurements indicate an essentially flat potentiometric surface at the site.

6.3.5 Photographs

Photograph Location Number	Azimuth	Description
PL–1	240	Perimeter sign P28 and the west fence.
PL–2	340	Site marker SMK–1 at the site entrance.
PL–3	90	Monitoring wells 100–SC and 110–DC, and reclaimed drilling area.
PL–4	15	Upper surface of the disposal cell.
PL–5	340	Riprap-armored slope between the upper and lower surfaces of the disposal cell.
PL–6	190	North swale discharge point.
PL–7	125	Vegetation on the east slope and standing water in Pit 4.
PL–8	45	Monitoring well K.G.S. #3.

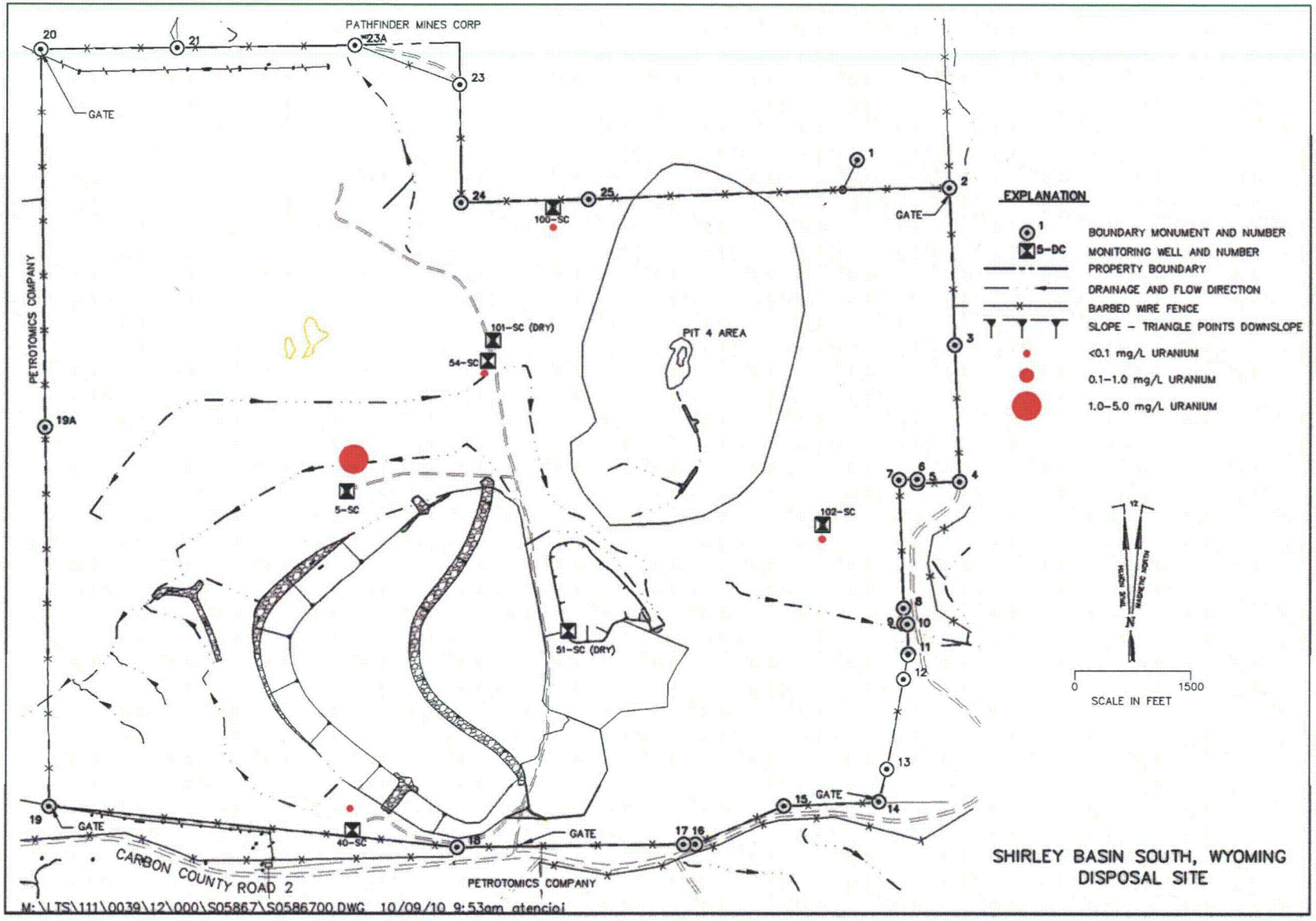


Figure 6–4. June 2010 Uranium Concentrations in the Upper Sand Aquifer at the Shirley Basin South, Wyoming, Disposal Site

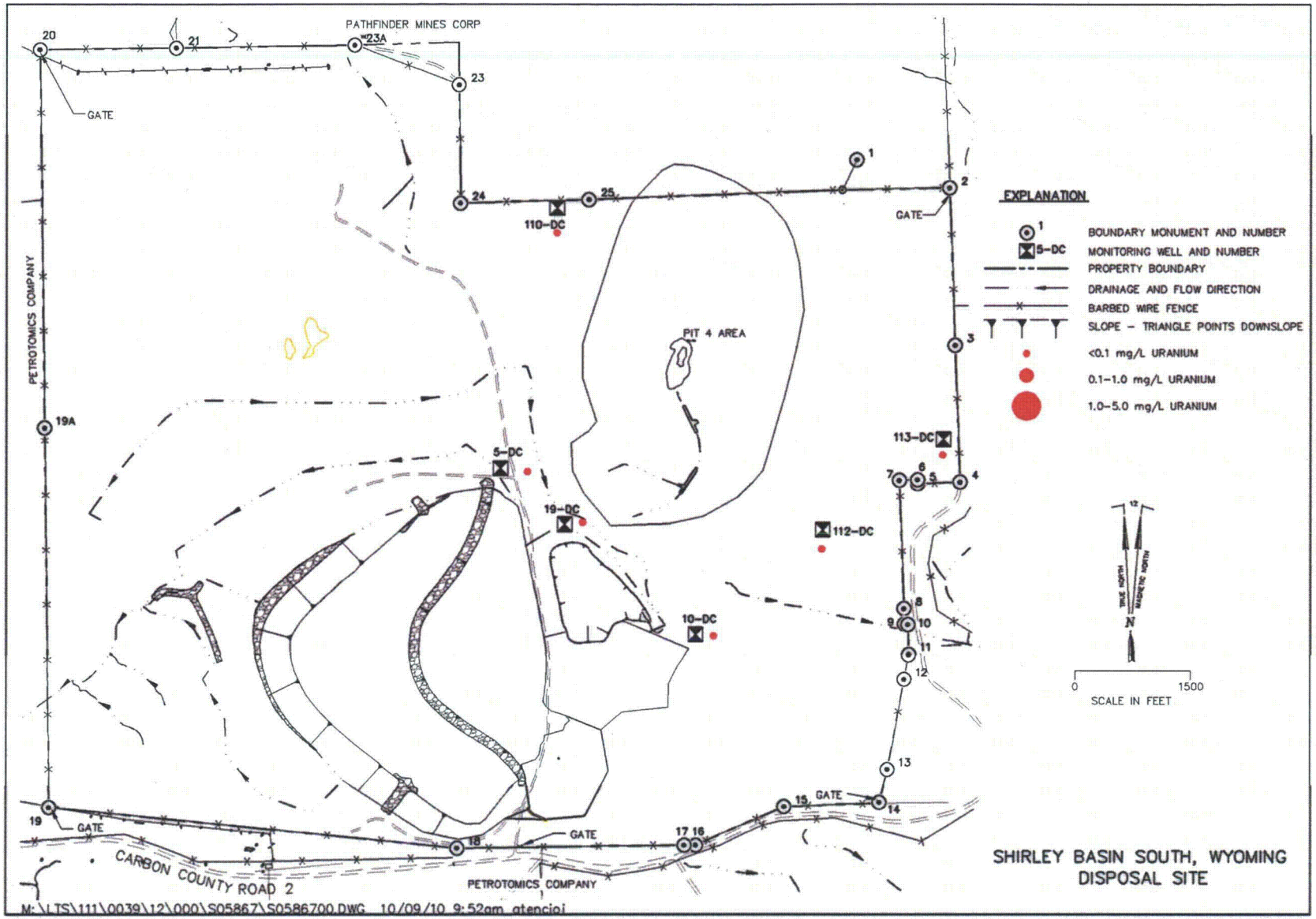


Figure 6–5. June 2010 Uranium Concentrations in the Main Sand Aquifer at the Shirley Basin South, Wyoming, Disposal Site

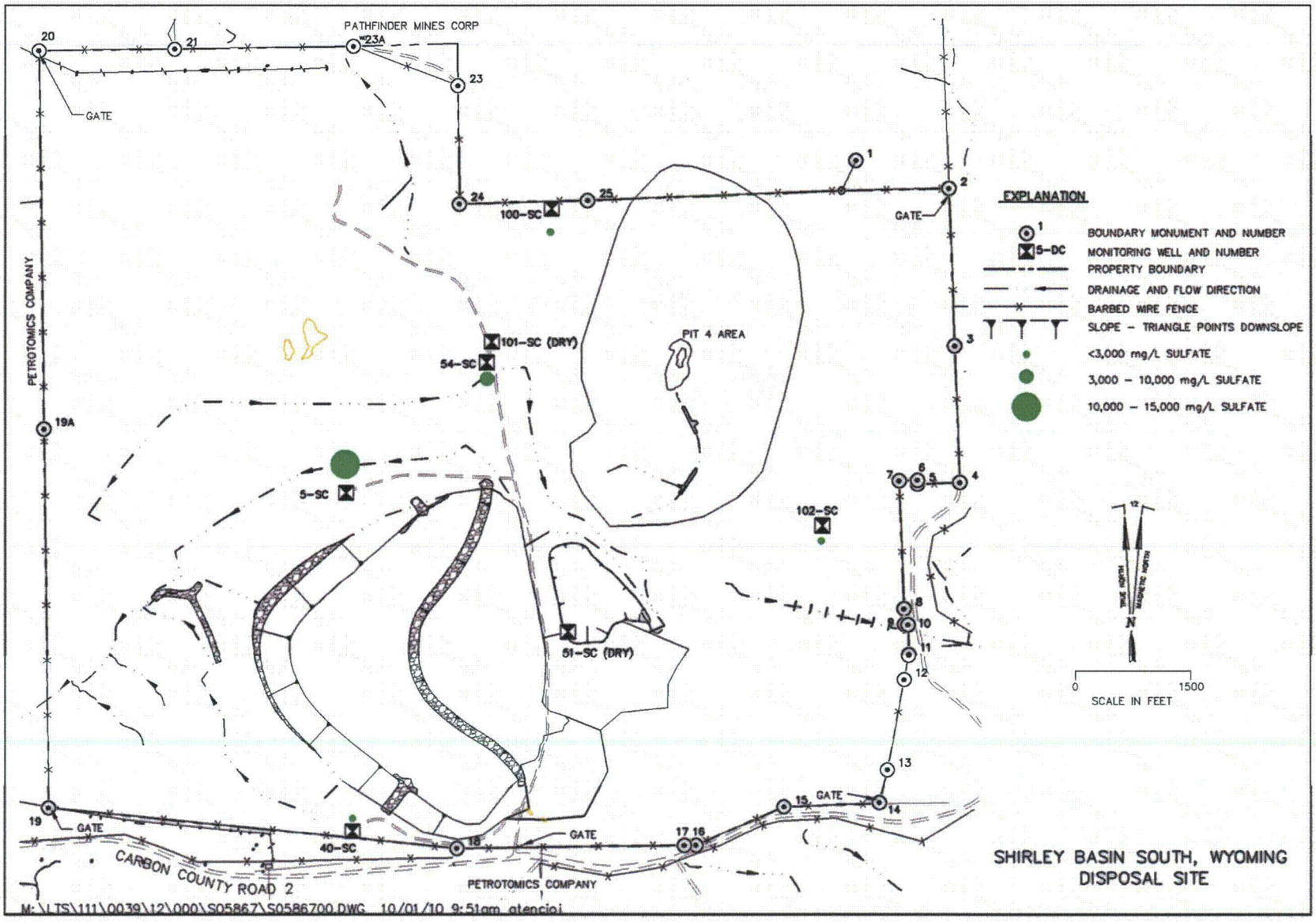


Figure 6–6. June 2010 Sulfate Concentrations in the Upper Sand Aquifer at the Shirley Basin South, Wyoming, Disposal Site

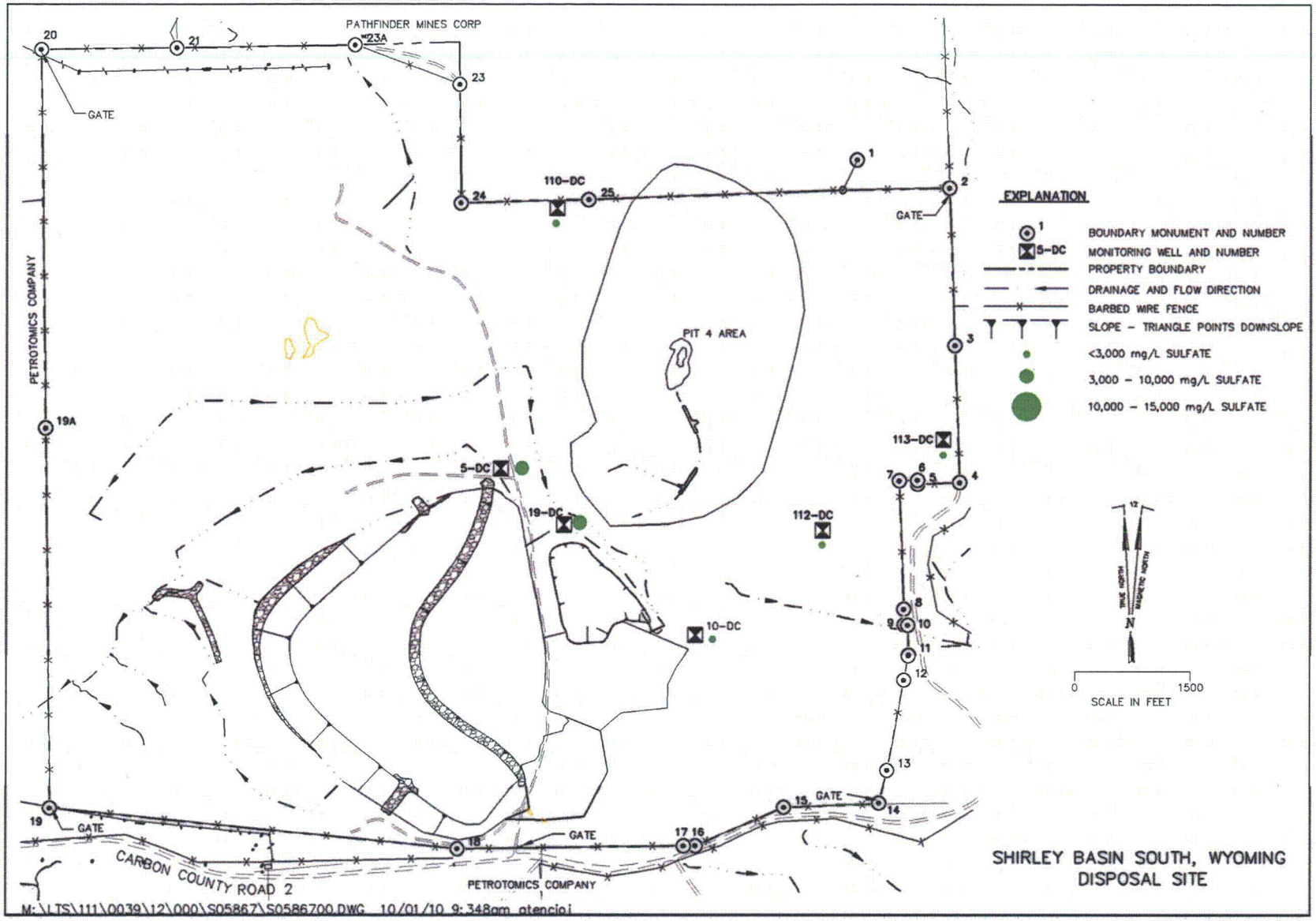


Figure 6–7. June 2010 Sulfate Concentrations in the Main Sand Aquifer at the Shirley Basin South, Wyoming, Disposal Site

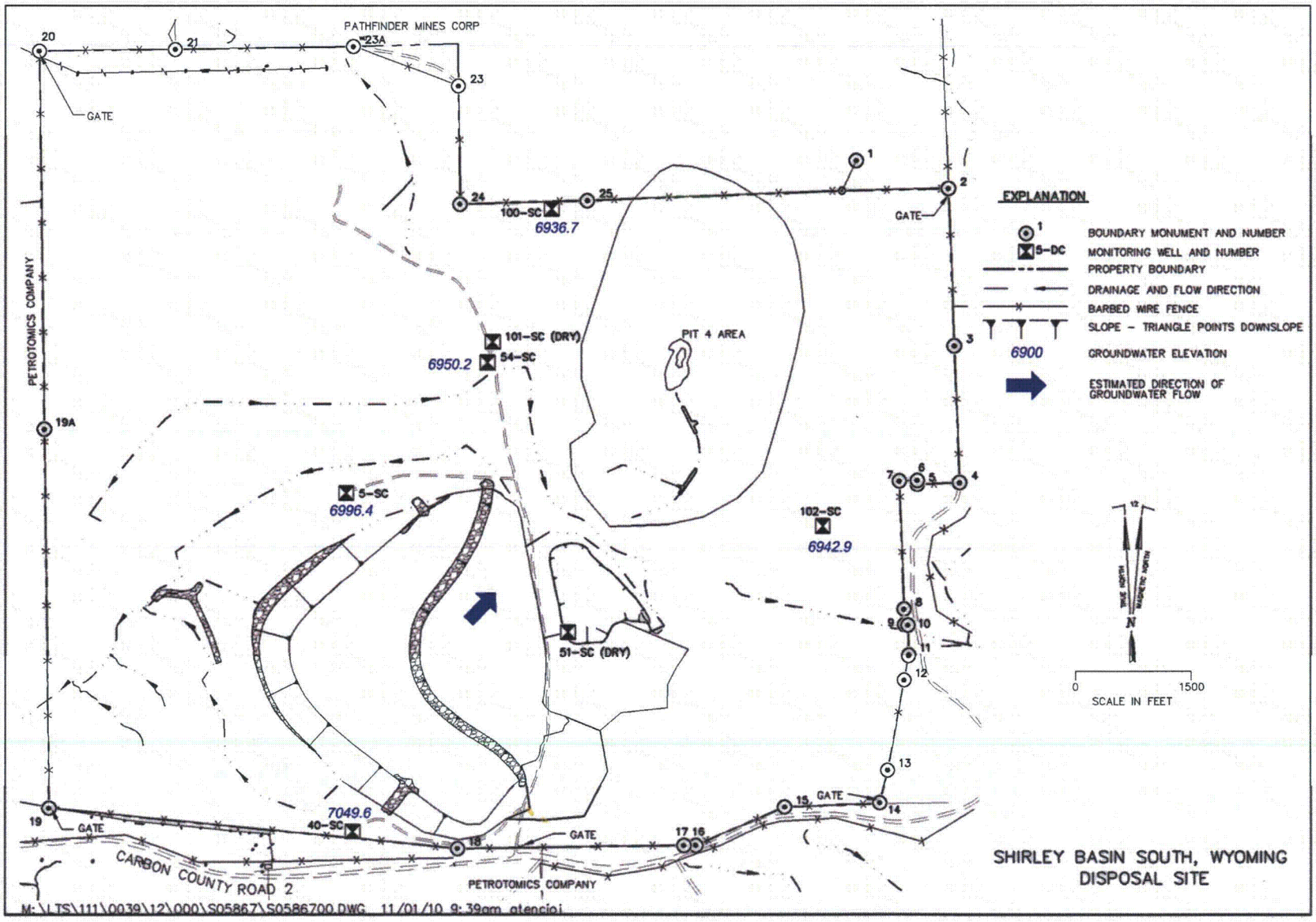


Figure 6–8. Groundwater Elevations and Estimated Flow Direction in the Upper Sand Aquifer at the Shirley Basin South, Wyoming, Disposal Site

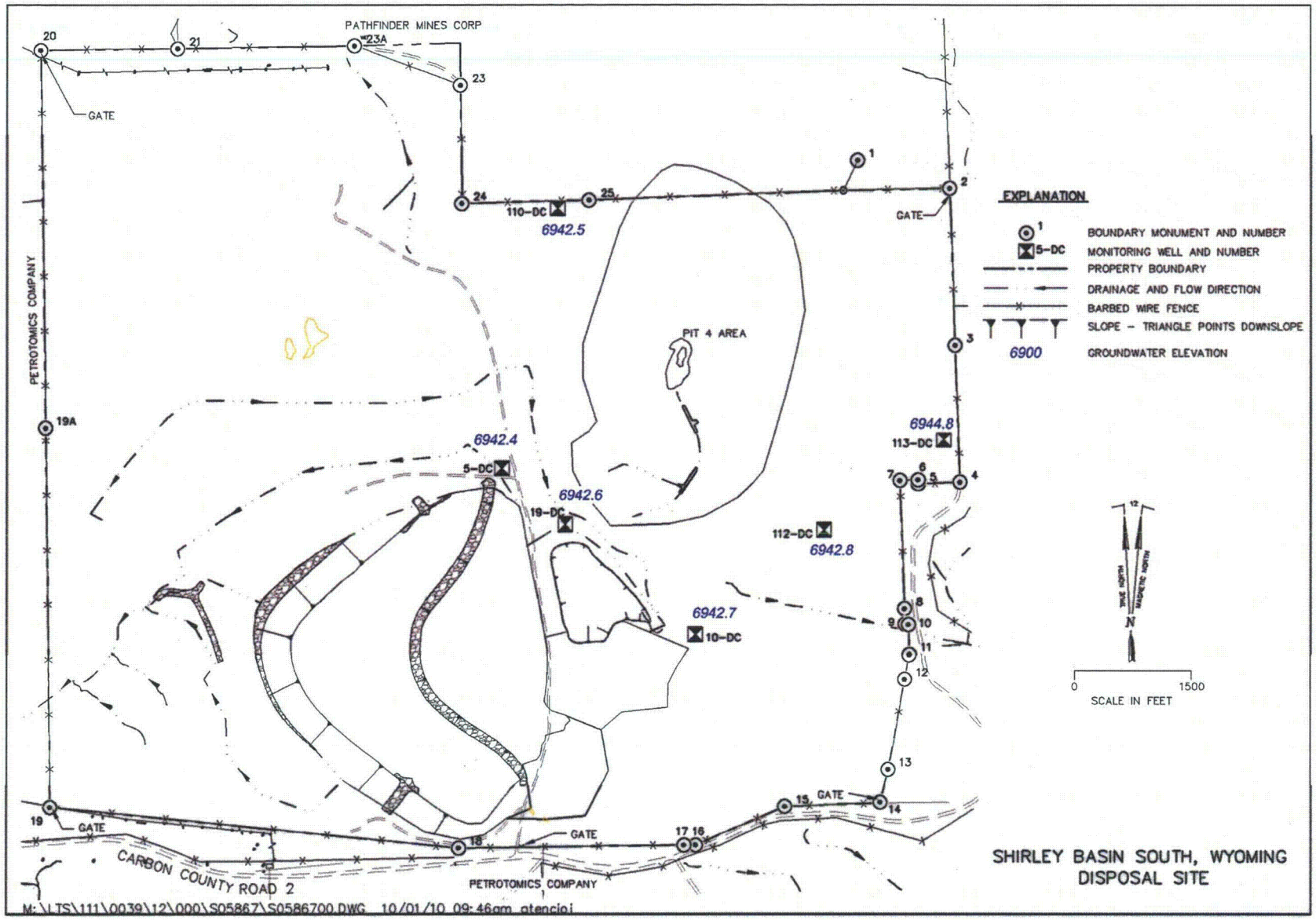
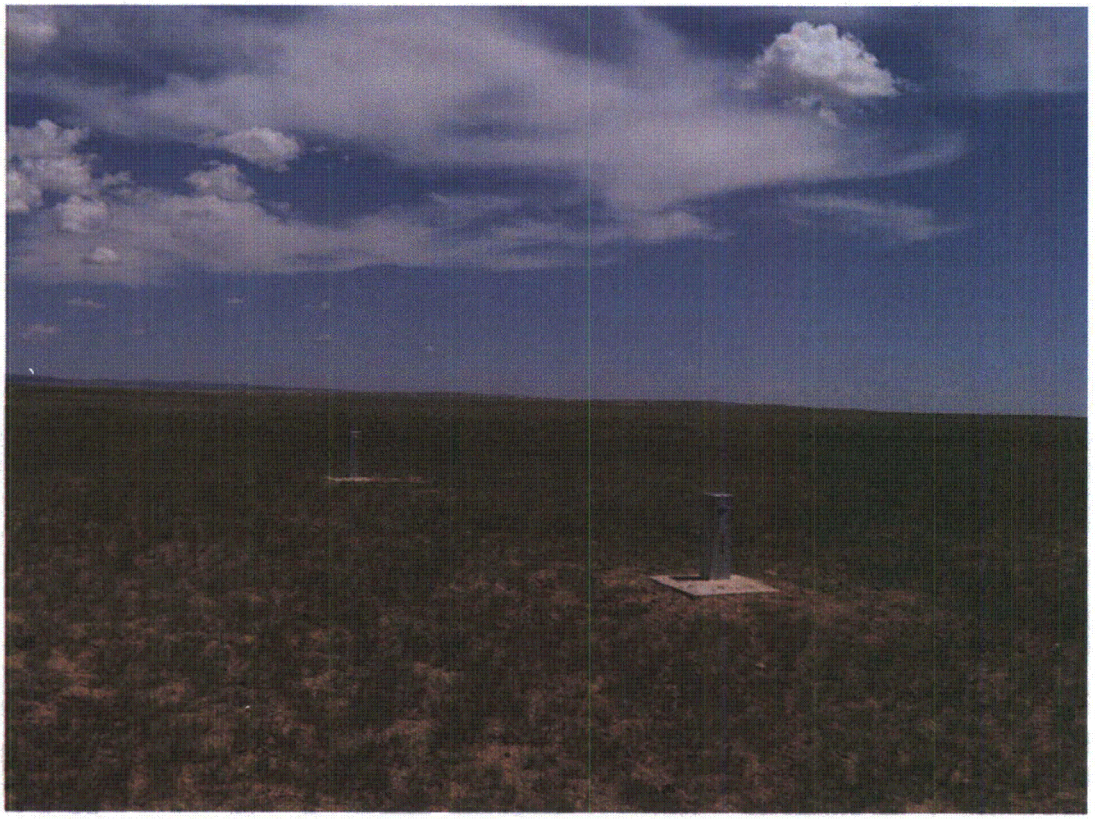


Figure 6–9. Groundwater Elevations in the Main Sand Aquifer at the Shirley Basin South, Wyoming, Disposal Site

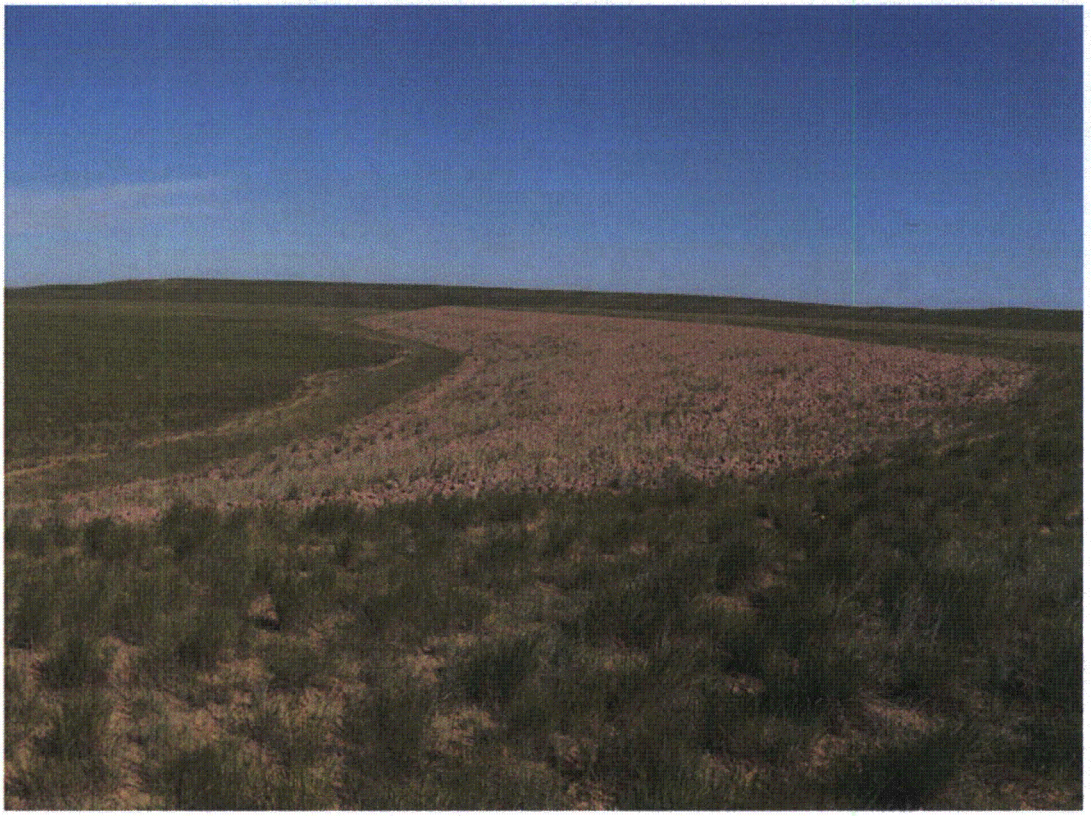
SBS 6/2010. PL–1. Perimeter sign P28 and the west fence.

SBS 6/2010. PL–2. Site marker SMK–1 at the site entrance.



SBS 6/2010. PL–3. Monitoring wells 100–SC and 110–DC, and reclaimed drilling area.

SBS 6/2010. PL–4. Upper surface of the disposal cell.



SBS 6/2010. PL–5. Riprap-armored slope between the upper and lower surfaces of the disposal cell.

SBS 6/2010. PL–6. North swale discharge point.

SBS 6/2010. PL–7. Vegetation on the east slope and standing water in Pit 4.

SBS 6/2010. PL–8. Monitoring well K.G.S. #3.

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