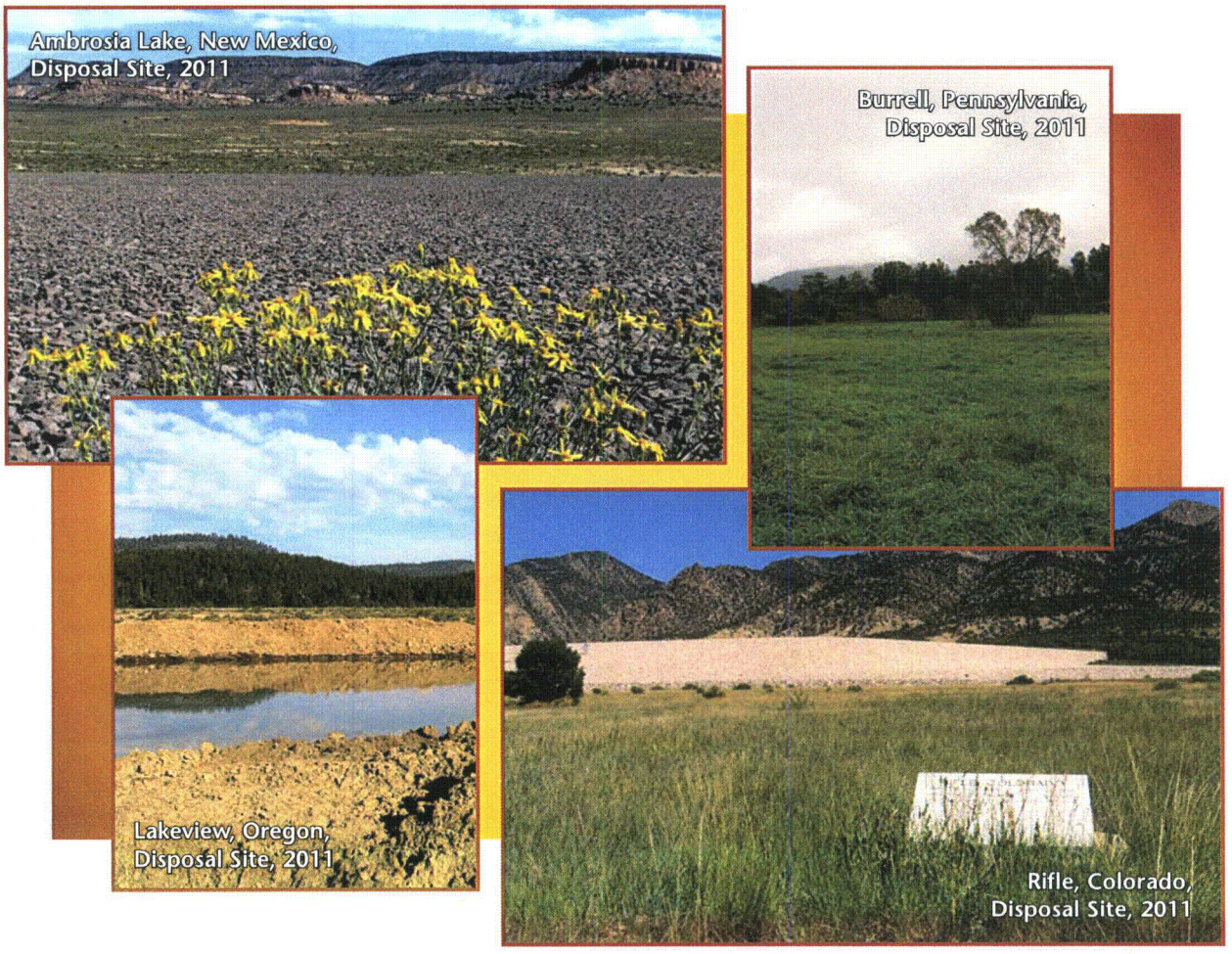
LMS/S08056

U.S. DEPARTMENT OF ENERGY

Legacy Management

2011 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites

January 2012



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U.S. Department of Energy
Office of Legacy Management

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Abbreviations

ACL	alternate concentration limit
BLM	U.S. Bureau of Land Management
CAA	Custodial Access Agreement
CFR	*Code of Federal Regulations*
cm/s	centimeter(s) per second
D_{50}	mean diameter
DOE	U.S. Department of Energy
EDA	energy dissipation area
EPA	U.S. Environmental Protection Agency
FM	Farm-to-Market Road
GCAP	Groundwater Compliance Action Plan
LM	Office of Legacy Management
LTSP	Long-Term Surveillance Plan
MCL	maximum concentration limit
mg/L	milligrams per liter
NECA	Navajo Engineering and Construction Authority
NMED	New Mexico Environment Department
NRC	U.S. Nuclear Regulatory Commission
PL	photograph location
POC	point-of-compliance
POE	point of exposure
TDS	total dissolved solids
UBL	upper baseline limit
UMTRCA	Uranium Mill Tailings Radiation Control Act of 1978 (88 USC 7901, *et seq.*)
UNC	United Nuclear Corporation
USFS	U.S. Forest Service

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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 (LM) in 2011 at 19 uranium mill tailings disposal sites established under Title I of the Uranium Mill Tailings Radiation Control Act (UMTRCA) of 1978.[1] These activities verified that the UMTRCA Title I disposal sites remain in compliance with license requirements.

DOE operates 18 UMTRCA Title I sites under a general license granted by the U.S. Nuclear Regulatory Commission (NRC) in accordance with Title 10 *Code of Federal Regulations* Part 40.27 (10 CFR 40.27). As required under the general license, a long-term surveillance plan (LTSP) for each site was prepared by DOE and accepted by NRC. The Grand Junction, Colorado, Disposal Site, one of the 19 Title I sites, will not be included under the general license until the open, operating portion of the cell is closed. The open portion will be closed either when it is filled or in 2023. This site is inspected in accordance with an interim LTSP.

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

Annual site inspections and monitoring are conducted in accordance with site-specific 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 in accordance with the LTSP. LTSPs and site compliance reports are available on the Internet at http://www.lm.doe.gov/.

All of the sites require some degree of routine monitoring and maintenance, which may include groundwater and surface water monitoring, minor erosion control, vegetation and noxious weed control, fence and gate repairs, sign replacement, and minor trash removal. The following nonroutine activities[2] occurred in 2011:

- Lakeview, Oregon:
  - DOE continued riprap gradation monitoring to ensure that disposal cell erosion protection is adequate. Rock durability monitoring was integrated into the gradation monitoring.
- Rifle, Colorado:
  - DOE discontinued the land surveying of settlement plates and standpipes in 2011. This was done because surveys conducted between 2005 and 2010 indicated only negligible movement in the disposal cell cover (not in any particular direction). This decision was corroborated by a recent engineering evaluation, which concluded that the disposal cell

[1] Congress directed that the Moab, Utah, Processing Site be remediated under Title I of UMTRCA. This site eventually will become the 20th Title I disposal site.
[2] Nonroutine activities are activities implemented in response to changes in site conditions, regulatory setting, or management structure following a regulatory compliance review.

cover and side slopes are expected to remain stable based on current and projected future site conditions.

— DOE continues to remove and evaporate pore water from the disposal cell, a task that began in 2001 in response to exceeding the LTSP-required action level.

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

2011 Summary of UMTRCA Title I Site Actions and Issues

Site	Chapter	Page	Index No.	Actions and Issues
Ambrosia Lake, New Mexico	1	1–6 1–6	1A 1B	Groundwater monitoring. Installed new monitoring well.
Burrell, Pennsylvania	2	2–5 2–7	2A 2B	Maintenance: vegetation management plan. Groundwater monitoring.
Canonsburg, Pennsylvania	3	3–5 3–6 3–9	3A 3B 3C	Maintenance: noxious weed control and mowing of grass cell cover. Maintenance: noxious weed control and mowing along boundary fence. Groundwater monitoring frequency change recommendation.
Durango, Colorado	4	4–6 4–6 4–7	4A 4B 4C	Maintenance: repair pond liner. Maintenance: repair shed door. Groundwater monitoring.
Falls City, Texas	5	5–6 5–6	5A 5B	Lock and gate removed from County Road 202. Groundwater monitoring.
Grand Junction, Colorado	6	6–7	6A	Groundwater monitoring.
Green River, Utah	7	7–6	7A	Groundwater monitoring.
Gunnison, Colorado	8	8–2 8–6	8A 8B	Maintenance: minor fence repair. Groundwater monitoring.
Lakeview, Oregon	9	9–6	9A	Evaluation: riprap gradation and durability monitoring.
Lowman, Idaho	10	10–2 10–2	10A 10B	Maintenance: perimeter sign repair. Maintenance: vegetation management.
Maybell, Colorado	11	11–2 11–2 11–6	11A 11B 11C	Maintenance: minor fence repair Maintenance: perimeter sign replacement. Maintenance: vegetation management.
Mexican Hat, Utah	12	12–7	12A	Seep monitoring.
Naturita, Colorado	13	13–2 13–8	13A 13B	Maintenance: minor fence repair. Groundwater monitoring.
Rifle, Colorado	14	14–6 14–8 14–9	14A 14B 14C	Termination of annual survey of settlement plates and standpipes. Disposal cell pore water monitoring. Termination of MW–03 water quality monitoring.
Salt Lake City, Utah	15	15–5	15A	Riprap degradation monitoring.
Shiprock, New Mexico	16	16–5	16A	Maintenance: repair gaps in fence and gate.
Slick Rock, Colorado	17	17–2	17A	Maintenance: perimeter sign replacement.
Tuba City, Arizona	19	19–6	19A	Groundwater monitoring.

1.0 Ambrosia Lake, New Mexico, Disposal Site

1.1 Compliance Summary

The Ambrosia Lake, New Mexico, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site was inspected on August 24, 2011. The disposal cell was in excellent condition. No maintenance needs or cause for a follow-up or contingency inspection was identified.

1.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the *Long-Term Surveillance Plan for the Ambrosia Lake, New Mexico, Disposal Site* (DOE/AL/62350–211, Rev. 1, U.S. Department of Energy [DOE], July 1996; LTSP) and in procedures established by DOE to comply with the requirements of Title 10 *Code of Federal Regulations* Part 40.27 (10 CFR 40.27). Table 1–1 lists these requirements.

Table 1–1. License Requirements for the Ambrosia Lake Disposal Site

Requirement	Long-Term Surveillance Plan	This Report
Annual Inspection and Report	Section 6.0	Section 1.3.1
Follow-Up or Contingency Inspections	Sections 6.0 and 7.0	Section 1.3.2
Routine Maintenance and Repairs	Section 8.0	Section 1.3.3
Groundwater Monitoring	Section 5.0	Section 1.3.4
Corrective Action	Section 9.0	Section 1.3.5

Institutional Controls—The 288-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 40.27) in 1998. DOE is the licensee and, in accordance with the requirements for UMTRCA Title I 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, warning/no-trespassing signs along the property boundary, and a locked gate at the entrance to the site access road. Verification of these institutional controls is part of the annual inspection.

Inspectors found no evidence that these institutional controls were ineffective or violated.

1.3 Compliance Review

1.3.1 Annual Inspection and Report

The site, north of Grants, New Mexico, was inspected on August 24, 2011. The results of the inspection are described below. Figure 1–1 shows features and photograph locations (PLs) mentioned in this report. Numbers in the left margin of this report refer to items summarized in the "Executive Summary" table.

1.3.1.1 Specific Site-Surveillance Features

Access Road, Entrance Sign, and Perimeter Signs—Access to the site is along a gravel road that crosses private property and leads to the site for approximately 1 mile from New Mexico State Highway 509. There is a locked gate across this road where it leaves Highway 509 because the road continues to private mining and grazing interests that lie east of the site. Numerous locks are connected in series to allow other users to pass through the gate. The access road continues through the DOE-owned property along the southern boundary of the site. DOE has been granted permanent access to the site.

The entrance sign and all perimeter signs were in good condition (PL–1). Posts for perimeter signs P1 through P15 include mining restriction-area warning signs.

Site Markers and Monuments—The two granite site markers, three combined survey and boundary monuments, and five additional boundary monuments were all undisturbed and in excellent condition (PL–2).

Monitoring Wells—Monitoring well 0409, installed in May 2001, was in good condition. The other two wells on the site (0675 and 0678) were also in good condition. Gully formation adjacent to monitoring well 0678 appears to be stabilizing, and the well is not threatened.

Mine Vents—A mine vent shaft, associated with an abandoned underground mine, is within the site boundary in the northern portion of the site. The vent has a casing, which rises approximately 3 feet above the ground, and a spot-welded cover. The vent was secure at the time of the inspection. Inspectors will continue to monitor the condition of the vent to ensure that the closure remains secure.

1.3.1.2 Transects

To ensure a thorough and efficient inspection, the site is divided into four areas referred to as "transects": (1) the riprap-covered top of the disposal cell, (2) the riprap-covered side slopes and apron of the cell, (3) the graded and revegetated area between the disposal cell and the site perimeter, and (4) the outlying area.

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

Top of Disposal Cell—The 91-acre disposal cell was completed in 1994. The basalt riprap-covered top of the disposal cell was in excellent condition. There was no evidence of cracking, slumping, or erosion (PL–3). No deep-rooted shrubs were present at the time of the inspection.

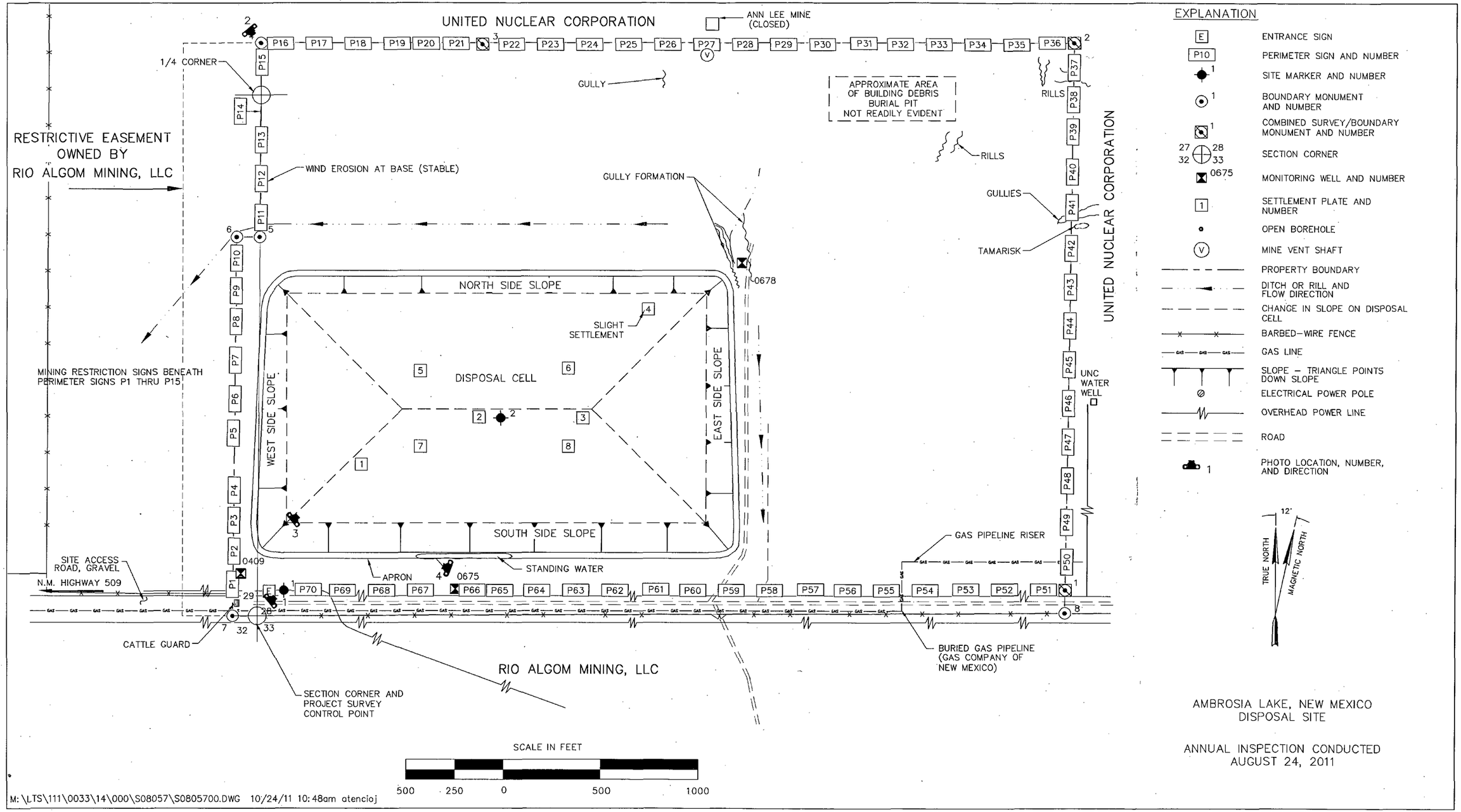

Figure 1–1. 2011 Annual Compliance Drawing for the Ambrosia Lake Disposal Site

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A shallow depression around settlement plate SP–4, near the northeast corner of the disposal cell cover, was first noted during the 1997 inspection and continued to grow in depth and area in subsequent years. The depression was repaired in August 2005. Surveys of the eight settlement plates were conducted in September 2005, September 2006, and September 2007 to monitor for continued settlement at SP–4. The surveys indicated no significant changes at the repaired location. Additional surveys will be conducted only if significant settlement is observed. Visual observations during the 2011 inspection indicate that no additional settlement has occurred since the last inspection. This location will continue to be monitored.

Scattered annual weeds and perennial grasses and forbs are growing on the disposal cell cover. No deep-rooted shrubs were present on the cell cover at the time of the inspection.

Side Slopes and Apron—The basalt riprap-covered side slopes and apron were in excellent condition and showed no evidence of cracking, settling, slumping, or erosion. Standing water from recent rainfall events was present in the apron along the south side of the disposal cell (PL–4). This water likely dissipates both through evaporation and through infiltration into the underlying alluvium.

Graded and Revegetated Site Area—In general, site vegetation appeared to be healthy. However, some areas are windswept and have little growth. Revegetation has not progressed sufficiently to sustain grazing.

Rills and gullies within the DOE property north and east of the disposal cell have been monitored for several years. These erosional features, which appear to be stabilizing, do not threaten the disposal cell's performance or integrity. The features are sufficient distances from the disposal cell, with headward erosion occurring away from the cell and no significant sedimentation.

The access road and a power line cross the site near and parallel to the site's southern boundary. In addition, there is a gas pipeline riser in the southeastern part of the site. This riser is associated with a buried gas pipeline along the southern edge of the site. No changes or disturbances associated with these features were observed.

Outlying Area—The area within 0.25 mile of the site boundary was inspected. A water supply well, owned by United Nuclear Corporation (UNC) and located near the eastern property boundary, was upgraded and reactivated by UNC during the previous year. This work did not impact the site. There were no other activities in the immediate vicinity that would impact the site.

1.3.2 Follow-Up or Contingency 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 or contingency inspections were required in 2011.

1.3.3 Routine Maintenance and Repairs

No routine maintenance or repairs were required in 2011.

1.3.4 Groundwater Monitoring

In accordance with the LTSP, groundwater monitoring is not required at this site because (1) the groundwater is heavily contaminated from underground uranium mining and naturally occurring mineralization, and (2) the uppermost aquifer is of limited use due to its low yield. Consequently, NRC concurred in the application of supplemental standards at the site and the exemption of both compliance and performance groundwater monitoring. However,
1A at the request of the New Mexico Environment Department (NMED), DOE conducts groundwater monitoring as a best management practice.

Monitoring well 0675 is completed in weathered Mancos Shale just below its contact with the overlying alluvium, and monitoring well 0678 is completed in a sandstone unit (Tres Hermanos B unit) of the Mancos Shale. DOE originally agreed to sample these locations once every third year for 30 years; however, annual sampling was initiated in November 2010 at the request of NMED. Monitoring results are provided to NMED and NRC.

1B DOE installed a new monitoring well (0409) in May 2011 in support of a regional groundwater investigation being conducted by NMED. The well, located on DOE property adjacent to the southwest corner of the disposal cell, is completed in an alluvium-filled paleochannel. The bottom of the well screen is at the contact between the alluvium and sandstone of the Tres Hermanos C unit of the Mancos Shale. The well was dry at the time of construction and was also dry when checked in July 2011. The lack of groundwater in the well suggests that groundwater is not leaving the southwest portion of the site via alluvium.

1.3.5 Corrective Action

Corrective action is taken to correct out-of-compliance or hazardous conditions that create a potential health and safety problem or that may affect the integrity of the disposal cell or compliance with 40 CFR 192.

No corrective action was required in 2011.

1.3.6 Photographs

Table 1–2. Photographs Taken at the Ambrosia Lake Disposal Site

Photograph Location Number	Azimuth	Description
PL–1	50	Entrance sign and site marker SMK–1.
PL–2	140	Boundary monument BM–4.
PL–3	50	View northeast across the disposal cell cover.
PL–4	290	Standing water in the south apron.

AMB 8/2011. PL–1. Entrance sign and site marker SMK–1.

AMB 8/2011. PL–2. Boundary monument BM–4.

AMB 8/2011. PL–3. View northeast across the disposal cell cover.

AMB 8/2011. PL–4. Standing water in the south apron.

2.0 Burrell, Pennsylvania, Disposal Site

2.1 Compliance Summary

The Burrell, Pennsylvania, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site, inspected on October 4, 2011, was in excellent condition. The disposal cell and all associated drainage diversion structures were in good condition and functioning as designed. No cause for a follow-up or contingency inspection was identified.

An effective vegetative management program that aligns with requirements set forth within the *Long-Term Surveillance Plan for the U.S. Department of Energy Burrell Vicinity Property, Blairsville, Pennsylvania* (GJO–2002–331–TAR, U.S. Department of Energy [DOE], revised April 2000; LTSP) has proven successful. One technique includes seeding specific areas to deter the growth of invasive Japanese knotweed, an eco-friendly approach to reducing the amount of herbicide application.

Groundwater monitoring is required every 5 years and was last conducted in October 2009. The next sampling event is scheduled for 2014. Past monitoring results have indicated that the disposal cell is not releasing any contamination and is performing as designed.

2.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the LTSP and in procedures established by DOE to comply with the requirements of Title 10 *Code of Federal Regulations* Part 40.27 (10 CFR 40.27). Table 2–1 lists these requirements.

Table 2–1. License Requirements for the Burrell Disposal Site

Requirement	Long-Term Surveillance Plan	This Report
Annual Inspection and Report	Section 3.3	Section 2.3.1
Follow-Up or Contingency Inspections	Section 3.5	Section 2.3.2
Routine Maintenance and Repairs	Section 3.6	Section 2.3.3
Groundwater Monitoring	Section 3.7	Section 2.3.4
Corrective Action	Section 3.6.3	Section 2.3.5

Institutional Controls—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 along the property boundary, and locked gates.

The 72-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 40.27) in 1994. DOE is the licensee and, in accordance with the requirements for UMTRCA Title I sites, is responsible for the custody and long-term care of the site.

With the exception of bullet holes in several of the site perimeter signs, inspectors found no evidence that these institutional controls were ineffective or violated.

2.3 Compliance Review

2.3.1 Annual Inspection and Report

The site, east of Blairsville, Pennsylvania, was inspected on October 4, 2011. The results of the inspection are described below. Figure 2–1 shows features and photograph locations (PLs) mentioned in this report. Numbers in the left margin of this report refer to items summarized in the "Executive Summary" table.

2.3.1.1 Specific Site-Surveillance Features

Site Access, Fence, Gates, and Signs—Access to the site is off Strangford Road on an access road that lies within a perpetual right-of-way through private property (Tract 201–E). The access road continues across DOE-leased land and crosses the Norfolk Southern railroad tracks to the entrance gate at the east end of the site. Authorized personnel who need access to the railroad tracks and to the several natural-gas wells nearby also use the road.

The chain-link security fence, replaced in 2007, remains in excellent condition, with the exception of a bent rail on the south fence (PL–1). The fence rail was damaged when a tree recently fell across it. The tree was safely removed from the fence shortly after being discovered. The top rail of the fence needs to be replaced. A vegetation-free corridor remains established along the fence line (PL–2). The entrance gate and four personnel gates were in good condition. Several of the 17 perimeter signs mounted on the security fence have been damaged by bullet holes, but they remain serviceable (PL–3).

Site Markers and Monuments—The site has nine markers (a site marker and eight erosion control markers). Site marker SMK–1 was in excellent condition. All eight erosion control markers were located during the inspection, and in excellent condition. Erosion control marker EC–7 was recently replaced. In response to recommendations made in the 2010 inspection, dense vegetation was cleared from all of the erosion control markers, making them easy to locate during this year's inspection.

The site has 10 monuments (three survey monuments and seven boundary monuments). Survey monument SM–102 could not be located. A global positioning system will be used during next year's inspection to relocate the monument. Of the seven boundary monuments, six were in good condition. Boundary monument BM–5 was in the process of being replaced.

Monitoring Wells—The site has four pairs of monitoring wells. Each pair consists of a shallow (alluvial) completion and a deeper (bedrock) completion. Monitoring wells were not inspected in 2010. The water sampling crew last inspected them in 2009. The monitoring wells will be inspected again when they are sampled in 2014. All wells encountered during the 2010 site inspection were locked and secured. All of the outer protective casings had been recently painted and identified with brass identification tags (PL–4).

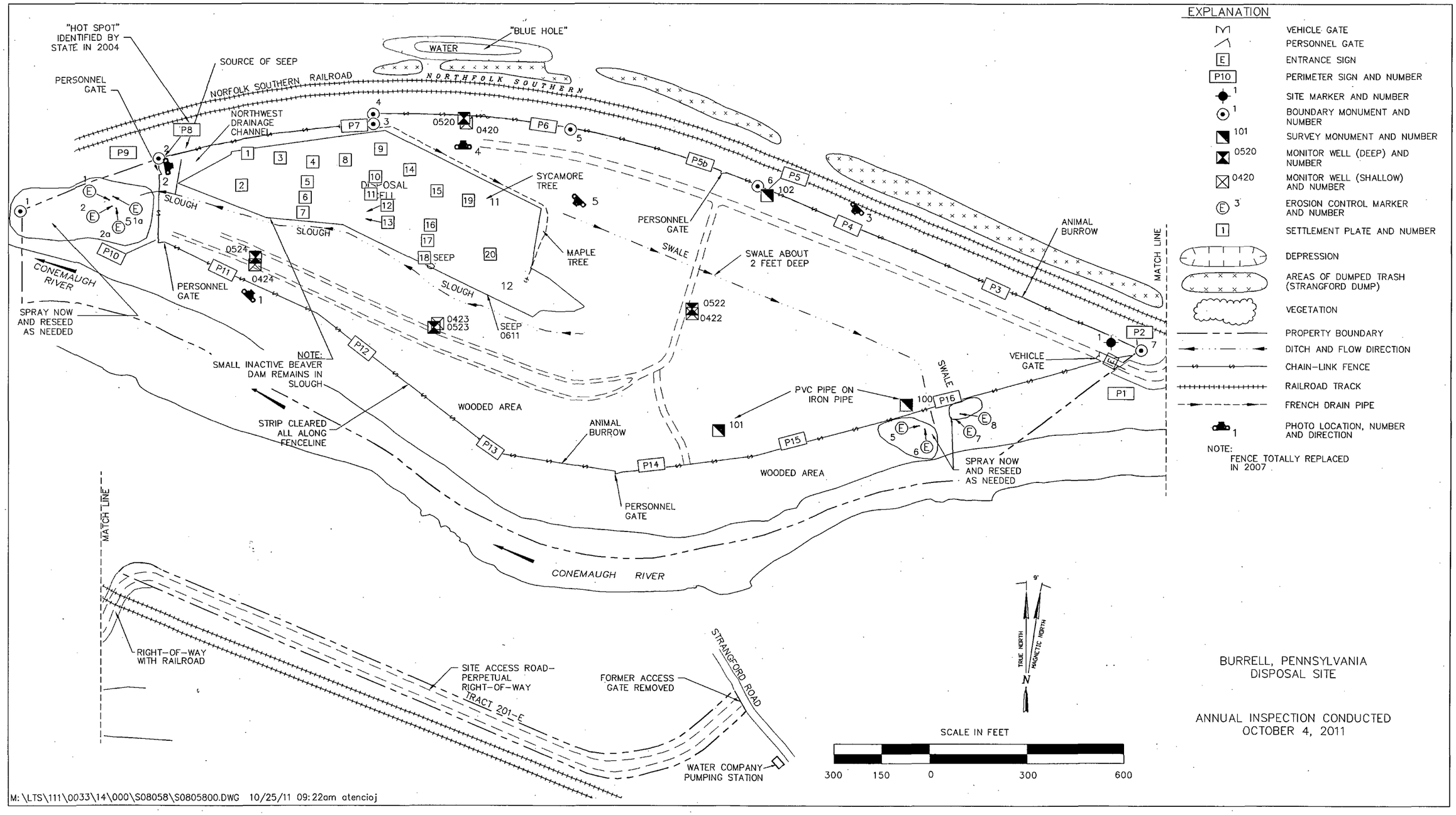

Figure 2–1. 2011 Annual Compliance Drawing for the Burrell Disposal Site

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2.3.1.2 Transects

To ensure a thorough and efficient inspection, inspectors divided the site into four areas called "transects": (1) the disposal cell, (2) the area between the disposal cell and site boundary, (3) the site perimeter, and (4) the outlying area.

The area inside each transect was inspected by walking a series of traverses. Within each transect, the inspectors examined specific site-surveillance features, drainage structures, and vegetation. Inspectors also looked for evidence of settlement, erosion, or other modifying processes that might affect the site's integrity or long-term performance.

Disposal Cell—The riprap-covered disposal cell was in excellent condition (PL–5). There were no indications of cell instability, such as slumping, bulging, or differential settlement. Rock quality was excellent; degradation of the limestone riprap was not evident.

Active control of vegetation on the cell cap has not been required since 2000. Past studies at the site concluded that deep-rooted plant growth on the cell puts the public and the environment at no greater risk of exposure to contaminants within the disposal cell. Vegetation growth on the cell might actually enhance cover performance through evapotranspiration. These studies further concluded that plant growth would not impede the proper functioning of the radon barrier. NRC concurred on the revised LTSP, which no longer requires active control of deep-rooted vegetation on the cell cover. NRC has suggested that DOE reevaluate the effects of vegetation on cover performance in 10 to 20 years to confirm performance parameters and predictions. The timing for this assessment is, therefore, between 2007 and 2017.

In 2008, a vegetation management plan for the site was issued. Although vegetation is allowed to grow on the disposal cell, the vegetation plan directs that the cell cap be sprayed for noxious
2A weeds. Through spraying efforts, the presence of Japanese knotweed on the cell cap and side slopes is declining, but continued efforts are needed. Deep-rooted woody species continue to proliferate on the cell cap (i.e., sycamore, tree of heaven, elm, tulip poplar, black locust, catalpa, maple). As the trees mature, there is some concern that uprooting could damage the disposal cell cover, which would require repair. Another concern with the continued growth of vegetation on the cell cap is the ability to observe potential indications of cell instability (e.g., slumping, bulging, differential settlement).

No active seeps were found along the south slope of the disposal cell during the site inspection.

Area Between the Disposal Cell and Site Boundary—The area surrounding the disposal cell and inside the security fence was cleared during reclamation and is now covered by thick grass and reestablishing hardwood trees. Periodic mowing maintains access to monitoring wells. The area east of the cell remains grassland.

An effective vegetative management program that aligns with requirements set forth within the LTSP has proven successful. One technique includes seeding specific areas to deter the growth of invasive Japanese knotweed, an eco-friendly approach to reducing the amount of herbicide application.

A French drain was installed along the base of the north side slope of the disposal cell in 1998 to prevent water from ponding next to the cell. Inspection findings dating back to 1998 indicate

that, before the French drain was installed, rainwater and snowmelt would collect off the north side of the disposal cell. Saturated soil and wetland vegetation (cattails and purple loosestrife) were present. At the same time that wetland vegetation was growing on the north slope of the disposal cell, seeps were occurring on the south slope of the disposal cell. It was thought that the source of water for the seeps could be the ponded water north of the cell. No water has been observed flowing from the seeps on the south slope of the disposal cell since the French drain was installed. In spring 2010, though, a new seep was observed on the south slope (seep 0611). The seep was sampled. No maximum concentration limit exceedances were measured in the sample. Inspectors in 2010 observed cattails and purple loosestrife growing once again between the north slope of the disposal cell and the location of the French drain, indicating that the area might not be draining efficiently. This area was revisited during the 2011 inspection and appeared unchanged. Inspection of the outlet to the French drain indicates that the drain outlet is clear of obstructions.

A small, inactive beaver dam remains within the slough at the base of the south slope of the disposal cell, and water continues to collect behind it. The water level behind the dam this year was higher than in previous years due to recent rains but still is not high enough to saturate the tailings or impact the integrity of the disposal cell. Therefore, DOE has elected not to remove the dam. Instead, DOE will continue to monitor the dam and its possible impacts on the disposal site.

Site Perimeter—A known seep along the north security fence, about 60 feet east of perimeter sign P8 and west of the disposal cell, was flowing at the time of the 2011 inspection. This area will continue to be monitored for seeps to determine if they threaten the disposal cell's integrity. Conceivably, the seeps also could destabilize the nearby railroad embankment. The water for this seep may be coming from other seeps on the bluffs, above and just north of the railroad tracks.

Outlying Area—The area beyond the site boundary for a distance of 0.25 mile was visually examined for signs of erosion, development, and other changes that might affect the site. North of the site, a dirt road parallels the railroad tracks and provides access to a long, narrow, wooded area that has been used as an illegal dump over the years. In 2011, no new trash was observed. The dump is not a threat to the disposal site but is an indication of the overall level of activity near the disposal site and may be a predictor of vandalism. For this reason, the area will continue to be monitored. All other areas around the site remained unchanged.

2.3.2 Follow-Up or Contingency Inspections

DOE will conduct follow-up inspections if (1) an annual inspection or other site visit reveals a condition that must be reevaluated during a return to the site, or (2) a citizen or outside agency notifies DOE that conditions at the site are substantially changed.

No follow-up or contingent inspections were required in 2011.

2.3.3 Routine Maintenance and Repairs

In 2011, noxious and invasive weed control continued, and the routes to the monitoring wells were mowed. Minor maintenance was conducted at the monitoring wells. Protective casings were painted and brass identification tags installed. Two broken or missing boundary monuments and one erosion control marker were replaced.

2.3.4 Groundwater Monitoring

In accordance with the LTSP, DOE monitors groundwater at the site as a best management practice to evaluate the disposal cell's performance. The groundwater monitoring network consists of eight wells (in four pairs) that are monitored for four target analytes: lead, molybdenum, selenium, and uranium. The revised LTSP stipulates that monitoring be performed every 5 years. DOE last conducted monitoring in 2009 (presented in the 2010 report). The results indicated that there was no contamination being released and that the disposal cell is performing as designed. The next monitoring is scheduled for October 2014.

2B

2.3.5 Corrective Action

Corrective action is taken to correct out-of-compliance or hazardous conditions that create a potential health and safety problem or that may affect the integrity of the disposal cell or compliance with 40 CFR 192.

No corrective action was required in 2011.

2.3.6 Photographs

Table 2–2. Photographs Taken at the Burrell Disposal Site

Photograph Location Number	Azimuth	Description
PL–1	45	Damage to perimeter fence.
PL–2	80	Vegetation cleared from perimeter fence.
PL–3	225	Bullet holes in perimeter fence sign P3.
PL–4	NA	Brass ID tag, top of monitoring well 0520.
PL–5	225	Northeast corner of disposal cell.

BUR 10/2011. PL–1. Damage to perimeter fence.

BUR 10/2011. PL–2. Vegetation cleared from perimeter fence.

BUR 10/2011. PL–3. Bullet holes in perimeter fence sign P3.

BUR 10/2011. PL–4. Brass ID tag, top of monitoring well 0520.

BUR 10/2011. PL–5. Northeast corner of disposal cell.

3.0 Canonsburg, Pennsylvania, Disposal Site

3.1 Compliance Summary

The Canonsburg, Pennsylvania, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site was inspected on October 4, 2011. The disposal cell and all associated surface water diversion and drainage structures were in excellent condition and functioning as designed. No other maintenance needs or cause for a follow-up or contingency inspection was identified.

Vegetation management continues to be successfully implemented. Control of invasive species identified through physical site inspections, combined with mowing the grassland for weed control, has proven to be effective.

DOE conducts groundwater monitoring at the site annually. October 2010 monitoring results, which were not available in time to be included in the 2010 compliance report, are provided in this report. Results from 2010 demonstrate continued compliance with established site standards. October 2011 monitoring results are not available for this report and will be provided in the compliance report for 2012.

In accordance with the *Long-Term Surveillance Plan for the U.S. Department of Energy Canonsburg Uranium Mill Tailings Disposal Site, Canonsburg, Pennsylvania* (LMS/CAN/S00404-0.0, U.S. Department of Energy [DOE], revised September 22, 2008; LTSP), a groundwater monitoring assessment was conducted following the collection of samples in fall 2010 to recommend whether to continue, modify, or terminate the groundwater monitoring program. The assessment, which is currently undergoing U.S. Nuclear Regulatory Commission (NRC) review, concluded that the compliance strategy for the site remains effective, and that the low and slowly changing concentrations of uranium in both groundwater and surface water warrant a monitoring change. The assessment recommends that following the collection of samples in 2011, the frequency of monitoring be reduced from annual to once every 5 years.

3.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the LTSP and in procedures established by DOE to comply with the requirements of Title 10 *Code of Federal Regulations* Part 40.27 (10 CFR 40.27). Table 3–1 lists these requirements.

Table 3–1. License Requirements for the Canonsburg Disposal Site

Requirement	Long-Term Surveillance Plan	This Report
Annual Inspection and Report	Section 3.3	Section 3.3.1
Follow-Up or Contingency Inspections	Section 3.4	Section 3.3.2
Routine Maintenance and Repairs	Section 3.5	Section 3.3.3
Groundwater and Surface Water Monitoring	Section 3.7	Section 3.3.4
Corrective Action	Section 3.6	Section 3.3.5

Institutional Controls—Institutional controls at the site, as defined by DOE Policy 454.1, consist of federal ownership of the property, a site security fence, warning/no-trespassing signs on the security fence, and a locked gate at the entrance to the site. Verification of these institutional controls is part of the annual inspection.

The 34.2-acre site is owned by the United States of America and was accepted under the NRC general license (10 CFR 40.27) in 1996. DOE is the licensee and, in accordance with the requirements for UMTRCA Title I sites, is responsible for the custody and long-term care of the site.

Institutional controls also apply to Area C and former Tract 117, which are southeast of Strabane Avenue. Area C (3.1 acres) was sold and transferred in 2006, and former Tract 117 (0.431 acre) was sold and transferred in 2009; the same private party purchased both. DOE and the Commonwealth of Pennsylvania complied with restrictions on parcel transfers stipulated in UMTRCA and the Cooperative Agreement between DOE and the Commonwealth. The deed for Area C and former Tract 117 establishes restrictions to limit excavation in the areas, prohibits the disturbance of the stream bank, maintains access for monitoring, and prevents the areas from being used for residential purposes. Inspectors found no evidence that these institutional controls were ineffective or violated.

Large piles of fill material have been placed on Area C by the property owner within the last year (photograph location [PL]–1). The placement of the fill does not violate any institutional controls connected with the property. A minimum of 20 feet of clearance is being maintained to DOE groundwater monitoring wells. Post-inspection discussions with the property owner indicate that the placement of additional fill material on the property is not anticipated at this time.

3.3 Compliance Review

3.3.1 Annual Inspection and Report

The site, between the communities of Canonsburg and Houston, Pennsylvania, was inspected on October 4, 2011. Figure 3–1 shows features and PLs mentioned in this report. Numbers in the left margin of this report refer to items summarized in the "Executive Summary" table.

3.3.1.1 Specific Site-Surveillance Features

Access, Gates, Fence, and Signs—Access to the site is directly from Strabane Avenue, a public right-of-way within the Borough of Canonsburg in Washington County, Pennsylvania. The security fence and all four site gates were in excellent condition. A vegetation-free buffer zone is being maintained around the entire site security fence (PL–2). The entrance sign and 11 perimeter signs were in good condition.

A small footbridge was installed north of the disposal cell in 2010, improving access to an unfenced portion of the site. The footbridge provides a safer way for the public to cross a riprap-lined diversion ditch. The footbridge was in excellent condition.

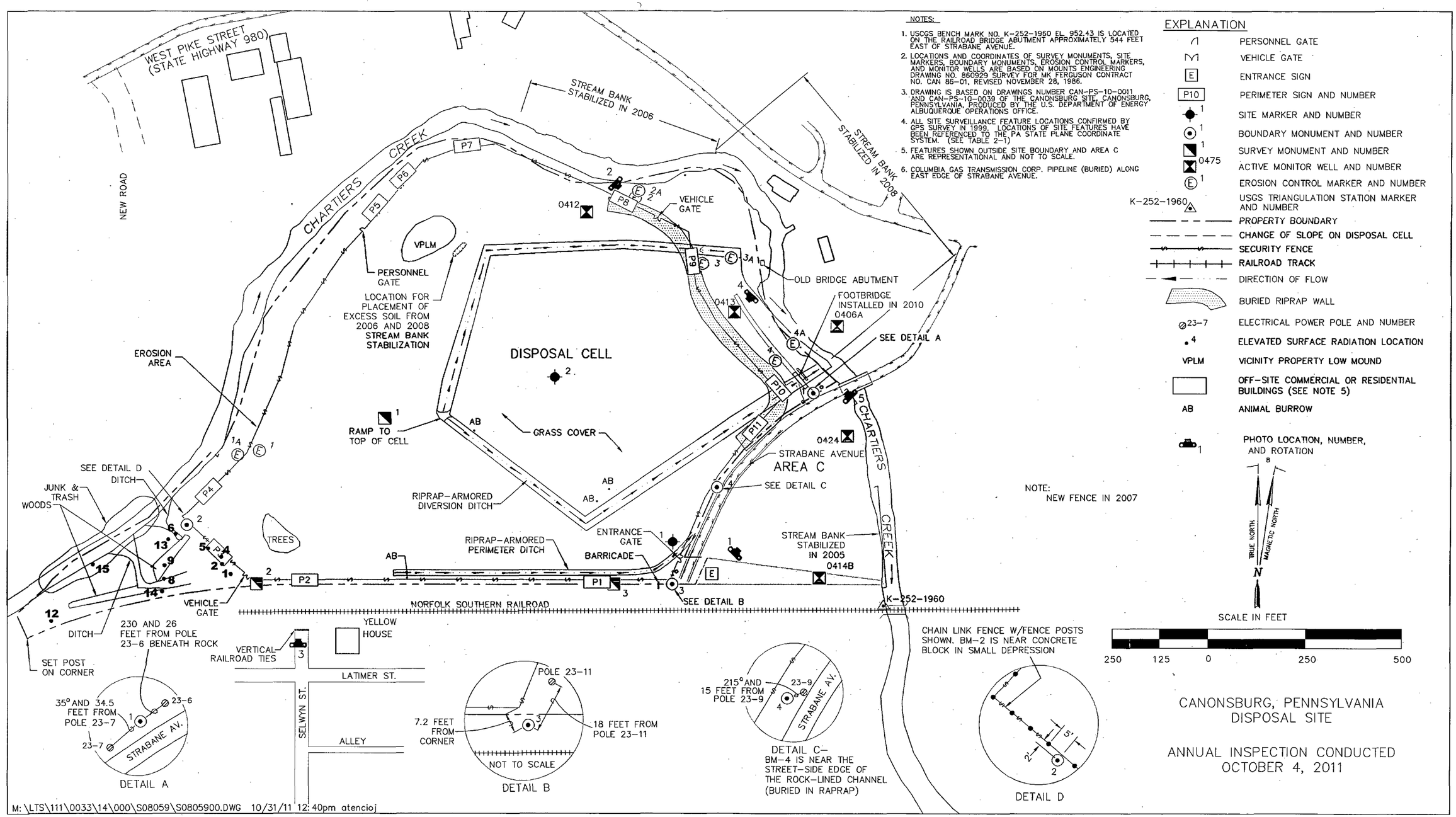

Figure 3–1. 2011 Annual Compliance Drawing for the Canonsburg Disposal Site

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Site Markers and Monuments—The site contains two site markers, eight erosion control markers, three survey monuments, and four boundary monuments.

All site markers and monuments are in excellent condition. Erosion control marker EC–4A was replaced just prior to this year's inspection. The original monument was lost several years ago to flooding along Chartiers Creek. Installation of a replacement marker was delayed to coincide with the completion of several stream bank stabilization projects in the area of the monument, including revegetation associated with those projects.

Monitoring Wells—The site's monitoring well network consists of five wells (0406A, 0412, 0413, 0414B, and 0424). The wells are inspected when they are sampled. Monitoring is usually scheduled to be conducted during the same week as the annual inspection, but this year the inspection schedule was accelerated and the sampling schedule was not.

All of the monitoring wells were in excellent condition. Monitoring well 0410 (a background well that was no longer used) was safely plugged and abandoned on September 12, 2011, in accordance with the Pennsylvania Water Well Drillers License Act (Act 610). The site of the abandoned well was in excellent condition (PL–3).

Several minor well maintenance tasks were safely completed in September 2011:

- Drain holes were installed in the protective casings of wells 0406A, 0412, and 0413.
- A brass identification tag was installed on well 0413.
- A concrete pad and protective bollards were installed at well 0413 (PL–4).
- Protective bollards were repaired or installed at wells 0414B and 0424.

3.3.1.2 Transects

To ensure a thorough and efficient inspection, inspectors divided the site into five areas called "transects": (1) the disposal cell, (2) the diversion channels and perimeter ditch, (3) the other areas on site, (4) the site perimeter, and (5) the outlying area.

The area inside each transect is inspected by walking a series of traverses. Within each transect, the inspectors examine specific site-surveillance features, drainage structures, and vegetation. Inspectors also look for evidence of settlement, erosion, or other modifying processes that might affect the site's integrity or long-term performance.

Disposal Cell—The grass-covered disposal cell surface was in excellent condition. There was no
3A evidence of slumping, settling, erosion, or other modifying processes. The grass was mowed in accordance with the LTSP. Noxious and invasive weeds continue to be successfully controlled through a combination of mowing and spot-spraying.

Animal burrows continue to be observed on the cell cover. Because a 36-inch-thick clay layer (radon barrier), an 18-inch-thick rock layer, and a 12-inch-thick topsoil layer overlie the buried tailings at this site, biointrusion into the tailings is unlikely, and such burrows should not pose a risk to the disposal cell's integrity or the public's health. The location, level of activity, and significance of burrows on the cell cover will continue to be monitored.

Diversion Channels and Perimeter Ditch—Diversion channels around the disposal cell and the perimeter ditch along the south side of the site are armored with riprap and were in good condition. No indications of diminished rock durability were noted. Woody vegetation in the diversion ditches continues to be controlled by cutting and spraying.

Other Areas on Site—Thick grass covers the area surrounding the disposal cell. The grass extends beyond the security fence to the north and east as far as the bank of Chartiers Creek. The grass inside the site boundary was in excellent condition. It is mowed in accordance with the
3B LTSP. Vegetation management continues to be successfully implemented. Control of invasive species identified through physical site inspections, combined with mowing the grassland for weed control, has proven to be effective.

Site Perimeter—Chartiers Creek is an active, meandering waterway that abuts the east, north, and west portions of the site. As a result of flooding in past years, particularly in 2004, the creek cut into the bank and resulted in a series of stream bank stabilization efforts. Both the Borough of Canonsburg and DOE funded the work. NRC representatives evaluated the plans and concurred on the work.

In 2001, the Chartiers Creek bank along Area C was reconstructed to stop slumping. In 2004, inspectors found that floodwater eroded the stream bank. Approximately 100 feet of reconstructed stream bank was damaged downstream from the Strabane Avenue Bridge, and 200 feet was damaged upstream from the railroad bridge. Floodwater cut laterally into the bank and scoured behind the riprap and fabric in places. DOE notified NRC, performed a follow-up inspection of the damage, and developed recommendations for creek bank repair along Area C. NRC concurred on the recommendations, and in April 2005 repairs were made (scoured areas along Area C were filled with riprap to restore the creek bank profile). Shrub and forb seed was broadcast to further stabilize the bank with vegetation. In 2006, the area between perimeter signs P7 and P8 was stabilized, and in 2008, the area between perimeter sign P8 and Strabane Avenue Bridge was stabilized. The stabilization work consisted of cutting back the slope of the creek bank and armoring the toe with riprap keyed into bedrock. Geotextile fabric underlies the riprap. Above the riprap, stabilization matting and new plantings of live fascines protect the slope.

In 2009, reseeding and the planting of large saplings (greater than 2 inches in diameter) took place within the area that was regraded in 2008 as part of a stream bank stabilization project. The trees were planted under a third-party DOE Office of Legacy Management grant. Several of the trees planted in 2009 did not survive and were replaced with healthy trees in 2010, which continue to do well. The stream bank stabilization project dramatically changed the look of the site. There is a sharp contrast between the riprap-armored south bank of Chartiers Creek (where vegetation growth is managed) and the unarmored north bank (where vegetation growth is not managed) (PL–5).

Outlying Area—The predominant land use near the site is residential and commercial. The area outward, for a distance of approximately 0.25 mile, was visually inspected. No new development or changes in land use were observed that would affect the safety or security of the site.

It was noted during the inspection that large piles of fill material had been placed on Area C by the property owner. The placement of the fill does not violate any institutional controls connected with the property. A minimum of 20 feet of clearance is being maintained to DOE

groundwater monitoring wells. Post-inspection discussions with the property owner indicate that the placement of additional fill material on the property is not anticipated at this time.

In 2007, DOE conducted a radiological survey on a small portion of the site property that lies outside the perimeter fence southwest of the disposal cell. The survey was conducted to evaluate the potential for releasing this portion of the site for industrial reuse. The survey identified isolated radium-226 contamination in soil that exceeded UMTRCA standards for unrestricted use. DOE retains this portion of the site. Under the current property use, the radiological conditions do not pose unacceptable risk to personnel, and no corrective measures are required. DOE has added monitoring for disturbance of this area to inspection procedures. No disturbances were noted during this year's inspection.

3.3.2 Follow-Up or Contingency Inspections

DOE will conduct follow-up inspections if (1) an annual inspection or other site visit reveals a condition that must be reevaluated during a return to the site, or (2) a citizen or outside agency notifies DOE that conditions at the site are substantially changed.

No follow-up or contingency inspections were required in 2011.

3.3.3 Routine Maintenance and Repairs

In 2011, DOE controlled woody growth within the diversion channels, mowed grass on and adjacent to the disposal cell, cleared vegetation from the perimeter fence, sprayed noxious and invasive weeds, plugged and abandoned an unused groundwater monitoring well, and performed routine maintenance at the remaining five groundwater monitoring wells, including installing drain holes in the protective casings, installing identification tags, installing concrete pads, and installing or repairing protective bollards.

3.3.4 Groundwater and Surface Water Monitoring

DOE monitors groundwater and surface water at the site to comply with the requirements in the revised LTSP. The revised LTSP combines the objectives of both the original LTSP (issued in 1995) and the *Ground Water Compliance Action Plan and Application for Alternative Concentration Limits for the Canonsburg, Pennsylvania, UMTRA Project Site* (U0035901, DOE, February 2000; GCAP). Monitoring prescribed in the original LTSP was a best management practice because NRC determined that cell performance monitoring to ensure compliance with remedial actions discussed under Subpart A of 40 CFR 192 was not required since the disposal cell's design was adequate to provide long-term protection of human health and the environment. The GCAP required monitoring for a period of no less than 5 years (through 2004) and up to 30 years (through 2029, which is the estimated time for any contamination to naturally attenuate). This monitoring period was established to ensure compliance with Subpart B of 40 CFR 192, which applies to contamination related to legacy uranium-processing sites. The Subpart B protection strategy is no remediation in conjunction with the application of an alternate concentration limit (ACL) for uranium.

The objectives of groundwater monitoring under the revised LTSP are to (1) evaluate downgradient contaminant trends in groundwater in the shallow unconsolidated materials and in

surface water, (2) demonstrate that concentrations of uranium at point-of-compliance (POC) locations are decreasing as predicted and that the system remains in compliance with the GCAP, and (3) ensure that remedial actions at the site and Area C continue to protect human health, safety, and the environment. The ACL for uranium is 1.0 milligram per liter (mg/L) at POC wells (0412, 0413, and 0414B). The U.S. Environmental Protection Agency maximum concentration limit (MCL) for uranium is 0.044 mg/L (40 CFR 192, Subpart A, Table 1). The uranium limit established for the point of exposure (POE) in Chartiers Creek is 0.01 mg/L (surface location 0602).

The monitoring network consists of five wells (0406a, 0412, 0413, 0414B, and 0424) completed in the uppermost aquifer (shallow unconsolidated materials), and one surface water location in Chartiers Creek (0602). Routine field measurements are collected, water levels measured, and uranium concentrations determined annually.

DOE considers the risk associated with uranium in groundwater within the unconsolidated materials and shallow bedrock (defined as the uppermost aquifer for regulatory purposes) beneath the site to be negligible because neither is considered a viable aquifer, from a water-resource perspective, even though the zone is capable of discharging to surface water (Appendix A to 10 CFR 40). Because the materials are not ideal for aquifer formation and because the source of recharge to the shallow units is minimal, sustained yield to a well from these units would be limited. The shallow groundwater is not used as a drinking water source in the area although some domestic water is derived from a few private wells that extend deeper than 100 feet.

Institutional controls, in the form of government ownership of the site, prevent access to the groundwater directly beneath the site. NRC concurred on deleting groundwater use restrictions for Area C in 2003. Most of the residents in the area are connected to a municipal water system, which is supplied by surface water reservoirs upgradient of the site. Chartiers Creek, the discharge point for the shallow groundwater beneath the site, is not a source of potable water. Additionally, uranium concentrations reported from samples collected from the creek are near the detection limit. Therefore, site-related concentrations do no pose an unacceptable risk to human health and the environment.

Monitoring Results—DOE conducted groundwater monitoring in October 2010, and results were not available in time to be included in the 2010 compliance report. Therefore, the results from 2010 are presented in this report. DOE also conducted groundwater monitoring in October 2011. Results from October 2011 are not available for this report, but they will be provided in the 2012 compliance report.

Analytical results for groundwater and surface water monitoring are presented below. Time-concentration plots for uranium, from 1995 through 2010, are shown in Figure 3–2 for groundwater and in Figure 3–3 for surface water. The results of the 2010 monitoring demonstrate continued compliance with established site standards.

Groundwater—Uranium concentrations in 2010 were considerably below the established ACL (Figure 3–2). With the exception of monitoring wells 0412 and 0413, uranium concentrations in 2010 also were below the MCL.

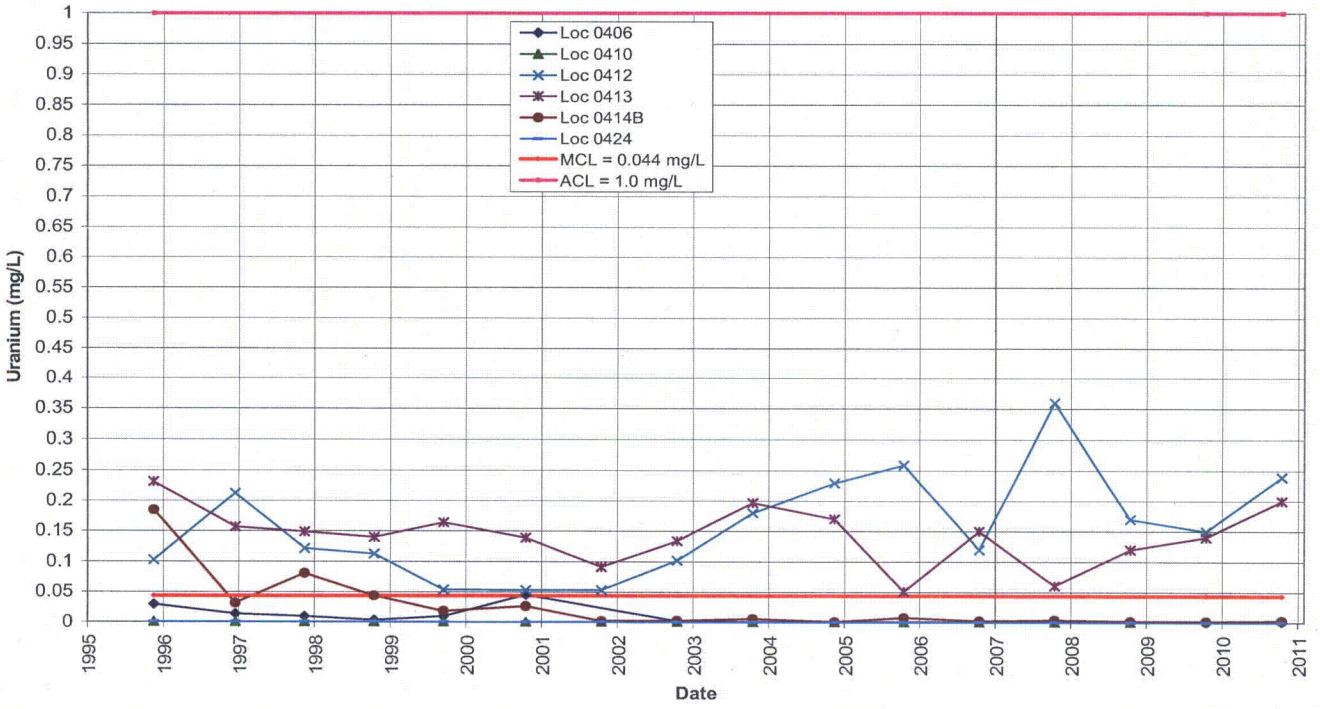

Figure 3–2. Time-Concentration Plot of Uranium in Groundwater at the Canonsburg Disposal Site

Surface Water—Only one surface water location (0602) is sampled under the revised LTSP. The uranium concentration of surface water at location 0602 in 2010 remained below the target concentration of 0.01 mg/L (Figure 3–3).

Evaluation of Monitoring Efforts—In 2011, DOE evaluated the groundwater and surface water monitoring program at the site, as required by the LTSP, to recommend whether to continue, modify, or terminate monitoring efforts. Five additional years of monitoring data (2006 through 2010) were added to the previous data set (1986 through 2005). The assessment concluded that:

- Groundwater and surface water uranium concentrations remain well below site ACLs, resulting in no adverse impact at the POE in Chartiers Creek. Therefore, the compliance strategy continues to be protective of human health and the environment.
- Water levels measured at the site are steady and within the historical range.
- A monitoring change is warranted due to the low and slowly changing concentrations of uranium in both groundwater and surface water.

3C The assessment recommended that following the collection of samples in 2011, the frequency of monitoring at the site be reduced from annual to once every 5 years for cell performance purposes. The assessment is currently undergoing NRC review.

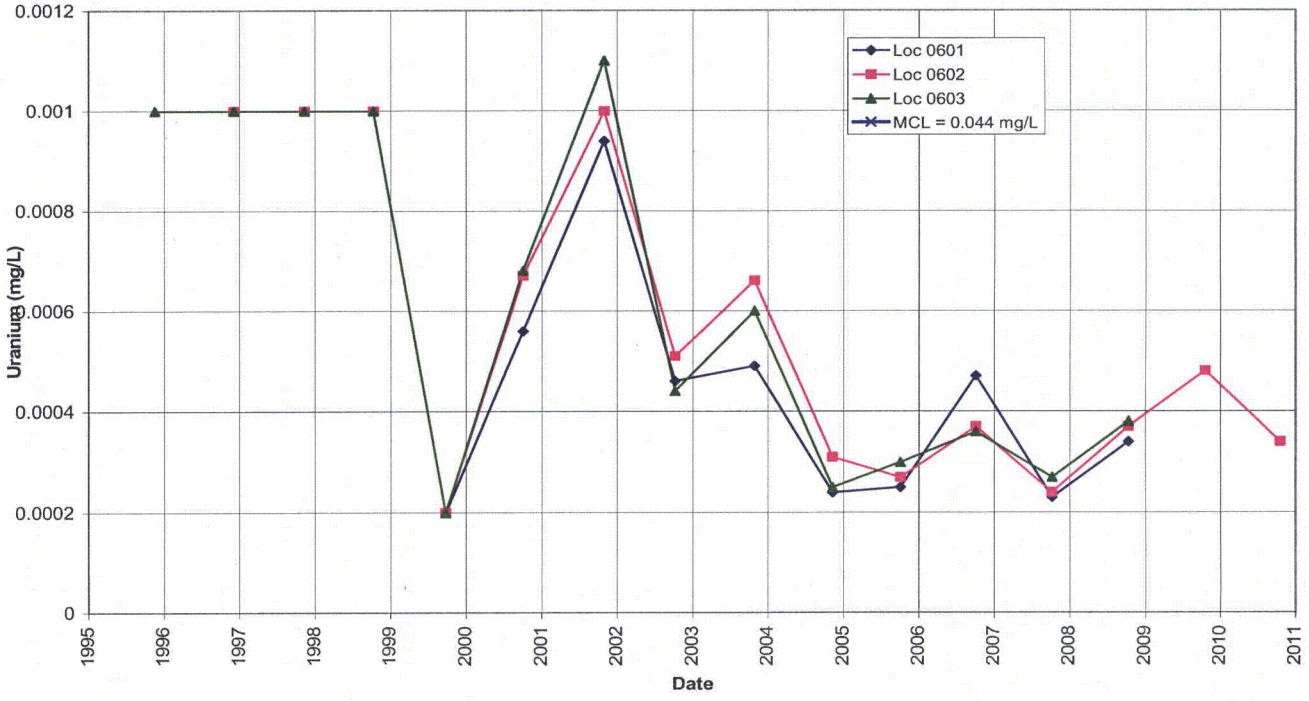

Figure 3–3. Time-Concentration Plot of Uranium in Surface Water at the Canonsburg Disposal Site

3.3.5 Corrective Action

Corrective action is taken to correct out-of-compliance or hazardous conditions that create a potential health and safety problem or that may affect the integrity of the disposal cell or compliance with 40 CFR 192.

No corrective action was required in 2011.

3.3.6 Photographs

Table 3–2. Photographs Taken at the Canonsburg Disposal Site

Photograph Location Number	Azimuth	Photograph Description
PL–1	45	Fill material on Area C property.
PL–2	135	Vegetation-free corridor along base of perimeter fence.
PL–3	360	Prior location of monitoring well 0410.
PL–4	135	Monitoring well 0413.
PL–5	215	Contrast between riprap stream bank, where vegetation is managed, and non-riprap stream bank, where vegetation is not managed.

CAN 10/2011. PL–1. Fill material on Area C property.

CAN 10/2011. PL–2. Vegetation-free corridor along base of perimeter fence.

CAN 10/2011. PL–3. Prior location of monitoring well 0410.

CAN 10/2011. PL–4. Monitoring well 0413.

CAN 10/2011. PL–5. Contrast between riprap stream bank, where vegetation is managed, and non-riprap stream bank, where vegetation is not managed.

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4.0 Durango, Colorado, Disposal Site

4.1 Compliance Summary

The Durango, Colorado, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site was inspected on May 31, 2011. The disposal cell and all associated surface water diversion and drainage structures were in good condition and functioning as designed. The water level in the disposal cell has dropped, which satisfies criteria for the permanent closure of the transient drainage water collection and treatment system. The retention pond contains precipitation and transient drainage water from the disposal cell; this water is being pumped out and then dispersed, through drip lines, onto the pond side slopes to enhance evaporation. A tear discovered in the pond liner during the inspection was repaired on July 27, 2011. No other maintenance needs or cause for a follow-up or contingency inspection was identified.

Trespassing and vandalism have been difficult to control at the site. Although the U.S. Department of Energy (DOE) has implemented various engineered, institutional, and administrative controls at the site, including increased patrols by county sheriff officers, vandalism continues to be an ongoing concern and maintenance issue. Impacts of the construction of the Animas–La Plata Project nearby and increased recreational use in the area will continue to be monitored.

4.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the *Long-Term Surveillance Plan for the Bodo Canyon Disposal Site, Durango, Colorado* (DOE/AL/62350–77, Rev. 2, DOE, September 1996; LTSP) and in procedures established by DOE to comply with the requirements of Title 10 *Code of Federal Regulations* Part 40.27 (10 CFR 40.27). Table 4–1 lists these requirements. A revised LTSP was prepared in May 2010 and has been submitted to the U.S. Nuclear Regulatory Commission (NRC) and the Colorado Department of Public Health and Environment for concurrence.

Table 4–1. License Requirements for the Durango Disposal Site

Requirement	Long-Term Surveillance Plan	This Report
Annual Inspection and Report	Section 6.0	Section 4.3.1
Follow-Up or Contingency Inspections	Section 7.0	Section 4.3.2
Routine Maintenance and Repairs	Section 8.0	Section 4.3.3
Groundwater Monitoring	Section 5.0	Section 4.3.4
Corrective Action	Section 5.0	Section 4.3.5

Institutional Controls—Institutional controls at the site, as defined by DOE Policy 454.1, consist of federal ownership of the property, warning/no-trespassing signs (entrance and perimeter signs) along the property boundary, and a locked gate at the entrance to the site. The 121-acre site is owned by the United States of America and was accepted under the NRC general license (10 CFR 40.27) in 1996. DOE is the licensee and, in accordance with the requirements for UMTRCA Title I sites, is responsible for the custody and long-term care of the site.

Inspectors found no evidence that these institutional controls were ineffective or violated.

4.3 Compliance Review

4.3.1 Annual Inspection and Report

The site, southwest of Durango, Colorado, was inspected on June 10, 2011. The results of the inspection are described below. Figure 4–1 shows features and photograph locations (PLs) discussed in this report. Numbers in the left margin of this report refer to items summarized in the "Executive Summary" table.

4.3.1.1 Specific Site-Surveillance Features

Access Road, Entrance Gates, Entrance Sign, and Perimeter Signs—Access to the site is by La Plata County Road 212, which is a dedicated public right-of-way that crosses the southwest corner of the DOE property. The entrance gate and guardrails along the county road, and the original entrance gate closer to the cell, were in good condition.

Numerous perimeter signs have bullet holes but remain legible. Perimeter sign P2 has been stolen many times, but because adjacent signs are within sight, it is no longer being replaced. The bases of perimeter signs P41 and P44 are being undercut by erosion but currently remain stable.

Many of the perimeter signs are difficult to find amid the pine trees, thick oak brush, and steep drainages. To make identification easier, inspectors recorded the signs' locations with a global-positioning-system unit during the 2010 inspection and placed permanent, adhesive numbers on them during the 2011 inspection.

Site Markers and Monuments—All site markers, survey monuments, and boundary monuments were in excellent condition except for site marker SMK–1 and boundary monuments BM–3, BM–4, and BM–6. Site marker SMK–1, near the entrance gate, is superficially pocked from gunfire but remains legible. Boundary monument BM–3 and two of its reference monuments are in a small gully and are threatened by erosion; however, the monuments are currently stable. Several years ago, one of the reference monuments for boundary monument BM–4 was bent to the ground, and the cap was removed, but BM–4 itself is intact. Before the 2004 inspection, boundary monument BM–6 was destroyed when a pipeline was constructed near the site. A decision was made not to replace it because both of its witness corners remained in good condition.

Monitoring Wells and Other Wells—Monitoring wells were locked and in good condition. The cap on one of the disposal cell's transient drainage collection system vent wells, PVC–1, is cracked but remains functional.

4.3.1.2 Transects

To ensure a thorough and efficient inspection, inspectors divided the site into six areas called "transects": (1) the top of the disposal cell, (2) the side slopes of the disposal cell, (3) the drainage ditches, (4) the treatment cells and holding pond, (5) the site boundary, and (6) the outlying area.

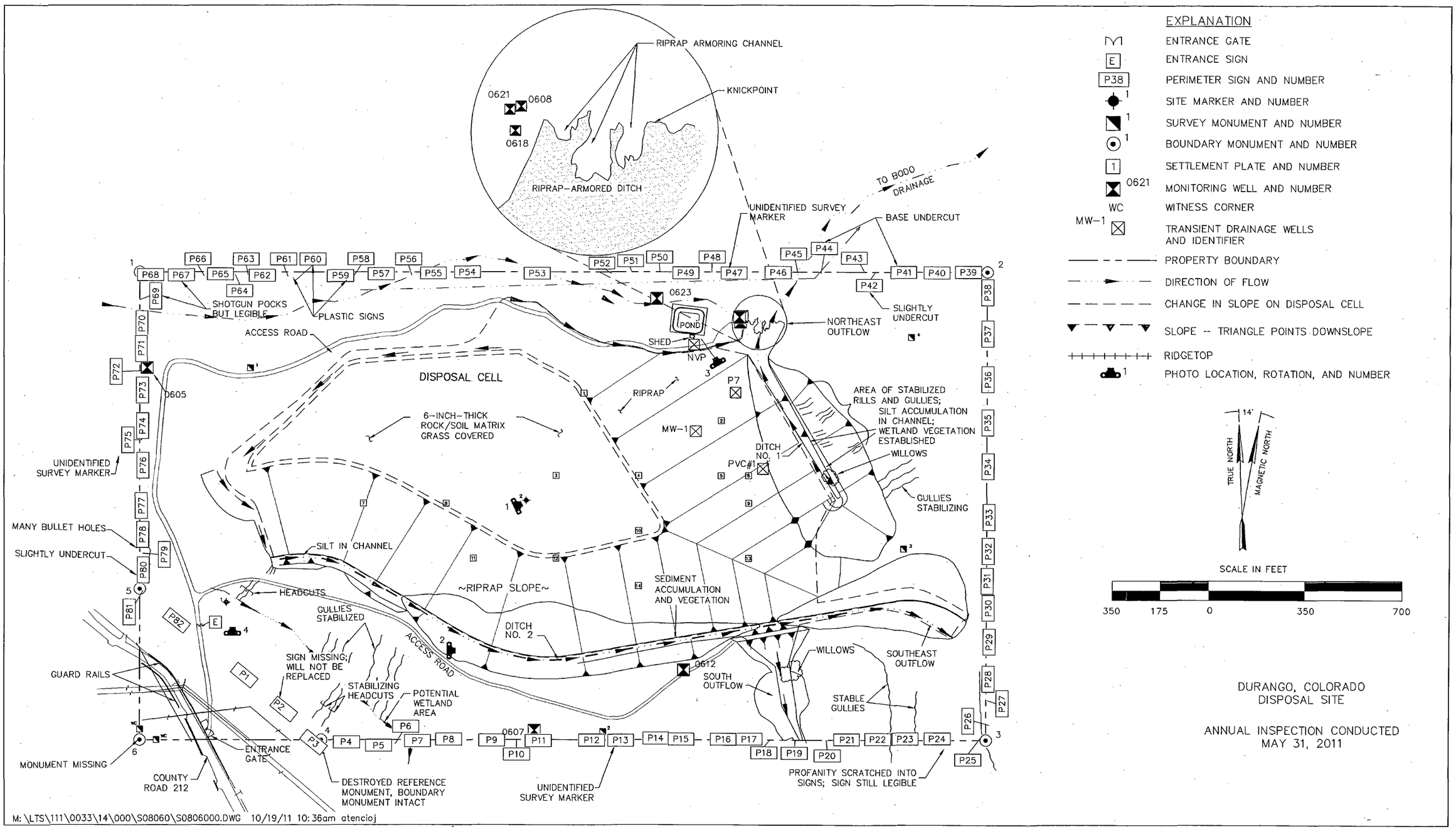

Figure 4–1. 2011 Annual Compliance Drawing for the Durango Disposal Site

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The area inside each transect was inspected by walking a series of traverses. Within each transect, the inspectors examined specific site-surveillance features, drainage structures, and vegetation, along with other features. Inspectors also looked for evidence of settlement, erosion, or other modifying processes.

Top of the Disposal Cell—The top of the disposal cell (PL–1) was in excellent condition. No evidence of settling, slumping, or erosion was observed.

Vegetation on the rock/soil matrix cover remains healthy. Plant cover consists primarily of seeded grass species and several "volunteer" species, including deep-rooted woody shrubs (e.g., dryland alfalfa).

In accordance with the LTSP, deep-rooted woody plants must be removed from the disposal cell when the plant's shoot height equals or exceeds 3.5 feet (1.1 meters) from the base; this height criterion is based on an assumed root-to-shoot ratio of 1 to 1. Although the aboveground height of the dryland alfalfa growing on the cell top will never exceed the 3.5-foot criterion listed in the LTSP for woody species, it is known to be a deep-rooted plant. This species is now being controlled with herbicide on the disposal cell cover. At the time of the 2011 inspection, no alfalfa plants were identified.

Side Slopes of the Disposal Cell—The riprap-covered side slopes of the disposal cell were in good condition. There was no evidence of subsidence, rock deterioration, or slope failure.

Deep-rooted woody shrubs and trees have, in the past, become established on the cell's side slopes. Once they reach 3 feet in height, they are removed or treated with herbicide. At the time of the 2011 inspection, no woody species over 3 feet in height were observed. Past herbicide treatment has eliminated noxious weeds from the side slopes. The side slopes will continue to be monitored for the presence of noxious weeds and woody species.

Drainage Ditches—Rock-armored drainage ditches beneath the toe of the side slope on the northwest, south, and east sides of the disposal cell direct runoff into natural drainages that carry storm water away from the disposal site. Past erosion and sloughing in Ditch No. 1 have allowed wetland vegetation, including willows, to take root in areas where moist sediments have accumulated. In other places, trees as tall as 15 feet grow in the drainage ditches. The sediment deposits and vegetation currently will not compromise the drainage ditches' performance in a large storm. Should colluvial deposits or excessive vegetation dam a drainage ditch so as to impound water, the deposits or vegetation will be removed. Inspectors saw no evidence of recent accumulations of sloughed material in the ditches (PL–2).

The riprap-covered outflow of Ditch No. 1 was designed to erode back to a rock-filled trench and self-armor in the process. No significant erosion has occurred in Ditch No. 1 since it was last surveyed in 1999.

The southeast and south outflows spill into steep, natural channels and are also monitored annually. The channels at these locations are armored by riprap and bedrock. Both outflow channels were stable and in good condition at the time of the 2011 inspection.

Retention Pond—The retention pond northeast of the disposal cell collects pore water that drains from the wet tailings encapsulated within the disposal cell (i.e., transient drainage). A solar-powered water management system installed in 2007 distributes water collected in the
4A retention pond through drip lines and onto the lined pond side slopes to enhance evaporation. A tear discovered in the pond liner during the inspection was repaired on July 27, 2011.

A security fence surrounds the retention pond, and a shed contains instrumentation to measure the transient drainage flow from the collection gallery. Both the fence and the shed were secure
4B at the time of the inspection (PL–3). Inspectors noted that the shed door needed repairs, and repairs were made on September 21, 2011.

In June 2006, the criteria for the permanent closure of the toe drain and the water collection and treatment system, as described in the LTSP, were met. The treatment cells were removed in October 2010; the pond and evaporation system remain in use.

Site Boundary—The site is not fenced. Missing and damaged perimeter signs indicate continued trespassing and vandalism. However, before the guardrail and gate along County Road 212 were installed in 2000, the public used the area between the county road and the original entrance gate quite heavily. Since the installation of the guardrail, use of this area has been minimal except for the destruction and theft of perimeter signs.

Historical rill and gully erosion has occurred at various locations on site, but most rills and gullies are stabilizing, and none are currently threatening the performance of the disposal cell or its associated surface water diversion structures. The establishment of vegetation and the exposure of resistant bedrock in the gullies are preventing further erosion in most of the gullies. No new headcutting was observed in 2011 (PL–4). DOE will continue to monitor the site for active erosion.

Numerous areas along the site boundary are infested with State-listed noxious weeds. These areas have been treated with herbicide since 2002 and now contain few weeds. They will continue to be monitored and treated as needed.

Outlying Area—The area beyond the site boundary for a distance of 0.25 mile was visually inspected for signs of erosion, development, or other disturbances that might impact the integrity of the site. The land surrounding the site is primarily used for recreation and wildlife habitat. The U.S. Bureau of Reclamation continues to construct the Animas–La Plata Project, a surface water diversion system. The site is immediately adjacent to the northern Ridges Basin Reservoir area boundary. Recreational use of the outlying area is expected to increase substantially upon completion of the reservoir project. Currently, there is no concern regarding the outlying area.

4.3.2 Follow-Up or Contingency Inspections

DOE will conduct follow-up inspections if (1) an annual inspection or other site visit reveals a condition that must be reevaluated during a return to the site, or (2) a citizen or outside agency notifies DOE that conditions at the site are substantially changed.

No follow-up or contingency inspections were required in 2011.

4.3.3 Routine Maintenance and Repairs

The pond liner was repaired on July 27, 2011.

The shed door was repaired on September 21, 2011.

Noxious weeds were treated in the spring and the fall.

4.3.4 Groundwater Monitoring

4C

In accordance with the LTSP, groundwater is monitored at the site to verify the initial performance of the disposal cell. The monitoring network consists of seven wells (Table 4–2 and Figure 4–1). Four wells are completed in the uppermost aquifer (bedrock of the Cliff House Sandstone and the Menefee Formation), including one upgradient background well (0605) and three downgradient point-of-compliance (POC) wells (0607, 0612, and 0621). Three wells are completed in the alluvium, one upgradient (0623) and one downgradient (0608) of the disposal cell. The third alluvial well, monitoring well 0618 (screened to the bottom of the alluvial aquifer), was installed adjacent to well 0608 (screened to 10 feet above the base of the alluvial aquifer) and added to the monitoring network in 2002, as a best management practice, because it intercepts the full saturated zone of the alluvial aquifer.

Table 4–2. Groundwater Monitoring Network at the Durango Disposal Site

Monitoring Well	Well Compliance Type	Hydrologic Relationship
0605	Background	Upgradient (uppermost aquifer)
0607	Point-of-Compliance	Downgradient (uppermost aquifer)
0612	Point-of-Compliance	Downgradient (uppermost aquifer)
0621	Point-of-Compliance	Downgradient (uppermost aquifer)
0623	Background	Upgradient (alluvial aquifer)
0608	Best Management Practice	Downgradient (alluvial aquifer)
0618	Best Management Practice	Downgradient (alluvial aquifer)

Groundwater samples are collected annually and analyzed for three indicator parameters: molybdenum, selenium, and uranium. To monitor the increased uranium observed in well 0618, wells 0608, 0618, and 0621 have been increased to monthly sampling as weather permits. The site-specific standards used for the three indicator parameters are the respective maximum observed background concentrations reported in groundwater samples collected from wells completed in the bedrock aquifer as identified in Table 5–4 of the LTSP. These site-specific standards are provided below in Table 4–3. Time-concentration plots for uranium, selenium, and molybdenum monitoring results are included as Figures 4–2, 4–3, and 4–4, respectively.

Table 4–3. Site-Specific Groundwater Standards for the Durango Disposal Site, Based on Background

Constituent	Standard (mg/L)
Molybdenum	0.22
Selenium	0.042
Uranium	0.077

mg/L = milligrams per liter
Note: Site-specific groundwater standards represent the maximum observed background concentrations reported in samples collected from wells completed in the bedrock aquifer (LTSP, Table 5–4).

Uranium concentrations in monitoring well 0618 had decreased since 2009 and were below the standard until an increase observed during the June 2011 sampling event. Concentrations in well 0608 have decreased slightly. Selenium concentrations decreased slightly in both of these wells, and molybdenum remained steady. Analytical results from all other locations are on trend with previous results.

In 2009, the most significant groundwater monitoring result reported was the uranium concentration in well 0618. The uranium concentration of 0.11 milligram per liter (mg/L) reported in this well in November 2009 is consistent with the increasing trend that began in 2005, and exceeded the site-specific standard of 0.077 mg/L. In fall 2009, well 0618 was redeveloped, and the purging method and pump materials were evaluated. The uranium levels had decreased below the standard in 2010. The 2011 results show an increase in uranium back above the standard as well as above levels observed in 2009 (0.12 mg/L). All other concentrations of uranium, along with all concentrations of both selenium and molybdenum, remain on trend and well below their respective standards.

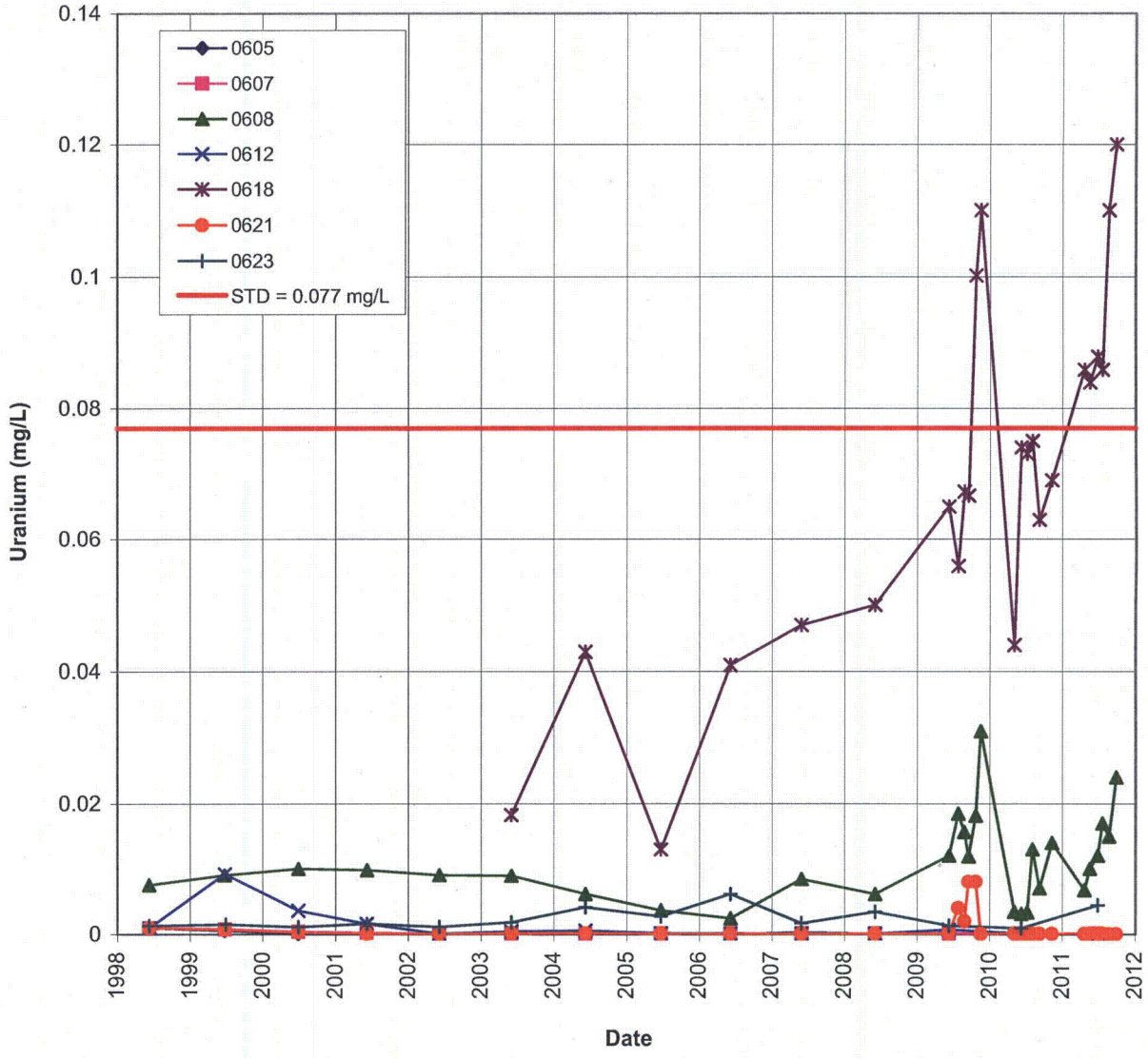

Figure 4–2. Time-Concentration Plot of Uranium in Groundwater at the Durango Disposal Site

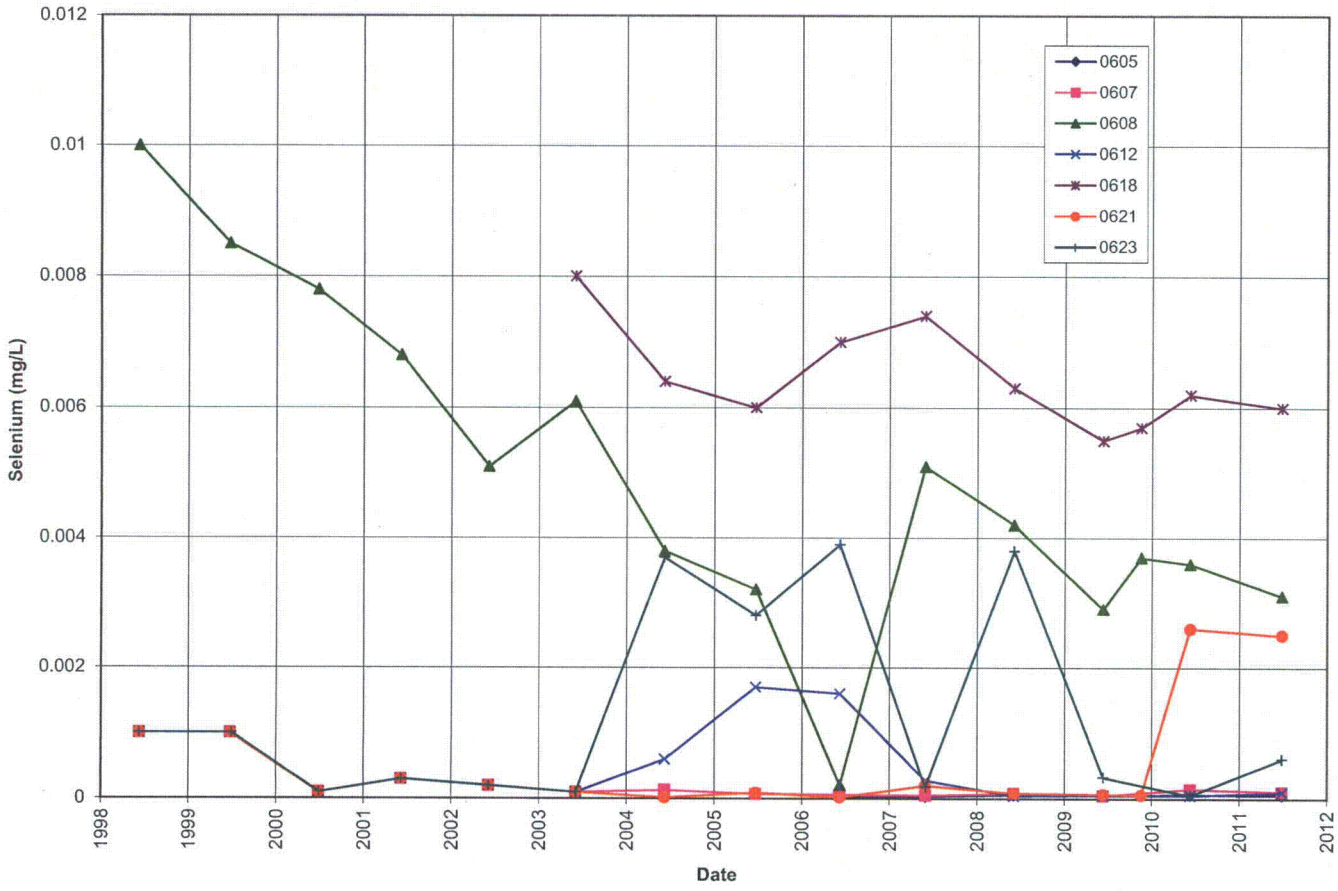

Figure 4–3. Time-Concentration Plot of Selenium in Groundwater at the Durango Disposal Site

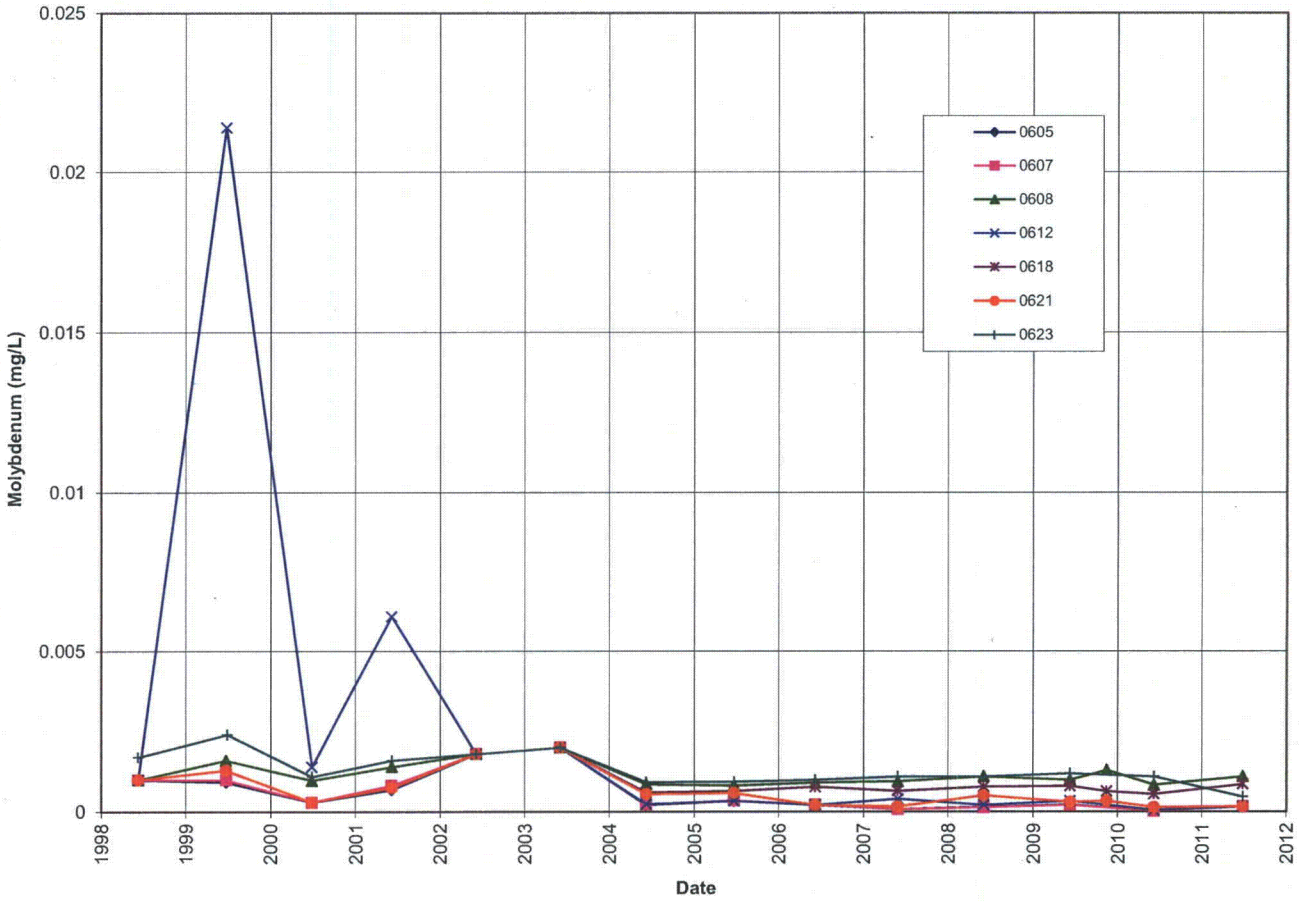

Figure 4–4. Time-Concentration Plot of Molybdenum in Groundwater at the Durango Disposal Site

4.3.5 Corrective Action

Corrective action is taken to correct out-of-compliance or hazardous conditions that create a potential health and safety problem or that may affect the integrity of the disposal cell or compliance with 40 CFR 192.

No corrective action was required in 2011.

4.3.6 Photographs

Table 4–4. Photographs Taken at the Durango Disposal Site

Photograph Location Number	Azimuth	Description
PL–1	65	Site marker SMK–2 and cell top.
PL–2	90	Ditch No. 2.
PL–3	330	New fence around east side of retention pond area.
PL–4	360	Headcuts of gullies below southwest corner of disposal cell; no change from 2009.

DUR 5/2011. PL–1. Site marker SMK–2 and cell top.

DUR 5/2011. PL–2. Ditch No. 2.

DUR 5/2011. PL–3. New fence around east side of retention pond area.

DUR 5/2011. PL–4. Headcuts of gullies below southwest corner of disposal cell; no change from 2009.

5.0 Falls City, Texas, Disposal Site

5.1 Compliance Summary

The Falls City, Texas, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site was inspected on January 11, 2011. The disposal cell and all associated surface water diversion and drainage structures were in excellent condition and functioning as designed. No maintenance needs or cause for a follow-up or contingency inspection was identified.

Under normal weather conditions, grass is harvested (cut and bailed) from the site, including from the disposal cell cover, two or three times a year, resulting in a successful beneficial reuse of the site. Due to ongoing drought conditions in Texas, no hay was harvested from the site in 2011. In-the-field discussions with vegetation and site management personnel during the annual inspection continue to be used to improve the efficiency and effectiveness of site maintenance activities.

Activity surrounding the site has increased this past year. County Road 202 (which runs along the northwest perimeter fence) was opened to the public. Opening this road makes the site more susceptible to potential trespass and vandalism. Oil and gas exploration has increased significantly in the area. New underground pipelines have been installed next to the site along County Road 202 and Farm-to-Market Road (FM) 1344. Traffic near the site has also increased as a result of oil and gas industry activity.

The U.S. Nuclear Regulatory Commission (NRC) does not require groundwater monitoring at the site. It is conducted as a best management practice. Groundwater was sampled in April 2011 in accordance with the *Long-Term Surveillance Plan for the U.S. Department of Energy Falls City Uranium Mill Tailings Disposal Site, Falls City, Texas* (DOE–LM/1602–2008, U.S. Department of Energy [DOE], March 2008; LTSP). Uranium concentrations at monitoring well 0891 (completed in the Dilworth aquifer) increased in 2011 and are currently elevated when compared to the historical range for the well but not for the aquifer. The new maximum uranium concentration measured at monitoring well 0891 is 2.9 milligrams per liter (mg/L). Water levels measured in 2011 were consistent with past years.

As prescribed in the LTSP, a groundwater monitoring assessment was conducted following the collection of samples in spring 2010 to recommend whether to continue, modify, or terminate the groundwater monitoring program. The assessment is currently undergoing NRC review. The report recommends that following the collection of samples in spring 2011, the groundwater monitoring activities at the site be discontinued. This recommendation is supported by 5 additional years of monitoring results that have not varied significantly from their historical range for the aquifer. Furthermore, the aquifer beneath the site has a U.S. Environmental Protection Agency (EPA) "limited use" designation, and narrative supplemental standards for groundwater (Title 40 *Code of Federal Regulations* Part 192.2[g] [40 CFR 192.2(g)]) apply. Continued monitoring would not provide additional protectiveness of human health and the environment.

5.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the LTSP and in procedures established by DOE to comply with the general license requirements at 10 CFR 40.27. Table 5–1 lists these requirements.

Table 5–1. License Requirements for the Falls City Disposal Site

Requirement	Long-Term Surveillance Plan	This Report
Annual Inspection and Report	Section 3.3	Section 5.3.1
Follow-Up or Contingency Inspections	Section 3.4	Section 5.3.2
Routine Maintenance and Repairs	Section 3.5	Section 5.3.3
Groundwater Monitoring	Section 3.7	Section 5.3.4
Corrective Action	Sections 3.6	Section 5.3.5

Institutional Controls—Institutional controls at the site, as defined by DOE Order 454.1, consist of federal ownership of the property, a site perimeter fence, warning/no-trespassing signs along the property boundary, and locked gates in the perimeter fence.

The 231-acre site is owned by the United States of America and was accepted under the NRC general license (10 CFR 40.27) in 1998. DOE is the licensee and, in accordance with the requirements for UMTRCA Title I sites, is responsible for the custody and long-term care of the site.

No evidence of trespass was observed during the site inspection this year.

5.3 Compliance Review

5.3.1 Annual Inspection and Report

The site, southwest of Falls City, Texas, was inspected on January 11, 2011. The results of the inspection are described below. Figure 5–1 shows features and photograph locations (PLs) mentioned in this report. Numbers in the left margin of this report refer to items summarized in the "Executive Summary" table.

5.3.1.1 Specific Site-Surveillance Features

Access Road, Entrance Gate, Fence, and Signs—Access to the site is through a vehicle gate directly off a public right-of-way (FM 1344). The main entrance gate (replaced in 2006) and the vehicle gate at the north corner of the site were locked and functional.

The five-strand barbed-wire perimeter fence, which surrounds the site property boundary, and the entrance sign next to the main entrance gate were in good condition.

In the west corner of the site, a 16-foot-long panel of the perimeter fence that could be opened easily was replaced in 2010 with barbed-wire consistent with the rest of the fence to provide added site security.

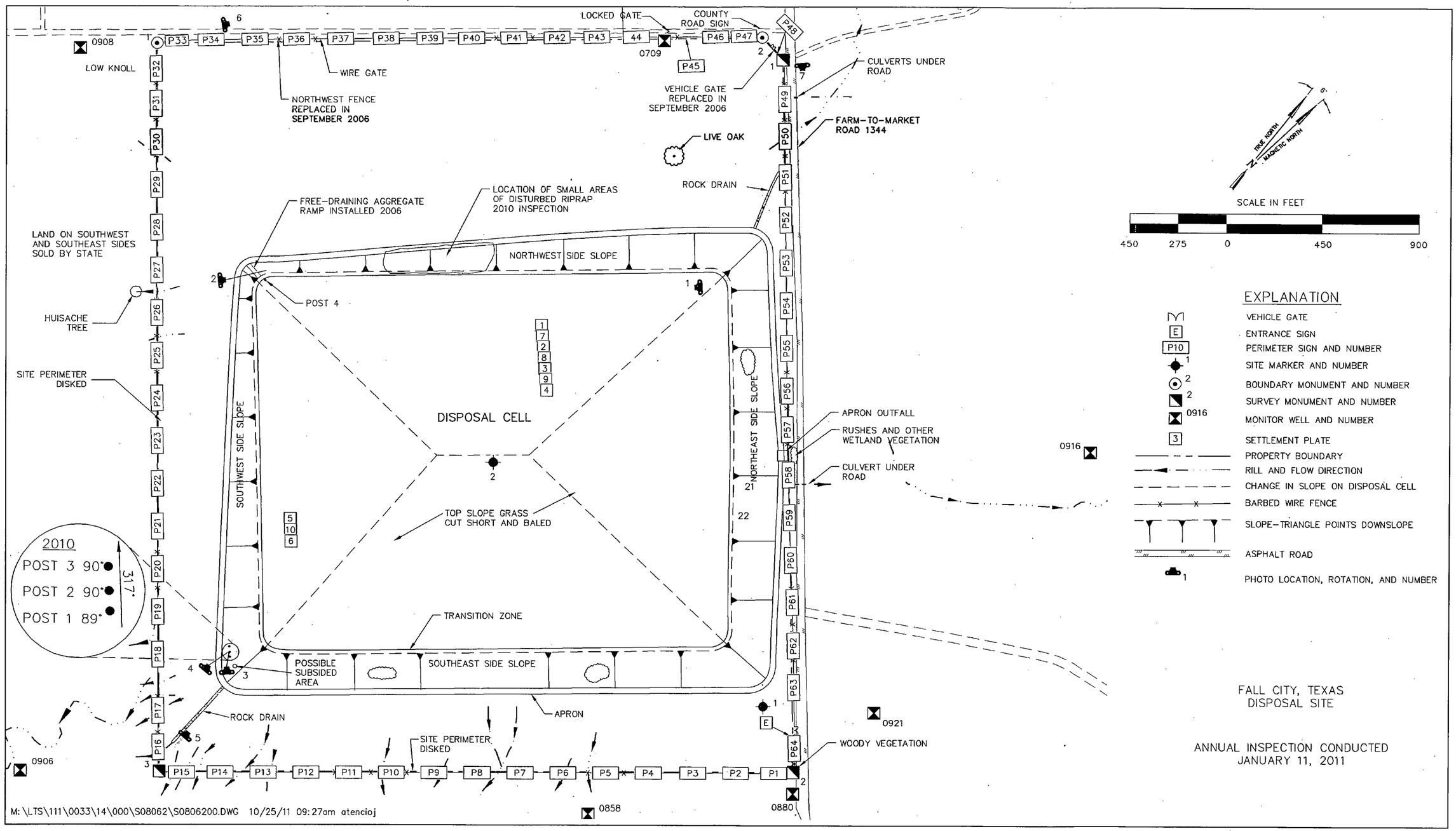

Figure 5–1. 2011 Annual Compliance Drawing for the Falls City Disposal Site

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Site Markers and Monuments—The two site markers, SMK–1 at the entrance gate and SMK–2 on top of the disposal cell, were in excellent condition.

Three survey monuments and two boundary monuments, situated at the corners of the site, were undisturbed and in excellent condition.

Monitoring Wells—There are seven monitoring wells in the cell performance network and five wells in the groundwater compliance network. All monitoring wells were inspected when they were sampled in April 2011 and were secure and in excellent condition.

5.3.1.2 Transects

To ensure a thorough and efficient inspection, inspectors divided the site into three areas called "transects": (1) the top and side slopes of the disposal cell, (2) the site perimeter, and (3) the outlying area.

The area inside each transect was inspected by walking a series of traverses. Within each transect, inspectors examined specific site-surveillance features, drainage structures, and vegetation. Inspectors also looked for evidence of settlement, erosion, or other modifying processes.

Top and Side Slopes of the Disposal Cell—The top of the disposal cell is grass-covered and in excellent condition; there was no indication of settlement, rock degradation, erosion, or other signs of instability. Each year, a local rancher cuts and bales hay from the disposal site, including from the top of the cell, resulting in a beneficial reuse of the site. Grass on top of the disposal cell is cut and baled for livestock and is kept cut short to control the risk of fire. During most years, grass on top of the disposal cell is cut and baled two or three times. Due to ongoing drought conditions in Texas, no hay was harvested from the site in 2011.

Vegetation management on the disposal cell was excellent. Deep-rooted vegetation that encroaches on the disposal cell is cut and treated with herbicide in accordance with the LTSP. Deep-rooted vegetation is of concern because it can penetrate the radon barrier.

The side slopes of the disposal cell are covered with riprap and are in excellent condition (PL–1 and PL–2). No evidence of riprap degradation was observed. In 2007, inspectors noted a slight low spot in the riprap at the toe of the southwest corner of the side slope. Although this spot is likely an artifact of construction, particular attention is paid to this area during inspections to determine if movement or subsidence can be observed. In 2008, three t-posts were installed in a straight line running at an orientation of 317 degrees (PL–3). Each post has a vertical pitch of 90 degrees. These posts provide reference points to assess possible movement. A level is used to measure the vertical pitch of the posts. If a post moves out of line with the others or changes pitch, it indicates possible movement. No movement was detected (PL–4).

An access ramp is located at the west corner of the side slope to facilitate access by maintenance equipment to the top of the disposal cell. The ramp was installed in 2006 and constructed with clean, angular riprap of progressively smaller sizes to provide a free-draining and stable driving surface that does not encourage vegetation encroachment. The ramp was in excellent condition but will probably need an additional layer of small gravel in the next few years.

Site Perimeter—The area between the perimeter fence and the toe of the disposal cell is covered with well-established grass. The grass-covered areas between the disposal cell and the property line are cut short to reduce the risk of fire. During most years, these areas are cut and baled two or three times. Due to ongoing drought conditions in Texas, no hay was harvested from the site in 2011.

In past inspections, wild hog burrows have been observed under the fence line in some areas. These burrows are filled in as they are located. Although it is possible that the burrows could compromise the fence's integrity, they are considered a minor nuisance at this time.

Water was observed slowly flowing in the south rock drain during this year's inspection (PL–5). No water was observed in the north rock drain. Vegetation is left uncut at the outlets of the rock drains to assist in dissipating the energy of site runoff during storm events. Baffling the flow of water at the outlets helps to alleviate soil erosion near the outlet areas during large precipitation events. Tall, thick grass at the drain outlets is, therefore, considered a desirable feature. Vegetation in the apron outfall, located midway along the northeast side slope, is being properly managed.

Outlying Area—The area outward from the disposal site for a distance of 0.25 mile was visually inspected. No development or disturbance that could affect site integrity was observed.

5A County Road 202 runs along the northwest side of the property boundary. Prior to this year, public access to the road was restricted by a locked gate. During this year's inspection, the road was open and likely will remain so. Removing the lock and gate and opening the road to the public could lead to future vandalism and trespass issues at the site.

Significant oil and gas industry activity was noted around the area of the site during this year's inspection. Underground pipelines were installed along County Road 202 (which runs along the northwest side of the property) (PL–6) and along FM 1344 (which runs along the southeast side of the property) (PL–7).

5.3.2 Follow-Up or Contingency Inspections

DOE will conduct follow-up inspections if (1) an annual inspection or other site visit reveals a condition that must be reevaluated during a return to the site, or (2) a citizen or outside agency notifies DOE that conditions at the site are substantially changed.

No follow-up or contingency inspections were required in 2011.

5.3.3 Routine Maintenance and Repairs

In 2011, DOE continued to control undesirable vegetation on the disposal cell and in the rock-lined ditches.

5.3.4 Groundwater Monitoring

5B Groundwater monitoring was conducted at the site in April 2011. As prescribed in the revised LTSP issued in March 2008, groundwater monitoring at the site as a best management practice has two components:

1) Monitor groundwater to demonstrate the initial performance of the disposal cell (40 CFR 192, Subpart A).

2) Monitor groundwater for plume movement to demonstrate that potential users of groundwater downgradient of the site are not exposed to contamination related to the former processing site (40 CFR 192, Subpart B).

Because narrative supplemental standards apply to the uppermost aquifer at the site, no concentration limits or points of compliance have been established. Groundwater in the uppermost aquifer beneath the site has an EPA designation of "limited use" (Class III) because it is not currently or potentially a source of drinking water due to widespread ambient contamination that cannot be cleaned up using methods reasonably employed by public water supply systems. Background groundwater quality varies by orders of magnitude in the area because the uppermost aquifer is in a location where uranium mineralization is naturally redistributed. For these reasons, the NRC general license does not require groundwater monitoring at the site.

Two aquifers of interest underlie the site: the shallow Deweesville/Conquista aquifer and the deeper Dilworth aquifer. Because the two aquifers are hydraulically connected, they constitute the uppermost aquifer for regulatory purposes. The Dilworth aquifer is underlain by the Manning Clay, a 300-foot-thick aquitard that isolates the uppermost aquifer from better-quality groundwater in deeper aquifers. Groundwater samples at the site are collected from both the Deweesville/Conquista aquifer and the underlying Dilworth aquifer.

The disposal cell performance monitoring network consists of five monitoring wells (0709, 0858, 0880, 0906, and 0921) that are completed in the uppermost aquifer and sampled as specified in the revised LTSP. Two additional cell performance monitoring wells (0908 and 0916), also completed in the uppermost aquifer, are designated for water-level measurements only.

The groundwater compliance monitoring network consists of five monitoring wells (0862, 0886, 0891, 0924, and 0963) that are completed in the uppermost aquifer and sampled annually as specified in the revised LTSP. Figure 5–2 shows the monitoring well networks.

The revised LTSP prescribes continued annual monitoring of the current network of wells through 2010 as a best management practice and reduces the analyte list to total uranium and field measurements of temperature, pH, conductivity, turbidity, alkalinity, dissolved oxygen, and oxidation-reduction potential.

The revised LTSP (which incorporates the *Ground Water Compliance Action Plan*, March 19, 1998) identifies low pH levels in groundwater as an indicator of the extent and movement of the legacy groundwater plumes. Changes in the baseline geochemical conditions may also indicate leachate movement from the disposal cell into the uppermost aquifer. Tailings pore fluids were lower in pH than background groundwater was. However, because pH levels and other signature contaminants in tailings pore fluids are essentially indistinguishable from

processing-related contamination, it is difficult to determine if contamination comes from the disposal cell or from legacy processing activities.

DOE has determined that pH and uranium concentrations do not co-vary. This is an indication that other factors contribute to uranium distribution in the uppermost aquifer, such as natural redistribution of uranium in this active ore-forming environment. Therefore, increasing uranium levels at a monitoring location without an attendant drop in pH probably does not indicate movement of processing-related contamination. Groundwater chemistry at monitoring locations near the formation subcrop may also be influenced by residence time as a response to precipitation or changes in oxidation state within the formation. If increases in uranium are sporadic and not accompanied by decreases in pH, DOE concludes that the elevated uranium is naturally occurring. Time-concentration plots for pH and uranium from 1996 through April 2011 are included as Figures 5–3 through 5–6.

Groundwater Quality Monitoring Results—This report considers groundwater monitoring results through April 2011. In 2011, monitoring wells were sampled for uranium and field parameters. Water levels were also measured.

At the cell performance monitoring wells, pH levels have historically been higher than the pH in tailings pore fluids, with no significant upward or downward trends. In 2011, the pH levels for the cell performance wells remained within the historical range (Figure 5–3).

At the groundwater compliance monitoring wells, pH levels have historically been higher than the pH in the plumes of groundwater contaminated by processing activities, with no significant upward or downward trends, except that the pH at well 0963 has historically been lower than at the other locations. In 2011, the pH levels for the compliance monitoring wells remained within the historical range (Figure 5–4).

In 2011, the uranium concentrations in the cell performance network remained relatively stable, approximately 1.4 mg/L or less, with one exception. At well 0880, uranium has varied from a low concentration of 1.38 mg/L in 2008 to a high concentration of 14 mg/L in 2004 (Figure 5–5). Over time, the concentration of uranium in this well has been variable and, until 2008, substantially greater than the uranium concentrations at the other cell performance wells. The pH at this location is lower than and has varied more than at other locations in the cell performance monitoring network (Figure 5–3). Water levels are also generally falling at well 0880 (see the following section, "Groundwater-Level Monitoring Results"). These results suggest that the interaction among the disposal cell, the legacy groundwater mound, and processing plumes is still equilibrating. However, monitoring results do not indicate that the disposal cell is contributing to the degradation of the uppermost aquifer. Because the groundwater in the uppermost aquifer is not used as a potable water source near the site, the site remains protective.

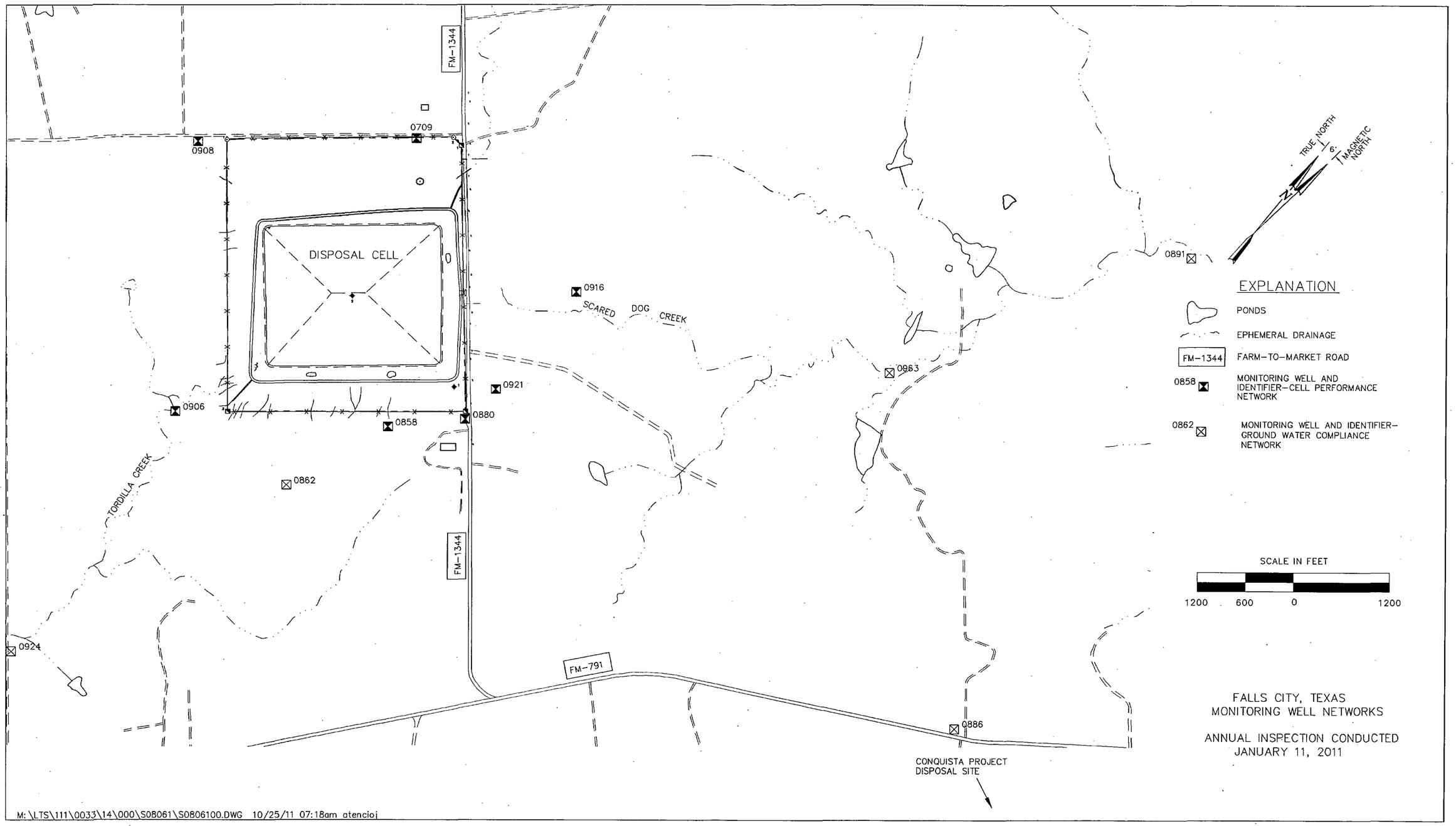

Figure 5–2. Combined Monitoring Well Network at the Falls City Disposal Site

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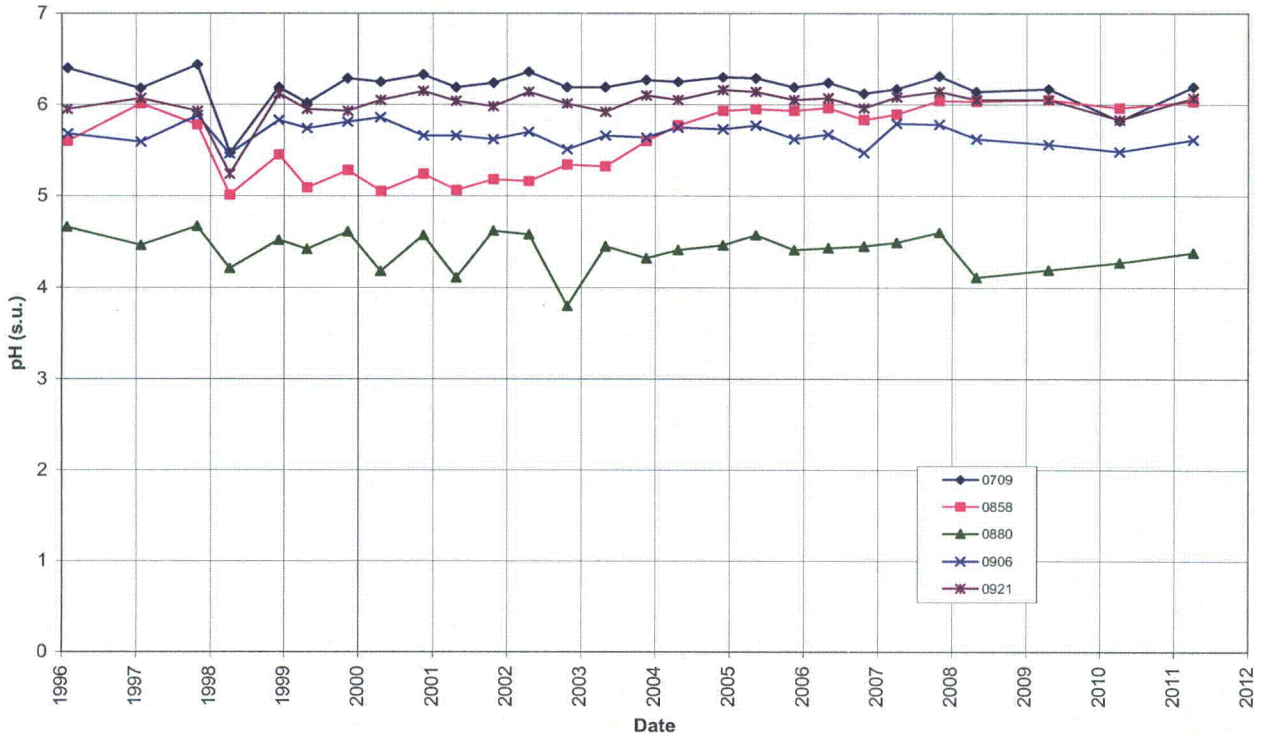

Figure 5–3. pH in Groundwater at Cell Performance Monitoring Locations at the Falls City Disposal Site

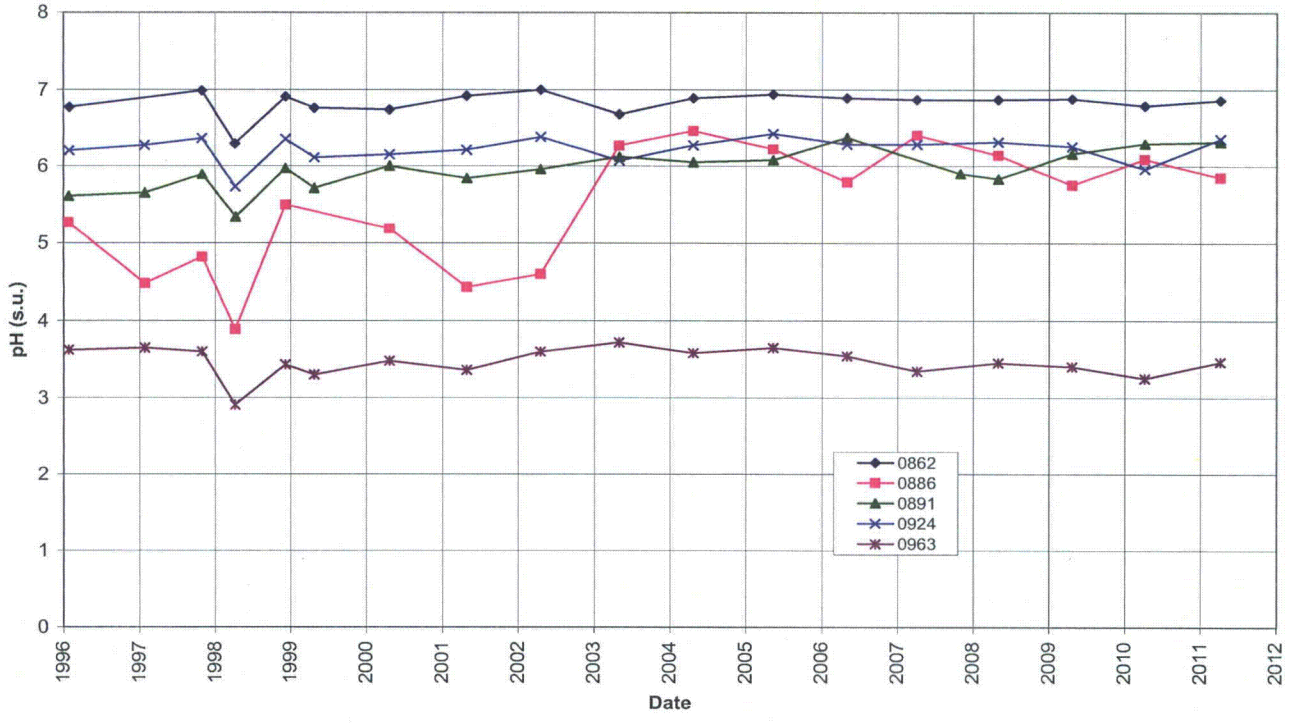

Figure 5–4. pH in Groundwater at Compliance Monitoring Locations at the Falls City Disposal Site

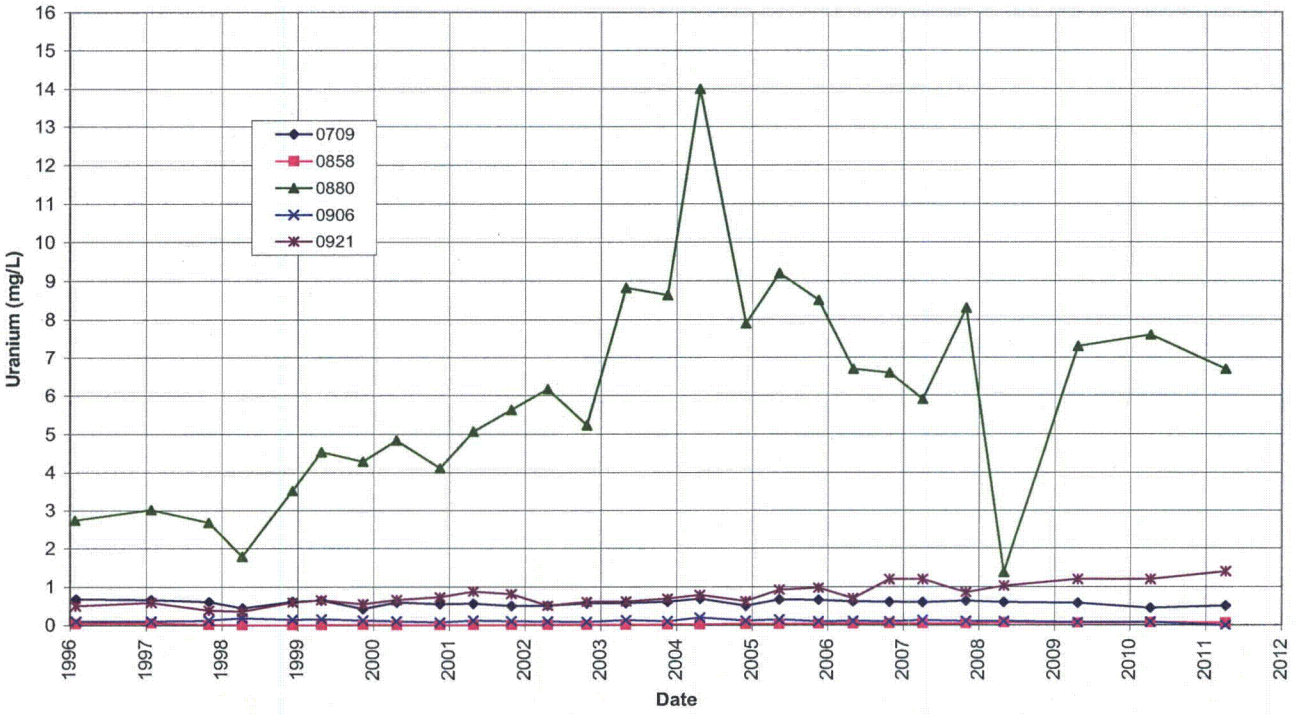

Figure 5–5. Uranium in Groundwater at Cell Performance Monitoring Locations at the Falls City Disposal Site

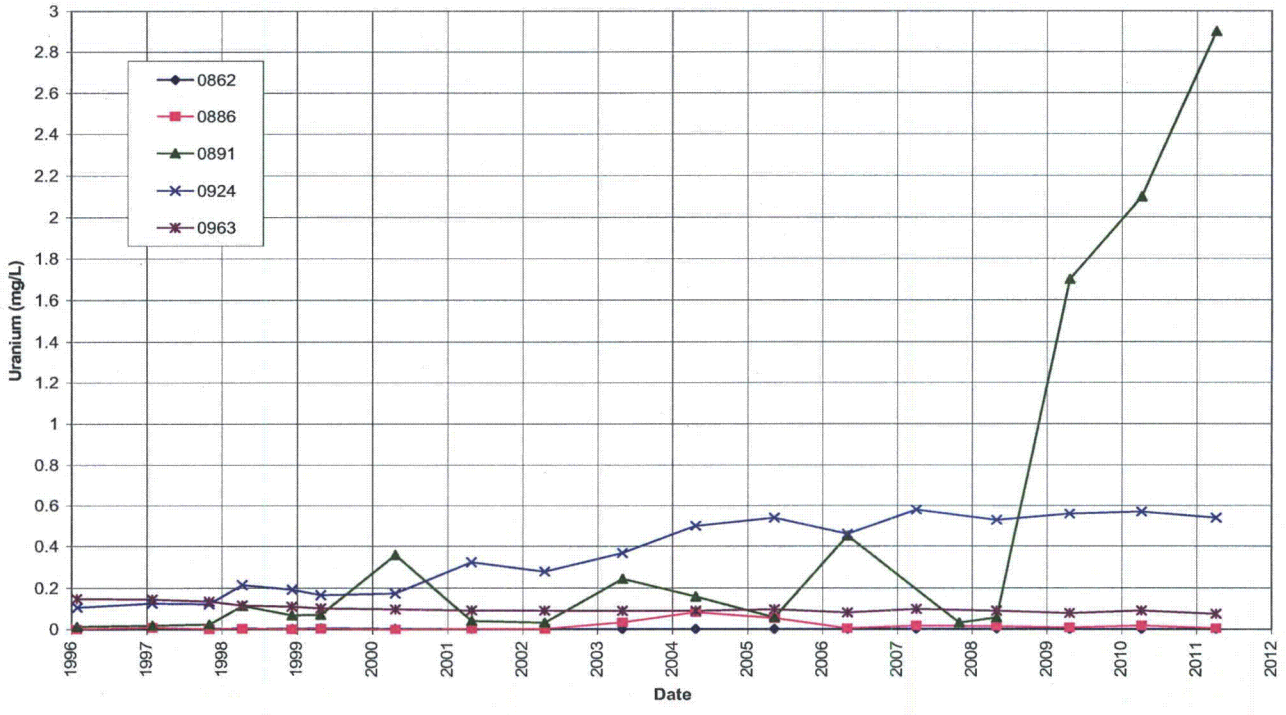

Figure 5–6. Uranium in Groundwater at Compliance Monitoring Locations at the Falls City Disposal Site

The concentration of uranium in groundwater within the compliance monitoring network shows that the uranium concentration trends at monitoring wells 0862, 0886, and 0963 remain stable at low levels (<0.2 mg/L) (Figure 5–6). The increasing uranium concentration trend at well 0924 appears to be leveling off between 0.5 mg/L and 0.6 mg/L. The uranium concentrations measured at well 0891 in 2009 (1.7 mg/L), 2010 (2.1 mg/L), and 2011 (2.9 mg/L) are anomalously high compared to historical measurements at the well, but not for the aquifer.

The new maximum uranium concentration measured at monitoring well 0891 in 2011 (2.9 mg/L) is below the maximum concentration reported for the aquifer, which is also the value used in the risk assessment for the Dilworth groundwater (3.04 mg/L). Site-related contamination poses no risk to the uppermost aquifer at the site because the groundwater from this aquifer is not used for human consumption as a result of its designation as "limited use." Additionally a 300-foot-thick aquitard isolates the uppermost aquifer from the better-quality groundwater in deeper aquifers.

Groundwater-Level Monitoring Results—Water levels measured in 2011 in the disposal cell performance network were consistent with previously measured levels (Figure 5–7). Since 1996, groundwater levels in the disposal cell performance network wells have slightly fallen. The water level in monitoring well 0906 has fluctuated more than the other wells over the years. Monitoring well 0906 is directly down slope of the disposal cell, and the historical fluctuation may be the result of the infiltration of water shed by and conveyed away from the disposal cell, reflecting variations in annual precipitation. Other contributors that may influence local groundwater levels include (1) the dissipation of the processing-site-related groundwater mound beneath the disposal cell, and (2) the dissipation of transient drainage from the disposal cell.

Two cell performance monitoring wells, 0908 and 0916, are not shown in Figure 5–7. These wells, designated for groundwater-level monitoring only, are completed in the unsaturated zone of the Conquista Sandstone and have been dry since 1996.

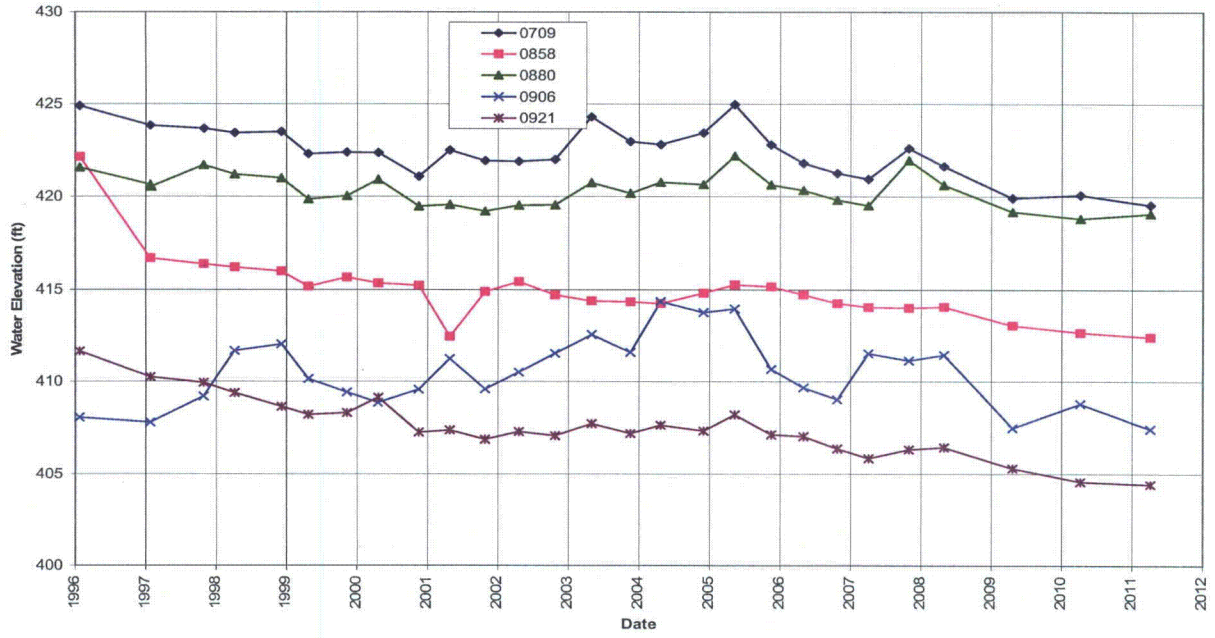

Figure 5–7. Water-Level Measurements at Cell Performance Monitoring Locations at the Falls City Disposal Site

In contrast, water levels in the groundwater compliance monitoring network wells have all increased slightly between 1996 and 2011 (Figure 5–8).

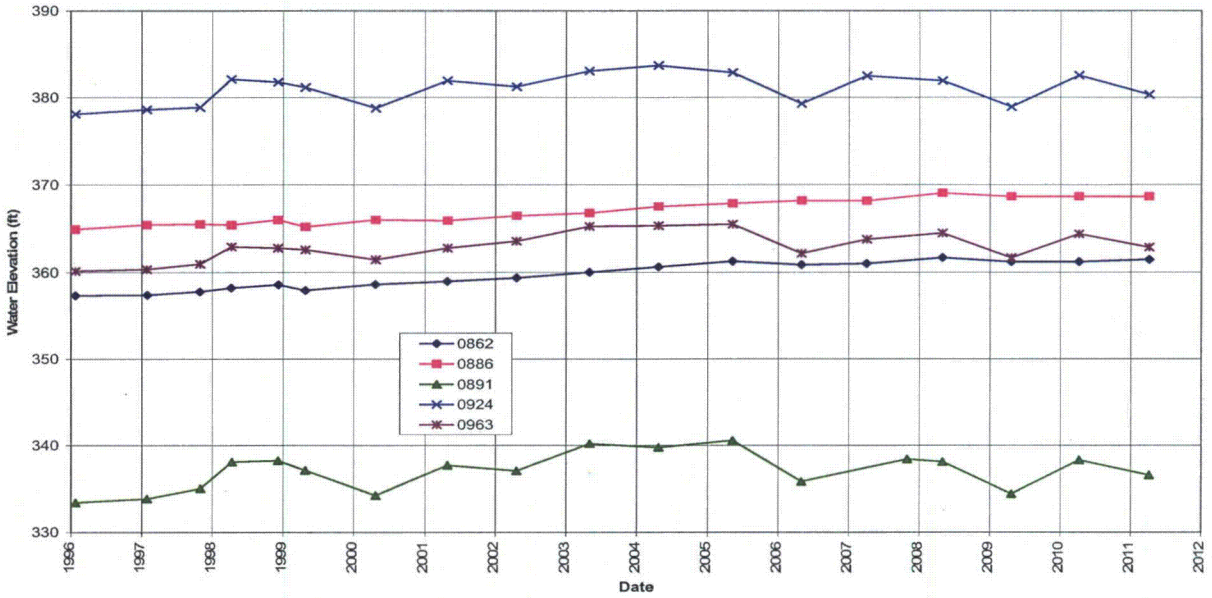

Figure 5–8. Water-Level Measurements at Compliance Monitoring Locations at the Falls City Disposal Site

Evaluation of Groundwater Monitoring—Site-related contamination poses no risk to the uppermost aquifer at the site because groundwater from this aquifer is not used for human consumption as a result of its designation as "limited use." Potable (domestic) water is produced locally from the Carrizo Sandstone that lies 2,000 feet below the surface near the site. Additionally, a 300-foot-thick aquitard isolates the uppermost aquifer from the better-quality groundwater in deeper aquifers.

In 2010, DOE evaluated the groundwater monitoring program at the site, as required every 5 years by the LTSP. Five years of additional groundwater monitoring data (2006 through 2010) at the site were compared to previous data (1996 through 2005). The comparison showed that hazardous constituent concentrations continued to fluctuate in the uppermost aquifer, but the fluctuations in the past 5 years were within the historical range reported for the aquifer in the area of the site. Uranium concentrations at monitoring well 0891 have increased over the past 5 years. The concentration of the sample collected in April 2011 was at an all-time high for the well, 2.9 mg/L. The comparison also showed no new unexpected water-level changes.

The 2010 evaluation recommends that after the collection of samples in 2011, groundwater monitoring activities at the site be discontinued. It is proposed that DOE will not plug and abandon the 12 monitoring wells at the site until the nearby Title II Conquista site transfers to the DOE Office of Legacy Management (LM), which is projected to occur in 2017. The Conquista site is just south of, and adjacent to, the Falls City site. Upon the Conquista site's transfer to LM, DOE will assess whether a joint monitoring approach is warranted (either as a one-time event or as periodic monitoring). Once NRC approves the recommended monitoring strategy for the Conquista site, wells no longer deemed necessary to a Conquista monitoring effort would be

decommissioned following State of Texas guidelines for plugging and abandoning groundwater monitoring wells. Recommendations made in the 2010 evaluation are currently undergoing NRC review.

5.3.5 Corrective Action

Corrective action is taken to correct out-of-compliance or hazardous conditions that create a potential health and safety problem or that may affect the integrity of the disposal cell or compliance with 40 CFR 192.

No corrective action was required in 2011.

5.3.6 Photographs

Table 5–2. Photographs Taken at the Falls City Disposal Site

Photograph Location Number	Azimuth	Photograph Description
PL–1	225	Contact between grassy top and riprap sides of disposal cell, looking down northwest face of disposal cell.
PL–2	45	Contact between grass cover and riprap side slope of disposal cell, looking northeast down northwest side slope of disposal cell.
PL–3	317	Looking down line of t-posts, south corner of disposal cell.
PL–4	4	Vertical pitch measurement at Post 3.
PL–5	NA	Water ponded at outlet of south rock drain.
PL–6	40	Cleared ground along northwest side of road marks installation of new underground pipelines for oil/gas industry next to site.
PL–7	135	Route of new pipeline installed east of FM 1344.

FCT 1/2011. PL–1. Contact between grassy top and riprap sides of disposal cell, looking down northwest face of disposal cell.

FCT 1/2011. PL–2. Contact between grass cover and riprap side slope of disposal cell, looking northeast down northwest side slope of disposal cell.

FCT 1/2011. PL–3. Looking down line of t-posts, south corner of disposal cell.

FCT 1/2011. PL–4. Vertical pitch measurement at Post 3.

FCT 1/2011. PL–5. Water ponded at outlet of south rock drain.

FCT 1/2011. PL–6. Cleared ground along northwest side of road marks installation of new underground pipelines for oil/gas industry next to site.

FCT 1/2011. PL–7. Route of new pipeline installed east of FM 1344.

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6.0 Grand Junction, Colorado, Disposal Site

6.1 Compliance Summary

The Grand Junction, Colorado, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site was inspected on March 23, 2011. The disposal cell and all associated surface water diversion and drainage structures were in good condition and functioning as designed. A portion of the disposal cell remains open and is operated by the U.S. Department of Energy (DOE) to receive additional low-level radioactive waste materials from various sources. The annual inspection requirement applies only to the closed and completed portion of the disposal cell and the surrounding site.

Groundwater monitoring was performed as a best management practice. No maintenance needs were identified. No cause for a follow-up inspection was identified.

6.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the *Interim Long-Term Surveillance Plan for the Cheney Disposal Site Near Grand Junction, Colorado* (DOE/AL/62350–243, Rev. 1, DOE, April 1998; LTSP) and in procedures established by DOE to comply with the requirements of Title 10 *Code of Federal Regulations* Part 40.27 (10 CFR 40.27). Table 6–1 lists these requirements.

Table 6–1. License Requirements for the Grand Junction Disposal Site

Requirement	Long-Term Surveillance Plan	This Report
Annual Inspection and Report	Section 3.0	Section 6.3.1
Follow-Up or Contingency Inspections	Section 3.4	Section 6.3.2
Routine Maintenance and Repairs	Sections 2.7.3 and 4.0	Section 6.3.3
Groundwater Monitoring	Section 2.6	Section 6.3.4
Corrective Action	Section 5.0	Section 6.3.5

Institutional Controls—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 along the property boundary, and a locked gate at the entrance to the site access road.

The United States of America owns the 360-acre site. DOE will operate the site until final closure. Only closed and completed parts of the disposal cell and the area surrounding the site are addressed during the annual inspection. Approximately 21 acres in the center of the disposal cell are active to receive residual radioactive material and other authorized radioactive waste. The active area, the temporary structures associated with its operation, and the temporary contaminated material stockpile areas are not part of the annual inspection except as they may affect the long-term safety and performance of the closed portion of the disposal cell.

Inspectors found no evidence that the institutional controls were ineffective or violated.

6.3 Compliance Review

6.3.1 Annual Inspection and Report

The site, south of Grand Junction, Colorado, was inspected on March 23, 2011. The results of the inspection are described below. Figure 6–1 shows features and photograph locations (PLs) mentioned in this report. Numbers in the left margin of this report refer to items summarized in the "Executive Summary" table.

Weekly environmental and security inspections of the entire site are performed to verify that the site is secure, and radon is monitored continuously to ensure that the open portion of the cell protects human health and the environment. This portion of the disposal cell is scheduled to remain open until 2023, or until filled to its design capacity, at which time it will be closed in accordance with design criteria. Once the U.S. Nuclear Regulatory Commission (NRC) concurs on the final closure of the open portion of the cell and the final version of the LTSP, the site will be accepted under the NRC general license (10 CFR 40.27). DOE will then become the licensee and, in accordance with the requirements for UMTRCA Title I sites, be responsible for the custody and long-term care of the site. The open and active portion of the disposal cell within the closed but unlicensed portion of the disposal cell makes the site unique among the 19 UMTRCA Title I disposal sites.

6.3.1.1 Specific Site-Surveillance Features

Site Access Gate, Access Road, Entrance Gate, and Fence—A double swing stock gate, at the U.S. Highway 50 right-of-way fence, and a double swing chain-link gate, 1.7 miles east at the site entrance, control access to the site. The DOE locks, chains, and gates were in excellent condition.

A paved all-weather access road extends approximately 1.7 miles east from U.S. Highway 50 along DOE's perpetual right-of-way across federal land administered by the U.S. Bureau of Land Management (BLM). No erosion problems were observed along the access road.

A standard four-strand barbed-wire stock fence runs along the access road right-of-way corridor and also surrounds the disposal area. The fence is secure and remains in good condition.

Entrance and Perimeter Signs—An entrance sign is at the entrance gate, and 29 perimeter signs are at regular intervals along the DOE property boundary. The signs are installed on galvanized steel posts set in concrete. All of the signs were in excellent condition.

Additional warning signs are posted on the wire perimeter fence and are associated with the operation of the open cell. Metal controlled-area signs and yellow plastic no-trespassing signs are secured to the fence in pairs. There are 75 warning signs, each about 200 feet apart along the site boundary. All signs were present and legible.

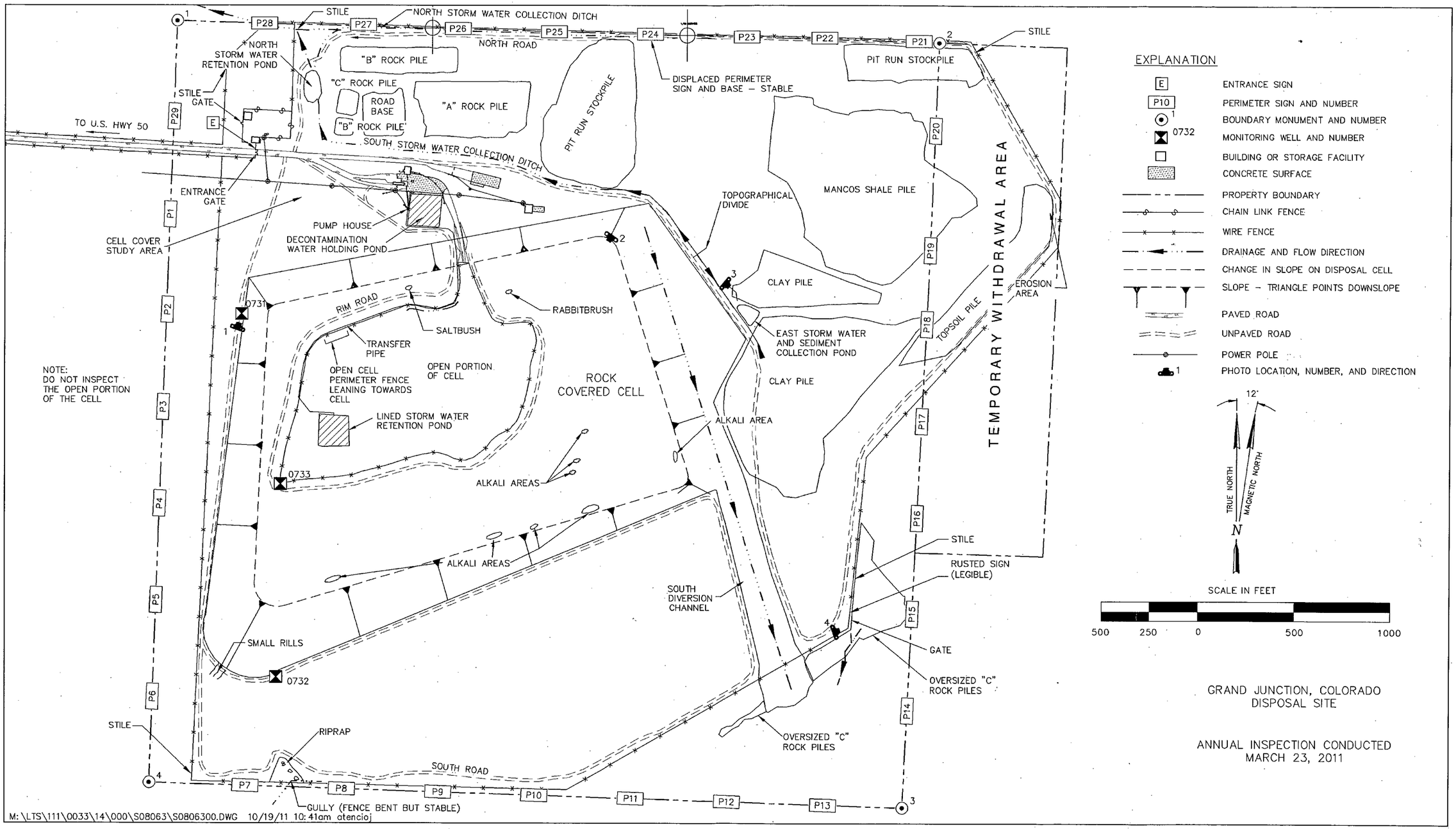

Figure 6–1. 2011 Annual Compliance Drawing for the Grand Junction Disposal Site

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Site Markers and Monuments—Granite site markers similar to those installed at other sites will not be installed at this site until the disposal cell is closed.

The site has four permanent boundary monuments, one at each of the four corners. The monuments mark the exact location of the site corners. All of the boundary monuments were in excellent condition.

Monitoring Wells—The groundwater monitoring network consists of three monitoring wells. All three are inside the site boundary. The wells were secure and in excellent condition (PL–1).

6.3.1.2 Transects

To ensure a thorough and efficient inspection, inspectors divided the site into five areas called "transects": (1) the closed portion of the disposal cell, (2) the diversion structures and drainage channels, (3) the area between the disposal cell and the site boundary, (4) the site perimeter, and (5) the outlying area.

The area inside each transect was inspected by walking a series of traverses. Within each transect, the inspectors examined specific site-surveillance features, drainage structures, and vegetation, along with other features. Inspectors also looked for evidence of settlement, erosion, slumping, or other phenomena that might affect the site's integrity or long-term performance.

Closed Portion of the Disposal Cell—Basalt riprap covers the top and side slopes of the disposal cell. The rock is durable and in excellent condition. There is no evidence of slope instability. The cover was in excellent condition with no evidence of settling or erosion (PL–2).

Some large basalt boulders in the apron at the toe of the southwest corner of the disposal cell have shifted, and minor erosion had recently occurred on the site road at that location. It is assumed that these conditions are attributable to freeze-thaw actions and runoff from melting snow and ice. The disposal cell side slope at this location is stable, and there is no concern regarding the integrity or function of the disposal cell.

Grasses and weeds grow on most of the cell cover, and scattered deep-rooted vegetation (primarily shrubs) has persisted on the cover. The grasses and weeds have shallow root systems and do not degrade cell cover performance. Historically, deep-rooted shrubs have been considered to pose a potential threat to the long-term integrity of the radon barrier and were periodically removed or treated with herbicide. However, recent studies by DOE and the U.S. Environmental Protection Agency (EPA) have indicated that evapotranspiration cover designs perform significantly better than the conventional rock-covered compacted soil layer designs (as used at this site) in terms of limiting permeability and the percolation of moisture into the cells. Therefore, as part of DOE's Renovated Evapotranspiration Cover Assessment Project, a test facility consisting of two lysimeters was constructed at the site in 2007 to compare the performance of the existing cover design with a renovated evapotranspiration design. DOE will use the results from this study to make long-term surveillance and maintenance decisions at this and similar sites.

Diversion Structures and Drainage Channels—The south diversion channel is a large riprap-armored structure that conveys runoff from the disposal cell southeast into a natural drainage that

flows away from the site to the southwest. The diversion channel is in excellent condition. Some plant growth, including grasses, weeds, and deep-rooted shrubs, exists within the channel. However, there is not enough growth to impede water flow within the channel. Erosional features at the outfall of the channel are self-armoring with large basalt boulders and are stable.

Other drainage features at the site include north and south storm water collection ditches, the north storm water retention pond, and a storm water and sediment collection pond on the east side of the south diversion channel (PL–3). These small drainage features control storm water runoff primarily from the various cover materials stockpiled on the northern and eastern portions of the disposal site property. The north storm water collection ditch also captures storm water run-on from a large catchment area north and east of the disposal site. The ditches and ponds are functioning as designed.

Area Between the Disposal Cell and the Site Boundary—There are 12 discrete stockpiles of rock and soil between the disposal cell and the site boundary on the north and east sides of the disposal cell. These materials eventually will be used to cover and close the open cell. Natural vegetation is generally well established and is protecting the stockpiles from significant erosion.

On the south and west sides of the site, between the disposal cell and the perimeter fence, the ground is relatively flat and covered with native vegetation that consists primarily of perennial grasses and small shrubs. No erosion was observed in the undisturbed areas south and west of the disposal cell.

Site Perimeter—A location of active erosion near the southeast corner of the perimeter fence was repaired in 2009. The area was regraded, basalt boulders were installed to reduce erosion, and a drainage ditch to redirect runoff was constructed. No new erosion was apparent (PL–4). A gully is present along the south perimeter fence (near perimeter sign P8) on the fringe of a riprap-armored drainage area. It does not appear to be actively eroding at this time. At some point, the gully may erode beneath one or more of the line posts; however, the fence and posts were taut and stable at the time of the inspection.

Outlying Area—The area outward from the site for a distance of 0.25 mile was visually inspected. No development or disturbance that could affect the site was observed. Most of the land surrounding the site is rangeland administered by BLM. The land is covered by native grass and shrubs, and is used primarily for cattle grazing.

Directly east of the site, just beyond the site boundary, there is a 40-acre temporary withdrawal area of federal land administered by BLM. The temporary withdrawal area is not included in the interim LTSP and, therefore, is not formally inspected. DOE uses the temporary withdrawal area to stockpile cover materials for the eventual closure of the open portion of the cell.

6.3.2 Follow-Up or Contingency Inspections

DOE will conduct follow-up inspections if (1) an annual inspection or other site visit reveals a condition that must be reevaluated during a return to the site, or (2) a citizen or outside agency notifies DOE that conditions at the site are substantially changed.

No follow-up or contingency inspections were required in 2011.

6.3.3 Routine Maintenance and Repairs

No routine maintenance or repairs were required in 2011.

6.3.4 Groundwater Monitoring

Because narrative supplemental standards apply (40 CFR Part 192.21 [g]), groundwater in the uppermost aquifer (Dakota Sandstone) beneath the site need not be monitored. The basis for 6A supplemental standards is that the groundwater is designated "limited use" because the total dissolved solids (TDS) content exceeds 10,000 milligrams per liter (mg/L) (40 CFR Part 192.11 [e]). Confined groundwater in the uppermost aquifer lies approximately 750 feet below the existing ground surface and is hydrogeologically isolated from the tailings material by mudstones and shales of the Mancos Shale.

In lieu of monitoring groundwater in the uppermost aquifer, DOE voluntarily monitors groundwater as a best management practice from two monitoring wells completed in (or very near) buried alluvial paleochannels adjacent to the disposal cell (0731 and 0732) and one monitoring well in the disposal cell (0733) (Table 6–2). This best-management-practice monitoring is done to assess the disposal cell's performance and to ensure that seepage (transient drainage) from the disposal cell is not impacting any groundwater in the paleochannels. The paleochannel wells are along the west (downgradient) edge of the disposal cell and are screened at the interface between the alluvium and shallow Mancos Shale. The third well is in the southwest corner of the open portion of the disposal cell and is used primarily for the measurement of water levels in the deepest part of the disposal cell to demonstrate that the groundwater elevation directly beneath the cell has not risen enough to move laterally into the paleochannels.

Table 6–2. Groundwater Monitoring Network at the Grand Junction Disposal Site

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

Groundwater-Level Monitoring—Static water-level measurements are obtained from each well before water quality samples are collected (Figure 6–2). In September 2006, a datalogger was installed in each well to obtain continuous water-level measurements (at a 4-hour interval).

Since 1998, the water level in disposal cell well 0733 has risen approximately 2.9 feet and has remained significantly lower than the water levels in the two paleochannels wells (0731 and 0732) (Figure 6–2). Water levels within the two paleochannels wells are approximately equal to 1998 levels. The trends for wells 0731 and 0732 have been slightly decreasing, with level fluctuations that range from 2 to 5 feet. Given these elevations, groundwater at the base of the disposal cell at well 0733 has no potential to migrate to the paleochannels at wells 0731 and 0732.

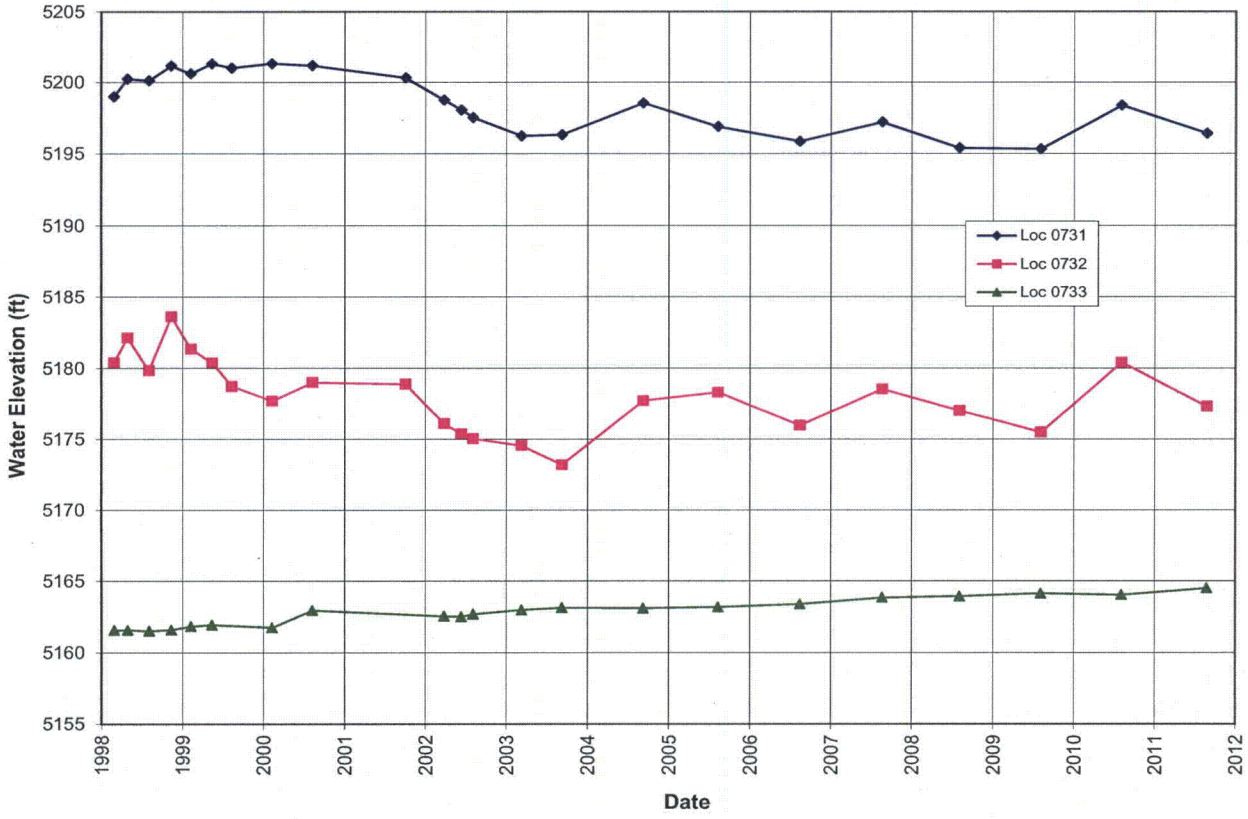


Figure 6–2. Water-Level Measurements at the Grand Junction Disposal Site

Groundwater Quality Monitoring—Groundwater samples are analyzed for standard field parameters and the following indicator analytes: molybdenum, nitrate, selenium, sulfate, TDS, uranium, vanadium, and polychlorinated biphenyls. Key indicator analytes are molybdenum, nitrate, selenium, and uranium. At 40 CFR 192, Subpart A, Table 1, EPA has established maximum concentration limits (MCLs) for these analytes in groundwater (Table 6–3). Time-concentration plots, from 1998 through 2011, for three key indicator analytes—nitrate (as nitrogen), selenium, and uranium—are shown on Figures 6–3 through 6–5.

Table 6–3. Maximum Concentration Limits for Groundwater at the Grand Junction Disposal Site

Constituent	MCL[a] (mg/L)
Molybdenum	0.1
Nitrate (as Nitrogen)	10
Selenium	0.01
Uranium	0.044

[a] EPA MCLs as listed in 40 CFR 192, Subpart A, Table 1.

Nitrate (as nitrogen) concentrations in groundwater continued to exceed the MCL of 10 mg/L in the paleochannel monitoring wells (0731 and 0732) through 2011 (Figure 6–3). Concentrations

in well 0731, following an initial steep downward trend, remained below the MCL from 2000 through 2004. In 2005 and continuing through 2011, concentrations steadily increased and remain above the MCL. Concentrations in well 0732, though varied, have consistently remained above the MCL since 1998. Concentrations in well 0733 continued a significant downward trend, dropping below the MCL in 2006, and reaching a low of 3.4 mg/L in 2011. Historically, the highest concentration of nitrate (96 mg/L) occurred in 1998 from disposal cell well 0733. In 2011, the concentration of nitrate has increased slightly, and the nitrate levels in both paleochannel monitoring wells are very similar: 31 mg/L in well 0731 and 32 mg/L in well 0732.

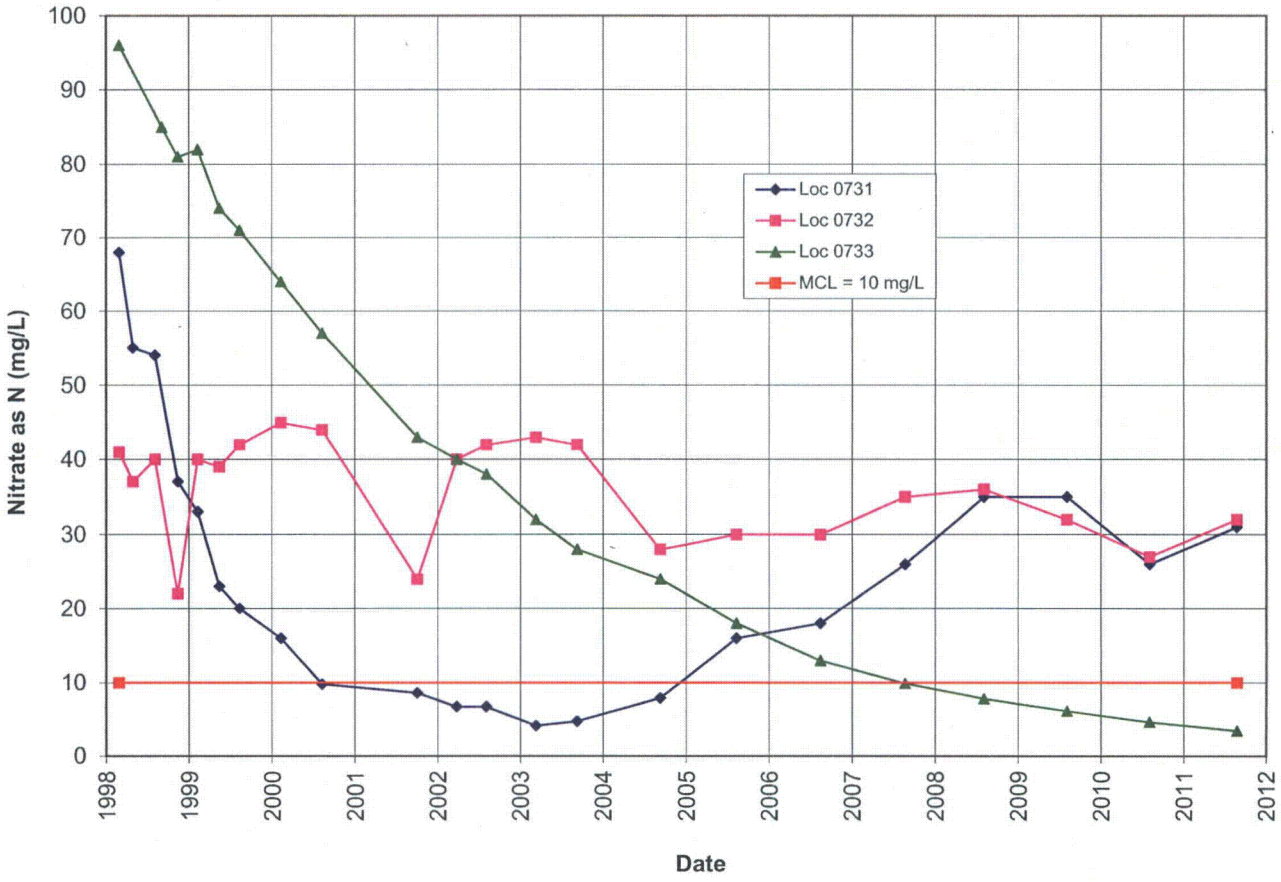


Figure 6–3. Time-Concentration Plots of Nitrate (as Nitrogen) in Groundwater at the Grand Junction Disposal Site

Selenium occurs naturally in the Mancos Shale deposits that underlie the disposal cell, and may be the cause of the elevated concentrations reported in both paleochannel monitoring wells (0731 and 0732). Selenium concentrations continued to exceed the MCL of 0.01 mg/L in the paleochannel wells (Figure 6–4). Concentrations in well 0731 displayed a sharp decreasing trend, and the decreasing trend continued until 2003, when a slight upward trend began. Selenium concentrations in well 0731 have decreased since 2009. Concentrations in well 0732 continue to display no trend. In well 0733, the selenium concentration of 0.0038 mg/L remained well below the standard, with no trend evident.

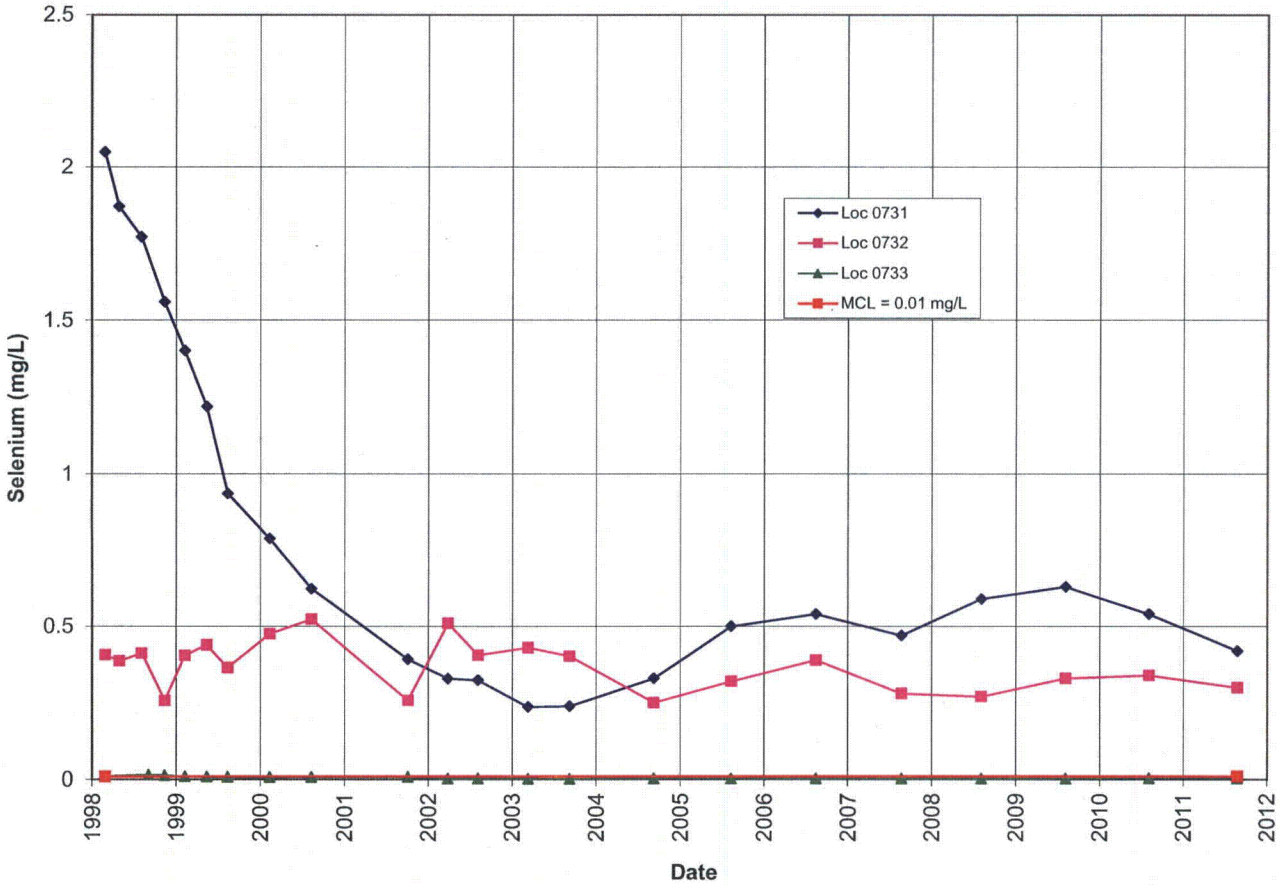


Figure 6–4. Time-Concentration Plots of Selenium in Groundwater at the Grand Junction Disposal Site

Uranium concentrations in groundwater were below the MCL of 0.044 mg/L in paleochannel wells 0731 and 0732, and were above the MCL in well 0733 (Figure 6–5). Concentrations in well 0731, after an initial increase above the MCL, have displayed a decreasing trend that continued in 2011. Concentrations in well 0732 have remained relatively consistent. Concentrations in well 0733 remained relatively consistent through 2003, at which time an upward trend began, which has leveled off at 0.11 mg/L for the 2010 and 2011 sampling events.

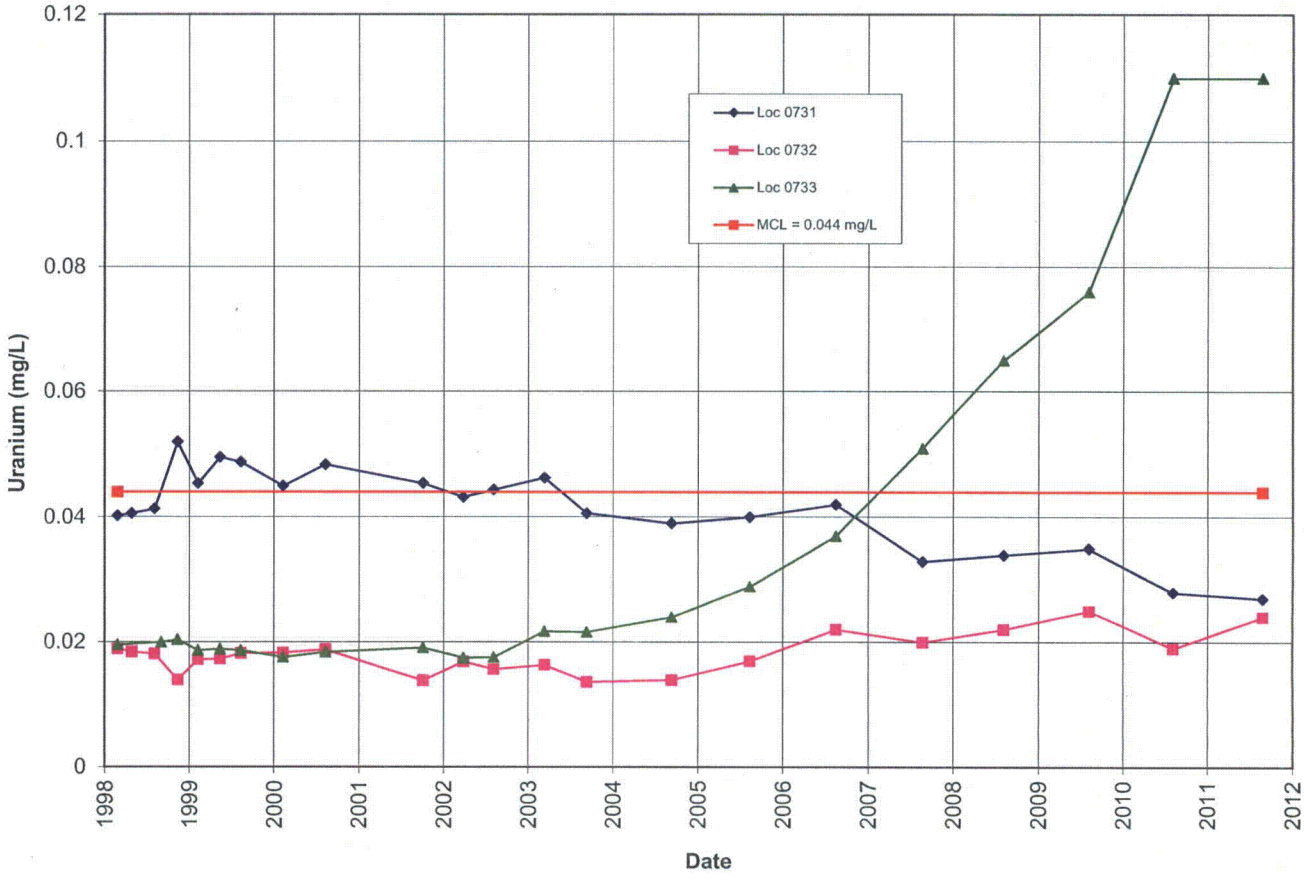


Figure 6–5. Time-Concentration Plots of Uranium in Groundwater at the Grand Junction Disposal Site

6.3.5 Corrective Action

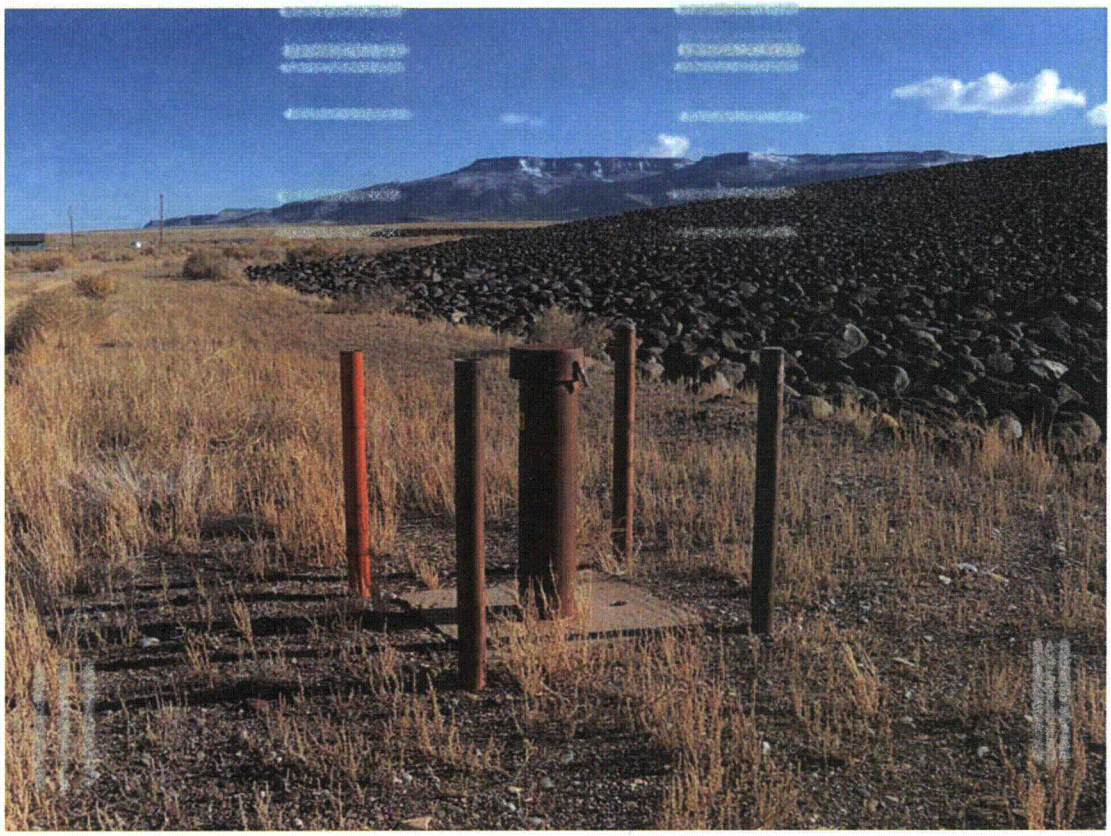
Corrective action is taken to correct out-of-compliance or hazardous conditions that create a potential health and safety problem or that may affect the integrity of the disposal cell or compliance with 40 CFR 192.

No corrective action was required in 2011.

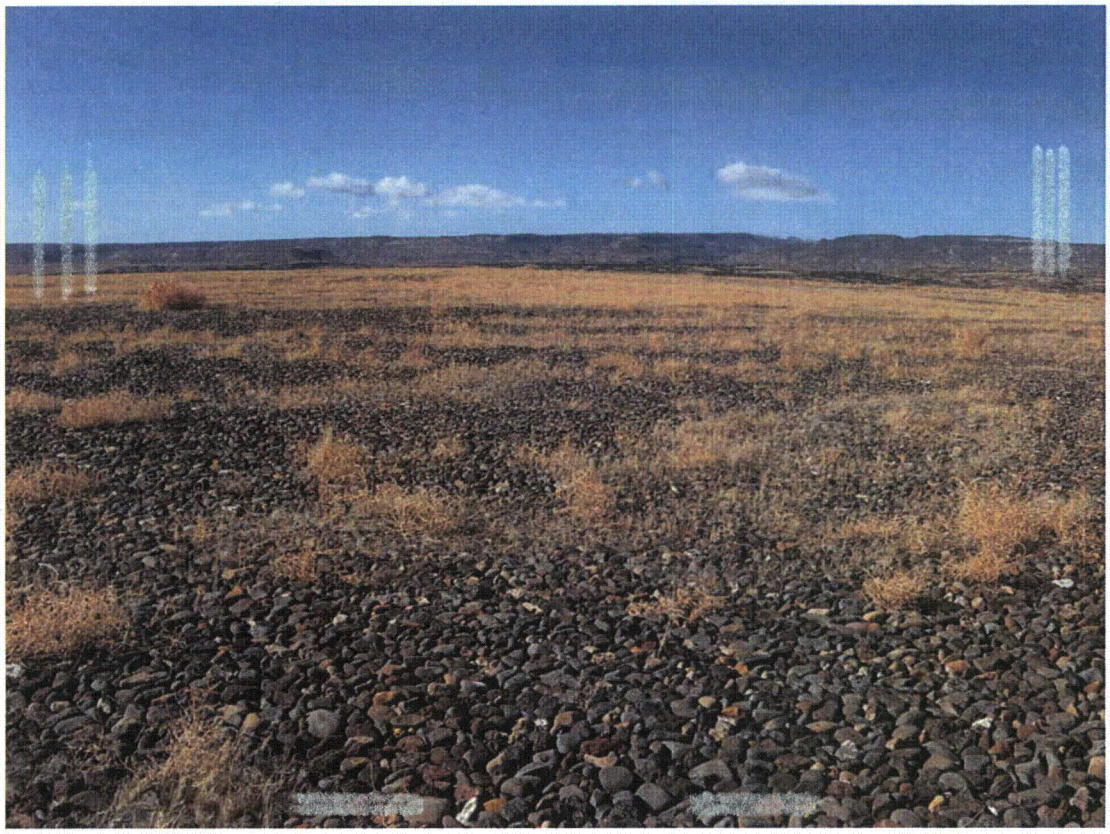
6.3.6 Photographs

Table 6–4. Photographs Taken at the Grand Junction Disposal Site

Photograph Location Number	Azimuth	Photograph Description
PL–1	20	Monitoring well 0731 near the northwest corner of the disposal cell.
PL–2	215	Northeast corner of the disposal cell cover.
PL–3	130	East storm water and sediment collection pond.
PL–4	70	Riprap erosion protection near the southeast corner of the perimeter fence.



GRJ 3/2011. PL–1. Monitoring well 0731 near the northwest corner of the disposal cell.



GRJ 3/2011. PL–2. Northeast corner of the disposal cell cover.

GRJ 3/2011. PL–3. East storm water and sediment collection pond.

GRJ 3/2011. PL–4. Riprap erosion protection near the southeast corner of the perimeter fence.

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7.0 Green River, Utah, Disposal Site

7.1 Compliance Summary

The Green River, Utah, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site was inspected on March 29, 2011. The disposal cell was in excellent condition. Groundwater monitoring continued for the purpose of evaluating cell performance; no constituents of concern exceeded their respective proposed alternate concentration limits (ACLs). No additional maintenance needs or cause for a follow-up or contingency inspection was identified.

7.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the *Long-Term Surveillance Plan for the Green River, Utah, Disposal Site* (DOE/AL/62350–89, Rev. 2, U.S. Department of Energy [DOE], July 1998; LTSP) and in procedures established by DOE to comply with the requirements of Title 10 *Code of Federal Regulations* Part 40.27 (10 CFR 40.27). Table 7–1 lists these requirements.

Table 7–1. License Requirements for the Green River Disposal Site

Requirement	Long-Term Surveillance Plan	This Report
Annual Inspection and Report	Section 6.0	Section 7.3.1
Follow-Up or Contingency Inspections	Section 7.0	Section 7.3.2
Routine Maintenance and Repairs	Section 8.0	Section 7.3.3
Groundwater Monitoring	Section 5.2	Section 7.3.4
Corrective Action	Section 9.0	Section 7.3.6

Institutional Controls—The 25-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 40.27) in 1998. DOE is the licensee and, in accordance with the requirements for UMTRCA Title I 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 disposal cell perimeter security fence, warning/no-trespassing signs along the property boundary, and a locked gate at the entrance to the site. Verification of these institutional controls is part of the annual inspection.

Inspectors found no evidence that these institutional controls were ineffective or violated.

7.3 Compliance Review

7.3.1 Annual Inspection and Report

The site, southeast of Green River, Utah, was inspected on March 29, 2011. The results of the inspection are described below. Figure 7–1 shows features and photograph locations (PLs) mentioned in this report. Numbers in the left margin of this report refer to items summarized in the "Executive Summary" table.

7.3.1.1 Specific Site-Surveillance Features

Access Road, Entrance Gate, Fence, and Signs—The site can be accessed either from the Town of Green River or from U.S. Interstate Highway 70 via a paved road. The access route crosses State land and U.S. Army property. Perpetual access has been granted to DOE through right-of-way agreements with both agencies.

Entrance to the site is through a locked steel gate in the access road right-of-way fence. Past this gate, a short track leads across State land to the disposal cell, which is enclosed within a chain-link security fence. The chain-link fence is set back between 50 and 250 feet from the site boundary. Two vehicle access gates are installed in this fence at the south and east corners of the fence line. A personnel gate is at the north corner of the fence line. The security fence and gates were in excellent condition.

One entrance sign and 17 perimeter signs are positioned on posts set along the unfenced site boundary. Perimeter sign P12 has a bullet dent but is legible. The other signs were in excellent condition.

Site Markers and Monuments—Two granite site markers are on site, and both were in good condition (PL–1). The concrete base of site marker SMK–1 has several cracks, but there is no need for repairs at this time. Eleven boundary monuments and three survey monuments are along the site perimeter. All of the monuments were in excellent condition.

Monitoring Wells—The twenty-two groundwater monitoring wells were secure and in excellent condition at the time of the inspection (PL–2). Section 7.3.4 describes the groundwater monitoring and its results.

7.3.1.2 Transects

To ensure a thorough and efficient inspection, the site is divided into three transects: (1) the disposal cell and adjacent area inside the security fence, (2) the site perimeter between the security fence and the site boundary, and (3) the outlying area.

Within each transect, the inspectors examined specific site-surveillance features, vegetation, and other features. Inspectors also looked for evidence of settlement, erosion, or other modifying processes.

Disposal Cell and Adjacent Area Inside the Security Fence—The 6-acre disposal cell was completed in 1989. The slopes of the disposal cell cover are armored with basalt rock. No evidence of any disturbance of the cell surfaces was observed. No vegetation was present on the cell. The quality of the rock is excellent, and the disposal cell cover was in excellent condition (PL–3).

A basalt boulder-filled trench, referred to as an apron, surrounds the disposal cell. The apron collects all runoff water from the cell, and the water is reduced by evaporation, evapotranspiration through deep-rooted shrubs that grow along the apron, and infiltration into the underlying bedrock and aquifer through the sides and bottom of the apron. The apron was in excellent condition (PL–4).

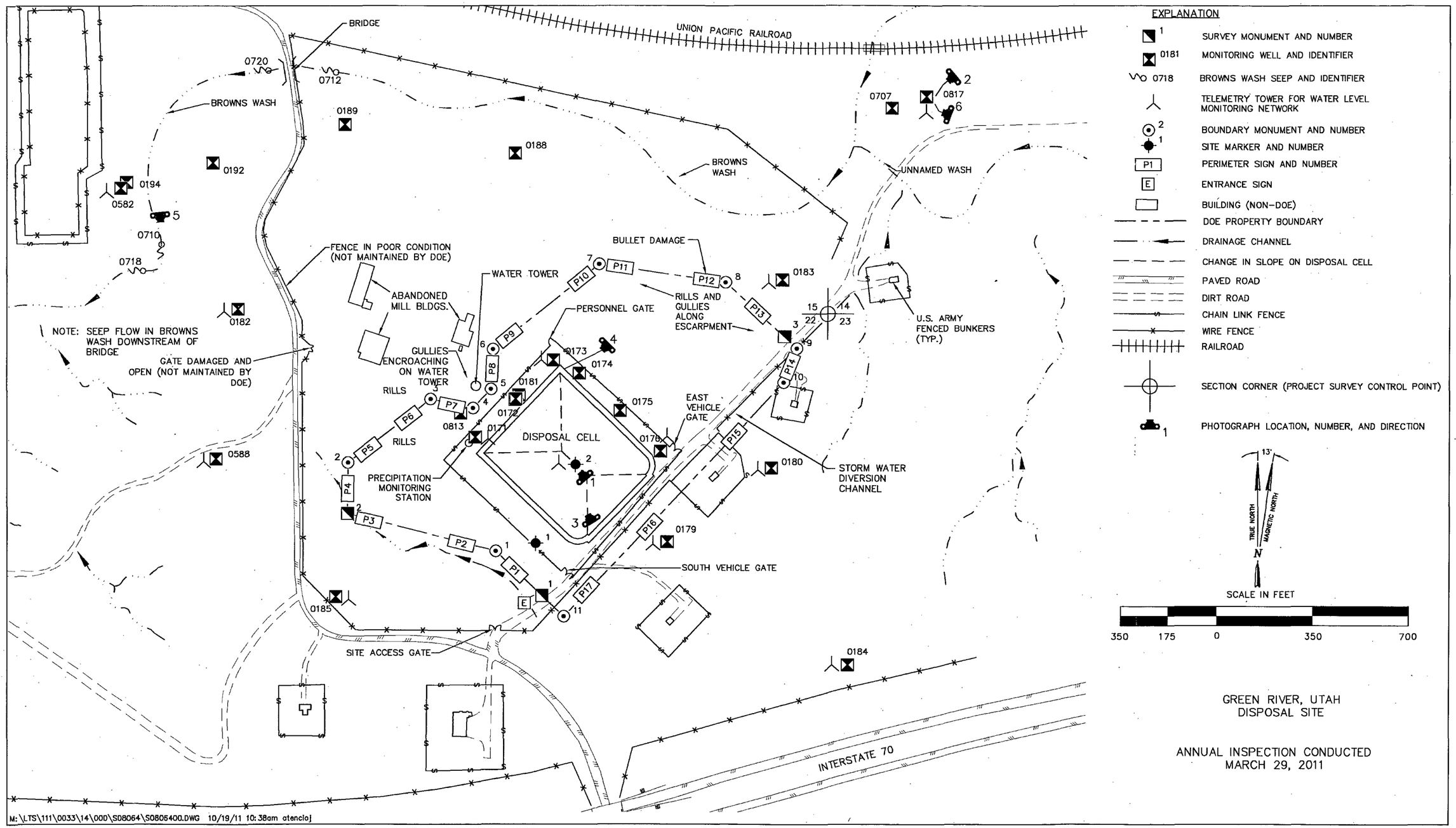

Figure 7–1. 2011 Annual Compliance Drawing for the Green River Disposal Site

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Site Perimeter Between the Security Fence and the Site Boundary—Rills and gullies are present on the west side of the property but do not encroach on disposal cell structures and currently are not affecting any site surveillance features. Rills and gullies are also present along the escarpment northeast of the disposal cell in the area between boundary monument BM–7 and survey monument SM–3. Maximum gully depth in this area is approximately 3 feet. The rill and gully erosion does not encroach on disposal cell structures but could eventually damage perimeter signs and boundary monuments; therefore, the erosion features in this area will continue to be monitored.

Trespassing occurs on the site from several access points through State land. The barbed-wire stock fence on the surrounding State-owned property provides only minimal security; the fence west of the site is in poor condition, and a gate providing access to the former mill buildings and the DOE site is broken off its hinges. The site is also accessible through remote open access points north and east of the property. DOE property will continue to be monitored for adverse public use indicated by trash, tire ruts, and vandalism.

Outlying Area—The area extending outward from the site for a distance of 0.25 mile was checked for signs of erosion, development, or other disturbance that might affect site security or integrity. Areas of erosion noted during recent and previous inspections include the natural drainage southwest of the site, and rills and gullies northwest of the water tower. Minor erosion continues but currently does not threaten the integrity of the disposal cell or site-surveillance features.

Abandoned buildings and a water tower associated with the former milling activities at the site are northwest and upwind of the DOE property. The buildings are in a severe state of disrepair, and debris (e.g., roofing materials, siding, trash) tends to be blown from the buildings onto the DOE property. Accumulation of materials blown onto DOE property was not significant but will continue to be monitored; debris will be removed as necessary.

A new overhead power line was installed since the last inspection. The power line, with a north-south alignment, crosses private property approximately 700 feet west of the site. Construction activities did not impact the site, and the presence of the power line does not affect the site.

The conditions of Browns Wash were observed during the inspection. Flow was occurring in the channel between the road bridge and the backwater area near the confluence with the Green River (PL–5). The streambed upstream of the bridge was dry; therefore, the flow downstream of the bridge was from seeps. Because the middle sandstone unit is not present under the principal seep area (seep location 0718), the source of the seep water is most likely from the Browns Wash alluvium.

The backwater area near the mouth of Browns Wash was investigated because of its potential to be a fish-spawning location. The backwater area had scoured out since the last inspection, and the water was several feet deep. The conditions of Browns Wash channel and the backwater area change substantially after each runoff event as sediment is either scoured or deposited along the channel bottom.

7.3.2 Follow-Up or Contingency 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 or contingency inspections were required in 2011.

7.3.3 Routine Maintenance and Repairs

No maintenance or repairs were conducted in 2011.

7.3.4 Groundwater Monitoring

7A In compliance with 40 CFR 192, Subpart A, and as stipulated in the LTSP, the groundwater monitoring network consists of four point-of-compliance (POC) wells northwest of the disposal cell (0171, 0173, 0181, and 0813). Two additional POC wells (0176 and 0179) have been added to the compliance network. The purpose of the monitoring is to evaluate the performance of the disposal cell. Additionally, wells 0188, 0189, 0192, and 0194, completed in the contaminated but low-yield Browns Wash alluvium, have been added to the groundwater monitoring network as a best management practice. The *Draft Groundwater Compliance Action Plan for the Green River, Utah, Disposal Site* (August 2011; GCAP) adds additional best management practice wells. These wells (0182, 0184, 0185, and 0588) are completed in the basal unit of the Cedar Mountain Formation.

Monitoring wells 0171, 0173, 0176, 0179, 0183, 0813, and 0817 are currently providing continuous water-level measurements for the contaminated middle sandstone unit, and wells 0182, 0184, 0185, 0582, and 0588 are providing continuous water-level measurements for the uncontaminated basal sandstone unit in the Cedar Mountain Formation. A telemetry system was installed at these wells in January 2007 to send data to the DOE Office of Legacy Management (LM) office in Grand Junction (PL–6). Wells 0817 and 0582, completed in the middle sandstone unit and basal sandstone unit, respectively, are capped to prevent artesian flow and to allow continuous measurements of the potentiometric surface through pressure transducers. DOE owns additional wells in the site vicinity (shown on the attached drawing) that are not included in the groundwater monitoring network (0172, 0174, 0175, and 0707). DOE will retain these wells in case future monitoring is desired.

Based on the evaluation of several years of analytical data and associated risk, the ACLs listed in Table 7–2 have been proposed in the GCAP. If NRC and the State of Utah accept the GCAP, these proposed ACLs will apply to all POC wells.

Table 7–2. Proposed Alternate Concentration Limits for Point-of-Compliance Wells at the Green River Disposal Site

Constituent	Standard (mg/L)[a]	Proposed ACL (mg/L)
Arsenic	0.05	1.9
Nitrate + Nitrite as Nitrogen	10	4,270
Selenium	0.01	8.5
Uranium	0.044	2.3

[a] U.S. Environmental Protection Agency maximum concentration limit (40 CFR 192, Table 1).
Key: ACL = alternate concentration limit; mg/L = milligrams per liter

Quarterly monitoring of the original four POC wells was conducted from 1998 through June 2007. Risk analyses have determined that there is no unacceptable risk to human health and the environment as a result of site-related contamination in groundwater near the site because the groundwater is not used and because site contaminants do not affect river water quality. Therefore, DOE determined that there was no health or cost benefit associated with continuing quarterly monitoring. Annual monitoring has been implemented instead.

Cell Performance Monitoring—Table 7–3 provides the analytical results for the June 2011 sampling event at the proposed POC wells. Time-concentration plots for the four target analytes—arsenic, nitrate, selenium, and uranium—are shown on Figures 7–2 through 7–5.

Table 7–3. 2011 Analytical Results for Point-of-Compliance Wells at the Green River Disposal Site

Monitoring Well	Arsenic (mg/L)		Nitrate[a] (mg/L)		Selenium (mg/L)		Uranium (mg/L)	
	ACL	Sample Result	ACL	Sample Result	ACL	Sample Result	ACL	Sample Result
0171	1.9	0.0011	4,270	44	8.5	0.14	2.3	0.1
0173	1.9	0.0016	4,270	230	8.5	0.088	2.3	0.019
0176	1.9	0.00029	4,270	68	8.5	0.86	2.3	0.0025
0179	1.9	0.00074	4,270	19	8.5	0.3	2.3	0.17
0181	1.9	0.0038	4,270	80	8.5	0.011	2.3	0.013
0813	1.9	0.063	4,270	0.01	8.5	0.00064	2.3	0.018

[a] Nitrate = nitrate plus nitrite as nitrogen
Key: ACL = proposed alternate concentration limit; mg/L = milligrams per liter; ND = not detected (below laboratory detection limit)

Arsenic concentrations in groundwater remain below the U.S. Environmental Protection Agency (EPA) maximum concentration limit (MCL) of 0.05 milligram per liter (mg/L) in all POC wells except well 0813, and remain considerably below the proposed ACL of 1.9 mg/L in all POC wells. In well 0813, levels continue to exceed the MCL, as shown on Figure 7–2, but are substantially below the proposed ACL. The results for this well indicate that arsenic concentrations have trended downward since 2005.

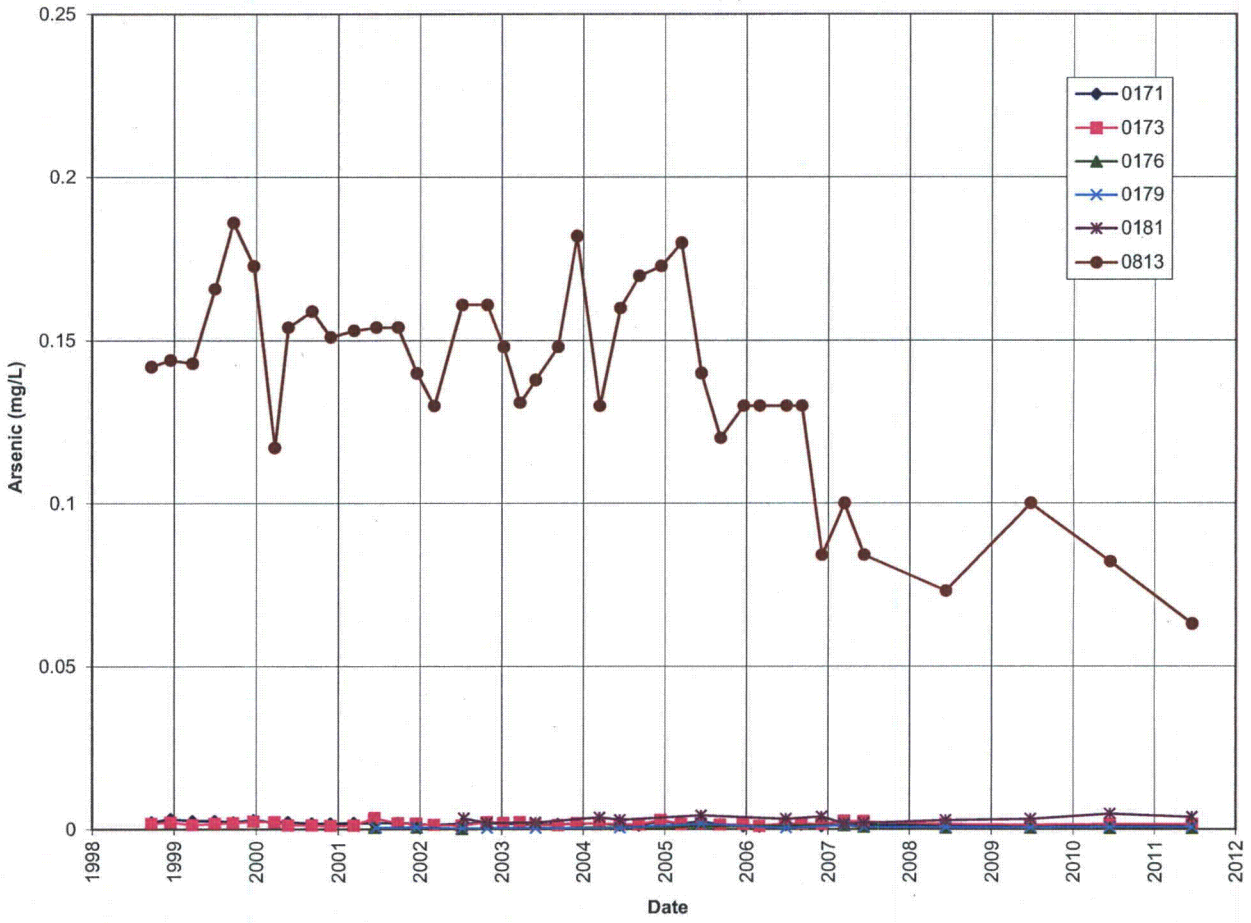


Figure 7–2. Time-Concentration Plots of Arsenic in Groundwater at the Green River Disposal Site

Nitrate concentrations have been measured as nitrate plus nitrite as nitrogen since early 2004 (before then, nitrate was measured as NO_3). Concentrations have continued to exceed the EPA MCL of 10 mg/L in all POC wells except well 0813, but they are considerably below the proposed ACL of 4,270 mg/L in all wells (Figure 7–3). Nitrate concentrations in well 0813 continue to be below the laboratory detection limit. Nitrate concentrations in the other wells are similar to previous measurements, and no trends are apparent.

Selenium concentrations in wells 0181 and 0813 remain below the EPA MCL of 0.01 mg/L. Concentrations in the other wells continue to be above the standard but are substantially below the proposed ACL of 8.5 mg/L (Figure 7–4). Well 0176 was showing a decreasing trend; however, the June 2011 result has rebounded to 2007 levels.

Uranium concentrations in groundwater remain below the EPA MCL of 0.044 mg/L in all POC wells except wells 0171 and 0179, and remain considerably below the proposed ACL of 2.3 mg/L in all POC wells. The highest uranium concentrations continue to occur in well 0179 (0.17 mg/L), which is upgradient of the disposal cell. The reason for the elevated concentration of uranium in well 0179 has not been determined, but it may be due to natural causes. At well 0171, concentrations exceed the MCL and indicate an upward trend since 1998 (Figure 7–5). Because uranium is the only constituent of concern that has indicated an upward trend in well 0171, no conclusions regarding the cause of the trend have been reached.

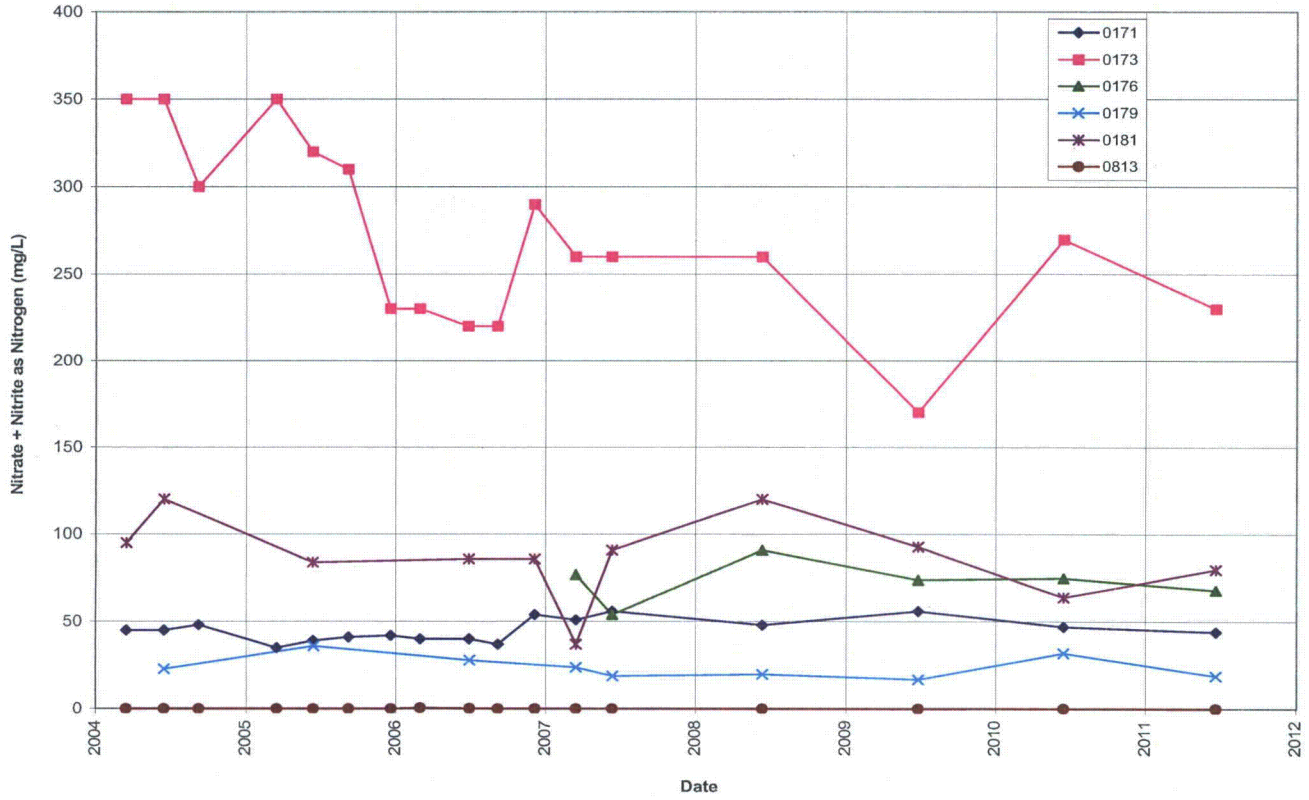


Figure 7–3. Time-Concentration Plots of Nitrate in Groundwater at the Green River Disposal Site

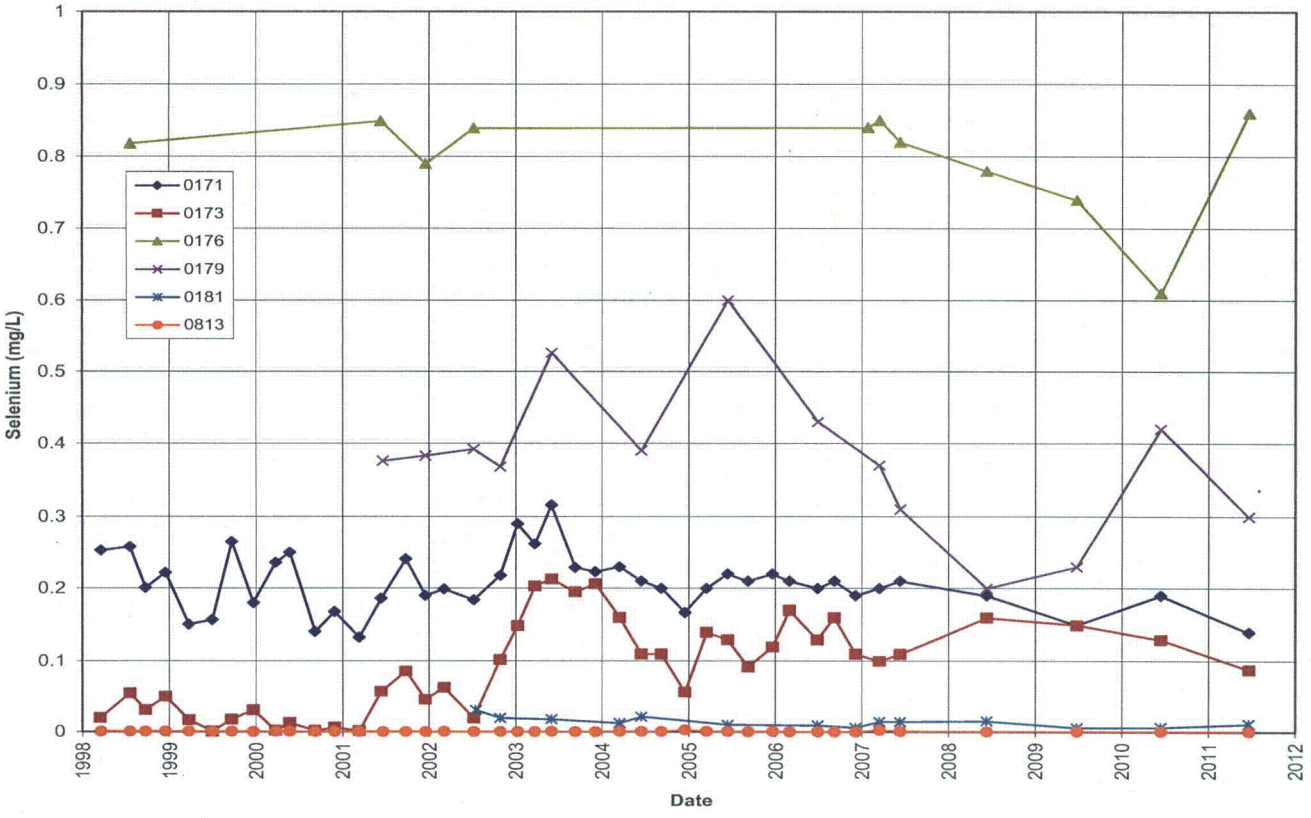


Figure 7–4. Time-Concentration Plot of Selenium in Groundwater at the Green River Disposal Site

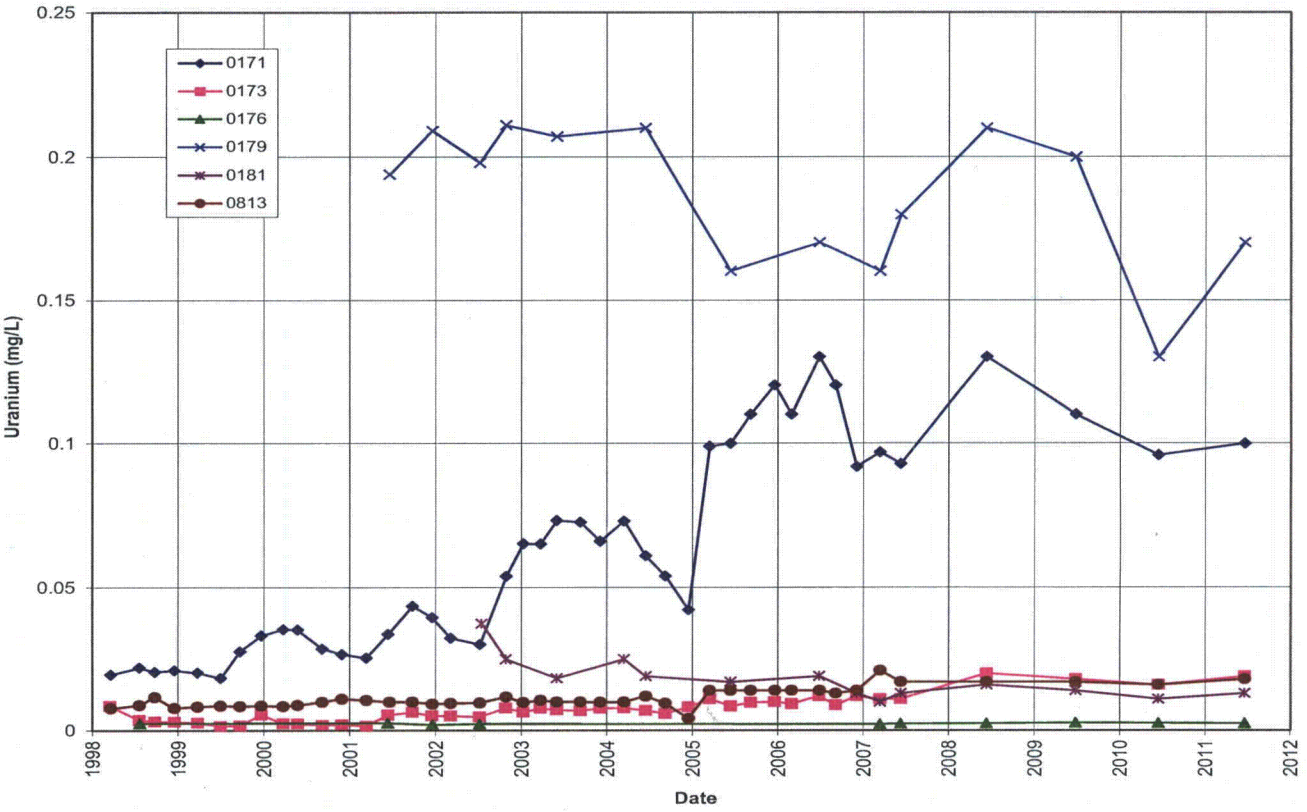


Figure 7–5. Time-Concentration Plot of Uranium in Groundwater at the Green River Disposal Site

Groundwater-Level Monitoring—Groundwater levels in several monitoring wells adjacent to the disposal cell have been measured manually since 1991, and continuously with down-hole dataloggers since 1999. Thirteen wells currently have dataloggers, and a telemetry system was installed in 2007 to transmit the continuous water-level monitoring data to the LM office in Grand Junction. The purpose of continuous monitoring is to evaluate the hydraulic gradient and flow directions in the two Cedar Mountain Formation aquifers near the disposal cell.

Water-level hydrographs of the POC wells, completed in the middle sandstone aquifer, indicate that the groundwater elevation decreased approximately 3 feet overall from 1998 through 2004, and then increased approximately 8 feet between 2004 and 2007. Water levels have decreased approximately 2 to 3 feet since 2007, although slight increases occurred in 2010 and 2011 (Figure 7–6).

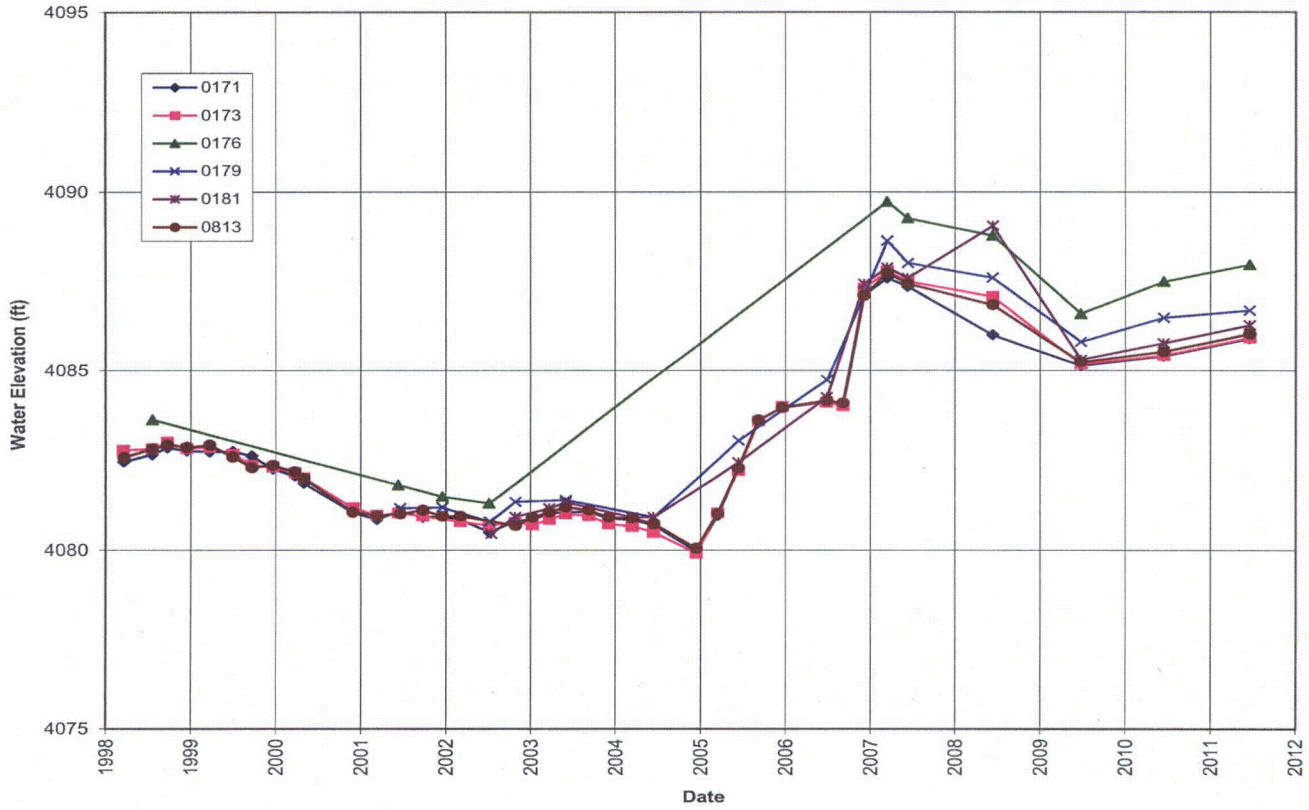


Figure 7–6. Groundwater Elevations at the Green River Disposal Site

The monitoring well locations in the two Cedar Mountain aquifers are not ideal (i.e., no nested well pairs in the upper and lower aquifers) to define both the groundwater flow directions and the hydraulic gradient between the aquifers. However, groundwater elevation data derived from the existing well network are adequate to determine that flow direction in the upper aquifer is toward the west-northwest, while flow direction in the lower aquifer is toward the southwest. The data also suggest that there is a neutral gradient between the two aquifers, therefore neither inducing nor retarding contaminant migration from the contaminated upper aquifer to the uncontaminated lower aquifer.

Browns Wash Alluvium Well Monitoring—Analytical results for the June 2011 sampling event at the wells completed in the Browns Wash alluvium are provided in Table 7–4. Because of the proposed application of supplemental standards, ACLs do not apply to the alluvium groundwater. Contaminants are expected to eventually be flushed out of the alluvium as the groundwater migrates toward the Green River alluvium and the Green River.

Table 7–4. 2011 Analytical Results for the Browns Wash Alluvium Wells at the Green River Disposal Site

Monitoring Well	Arsenic (mg/L)	Nitrate[a] (mg/L)	Selenium (mg/L)	Uranium (mg/L)
0188	0.00027	9.5	0.034	0.074
0189	0.00064	39	0.067	0.34
0192	0.00028	79	0.11	0.48
0194	0.0025	370	0.024	4.1

[a] Nitrate = nitrate plus nitrite as nitrogen
Key: mg/L = milligrams per liter

Concentrations of arsenic, nitrate, and uranium have been steady in wells 0188 and 0192 but variable in wells 0189 and 0194. The highest arsenic, nitrate, and uranium concentrations were in well 0194. The highest and most variable selenium concentrations have been occurring in well 0192. Generally, the groundwater quality degrades from east (upgradient) to west (downgradient). This condition may be indicating that the contaminated alluvium groundwater is gradually moving downgradient.

Cedar Mountain Formation Basal Unit Well Monitoring—Analytical results for the June 2011 sampling event at the wells completed in the basal unit of the Cedar Mountain Formation are provided in Table 7–5.

Table 7–5. 2011 Analytical Results for the Basal Unit of the Cedar Mountain Formation Wells at the Green River Disposal Site

Monitoring Well	Arsenic (mg/L)	Nitrate[a] (mg/L)	Selenium (mg/L)	Uranium (mg/L)
0182	0.0035	0.022	0.000075	0.001
0184	0.0018	0.078	0.00035	0.0029
0185	0.0017	0.078	0.00031	0.0028
0588	0.00099	0.12	0.000061	0.00067

[a] Nitrate = nitrate plus nitrite as nitrogen
Key: mg/L = milligrams per liter

Beginning in 2011, these wells were added to the list of wells that are sampled annually. Data from this sampling will be used to assess any downward migration of contaminants from the middle sandstone to the basal sandstone. Sulfate will be added to the analyte list because sulfate is relatively unaffected by natural attenuation. Therefore, sulfate should be a good indicator of contaminant transport.

7.3.5 Surface Water Monitoring

According to the site conceptual model, the ultimate point of exposure for groundwater in the middle sandstone unit is the Green River, while exposure to Browns Wash alluvium water is the Green River and Browns Wash backwater. Risk analyses have determined, however, that there are no unacceptable risks to potential receptors (human or ecological) at these locations. As a best management practice, DOE monitors the surface water at these two locations to verify that any contaminated groundwater would not harm ecological receptors in Browns Wash and the Green River. Table 7–5 provides proposed surface water standards in accordance with Utah Rule R317–2, Table 2.14.2.

Table 7–6. Proposed Surface Water Standards for the Browns Wash and Green River Sampling Locations

Constituent	Surface Water Standard (mg/L)
Ammonia as nitrogen	About 0.5 to 1.0 (pH- and temperature-dependent)
Arsenic	0.150 (4-day)
Nitrate + nitrite as nitrogen	4
Selenium	0.0046 (4-day)
Uranium	No standard

Key: mg/L = milligrams per liter

A location in the Green River immediately downstream of the mouth of Browns Wash (0846) and a location in the backwater area of Browns Wash (0847) are sampled annually. Analytical results for the June 2011 sampling event are provided in Table 7–7. To date, no surface water sample results have exceeded the standards, and there is no indication that site contamination has degraded the surface water quality at these locations.

Table 7–7. 2011 Analytical Results for the Surface Water Locations at the Green River Disposal Site

Location	Ammonia as Nitrogen (mg/L)	Arsenic (mg/L)	Nitrate[a] (mg/L)	Selenium (mg/L)	Uranium (mg/L)
0846 (Green River)	ND	0.0013	0.034	0.00042	0.0013
0847 (Backwater)	ND	0.0018	0.12	0.00089	0.0022

[a] Nitrate = nitrate plus nitrite as nitrogen

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

7.3.6 Corrective Action

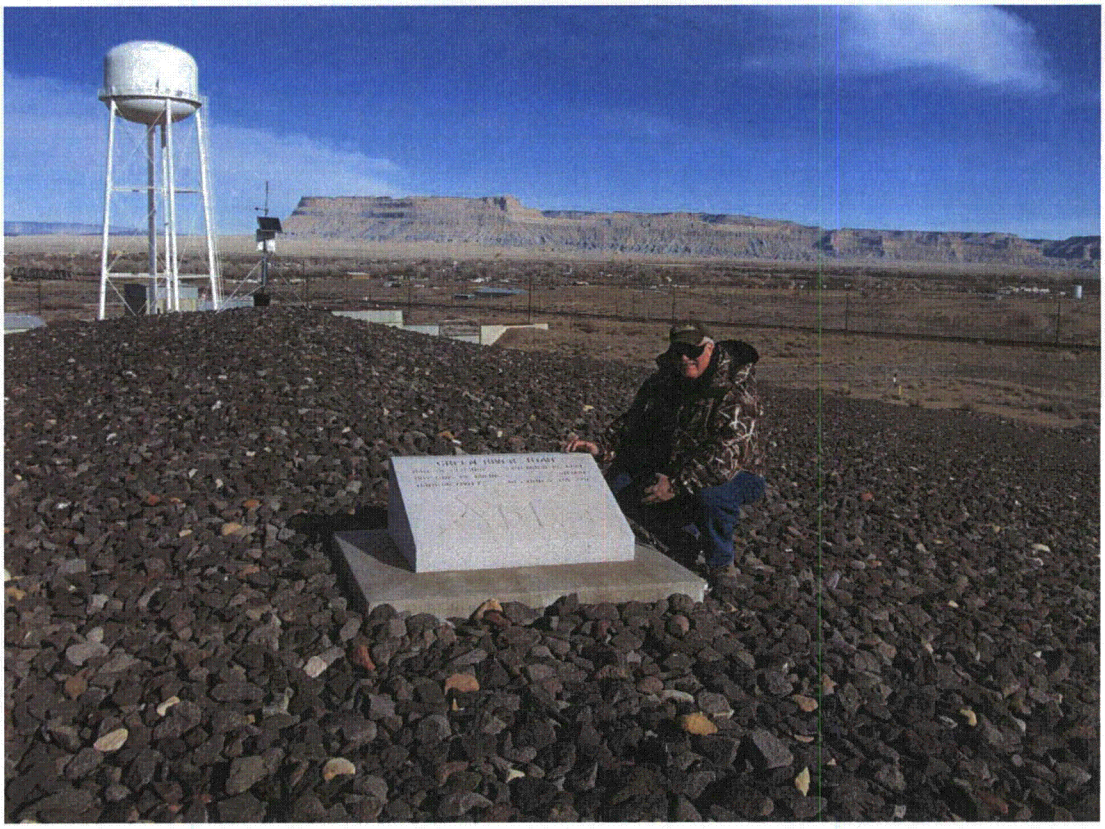
Corrective action is taken to correct out-of-compliance or hazardous conditions that create a potential health and safety problem or that may affect the integrity of the disposal cell or compliance with 40 CFR 192.

No corrective action was required in 2011.

7.3.7 Photographs

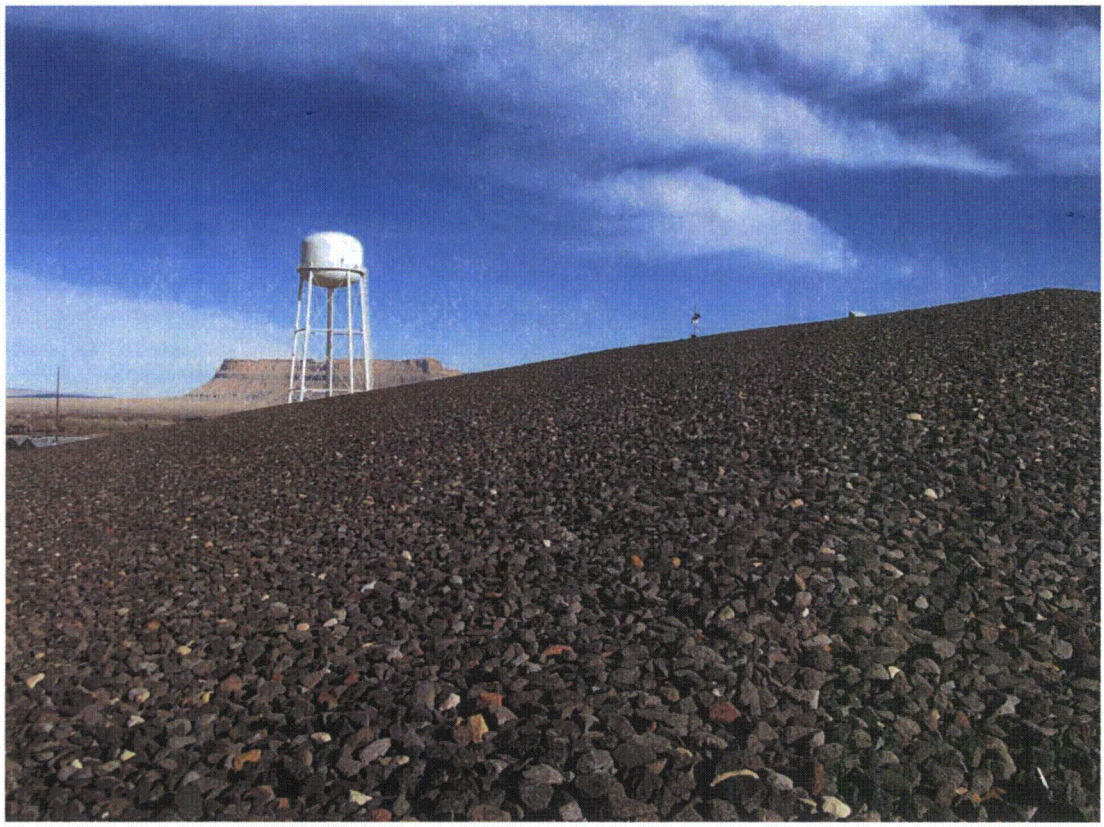
Table 7–8. Photographs Taken at the Green River Disposal Site

Photograph Location Number	Azimuth	Description
PL–1	320	Site marker SMK–2 on the disposal cell top.
PL–2	330	Monitoring well 0817.
PL–3	330	Southwest side slope of the disposal cell.
PL–4	225	Northwest side slope and apron of the disposal cell.
PL–5	175	Seep 0710 in Browns Wash.
PL–6	290	Monitoring well 0817 and enclosed telemetry tower.



GRN 3/2011. PL–1. Site marker SMK–2 on the disposal cell top.

GRN 3/2011. PL–2. Monitoring well 0817.



GRN 3/2011. PL–3. Southwest side slope of the disposal cell.

GRN 3/2011. PL–4. Northwest side slope and apron of the disposal cell.

GRN 3/2011. PL–5. Seep 0710 in Browns Wash.

GRN 3/2011. PL–6. Monitoring well 0817 and enclosed telemetry tower.

8.0 Gunnison, Colorado, Disposal Site

8.1 Compliance Summary

The Gunnison, Colorado, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site was inspected on June 7, 2011. The disposal cell and all associated surface water diversion and drainage structures were in excellent condition and functioning as designed. Six riprap test areas on the cell apron and diversion ditches were visually inspected; no apparent rock degradation was noted when compared to previous photos. A broken fence strand was repaired. No other maintenance needs or cause for a follow-up or contingency inspection was identified.

8.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the *Long-Term Surveillance Plan for the Gunnison, Colorado, Disposal Site* (DOE/AL/62350–222, Rev. 2, U.S. Department of Energy [DOE], April 1997; LTSP) and in procedures established by DOE to comply with the requirements of Title 10 *Code of Federal Regulations* Part 40.27 (10 CFR 40.27). Table 8–1 lists these requirements.

Table 8–1. License Requirements for the Gunnison Disposal Site

Requirement	Long-Term Surveillance Plan	This Report
Annual Inspection and Report	Section 3.0	Section 8.3.1
Follow-Up or Contingency Inspections	Section 3.5	Section 8.3.2
Routine Maintenance and Repairs	Section 5.0	Section 8.3.3
Groundwater Monitoring	Section 4.1	Section 8.3.4
Corrective Action	Section 6.0	Section 8.3.5

Institutional Controls—Institutional controls at the disposal site, as defined by DOE Policy 454.1, consist of federal ownership of the property, a site perimeter fence, warning/no-trespassing signs along the property boundary, and locked gates on the site perimeter. The 92-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 40.27) in 1997. DOE is the licensee and, in accordance with the requirements for UMTRCA Title I sites, is responsible for the custody and long-term care of the site.

Inspectors found no evidence that these institutional controls were ineffective or violated.

8.3 Compliance Review

8.3.1 Annual Inspection and Report

The site, southeast of Gunnison, Colorado, was inspected on June 7, 2011. The results of the inspection are described below. Figure 8–1 shows features and photograph locations (PLs) mentioned in this report. Numbers in the left margin of this report refer to items summarized in the "Executive Summary" table.

8.3.1.1 Specific Site-Surveillance Features

Access Road, Entrance Gate, Signs, and Fence—Access to the site is off Gunnison County Road 42 onto U.S. Bureau of Land Management (BLM) Road 3068 to the site entrance gate. The road to the site is an all-weather gravel road maintained by BLM and was in good condition.

The entrance gate is a simple barbed-wire gate in the stock fence that surrounds the site. The entrance gate, located along the south portion of the perimeter fence, was secured by a padlock and chain to the adjoining post and was in good condition. Two other locked barbed-wire gates—one on the north fence line and the other on the east fence line—provide monitoring well access. The gates were locked and in excellent condition.

8A A three-strand, barbed-wire fence delineates the site; most of it is set along the property boundary. A broken strand near perimeter sign P8 was repaired. Otherwise, the fence was in good condition.

The entrance sign, at the south entrance gate, was in good condition. Forty-five perimeter signs are bolted to the perimeter fence posts and were in good condition.

Site Markers and Monuments—Both granite site markers, SMK–1 (just inside the south entrance gate) and SMK–2 (on top of the disposal cell), were in good condition. Combined survey/boundary monuments (SM–1/BM–1, SM–2/BM–2, and SM–3/BM–3) and eight additional boundary monuments (BM–4 through BM–11) also were in excellent condition.

Monitoring Wells—Sixteen wells constitute the groundwater monitoring network at the site. Six of the wells are for monitoring cell performance, two are for monitoring background groundwater quality, and eight are for water-level measurements. The wells were secure and in excellent condition (PL–1).

8.3.1.2 Transects

To ensure a thorough and efficient inspection, inspectors divided the site into four areas called "transects": (1) the riprap-covered disposal cell; (2) the riprap-covered side slopes, apron, and diversion ditches; (3) the area between the disposal cell and the site boundary; and (4) the outlying area.

The area inside each transect was inspected by walking a series of traverses. Within each transect the inspectors examined specific site-surveillance features, drainage structures, and vegetation, along with other features. Inspectors also looked for evidence of settlement, erosion, or other modifying processes that might affect the site's integrity or long-term performance.

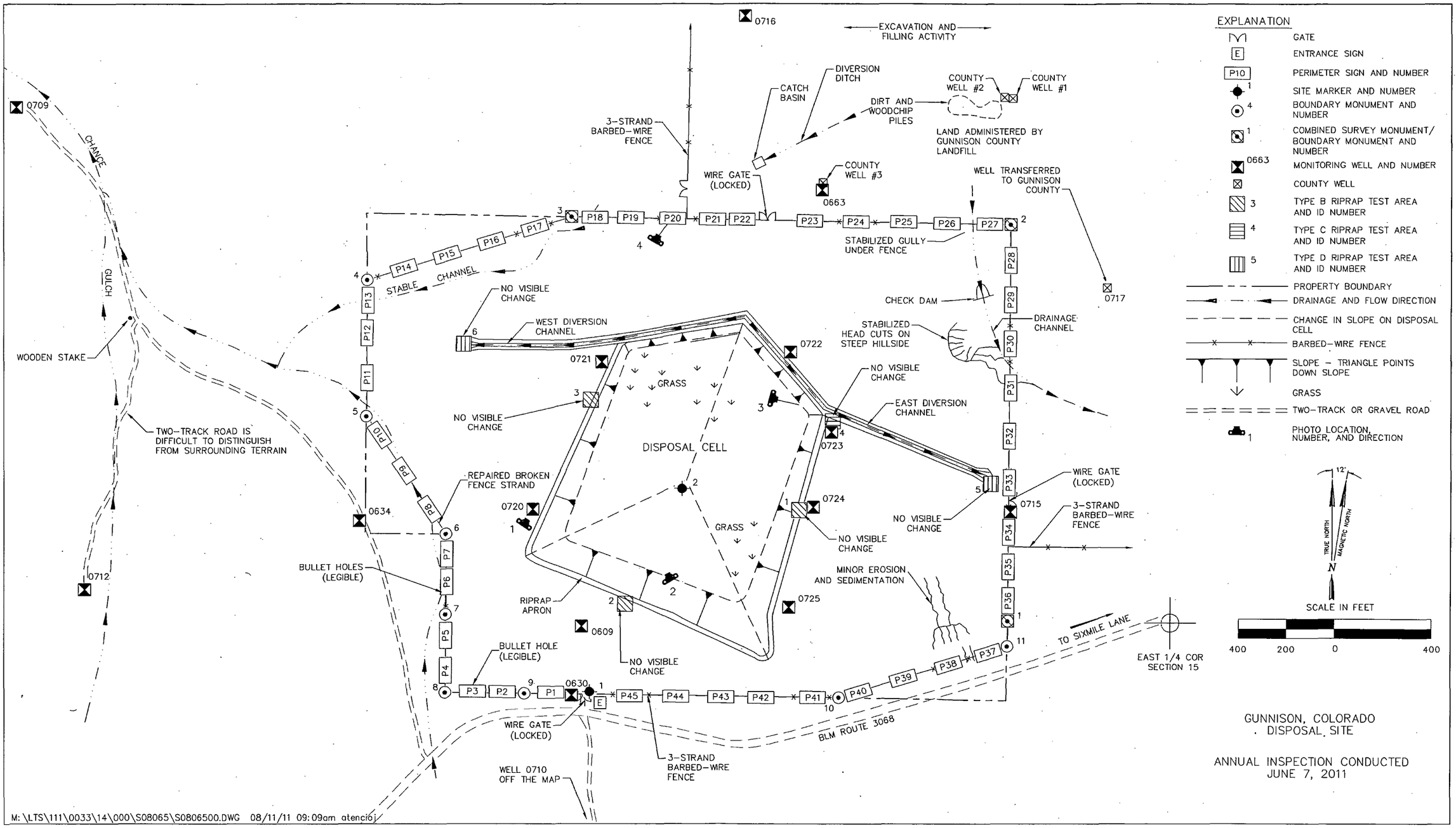


Figure 8–1. 2011 Annual Compliance Drawing for the Gunnison Disposal Site

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Top of the Disposal Cell—The top of the disposal cell was in excellent condition (PL–2). There was no evidence of erosion, settling, slumping, or rock degradation. Several isolated patches of grass are randomly distributed over the disposal cell cover; however, these shallow-rooted plants are not a cause for concern.

Side Slopes, Apron, and Diversion Ditches—The riprap-covered side slopes, apron, and diversion ditches were in good condition (PL–3). No evidence of slumping, settling, rock degradation, or encroachment of vegetation was observed.

The condition of the riprap in six monitoring test areas was visually inspected. The test areas, each roughly 1 square meter in area, are in critical flow path locations in the apron and diversion channels. The corners of each monitoring plot are marked with orange paint; new paint was applied during the inspection. The riprap in all of the test areas was in excellent condition. When the rocks were compared to the photos taken of them in 2007, there was no evidence that individual rocks had split or otherwise been degraded. As outlined in the LTSP, annual photographing and comparing of these test areas was performed through 2002; after that, the LTSP requires the test areas to be photographed every 5 years (through 2017). The next photos will be taken in 2012.

At the southeast corner of the cell apron, water draining off the cell occasionally ponds in a low-lying area along the edge of the riprap. The riparian-type vegetation that has become established in this area indicates that the area retains moisture much of the time. Water collection in this area does not pose a problem because the cell is designed to drain to the southeast, and any water that ponds there is below the elevation of the entombed tailings material. This location was dry at the time of the inspection.

Area Between the Disposal Cell and the Site Boundary—There are reclaimed and undisturbed areas between the disposal cell and the site perimeter. Both types of areas are in excellent condition. In general, reclaimed areas have good vegetation coverage, mostly grass. As expected, shrubs and forbs are much less abundant and less diverse in reclaimed areas than they are in undisturbed areas. Overall, however, the vegetation at the site is very healthy.

Several locations in areas of steep topography had been susceptible to erosion in the past. Recent snowmelt runoff caused minor rill erosion and sediment deposition at a location near the southeast corner of the site. All other areas were stable, with no evidence of new erosion.

Outlying Area—Gunnison County owns the land that adjoins the site boundary to the north and east, and uses the land for a municipal landfill. In 2001, the County installed several fences and monitoring wells in these areas. The monitoring wells are identified as County wells 1, 2, and 3 on Figure 8–1. DOE transferred monitoring well 0717 to the County in 2001. Gates installed in the County fence for access to the wells remain unlocked.

Landfill operations have encroached to within approximately 400 feet of the northeast corner of the DOE property boundary (PL–4). A diversion ditch and catchment basin were constructed on landfill property north of the site. These features were constructed to control runoff and sediment transport onto landfill property. Although landfill activities do not appear to threaten the site, future inspections will continue to monitor the level of activity occurring near the DOE property boundaries and site-surveillance features (e.g., fences, monitoring wells).

8.3.2 Follow-Up or Contingency Inspections

DOE will conduct follow-up inspections if (1) an annual inspection or other site visit reveals a condition that must be reevaluated during a return to the site, or (2) a citizen or outside agency notifies DOE that conditions at the site are substantially changed.

No follow-up or contingency inspections were required in 2011.

8.3.3 Routine Maintenance and Repairs

A broken fence strand was repaired.

8.3.4 Groundwater Monitoring

8B DOE monitors groundwater at the site to demonstrate compliance with U.S. Environmental Protection Agency (EPA) groundwater protection standards in 40 CFR 192.03 and to demonstrate that the disposal cell is performing as designed. The monitoring network consists of 16 wells, including six point-of-compliance (POC) wells to monitor cell performance, two background wells, and eight wells for water-level measurements (Table 8–2).

In accordance with the LTSP, groundwater was sampled and water levels were measured annually from 1998 through 2001. Following the 2001 sampling event, the monitoring frequency changed to once every 5 years, and sampling and water-level measurements were collected in 2011.

The indicator analyte for cell performance at the site is uranium. This analyte was selected on the basis of its presence in tailings pore fluid, its relatively high mobility in ground water, and its low concentration in upgradient (background) groundwater. The target concentration of uranium is 0.013 milligram per liter (mg/L). The basis for this value is the maximum observed concentration of uranium in background samples determined prior to long-term surveillance and maintenance. The maximum concentration level that EPA established for uranium is higher: 0.044 mg/L.

Table 8–2. Active Monitoring Wells at the Gunnison Disposal Site

Point-of-Compliance and Background Wells	Water-Level Wells
0720 (point-of-compliance)	0630
0721 (point-of-compliance)	0634
0722 (point-of-compliance)	0663
0723 (point-of-compliance)	0709
0724 (point-of-compliance)	0710
0725 (point-of-compliance)	0712
0609 (background)	0714
0716 (background)	0715

Groundwater Quality Monitoring—Groundwater at the site was sampled in May 2011. The concentrations of uranium in samples collected at background wells 0609 and 0716 were

0.0038 mg/L and 0.0022 mg/L, respectively. The concentrations of uranium in samples collected from POC wells ranged between 0.001 mg/L and 0.005 mg/L, which is consistent with historical results, as shown in the time-versus-concentration graph (Figure 8–2). Uranium results from the POC wells were an order of magnitude below the action level of 0.013 mg/L.

Samples also were analyzed for major anions (chloride and sulfate) and cations (calcium, magnesium, potassium, and sodium), metals (iron and manganese), and total dissolved solids as indicators of general water quality. These results were consistent with historical results, indicating no significant change in general water chemistry. The consistent general water quality, along with the low uranium concentrations, indicates that the disposal cell continues to perform as an efficient containment system.

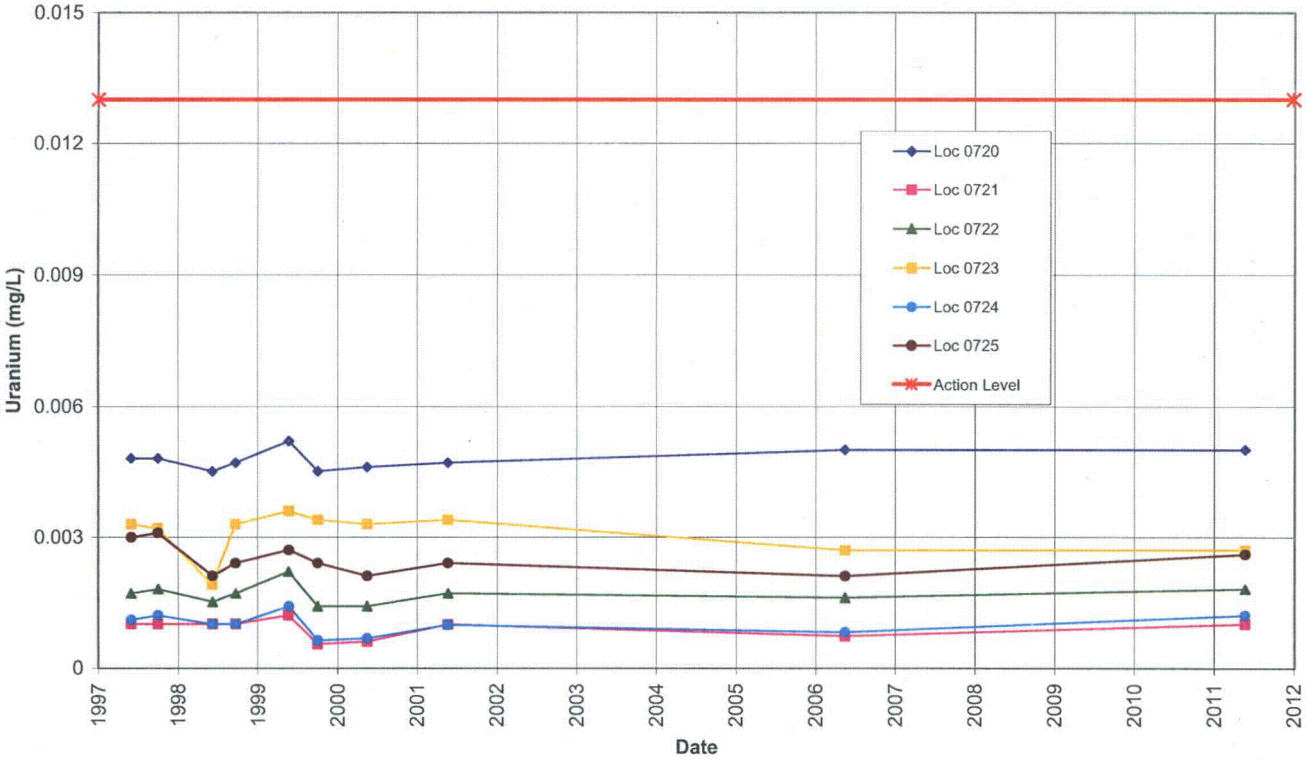


Figure 8–2. Time-Concentration Plots of Uranium in Groundwater at the Gunnison, Colorado, Disposal Site

Groundwater-Level Monitoring—Water levels from the entire monitoring network were measured in May 2011. Data from water-level measurements show only minor fluctuations in groundwater elevations since completion of the disposal cell in 1995; hydrographs from selected wells across the site illustrate this consistency in water levels (Figure 8–3). Water-level measurements indicate essentially steady-state groundwater conditions at the site.

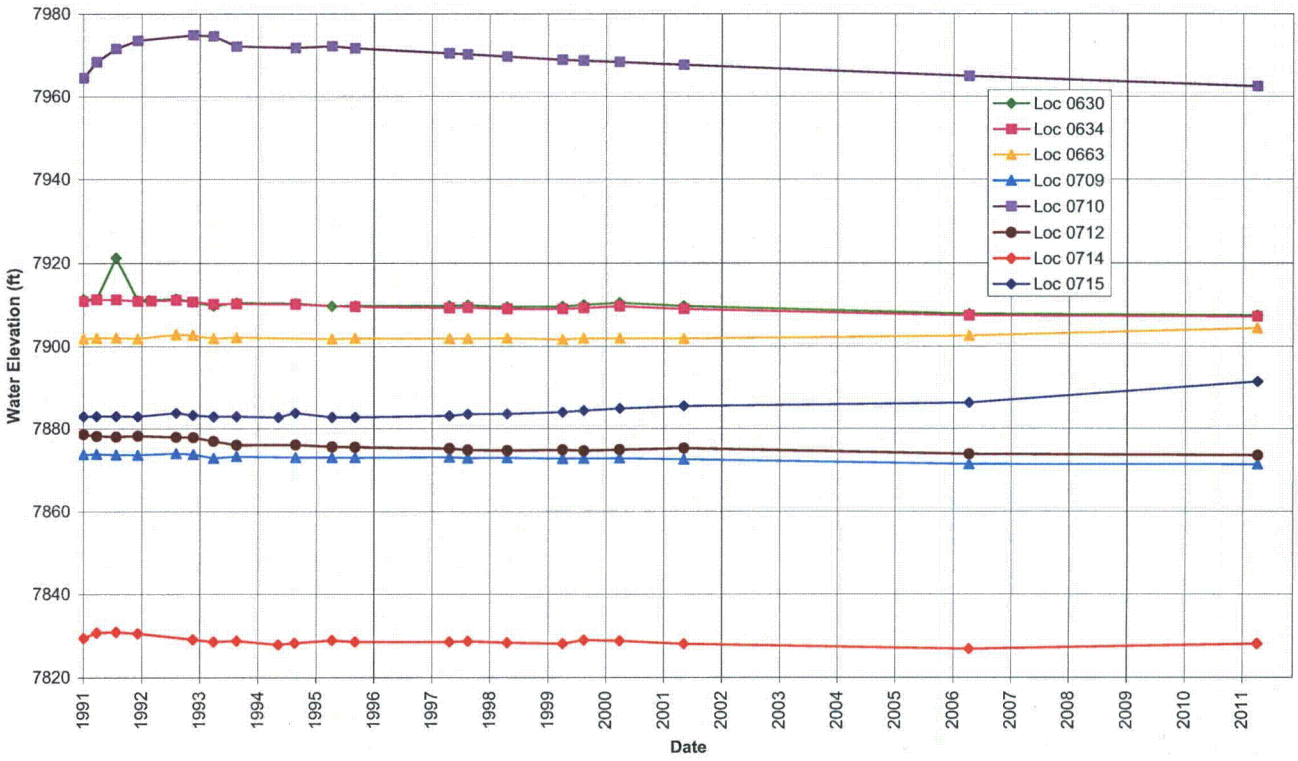


Figure 8–3. Water-Level Measurements at Active Monitoring Wells at the Gunnison, Colorado, Disposal Site

8.3.5 Corrective Action

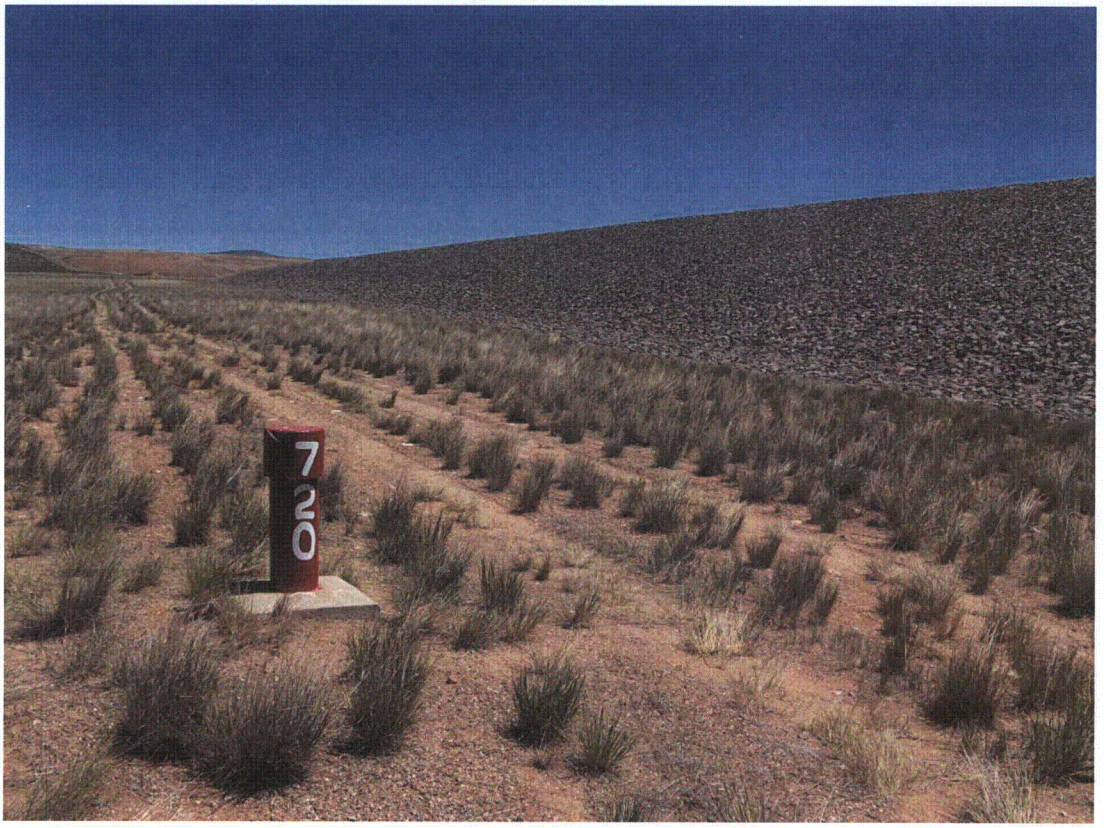
Corrective action is taken to correct out-of-compliance or hazardous conditions that create a potential health and safety problem or that may affect the integrity of the disposal cell or compliance with 40 CFR 192.

No corrective action was required in 2011.

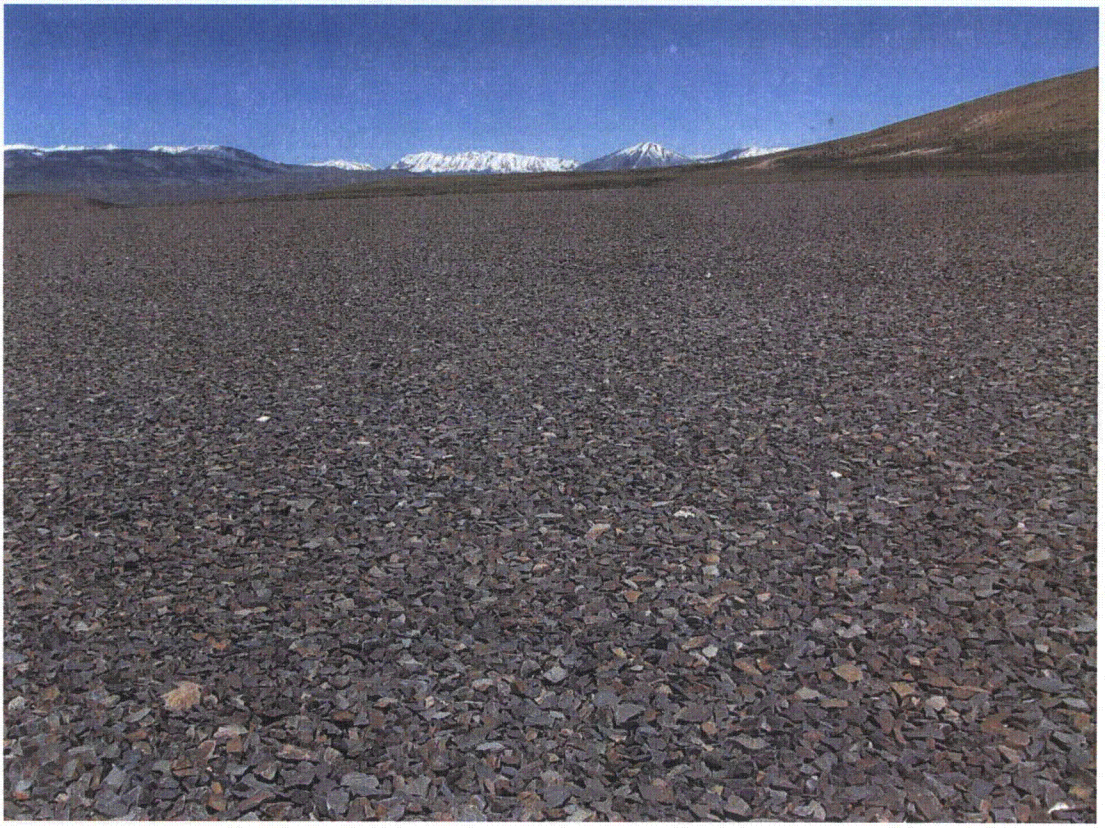
8.3.6 Photographs

Table 8–3. Photographs Taken at the Gunnison Disposal Site

Photo Location Number	Azimuth	Description
PL–1	35	Monitoring well 0720.
PL–2	330	West portion of the disposal cell top.
PL–3	210	East diversion channel.
PL–4	30	County landfill activities northeast of the site.



GUN 6/2011. PL–1. Monitoring well 0720.



GUN 6/2011. PL–2. West portion of the disposal cell top.

GUN 6/2011. PL–3. East diversion channel.

GUN 6/2011. PL–4. County landfill activities northeast of the site.

9.0 Lakeview, Oregon, Disposal Site

9.1 Compliance Summary

The Lakeview, Oregon, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site was inspected by the U.S. Department of Energy (DOE) on September 7 and 8, 2011, and was in good condition. Gradation and durability rock monitoring was conducted during the annual inspection to further assess the degradation of erosion control rock riprap on the west side slope of the cell. Excluding the rock degradation concerns, the cell appears to be in good condition. No cause for a follow-up inspection was identified.

9.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the site are specified in the *Long-Term Surveillance Plan for the Collins Ranch Disposal Site, Lakeview, Oregon* (DOE/AL/62350–19F, Rev. 3, DOE, August 1994, as revised; LTSP) and in procedures established by DOE to comply with the requirements of Title 10 *Code of Federal Regulations* Part 40.27 (10 CFR 40.27). These requirements are listed in Table 9–1.

Table 9–1. License Requirements for the Lakeview Disposal Site

Requirement	Long-Term Surveillance Plan	This Report
Annual Inspection and Report	Section 6.1	Section 9.3.1
Follow-Up or Contingency Inspections	Section 7.0	Section 9.3.2
Routine Maintenance and Repairs	Section 8.0	Section 9.3.3
Groundwater Monitoring	Section 5.3	Section 9.3.4
Corrective Action	Section 9.0	Section 9.3.5

Institutional Controls—The 40-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 40.27) in 1995. DOE is the licensee and, in accordance with the requirements for UMTRCA Title I 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 site perimeter fence, warning/no-trespassing signs along the property boundary, and a locked gate at the entrance to the site. Inspectors found no evidence that these institutional controls were ineffective or violated. No follow-up actions were required in regard to institutional controls.

9.3 Compliance Review

9.3.1 Annual Inspection and Report

The site, northwest of Lakeview, Oregon, was inspected on September 7 and 8, 2011. The results of the inspection are described below. Figure 9–1 shows features and the photograph locations (PLs) mentioned in this report. Numbers in the left margin of this report refer to items summarized in the "Executive Summary" table.

Seismic Activity—The site is in a seismically active region. The U.S. Geological Survey National Earthquake Information Center notifies DOE when earthquakes of magnitude 3.0 or greater occur within 0.3 degrees (about 20 miles) of a disposal cell and when earthquakes of magnitude 5.0 or greater occur within 1.0 degree (about 70 miles) of a disposal cell. No seismic activity at or exceeding the reporting threshold occurred in 2011.

9.3.1.1 Specific Site-Surveillance Features

Access Road, Entrance Gate, Fence, and Signs—Access to the site is gained by traveling a gravel road that heads west off County Road 2-16B. DOE was granted a perpetual easement on the approximately 1.2-mile access road between the County road and the DOE property boundary. A locked gate across the access road on the adjacent privately owned land limits access to the site. Since the last annual inspection, the old gate had been removed and a new gate is being constructed farther to the east. The site access road is a gravel-surfaced road in good condition. Portions of the road appeared to have been recently bladed, likely by the land owner. The site gate and the pedestrian gate were locked and in good condition. No recent indication of vandalism was observed at the site during the inspection.

The site boundary fence is generally in good condition, but some loose and broken wire strands were noted; tightening and maintenance of the fence will be needed within the next few years, as will some pruning of vegetation near the fence line. The site entrance sign and the 12 perimeter signs were in good condition.

Site Markers and Monuments—The two site markers, three survey monuments, and three boundary monuments are in good condition. Site marker SMK–2, located on top of the disposal cell, is shown in PL–1.

Monitoring wells—The groundwater monitoring network comprises eight point-of-compliance wells (four monitoring well pairs: 0602/0609, 0603/0608, 0604/0607, and 0605/0606) located east and south of the cell and one upgradient compliance well (0515) located west of the disposal site. All nine wells were inspected and found locked and in good condition.

Seven additional DOE-owned monitoring wells (0513, 0514, 0516, 0520, 0521, 0522, and 0523) exist on privately owned property near the site but are not part of the compliance monitoring network. These wells were inspected during the 2011 annual inspection and were in fair to good condition.

The well aprons on wells 0513, 0521, and 0522 are cracked. Well 0516 was missing a lock, which was replaced during the inspection. Printed well numbers were adhered to all site monitoring well casings during the inspection to cover the previously painted well identification numbers, which had become faded.

9.3.1.2 Transects

To ensure a thorough and efficient inspection, inspectors divided the site into three areas called "transects": (1) the top of disposal cell; (2) the side slopes of the disposal cell and adjacent drainage channel, aprons, and trench drains; and (3) other on-site areas, the site perimeter, and the outlying area.

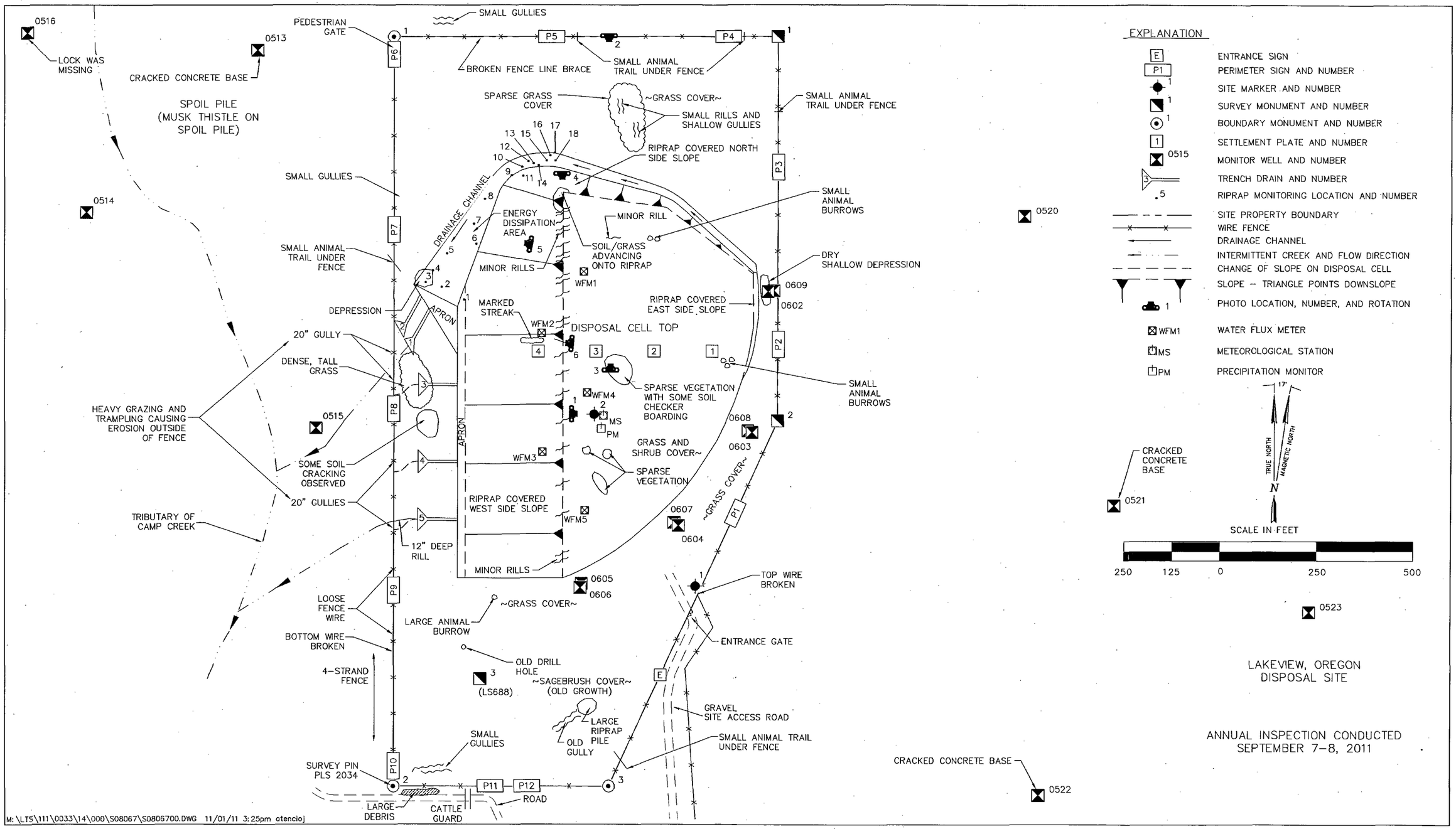


Figure 9–1. 2011 Annual Compliance Drawing for the Lakeview Disposal Site

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The area inside each transect was inspected by walking a series of traverses. Within each transect, the inspectors examined specific site-surveillance features, drainage structures, vegetation, and other features. Inspectors also looked for evidence of settlement, erosion, or other modifying processes that might affect the site's integrity or long-term performance.

Top of the Disposal Cell—The top-slope cover shows no sign of cell settlement, displacement, or slumping. At the time of cell construction, the entire cell top slope was covered in 12 inches of Type A riprap, and 4 inches of soil was placed over the riprap. The soil was included to allow for a grass cover to be established, which would help minimize the visual impacts of the cell. The design for the top of the disposal cell has created conditions that favor the growth of deep-rooted plants. The growth of shrubs is favored by movement of precipitation through the riprap, bedding, and compacted soil (radon barrier) layers. Grasses and forbs (rabbitbrush, sagebrush, and bitterbrush plants) growing on the top of the disposal cell have gradually increased over the years, and areas of deeper-rooted wheatgrasses have spread (PL–2). Some sparsely vegetated areas still exist on the top of the disposal cell.

Riprap was observed through the soil on the top slope in numerous small areas during the inspection. The areas range in size from approximately 4 inches to 1.5 feet. These areas are intermittently located across the top slope and are likely caused by the infilling of the soil into the void spaces in the riprap below. The beginning development of checkerboard erosion patterns was observed sporadically in soil in some of the more sparsely vegetated areas on the top slope (PL–3). This minor erosion pattern could indicate that water on the top slope is attempting to channelize. No structural or cell performance concerns are associated with the riprap becoming visible or the developing checkerboard erosion on the top slope because the presence of riprap beneath the soil would prevent erosion. Some minor rilling was also noted on the north portion of the top slope. This area should be monitored, but it does not signify a potential problem because it is also underlain by riprap.

The contact boundary between the cell top and side slopes was inspected and generally appears stable and uniform except at the northernmost corner of the side slopes where soil has been transported off of the top slope, allowing for some grass to establish at the top of the side slopes (PL–4). Approximately 25 minor erosion rills were observed in the top-slope soil cover along the west contact. These rills appeared less defined than they did during the last inspection. No evidence of erosion was observed along the north contact. The extent of rilling on the west side slope will continue to be monitored during future annual inspections. However, no structural or cell performance concerns are associated with the minor encroachment of the grass onto the side slope or the presence of the minor rills because the riprap rock cover is continuously present beneath the top-slope soil cover and the slope crest, and continues as the side slope.

Two small clusters of small animal burrows were observed on the cell cover. The diameter of each burrow was approximately 1 inch. No soil piles were observed near the burrows, and no follow-up action is recommended.

Disposal Cell Cover Performance Evaluation—Past field investigations at the site indicate that a combination of soil development and root intrusion by the deep-rooted shrubs has increased the hydraulic conductivity of the radon barrier in the cell cover, which may allow meteoric water to percolate into the underlying tailings. In contrast, an increase in plant cover indicates an increase in transpiration rate, which removes water from the root zone.

Encroachment by deep-rooted shrubs was observed shortly after the construction of the disposal cell was completed in 1989. As designed and constructed, the cover is a favorable habitat for deep-rooted plants. Root intrusion and soil development have increased the permeability of the radon barrier. In situ tests have shown that the saturated hydraulic conductivity of the radon barrier ranges between 1×10^{-6} and 1×10^{-4} centimeters per second (cm/s). The design target was 1×10^{-7} to 1×10^{-8} cm/s.

In 2005, LM began an evaluation of a new device called a water fluxmeter, a passive wicking lysimeter, to directly measure percolation flux through the site's disposal cell cover. Three water fluxmeters installed in holes augered through the top slope of the cover and into tailings capture percolation just below the compacted soil layer in the cover. Monitoring results showed significant percolation through the cover. Cumulative percolation averaged 996 millimeters during 2006, 186 millimeters during 2007, 444 millimeters during 2008, and 155 millimeters during 2009. These values are assumed to be greater than the mean percolation for the cover because the three water fluxmeters were intentionally placed in downslope locations where water accumulates in the sand drainage layers. The evaluation also included monitoring moisture content in the tailings. Tailings beneath the side slope of the disposal cell remained saturated during the entire 5-year period.

To address concerns about the potential for high percolation flux and saturated tailings to leach contaminants into groundwater and the potential for seismic activity to render the disposal cell slope unstable, DOE conducted an investigation from May 12 through 14, 2010. The investigation followed the *Geotechnical Hole Field Plan* (April 2010), which NRC concurred on. Information obtained during the field activities and determinations made as a result of the investigation were submitted to NRC in a Summary of Results letter dated August 25, 2010. Results of this investigation concluded that widespread saturated conditions did not exist within the cell and that a special follow-up inspection was not warranted with respect to slope stability.

Side Slopes of the Disposal Cell and Adjacent Drainage Channel, Aprons, and Trench Drains—No evidence of settlement, displacement, or slumping was observed in these areas during the inspection. Concerns about the size and durability of the riprap are discussed below under "Riprap Condition Evaluation."

Some grass is present in the riprap on the north and west side slope, in the upper (eastern) part of the drainage channel, in the energy dissipation area (EDA) at the lower end of the drainage channel, and in the western apron area. The relatively sparse plant growth in the drainage channel will not affect the function of the channel and is not considered a problem. No trees or bushes were observed in the drainage channel. An area of dense, long grass exists near trench drains 1 and 3, which suggests wetter conditions and would be periodically expected in this area due to the normal functioning of the runoff control features. No ponded water was observed. Some sporadic areas of soil cracking were observed in the soils in the areas near the trench drains, but the grasses covering this area are dense and provide erosion protection.

9A **Riprap Condition Evaluation**—Degradation of erosion control basalt rock riprap, observed at the site since the mid-1990s, has been monitored as part of the annual inspections, as identified in addendums to the LTSP, to determine the mean diameter (D_{50}) value of the Type B riprap on the west side slope. The rock deterioration is likely due to physical weathering and chemical processes. It is an ongoing concern because the riprap was sized to withstand the erosive energy of precipitation events. To help compensate for the degradation concern, the original cell

design's rock specifications were modified prior to cell construction. The percentage of crumbling rocks on the surface appears to have increased since the mid-1990s, and rock degradation continues to be observed.

The method used for the rock gradation monitoring measures the number of rocks retained per sieve size. In 2011, the gradation monitoring was performed for the 15th consecutive year. An additional sieve size (less than 1 inch) has been included in the monitoring since 2009. Particle size distribution by count data was collected at 20 random locations, and approximately 25 rocks were sampled at each location (PL–5). An evaluation of the rock size measurement data from 2011 indicates that the west side slope riprap D_{50} is 2.49 inches with a 95 percent confidence interval between 2.28 and 2.70 inches.

Results of the 2010 gradation monitoring, including a graph showing the results since 1997, are provided as Appendix A. The 2011 D_{50} value is 0.04 inch larger than the value of 2.43 inches measured during the 2010 gradation monitoring. As shown on the graph, the downward curve of D_{50} values has become more level over the past 8 years, which may indicate that the degradation rate of the riprap has slowed. Prior results indicated a gradual overall decrease in the cover rock D_{50} size by about 20 percent.

As specified in the LTSP, the original cell design required a D_{50} design range envelope of 2.7 to 3.9 inches for Type B side slope riprap gradation to ensure that the cell is protected from erosion. The 2011 D_{50} value is less than this size.

At the request of NRC, DOE performed rock durability monitoring during the 2009, 2010, and 2011 inspections, using the rock type classifications shown in Table 9–2. The table identifies the rock types, provides rock descriptions, assigns a durability class and code (ranging from "highly durable" to "nondurable – crumbled/rubblized"), and is representative of the rocks found on the side slopes. The Table 9–2 durability classes were assigned by a geologist/mineralogist's examination of the rocks and are not based on laboratory durability testing standards. Each rock used for the gradation monitoring was classified during the durability monitoring into one of eight durability classes (A, B, Ca, Cb, Da, Db, E, or F). As requested by NRC, for the 2010 monitoring, Durability Class A rocks were divided into four subclasses: unfractured (Au), hairline fractured (Ah*, where the number in place of the asterisk indicates the number of fractures present [e.g., Ah3]), open fractured (Ao*, where the number in place of the asterisk indicates the number of fractures present [e.g., Ao3]), and a rock that had split since placement on the cell (As). The 2010 table was retained for the 2011 monitoring.

The durability monitoring was conducted in conjunction with the gradation monitoring, using the same rocks. After the size of a rock was determined, the rock was handed to the project geologist/mineralogist for rock type identification. The associated durability class (or subclass) code was then recorded under the appropriate rock size column for that sample location.

Results of the durability monitoring, which are provided on the accompanying 2011 durability summary table in Appendix A, show that most of the rocks (56.4 percent) are classified as having a durability class of "highly durable" or "durable." The majority of the rocks are Durability Class Code A (28.5 percent) with a durability class of "highly durable," followed closely by Class Code B (27.9 percent) with a durability class of "durable," Class Code Ca (16.7 percent) with a durability class of "moderately durable," and Cb (13.6 percent), which also has a durability class of "moderately durable." The final four durability classes (Classes Da, Db,

E, and F) comprise single digit percentages of the total number of rocks classified (484) and have durability classes ranging from "susceptible to near-term degradation" to "nondurable – crumbled/rubblized." Only one Class F rock was identified. Of the Class A rocks, 11.2 percent are Subclass Au, 11.5 percent are Subclass Ah (with 1 to 3 hairline fractures), 4.3 percent are Subclass Ao (with 1 to 3 open fractures), and 1.4 percent are Subclass As.

Table 9–2. Rock Type and Durability Class

Rock Type Identification Number	Rock Type Description	Durability Class	Durability Class Code	Durability Subclass Code
1	Dense, hard, very fine-grained, dark gray basalt with no joints, fractures, white deposits, or alteration.	Highly Durable	A	Au
	As above in Au, except with tight, hairline fractures. Value that appears in place of the asterisk indicates the number of tight, hairline fractures.		A	Ah*
	As above in Au, except with open fractures. Value that appears in place of the asterisk indicates the number of open fractures in the rock that are ready to split.		A	Ao*
	As above in Au, except that the rock has split along fractures since placement on the cover, but the rocks are still in place.[a]		A	As
2	Dense, hard, dark gray to grayish-brown, olivine basalt. No joints or white deposits; olivine phenocrysts have altered to amber and brown material representing various minerals such as iddingsite, antigorite, chlorite, and nontronite. On some exposed surfaces, altered olivine phenocrysts have weathered out to give a vesicular appearance.	Durable	B	----
3a	Dense, fine-grained, grayish-brown to brown basalt with hairline fractures. Basalt is slightly altered, and fractured outer surfaces have a brown, limonite-like coating.	Moderately Durable	Ca	----
3b	Greenish-gray to green, dense basalt with hairline fractures. Some fractures may have white or light brown coatings. Deuteric and hydrothermal alteration have imparted a distinctive greenish cast to the basalt, resulting from alteration of calcic plagioclase to the more sodic plagioclase albite-oligoclase.	Moderately Durable	Cb	----
4a	Fine-grained, highly fractured gray to greenish-gray basalt. Hairline to open fractures are mostly coated with white to pink calcite and commonly with the zeolite mineral analcime.	Susceptible to Near-Term Degradation	Da	----
4b	Greenish-gray to grayish-brown olivine basalt that is highly fractured. Olivine phenocrysts have altered to brown material, possibly nontronite.	Susceptible to Near-Term Degradation	Db	----
5	Fine- to medium-grained, soft, grayish-green, highly altered basalt. Rock has a granular appearance, has relatively low specific gravity, is probably highly chloritized, and has commonly disintegrated (rubblized) into pieces smaller than 1 inch in diameter.	Nondurable - Crumbled/ Rubblized	E	----
6	Non-basaltic rocks such as sandstone or quartzite.	Highly Durable to Nondurable	F	----

[a] "As" must be determined while the rocks are still in place on the side slope before the rocks are picked up for gradation monitoring. The size of the monitored rock reflects the size of the selected/marked split piece, not the size of the pre-split rock.

The results of the 2011 durability monitoring are generally similar to those of the 2010 monitoring. The 2011 results had a lower percentage of Durability Class Code A rocks (28.5 percent) than the 2010 results did (47.2 percent). Conversely, the percentage of Durability Class B rocks increased from 2010 (20.02 percent) to 2011 (27.9 percent), and the percentage of Class Cb rocks increased from 1.0 percent in 2010 to 13.3 percent in 2011. A summary table showing the durability monitoring results for 2009, 2010, and 2011, by percent rock durability class, is included in Appendix B.

The 2011 durability summary table in Appendix A also shows the correlation between rock size and durability class. The data indicate that most rocks retained on the larger sieve sizes (4-inch, 3-inch, and 2½-inch) are Class B rocks, followed by Class A rocks, of which the majority are fractured. Of the rocks retained on the smaller sieves (less than 2½-inch), most are Class A. The data suggest that the initial Class A rocks placed on the disposal cell have tended to shatter into smaller fragments, whereas the Class B rocks have remained more intact; however, all rocks have generally weathered and have become smaller than the original design sizes.

No significant changes in the amount or sizes of "streaks" (defined as areas with smaller-sized rocks generally elongated down the slope) on the west side slope were noted during the annual inspection. Examination of the streak that was marked with paint during the 2009 inspection showed no expansion (PL–6). No evidence of erosion occurring within a streak was observed during the inspection.

The annual photographic monitoring of the 18 photograph points for long-term rock monitoring was conducted in the EDA. Minor rock degradation has been observed since monitoring began at the original 10 photographic locations established in 1997 and at the 8 additional locations established in 2000. The rock type used in the EDA and drainage channel areas is much more homogeneous than the varied rock types used on the side slopes and appeared to be predominantly Class B rock in good condition.

Water previously observed at times in the large depression in the EDA at the lower end of the drainage channel was absent. Water is potentially a concern because inundation may accelerate deterioration of the large riprap by the freeze-thaw process, although the Class B rocks are apparently not as susceptible to freeze-thaw as other rock types present on the cell.

Site Perimeter and Outlying Area—This transect includes the seeded grass area extending from the disposal cell to the site boundary, the site fence, and the native shrub and grass communities within 0.25 mile surrounding the site.

During the annual site inspection, an area (approximately 50 feet by 15 feet) located upgradient of the drainage channel, near monitoring wells 0602 and 0609, was observed as a shallow depression. The area was dry but showed evidence of previously ponded water (with a maximum depth of approximately 6 inches). The depression has been noted during past inspections and does not appear significant. No maintenance is required at this time.

Gullies that formed in seeded areas extending west of trench drains 1 through 5 were filled with rock in 2000. Although the rock has generally arrested the head-cutting that was proceeding from the Byers property onto the DOE property, some minor head-cutting is still evident although it did not appear to be recent. Several small gullies have formed in heavily grazed areas down

slope of the fence line onto the Byers property and were identified during previous inspections. No indication of recent erosion was observed during the annual site inspection. Although no repairs are warranted at this time, the area will likely need minor maintenance in the next few years.

Small gullies were identified in past years along the southern side of the site inside the fence. These gullies are located downhill of an inclined road that intersects the fence line near a cattle guard and probably represent overflow along the road during rain events. This area has not shown evidence of recent erosion. No maintenance is required in this area.

Several small rills and shallow gullies were previously observed on site in the area north of the cell where grass reestablishment has been limited. No changes were observed in this area during the annual inspection. Although no maintenance is required in this area, this area should be watched to ensure that conditions do not degrade.

Some general changes were observed in the areas adjacent to the site during the annual inspection. Construction activities appear to have been completed since last year's inspection on the residential structure located near the access road gate and on what appears to be an observation hut located on top of Augur Hill to the north of the site. Also, as previously discussed, the access road gate has been moved. It also appeared that some cattle-loading pens are being constructed along the access road. A new gate had been installed near the site entrance gate area, which connects the existing access road with an unimproved roadway along the outside of the site fence on private property.

In the off-site area to the west of the site, it was noted during the annual inspection that large quantities of musk thistle had grown on the spoil pile. The site should be watched to ensure that thistle infestation does not occur at the site from this off-site source. Musk thistle is a State-designated noxious weed.

It was also noted that the privately owned stock pond areas, also to the west of the site, had been dredged and apparently enlarged since the last inspection. Water is being retained in the ponds.

9.3.2 Follow-Up or Contingency Inspections

DOE will conduct follow-up inspections if (1) an annual inspection or other site visit reveals a condition that must be reevaluated during a return to the site, or (2) a citizen or outside agency notifies DOE that conditions at the site are substantially changed.

No follow-up or contingency inspections were required in 2011.

9.3.3 Routine Maintenance and Repairs

The only routine maintenance performed at the site in 2011 pertained to the monitoring wells, where printed well numbers were adhered to all well casings to cover the previously painted well identification numbers, which had become faded, and to a replacement lock being added to well 0516.

9.3.4 Groundwater Monitoring

DOE monitors groundwater quality in the uppermost aquifer at this site once every 5 years to demonstrate that the disposal cell is not leaching contaminants. No groundwater monitoring was performed in 2011. The most recent sampling event was performed in 2009. Constituents analyzed every 5 years include arsenic, cadmium, and uranium. Maximum concentration limits (MCLs), established by the U.S. Environmental Protection Agency (EPA) in Table 1 to Subpart A of 40 CFR 192, are 0.05 milligram per liter (mg/L) for arsenic, 0.01 mg/L for cadmium, and 0.044 mg/L for uranium. Concentrations of these constituents were well below their respective limits in 2009. They also were consistent with sampling results from 2004 and remained within the historical range. Based on the monitoring results to date, there is no indication of any degradation of groundwater in the vicinity of the site. The next cell performance groundwater monitoring is scheduled for 2014.

9.3.5 Corrective Action

Corrective action is taken to correct out-of-compliance or hazardous conditions that create a potential health and safety problem or that may affect the integrity of the disposal cell or compliance with 40 CFR 192.

No corrective action was required in 2011.

9.3.6 Photographs

Table 9–3. Photographs Taken at the Lakeview Disposal Site

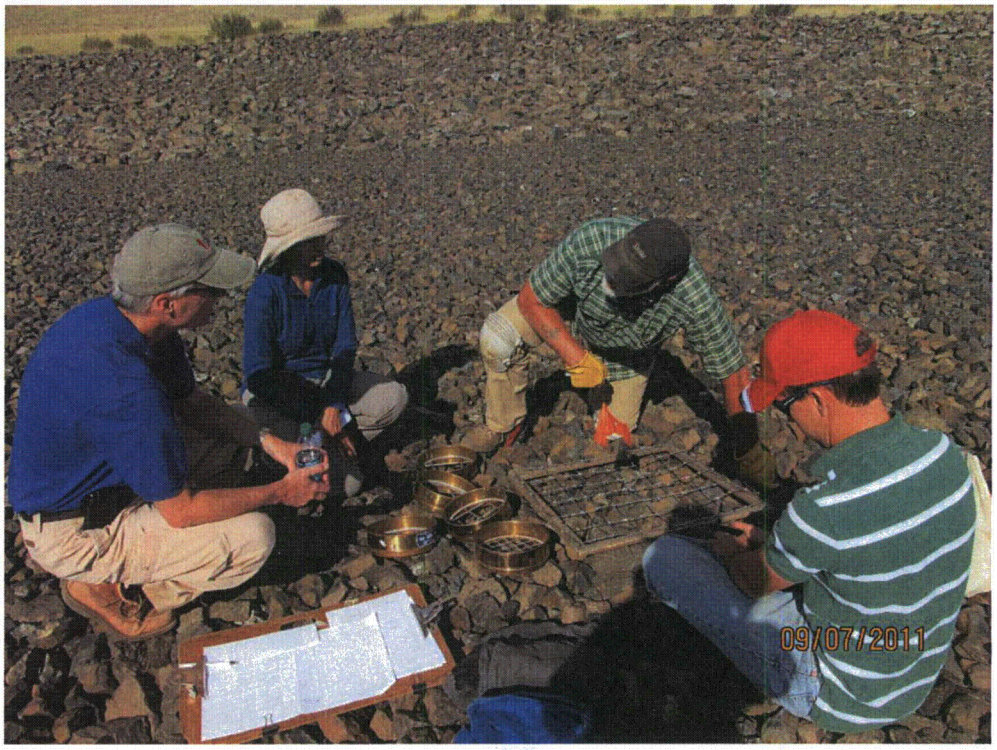
Photo Location Number	Azimuth	Photograph Description
PL–1	90	Site marker SMK–2 on top slope.
PL–2	180	View from north site fence to south, showing cell top and side slopes.
PL–3	NA	Sparsely vegetated area on top slope, showing some checkerboard erosion.
PL–4	180	Photo taken (looking south) at intersection of west and north side slopes and top slope. Soil from top slope is being deposited onto side slope riprap.
PL–5	280	DOE representatives watching rock monitoring on west side slope. A grid is used to mark rocks for gradation and durability monitoring. Marked rocks are first sized using a series of sieves and then identified by rock type and durability class.
PL–6	275	Marked streak (area of finer rock) on west side slope near water flux meter 2. Photo taken looking down slope to west.

LKV 9/2011. PL–1. Site marker SMK–2 on top slope

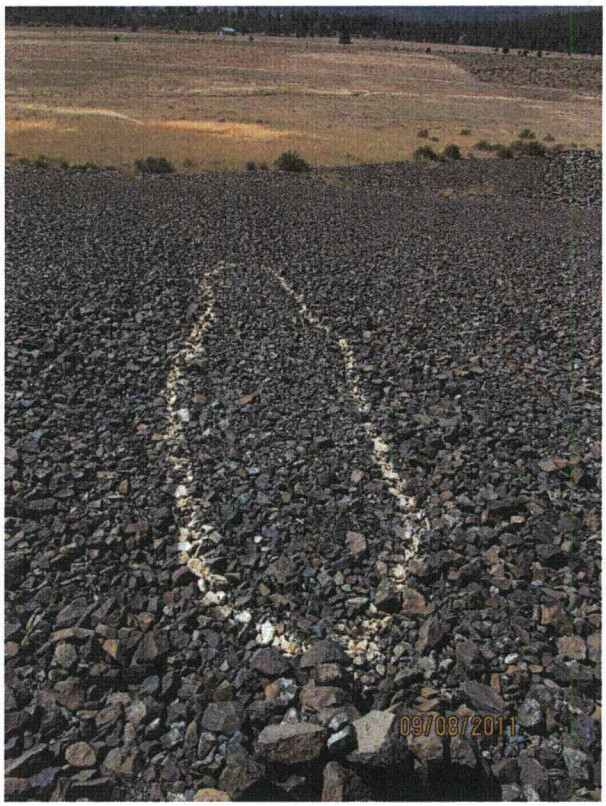
LKV 9/2011. PL–2. View from north site fence to south, showing cell top and side slopes.

LKV 9/2011. PL–3. Sparsely vegetated area on top slope, showing some checkerboard erosion.

LKV 9/2011. PL–4. Photo taken (looking south) at intersection of west and north side slopes and top slope. Soil from top slope is being deposited onto side slope riprap.



LKV 9/2011. PL–5. DOE representatives watching rock monitoring on west side slope. A grid is used to mark rocks for gradation and durability monitoring. Marked rocks are first sized using a series of sieves and then identified by rock type and durability class.



LKV 9/2011. PL–6. Marked streak (area of finer rock) on west side slope near water fluxmeter 2. Photo taken looking down slope to west.

Appendix A

2011 Rock Gradation and Durability Monitoring Results For Type B Riprap at the Lakeview, Oregon, Disposal Site

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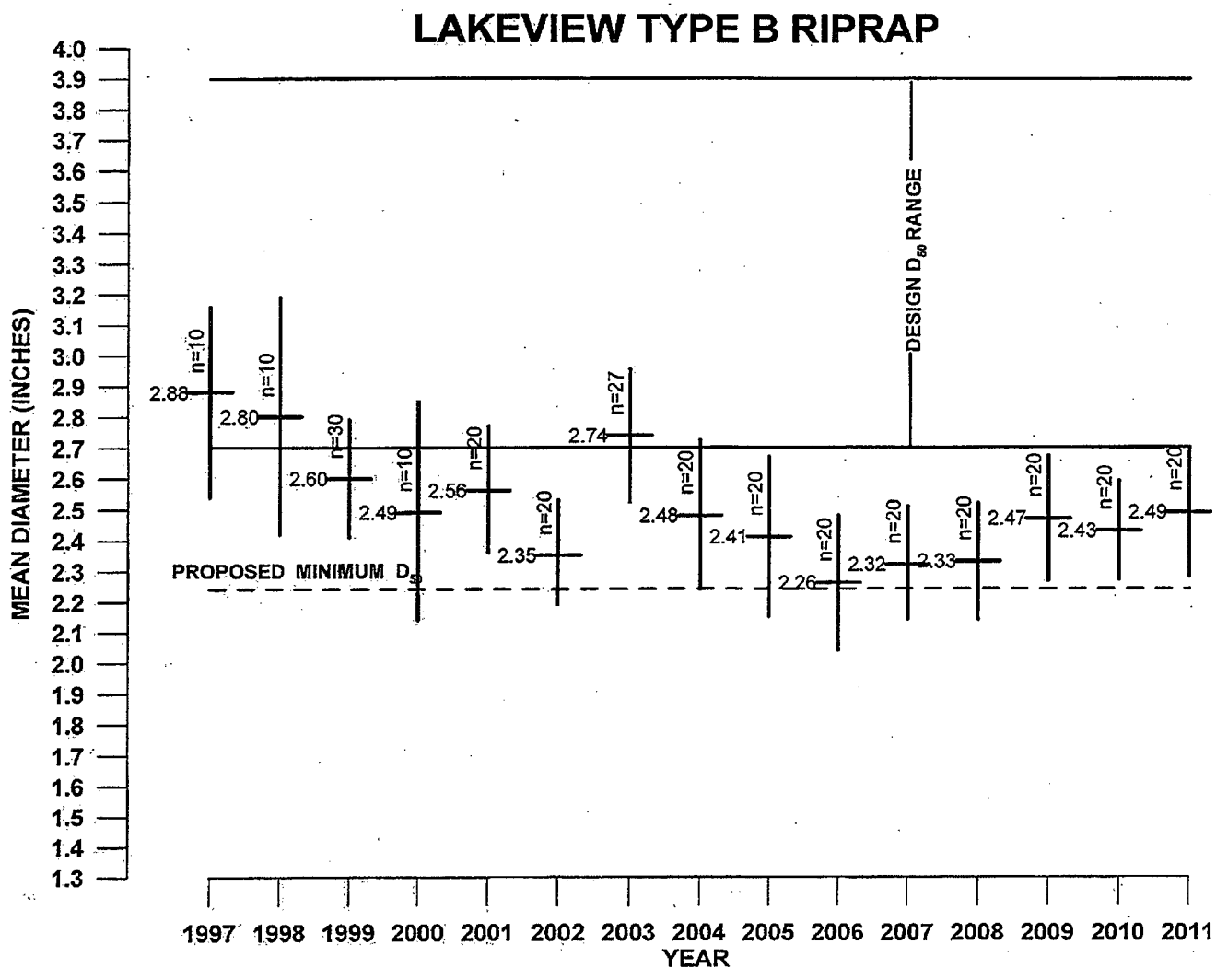
LAKEVIEW TYPE B RIPRAP
MEAN DIAMETER (INCHES)
4.0
3.9
3.8
3.7
3.6
3.5
3.4
3.3
3.2
3.1
3.0
2.9
2.8
2.7
2.6
2.5
2.4
2.3
2.2
2.1
2.0
1.9
1.8
1.7
1.6
1.5
1.4
1.3
DESIGN D_{50} RANGE
PROPOSED MINIMUM D_{50}
n=10
2.88
n=10
2.80
n=30
2.60
n=10
2.49
n=20
2.56
n=20
2.35
n=27
2.74
n=20
2.48
n=20
2.41
n=20
2.26
n=20
2.32
n=20
2.33
n=20
2.47
n=20
2.43
n=20
2.49
1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011
YEAR

LAKEVIEW TYPE B RIPRAP
2011 DURABILITY SUMMARY TABLE
(NUMBER OF OCCURRENCES RETAINED ON SIEVE)

DURABILITY CLASS & SUBCLASS	SIEVE SIZE 4 - inch	3 - inch	2.5 - inch	1.5 - inch	1-inch	< 1 - inch	total by durability class	% of total		
class Au	2	9	5	23	14	1	54	11.2		
class As	0	1	2	3	0	1	7	1.4		
class Ao1	1	9	4	5	0	0	19	3.9		
class Ao2	0	1	0	0	0	0	1	0.2		
class Ao3	1	0	0	0	0	0	1	0.2		
class Ao5	0	0	0	0	0	0	0	0.0		
class Ah1	0	14	11	10	1	1	37	7.6		
class Ah2	2	7	0	2	2	0	13	2.7	total "A"	% of
class Ah3	1	4	1	0	0	0	6	1.2	durability	total
class Ah4	0	0	0	0	0	0	0	0.0	138	28.5
class B	17	46	27	35	9	1	135	27.9		
class Ca	1	20	9	43	4	4	81	16.7		
class Cb	7	13	9	30	7	0	66	13.6		
class Da	1	6	1	10	9	11	38	7.9		
class Db	1	3	4	5	1	4	18	3.7		
class E	0	0	0	3	1	4	8	1.7		
							484	100.0		
total by sieve size	34	133	73	169	48	27	484	total		
% of total	7.0	27.5	15.1	34.9	9.9	5.6	100.0			

PERCENTAGE PASSING BY SIEVE SIZE

DURABILITY CLASS & SUBCLASS	4 - inch	3 - inch	2.5 - inch	1.5 - inch	1-inch	< 1 - inch
class Au	2.9	13.5	38.4	38.5	37.5	25.9
class As	0.0	0.0	0.0	2.4	0.0	0.0
class Ao1	2.9	4.5	5.5	2.4	0.0	0.0
class Ao2	0.0	2.3	2.7	1.2	0.0	0.0
class Ao3	0.0	0.8	0.0	0.0	0.0	0.0
class Ao5	0.0	0.8	0.0	0.0	0.0	0.0
class Ah1	0.0	4.5	11.0	13.6	4.2	7.4
class Ah2	8.8	6.8	9.6	1.8	2.1	0.0
class Ah3	0.0	2.3	0.0	0.0	0.0	0.0
class Ah4	2.9	0.0	0.0	0.0	0.0	0.0
class B	50.0	24.8	43.8	7.7	6.3	7.4
class Ca	2.9	9.8	21.9	19.5	6.3	18.5
class Cb	0.0	0.0	1.4	1.8	2.1	0.0
class Da	5.9	4.5	13.7	11.8	0.0	11.1
class Db	0.0	3.8	6.8	7.7	8.3	7.4
class E	0.0	0.0	0.0	1.8	0.0	44.4

Rock Types and Durability Classes and Subclasses

Rock Type Identification Number	Rock Type Description	Durability Class	Durability Class Code	Durability Subclass Code
1	Dense, hard, very fine-grained, dark gray basalt with no joints, fractures, white deposits, or alteration.	Highly Durable	A	Au
	As above in Au, except with tight, hairline fracture(s). Asterisk indicates the number of tight, hairline fractures.		A	Ah*
	As above in Au, except with open fracture(s). Asterisk indicates the number of open fractures in the rock that are ready to split.		A	Ao*
	As above in Au, except that the rock has split along fractures since placement on the cover, but the rocks are still in place.[1]		A	As
2	Dense, hard, dark gray to grayish brown, olivine basalt. No joints or white deposits; olivine phenocrysts have altered to amber and brown material representing various minerals such as iddingsite, antigorite, chlorite, and nontronite. On some exposed surfaces, altered olivine phenocrysts have weathered out to give a vesicular appearance.	Durable	B	----
3a	Dense, fine-grained, grayish brown to brown basalt with hairline fractures. Basalt is slightly altered and fractured outer surfaces have a brown, limonite-like coating.	Moderately Durable	Ca	----
3b	Greenish gray to green, dense basalt with hairline fractures. Some fractures may have white or light brown coatings. Deuteric and hydrothermal alteration have imparted a distinctive greenish cast to the basalt resulting from alteration of calcic plagioclase to the more sodic plagioclase, albite-oligoclase.	Moderately Durable	Cb	----
4a	Fine-grained, highly fractured gray to greenish gray basalt. Hairline to open fractures are mostly coated with white to pink calcite and commonly with the zeolite mineral, analcime.	Susceptible to Near-Term Degradation	Da	----
4b	Greenish gray to grayish brown olivine basalt that is highly fractured. Olivine phenocrysts have altered to brown material, possibly nontronite.	Susceptible to Near-Term Degradation	Db	----
5	Fine- to medium-grained, soft, grayish green, highly altered basalt. Rock has a granular appearance, has relatively low specific gravity, is probably highly chloritized, and it has commonly disintegrated (rubblized) into pieces smaller than 1 inch in diameter.	Nondurable - Crumbled/ Rubblized	E	----
6	Non-basaltic rocks such as sandstone or quartzite	Highly Durable to Nondurable	F	----

[1]Determine "As" while the rocks are still in place on the side slope before the rocks are picked up for gradation monitoring. The size of the monitored rock will reflect the size of the selected/marked split piece, not the size of the pre-split rock.

October 6, 2010

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September 7 - 8, 2011 **LAKEVIEW**

D_{50} by size - 5 seives

sample	total	number retained						cumulative number passing					cumulative percent passing					D_{50}	
number	painted	4 - inch	3 - inch	2.5 - inch	1.5 - inch	1-inch	<1-inch	4 - inch	3 - inch	2.5 - inch	1.5 - inch	1.0 - inch	4 - inch	3 - inch	2.5 - inch	1.5 - inch	1.0 - inch	(inch)	P/F
CP 1	23	0	3	6	8	6	0	23	20	14	6	0	100	87	61	26	0	2.19	F
CP 11	24	2	8	4	8	1	1	22	14	10	2	1	92	58	42	8	4	2.75	P
CP 2	24	0	4	8	11	0	1	24	20	12	1	1	100	83	50	4	4	2.50	F
CP 12	25	2	8	3	6	4	2	23	15	12	6	2	92	60	48	24	8	2.58	F
CP 3	24	2	3	4	13	2	0	22	19	15	2	0	92	79	63	8	0	2.27	F
CP 13	25	1	12	4	5	1	2	24	12	8	3	2	96	48	32	12	8	3.04	P
CP 4	24	1	6	2	7	5	3	23	17	15	8	3	96	71	63	33	13	2.07	F
CP 14	26	3	11	9	2	1	0	23	12	3	1	0	88	46	12	4	0	3.09	P
CP 5	25	1	6	2	13	1	2	24	18	16	3	2	96	72	64	12	8	2.23	F
CP 15	24	2	5	6	10	1	0	22	17	11	1	0	92	71	46	4	0	2.58	F
CP 6	24	0	8	5	11	0	0	24	16	11	0	0	100	67	46	0	0	2.60	F
CP 16	24	1	7	0	5	6	5	23	16	16	11	5	96	67	67	46	21	1.70	F
CP 7	25	2	4	1	14	2	2	23	19	18	4	2	92	76	72	16	8	2.11	F
CP 17	24	1	2	1	13	4	3	23	21	20	7	3	96	88	83	29	13	1.88	F
CP 8	23	2	15	3	3	0	0	21	6	3	0	0	91	26	13	0	0	3.37	P
CP 18	24	0	2	3	15	2	2	24	22	19	4	2	100	92	79	17	8	2.03	F
CP 9	23	4	7	4	4	1	3	19	12	8	4	3	83	52	35	17	13	2.94	P
CP 19	25	2	7	4	9	2	1	23	16	12	3	1	92	64	48	12	4	2.56	F
CP 10	24	5	11	3	5	0	0	19	8	5	0	0	79	33	21	0	0	3.36	P
CP 20	24	3	4	1	7	9	0	21	17	16	9	0	88	71	67	38	0	1.93	F
total sum	484	34	133	73	169	48	27	450	317	244	75	27	93	65	50	15	6	2.49	F

Sept. 8, 2011	
Mean	2.49
Standard E	0.109
Median	2.53
Mode	2.58
Standard D	0.489
Sample Va	0.239
Range	1.67
Minimum	1.70
Maximum	3.37
Sum	49.79
Count	20

computed S.E. = 0.109

95% conf. int: 2.70
2.28

n req'd (within 0.1")	α (%)
22	5
15	10
9	20

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Appendix B

Summation of 2009, 2010, and 2011 Rock Durability Monitoring Results For Type B Riprap at the Lakeview, Oregon, Disposal Site

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Summation Table of 2009, 2010, and 2011 Rock Durability Monitoring Results

Rock Durability Class/Subclass Code	2009 Percent	2010 Percent	2011 Percent	Durability Class	Comments
Au	NA[1]	27.7	11.2	Highly Durable	
Ah	NA[1]	13.8	11.5	Highly Durable	Sum of all Ah*
Ao	NA[1]	4.8	4.3	Highly Durable	Sum of all Ao*
As	NA[1]	0.8	1.4	Highly Durable	
All A	37.5	47.2	28.5	Highly Durable	Sum of Au, Ah, Ao, and As
B	25.9	20.2	27.9	Durable	
Ca	21.4	14.4	16.7	Moderately Durable	
Cb	6.9	1.0	13.6	Moderately Durable	
Da	4.5	8.3	7.9	Susceptible to Near-Term Degradation	
Db	1.6	5.9	3.7	Susceptible to Near-Term Degradation	
E	2.2	3.0	1.7	Nondurable - Crumbled/ Rubblized	
F	0	0	0.2	Varied	
All A + B	63.4	67.4	56.4	Highly Durable and Durable	

[1] NA = Not applicable. Only the category of Rock Durability Class Code A was monitored in 2009; subclass data was not included until the 2010 durability monitoring.

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