Department of Energy
Office of Legacy Management

AUG 1 2 2009

Myron Fliegel
U.S. Nuclear Regulatory Commission
Mail Stop T8F5
Washington, DC 20555-0001

Subject: Transmittal of Draft Final *Long-term Surveillance Plan for the Bear Creek, Wyoming (UMTRCA Title II) Disposal Site, Converse County, Wyoming*

Dear Mr. Fliegel:

Four copies of the subject Long-Term Surveillance Plan (LTSP) are enclosed for review by the U.S. Nuclear Regulatory Commission (NRC). This document demonstrates how the U.S. Department of Energy (DOE) will fulfill the requirements of Title 10, *Code of Federal Regulations*, Part 40.28 as long-term custodian of the Bear Creek, Wyoming, site. Placeholders remain in this LTSP for real property documentation. DOE understands that NRC cannot accept this document until the final real property documentation is appended.

DOE submitted a draft LTSP for this site on July 25, 2002. NRC responded on August 16, 2002, that the document had been accepted for review. On October 8, 2002, NRC provided review comments in a Technical Evaluation Report (TER). The Wyoming Department of Environmental Quality submitted comments on the LTSP to DOE and NRC on November 26, 2002. DOE incorporated the state's comments in the LTSP except for the suggestion to develop a memorandum of understanding between DOE and the Wyoming State Engineer's Office.

Although the formal submittal of Wyoming comments was in November 2002, the October 2002 TER incorporated the state's recommendations that DOE generate ground water contour maps and isoconcentration maps for uranium and sulfate. Because the well coverage is along narrow flow paths, DOE may be able to present a graphical depiction of water levels and chemistry but has indicated in the LTSP that isoconcentration maps will not be presented. The TER also contains the recommendation that DOE present time versus concentration maps for all wells. The LTSP indicates that DOE will present these plots in the annual compliance report. Additionally, DOE incorporated the Wyoming request to contact the State Engineer's Office every 10 years to assess regional ground water demands.

2597 B 3/4 Road, Grand Junction, CO 81503	3600 Collins Ferry Road, Morgantown, WV 26505
1000 Independence Ave., S.W., Washington, DC 20585	11025 Dover St., Suite 1000, Westminster, CO 80021
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232 Energy Way, N. Las Vegas, NV 89030	
REPLY TO: Grand Junction Office	

DOE proposes revision of the ground water monitoring program from that presented in the final alternate concentration limits application and concurrence. The revised program eliminates five metals that have either been at background levels or significantly less than regulatory limits (or appear to be naturally occurring) and includes pH and specific conductance to monitor movement of the acidic contamination and changes in total dissolved solids.

In the enclosed draft final LTSP, DOE has added additional information about geology, hydrology, and ground water conditions, as well as details of the engineered structures. This is intended to aid inspectors and stakeholders in understanding how the site is expected to perform and to recognize changes that may result in increased risk or significant threats to integrity.

I look forward to discussing with you or your staff the anticipated review time for this LTSP. Please call me at (720) 377-9682 or email me at scott.surovchak@lm.doe.com with questions.

Sincerely,

Scott R. Surovchak
Site Manager

Enclosure

cc:
T. McLaughlin, NRC
R. Bush, DOE-LM (e)
File: BRC 505.15 (Roberts)

surovchak\bear creek\7-30-09 LTSP submittal 6-19-09.doc

LMS/BRC/S00712-0.0

Long-Term Surveillance Plan for the Bear Creek, Wyoming (UMTRCA Title II) Disposal Site Converse County, Wyoming

August 2009

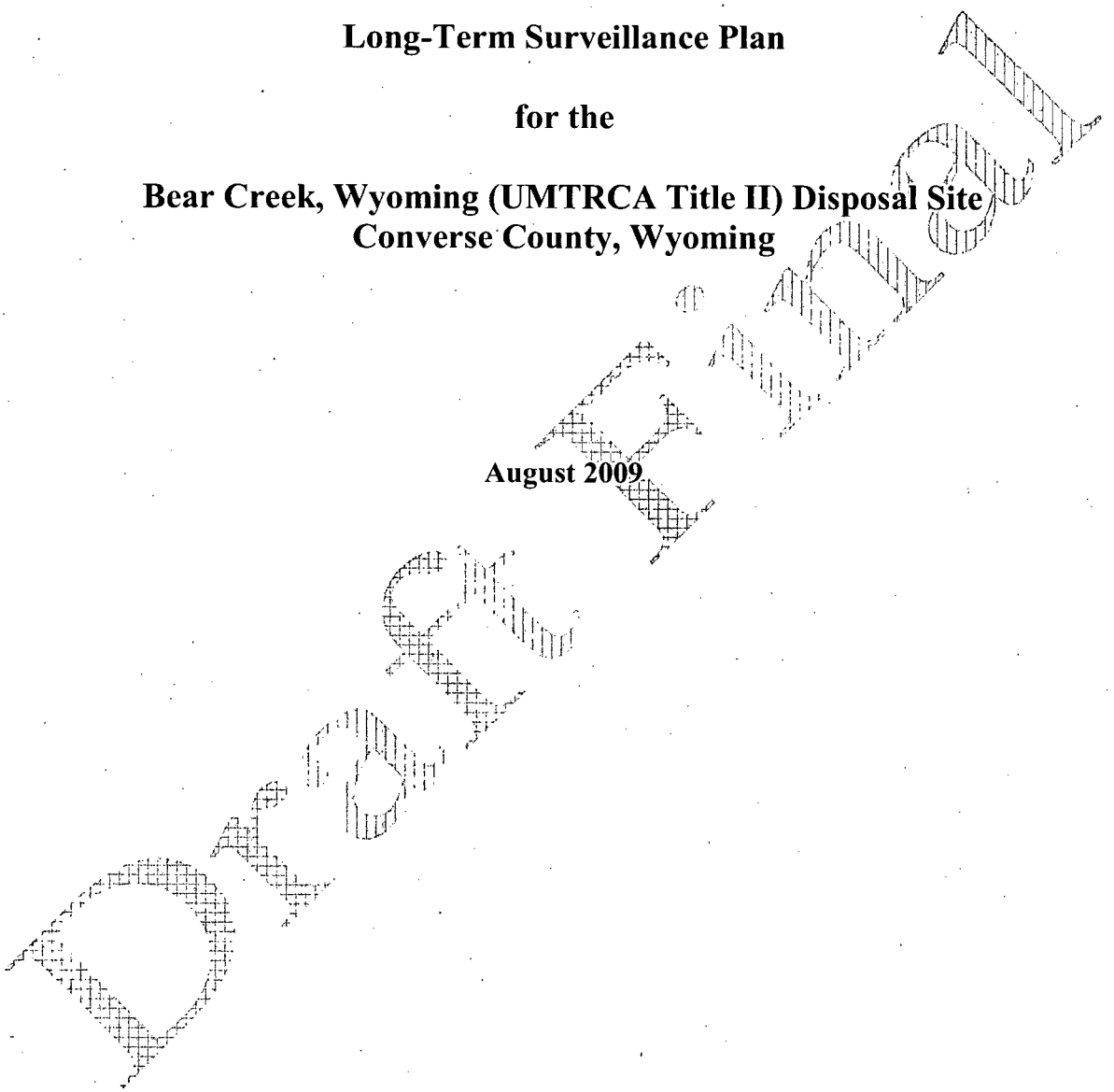
U.S. DEPARTMENT OF ENERGY | Legacy Management

LMS/BRC/S00712-0.0

Long-Term Surveillance Plan

for the

Bear Creek, Wyoming (UMTRCA Title II) Disposal Site
Converse County, Wyoming



August 2009

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Abbreviations

ACL	alternate concentration limit
BCUC	Bear Creek Uranium Company
CAP	corrective action program
CFR	*Code of Federal Regulations*
DOE	U.S. Department of Energy
D_{50}	median diameter
EMS	Environmental management system
LM	Office of Legacy Management
LTSP	Long-Term Surveillance Plan
MW	monitor well
NRC	U.S. Nuclear Regulatory Commission
PMF	probable maximum flood
POC	point-of-compliance
POE	point of exposure
TDS	total dissolved solids
UMTRCA	Uranium Mill Tailings Radiation Control Act
UPR	Union Pacific Resources, Incorporated
USC	*United States Code*

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1.0 Introduction

1.1 Purpose

This Long-Term Surveillance Plan (LTSP) explains how the U.S. Department of Energy (DOE) will fulfill general license requirements of Title 10 *Code of Federal Regulations* Part 40.28 (10 CFR 40.28) as the long-term custodian of the former Union Pacific Resources, Incorporated (UPR) Bear Creek uranium mill tailings disposal site in Converse County, Wyoming. The DOE Office of Legacy Management (LM) is responsible for preparing, revising, and implementing this LTSP, which specifies procedures for inspections, monitoring, maintenance, reporting requirements, and the maintenance of records pertaining to the site.

1.2 Legal and Regulatory Requirements

The Uranium Mill Tailings Radiation Control Act (UMTRCA) of 1978 (Title 42 *United States Code* Section 7901 [42 USC 7901]) as amended, provides for the remediation (or reclamation) and regulation of uranium mill tailings regulated under Title I and Title II of UMTRCA. Title I addresses former uranium mill sites that were unlicensed as of January 1, 1978, and essentially abandoned. Title II addresses uranium mill sites under specific license as of January 1, 1978. In both cases, the licensing agency is the U.S. Nuclear Regulatory Commission (NRC), or in the case of certain Title II disposal sites, an agreement state. The former UPR Bear Creek site is regulated under Title II of UMTRCA. The State of Wyoming is not an agreement state.

Federal regulations at 10 CFR 40.28 provide for the licensing, custody, and long-term care of uranium and thorium mill tailings sites closed (reclaimed) under Title II of UMTRCA.

A general license is issued by NRC for custody and long-term care, including monitoring, maintenance, and emergency measures necessary to ensure that uranium and thorium mill tailings disposal sites will be managed in such a way that they keep the public safe, do not compromise public health, and protect the environment after reclamation activities are complete.

The general long-term custody license becomes effective when NRC or an agreement state terminates the current specific license, and when NRC accepts a site-specific LTSP (such as this document).

LTSP requirements and general requirements for the long-term custody of the Bear Creek, Wyoming, disposal site are addressed in various sections of this LTSP (Table 1–1).

The plans, procedures, and specifications in this LTSP are based on the guidance document, *Guidance for Implementing the Long-Term Surveillance Program for UMTRCA Title I and Title II Disposal Sites* (DOE 2001). The rationale and procedures in the guidance document are considered part of this LTSP.

Table 1–1. LTSP and the Long-Term Custodian (DOE) Requirements for the Bear Creek, Wyoming, Disposal Site

LTSP Requirements		
	Requirement	**Reference**
1.	Description of final site conditions	Section 2.0
2.	Legal description of the site	Appendix A
3.	Description of the long-term surveillance program	Section 3.0
4.	Criteria for follow-up inspections	Section 3.5.1
5.	Criteria for maintenance and emergency measures	Section 3.6
Long-Term Custodian (DOE) Requirements		
	Requirement	**Reference**
1.	Notification to NRC of changes to the LTSP	Section 3.1
2.	NRC permanent right-of-entry	Section 3.1
3.	Notification to NRC of significant construction, actions, or repairs at the site	Sections 3.5 and 3.6

1.3 Role of the U.S. Department of Energy

In 1988, DOE designated the Grand Junction, Colorado, facility as the program office for managing the long-term surveillance and maintenance of DOE disposal sites that contain regulated low-level radioactive materials and portions of sites that do not have a DOE mission after cleanup, as well as other sites (including Title II sites) as assigned, and to establish a common office for the security, surveillance, monitoring, and maintenance of those sites.

In December 2003, DOE formally established LM. The LM mission includes "implementing long-term surveillance and maintenance at sites to ensure that human health and the environment are protected." LM is responsible for implementing this LTSP after it is accepted by NRC and the site becomes regulated under the general license.

According to the objectives of DOE Order 450.1A, *Environmental Protection Program*, DOE sites must implement sound stewardship practices protective of the air, water, land, and other natural and cultural resources potentially affected by their operations. DOE Order 450.1A requires DOE sites to have an environmental management system (EMS) to implement these practices. The LM EMS incorporates federal mandates specified in Executive Order 13423, *Strengthening Federal Environmental, Energy, and Transportation Management*, and DOE Order 430.2B, *Departmental Energy, Renewable Energy and Transportation Management.*

2.0 Final Site Conditions

Reclamation at the former Bear Creek Uranium Company (BCUC) mill in Converse County, Wyoming, consisted of demolishing site structures and consolidating contaminated materials in the mill tailings impoundment according to an accepted reclamation plan (UPR 1991). NRC concurred that site reclamation was complete in 2001 (NRC 2001). Seepage through the tailings embankment during operations resulted in contamination that was impracticable to remediate through corrective action. Therefore, BCUC proposed alternate concentration limits (ACLs), which NRC accepted in 1997 (NRC 1997). The grass-covered disposal cell occupies 101 acres of the 1,000-acre site.

2.1 General Description of the Disposal Site and Vicinity

The Bear Creek disposal site is located in rural Converse County, approximately 45 miles northeast of Casper and about 37 miles north-northwest of Douglas, Wyoming (Figure 2–1 and Figure 2–2). The nearest sizeable town is Glenrock, about 29 miles south-southwest of the site (NRC et al. 1977).

Central Wyoming's weather and climate are dominated by low- and high-pressure centers, with attendant frontal systems, that migrate through the area throughout the year. Temperatures vary from summer highs near 100 °F to winter lows near −40 °F. The seasons are distinct, with mild summers and harsh winters. Spring and fall are transition seasons, with warm days and cold nights (NRC et al. 1977).

The climate is semiarid, with a mean annual precipitation of 12 inches. More than 50 percent of the annual precipitation occurs during May, June, and July, in the form of wet snow and rain. Heavy snowfalls can occur during both spring and fall. Late-spring and summer thunderstorms are scattered, and the amounts of rain from such storms is extremely variable, in terms of both location and intensity. The mean annual snowfall at Bill, Wyoming (approximately 15 miles east of the Bear Creek site on Wyoming State Highway 59), averaged over a 13-year period ending in 1960, was 72.2 inches. Prevailing winds are from the west and southwest (NRC et al. 1977).

The disposal site lies within an ephemeral drainage known as Lang Draw. The Bear Creek site is approximately 5,100 feet above sea level.

Land in the immediate vicinity is primarily used for ranching, livestock grazing, wildlife habitat, and mineral exploration. The reclaimed open pits of the Bear Creek Uranium Mine, which supplied the mill, are in the immediate vicinity of the site. The UMTRCA Title I Spook site is approximately 1 mile south of the Bear Creek site.

The ore processed in the Bear Creek mill came from several open-pit mining operations in the immediate vicinity of the mill site.

2.1.1 Site Ownership

The federal government owns the 1,000-acre Bear Creek disposal site property. Access to the disposal site is provided by a non-exclusive road easement granted by an adjacent property owner. A copy of this easement and other real estate documentation is included in Appendix A.

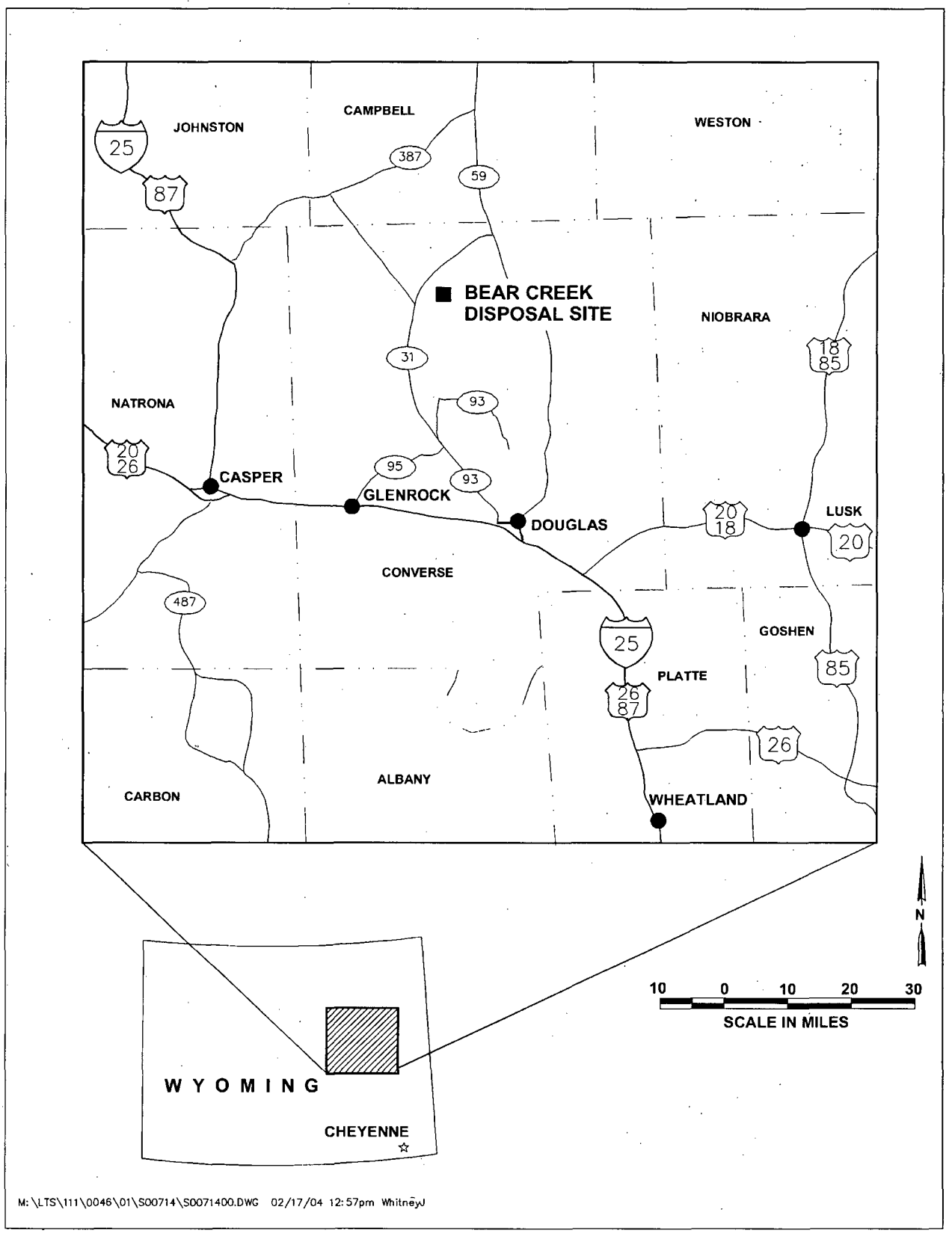

Figure 2–1. General Location Map of the Bear Creek, Wyoming, Disposal Site

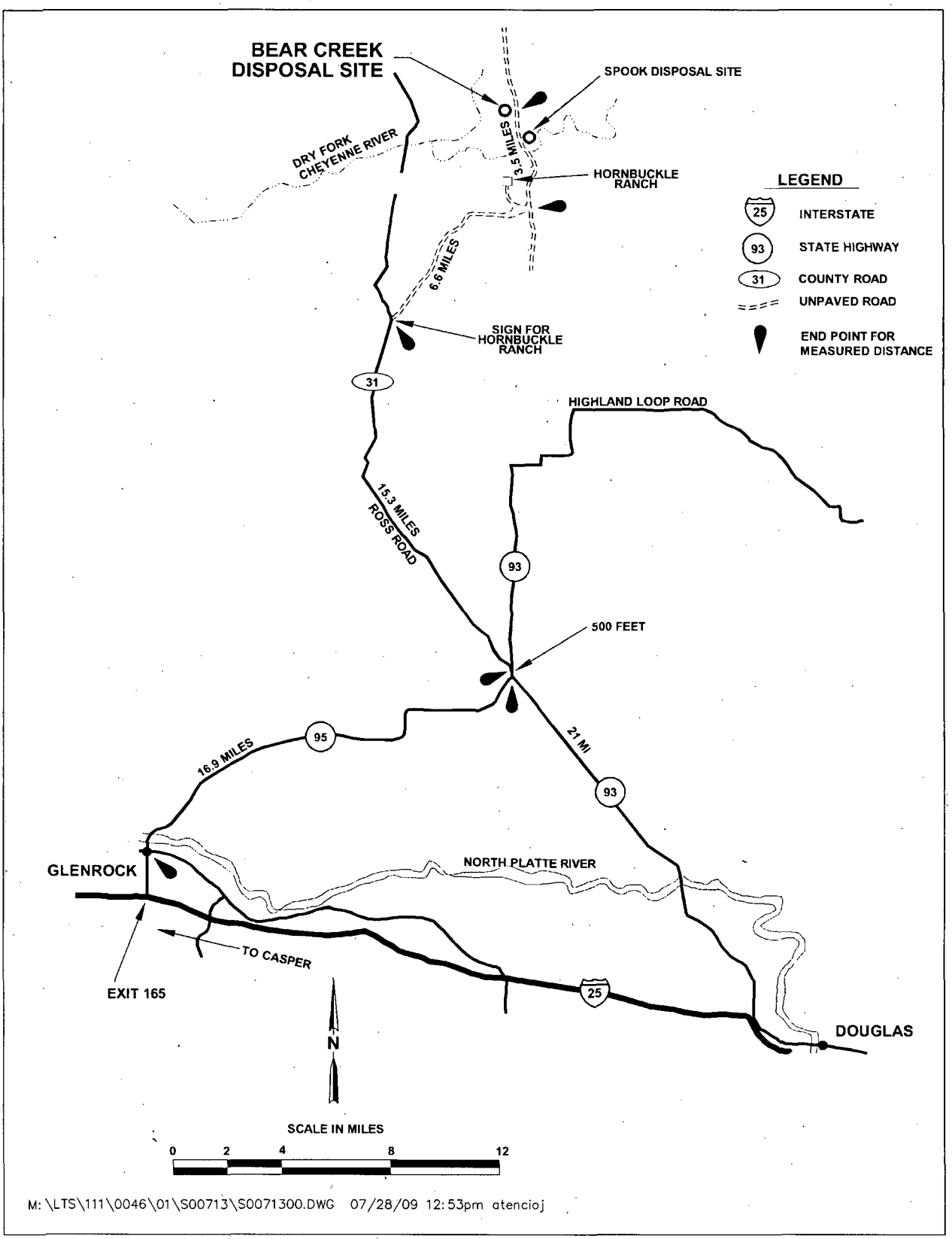

Figure 2–2. Bear Creek, Wyoming, Disposal Site Location Map

2.1.2 Directions to the Disposal Site

From Casper, Wyoming, travel east on Interstate 25 approximately 15 miles to exit 165 for Glenrock, Wyoming. Exit Interstate 25 and proceed north to the stoplight at the intersection in the center of Glenrock. Proceed north and northeast 16.9 miles on State Highway 95 to the intersection with State Highway 93. Turn left and proceed about 500 feet on State Highway 93 to the intersection with County Road 31 (Ross Road). Turn left (going northwest) on to County Road 31 and proceed north for 15.3 miles to the entrance to the Hornbuckle Ranch, on the right side of the road. Turn on to the Hornbuckle Ranch road (a gravel road), and proceed 6.6 miles to its junction with another gravel road. Turn north on this gravel road and travel 3.5 miles, passing the Spook Title I site on the right at about 2.5 miles, to the Bear Creek site (Figure 2–2).

2.2 Site History

The Bear Creek uranium mill was owned and operated by BCUC, which was a joint venture of Southern California Edison and Rocky Mountain Energy. Rocky Mountain Energy was the operating partner. Company reorganization incorporated Rocky Mountain Energy into UPR (UPR 1999). Anadarko Petroleum Corporation acquired UPR in 2000.

Milling commenced in September 1977 under NRC License Number SUA-1310 and continued until January 20, 1986. The milling processes incorporated sulfuric acid leaching, sodium chlorate oxidant, liquid ion-exchange, extraction, and concentration. As a result of these operations, approximately 4.7 million tons of tailings were produced and discharged as a slurry into an above-grade tailings basin (UPR 1997).

The tailings basin was installed in 1977 in a local drainage known as Lang Draw and consisted of a zone-fill dam and compacted soil-lined basin. Although state-of-the-art dam and liner construction techniques were used, BCUC anticipated that some seepage would occur and constructed a seepage catchment structure below the tailings dam to intercept the seepage and pump it back to the tailings basin. Surface seepage was first observed in 1978. Several wells were developed to determine groundwater contamination potential, and elevated chloride levels were observed (believed to be indicative of seepage). Additional wells were completed as recovery wells, and seepage recovery was begun in 1979. In 1985, NRC required the implementation of a groundwater detection-monitoring program. Indicator parameters were arsenic, selenium, and pH.

After 1986, an interim cover and three evaporation ponds were constructed on top of the tailings area. The evaporation ponds were part of a groundwater corrective action program (CAP) (UPR 1999). The mill and solvent extraction buildings were decommissioned in 1988.

NRC concurred in the reclamation plan in 1984 and in modifications to the plan to reduce the volume of encapsulated tailings in 1986. BCUC closed the tailings impoundment in December 1999. NRC documented concurrence that the reclamation plan was implemented in 2001 (NRC 2001). NRC documented acceptance of the application for alternate concentration limits in 1997 (NRC 1997).

Groundwater compliance history is presented in Section 2.5.2, "Groundwater Conditions."

2.3 Disposal Site Description

2.3.1 Description of Surface Conditions

The Bear Creek site incorporates a combination of rock armoring, contouring, and revegetation to achieve the necessary surface water drainage control and erosion protection to satisfy the longevity design requirements. The revegetated surfaces have been planted with a mix of prairie grasses that have proven to be successful in reclaiming nearby surface mine areas and will help provide soil stability.

The disposal cell is surrounded by barbed-wire fencing to allow control of grazing on the grass-covered cell. Other portions of the site are accessible for livestock grazing.

2.3.2 Permanent Site Surveillance Features

Permanent long-term surveillance features at the Bear Creek site consist of boundary monuments, a site marker, and warning signs. These features will be inspected and maintained as necessary as part of the passive institutional controls for the site.

Ten monuments mark the final site boundary, one at each of the six corners of the 1,000-acre disposal site, one at each of the two section corners along the east and west property boundaries, and two monuments at section quarter corners along the east property boundary.

One unpolished granite marker with an incised message identifying the site of the Bear Creek disposal cell is placed near the crest of the tailings dam, where a person entering the property would likely discover it. The message on the granite site marker is shown on Figure 2–3.

Entrance signs are located at the three gates in the fence surrounding the cell and at the gate in the southeast corner of the site. Perimeter signs containing the same information as on the entrance signs are mounted on steel posts set in concrete approximately 5 to 8-feet inside the fence surrounding the cell. Signs are placed at locations that reasonably may be seen when approaching the site. The signs display the DOE 24-hour telephone number (Figure 2–4).

The positions of the permanent site surveillance features are shown on Figure C–1.

BEAR CREEK, WYOMING

DATE OF CLOSURE: DECEMBER 1999

TONS OF TAILINGS: 4,500,000

860 CURIES, RA-226

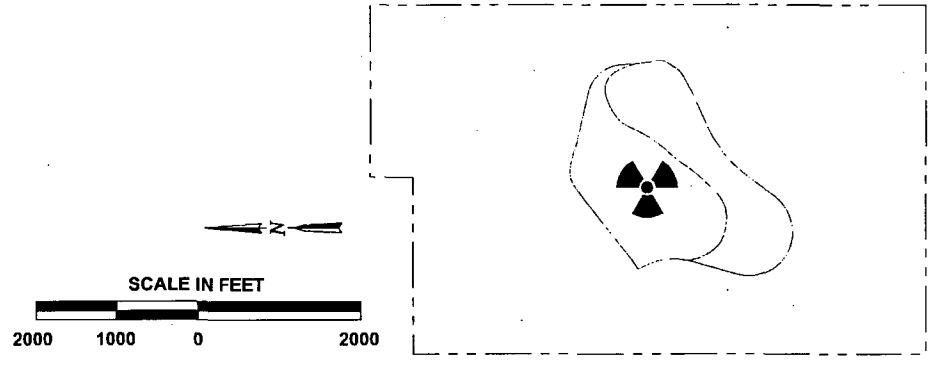

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Figure 2–3. Site Marker at the Bear Creek, Wyoming, Disposal Site

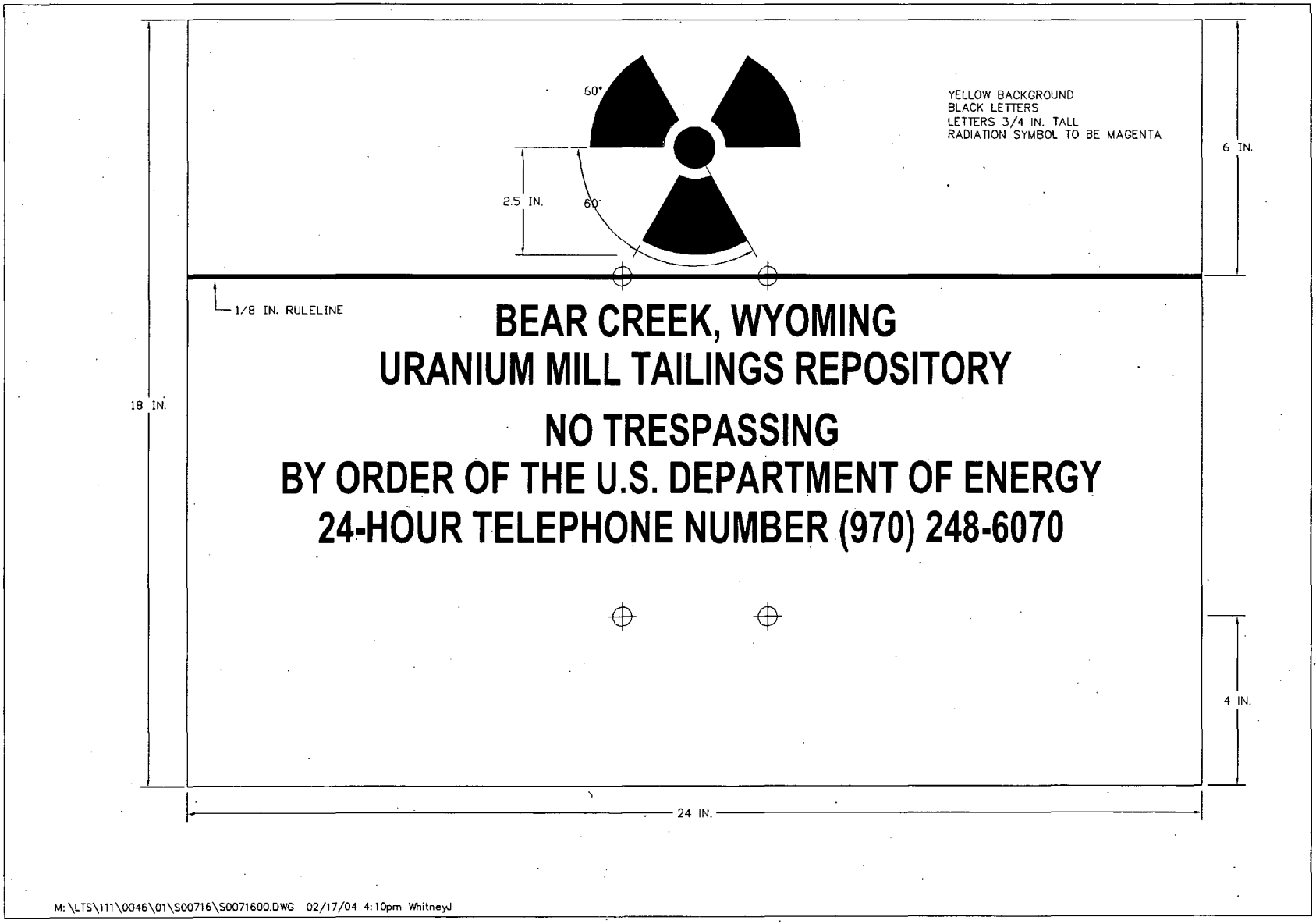

Figure 2–4. Warning Sign at the Bear Creek, Wyoming, Disposal Site

2.4 Tailings Impoundment Design

The objective of the tailings impoundment system is to isolate the uranium mill tailings from the surrounding environment. This is accomplished by reducing radon gas emission rates to below regulatory standards, minimizing infiltration of meteoric water that could potentially leach contaminants into the subsurface, and physically containing the contaminated materials within a durable containment structure to prevent dispersion.

The original tailings impoundment was created by constructing an embankment across Lang Draw. Tailings slurry was deposited behind the embankment, forming a tailings pond. To improve stability, seepage through the tailings embankment foundation was controlled by excavating a cutoff trench to the top of the bedrock beneath the center of the embankment and backfilling with impermeable material. As an additional measure to contain seepage from the tailings pond, BCUC constructed a dike across Lang Draw approximately 600 feet downstream of the tailings embankment (NRC et al. 1977).

The tailings pile was reclaimed in place by flattening and armoring the embankment face and grading and covering the tailings. The reclaimed tailings impoundment occupies approximately 163 acres, of which approximately 101 acres are covered by a radon barrier. A storm water diversion system hydraulically isolates the tailings, preventing erosion over the long-term and helping to achieve the necessary impoundment stability, as shown on Figure 2–5 (UPR 1991). A cross section of the tailings embankment and impoundment is shown on Figure 2–6.

The drainage area above the tailings embankment and diversion channel is 706 acres. The tailings embankment, cell cover, and storm water diversion system were designed to withstand the probable maximum flood (PMF) event of 13.84 inches of rainfall in 6 hours (UPR 1991).

2.4.1 Embankment

Slopes on the face of the embankment were flattened and protected by riprap. The upper portion of the embankment is at a slope of 4 (horizontal) to 1 (vertical) (4:1) and armored with a 6-inch-thick layer of durable rock having a median diameter (D_{50}) of 3 inches. The lower portion of the embankment is at a slope of 5:1 and armored with an 8-inch-thick layer of rock having a D_{50} of 4 inches. All riprap is underlain by a 6-inch-thick bedding and filter layer of gravel.

Channels along the toe of the embankment convey runoff water to five interceptor channels that carry the water down-slope to the north. The toe channels and the upper 100 feet of the interceptor channels are protected by riprap with a D_{50} of 9 inches.

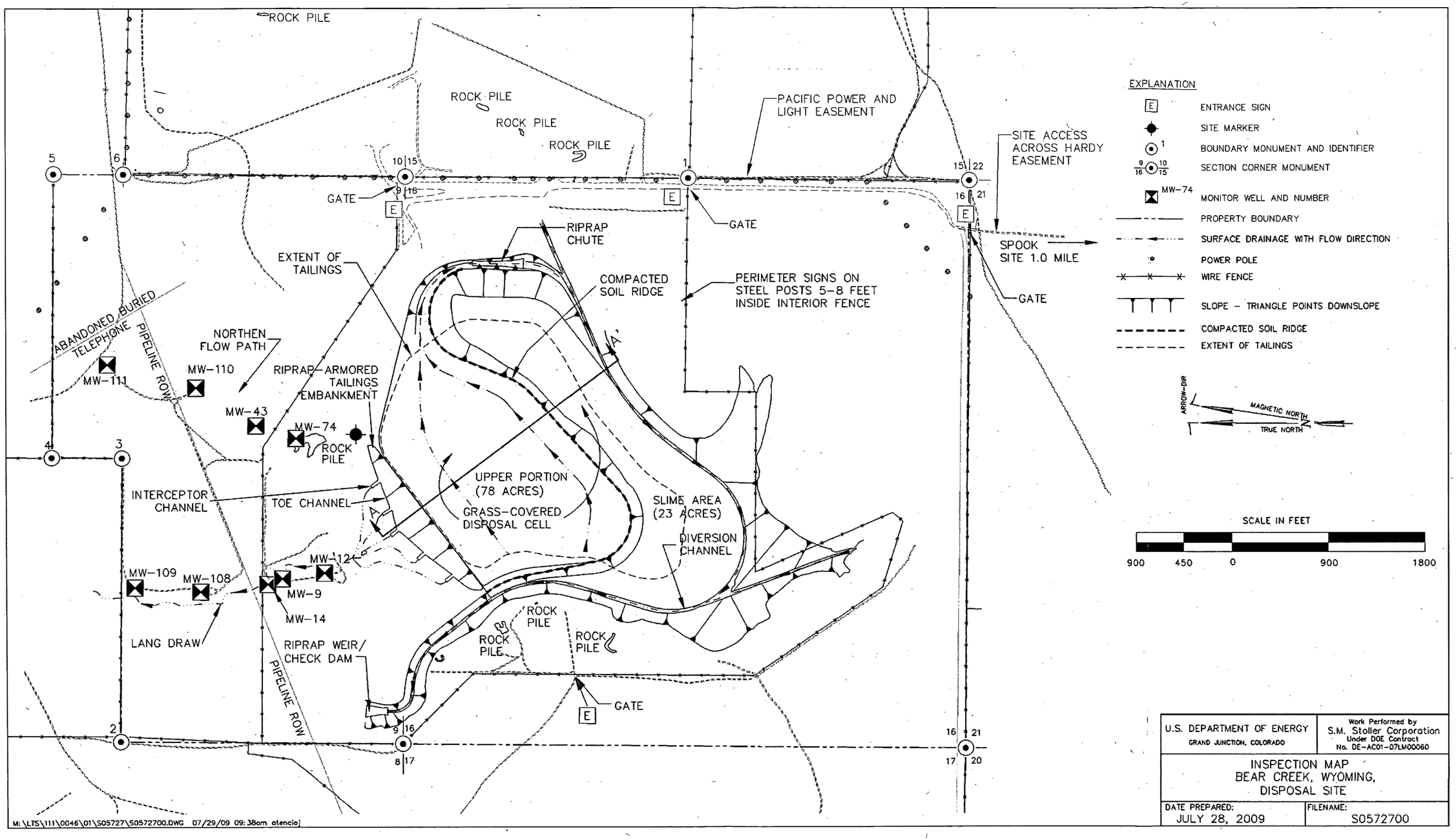

Figure 2–5. Site Map, Bear Creek, Wyoming, Disposal Site Insert revised

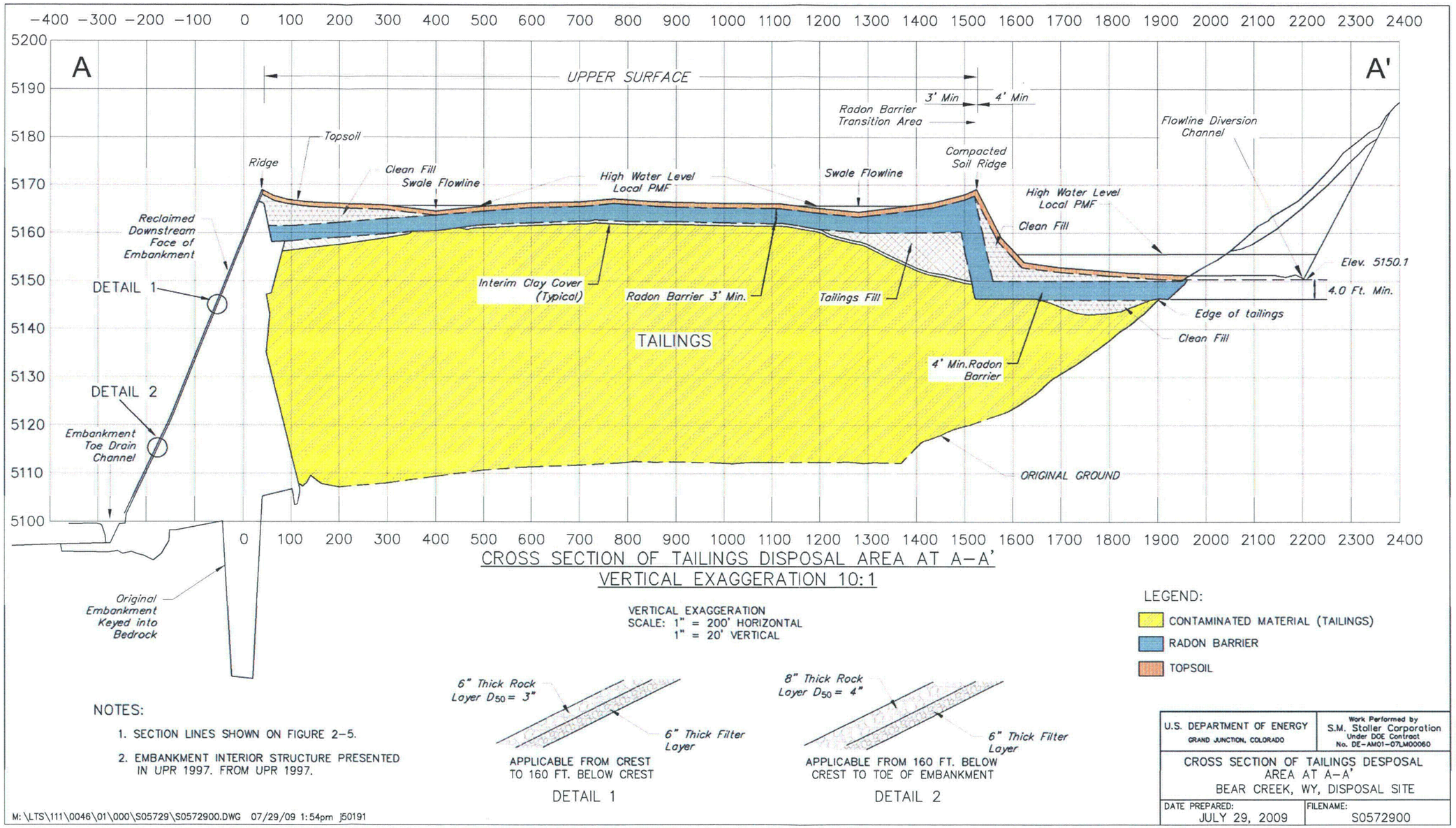

Figure 2–6. Tailings Dam and Impoundment Cross Section

2.4.2 Cover, Top Slope, and Storm Water Diversion System

An interim clay cover was placed over the tailings during construction for protection prior to placement of the final cover materials.

A ridge of compacted soil was constructed around the south edge of the upper portion of the disposal cell top slope to reduce the catchment area on the cell top to 78 acres and isolate the upper surface from the rest of the cell. Two shallow grass-covered swales convey storm water eastward to a chute located on outcropping bedrock east of the cell. The top slopes are flat enough to withstand erosion, and the vegetation was not calculated in the design to provide erosion protection.

BCUC placed a minimum of 3 feet of compacted soil radon barrier over the upper surface (78 acres) and a minimum of 4 feet over the fine-particle (or "slimes") area (23 acres) that lies outside the compacted soil ridge. The radon barrier covers 101 acres of tailings.

One foot of topsoil was placed over a layer of random fill[1] that covers the radon barrier material, and planted with shallow-rooted grasses (UPR 1999).

2.4.3 Chute

A chute collects storm water from the swales and conveys it to the diversion channel. The chute was excavated into claystone and sandstone. It is armored with riprap in three zones with D_{50}s of 24 inches, 15 inches, and 9 inches, respectively, from the top of the chute to the discharge. As riprap size decreases, the side slopes of the chute flatten from 2:1 to 3:1 and then to 5:1. The entire chute is underlain by a 6-inch-thick layer of filter gravel and a 6-inch-thick layer of rocks that have a D_{50} of 3 inches.

2.4.4 Diversion Channel

A diversion channel conveys storm water around the south side of the disposal cell from the toe of the chute to a discharge point west of the embankment. As the diversion channel curves around the tailings area, surface drainage from the approximately 85-acre reclaimed surface immediately adjacent to the former tailings pile also flows into the channel. The grass-covered diversion channel is approximately 2,000 feet long and constructed with a flat slope and wide bottom to control erosion.

2.4.5 Rock Weir

The mouth of the diversion channel empties to a rock weir. This structure is engineered to act as a check dam and absorb the erosive force of a PMF and discharge it to Lang Draw down-slope of the embankment. The weir is constructed in outcropping sandstone and claystone. The structure has sides with a 2:1 slope and broadens toward the discharge. The entire structure is underlain by 6-inch-thick layers of filter rock and rock with a D_{50} of 3 inches. Riprap armoring has a D_{50} of 15 inches in the approach section at the head of the weir, a D_{50} of 24 inches in the central control section, and a D_{50} of 15 inches in the lower transition section. The riprap is as much as 48 inches thick.

[1] Random fill is clean (i.e., uncontaminated) material that has not been processed for particle size.

2.5 Geology, Hydrology, and Groundwater

2.5.1 Site Geology and Hydrology

The Bear Creek site is in the central Southern Powder River Basin. The basin lies between the Black Hills on the east and the Bighorn Mountains on the west. South of the site are the Laramie Mountains, the Hartville uplift, and the Powder River lineament (Wright 1975). The regional dip is to the northwest.

The Bear Creek site is situated on the lower part of the Eocene-age Wasatch Formation. The Wasatch Formation typically consists of unconsolidated and discontinuous fluvial braided-stream deposits of clayey sand interspersed with claystone and siltstone. Three near-surface or outcropping sandstone layers of the Wasatch Formation in this area include, in order of increasing depth, the K Sand, the N Sand, and the Ore Sand. The Wasatch Formation is in turn conformably underlain by the Fort Union Formation.

Thin, limited deposits of alluvial material fill low areas on the bedrock surface and surface drainages. Alluvial deposits are on the order of 20 to 40 feet thick along Lang Draw.

The K Sand ranges from 5 to 40 feet thick in the vicinity of the tailings. It is a limited path for groundwater flow because it has been removed by erosion along Lang Draw, is of limited areal extent, and is generally above the level of the tailings.

The N Sand ranges from 5 to 50 feet thick in the vicinity of the tailings impoundment. Although the N Sand is separated from the tailings by siltstones and claystones, a lens of highly weathered sandstone beneath the northeast portion of the tailings cut-off trench allowed for leakage from the impoundment into the N Sand and alluvium along the Lang Draw flow path and into the N Sand along the Northern flow path.

The Ore Sand is separated from the shallower sands by at least 50 feet of claystones and siltstones (UPR 1997). Most of the uranium produced at the Bear Creek mill was mined from Ore Sand deposits 100 to 200 feet below the surface (NRC et al. 1977).

At the Bear Creek site, groundwater occurs in the Wasatch Formation under both confined and unconfined conditions. Limited amounts of groundwater can be found in some discontinuous sand lenses in the Wasatch Formation, such as the N Sand, which is located beneath the tailings impoundment. A deeper, more continuous unit within the Wasatch Formation, the Ore Sand, is the main source of stock water in the area. Groundwater in the Fort Union Formation is confined. In some cases, the hydrostatic head is sufficient for flow to occur at the land surface (NRC et al. 1977).

Locally, groundwater from embankment seepage saturated the alluvium and N Sand after milling commenced. The affected portions of the alluvium deposits and the N Sand are in hydraulic communication and together constitute the uppermost aquifer at the Bear Creek site. Results of characterization and monitoring indicated there were two flow paths associated with the seepage: the "Lang Draw" flow path and the "Northern" flow path. The flow paths define the seepage plume as two narrow lobes, which eventually merge 3,000 feet downgradient of the tailings impoundment (UPR 1997).

2.5.2 Groundwater Conditions

Seepage from the tailings impoundment was first observed in 1978. Several wells were developed to determine groundwater contamination potential. Elevated chloride levels, present in the tailings pore fluid and a highly mobile seepage indicator, were observed. In October 1979, several wells were installed for recovering tailings seepage. Seepage was pumped back into the tailings impoundment (UPR 1997). A seepage control dam was constructed in 1979 about 600 feet downstream of the tailings dam, and a "pump back" recovery system was operated to return seepage to the tailings impoundment for evaporation. Additional efforts included pumping the wells downgradient of the tailings dam and wells completed in the tailings to dewater the tailings. This water was evaporated, through various enhanced evaporation systems, on top of the tailings.

In 1985, NRC amended license SUA-1310 to formally require a groundwater detection-monitoring program. Indicator parameters were arsenic, selenium, and pH, and threshold values were established for point-of-compliance (POC) wells. The NRC required a groundwater CAP, which BCUC implemented in 1986 and operated until 1996. Threshold values for pH and selenium were exceeded in 1987. The CAP was formally approved by NRC in 1989 and incorporated as part of the BCUC byproduct materials license. The plan specified a monitoring network, a list of site constituents, and groundwater protection standards (UPR 1997). Constituents and standards are listed in Table 2–1. The monitoring network is discussed in Section 3.8.1. The extent of the contaminant plume was defined on the basis of pH less than 7.

Table 2–1. Background and Tailings Water Chemistry at the Bear Creek, Wyoming, Disposal Site

Constituent	Background (Well MW-9)[a]	Tailings Pore Fluids (TS-3)[b]	Tailings Pore Fluids (TS-5)[b]	ACLs	Class III GWPS
Beryllium (mg/L)	0.01	0.26	0.27		
Cadmium (mg/L)	0.01	0.62	0.58		
Chromium (mg/L)	0.05	0.3	0.44		
Molybdenum (mg/L)	0.02	<0.2	<0.1		
Nickel (mg/L)	0.05	4.5	4.9	3.8	
Ra-226+228 (pCi/L)	9.7	120	140	46	
Selenium (mg/L)	0.025	<0.5	<0.5		
Th-230 (pCi/L)	2.6	3,100	13,000		
Uranium, total (pCi/L)	98.7	4,197	4,874	2,038 (3.0 mg/L)[c]	
Chloride (mg/L)		550	600		2,000
Sulfate (mg/L)		18,700	19,300		3,000
TDS (mg/L)					5,000

Key: ACL = alternate concentration limit; GWPS = State of Wyoming groundwater protection standards; mg/L = milligrams per liter; MW = monitor well; pCi/L = picocuries per liter; TS = tailings sand well
[a]From UPR 1997; chemistry with neutral pH and low TDS considered "background."
[b]Analyses from UPR 1997.
[c]Using 677 pCi/mg; based on analyses in UPR 1997.

Pre-milling groundwater characterization was focused on the Ore Sand because that constituted the most abundant shallow aquifer in the area. Only after milling began and seepage was observed was attention shifted to the "uppermost aquifer" (i.e., the N Sand and alluvium).

Attempts to install upgradient background wells in these units were unsuccessful, as the units crop out at the surface in this direction. Therefore, NRC selected downgradient Monitor Well (MW)-9 as a representative background location. Background values were derived from this well prior to 1993 while pH was neutral and total dissolved solids (TDS) concentrations were low (Table 2–1).

The CAP was designed to recover contaminated groundwater and control and minimize the spread of the tailings seepage. From the CAP inception through 1996, approximately 301,000,000 gallons of seepage water was recovered and pumped back into the tailings pond (UPR 1997). Clay capping of the tailings began in 1988 and continued until 1991. Subsequent water from the recovery system was evaporated in clay-lined ponds on top of the tailings. This significantly improved the dewatering of the tailings impoundment.

The CAP was operated for more than 10 years and successfully reduced hazardous constituent levels, with the exception of uranium, to less than the license-established background standards as measured at the POC locations (Table 2–2). The CAP pulled the highly acidic plume back to within and under the tailings impoundment area and reduced the saturated thickness of the alluvium, N Sand, and tailings. Corrective action was terminated when evaluations indicated that further remediation would have little or no effect on controlling movement of the acid front. Further groundwater recovery was also determined to be impracticable due to the reduction in saturated thickness of the units. An application for ACLs was subsequently submitted and approved by NRC (UPR 1997 and NRC 1997).

Table 2–2. Monitoring Results from 2004 to 2008 at the Bear Creek, Wyoming, Disposal Site

Constituent	Range	Detects/Total Number of Samples
Beryllium (mg/L)	<0.01–<0.001	0/10
Cadmium (mg/L)	<0.01–<0.001	0/10
Chromium (mg/L)	<0.005–0.032	5/10
Molybdenum (mg/L)	<0.01–<0.001	0/10
Selenium (mg/L)	<0.001–0.014	21/25
Nickel (mg/L)	<0.001–0.032	15/45
Uranium, total (pCi/L)	1.2– 629.6	45/45
Radium-226 (pCi/L)	0.29 ± 0.12–4.4 ± 0.7	45/45
Radium-228 (pCi/L)	<1.0–9.5 ± 1.2	26/45
Thorium-230 (pCi/L)	<0.2	0/45
Chloride (mg/L)	16–886	20/20
Sulfate (mg/L)	803–2,160	20/20

Key: mg/L = milligrams per liter; pCi/L = picocuries per liter

ACLs have been granted for uranium, combined radium-226 and radium-228, and nickel. At the time ACLs were established, all constituents except uranium were below background concentrations at the POCs. However, modeling suggested that the low pH plume associated with the tailings would eventually move downgradient to the POCs, and elevated concentrations of uranium, radium, and nickel would move with the pH plume. Modeling was conducted to determine the maximum concentrations of these constituents expected to occur at the POCs; these values were approved as the ACLs (Table 2–1).

There are no current or projected future uses of alluvial or N Sand groundwater at or beyond the point of exposure (POE), and it is anticipated that those units will return to a condition of low saturation and yield. Nonetheless, a risk assessment was performed using maximum-modeled POE concentrations in groundwater. Results indicated that risks associated with predicted concentrations would not be significantly different than those associated with background concentrations. ACLs were therefore determined to be protective. The groundwater-monitoring plan for the Bear Creek site is described in detail in Section 3.7.1.

Recent monitoring data indicate that concentrations of beryllium, cadmium, chromium, molybdenum, nickel, and thorium-230 are mostly below detection and far below background levels established for the site. Selenium has been present at detectable concentrations, but at levels less than background. Radium, uranium, chloride, and sulfate are the only constituents that have been present in appreciable concentrations. Some individual wells appear to indicate increasing or decreasing trends for some of these constituents, but most show no clear long-term trends. Table 2–2 summarizes data for the site for the last 5 years of monitoring (2004–2008).

2.6 Institutional Control

Institutional control at the Bear Creek site consists of federal ownership. Construction of groundwater supply wells and residences on the disposal site property must be precluded in perpetuity, and federal ownership of the property ensures effective land-use control.

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3.0 Long-Term Surveillance Program

3.1 General License for Long-Term Custody

States have right of first refusal for long-term custody of Title II disposal sites (UMTRCA, Section 202 [a]). On July 15, 1994, the State of Wyoming exercised its right of first refusal and declined the long-term custody of the Bear Creek site (State of Wyoming 1994). Because the state declined this right, the site was transferred to DOE for long-term custody.

When NRC accepted this LTSP and terminated Anadarko Petroleum's license, SUA–1310, the site was included under NRC's general license for long-term custody (10 CFR 40.28 [b]). Concurrent with this action, title to the site transferred from Anadarko Petroleum to DOE.

Although sites are designed to last "for up to 1,000 years, to the extent reasonably achievable, and, in any case, for at least 200 years" (10 CFR 40, Appendix A, Criterion 6), there is no termination of the general license for DOE's long-term custody of the site (10 CFR 40.28 [b]).

Should changes to this LTSP be necessary, NRC must be notified of the changes, and the changes may not conflict with the requirements of the general license. Additionally, representatives of NRC must be guaranteed permanent right-of-entry for the purpose of periodic site inspections. DOE has acquired a perpetual easement to access the site across private land located between the Bear Creek site and the Spook UMTRCA Title I site to the south (Appendix A).

3.2 Requirements of the General License

To meet the requirements of the NRC license at 10 CFR 40.28, and 10 CFR 40, Appendix A, Criterion 12, the long-term custodian must, at a minimum, fulfill the following requirements. The section in this LTSP in which each requirement is addressed is in parentheses.

- Annual site inspection (Section 3.3).
- Annual inspection report (Section 3.4).
- Follow-up inspections and inspection reports, as necessary (Section 3.5).
- Site maintenance, as necessary (Section 3.6).
- Emergency measures in the event of catastrophe (Section 3.6).
- Environmental monitoring, if required (Section 3.7).

3.3 Annual Site Inspections

3.3.1 Frequency of Inspections

At a minimum, sites must be inspected annually to confirm the integrity of visible features at the site and to determine the need, if any, for maintenance, additional inspections, or monitoring (10 CFR 40, Appendix A, Criterion 12).

To meet this requirement, DOE will inspect the Bear Creek disposal site once each calendar year. The date of the inspection may vary from year to year, but DOE will endeavor to inspect the site approximately once every 12 months unless circumstances warrant variance. Any variance to this inspection frequency will be explained in the inspection report. DOE will notify NRC of the inspection at least 30 days in advance of the scheduled inspection date.

3.3.2 Inspection Procedure

For the purposes of inspection, the Bear Creek disposal site will be divided into areas called "transects." Each transect will be individually inspected. Proposed transects for the first inspection of the Bear Creek site are listed in Table 3–1 and shown on Figure 3–1.

Table 3–1. Transects Used During First Inspection of the Bear Creek, Wyoming, Disposal Site

Transect	Description
Cover of Tailings Impoundment	Repository impoundment cover.
Containment Dam and Diversion Channel	Riprap placement and integrity.
Site Perimeter and Balance of Site	Site perimeter, including 0.25 mile beyond site boundary, area between tailings impoundment and site boundary, site entrance, boundary monuments, entrance sign, and site marker.

The annual inspection will be a visual walk-through. The primary purpose of the inspection will be to look for evidence of degradation such as cover cracking or settlement, wind or water erosion, structural discontinuity of the containment dam, vegetation condition, and animal or human intrusions that could result in adverse impacts. Disposal site and disposal cell inspection techniques are described in detail in Attachment 4 of the guidance document (DOE 2001).

In addition to inspection of the site itself, inspectors will note changes and developments in the area surrounding the site, especially changes within the surrounding watershed basin. Significant changes within this area could include development or expansion of human habitation, erosion, road building, or other change in land use.

It may be necessary to document certain observations with photographs. Such observations may be evidence of vandalism or a slow modifying process, such as rill erosion, that should be monitored more closely during general site inspections. Photographs are documented on the Field Photograph Log. An example of the photograph log is included as Appendix B.

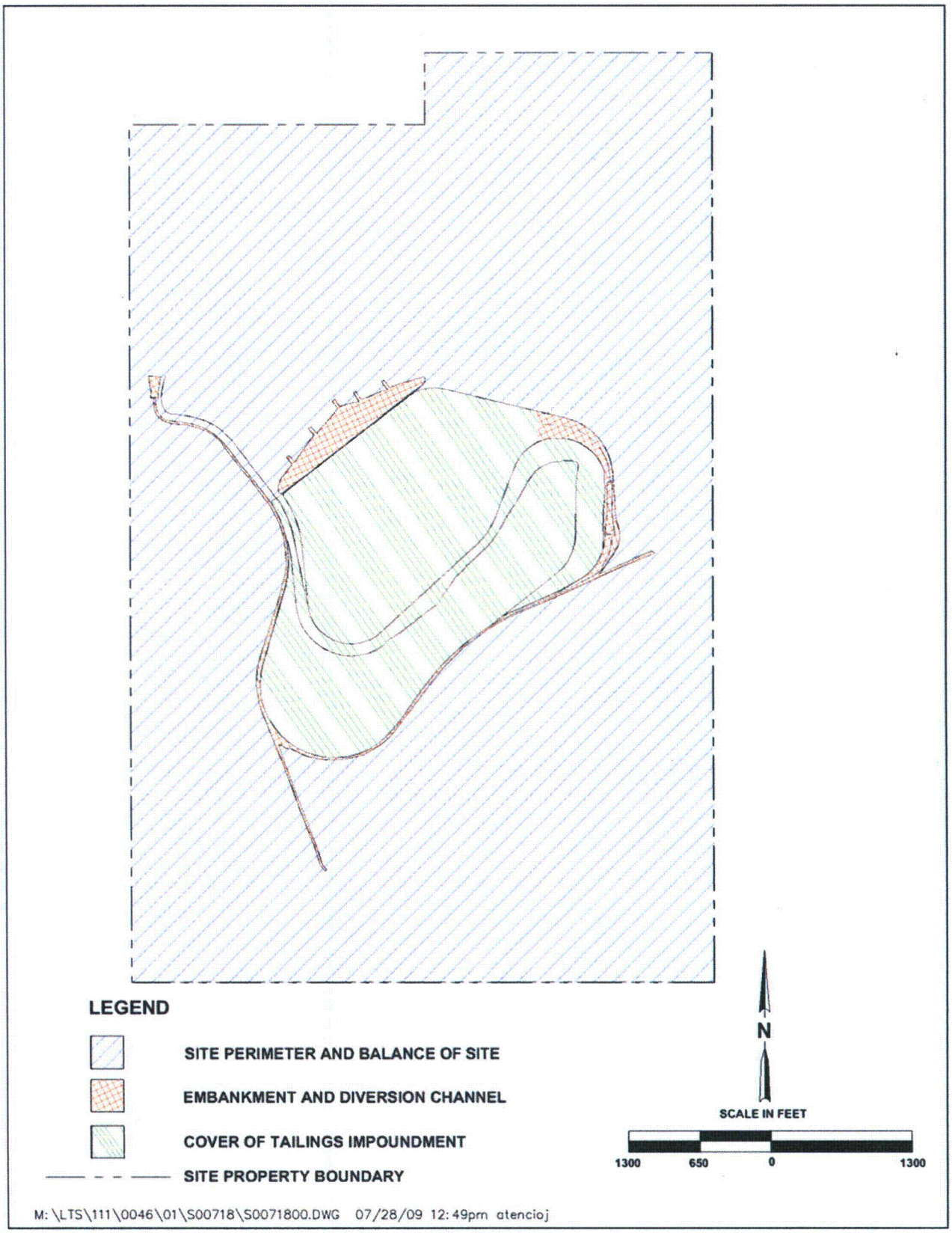


Figure 3–1. Map of Inspection Transects for the Bear Creek, Wyoming, Disposal Site

3.3.3 Inspection Checklist

The inspection checklist guides the inspection. The initial site-specific inspection checklist for the Bear Creek disposal site is presented in Appendix C.

The checklist is subject to revision. At the conclusion of the annual site inspection, inspectors will make notes regarding revisions to the checklist, if necessary, in anticipation of the next annual site inspection. Revisions to the checklist will include such items as new discoveries or changes in site conditions that must be inspected and evaluated during the next annual inspection.

3.3.4 Personnel

At least two inspectors normally perform annual inspections. Inspectors will be experienced engineers and scientists who have been specifically trained for the purpose through participation in previous site inspections.

Engineers will typically be trained in civil, geotechnical, or geological engineering. Scientists will include geologists, hydrologists, biologists, and environmental scientists representing various fields (e.g., ecology, soils, range management). If serious or unique problems develop at the site, more than two inspectors may be assigned to the inspection. Inspectors specialized in specific fields may be assigned to the inspection to evaluate serious or unusual problems and make recommendations.

3.4 Annual Inspection Report

Results of annual site inspections will be reported to NRC within 90 days of the last site inspection of that calendar year (10 CFR 40, Appendix A, Criterion 12). If the annual report cannot be submitted within 90 days, DOE will notify NRC of the circumstances. Annual inspection reports also will be distributed to the State and any other stakeholders who request a copy. The annual inspection report for the Bear Creek disposal site is included in a document containing the annual inspection reports for all sites licensed under 10 CFR 40.28.

3.5 Follow-up Inspections

Follow-up inspections are unscheduled inspections that may be required (1) as a result of discoveries made during a previous annual site inspection, or (2) as a result of changed site conditions reported by a citizen or outside agency.

3.5.1 Criteria for Follow-up Inspections

Criteria necessitating follow-up inspections are defined at 10 CFR 40.28 (b)(4). DOE will conduct follow-up inspections should the following occur:

- A condition is identified during the annual site inspection or other site visit that requires personnel, perhaps with specific expertise, to return to the site to evaluate the condition; or
- DOE is notified by a citizen or outside agency that conditions at the site are substantially changed.

With respect to citizens and outside agencies, DOE will establish and maintain lines of communication with local law enforcement and emergency response agencies to facilitate notification in the event of significant trespassing or vandalism or a natural disaster. Because the Bear Creek site is remote, DOE recognizes that local agencies may not necessarily be aware of current conditions there; however, these agencies will be requested to notify DOE or provide information should they become aware of a significant event that might affect the security or integrity of the site.

DOE may request the assistance of local agencies to confirm the seriousness of a condition before conducting a follow-up inspection or emergency response.

The public may use the 24-hour DOE telephone number posted prominently on the entrance sign to request information or to report a problem at the site.

Once a condition or concern is identified at the site, DOE will evaluate the information and determine whether a follow-up inspection is warranted. Conditions that may require a routine follow-up inspection include erosion; changes in vegetation; storm damage; trespassing; minor vandalism; or the need to evaluate, define, or perform maintenance tasks.

Conditions that threaten the safety or the integrity of the disposal site may require a more immediate (non-routine) follow-up inspection. Slope failure, a disastrous storm, a major seismic event, and deliberate human disturbance of an engineered structure are among these conditions.

DOE will use a graded approach with respect to follow-up inspections. The urgency of the follow-up inspection will be in proportion to the seriousness of the condition. The timing of the inspection may be governed by seasonal considerations. For example, a follow-up inspection to investigate a vegetation problem may be scheduled for a particular time of year when growing conditions are optimum. A routine follow-up inspection to perform maintenance or to evaluate an erosion problem might be scheduled to avoid snow cover or frozen ground.

In the event of "unusual damage or disruption" (10 CFR 40, Appendix A, Criterion 12) that threatens or compromises site safety, security, or integrity, DOE will:

- Notify NRC pursuant to 10 CFR 40, Appendix A, Criterion 12, or 10 CFR 40.60, whichever is determined to apply;
- Begin the DOE environmental, safety, and health reporting process (DOE Order 231.1A, Chg. 1; DOE 2004);
- Respond with an immediate follow-up inspection or emergency response team;
- Implement measures as necessary to contain or prevent the dispersion of radioactive materials (Section 3.6).

3.5.2 Personnel

Inspectors assigned to follow-up inspections will be selected on the same basis as for the annual site inspection (Section 3.3.4).

3.5.3 Reports of Follow-up Inspections

Results of routine follow-up inspections will be included in the next annual inspection report (Section 3.4). Separate reports will not be prepared unless DOE determines that it is advisable to notify NRC or another outside agency of a problem at the site.

If follow-up inspections are required for more serious or emergency reasons, DOE will submit to NRC a preliminary report of the follow-up inspection within the required 60 days (10 CFR 40, Appendix A, Criterion 12).

3.6 Routine Site Maintenance and Emergency Measures

3.6.1 Routine Site Maintenance

UMTRCA disposal sites are designed and constructed so that "ongoing active maintenance is not necessary to preserve isolation" of radioactive material (10 CFR 40, Appendix A, Criterion 12). The tailings impoundment has been designed and constructed to minimize the need for routine maintenance.

The cover of the tailings impoundment was constructed with minimal slope to promote positive drainage while minimizing runoff water velocities. The cover has been revegetated with indigenous plant species that are expected to endure for the long term. Because of the vegetation and shallow slopes, adverse wind or water erosion impacts that would require maintenance are not anticipated. The tailings impoundment area is fenced to prevent damage from livestock grazing in the vicinity. Areas where runoff water could achieve erosional velocities have been armored with riprap.

If an inspection of the disposal site cell reveals that a structure has failed or has been degraded in a way that compromises site protectiveness, repairs will be conducted to establish integrity of the disposal system. DOE will perform routine site maintenance, where and when needed, to maintain protectiveness. Results of site maintenance will be summarized in the annual site inspection report.

3.6.2 Emergency Measures

Emergency measures are the actions that DOE will take in response to "unusual damage or disruption" that threatens or compromises site safety, security, or integrity. DOE will contain or prevent the dispersal of radioactive materials in the unlikely event of a breach in cover materials.

3.6.3 Criteria for Routine Site Maintenance and Emergency Measures

Site intervention measures, from minor routine maintenance to large-scale reconstruction following potential disasters, lie on a continuum. Although 10 CFR 40.28 (b)(5) requires that increasingly serious levels of intervention trigger particular DOE responses, the criteria for those responses are not easily defined because the nature and scale of all potential problems cannot be foreseen. The information in Table 3–2, however, serves as a guide for appropriate DOE responses. The table shows that the primary differences between routine maintenance and an emergency response is the urgency of the activity and the degree of threat or risk. DOE's priority level, in column 1 of Table 3–2, bears an inverse relationship with DOE's estimate of probability; the highest-priority response is believed to be the least likely.

Table 3–2. DOE Criteria for Maintenance and Emergency Measures

Priority	Description[a]	Example	Response
1	Breach of disposal cell with dispersal of radioactive material.	Seismic event that exceeds design basis and causes massive discontinuity in cover.	Notify NRC. Immediate follow-up inspection by DOE emergency response team. Emergency actions to prevent further dispersal, recover radioactive materials, and repair breach.
2	Breach without dispersal of radioactive material.	Partial or threatened exposure of radioactive materials.	Notify NRC. Immediate follow-up inspection by DOE emergency response team. Emergency actions to repair the breach.
3	Breach of site security.	Human intrusion, vandalism.	Restore security; urgency based on assessment of risk.
4	Maintenance of specific site surveillance features.	Deterioration of signs, markers.	Repair at first opportunity.
5	Minor erosion or undesirable changes in vegetation.	Erosion not immediately affecting disposal cell, invasion of undesirable plant species.	Evaluate, assess impact, and respond as appropriate.

[a]Other changes or conditions will be evaluated and treated similarly on the basis of perceived risk.

3.6.4 Reporting Maintenance and Emergency Measures

Routine maintenance completed during the previous 12 months will be summarized in the annual inspection report.

In accordance with 10 CFR 40.60, within 4 hours of discovery of any Priority-1 or -2 event such as those listed in Table 3–2, DOE will notify NRC at:

Decommissioning and Uranium Recovery Licensing Directorate,
Division of Waste Management and Environmental Protection,
Office of Federal and State Materials and Environmental Management Programs,
U.S. Nuclear Regulatory Commission
11545 Rockville Pike
Rockville, Maryland 20852-2738

The phone number for the required 4-hour contact to the NRC Operations Center is (301) 816-5100.

3.7 Environmental Monitoring

3.7.1 Groundwater Monitoring

Section 3.7.1.1 describes corrective action monitoring requirements of license SUA-1310. DOE has evaluated those requirements along with recent monitoring results and made adjustments to the long-term monitoring requirements (Section 3.7.1.2).

3.7.1.1 Monitoring Requirements in License SUA-1310

NRC granted ACLs for uranium, combined radium-226 and -228, and nickel at the POC wells in 1997 (NRC 1997). Terms of the license also required monitoring of sulfate, chloride, total dissolved solids (TDS), selenium, and thorium-230. Table 3–3 lists the established ACL values and the pertinent groundwater protection standards for the Bear Creek site.

Table 3–3. Analytes, Alternate Concentration Limits, and Groundwater Protection Standards for the Bear Creek, Wyoming, Disposal Site

Analyte	ACL	Groundwater Protection Standard[a]
Uranium	2,038 pCi/L	NA
Combined Radium-226 and -228	46 pCi/L	NA
Nickel	3.8 mg/L	NA
Beryllium	NA	0.01 mg/L
Cadmium	NA	0.01 mg/L
Chromium	NA	0.05 mg/L
Molybdenum	NA	0.02 mg/L
Selenium	NA	0.025 mg/L
Thorium-230	NA	2.6 mg/L
Chloride	NA	2,000 mg/L
Sulfate	NA	3,000 mg/L
TDS	NA	5,000 mg/L

Key: ACL = alternate concentration limit; mg/L = milligrams per liter; NA = not applicable; pCi/L = picocuries per liter; TDS = total dissolved solids

[a]Metals limits are based on background chemistry measured at well MW-9. Chloride, sulfate, and TDS limits are based on Wyoming Class III Groundwater Protection Standards for livestock use applicable to this site.

Table 3–4 summarizes the groundwater monitoring plan provided in license SUA-1310.

Table 3–4. Groundwater Monitoring Plan in License SUA-1310, Amendment 47, for the Bear Creek, Wyoming, Disposal Site

Well Designation	Monitoring Frequency	Analytes	Comments
MW-9	Annually	Nickel, combined radium-226 and -228, selenium, thorium-230, uranium	Background well
MW-12	Annually	Nickel, combined radium-226 and -228, selenium, thorium-230, uranium, beryllium, cadmium, chromium, molybdenum	POC well in Lang Draw flow path
MW-14	Annually	Nickel, combined radium-226 and -228, selenium, thorium-230, uranium	Lang Draw flow path well
MW-43	Annually	Nickel, combined radium-226 and -228, selenium, thorium-230, uranium	Northern flow path well
MW-74	Annually	Nickel, combined radium-226 and -228, selenium, thorium-230, uranium, beryllium, cadmium, chromium, molybdenum	POC well in Northern flow path
MW-108	Annually	Nickel, combined radium-226 and -228, thorium-230, uranium, chloride, sulfate	Buffer zone well in Lang Draw flow path
MW-109	Annually	Nickel, combined radium-226 and -228, thorium-230, uranium, chloride, sulfate	Buffer zone well near property boundary on Lang Draw flow path
MW-110	Annually	Nickel, combined radium-226 and -228, thorium-230, uranium, chloride, sulfate	Buffer zone well in Northern flow path
MW-111	Annually	Nickel, combined radium-226 and -228, thorium-230, uranium, chloride, sulfate	Buffer zone well near property boundary on Northern flow path

3.7.1.2 Long-term Surveillance and Maintenance (LTSM) Monitoring Requirements

To determine appropriate long-term monitoring requirements for the Bear Creek site, DOE reviewed site-related documents and monitoring data. Based on this review, DOE has determined that the following changes in the monitoring requirements are appropriate:

- The elimination of beryllium, cadmium, and chromium as analytes. While these constituents were slightly elevated in tailings pore fluids relative to background (Table 2–1), beryllium and cadmium have not been detected in any monitor wells in the last 5 years. Chromium has been detected, but at levels less than background.
- The elimination of molybdenum and selenium as analytes. These constituents were not detected in tailings pore fluids and may not be site-related. Molybdenum has not been detected in any monitor well since 2004. Selenium levels have been less than background by an order of magnitude or more.
- The retention of nickel and thorium-230 for monitoring in all wells. While concentrations of these constituents have not been detected or have been less than background, these constituents (particularly thorium-230) were elevated in tailings pore fluids. Modeling indicates that nickel should be transported beyond POC wells.
- The retention of uranium, radium-226 and -228, chloride, and sulfate for monitoring in all wells. All of these constituents have been consistently present in monitor wells. Previously, chloride and sulfate monitoring was only required for buffer zone wells.[1] However, interpretation of those data could be problematic without including these analytes for up gradient wells in the monitoring network.
- The addition of pH and specific conductance as analytical parameters. These are routine monitoring parameters. Monitoring pH will determine if model predictions of the acid front movement are valid. Specific conductance is an estimator of TDS and can be used to demonstrate that Class III groundwater standards are met beyond the site boundary. Figure 3–2 shows the extent of the low-pH plume in 1997 (UPR 1997).

Long-term monitoring requirements are provided in Table 3–5.

The intent of the annual monitoring is to verify that the ACLs are not exceeded at the POC wells, to verify that trends in contaminant behavior are consistent with predicted behavior, and to verify continued compliance with the pertinent groundwater protection standards. Monitor well locations are shown on Figure 3–2.

DOE will inform NRC and the Wyoming Department of Environmental Quality of monitoring results and conduct confirmatory sampling if

- Monitoring results indicate that an ACL is exceeded at a POC well; or
- Trends indicate that attenuation is not occurring as predicted and offsite protectiveness may be compromised; or
- Applicable groundwater protection standards may be exceeded.

[1] The Wyoming Department of Environmental Quality requested that the transfer boundary be extended northward to create a buffer zone and that additional monitor wells (MW–108, MW–109, MW–110, and MW–111) be added to the monitoring network (WDEQ 1999).

Table 3–5. LTSM Monitoring Requirements

Well Designation	Monitoring Frequency	Analytes	Comments
MW-9	Annually	Nickel, combined radium-226 and -228, thorium-230, uranium, chloride, sulfate, pH, specific conductance	Buffer zone well in Lang Draw flow path (former background well)
MW-12	Annually	Nickel, combined radium-226 and -228, thorium-230, uranium, chloride, sulfate, pH, specific conductance	POC well
MW-14	Annually	Nickel, combined radium-226 and -228, thorium-230, uranium, chloride, sulfate, pH, specific conductance	Lang Draw flow path well
MW-43	Annually	Nickel, combined radium-226 and -228, thorium-230, uranium, chloride, sulfate, pH, specific conductance	Northern flow path well
MW-74	Annually	Nickel, combined radium-226 and -228, thorium-230, uranium, chloride, sulfate, pH, specific conductance	POC well
MW-108	Annually	Nickel, combined radium-226 and -228, thorium-230, uranium, chloride, sulfate, pH, specific conductance	Buffer zone well in Lang Draw flow path
MW-109	Annually	Nickel, combined radium-226 and -228, thorium-230, uranium, chloride, sulfate, pH, specific conductance	Buffer zone well near property boundary on Lang Draw flow path
MW-110	Annually	Nickel, combined radium-226 and -228, thorium-230, uranium, chloride, sulfate, pH, specific conductance	Buffer zone well in Northern flow path
MW-111	Annually	Nickel, combined radium-226 and -228, thorium-230, uranium, chloride, sulfate, pH, specific conductance	Buffer zone well near property boundary on Northern flow path

If the confirmatory sampling verifies the initial results, DOE will develop an evaluative monitoring work plan and submit that plan to NRC for review prior to initiating the evaluative monitoring program. Results of the evaluative monitoring program will be used, in consultation with NRC, to determine if further action is necessary.

Results of the groundwater monitoring program will be included in the annual inspection report (Section 3.4). Groundwater monitoring results will include concentration versus time graphs for sulfate and uranium for all wells. Monitor well coverage is insufficient for developing groundwater contour maps and iso-concentration maps.

DOE will conduct annual monitoring as specified in Table 3–3 for 5 years. At that time, the monitoring requirements, including analytes and monitoring frequency, will be reevaluated and adjusted as appropriate. Modification of the monitoring requirements will require NRC concurrence.

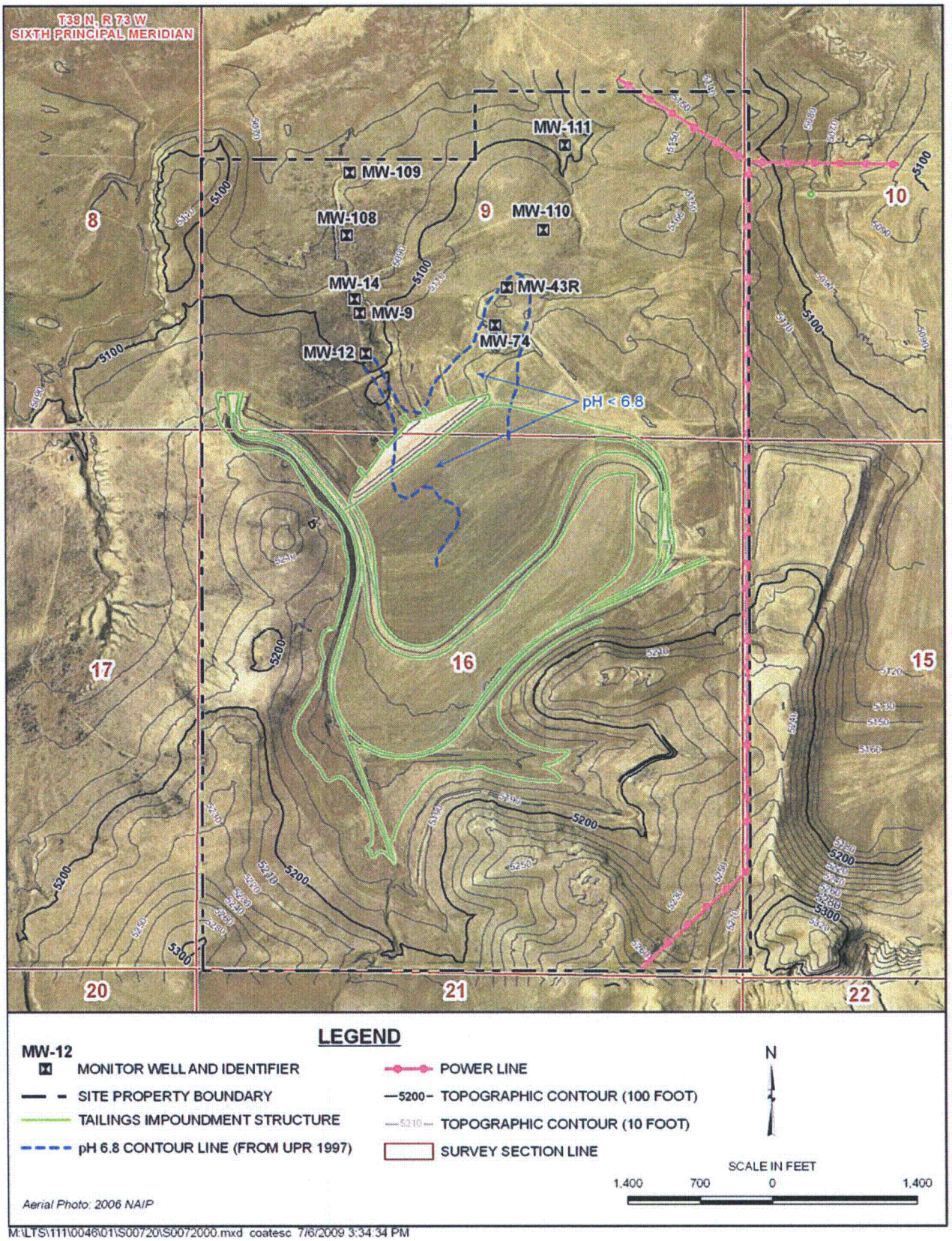


Figure 3–2. Monitor Well Locations at the Bear Creek, Wyoming, Disposal Site

3.7.2 Vegetation Monitoring

The disposal site was revegetated as part of the site reclamation. Vegetation at the disposal site is expected to help maintain surface stability and reduce erosion potential. Annual visual inspections will be conducted to verify the continued health of the on-site vegetation and to ensure that undesirable plant species do not proliferate at the site. Natural plant community succession caused by fire or other natural processes is expected and will be evaluated to ensure there is no adverse impact to the performance of the containment system.

3.8 Land Use Monitoring

During each annual site inspection, DOE will monitor land use in the area surrounding the site to ensure that changes in land or water use do not affect site protectiveness. For example, a resurgence of interest in uranium mining and processing could lead to increased activity in the vicinity of the site and an increased potential for site disturbance.

3.9 Institutional Control Monitoring

At the Bear Creek, Wyoming, site, institutional control monitoring will consist of the annual inspection. During the inspection, DOE will confirm that unauthorized entry and disturbance of site features has not occurred

Once every 10 years, beginning in 2010, DOE will check the records at the Wyoming State Engineer's Office to determine if there have been significant changes in water demands in the vicinity of the site.

3.10 Records

LM receives and maintains selected records to support post-closure site maintenance. Inactive records are preserved at a federal records center. Site records contain critical information required to protect human health and the environment, manage land and assets, protect the legal interests of DOE and the public, and mitigate community impacts resulting from the cleanup of legacy waste.

The records are managed in accordance with the following requirements:

- Title 44 *United States Code* Chapter 29 (44 USC 29), "Records Management by the Archivist of the United States and by the Administrator of General Services"; 44 USC 31, "Records Management by Federal Agencies"; and 44 USC 33, "Disposal of Records."
- 36 CFR 1220 through 1238, Subchapter B, "Records Management."
- DOE Guide 1324.5B, *Implementation Guide*.
- *Office of Legacy Management Information and Records Management Transition Guidance*.

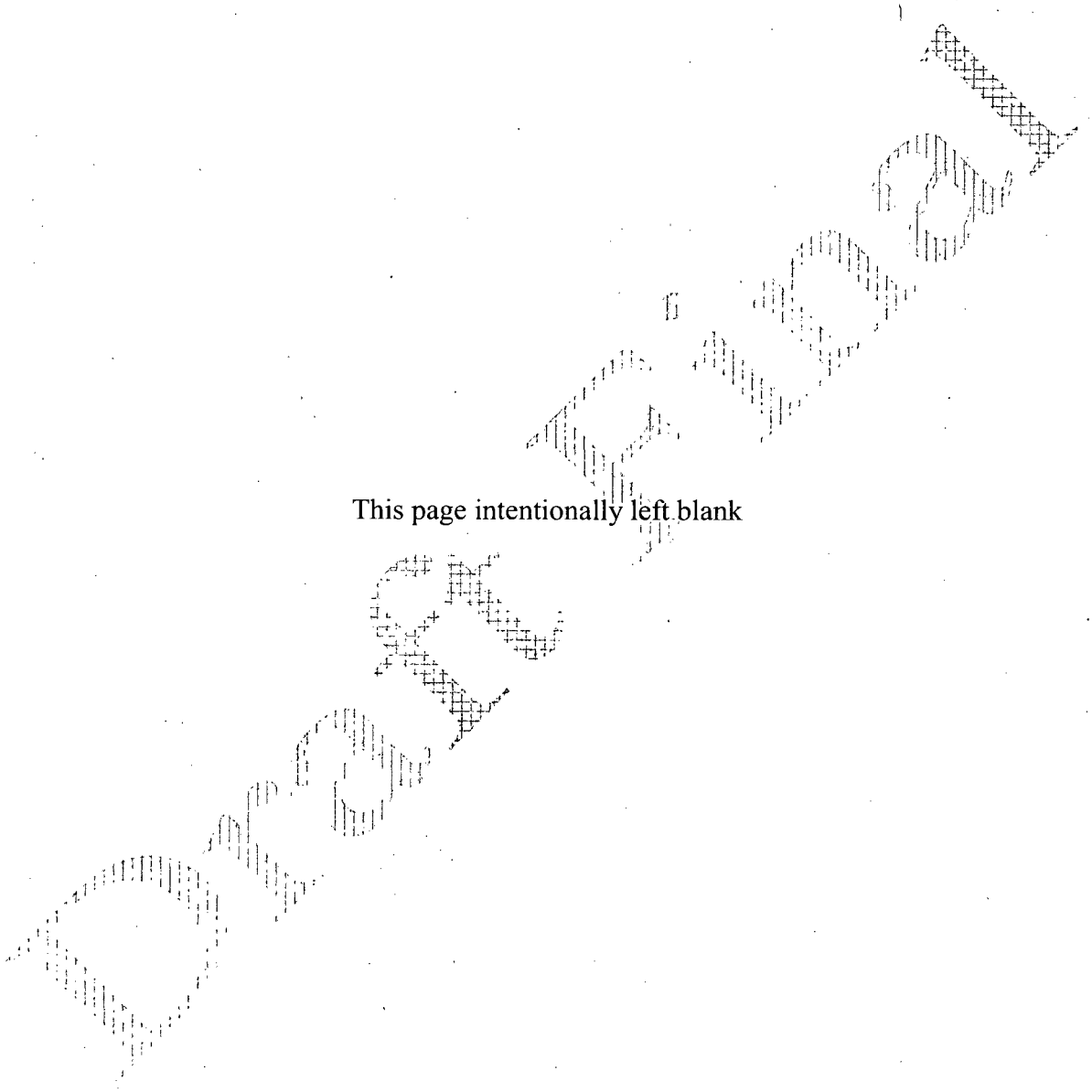
3.11 Quality Assurance

All activities related to the surveillance and maintenance of the Bear Creek site will comply with DOE Order 414.1A, *Quality Assurance*. Quality assurance requirements are routinely fulfilled by the use of a work-planning process, standard operating procedures, trained personnel, documents and records maintenance, and assessment activities. Requirements will be transmitted through procurement documents to subcontractors if and when appropriate.

3.12 Health and Safety

Health and safety requirements and procedures for LM activities are consistent with DOE orders, federal regulations, and applicable codes and standards. The DOE Integrated Safety Management process serves as the basis for the contractor's health and safety program.

Specific guidance is contained in the *Health and Safety Manual*, LMS/POL/S04321, or current guidance. This manual identifies specific hazards associated with the anticipated scope of work and provides direction for the control of these hazards. During the pre-inspection briefing, personnel are required to review the plan to ensure that they understand the potential hazards and the health and safety requirements associated with the work to be performed.



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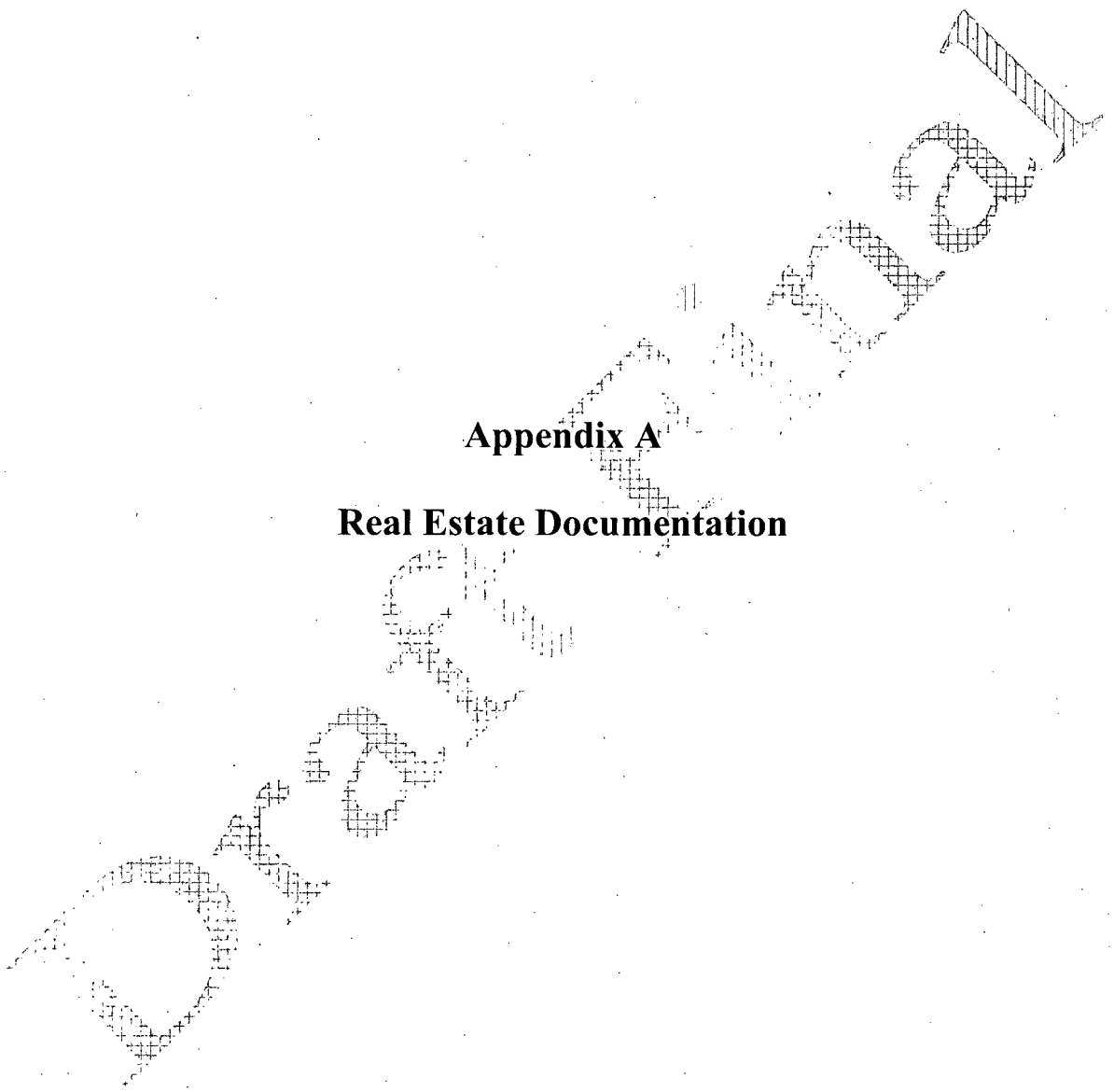

Appendix A

Real Estate Documentation

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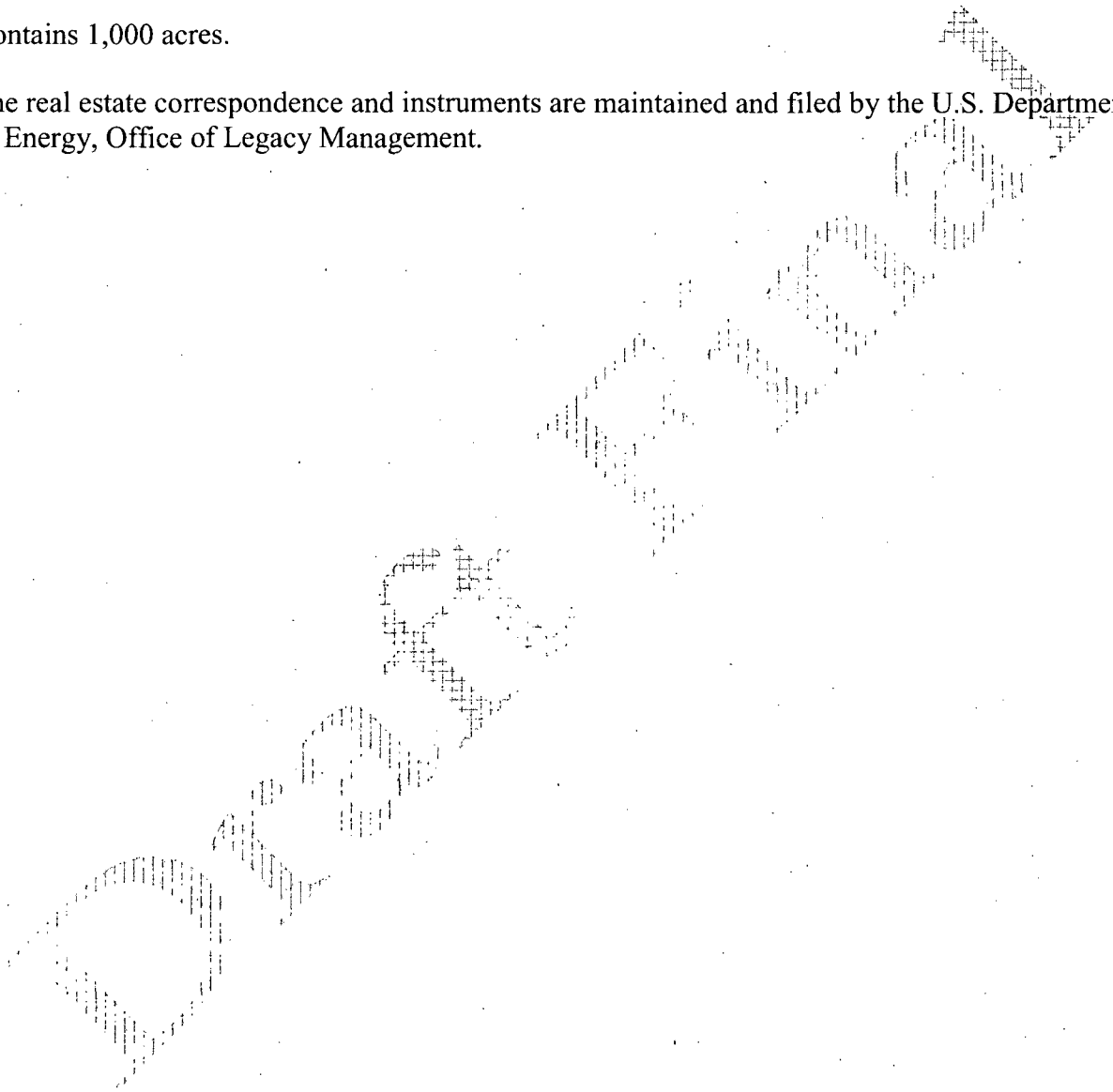
Legal Description of Site Boundary

The legal description of the 1,000-acre Bear Creek disposal site is:

> All of Section 16, the S ½ of Section 9, the S ½ SW ¼ NE ¼ of Section 9, and the S ½ SE ¼ NE ¼ of Section 9, all in T38N, R73W, 6th p.m., Converse County, Wyoming.

Contains 1,000 acres.

The real estate correspondence and instruments are maintained and filed by the U.S. Department of Energy, Office of Legacy Management.



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Recorded 10/21/2002 At 02:30 PM
Lucile K. Taylor, CONVERSE COUNTY Clerk & Recorder

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NON-EXCLUSIVE ROAD EASEMENT

KNOW ALL MEN BY THESE PRESENTS, that for the sum of TEN DOLLARS ($10.00) and other valuable consideration, the receipt and sufficiency of which is hereby acknowledged, Hardy Enterprises, a Limited Partnership; hereinafter called Grantor, hereby grants to RME Holding Company and its assigns, as Grantee a non-exclusive easement to use an existing private two track road, known locally as the "Kerr McGee haul road", located on the following described real property situated in the County of Converse, State of Wyoming, to wit:

Township 38N, Range 73W, 6th Principal Meridian

Section 21: E1/2

TO HAVE AND TO HOLD SAID EASEMENT FOREVER.

The above described road has been designated as the access route to the Bear Creek Uranium tailings site for long-term stewardship activities conducted by the United States Department of Energy or successor agency. This easement is for a one (1) mile (320 rod), more or less, portion of the private road traversing Section 21, T. 38 N., R. 73 W., which runs in a northerly direction from an abandoned uranium mine known as the "Spook Pit" located in the SE/4NE/4 of Section 28, T. 38 N., R. 73 W. The easement is for perpetual access to be used exclusively for monitoring and maintenance purposes at the Bear Creek Uranium site.

Use of the road for which this easement is granted is subject to the following additional provisions:

1. The above described road will be used exclusively by the Grantee for surveillance and maintenance activities at the Bear Creek Uranium Long-Term Stewardship site. This monitoring activity will involve a minimum two visits per year, each of which could involve several days of use by light vehicles. Additional visits also may be made following geologic events such as earthquakes or floods. If major repairs requiring the movement of heavy equipment become necessary at the Long-Term Stewardship site, a separate construction and access easement will be negotiated.

2. The easement described herein is granted in perpetuity for the full use as a road by Grantee, and is subject to the effect of reservations and leases, if any, for oil and gas, or other minerals in and under the land, and to

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the effect of all other easements of record, or granted in the future by Grantor.

3. Grantee will provide its own locks and keep both the north and south gates of Section 21 locked after passing through them, and Grantee will give advance notice to Grantor of planned dates of use of the road.

4. Grantee releases Grantor of all liability for Grantees' actions and operations.

5. Grantee will not perform low level aerial surveys or pipeline checks without prior notification and permission of Grantor.

6. Hunting, camping, fires, drugs, firearms, and dogs are prohibited on Grantors property.

Grantor covenants and assures Grantee that it is lawfully seized and possessed of the land aforesaid and has the full right, power and authority to execute this conveyance.

DATED this 22nd day of August, 2002

Grantee:	Grantor:
PME Holding Company	Hardy Enterprises, a Limited Partnership
BY: _____	BY: _____
Its: Authorized Agent	Its: General Partner

ACKNOWLEDGMENT

STATE OF WYOMING)
) ss.
COUNTY OF CONVERSE)

The foregoing instrument was acknowledged before me by E. Eugene Hardy as General Partner of Hardy Enterprises, a Limited Partnership this 22nd day of August, 2002.

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WITNESS my hand and official seal.

PAULA RIDER - NOTARY PUBLIC
County of Converse State of Wyoming

Notary Public

My Commission Expires: My Commission Expires Mar 4, 2007

STATE OF TEXAS)
) ss.
COUNTY OF HARRIS)

The foregoing instrument was acknowledged before me by Mary N. Butcher as Authorized Agent of RME Holding Company this 7th day of October, 2002.

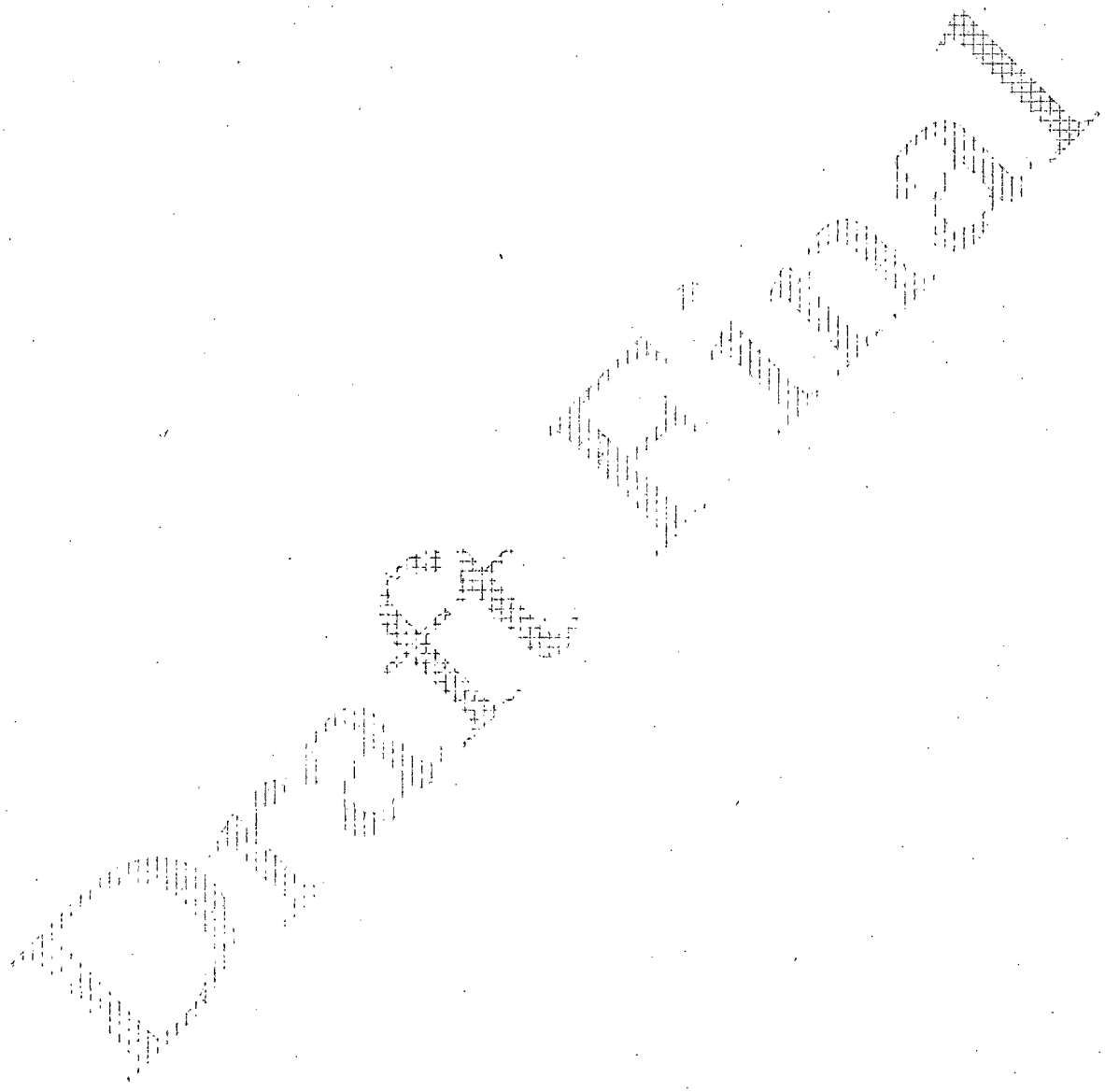
WITNESS my hand and official seal.

Notary Public

My Commission Expires: 9-10-06

MARILYN PRESGROVE
Notary Public
State of Texas
My Commission Expires
September 10, 2006

Insert warranty deed here



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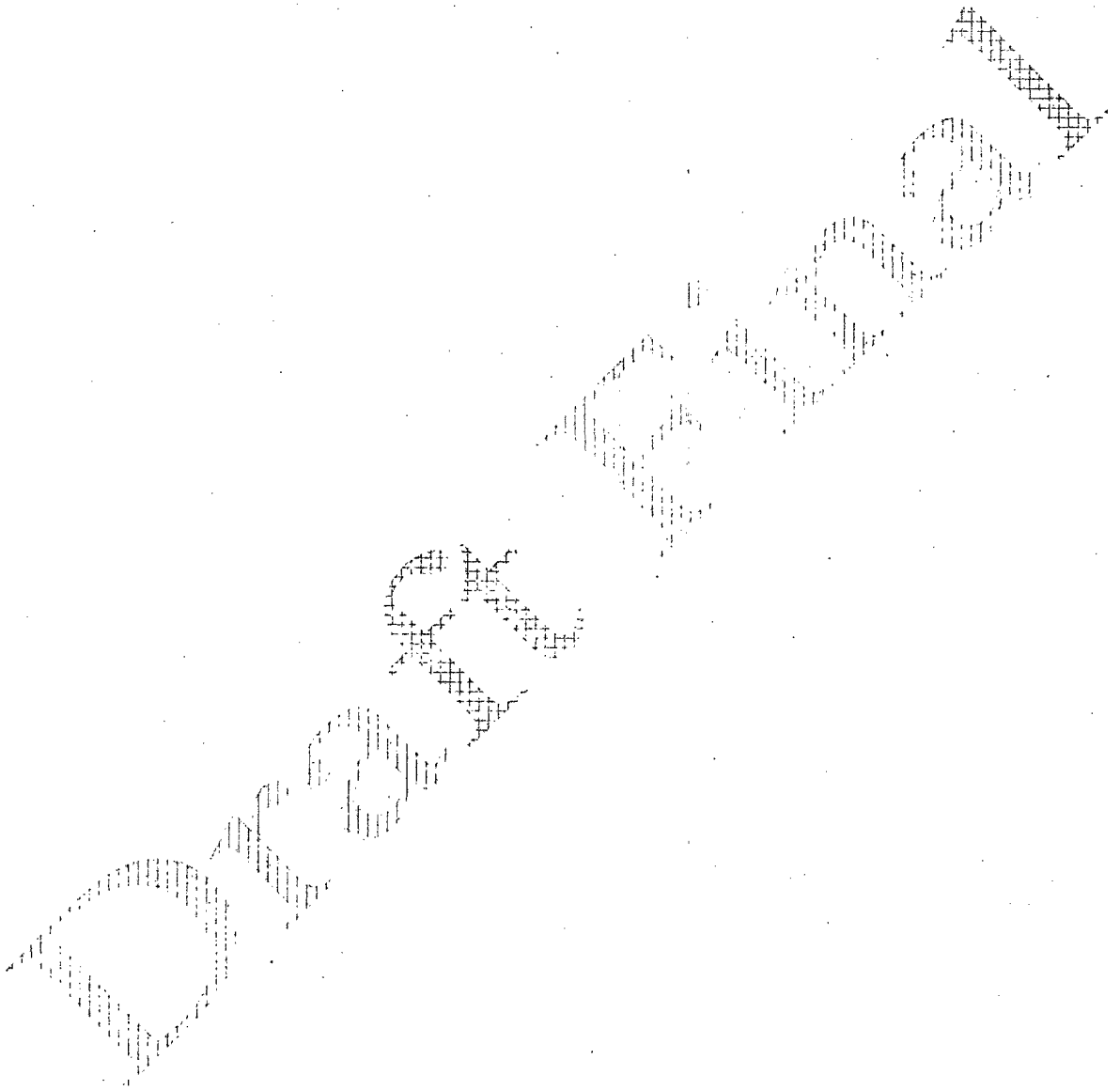

Appendix B

Example Field Photograph Log

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Field Photograph Log

Site: Purpose of Visit:

Date of Visit: Photo Type: (film and/or digital)

File Name	Film Frame No.	Azimuth	Field Inspection Photo No.	Trip Report PL No.	Post on Web (Y/N)	Photo Caption

Lead Inspector:
Assistant Inspector:
Remarks:
Electronic File Location:

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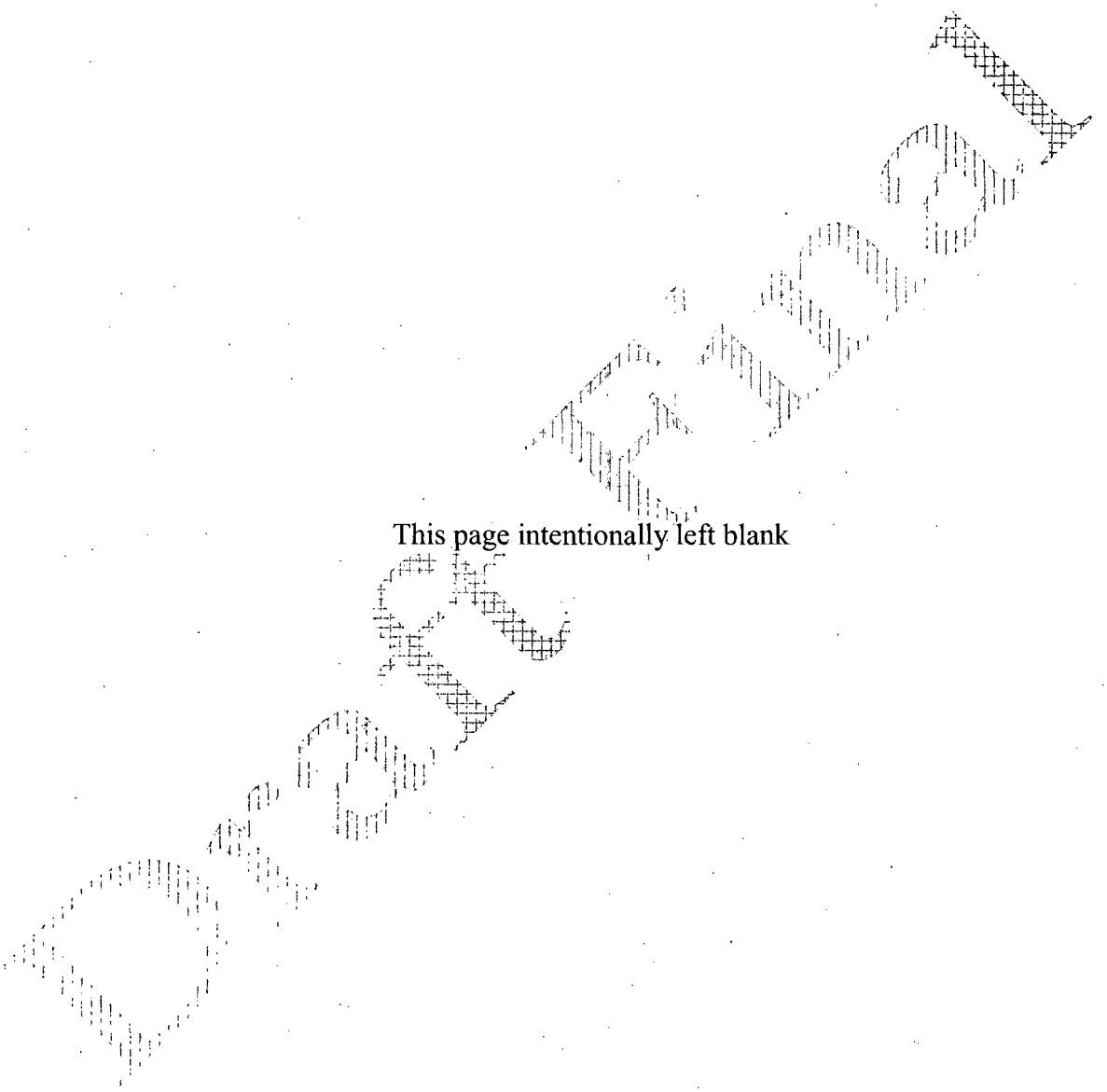

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Appendix C

Initial Site Inspection Checklist

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Inspection Checklist

Bear Creek, Wyoming, UMTRCA Title II Disposal Site

Status of Site Inspections

Date of This Revision: June 4, 2007

Last Annual Inspection:

Inspectors:

Next Annual Inspection (Planned):

Scheduled Inspectors:

No.	Item	Issue	Action
1	Protocols	NRC must be notified at least 30 days before the scheduled inspection.	
1	Access	Access is from the Spook, Wyoming, UMTRCA Title I site. Easement is established across Hardy property. Courtesy call to Gene Hardy is appropriate (307-358-3640). Ensure that a courtesy call to Kirk Hornbuckle (307-358-4807) has been made as well (easement to Spook site is across Hornbuckle property).	Gene Hardy and Kirk Hornbuckle have been contacted.
2	Specific site surveillance features	See attached table. No issues at this time.	Verify features and note condition.
3	Cover of tailings impoundment	The cover of the tailings impoundment has been revegetated to control wind and water erosion, although vegetation is not integral to the tailings isolation design.	Inspect impoundment cover settling or slumping and note condition of vegetation. There should not be any grazing on the impoundment cover at this time. Inspect for burrowing.
4	Containment dam and diversion channel	The containment dam face, the chute section and the check dam (weir) surfaces have been armored with riprap for erosion protection.	Inspect riprap and note evidence of settling, slumping, rock displacement, or rock degradation.
5	Site perimeter and balance of site	No erosion issues were noted during the last site visit in 2004. Canada thistle has been found and treated at the site.	Note the general condition of the site and any changes in activity within 0.25 mile of the site (the surrounding land currently is grazed). Inspect for Canada thistle or any other noxious weeds. If found, note locations on the inspection map.

Specific Site Surveillance Features—Bear Creek, Wyoming, Disposal Site

Feature	Comment
Access Road	Easement across Hardy property extending from easement across Hornbuckle property for Spook site. Road north of the Dry Fork has been improved for oil and gas operations.
Warning Signs	Located at the south site boundary at Hardy gate.
Perimeter Fence	Barbed-wire stock fence.
Site Marker (1)	Located at the crest of the cell.
Boundary Monuments and Section Corner Monuments (10)	Located adjacent to the disposal cell.
Monitor Wells (9)	Background well: MW–9. POC wells: MW–12 (Lang Draw flow path) and MW–74 (Northern flow path). Downgradient wells: MW–14 and (Lang Draw flow path) and MW–43 (Northern flow path). Buffer zone wells: MW–108 and MW–109 (Lang Draw flow path); MW–110 and MW–111 (Northern flow path).

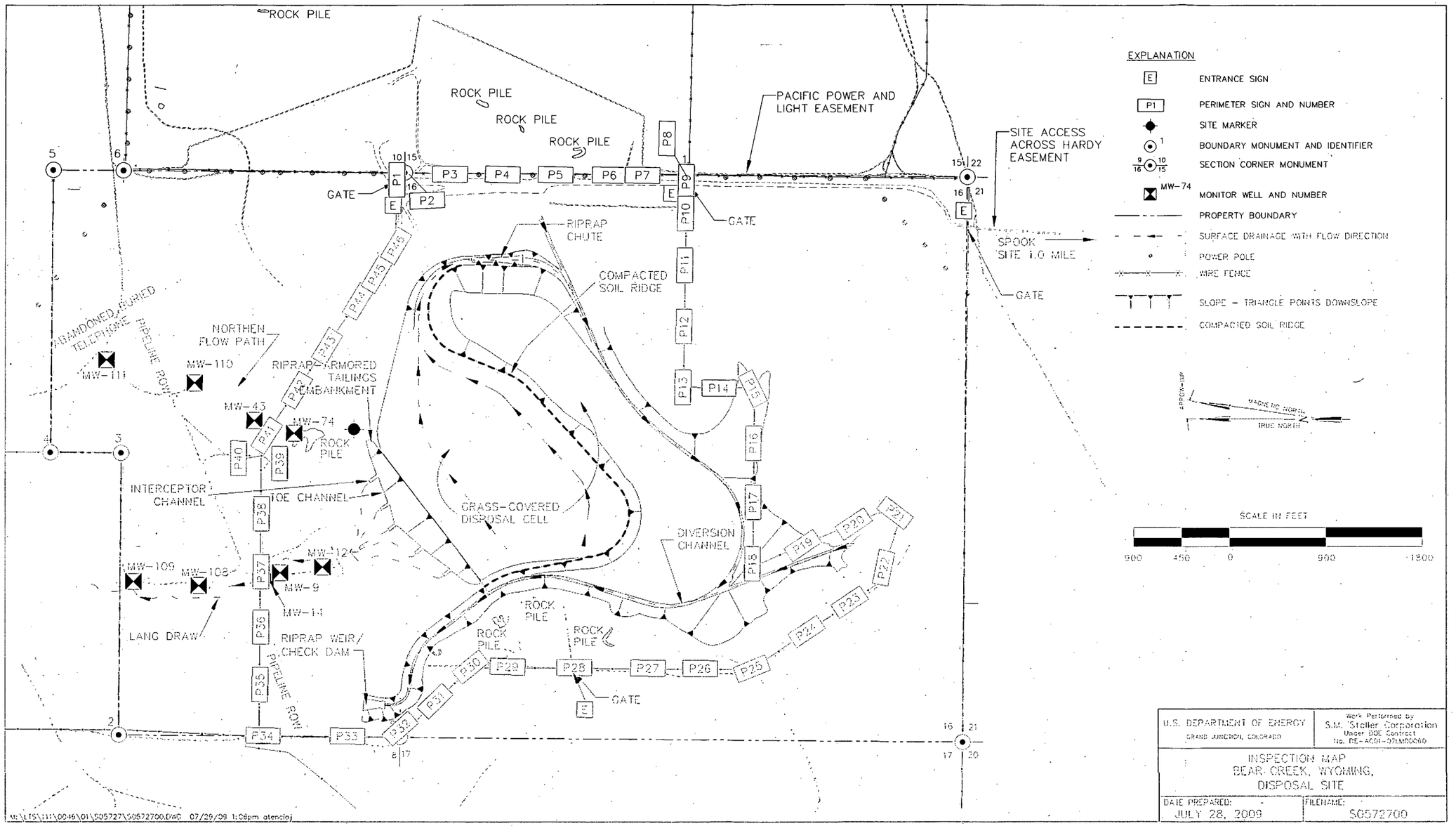

Figure C-1. Initial Site Inspection Map for the Bear Creek, WY, Disposal Site

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