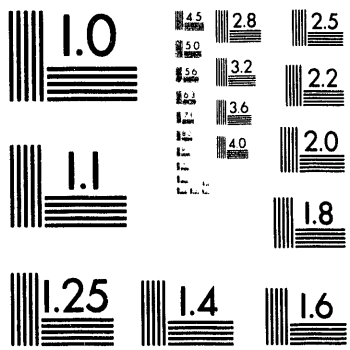
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1 of 2

DOE/AL/62350-77

LONG-TERM SURVEILLANCE PLAN FOR THE BODO CANYON DISPOSAL SITE, DURANGO, COLORADO

March 1994

Prepared for
U.S. Department of Energy
UMTRA Project Office
Albuquerque, New Mexico

Prepared by
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LIST OF ACRONYMS AND ABBREVIATIONS

Acronym	Definition
ac	acre
BMT	boundary monument
CDH	Colorado Department of Health
CDOW	Colorado Division of Wildlife
cm	centimeter
cm/s	centimeters per second
CR	County Road
DOE	U.S. Department of Energy
DQO	data quality objective
EPA	U.S. Environmental Protection Agency
ft	foot/feet
ft/day	feet per day
ft/yr	feet per year
GJPO	Grand Junction Projects Office
ha	hectare
in	inch
km	kilometer
km^2	square kilometer
LTSP	long-term surveillance plan
m	meter
m/day	meters per day
m/yr	meters per year
MCL	maximum concentration limit
mi	mile
mi^2	square mile
MSL	mean sea level
NRC	U.S. Nuclear Regulatory Commission
NWS	National Weather Service
PMP	probable maximum precipitation
POC	point of compliance
QA	quality assurance
QC	quality control
RAP	remedial action plan
RRM	residual radioactive materials
SM	survey monument
SMK	site marker
SOP	standard operating procedure
SOW	statement of work
TAC	Technical Assistance Contractor
UMTRA	Uranium Mill Tailings Remedial Action
UMTRCA	Uranium Mill Tailings Radiation Control Act
USGS	U.S. Geologic Survey
VCA	Vanadium Corporation of America
WSAP	water sampling and analysis plan

1.0 INTRODUCTION

This long-term surveillance plan (LTSP) for the Durango, Colorado, Uranium Mill Tailings Remedial Action (UMTRA) Project disposal site describes the surveillance activities for the Durango (Bodo Canyon) disposal site, which will be referred to as the disposal site throughout this document. The U.S. Department of Energy (DOE) will carry out these activities to ensure that the disposal site continues to function as designed. This LTSP was prepared as a requirement for acceptance under the U.S. Nuclear Regulatory Commission (NRC) general license for custody and long-term care of residual radioactive materials (RRM). RRMs include tailings and other uranium ore processing wastes still at the site, which the DOE determines to be radioactive. This LTSP is based on the DOE's *Guidance for Implementing the UMTRA Project Long-term Surveillance Program* (DOE, 1992).

1.1 BACKGROUND

Title I of the *Uranium Mill Tailings Radiation Control Act* (UMTRCA) of 1978 (42 USC §7901 *et seq.*) authorized the DOE to perform remedial action at 24 inactive uranium processing sites to reduce the potential effect on public health from the unstabilized RRM in and around the uranium mill tailings. The Durango, Colorado, uranium processing site in La Plata County, Colorado, was one of 24 sites identified for remediation in the UMTRCA. The DOE and the state of Colorado entered into a cooperative agreement under the UMTRCA, establishing the terms and conditions of the remedial action (DOE Cooperative Agreement No. DE-FC04-81AL16257, October 19, 1981).

1.2 LICENSING PROCESS

The NRC has developed regulations (10 CFR §40.27) (effective November 29, 1990 (55 FR 45591)) for issuing a general license to cover the long-term care of DOE UMTRA (Title I) disposal sites, including the Bodo Canyon disposal site. The license is available to the DOE (or any succeeding federal agency designated by the President) and has no termination date. The purpose of this general license is to ensure that the UMTRA disposal sites are cared for in a manner that protects public health and safety and the environment after remedial action is complete. A disposal site is accepted under the general license 1) when the NRC concurs that remedial action is complete at that site and formally accepts the site LTSP, and 2) when the DOE obtains custody or ownership of the disposal site.

Since RRM from the Durango uranium processing site were relocated, the licensing process proceeds in one step. The NRC is currently reviewing the Draft Completion Report for the Durango remedial action project (DOE, 1991). Until the NRC completes their review of the Draft Completion Report, the disposal site will remain in prelicensing status. Following acceptance of the final LTSP and certification reports, the licensing process for the disposal site will be completed.

1.2.1 Acquisition

The land on which the disposal site is located was acquired by the Colorado Department of Health (CDH). The site consists of two parcels, Tracts 101 and 102. The parcels were deeded to CDH on August 4, 1987, and November 6, 1992, respectively. On October 20, 1993, the state of Colorado forwarded draft deeds and supporting documentation for the transfer of the site to the federal government, pursuant to 42 USC §7914(f). The U.S. Army Corps of Engineers, Omaha Office, must provide real estate support services to the DOE and is responsible for effectuating the title transfer.

For additional information, see Attachment 1, which provides the legal description for the disposal site, Tracts 101 and 102.

1.3 LONG-TERM SURVEILLANCE PLAN

This LTSP meets the requirements of 10 CFR §40.27 by addressing the following:

- Site description and ownership.
- Description of final site conditions.
- Site inspection procedures and personnel.
- Custodial maintenance and corrective action programs.
- Record keeping and reporting.
- Quality assurance (QA) ground water monitoring activities.
- Emergency response.

2.0 SITE FINAL CONDITIONS

2.1 SITE HISTORY

The Durango uranium processing mill was located southwest of the Durango town limits, on the west bank of the Animas River (Figure 2.1). In the early 1880s the uranium processing mill was used as a lead smelter by the American Smelting and Refining Company around the turn of the century. In 1942, U.S. Vanadium Corporation leased the property from American Smelting and Refining Company and constructed a mill on the processing site. This mill reprocessed vanadium tailings to recover uranium for the Manhattan Project. American Smelting and Refining Company operated the mill until 1946, when the mill was shut down. In 1949, Vanadium Corporation of America (VCA) leased, and subsequently purchased, the processing site. The VCA operated the mill and sold uranium to the U.S. Atomic Energy Commission until March 1963, when the mill shut down permanently. Ranchers Exploration and Development Corporation purchased the mill in 1977. Hecla Mining Company acquired Ranchers Exploration and Development Corporation in July 1984.

Remedial action to relocate and stabilize the RRM at the uranium processing site was initiated on November 8, 1979. A total of 3,460,000 dry tons (3,515,360 tonnes) of RRM were relocated to the disposal site (DOE, 1993).

Concurrence from the NRC on the remedial action plan is pending (Attachment 2).

2.2 FINAL SITE CONDITIONS

2.2.1 Description and location of the disposal site area

The disposal site comprises approximately 120.6 acres (ac) (48.8 hectares [ha]) in La Plata County, Colorado, approximately 3.5 road miles (mi) (5.6 kilometers [km]) southwest of Durango, Colorado (Figure 2.1), in the eastern half of Section 36, Township 35 North, Range 10 West, and the western half of Section 31, Township 34 1/2 North, Range 9 West, New Mexico Principal Meridian (Figure 2.2) (DOE, 1993).

The disposal site is in the upper west end of Bodo Canyon, an ephemeral drainage basin of about 4.5 square miles (mi^2) (11.6 square kilometers [km^2]) bordered by Smelter Mountain on the north, Carbon Mountain on the south, the Animas River on the east (Figure 2.2).

The disposal site lies at an elevation of approximately 7100 feet (ft) (2200 meters [m]) above mean sea level (MSL). Area elevations range from 7725 ft (2355 m) at the top of Smelter Mountain (approximately 85 mi [137 km] from the site) to about 6600 ft (2000 m) at the entrance to Bodo Canyon. The Cliff House Sandstone of the Mesaverde Group (Cretaceous) underlies the site;

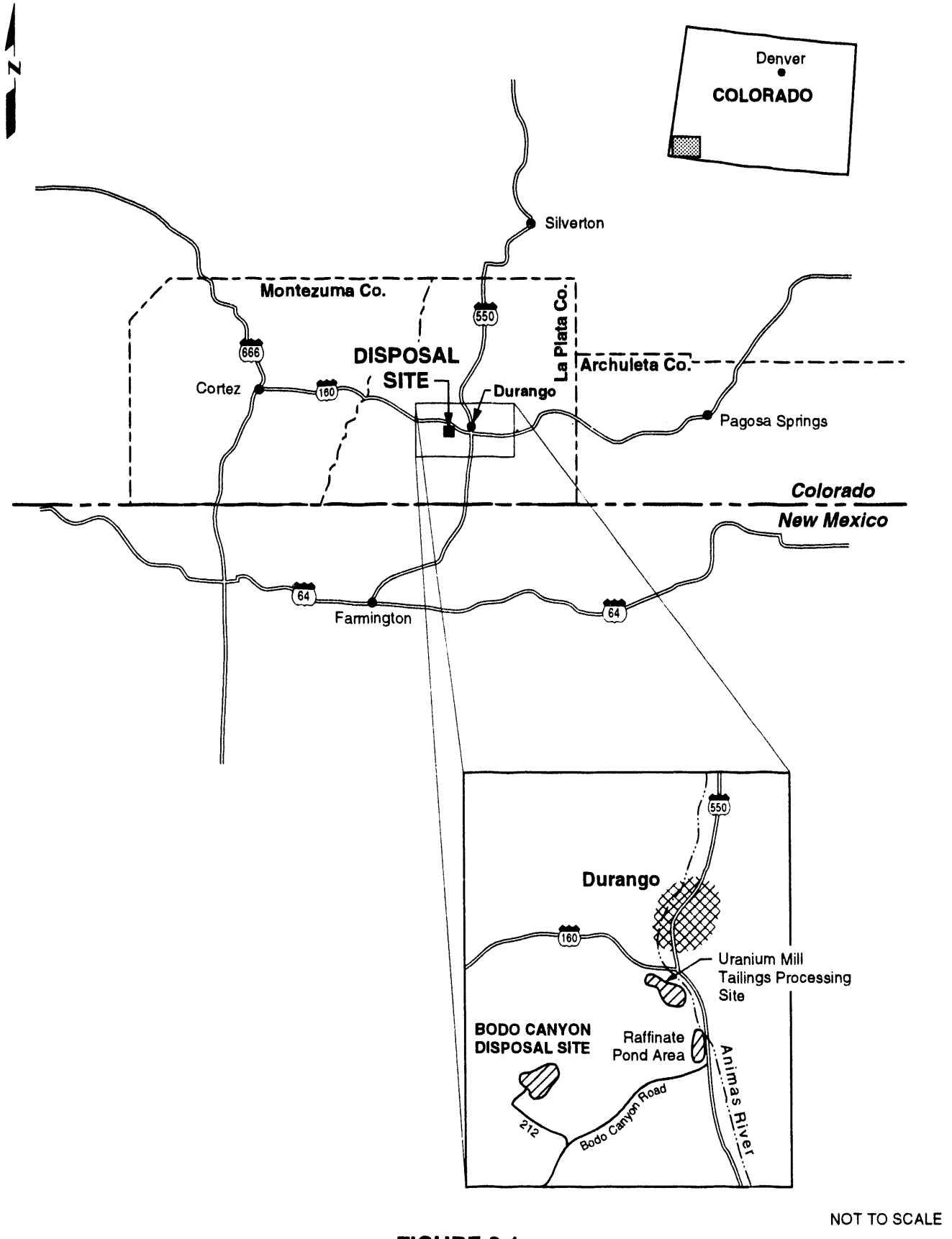

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FIGURE 2.1
LOCATION OF BODO CANYON DISPOSAL SITE
LA PLATA, COUNTY, COLORADO

MAC: SITE/DUR/LTSP/SITELOC

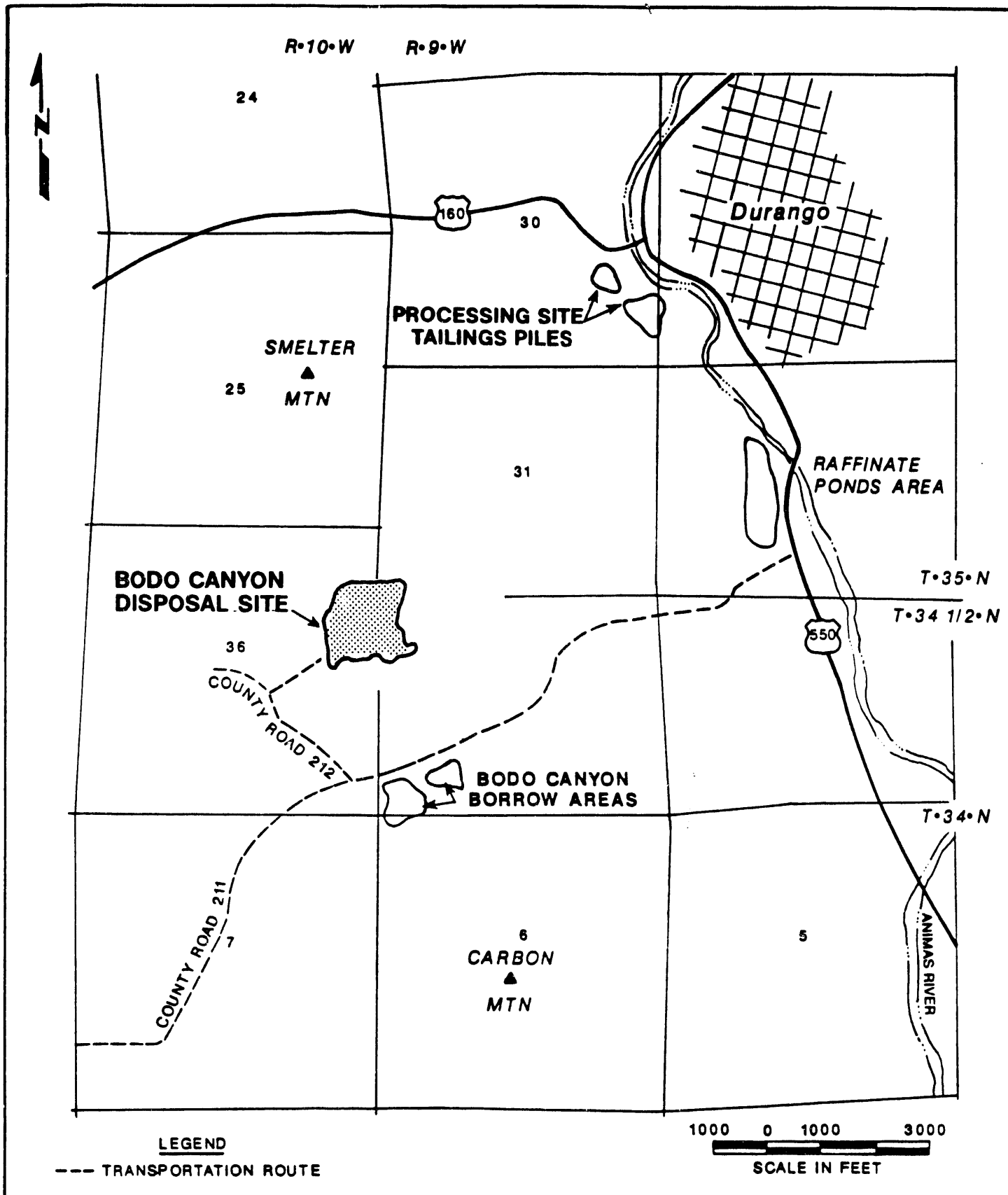

FIGURE 2.2
BODO CANYON DISPOSAL SITE AREA MAP, COLORADO

sandstone units are exposed in the hillside at the east end of the site. The site is near the north edge of the San Juan Basin and rocks in the area dip south toward the center of the basin. Grasses and sagebrush vegetate the bottomlands of Bodo Canyon (DOE, 1993).

Figure 2.2 provides a map of the Durango, Colorado, area. Additionally, the disposal site can be located using the following directions:

- Where U.S. Highway 160 joins U.S. Highway 550 (US-550/160) just west of downtown Durango, proceed south on US-550/160.
- Drive south on US-550/160, turn west (right) on County Road 211 (CR-211); CR-211 becomes a dirt road.
- Remain on CR-211, heading southwest.
- A substation is on the right side of the road. Remain on CR-211.
- Turn northwest (right) onto CR-212. Proceed northwest.
- Turn north (right) onto the entrance road.
- The site entrance gate is at the southwest corner of the site.

2.2.2 Disposal site access and security

The state of Colorado will be notified periodically concerning DOE site visits so that it may send observers. CDH holds keys to the lock on the disposal site security gate. Additionally, keys are kept by the DOE UMTRA Project Manager; the Technical Assistance Contractor (TAC) Project Manager; and the supervisory general engineer, Grand Junction Projects Office (GJPO) (Table 2.1).

Table 2.1 Bodo Canyon disposal site access key holders

Title and current contract	Telephone	Address
DOE UMTRA Project Manager (Albert Chernoff)	(505) 845-4022	U.S. Department of Energy UMTRA Project Office 2155 Louisiana NE Suite 4000 Albuquerque, New Mexico 87110
TAC UMTRA Project Manager (Roger Nelson)	(505) 888-1300	Jacobs Engineering Group Inc. 2155 Louisiana NE Suite 10,000 Albuquerque, New Mexico 87110
GJPO supervisory general engineer (Joe Virgona)	(303) 248-6006	Grand Junction Projects Office 2597 B 3/4 Road Grand Junction, Colorado 81503

2.2.3 Disposal cell design

The disposal cell is constructed partially below existing grade. It covers approximately 60 ac (24 ha), with maximum areal dimensions of 2400 x 1300 ft (730 x 400 m). Figure 2.3 gives a plan view of the disposal cell.

The radon barrier thickness was determined to be conservative, based upon radiological characterization of the contaminated materials obtained prior to and during construction. The radon emanation rate from the completed disposal cell meets the U.S. Environmental Protection Agency (EPA) standard of 20 picocuries per square meter per second. The tailings were encapsulated with a compacted 2-ft (0.6-m) thick radon barrier layer of uncontaminated silty clay and clay materials. On the sideslope, the upper 18 inches (in) (46 centimeters [cm]) of the radon barrier were amended with 7-percent bentonite to maintain a consistent radon barrier thickness on the top and sides of the cell. Additionally, the radon barrier on the topslope was constructed with a bentonite geomembrane (bentonite sandwiched between two geotextile membranes) on the surface to restrict infiltration into the barrier. The radon barrier is further protected by a 6-in (15-cm) sand filter/drainage layer on the cell sideslopes and top.

The topslope was completed with a 1.5-ft (0.5-m) biointrusion layer, a 2.5-ft (0.8-m) frost protection layer, and a 6-in (15-cm) rock/soil matrix. The matrix has a 1.5- to 2.0-percent grade away from a drainage divide at the center of the cell. In addition to the rock/soil layer, the cell topslope is covered with native grasses. The cover system for the embankment topslope is illustrated in Figures 2.4 and 2.5.

The sideslope was completed with a 6-in (15-cm) bedding layer, a 1.5-ft (0.5-m) frost-protection layer, another 6-in (15-cm) bedding layer, and a 1.0-ft (0.3-m) riprap layer. The riprap is keyed along the cell perimeter to prevent headcutting erosion at the cell boundary.

The drainage features of the embankment and general site grading ensure long-term embankment stability as required in 40 CFR §192.02(b). Runoff from the embankment flows to the apron and then to the adjacent natural ground on the northern slope of the cell. All other sideslopes of the cell drain to perimeter catchment ditches that channel the concentrated flows to outfall structures. Ditch No. 1 carries flow from the eastern slope and drains to an outfall structure at the arroyo north of the cell. Ditch No. 2 carries flows from the southern face of the cell and drains to an outfall structure at the escarpment to the east. Ditch No. 3 captures a smaller drainage from the northwestern and western slopes of the cell and a small upland drainage area. It also divides the drainage to the north and southwest. The ditches have sufficient depth and rock protection to carry runoff from the probable maximum precipitation (PMP) event. Significant precipitation events can create velocities capable of moving sediment buildup in the ditches. Flows in the major arroyos north and south of the cell, produced from a PMP event occurring in the upland drainage area, will not impact the toe of the disposal cell.

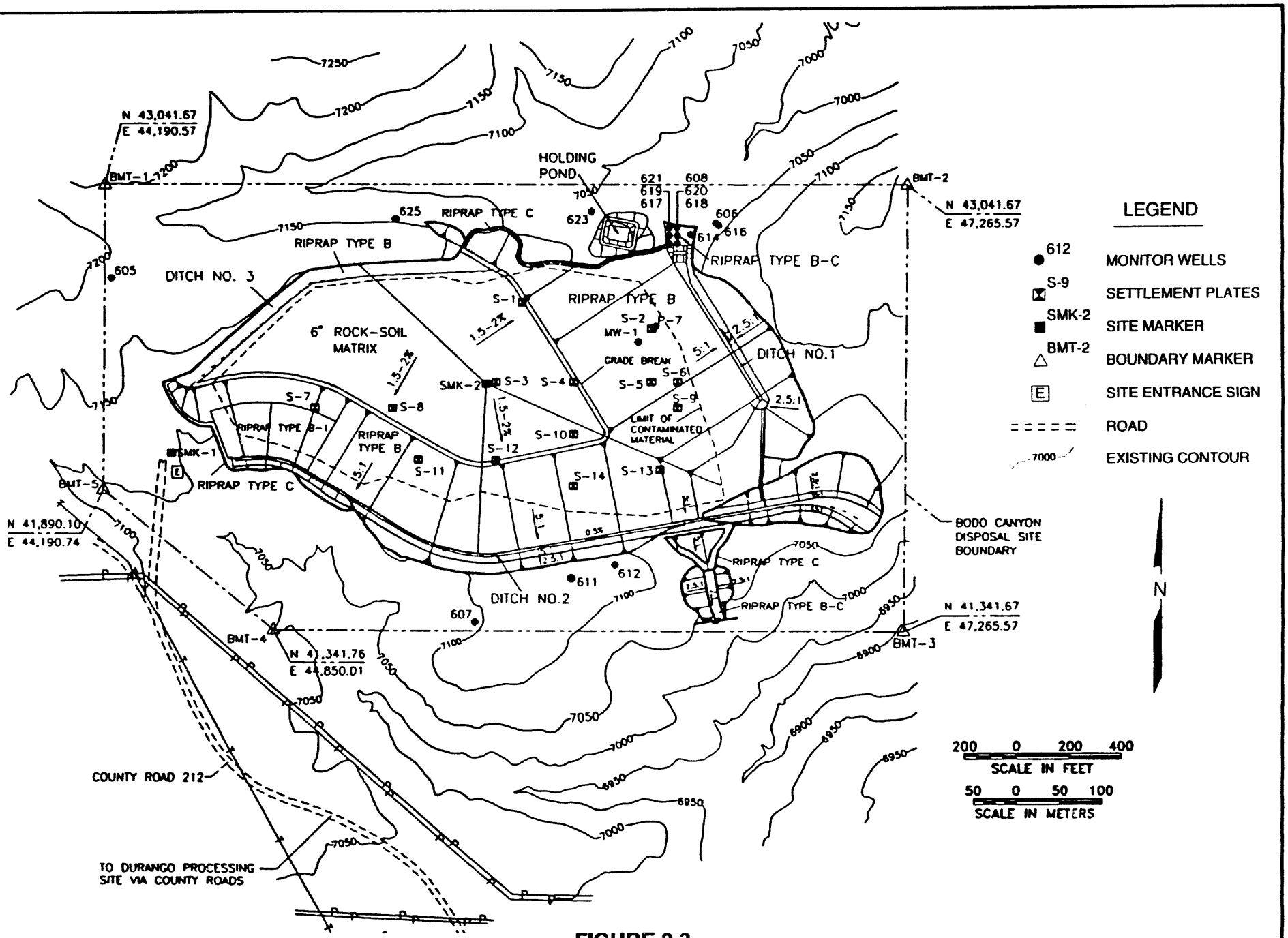

FIGURE 2.3
PLAN VIEW OF BODO CANYON DISPOSAL CELL

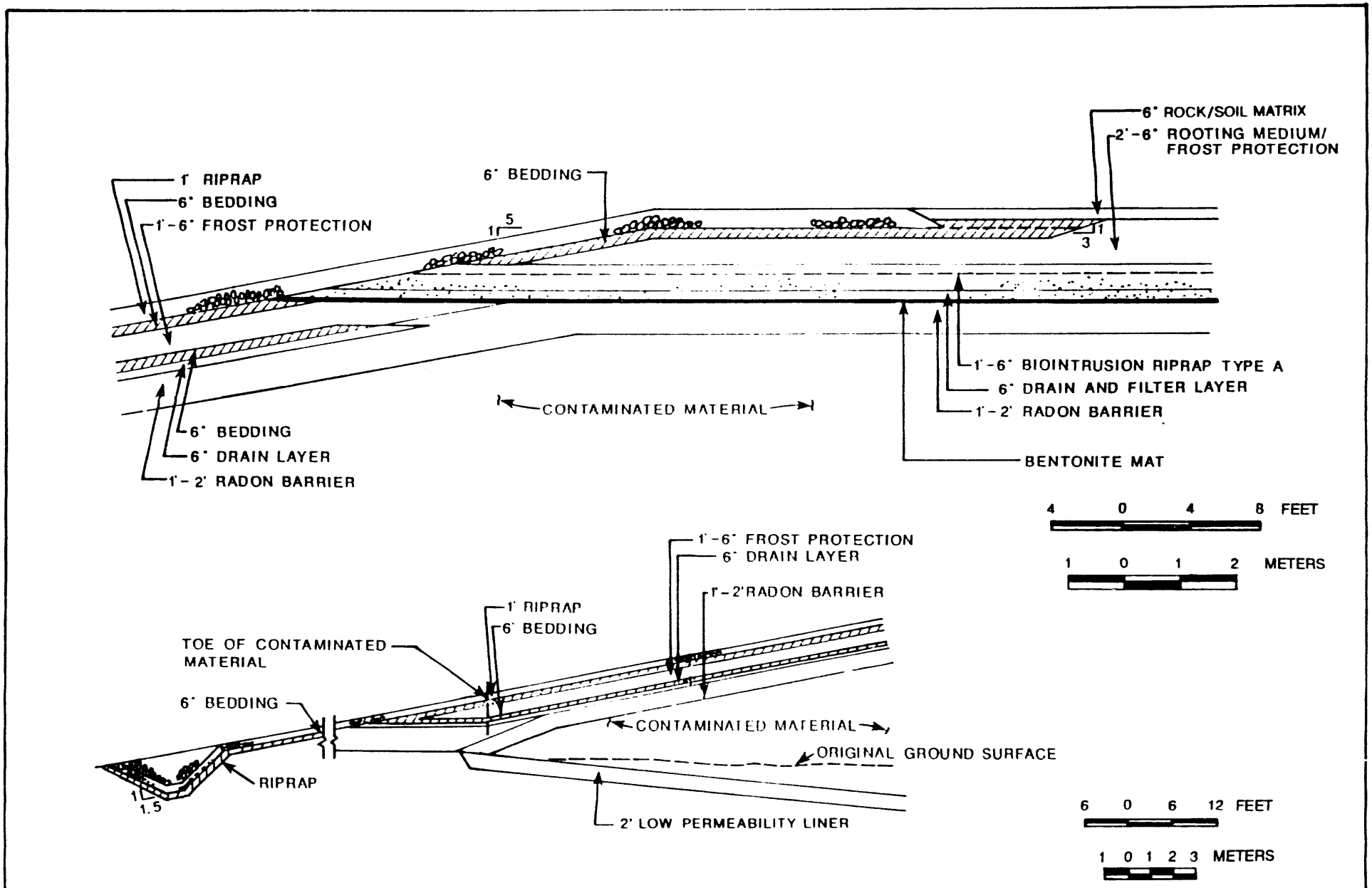

FIGURE 2.4
AS-BUILT CROSS SECTION OF COVER SYSTEM
BODO CANYON DISPOSAL CELL

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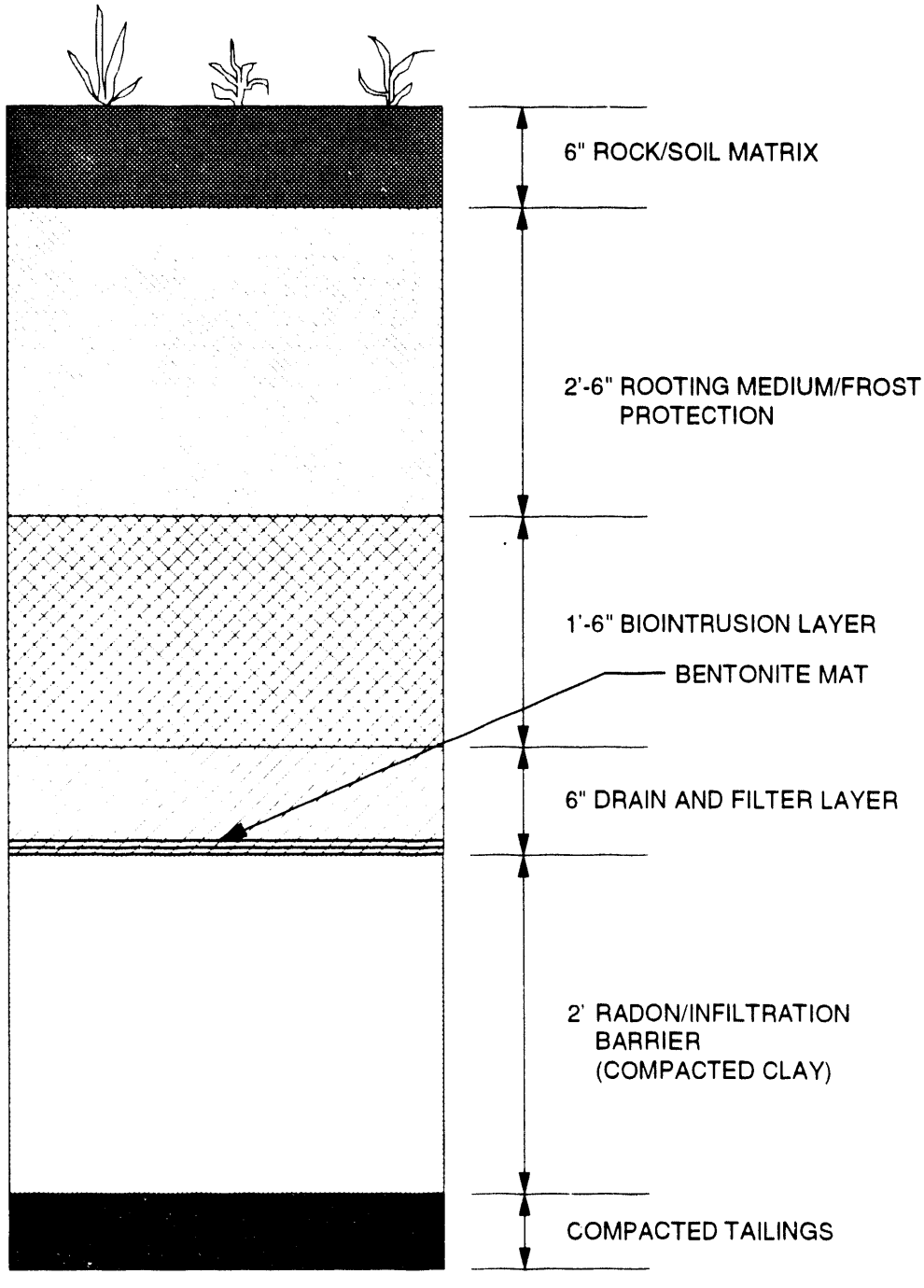

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FIGURE 2.5
TOPSLOPE COVER SYSTEM
BODO CANYON DISPOSAL SITE

The following major design features will mitigate potential ground water contamination at the disposal site:

- A low permeable liner on the sides and below the contaminated tailings (Figure 2.4).
- A compacted radon/infiltration clay barrier above the tailings material (Figure 2.5).
- A high conductivity sand drain/filter layer placed on the top of the radon barrier (Figure 2.5).

The low permeable liner placed underneath the tailings material is composed of natural, recompacted, silty clay and clay soils. These soils have high neutralization, adsorption, and ion exchange potential and thus provide a high attenuating capacity to restrict downward contaminant migration through the barrier.

During disposal cell construction, a seepage condition developed requiring the construction of a toe drain and holding pond which will be in service for a relatively short period of time. Attachment 3 describes the seepage condition that developed and the criteria and plan for final closure and decommissioning of the toe drain and holding pond. Because the toe drain and pond are temporary, no long-term surveillance of these features is described in this document in Attachment 3.

2.2.4 Disposal cell inspection and corrective action

The surface conditions of the disposal cell will be monitored during annual inspections to determine if the cell and erosion protection measures are performing as designed. The following guidelines and criteria for corrective action or repairs should be used during an inspection:

- Crest/topslope—The disposal cell will be observed for evidence of uneven settling and cracking. Cracks in the topslope surface, and any evidence of wind and water erosion (such as gully formation) will be noted. If bare or thin spots or diseased or burned vegetation are found on the topslope cover, cover stability will be assessed. If established engineering methods determine that the vegetated cover is unstable, corrective action to affected areas may be necessary. Temple's method for determining the stability of grass-lined channels and slopes should be used to assess the stability of a vegetated topslope area that is damaged or destroyed by disease or fire (Temple et al., 1987).
- Slopes—The unlikely occurrence of slope instability will be evidenced by bulges at the base and depressions or tension cracks at the top of the sideslopes. Any localized change in color or concentration of vegetation on the sideslopes will be recorded and examined for evidence of seepage. The

slopes will be examined for animal intrusion or burrowing and signs of human activity. The rock cover will be examined for excessive fracturing, oxidation, or other signs of deterioration of the individual rocks. Areas of sand accumulation and volunteer plant growth will be noted.

- Drainage ditch and drainage channels—Inspectors will walk along the entire length of each channel to determine if the channels are functioning and can be expected to continue functioning as designed. The channels and sideslopes will be examined for evidence of erosion or sedimentation, slides, debris, or growing vegetation. The sideslopes will also be examined for evidence of piping or animal burrowing that could lead to material sloughing into the channel.

- Periphery (within site boundaries)—The boundaries will be examined for gully or rill formation, mounding caused by sediment transport by wind or water, and vegetation changes. The area will also be examined for evidence of water seepage, such as wet spots and surface ponding.

The ground water protection design strategy at the disposal site will minimize the migration of contaminants from the disposal cell. Subsurface drainage into the foundation materials will meet the ground water protection strategy as a result of the following design considerations:

- The evapotranspiration of the rock/soil and vegetative cover.

- The high conductivity sand filter/drainage layer placed on top of the radon barrier that will drain much of the infiltrating water to the boundaries of the cell.

- The low permeability of the radon/infiltration barrier and the attenuating properties of the 2-ft (0.6-m) thick, low permeability of the liner under the tailings material.

Contaminated water that does filtrate into the foundation materials below the cell will migrate as unsaturated flow. Because the disposal cell will cut off natural recharge to the Bodo Canyon alluvium, the contaminant transport will be attenuated through the residual moisture storage capacity of the alluvium material. Additional reducing characteristics of the geology will attenuate selective constituents.

3.0 SITE DRAWINGS AND PHOTOGRAPHS

At the completion of remedial action, disposal site as-built conditions were documented with as-built drawings and photographs (MK-F, 1991). This information illustrates baseline conditions against which future conditions at the disposal site can be compared.

3.1 DISPOSAL SITE MAPS AND DRAWINGS

A site atlas that includes a Bodo Canyon disposal site map (Plate 1) is part of the Durango permanent site file. The GJPO will be responsible for maintaining and archiving all maps, drawings, and photographs after each site inspection. All drawings, maps, and photographs will be archived by the UMTRA Project Document Control Center. An index of the Durango permanent site file is provided in Attachment 4.

3.1.1 Disposal site map

The Bodo Canyon disposal site map (Plate 1) identifies the following site features:

- Disposal site plus an area of 0.25 mi (0.40 km) around the site boundary.
- Topographic features.
- Permanent site surveillance features.
- Entrance road and gate/barricade.
- Drainage gully and drainage channels.
- Disposal site boundary.
- Disposal cell.
- Ground water monitoring wells.

Updates to the map will include the year of revision and the revision number.

The disposal site map will serve as the base map for site inspections (Section 6.4). A new, separate inspection map will be prepared after each inspection, and will indicate the year and type of inspection performed.

All disposal site base maps and periodic site inspection maps will become part of the Durango permanent site file.

3.1.2 Disposal site as-built drawings

A set of as-built drawings provided by Morrison-Knudsen Ferguson (the Remedial Action Contractor) illustrates the final disposal cell construction and final disposal site conditions. These drawings were used to prepare the disposal site topographic map. These drawings are included in the *Durango Draft Completion Report* (MK-F, 1991) and are included in the Durango permanent site file.

3.2 SITE BASELINE PHOTOGRAPHS

A photographic record of the final site conditions at the disposal site is included and will be maintained in the Durango permanent site file. This record will consist of a series of aerial and ground photographs providing baseline visual records of final site construction activities and conditions and will complement the as-built drawings. The postconstruction photographs will provide an orientation tool prior to site inspection and a baseline record of surveillance features. These photographs may provide useful construction details if repairs or corrective action become necessary.

3.3 SITE AERIAL PHOTOGRAPHS

Aerial photographs for the disposal site were taken throughout remedial action activities from 1987 to 1989 and in 1990 and 1991 after surface remedial action was complete. These photographs provide a permanent record of site conditions, enable inspectors to monitor changes in site conditions (e.g., erosion patterns, vegetation changes, land use) over time, and provide a useful orientation tool prior to inspections of the disposal site. The need for new aerial photographs will be evaluated at 5-year intervals. Table 3.1 summarizes specifications for aerial photographs at the disposal site. More detailed guidance is provided in Attachment 3 of the *Guidance for Implementing the UMTRA Project Long-term Surveillance Program* (DOE, 1992).

3.4 SITE INSPECTION PHOTOGRAPHS

Photographs will be taken during site inspections to document conditions at the disposal site. These photographs will provide a continuous record for monitoring changing conditions over time. The photographs can be compared with the baseline photographs to monitor site integrity.

Each photograph will be recorded individually on a site inspection photo log (Attachment 5). An appropriate description of the feature photographed, including the azimuth (if necessary), will be entered into the log. Copies of disposal site inspection photographs and the photo logs will be included in annual site inspection reports.

If possible, each photograph will include a reference point such as a survey or boundary monument, a site marker, or a monitor well. For large-scale features such as drainage ditches or disposal cell slopes, a north arrow and scale will be included for reference.

For specific areas in which a photograph is used to monitor change over time, the distance from site feature and the azimuth will be recorded; all subsequent photographs will be taken from the same orientation to provide an accurate picture of changing conditions. The magnetic declination of the compass should be corrected for true north. This information will also be provided on the site inspection checklist and photo log.

Table 3.1 Aerial photography specifications for the Bodo Canyon disposal site

Area to be photographed	Final disposal site plus a minimum of 0.25 mi (0.4 km) beyond site boundaries unless site conditions require otherwise.
Products to be delivered	One set of vertical color, infrared stereo contact prints, 9-in (23-cm), scale 1 in = 200 ft (1 cm = 24 m) (representation fraction 1:2400); double weight, glossy, not trimmed.
	One index map, scale 1 in = 200 ft (1 cm = 24 m); flight lines and frame numbers will be provided.
	One set of 2 each of low and high oblique photographs (and negatives) in natural color, 8- x 10-in (20- x 25-cm); or 9- x 9-in (23- x 23-cm) contact prints.
Flight date	To be determined upon the acceptance of this LTSP.
Camera	Precision, 9- x 9-in (23- x 23-cm) format for vertical photos. A 35-millimeter (single lens reflex) or larger format camera for oblique photos is acceptable.
Film	Eastman-Kodak Aerochrome Infrared 2443, or its equivalent, for vertical photos.
	Eastman-Kodak Ektacolor, or its equivalent, for oblique photos.
Filter	Wratten Nos. 12 or 15 for infrared photos. Skylight filter for color photos.
Flight line coverage	60 percent end overlap; 30 percent average side overlap.
Ground control	Control stations will be second order, Class 1, for horizontal control and third order for vertical control (standard U.S. Geological Survey map accuracy specifications).

All disposal site inspection photographs taken, as well as all corresponding photo log forms, will be maintained in the Durango permanent site file.

Features to be photographed

The following disposal site features should be documented with photographs during every scheduled inspection at the disposal site:

- Permanent site surveillance features (Plate 1).
- Entrance road and gate/barricade.
- Drainage gully and drainage channels.
- Repository cover.
- Ground water monitor wells.
- Holding pond.
- Plant species.
- Erosion protection material (riprap).
- Vegetation.

New or potential problem areas identified during a site inspection will be well documented with photographs. Photographs will also be taken to record developing trends and to allow inspectors to make reasonable decisions concerning additional inspections, custodial maintenance or repairs, or corrective action.

4.0 PERMANENT SITE SURVEILLANCE FEATURES

Survey monuments (SM) and boundary monuments (BMT), site markers (SMK), and entrance and perimeter signs are the permanent surveillance features at the disposal site. Fourteen settlement plate and four survey monument coordinate locations are listed in Table 4.1. Five boundary monuments define the corners of the unfenced perimeter of the disposal site. Eighty-six warning signs are placed around the perimeter of the disposal site.

The construction and emplacement of the site surveillance features are described in the following subsections and meet the specifications delineated in the DOE's *Guidance for Implementing the UMTRA Project Long-term Surveillance Program* (DOE, 1992).

4.1 SURVEY MONUMENTS

SM-1 is in the northwest quadrant of the site, SM-2 is south of the repository, SM-3 and SM-4 are to the east (Plate 1). The monuments, Bernsten RT-1 metal markers, were set into the top of a truncated cone of reinforced concrete set in concrete. The design of the survey monuments is shown in Figure 4.1. The hole depths for the survey monuments were chosen so that the bottom of the holes are at least 18 in (46 cm) below frost line (total depth 38 in [97 cm]). The four metal bars in each hole used to reinforce the concrete also serve as potential locating devices when using metal detectors, should any of the monuments become buried over time. The monument extends at least 4 in (10 cm) above the ground surface so that it may be easily located.

4.2 BOUNDARY MONUMENTS

Five boundary monuments (BMT-1, BMT-2, BMT-3, BMT-4, and BMT-5) are located at the site. BMT-1, BMT-2, and BMT-3 mark the site's northwest, northeast, and southeast corners (Plate 1). BMT-4 is at the west end of the south boundary, and BMT-5 is at the south end of the west boundary (MK-F, 1991). Berntsen Federal aluminum survey monuments, Model A-1, were used for the five site boundary monuments. The design of the boundary monument is shown in Figure 4.2. The ceramic magnets epoxied in the cap and base are vertically oriented for maximum detection if they become covered. The monuments were set with the base 38 in (97 cm) below the ground surface and the top 10 in (25 cm) aboveground to facilitate location (Figure 4.2).

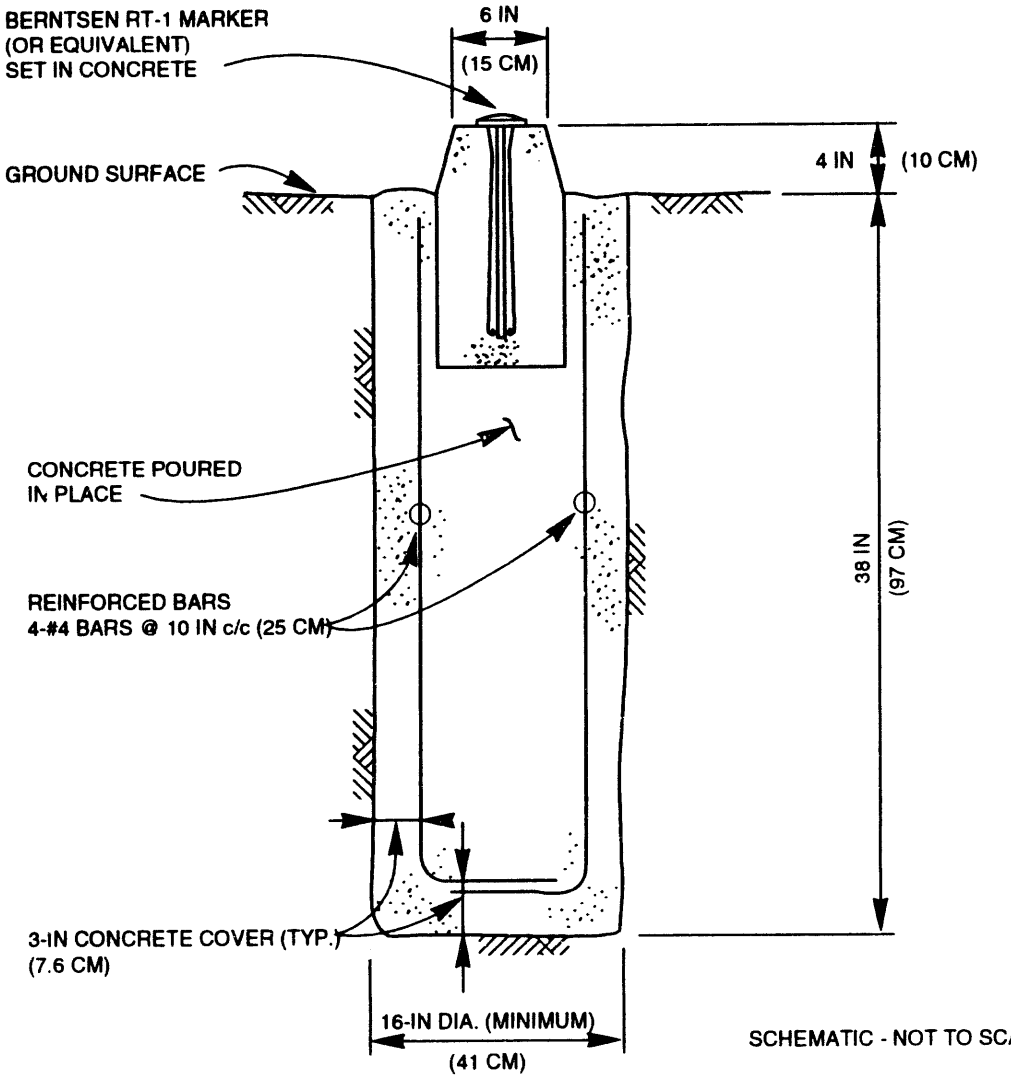
4.3 SITE MARKERS

Two unpolished granite site markers (SMK-1 and SMK-2) are within the restricted site boundary. SMK-1 is just inside the entrance gate. SMK-2 is on top of the repository revegetated area. Site markers were constructed with the dimensions shown in Figure 4.3. SMK-1 is set in a bed of reinforced concrete that extends 3 ft (0.9 m) below the ground surface (Figure 4.3). SMK-2 is set

Table 4.1 Locations of monuments and markers

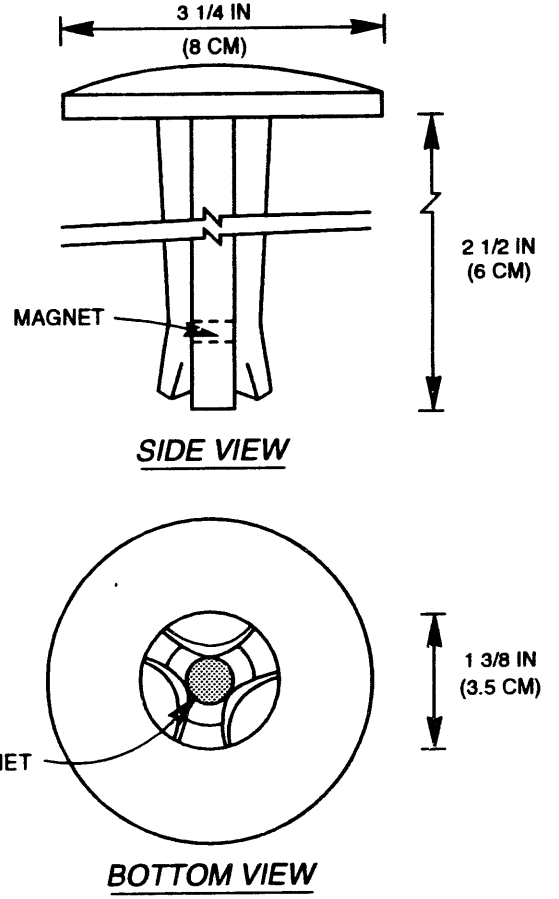
Symbol	Elevation 12/06/93	Elevation 10/20/93	Coordinates[a]
Settlement plates			
S-1	7146.83	7146.72	N 42600.4/E 45799.5
S-2	7072.57	7072.48	N 42500.0/E 46300.0
S-3	7151.79	7151.58	N 42299.5/E 45700.1
S-4	7144.58	7144.40	N 42299.7/E 46000.2
S-5	7093.95	7093.90	N 42299.8/E 46300.1
S-6	7076.93	7076.88	N 42300.8/E 46400.2
S-7	7122.30	7122.18	N 42200.4/E 45000.4
S-8	7147.30	7147.13	N 42199.6/E 45299.7
S-9	7087.71	7087.66	N 42200.6/E 46400.1
S-10	7146.98	7146.84	N 42100.2/E 46000.1
S-11	7125.55	7125.46	N 42000.5/E 45400.0
S-12	7144.15	7144.02	N 41999.6/E 45700.2
S-13	7111.41	7111.29	N 41964.2/E 46334.6
S-14	7112.53	7112.43	N 41899.8/E 46000.3
Survey monuments			
SM-1	7178.35		N 42692.34/E 44591.44
SM-2	7124.95		N 41370.10/E 45872.37
SM-3	7125.85		N 42035.81/E 46964.05
SM-4	7145.62		N 42804.37/E 46991.91
Boundary monuments			
BMT-1			N 43041.67/44,190.57
BMT-2			N 43041.67/E 47,265.57
BMT-3			N 41341.67/E 47,265.57
BMT-4			N 41341.76/E 44,850.01
BMT-5			N 41890.10/E 44,190.74

[a]Based on project survey control points established by the Bureau of Land Management.



SCHEMATIC - NOT TO SCALE

NOTE: c/c CENTER TO CENTER



SCHEMATIC - NOT TO SCALE

DETAIL
BERNTSEN RT-1
MARKER

FIGURE 4.1
UMTRA PROJECT SURVEY MONUMENT
BODO CANYON DISPOSAL SITE

MODIFIED FROM MK-F, 1990

BERNTSEN FEDERAL ALUMINUM SURVEY MONUMENT, MODEL A-1, STANDARD LOGO CAP

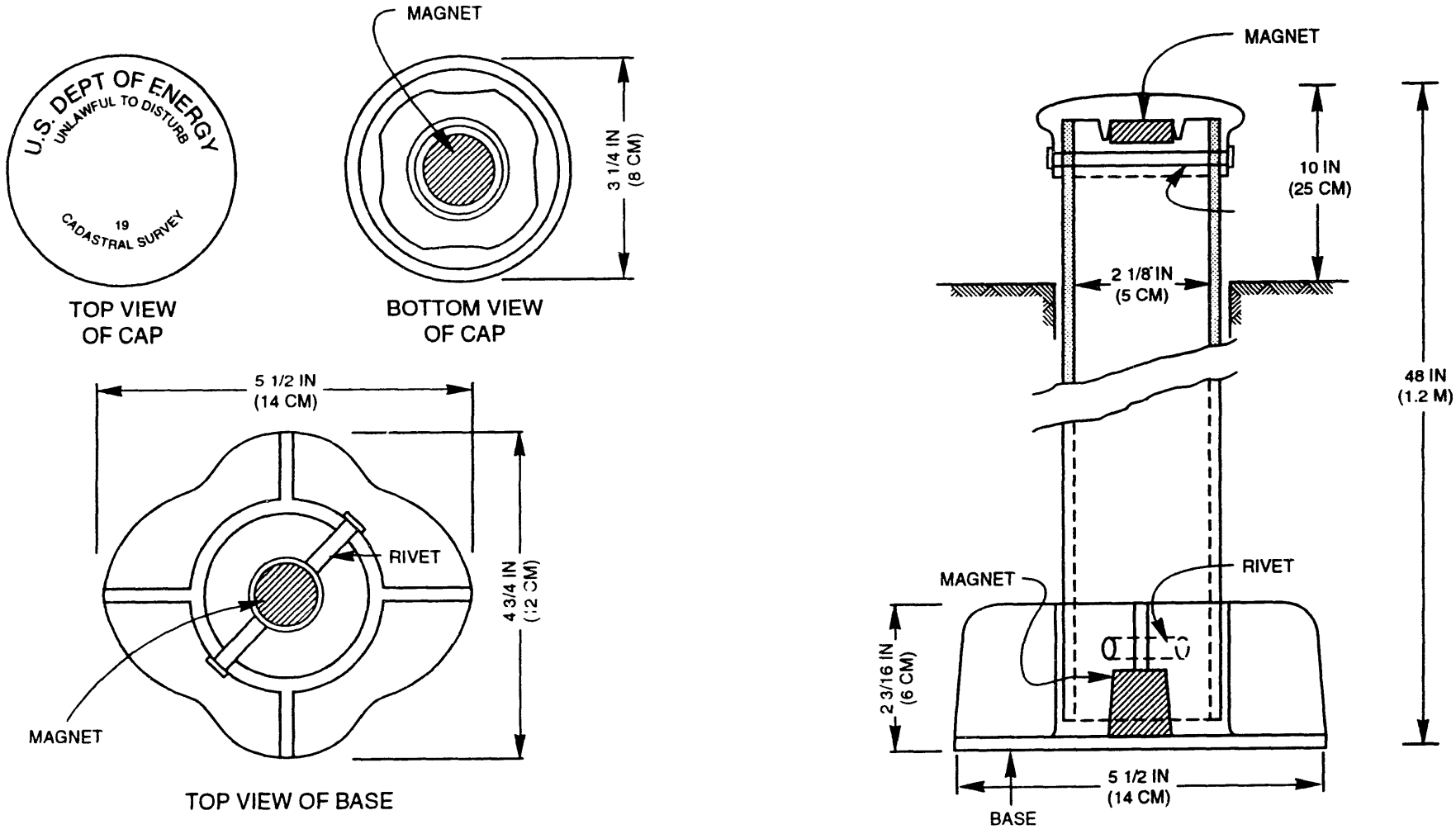
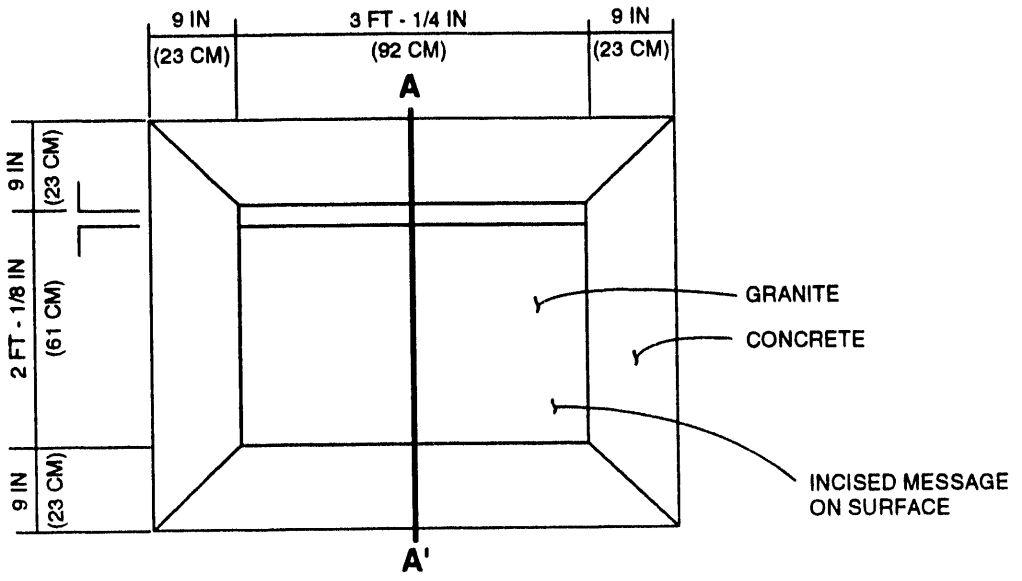
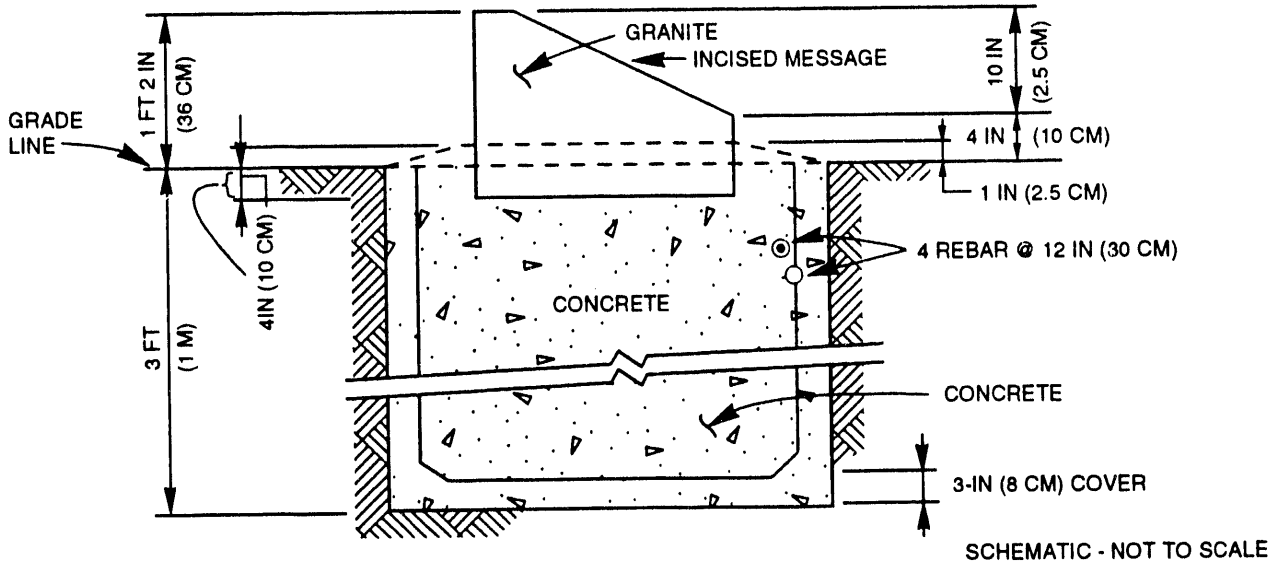


FIGURE 4.2
UMTRA PROJECT BOUNDARY MONUMENT
BODO CANYON DISPOSAL SITE



PLAN VIEW

SCHEMATIC - NOT SHOWN TO SCALE



SCHEMATIC - NOT TO SCALE

SECTION A - A'

MODIFIED FROM MK-F, 1987b

FIGURE 4.3
UMTRA PROJECT ENTRANCE SITE MARKER (SMK-1)
BODO CANYON DISPOSAL SITE

in a bed of reinforced concrete that extends to the top of the infiltration radon barrier (Figure 4.4). The markers identify the disposal site, the general location of the disposal cell, the date of closure (August 3, 1990), the dry tonnage of residual radioactive materials (3,460,000 dry tons [3,140,000 tonnes]), and the curies of radioactivity (1400 curies, radium-226) (Figure 4.5).

4.4 ENTRANCE AND PERIMETER SIGNS

The site entrance sign is at the entrance gate (Figure 4.6). In addition to the entrance sign, 86 perimeter signs are located at the site (Figure 4.7). These signs display the international symbol indicating the presence of radioactive materials. They also state that the disposal site is U.S. Government property and that trespassing is forbidden. The entrance sign has the same information as the perimeter signs, plus the name of the site and the name and telephone number of the DOE GJPO and CDH. When the DOE and CDH telephone number changes, the signs will be corrected and replaced.

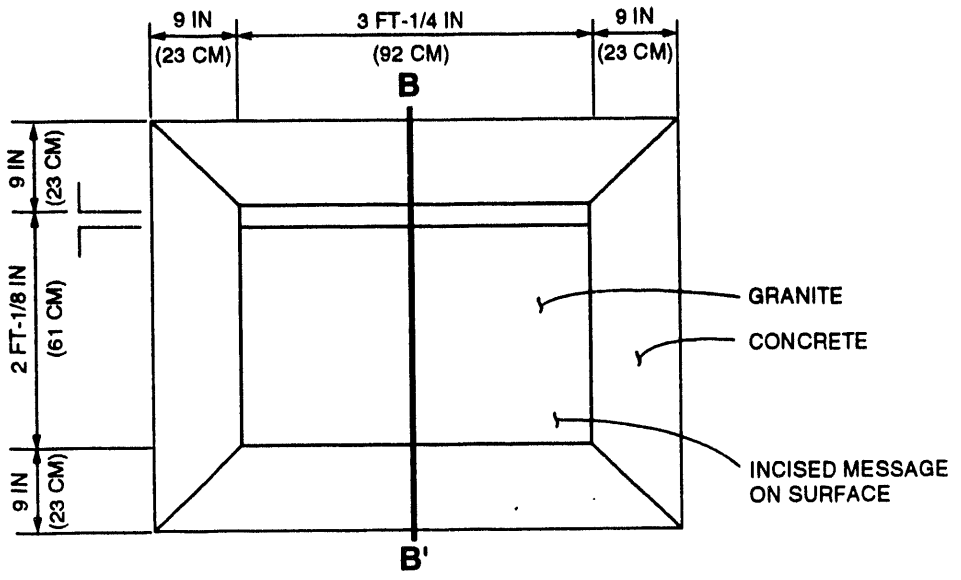
The signs are constructed in accordance with the dimensions and specifications shown in Figures 4.6 and 4.7. The tops of the signs are 70 in (180 cm) above the ground surface; the sign posts are embedded in concrete to a depth of 38 in (97 cm) below ground surface.

4.5 SETTLEMENT PLATES

Fourteen settlement plates are located on the disposal site, primarily on the south and east sideslopes of the repository (Plate 1). The total long-term settlement of the disposal cell could be measured using the 14 settlement plates. The plates were installed after the disposal cell was completed, using the specifications in Figure 4.8.

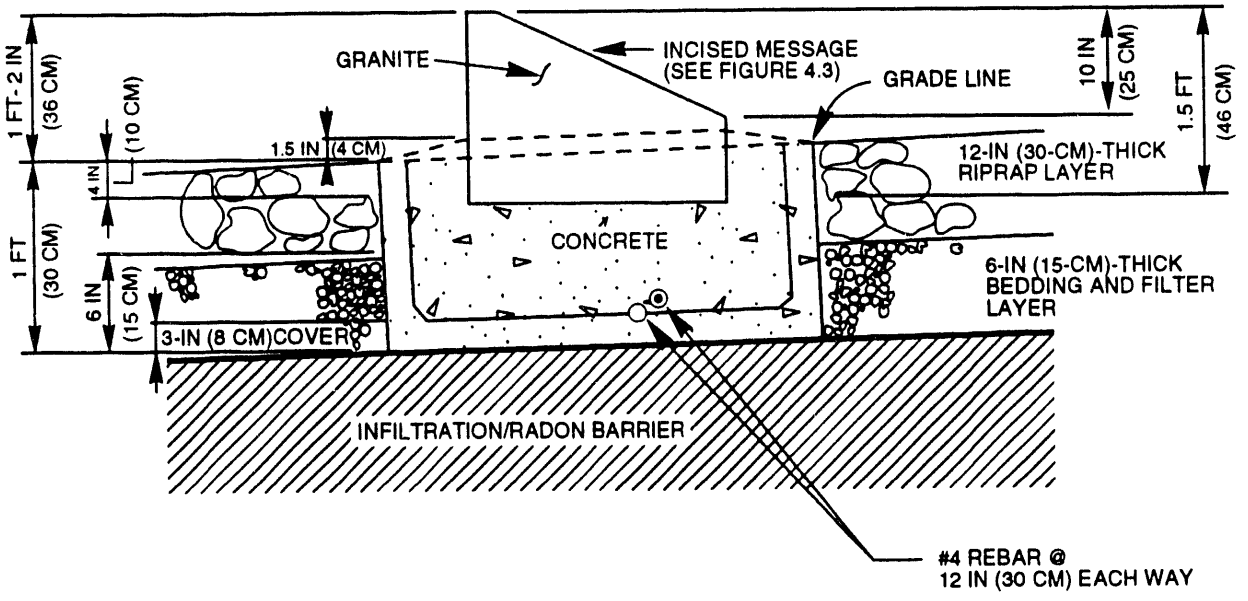
4.6 ADDITIONAL SITE-SURVEILLANCE FEATURES

A lined rectangular holding pond at the northeast corner of the repository serves as the collection and treatment point for construction waters draining from the base and toe of the repository. An 8-ft (2.4-m) post-and-multiple-stand wire deer fence surrounds the pond; access is gained through an unlocked gate at the northeast corner of the fence.



PLAN VIEW

SCHEMATIC - NOT SHOWN TO SCALE

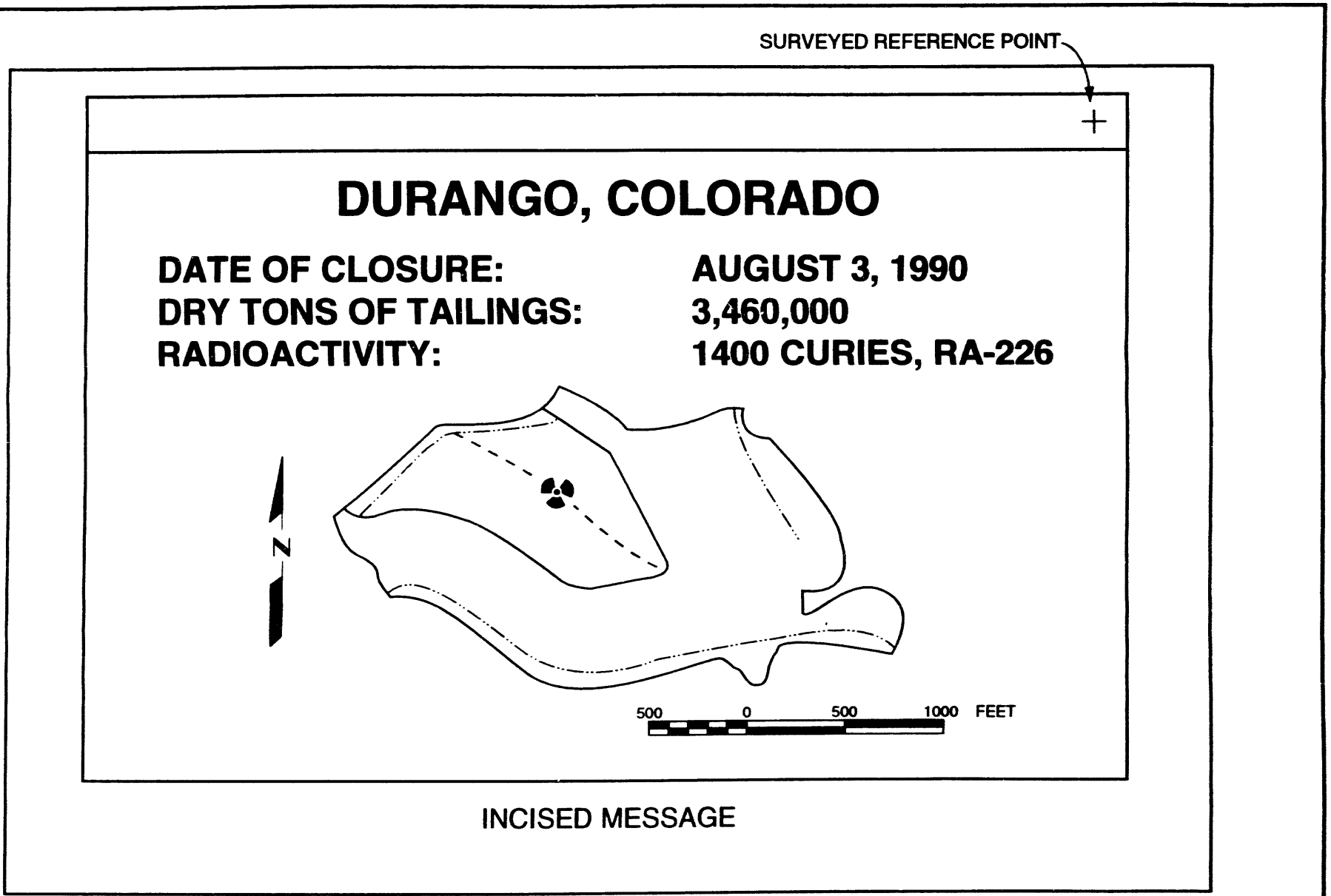


SCHEMATIC - NOT TO SCALE

SECTION B - B'

MODIFIED FROM MK-F, 1991

FIGURE 4.4
UMTRA PROJECT SITE MARKER AT CREST OF DISPOSAL CELL
BODO CANYON DISPOSAL SITE



NOTE: MINIMUM DEPTH OF INCISING TO BE 1/4 IN (0.6 CM)

MODIFIED FROM MK-F, 1990

FIGURE 4.5
UMTRA PROJECT SITE MARKER INCISED MESSAGE
BODO CANYON DISPOSAL SITE

MAC: SITE/DUR/LTSP/SITEINCISED

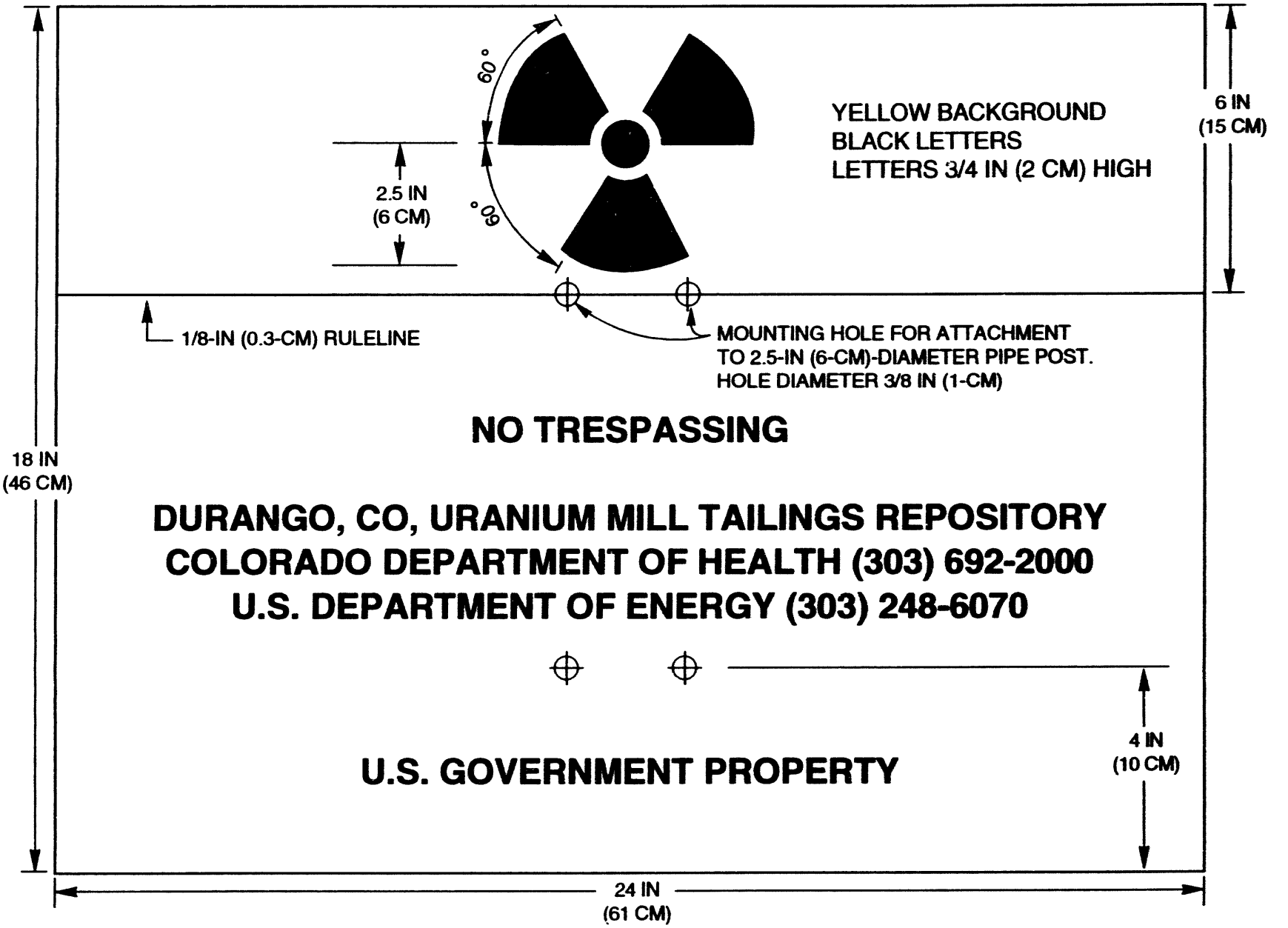


FIGURE 4.6
UMTRA PROJECT ENTRANCE SIGN AND MESSAGE
BODO CANYON DISPOSAL SITE

SCHEMATIC - NOT TO SCALE

MODIFIED FROM MK-F, 1990

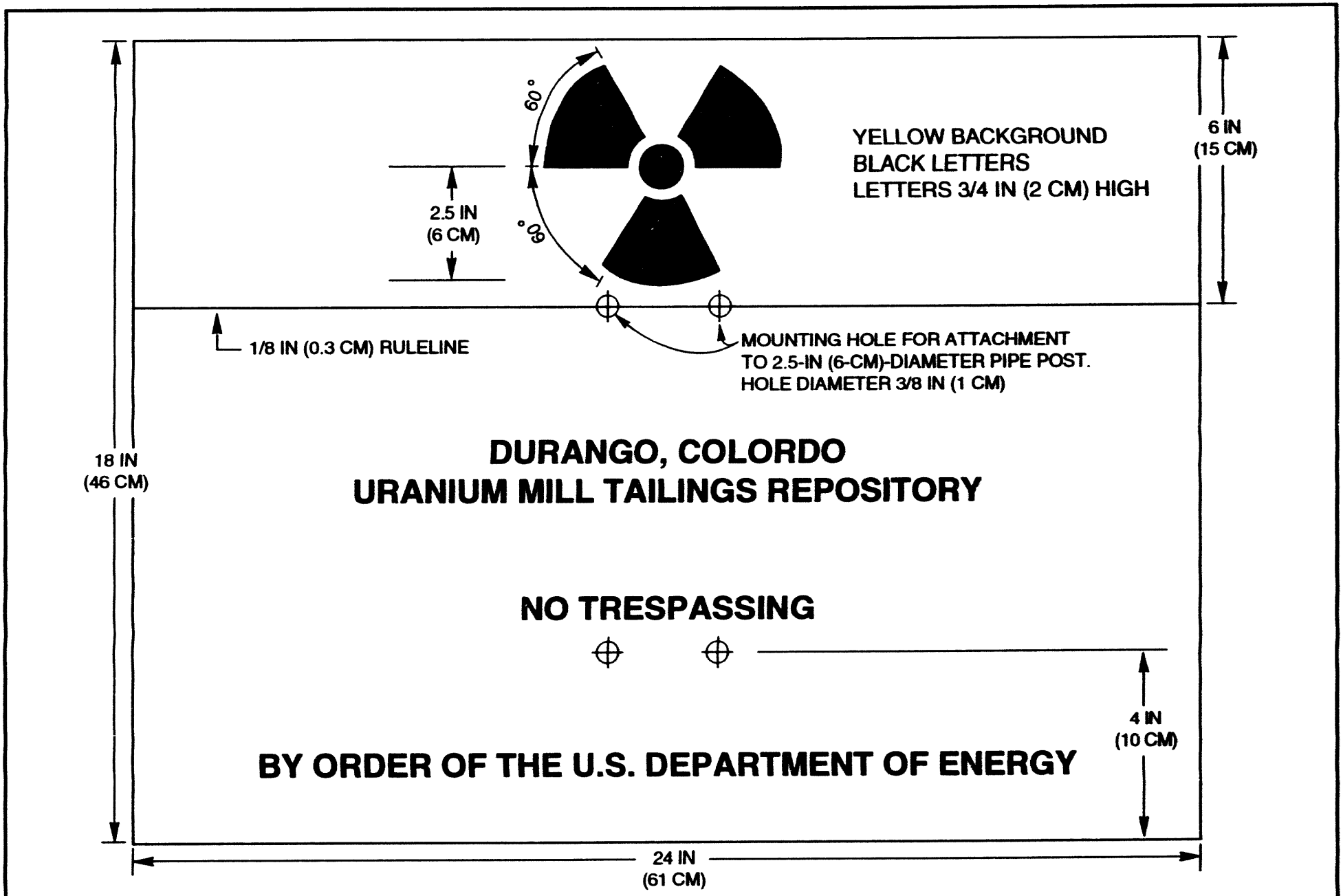


FIGURE 4.7
UMTRA PROJECT PERIMETER SIGN AND MESSAGE
BODO CANYON DISPOSAL SITE

SCHEMATIC - NOT TO SCALE

MODIFIED FROM MK-F, 1990

MAC: SITE/DUR/LTSP/PERSIGN

DUR LTSP

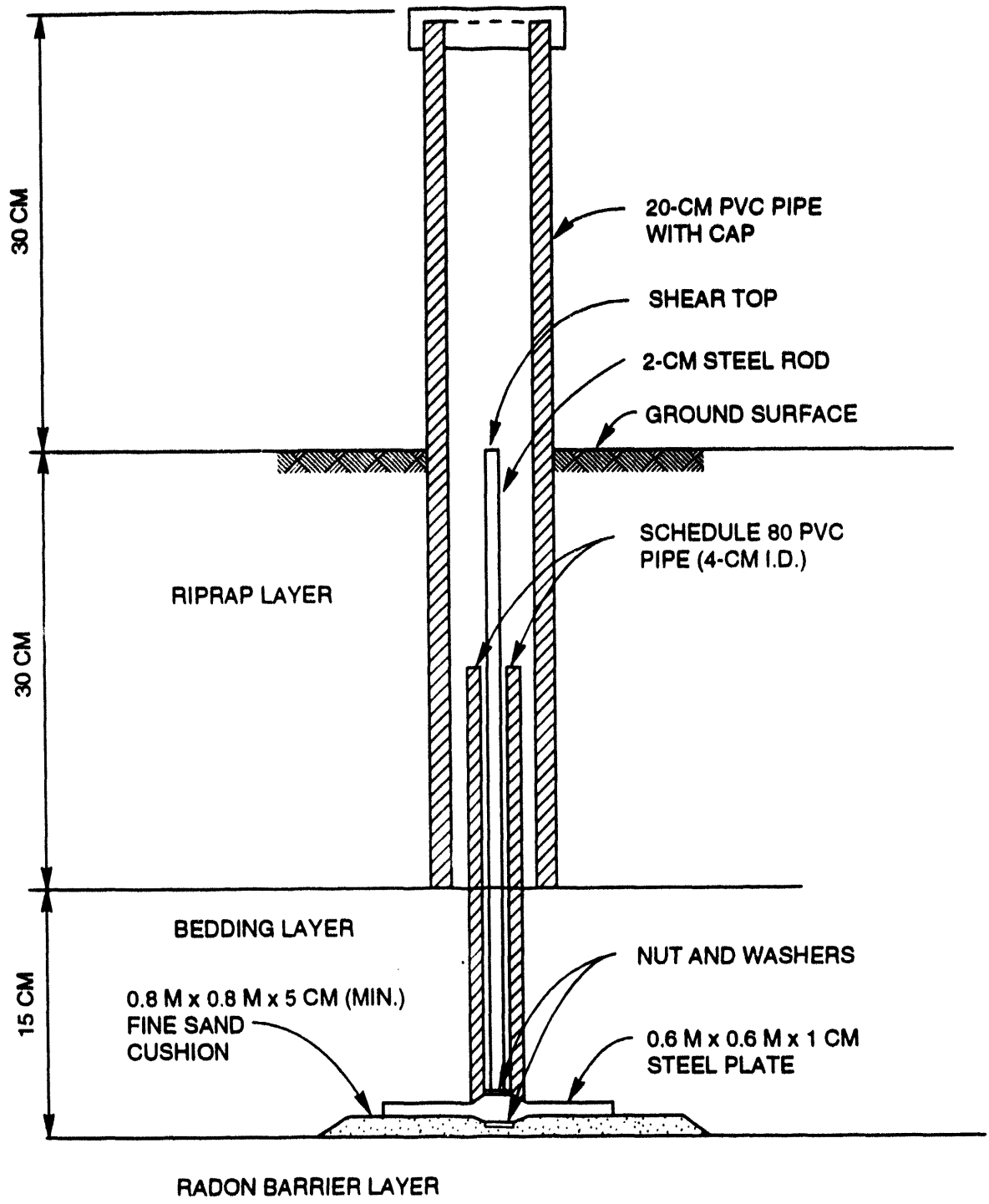


FIGURE 4.8
UMTRA PROJECT SETTLEMENT PLATE
BODO CANYON DISPOSAL SITE

5.0 GROUND WATER MONITORING

NRC regulations in 10 CFR §40.27(b)(1993) require that the disposal site LTSP describe existing ground water conditions and ground water activities or strategies that may be required to satisfy proposed EPA ground water standards (52 FR 36000 (1987)) published in 1987. Upon publication of final standards, this LTSP will be amended, as necessary.

The proposed ground water standards under 52 FR 36000 (1987) require that a ground water monitoring program be established for the disposal site. This program will be implemented and conducted over a 5-year period to demonstrate that the initial performance of the disposal cell meets the design requirements.

Long-term ground water monitoring at the disposal site will be necessary for the performance assessment developed in conjunction with the disposal cell design; the identification of specific hazardous constituents to be monitored, as necessary; and the monitoring for constituent concentrations (DOE, 1992). In addition, the ground water monitoring program will include a network of monitor and point of compliance (POC) wells and proposes a schedule for sampling and analysis.

5.1 GROUND WATER CHARACTERIZATION

The DOE has characterized the hydrogeologic units and has identified the constituents of concern at the disposal site, which are further discussed in the following subsections.

5.1.1 Ground water standards

The proposed EPA ground water protection standards consist of three components: 1) a list of the designated hazardous constituents from Table 1, Appendix I, 40 CFR Part 192, and Appendix IX, 40 CFR Part 264; 2) a corresponding list of proposed concentration limits for the constituents; and 3) a POC standard. Hazardous constituents from Table 1, Appendix I, 40 CFR Part 192, and Appendix IX, 40 CFR Part 264, were identified from characterization of the Durango tailings materials deposited at the disposal site.

5.1.2 Hydrostratigraphy

Physiographic setting

The disposal cell is in a southwest- to northeast-trending valley. Prior to installation of the disposal cell, the valley elevation ranged from approximately 7190 ft (2190 m) above MSL near the western end of the property to about 7020 ft (2140 m) below MSL at the extreme southeastern corner of the site (Figure 5.1). The canyon is bordered on both the northern and southern flanks by bedrock-supported ridges (Figure 5.2). The northern ridge is over 7160 ft (2180 m) high, and the southern ridge is over 7100 ft (2160 m) high. Elevation at the top of the disposal cell is approximately 7145 ft (2178 m) MSL.

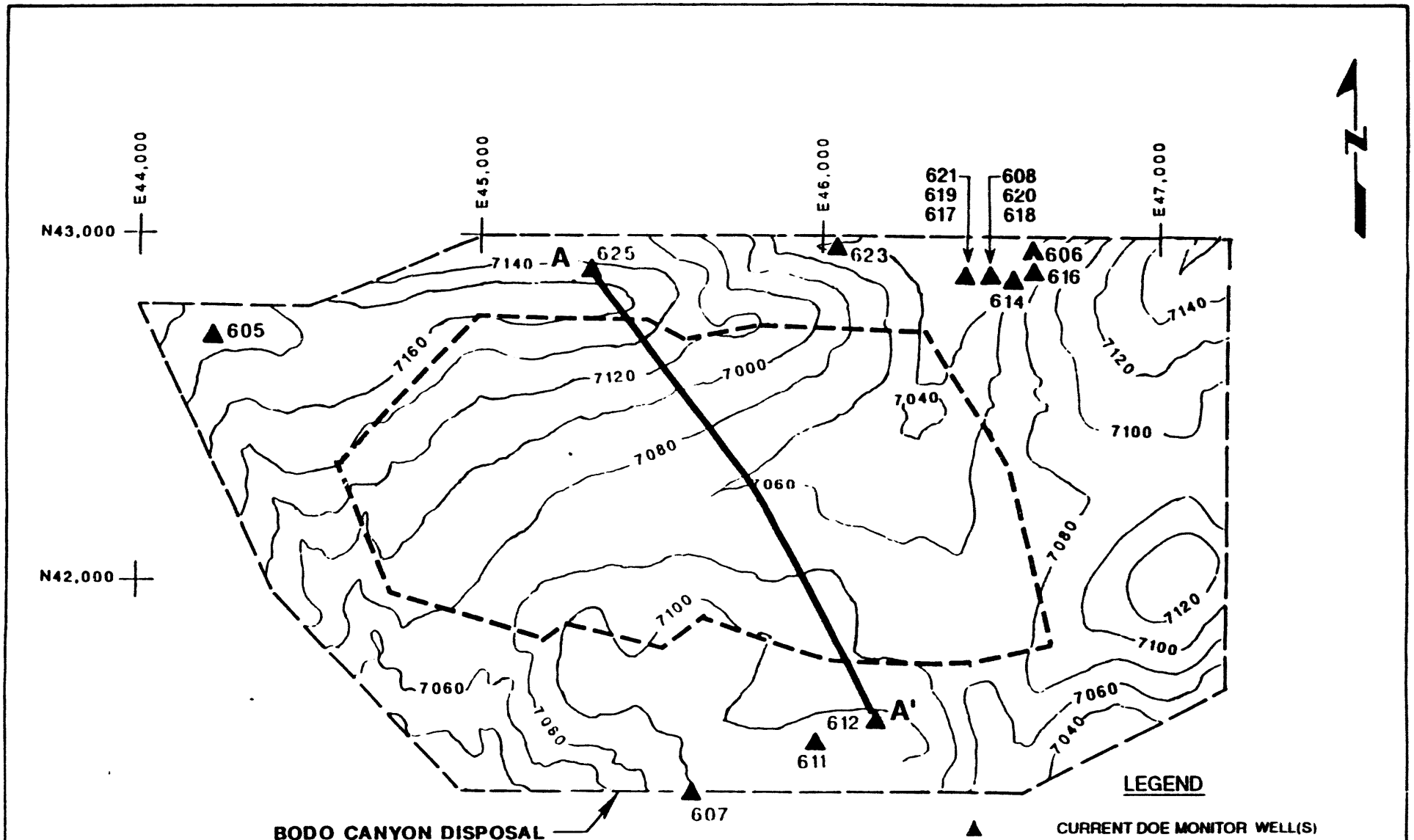
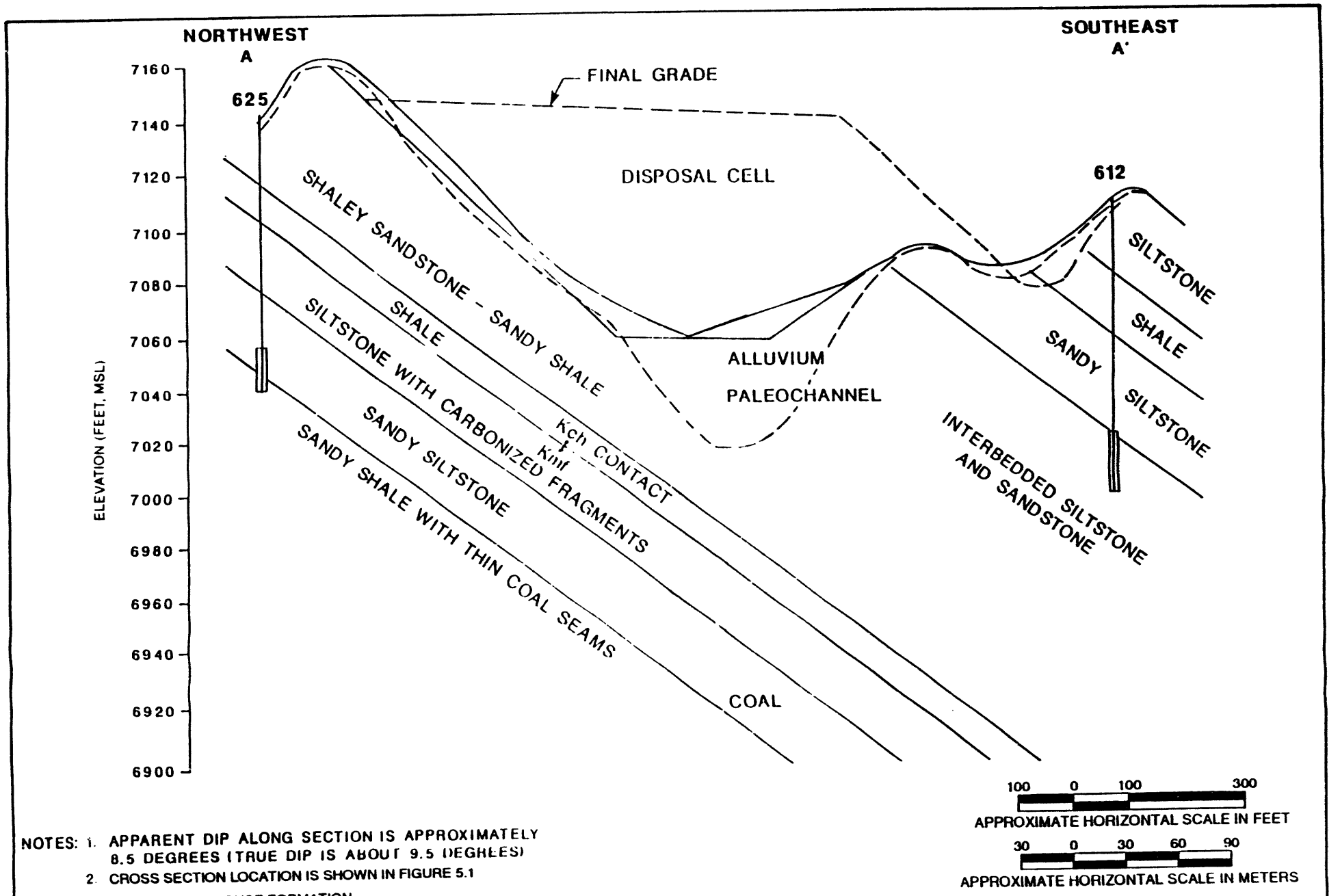


FIGURE 5.1
LOCATION OF MONITOR WELLS AND TOPOGRAPHIC MAP
BODO CANYON DISPOSAL SITE



NOTES: 1. APPARENT DIP ALONG SECTION IS APPROXIMATELY 8.5 DEGREES (TRUE DIP IS ABOUT 9.5 DEGREES)
2. CROSS SECTION LOCATION IS SHOWN IN FIGURE 5.1
3. Kch - CLIFF HOUSE FORMATION
Kmf - MENEFEE FORMATION

FIGURE 5.2
SCHEMATIC CROSS SECTION A-A'
BODO CANYON DISPOSAL SITE

at the top of the disposal cell is approximately 7145 ft (2178 m) MSL. Eastward-flowing arroyos are located north and south of the two flanking ridges. These arroyos are dry for much of the year.

Geology

The bedrock underlying the disposal site and supporting the ridges north and south of the canyon is the Cliff House Sandstone (CGS, 1981). The bedrock dips southeast at approximately 9.5 degrees.

The Cliff House Sandstone is approximately 200 ft (60 m) thick and contains two distinct units. The lower unit, which contains about 110 ft (34 m) of interbedded siltstone and sandstone with sandstone beds up to 3 ft (1 m) thick, supports the ridge north of the disposal cell and outcrops in the arroyo south of the south-flanking ridge. The upper unit of the Cliff House sandstone is more shaley and contains fewer and thinner sandstone beds. This unit is approximately 90 ft (30 m) thick and supports the southern ridge.

The Cliff House Sandstone is underlain by the Menefee Formation, which is between 250 and 350 ft (80 and 110 m) thick. The Menefee Formation outcrops in the arroyo at the extreme northeastern corner of the site. The contact between the lower unit of the Cliff House Sandstone and the Menefee Formation is distinguished primarily by evidence of coal and carbonized fragments in the Menefee. Otherwise, the gross lithologies of the two formations are very similar.

A southwest-northeast trending paleochannel in the lower unit of the Cliff House Formation parallels the axis of the valley occupied by the disposal cell (Figure 5.3). This paleochannel intersects the valley occupied by the eastward flowing arroyo north of the disposal cell.

The paleochannel is filled with as much as 65 ft (20 m) of alluvium consisting of silty clay, silt, and sand with some sandstone and shale fragments. This alluvium thins and is absent along the sides of the ridges north and south of the disposal cell. During remedial action, the alluvium was shaped and compacted with additional imported silty clay and clay soil, forming a low-permeability base for the disposal cell, and restricting the downward migration of contaminants (Figures 5.3 and 5.4).

Ground water—bedrock

Ground water elevations measured in monitor wells drilled into the bedrock beneath the cell before its construction, and into the bedrock north, south, and east of the cell, do not clearly identify a piezometric surface, flow direction, or gradient. Ground water relatively near the land surface (within 100 ft [30 m]) apparently occurs in different layers within the bedrock and these ground water bodies may have limited areal extent. Recharge of the near-surface ground water in the bedrock is probably only from local precipitation and is unrelated to

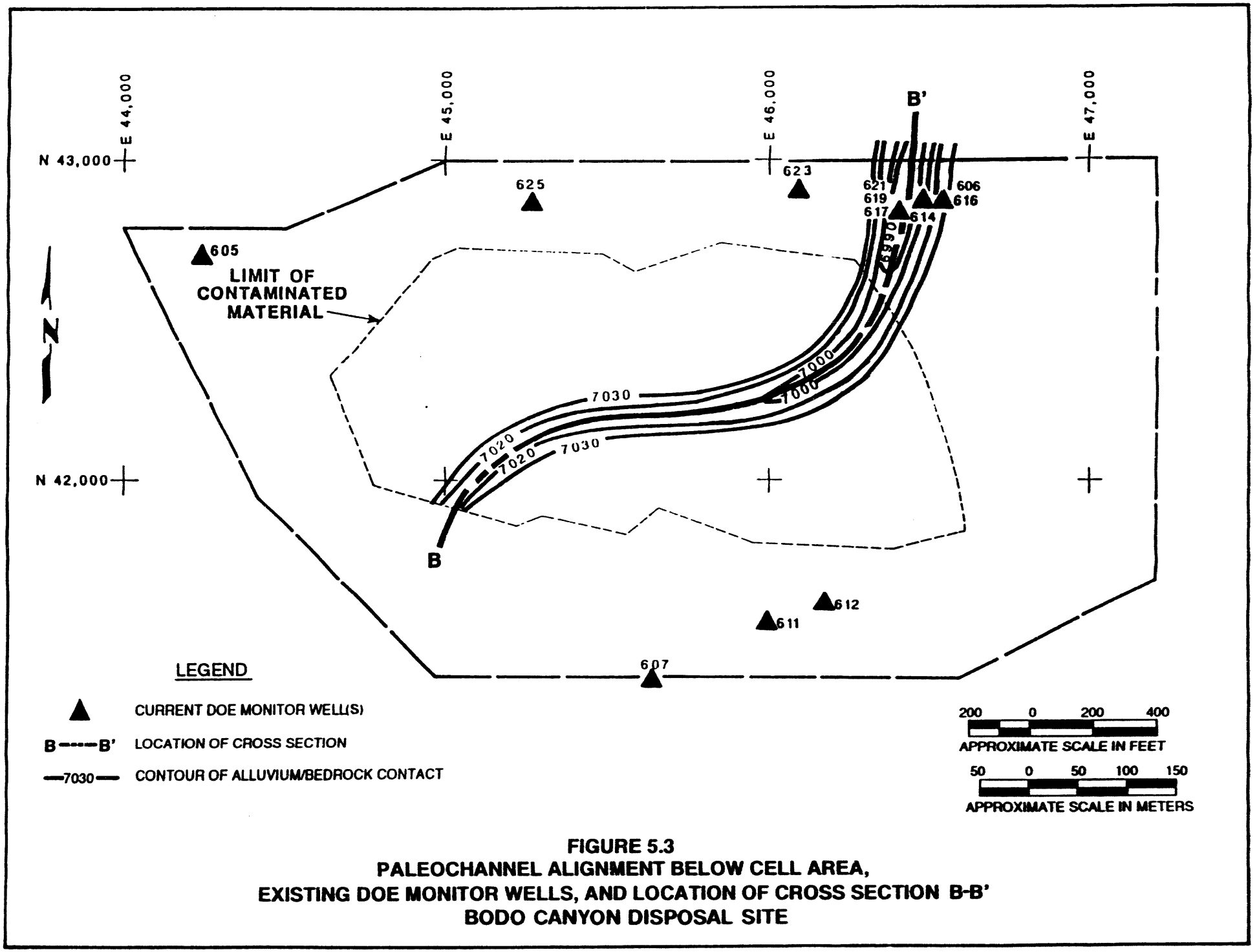
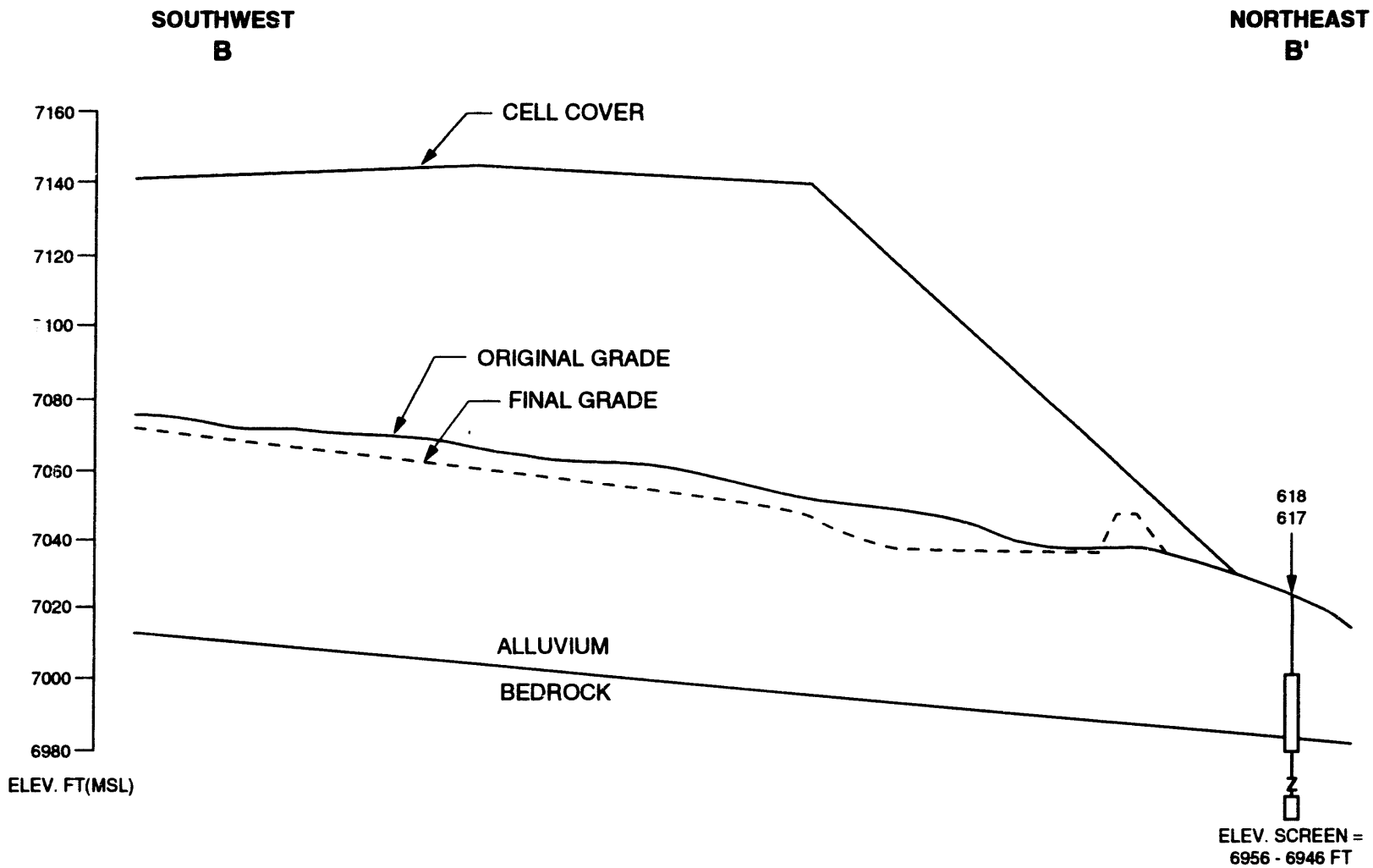


FIGURE 5.3
PALEOCHANNEL ALIGNMENT BELOW CELL AREA,
EXISTING DOE MONITOR WELLS, AND LOCATION OF CROSS SECTION B-B'
BODO CANYON DISPOSAL SITE



NOTE: CROSS SECTION LOCATION IS SHOWN IN FIGURE 5.3.

200 0 200 FEET

60 30 0 30 60 METERS

FIGURE 5.4
SCHEMATIC CROSS SECTION B - B'
BODO CANYON DISPOSAL SITE

MAC: SITE/DUR/LTSP/SCHM-XSEC

the deeper, regional flow regime. Ground water in the shallow bedrock appears to flow both southeast, downdip of the bedrock, and northeast, down the strike of the valley in the same direction as the ground water in the alluvium.

Ground water—alluvium

Shallow ground water occurs within the alluvium in the valley bottom. The depth to ground water prior to construction of the disposal cell varied seasonally. During the wet season, ground water was at or near the ground surface. The hydraulic conductivity of the shallow alluvium in most of the valley averages approximately 0.13 feet per day (ft/day) (0.46×10^{-4} centimeters per second [cm/s]), although an aquifer test performed at the confluence of the paleochannel and the north arroyo gave a value of 32 ft/day (10 meters per day [m/day]). Assuming a porosity of 0.25 and a gradient of 0.003 down the valley center, the rate of movement to the northeast will vary from approximately 0.6 feet per year (ft/yr) (0.2 meters per year [m/yr]) to about 140 ft/yr (40 m/yr). This amount of variability is not unusual for alluvial-filled valleys. For calculations of potential downward movement of ground water, the vertical conductivity is assumed to be one-third of the horizontal hydraulic conductivity.

The disposal cell fills more than 85 percent of the original valley. The design of the cell, including the compacted soil beneath it and the extremely low-permeability radon and infiltration barriers on its top, will prevent precipitation and snowmelt from percolating through the cell into the subsurface and recharging the ground water. As a result, the alluvial soils are expected to dewater with time.

5.1.3 Background ground water quality

Prior to construction of the disposal cell, the disposal site was used as pasture land managed by the Bureau of Land Management. No mining, milling or other industrial activities took place at the disposal site before placement of the cell. Therefore, all wells in the alluvium and the bedrock contain ground water representative of natural, background quality. Analytical data indicates, however, that the natural water quality varies between the alluvium and the bedrock. Recognizable variations also exist within the bedrock itself.

5.1.4 Monitored constituents and concentration limits

Table 5.1 lists the constituents monitored at the site.

In accordance with the remedial action plan (RAP), the Cliff House/Menefee Formation is classified as the uppermost aquifer at the disposal site. The proposed concentration limits for the listed constituents are also enumerated in Table 5.1. These limits are either the proposed or established maximum concentration limit (MCL) for the constituent, or the statistical maximum of the constituent, if it is higher than the MCL or if no MCL is established for that constituent.

Table 5.1 Proposed concentration limits at the Bodo Canyon disposal site

Hazardous constituent in tailings water	Proposed MCL	Tailings pore fluid median[a]	Cliff House/Menefee background ground water		Proposed concentration limit[c]
			Observed maximum[b]	Statistical maximum[b]	
Arsenic	0.05	0.24	0.024	0.01	0.05[d]
Barium	1.0	0.05	0.3	0.1	1.0[d]
Cadmium	0.01	0.036	0.019	0.001	0.01[d]
Chromium	0.05	0.01	0.12	0.01	0.05[d]
Lead	0.05	0.01	0.02	0.01	0.05[d]
Mercury	0.002	0.0002	0.0004	0.0002	0.002[d]
Molybdenum	0.1	1.73	0.22	0.06	0.10[b,d]
Net gross alpha (pCi/L)	15	NM	62	14	15[d]
Nitrate (NO_3)	44.0	1.6	43	1.6	44.0[d]
Radium-226 and -228 (pCi/L)	5.0	10.1	15	3.0	5.0[d]
Selenium	0.01	0.13	0.042	0.02	0.02[e]
Silver	0.05	0.01	0.03	0.01	0.05[b]
Uranium	0.044	4.54	0.028	0.0036	0.044[b]
Beryllium	None	0.01	0.023	0.02	0.02[f]
Cobalt	None	0.11	0.05	0.05	0.05[d]
Copper	None	0.04	0.03	0.02	0.02[f]
Nickel	None	0.04	0.07	0.04	0.04[f]
Vanadium	None	11.1	0.06	0.03	0.03[f]
Zinc	None	2.0	0.28	0.2	0.2[f]

Note: All units are in milligrams per liter except radium-226 and -228 and net gross alpha, which are in picocuries per liter (pCi/L).

[a]Ref.: DOE (1991).
[b]DART data base (December 1993).
[c]In the Cliff House/Menefee uppermost aquifer at the POC.
[d]Statistical maximum less than MCL.
[e]Statistical maximum greater than MCL.
[f]Statistical maximum.

NM - Not meaningful.

5.2 GROUND WATER MONITORING PROGRAM

The ground water monitoring program will monitor the uppermost aquifer, including analyzing ground water samples from a series of monitor wells downgradient from the disposal cell at the POC and upgradient from the disposal cell as background. This direct monitor well network is discussed in Section 5.2.1 of this report. Performance monitoring frequency is outlined in Section 5.2.2 of this report.

All aspects of the ground water monitoring program will be conducted in accordance with accepted industry QA practices, including directives in DOE Orders 5700.6C, *Quality Assurance*, and 5400.1, *General Environmental Protection Program*. The general sequence for conducting the ground water monitoring program is provided in Figure 5.5.

5.2.1 Direct ground water monitoring network

Ground water samples will be collected from upgradient monitor well 605 and downgradient POC wells 607, 611, and 612 southeast of the disposal cell, and well 621 to the northeast (Figure 5.1).

Water level measurements will be taken in the POC wells and in alluvial wells 606 and 623. These measurements will assess the effectiveness of the disposal cell in reducing rain and snow infiltration into the alluvium.

5.2.2 Sampling frequency

The sampling schedule takes into account such factors as background ground water quality, the geochemistry of the tailings pore fluid solution, horizontal and vertical ground water flow rates, possible seasonal variations in ground water, and the risk to human health and the environment. The Durango RAP (DOE, 1991) details these factors. In addition to collecting ground water samples, ground water levels will be measured before each well is sampled.

Upgradient and downgradient monitor wells are sampled semiannually for the first 5 years after construction is complete and annually thereafter. For consistency, annual sampling will be conducted at approximately the same time each year. This frequency is subject to change based on recommendations in the annual Durango water sampling and analysis plan (WSAP) (DOE, 1994).

The recommended long-term sampling frequency depends in part on the effectiveness of the remedial action as determined through the ongoing monitoring program (EPA, 1988).

5.2.3 Screening monitoring and exceedance validation

During the established ground water monitoring period (see Section 5.2.2), screening monitoring will be conducted to observe possible changes in ground

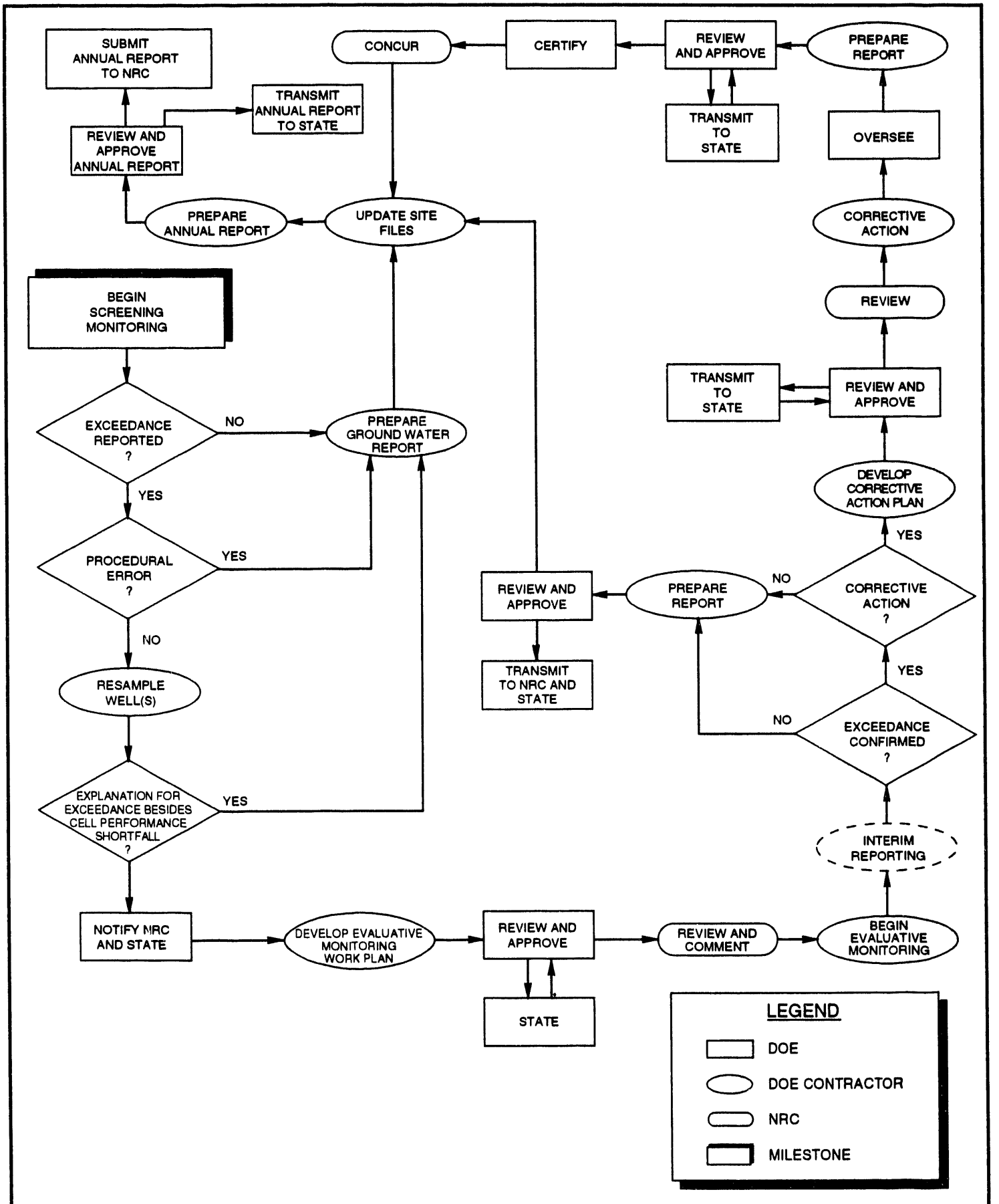


FIGURE 5.5
UMTRA PROJECT GROUND WATER MONITORING PROGRAM

MODIFIED FROM DOE, 1992

water quality and to assess cell performance. Screening monitoring involves routine water-quality data collection, data evaluation, and possible resampling. Exceedances in concentration limits are evaluated on a well-by-well and analyte-by-analyte basis. If an MCL presented in Table 5.1 is exceeded, the appropriate steps will be taken, as specified in Section 5.3.2 of the *Guidance for Implementing the UMTRA Project Long-term Surveillance Program* (DOE, 1992).

5.2.4 Evaluative monitoring

When sampling, evaluating, and resampling during screening monitoring does eliminate the disposal cell as the cause for the water-quality exceedance, additional evaluation and fieldwork (evaluative monitoring) may be required. The work will be conducted to determine if the disposal cell is the cause, and if so, the nature and extent of the exceedance. Evaluative monitoring may involve the procedures described in Section 5.3 of the *Guidance for Implementing the UMTRA Project Long-term Surveillance Program* (DOE, 1992).

5.2.5 Indirect monitoring

The DOE will directly monitor ground water at the disposal site (see Section 5.2.1). If screening and evaluative monitoring indicate a change in ground water quality attributable to the disposal cell design, the need for indirect monitoring will be assessed.

If evaluative monitoring indicates the performance of the disposal cell is the cause of a significant exceedance, it may be necessary to monitor the cover, the tailings, the subsoils, or a combination of components. Some indirect methods that may be applicable for monitoring changes in moisture content in the disposal cell include core sampling to determine gravimetric water content, neutron moisture monitoring, time-domain reflectometry, heat dissipation probes, or cross-hole tomography. Any indirect monitoring instrumentation that may be required will be installed in accordance with the appropriate standard operating procedures (SOP) or best management practices. Specific monitoring strategies and instrumentation will be selected in consultation with the NRC.

5.3 CORRECTIVE ACTION

The EPA-proposed standards (52 FR 36000 (1987)) require that a corrective action program be implemented within 18 months after verification of an established concentration limit exceedance for one or more of the monitored constituents. The goal of the corrective action program is to restore the disposal cell to its design requirements. NRC regulations (10 CFR §40.27(c)(5)(1993)) specify that the DOE will notify the NRC before implementing any significant corrective action. Section 9.0 provides guidance for implementing a corrective-action program.

If it is determined that corrective action is necessary, the DOE will prepare and submit a corrective action plan to the NRC for review (a copy of this plan also

will be transmitted to the CDH). The plan will include a monitoring program to demonstrate the effectiveness of the corrective action, which the DOE will implement after consultation with the NRC and the CDH.

As a part of evaluative monitoring, a risk assessment may be conducted to evaluate the potential harm from an exceedance to human health or the environment. If the risk assessment demonstrates no potential harm exists, the corrective action may involve no more than continued monitoring.

5.4 DATA VALIDATION AND QUALITY ASSURANCE

The UMTRA Project has established SOPs for monitor well installation development, water sampling, preservation and transport, field procedures, and chain of custody.

QA, quality control (QC), analytical data management, and validation will be detailed in a quality assurance implementation plan, which is being developed in accordance with DOE Order 5700.6C, *Quality Assurance*.

Sections 5.6.1 through 5.6.4 in the *Guidance for Implementing the UMTRA Project Long-term Surveillance Program* (DOE, 1992) summarize standard QA procedures that will be followed for water sampling, analytical QC, QA, and data validation.

The QA procedures described in this section are consistent with the *Resource Conservation and Recovery Act Ground Water Monitoring Technical Enforcement Guidance Document* (EPA, 1986).

At licensing, the ground water monitoring QA responsibilities at the disposal site will be transferred to the GJPO. The GJPO is then responsible for implementing procedures and developing a QA/QC program for ground water monitoring activities that is consistent with EPA guidance and DOE orders (see Section 12.0).

5.5 REPORTING

The data and results of the ground water monitoring program will be reported to the NRC and the CDH on an annual basis, when the POC and background monitor wells are sampled. These reports will be prepared in compliance with the environmental monitoring requirements of DOE Order 5400.1. All ground water monitoring data and supporting documentation will become part of the Durango permanent site file. The UMTRA Project Office will be responsible for preparing these reports until responsibility for the site is completely transferred to the GJPO. The following information will be included in the annual reports:

- A table of concentration limits for hazardous constituents.
- A table comparing water quality data to concentration limits.

- A summary of exceedances of concentration limits.
- Water-quality or water-level data (and indirect monitoring data, as necessary for evaluative monitoring).
- A summary of resampling, trends, exceedances, evaluative monitoring, or corrective action required during the reporting period.
- Significant trends or anomalies in the water-quality and water-level data. The narrative will compare collected data to preestablished baseline values.
- Significant changes in local hydrology.
- Analytical methods used to interpret water quality or indirect monitoring data trends.
- The qualitative or statistical procedure selected to compare ground water quality results with preestablished baseline values.
- A discussion of new wells or indirect monitoring stations that may have been installed, including the rationale for their installation, and all completion data.
- All completed field and laboratory forms.

In addition, the annual reports will evaluate the effectiveness of the disposal cell. At a minimum, the reports will do the following:

- Review historic screening compliance monitoring data.
- Summarize trends in water levels and water quality.
- Include a statistical analysis of historical data, as necessary.
- Evaluate the effectiveness of the disposal cell.
- Determine the effectiveness of the ground water monitoring plan and whether the plan should be modified.
- Determine if the remedial action is complete.

6.0 SITE INSPECTIONS

Disposal site inspections will be necessary to document changes to the disposal cell and site over time and to identify potential problems and avoid extensive maintenance, repairs, or corrective action. Fundamental to the inspections will be the detection and documentation of progressive changes caused by slow, natural processes. The findings from these inspections will be compared to the initial baseline conditions to provide a basis for future inspections. The following three types of site inspections will be conducted:

- Annual or scheduled site inspections.
- Follow-up inspections.
- Contingency inspections.

Appendix A, Criterion 12, 10 CFR Part 40, requires the DOE to submit the results of all routine site inspections to the NRC and the state of Colorado. A copy of all site inspection reports will be maintained in the Durango permanent site file within 90 days of the last UMTRA Project site inspection for that calendar year. Follow-up or contingency inspection reports must be submitted to the NRC within 60 days of the initial report and within 60 days after any other type of inspection.

6.1 INSPECTION FREQUENCY

The disposal site will be inspected annually for the first 5 years after licensing. At the end of the 5-year period, the GJPO will evaluate the need to continue annual inspections, basing its recommendation on an evaluation of the annual reports and any other reports filed for maintenance or unscheduled events. If it is determined that conducting less frequent inspections would not compromise the safety and integrity of the site, the GJPO will modify the LTSP and submit it to the NRC for approval. The state of Colorado will receive copies for review. Subsequent inspections will be considered a scheduled site inspection.

6.2 INSPECTION TEAM

The inspection team will consist of a chief inspector and one or more assistants. The chief inspector will be a geotechnical engineer, a civil engineer, or an engineering geologist knowledgeable in the processes that could adversely affect the site (e.g., geomorphic agents of change).

When an inspection team is needed for follow-up or assessment inspections, the team will include additional technical experts appropriate to the problems under investigation.

6.3 PREPARATION FOR INSPECTION

Before each inspection, inspectors will complete the following tasks:

- Review the final LTSP, the permanent site file, previous site-inspection reports and maps, and all maintenance or corrective action reports.

- Prepare a site-inspection checklist based on previous inspections or repairs and incorporate any needed modifications.

- Verify and update the names and telephone numbers of all parties with whom access or notification agreements have been executed.

- Schedule the site inspection.

- Notify the NRC, the state of Colorado, and adjacent landowners for possible attendance at the inspection. Names and addresses of adjacent landowners are available from the Durango permanent site file at the GJPO.

- Assemble all equipment needed for the inspection.

- Adjust the Brunton compass's magnetic declination for that of the Durango area (currently 14.7 degrees east of true north).

6.4 SITE INSPECTION AND INSPECTION CHECKLIST

The site inspection will cover the disposal site area, the disposal cell, and the immediate off-site areas. All site-inspection activities and observations should be recorded and described using the as-built drawings, the initial site inspection checklist (Attachment 6), the site inspection map, a field notebook, and photographs. Observations and photographic stations should be recorded on the field maps. After the inspection is complete, these maps should be drafted and retained in the Durango permanent site file.

The initial site inspection checklist (Attachment 6) is a guideline for the inspectors. After each inspection is complete, the checklist will be revised to include new information or to delete items that are no longer pertinent. Revisions to the checklist will be documented in the inspection report.

A photographic record of the disposal site inspection must be maintained. Site conditions should be documented by ground photographs to record developing trends and to enable the DOE to evaluate the need for, and extent of, future activities. Any site feature or condition that requires the inspectors to make a written comment, explanation, or description will be photographed, if possible. A site inspection photo log will be used to record the photographs (Attachment 5). All features will be photographed and recorded (see Section 3.4). The inspectors may determine the number of photographs, the view angles, and lenses to ensure that sufficient photographs are taken for agency review.

6.4.1 Off-site areas

The area within a maximum 0.25 mi (0.40 km) of the center of the disposal site will be surveyed for evidence of land use changes that indicate an increase in human activity. New roads or paths, changes in vegetation, or relevant

geomorphic features (e.g., gullies or aeolian formations) that could initiate site-threatening erosion will also be observed.

6.4.2 On-site areas

The integrity of the disposal cell will be evaluated by a series of transects around the perimeter of the disposal site; along the base, crest, and sideslopes of the disposal cell; and in and around the diversion channels. Sufficient transects must be walked so that the disposal site area is thoroughly covered and inspected. Diagonal transects of the crest will be made and the edge of the crest will be walked. Additional transects, at approximately 50-yd (46-m) intervals, will be walked along the sideslopes. The entire length of each diversion channel will be transected to determine if the channels are functioning, and can be expected to continue functioning, as designed.

At a minimum, the site perimeter and site area transects will be monitored for damage or disturbance to the following features:

- Site perimeter roads.
- Fences, gates, and locks.
- Permanent site-surveillance features.
- Ground water monitor wells.
- Site area vegetation or volunteer plant growth.
- Sedimentation or erosion.

Transects along the engineered component (diversion channels, cell sideslopes, cell crest, and cover) will be walked along their complete length and examined for evidence of the following:

- Structural instability due to differential settlement, subsidence, cracking, sliding, or creep.
- Erosion as evidenced by the development of rills or gullies.
- Sedimentation or debris.
- Rapid deterioration of the rock cover caused by weathering or erosion.
- Removal of rock or other disposal cell material.
- Seepage.
- Intrusion (inadvertent or deliberate) by humans or animals (e.g., vandalism, burrowing, trail development).
- Volunteer plant growth.

6.5 MODIFYING PROCESSES

Modifications caused by natural processes will most likely occur at the lower portion of the sideslopes of the disposal cell. These processes include gullying, headward erosion, cracking, landslides, creep, dissemination, deflation, animal or plant intrusion, and extreme natural events (e.g., tornadoes or earthquakes). Modifications caused by engineered components of the disposal cell will most likely result in plant and animal intrusion. The inspection report will include any modifying features observed during the inspection, a description of the problem, relevant measurements and photographs, and an assessment of possible impacts. The description of the modifying process will include information such as the following:

- Extent of area affected.
- Number of features (e.g., gullies) and their spacing, length, depth, and width.
- Related erosional features.
- Patterns of occurrence.
- Species of plants or animals found at the site.
- Location and density of volunteer plant growth.

Because the site is not enclosed by a fence, inadvertent or casual intrusion by humans or animals is of concern; therefore, evidence of cover removal, extensive vandalism to signs and monuments, or the presence of well-established trails should be described in detail. Continuing vandalism to the disposal site may require more active measures to control access.

If new conditions requiring continued observation, monitoring, or immediate action are discovered during an inspection, the problem and recommended follow-up action, as appropriate, should be described in the inspection report.

6.6 VEGETATION

The top of the embankment is sloped and covered with native grass. If vegetation becomes established in the erosion protection features, the integrity of the features will be assessed and a determination will be made of the need to remove the vegetation.

6.7 SITE INSPECTION MAP

A new site-inspection map will be prepared after each scheduled inspection, using the disposal site map (Plate 1) as a base. This map must include the following:

- Inspection traverses.
- Photographic locations.
- Locations and descriptions of new, anomalous, or unexpected features.
- Features identified during previous inspections for observation or monitoring.
- Inspection date.

6.8 REPORTING REQUIREMENTS

Upon completion of the field inspection, Section D of the initial site inspection checklist (Attachment 6) must be completed and the certification statement must be signed. Overlays for the as-built or revised drawings will be developed, noting any potential problems or other site conditions that may require attention. The revised drawings will be labeled with the type of site inspection and the date the site inspection was performed.

All photographs must be logged on a site inspection photo log (Attachment 5). A separate photo log should be completed for each roll of exposed film, with an entry for each photograph. The completed photo logs should be attached to the inspection checklist and paginated accordingly.

Documentary evidence of anomalous, new, or unexpected conditions or situations must be included to record developing trends, and to enable the responsible agency to make reasonable decisions concerning follow-up inspections, custodial maintenance, repair, and corrective action. Photographs may be considered documentation.

An annual site inspection report that includes the following information will be completed after every routine site inspection:

- Narrative of site inspection, results, conclusions, and recommendations.
- Site-inspection checklist and all relevant supporting documentation.
- Site-inspection map and other drawings, maps, or figures, as required.
- Inspection photographs and photo log sheet.
- Recommendations for additional follow-up inspections, repair, or custodial maintenance, if required.
- Follow-up or contingency inspection reports, if required.
- Custodial maintenance or repair report and certification, if required.
- Inspection certification.
- Ground water monitoring data and analyses, if applicable.

7.0 UNSCHEDULED INSPECTIONS

The need for an unscheduled inspection may be triggered by reports or information indicating that site integrity is or may be compromised.

7.1 FOLLOW-UP INSPECTIONS

Follow-up inspections are used to investigate and quantify specific problems detected during a scheduled inspection, ground water sampling event, special study, or other DOE activity. Inspections are needed to determine if processes currently active on or near the site threaten site security or stability and to evaluate the need for custodial maintenance, repair, or corrective action.

Follow-up inspections should be made by technical specialists in a discipline appropriate to the problem (e.g., a soils scientist or geomorphologist to evaluate erosion processes).

The first step of the follow-up procedure will be an on-site visit to determine the need for definitive tests or studies. Additional visits may be scheduled if more data are needed to draw conclusions and recommend corrective action. If maintenance, repair, or corrective action is warranted, the DOE will notify the NRC, the state of Colorado, and the adjacent residents (see Section 9.0).

7.2 CONTINGENCY INSPECTIONS

Contingency inspections are unscheduled inspections ordered by the DOE when it receives outside information indicating that site integrity is or may be compromised. Examples of trigger events for contingency inspections are reports of severe vandalism, intrusion by humans or livestock, severe rainstorms or floods, or unusual events such as tornadoes or earthquakes.

An assessment of each unusual event must be submitted to the NRC within 60 days of the initial report that damage or disruption has occurred at the disposal site (10 CFR Part 40 (1993)). The state of Colorado will also receive a copy of this report. At a minimum, this report must include the following:

- A description of the problem.
- A preliminary assessment of the maintenance, repair, or corrective action required.
- Conclusions and recommendations.
- Assessment data, including field and inspection data, and photographs.
- Names and qualifications of field inspectors.

A copy of the report, all other data, and documentation will be maintained in the Durango permanent site file. The annual report to the NRC will also include the results of these contingency inspection reports. If appropriate, the annual (or scheduled) disposal site inspection report will likewise contain the results of these inspections.

After reviewing the preliminary inspection/assessment report, the DOE must submit a corrective action plan for NRC approval within the 60-day period required by 10 CFR Part 40 (1993). A copy of the plan also must be submitted to the state of Colorado during this same time frame. Based on these findings, the GJPO will complete corrective action, following the guidance for implementing corrective action described in Section 9.0.

8.0 CUSTODIAL MAINTENANCE

Custodial maintenance will be performed at the disposal site on an as-needed basis. The need for unscheduled maintenance or repairs will be based on annual site, follow-up, or contingency inspections.

8.1 PLANNED MAINTENANCE

The only planned maintenance will be to prevent the establishment of shrubs and trees (principally into the cell) and to prevent erosion.

8.2 UNSCHEDULED MAINTENANCE OR REPAIR

Unscheduled custodial maintenance that may be required at the disposal site include the following:

- Repair or replace gate.
- Repair or replace entrance sign.
- Confirm survey monument locations.
- Maintain access road.
- Monitor security of settlement plates and possibly install a lock on each casing.
- Repair cover.
- Replace perimeter warning signs.
- Reestablish survey control and boundary monuments.
- Remove tumbleweeds or other debris from the diversion channels.
- Repair disposal cell due to animal burrows.
- Repair holding pond drain pipe.
- Reseed areas on the perimeter of the disposal cell where initial seeding failed.
- Remove volunteer plant growth on the disposal cell or in the diversion channels.

For these types of custodial actions, the GJPO will prepare a purchase order statement of work (SOW) to authorize the repair. This SOW will include contractor qualifications.

If problems are identified that may affect the integrity of the disposal cell or compliance with 52 FR 36000 (1987), the NRC must approve the recommended action in advance. The action will be treated as a corrective action.

8.3 CERTIFICATION AND REPORTING REQUIREMENTS

The following information on unscheduled maintenance or repair must be provided in the site inspection report and must be included in the annual report to the NRC:

- Summary of work required.
- Work order, purchase order, or SOW.
- Contractor qualifications, if applicable.
- Contractor documentation of completion of work.
- DOE certification of completion of work.

The DOE will inspect the site, as necessary, and review the report before certifying that all work is completed in accordance with all required specifications. Copies of all records, documentation, and certifications will be included in the Durango permanent site file. Copies of all relevant documentation will also be transmitted to the state of Colorado.

9.0 CORRECTIVE ACTION

If natural or unforeseen events threaten the stability of the disposal cell, corrective action could include temporary emergency measures. In addition, the DOE would evaluate the factors that caused the problem to ensure that recurrence is minimized or avoided.

When a potential problem is identified, the DOE will notify the NRC and the state of Colorado and will submit an inspection/preliminary assessment report for NRC review within 60 days of problem identification. The preliminary assessment report will evaluate the problem and will recommend the next step (e.g., immediate action or continued evaluation). After the NRC reviews the report and recommendations, the DOE will develop a corrective action plan for NRC approval. The DOE may combine the inspection and recommendation into one report, depending on the severity of the problem. Once the NRC has approved the corrective action, the DOE will implement the plan. Figure 9.1 illustrates the general sequence of events in the corrective action process. Figure 9.2 identifies the key elements in the corrective action process.

NRC regulations do not stipulate a time frame for implementing corrective action. However, the EPA-proposed ground water standards (52 FR 36000 (1987)) require that a corrective action program be placed into operation no later than 18 months after confirmation of an exceedance at a disposal cell. Assessing the extent of the problem and developing a corrective action plan will not be considered initiation of the corrective action program. Section 9.0 of the UMTRA LTSP guidance document contains further details on corrective action (DOE, 1992).

9.1 PROBLEM IDENTIFICATION

Site inspections by qualified inspectors and routine custodial maintenance are designed to identify problems at the developmental stage, eliminating the need for corrective action. However, extreme natural events, vandalism, or unanticipated events may create the need for additional data or evaluative monitoring to assess whether uncorrected problems would threaten site integrity. An on-site inspection/preliminary assessment would include, but not be limited to, the following:

- Quantifying the nature and extent of the problem.
- Reevaluating the engineering design parameters germane to the problem.
- Establishing a data collection and/or evaluative monitoring program to quantify the magnitude of the problem.

9.2 CERTIFICATION AND REPORTING REQUIREMENTS

The DOE will prepare a progress report on each corrective action while it is under way or while it is under evaluation. The NRC will receive a copy of each report following the corrective action, or the report will be attached to the

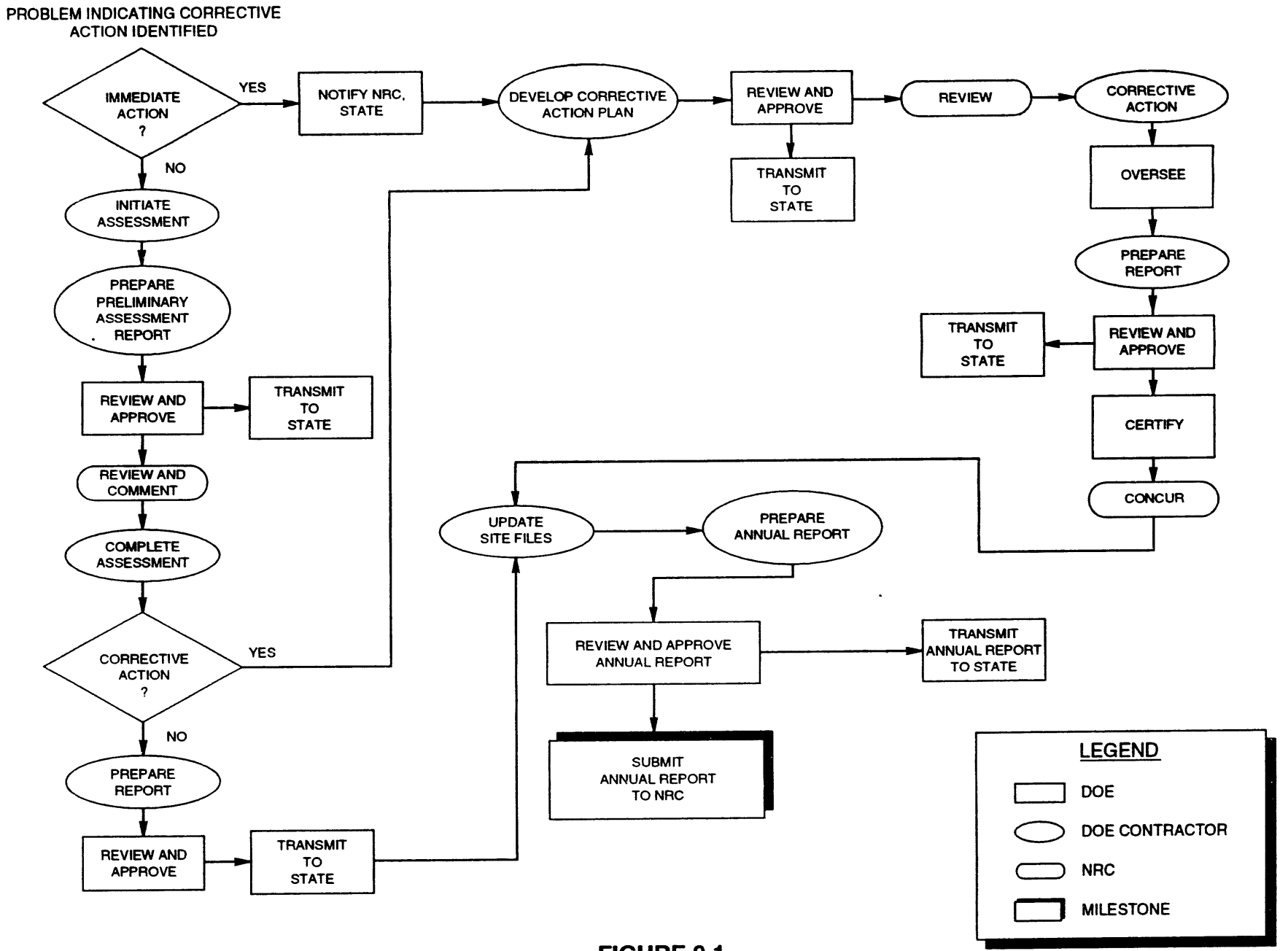
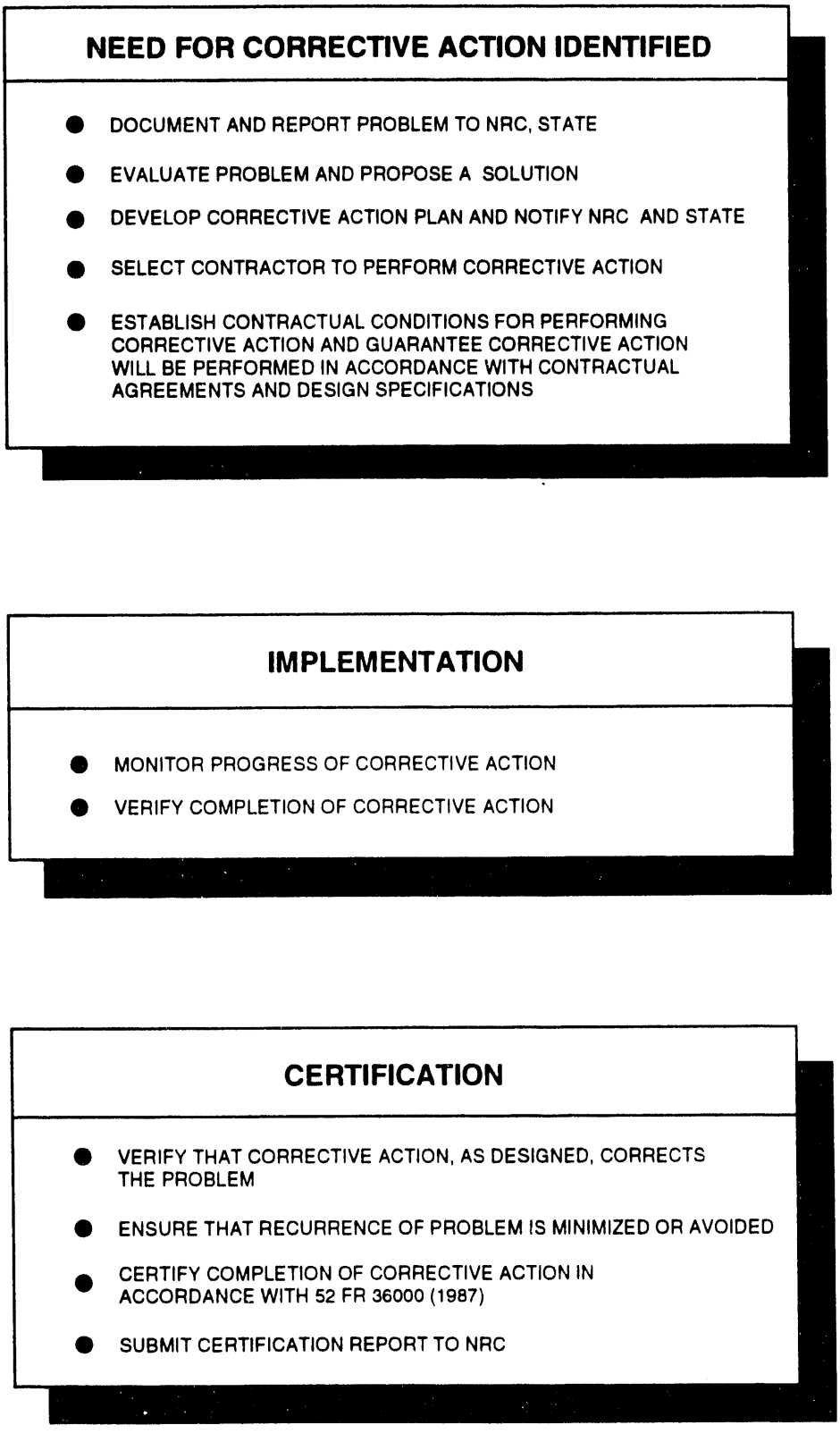


FIGURE 9.1
CORRECTIVE ACTION
UMTRA PROJECT LONG-TERM SURVEILLANCE PROGRAM

MODIFIED FROM DOE, 1992



MODIFIED FROM DOE, 1992

FIGURE 9.2
KEY ELEMENTS IN THE CORRECTIVE ACTION PROCESS

annual report. The NRC will be informed of all problems and solutions and all reports will be provided to the state of Colorado.

After corrective action is complete, all work completed will be certified in accordance with EPA standards. The NRC will review this certification. A copy of the certification statement will become part of the Durango permanent site file, as will all reports, data, and documentation generated during the corrective action.

10.0 RECORD KEEPING AND REPORTING REQUIREMENTS

The GJPO will maintain a Durango permanent site file containing all the information needed to prepare for and conduct site surveillance. All original deeds, custody agreements, and other property documents will be kept at the DOE Facilities and Property Management Division, Albuquerque, New Mexico. Copies of these documents also will be maintained in GJPO files. Carefully compiled, complete, and accurate reports of site-surveillance activities will be maintained in accordance with archival procedures set forth in 41 CFR Part 101 (1993) and 36 CFR Parts 1220-1238, Subchapter B, Records Management (1993).

As required by 55 FR 45591 (1990), the DOE will provide an annual report to the NRC documenting the results of the long-term surveillance program. Copies of the annual report will be provided to the state of Colorado and will be added to the Durango permanent site file. The annual reports and supporting documentation in the permanent site file will accomplish the following:

- Document the history of disposal site performance.
- Demonstrate to the NRC that licensing provisions were met.
- Provide the DOE and the NRC with the information needed to forecast future site surveillance and monitoring needs.
- Demonstrate to the public that site integrity has been maintained.

10.1 RECORDS

The GJPO will update the Durango permanent site file, as necessary, after completing the annual disposal site inspections. Original UMTRA Project records and files will be archived with the DOE UMTRA Project Office, Albuquerque, New Mexico. Copies of the documentation and annual updates will be kept in the permanent site file held by the GJPO, Grand Junction, Colorado.

Surveillance and maintenance documentation held at the GJPO will exist as a record collection separate from the UMTRA Project Document Control Center. As such, the records will be handled in accordance with DOE Order 1324.2A, *Records Disposition*, to ensure proper handling, scheduling, and disposition of the documents.

All information will be available for NRC and public review. The Durango permanent site file will include the following:

- Licensing documentation.
- The site-specific LTSP.

- Disposal site legal description, title, custody documentation, and cooperative agreements.
- Interagency agreements, authorizations, and access agreements.
- Documentation of rights of entry.
- Environmental assessment and finding of no significant impact.
- Disposal site characterization report and processing site characterization report.
- Final RAP and final design for construction.
- Pertinent design and construction documents and drawings.
- Site certification report (certification summary, completion, and final audit reports).
- As-built drawings.
- Site atlas (vicinity, topographic, and base maps).
- Baseline and aerial photographs.
- Ground water monitoring reports and records.
- Additional monitoring reports and records.
- Monitor well permits and well abandonment records.
- Annual reports to the NRC.
- Annual inspection reports and records.
- Follow-up or contingency inspection preliminary assessments, reports, and records.
- Custodial maintenance or repair reports and records.
- Corrective action plans, reports, and records.
- QA program plan.

Attachment 4 lists documentation that will be transferred to the GJPO for the long-term surveillance program.

10.2 REPORTS

The GJPO will provide an annual report to the NRC, documenting the results of the annual site inspections and any other activities conducted in conjunction with the long-term surveillance program. Criterion 12, Appendix A, 10 CFR Part 40 (1993), stipulates that the annual report must be submitted within 90 days after the date of the last UMTRA Project site inspection for that calendar year.

The GJPO will also submit reports to the NRC documenting follow-up or contingency inspections and any corrective action plans. If any unusual damage or disruption is discovered, Criterion 12, Appendix A, 10 CFR Part 40 (1993), requires that all preliminary inspection reports must be submitted within 60 days of the discovery.

The results of the ground water monitoring program will be reported annually to the NRC. The UMTRA Project Office will be responsible for preparing these ground water monitoring reports until this responsibility is transferred to the GJPO.

11.0 EMERGENCY NOTIFICATION AND REPORTING

The disposal cell was designed to comply with 40 CFR Part 192 (1993), with minimum maintenance and oversight for a period of 1000 years, or at least 200 years. However, unforeseen events could create problems that may affect the disposal cell's ability to remain in compliance with 40 CFR Part 192 (1993). Therefore, the DOE has requested notification from state and federal agencies of discoveries or reports of any purposeful intrusion or damage at the disposal site, as well as the occurrence of earthquakes, tornados, or floods in the disposal site area.

11.1 AGENCY AGREEMENTS

The DOE has negotiated notification agreements with the U.S. Geologic Survey (USGS) National Earthquake Information Center (Denver, Colorado), the Colorado State Office of the National Weather Service (NWS), and the La Plata County sheriff's department. Copies of draft notification requests are presented in Attachment 7. The designated point of contact for emergency notification is the GJPO 24-hour telephone line, 303-248-6070. This number is posted on the disposal site entrance sign so that members of the public can notify the DOE if problems are discovered.

In accordance with the agreements, the UMTRA Project Office will be the designated facility contact for the disposal site.

Returned response letters from all agencies will be kept in the Durango permanent site file.

Contact lists and telephone numbers for all agencies and parties with whom the DOE has entered into agreements will be updated annually, in conjunction with the site inspection, for inclusion in the disposal site-inspection report.

To further solidify written agreements with these agencies, the DOE GJPO will contact these agencies periodically to update them about the location of, and concerns for, the disposal sites.

11.2 UNUSUAL OCCURRENCES

The DOE has requested that the La Plata county sheriff's department notify the GJPO of any unusual occurrences in the disposal site area that may affect surface or subsurface stability.

The DOE has requested that the district ranger of the San Juan National Forest, Durango, Colorado, notify the GJPO of any unusual occurrences in the disposal site area that may affect surface or subsurface stability.

11.3 EARTHQUAKES

The DOE subscribes to the USGS Early Warning Service for notification when an earthquake is of sufficient magnitude to threaten a disposal site. This service provides data on the magnitude of the event and the location of the epicenter.

The USGS National Earthquake Information Center will notify the DOE GJPO if a seismic event occurs that fits any of the following descriptions:

- Any earthquake of magnitude 3.0 or greater, within 0.3 degree (about 20 mi [30 km]) of the site.
- Any earthquake of magnitude 5.0 or greater, within 1.0 degree (about 70 mi [110 km]) of the site.

11.4 METEOROLOGICAL EVENTS

The DOE will complete an agreement with the Colorado State Office of the NWS in Denver, Colorado, to notify the DOE GJPO within 8 hours of issuing a flash flood or tornado warning in La Plata County, Colorado.

12.0 QUALITY ASSURANCE

The GJPO is responsible for developing QA procedures specific to the UMTRA Project long-term surveillance program. The GJPO QA manual should specify the following requirements:

- Program planning.
- Program activities, including inspections, site maintenance, corrective action, and emergency responses.
- Monitoring that may be required.
- Personnel qualifications and training.
- Program surveillance and audits.
- Analytical QA.
- Analytical data validation.

All site inspections, monitoring data, records, photographs, maps, and other information related to the LTSP for the disposal site are subject to formal and unannounced audits by the DOE UMTRA Project Office or the NRC. Specific QA criteria have been developed for aerial photographs (DOE, 1992).

Ground water monitoring

Ground water monitoring is required for compliance with 52 FR 36000 (1987) at the disposal site. The ground water monitoring program will be conducted by the UMTRA Project Office until the site is licensed. Thereafter, site monitoring under the LTSP will be conducted by the GJPO.

QA activities for ground water monitoring will describe the policy, organization, functional activities, and QA/QC protocols needed to achieve the data quality objectives (DQO) of the intended use of the data. Specifically, QA activities will do the following:

- Identify the organizations involved with ground water monitoring activities and describe their operational, field, laboratory, and QA responsibilities.
- Summarize the DQOs for ground water restoration and the QA objectives for measuring data: precision, accuracy, representativeness, completeness, and comparability.
- Discuss procedures for field and laboratory analysis of environmental samples and for sample custody, handling, packaging, shipping, and documentation. Laboratory analyses of environmental samples include the following:

  - Inorganic, organic, and radiometric constituents.
  - Other chemical, physical, and water-quality parameters.

- Discuss QA in field measurements. The QA procedures for field and laboratory methods appear in applicable SOPs in the UMTRA Technical Assistance Contractor standard operating procedures manual (JEG, n.d.). When an SOP has not been completed for an activity, best management practices (standard industry procedures) will be followed.

- Describe data validation, QA/QC, data reporting calibration frequency, and preventive maintenance procedures for field and laboratory equipment.

- Establish guidance on internal QC checks, data reduction, validation, and reporting requirements for field and laboratory environmental samples.

- Present UMTRA Project system audit procedures and technical, field, and laboratory performance audit procedures.

- Suggest field and laboratory corrective actions and procedures for corrective actions resulting from audits.

- Present QA reporting procedures, outlining reporting requirements to management.

- Describe record keeping.

13.0 PERSONNEL HEALTH AND SAFETY

DOE Order 5480.1B, *Environment, Safety and Health (ES&H) Program for DOE Operations*, establishes personnel health and safety procedures for all DOE operations. The GJPO is responsible for health and safety procedures for GJPO personnel and subcontractors. The GJPO will determine health and safety requirements for its personnel in accordance with applicable orders and federal regulations. Because the disposal cell was constructed to control radium-226 and radon-222 releases from the RRM to within regulatory standards (52 FR 36000 (1987); 40 CFR §192.02(a) (1993)), radiation exposure tracking and dosimetry badges are not needed.

13.1 HEALTH AND SAFETY

The inspector's health and safety training and certifications, the locations and telephone numbers for emergency medical and law enforcement facilities, and the facility contact 24-hour telephone number will be verified before each site inspection.

Specific safety concerns at the disposal site include slip, trip, and fall hazards; animal, snake, and insect bites; heat and cold stress; fire hazards; puncture and cut hazards; and driving hazards.

Emergency medical and law enforcement

Local emergency medical and law enforcement agencies were briefed on the scope of work at the disposal site during the long-term surveillance and maintenance phase. The following 24-hour emergency numbers are pertinent:

- Fire: 911
- Ambulance: 911 or 303-247-4311
- Police/Sheriff: 911 or 303-385-2910; 303-247-1157

La Plata County has two hospitals, Mercy Medical Center and La Plata Community, both of which are located in Durango. The nearest hospital with ambulance service, a 24-hour emergency room, trauma service, and standard clinical facilities is Mercy Medical Center, approximately 5 mi (8 km) northeast of the disposal site (DOE, 1985). Mercy Medical center also has a "life flight" capability for transporting patients to Durango. Directions to the hospital from the site are as follows:

> Take County Road 211 to U.S. Highway 160, turn left on U.S. Highway 160 and continue to Park Avenue, turn right on Park Avenue. Mercy Medical Center Hospital is at 375 East Park Avenue.

The nearest residence (telephone) closest to the disposal site is approximately 0.75 mi (1.20 km) to the southwest where the Colorado Division of Wildlife

(CDOW) leases or rents a house. The CDOW maintains a shop at the residence and workers are present daily throughout the spring, summer, and fall work seasons. Other than this single residence, the nearest residents reside in Durango and Wildcat Canyon northeast and northwest of the site, respectively. Because a telephone may not be accessible, a mobile phone should be used (DOE, 1985).

13.2 REPORTABLE INCIDENTS

The inspection team should be briefed by the GJPO health and safety officer on potential site hazards and other requirements before site inspections or visits.

In accordance with DOE Order 5000.3B, *Occurrence Reporting and Processing of Operations Information*, any accident, injury, or environmental event (e.g., tornado, flood) occurring during the site inspection is a reportable incident. The condition or event will be reported to the GJPO facility manager or designated contact within 8 hours of the occurrence. The GJPO facility manager's 24-hour telephone number for reporting an incident is 303-248-6070.

14.0 LIST OF CONTRIBUTORS

The following individuals contributed to the preparation of this LTSP.

Name	Contribution
C. Silva (TAC)	Overall document responsibility; authorship
L. Ulland (TAC)	Document review
E. Artiglia (TAC)	Site management, document review
C. Yancey (TAC)	Document review
J. Lommler (TAC)	Engineering review
D. Tarbox (TAC)	Hydrology
P. Martinez (TAC)	Real estate
L. Keith, C. Slosberg (TAC)	Text processing
L. Wagner (TAC)	Graphic design
R. Meyers (TAC)	Engineering
A. Cree, D. Thalley, J. Torline (TAC)	Technical editing, document production, coordination

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Order 5000.3B, *Occurrence Reporting and Processing of Operations Information,* February 22, 1993, U.S. Department of Energy, Washington, D.C.

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10 CFR Part 40, "Domestic Licensing of Source Material," Title 10, *Code of Federal Regulations*, U.S. Nuclear Regulatory Commission (1993).

36 CFR Parts 1220-1238, "National Archives and Records," Subchapter B, Records Management, National Archives and Records Administration (1993).

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40 CFR Part 264, "Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities," U.S. Environmental Protection Agency (1993).

41 CFR Part 101, "Federal Property Management Regulations," General Services Administration (1993).

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52 FR 36000, "Standards for Remedial Actions at Inactive Uranium Processing Sites; Proposed Rule," September 24, 1987.

55 FR 45591, "Custody and Long-Term Care of Uranium and Thorium Mill Tailings Disposal Sites," October 30, 1990.

U.S. CODE

42 USC §7901 *et Seq.*, *Uranium Mill Tailings Radiation Control Act*, November 8, 1978.

ATTACHMENT 1

SITE OWNERSHIP/CUSTODY DOCUMENTATION

REAL ESTATE DOCUMENTATION
LONG TERM SURVEILLANCE PLAN
BODO CANYON DISPOSAL SITE
DURANGO, COLORADO

GENERAL

State acquisition of the Bodo Canyon disposal site was completed by the Remedial Program Management Unit of the Colorado Department of Health. The Bodo Canyon disposal site area acquired by the state contains approximately 120.6 acres (48.8 hectares [ha]). The site was acquired in two tracts. The first tract, tract 101, was acquired from the Colorado Department of Natural Resources, Division of Wildlife, through a Quit Claim Deed dated August 4, 1987. This tract consisted of 38.7 acres (15.7 ha). The second tract, tract 102, was acquired from the State Land Board and consisted of 81.36 acres (32.93 ha). The acquisition was effectuated through a Real Estate Exchange Agreement dated May 15, 1990.

The U.S. Department of Energy has requested that the state of Colorado forward draft deeds and supporting documentation for the transfer of the Bodo Canyon uranium mill tailings disposal site to the Federal Government pursuant to 42 USC §7914(f) of the Uranium Mill Tailings Radiation Control Act of 1978.

On October 20, 1993, the state of Colorado forwarded the documentation to the U.S. Army Corps of Engineers (USACE) for review. Upon completion of the review and determination that the documentation is complete and that no encumbrances are on the deeds, the USACE will effectuate the title transfer on behalf of the DOE.

DOCUMENTATION OF ACQUISITION

Disposal site/access

(1) Legal description: See attachment—Draft Deeds.

(a) TOWNSHIP THIRTY FIVE NORTH (T35 N, RANGE TEN WEST (R10 W) NEW MEXICO PRINCIPAL MERIDIAN (NMPM), LA PLATA COUNTY, COLORADO

In the East One-half (E 1/2) of Section Thirty-six, (Sec. 36), La Plata County, Colorado, more particularly described by metes and bounds as follows:

Beginning at a point on the east line of said Sec. 36, which point bears South 00° 39' 08" East a distance of 130.00 feet from the Northwest corner of Section Thirty-one (Sec. 31), Township Thirty-four and One-half North (T34 1/2 N), Range Nine West (R9W);

Thence West a distance of 2075.00 feet to a point;

Thence South a distance of 1700.00 feet to a point;

Then East a distance of 2094.35 feet to the east line of said Sec. 36;

Thence North 00° 39' 08" West a distance of 1700.00 feet to the point of beginning.

Containing 81.36 acres (32.93 ha), more or less.

(b) A Tract of land in Section Thirty-one (Sec. 31), Township Thirty-four and one half North (T34 1/2 N), Range Nine West (R9W), of the NMPM in La Plata County, state of Colorado being more particularly described as follows:

Beginning at a point on the West line of said Section 31, whence the Northwest corner of said Section 31 bears North 00° 39' 08" West a distance of 130.00 feet;
Thence East a distance of 1,000.00 feet;
Thence South a distance of 1,700.00 feet;
Thence West a distance of 980.65 feet to the West line of said Section 31;
Thence North 00° 39' 08" West a distance of 1,700.11 feet to the point of beginning;
Said Tract contains 38.7 acres (15.70 ha) more or less.
Also
Including all rights presently owned by the Grantor to any and all minerals, ore and metals of any kind and character and all coal, asphaltum, oil, gas, geothermal resources or other substances in, on or under the above described tract being conveyed.

(2) Filed: Deeds not yet recorded, see above for explanation.

REPOSITORY

Real estate correspondence and related documents are maintained and filed by the Property Management Branch, Facilities and Property Management Division, Albuquerque Operations Office, under the supervision of Corville J. Nohava, (505) 845-6450.

REFERENCE

42 USC §7901 *et seq.*, *Uranium Mill Tailings Radiation Control Act*, November 8, 1978.

ATTACHMENT 2

NRC CONCURRENCE AND LICENSING DOCUMENTATION

(DOCUMENTATION TO BE PROVIDED UPON NRC LICENSING)

ATTACHMENT 3

TOE DRAIN CLOSURE AND HOLDING POND DECOMMISSIONING PLAN

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF ACRONYMS AND ABBREVIATIONS

Acronym	Definition
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cm	centimeter
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
EPA	U.S. Environmental Protection Agency
ft	foot
in	inch
L	liter
m	meter
m^3	cubic meter
MCL	maximum concentration limits
mg/L	milligrams per liter
NRC	U.S. Nuclear Regulatory Commission
pCi/g	picocurie per gram
PVC	polyvinyl chloride
RCRA	Resource Conservation and Recovery Act
RRM	residual radioactive material
VP	vicinity property
yd^3	cubic yard

1.0 INTRODUCTION

Excess pore water from the tailings material has been collected in a toe drain collection system along the eastern slope of the Bodo Canyon disposal cell (disposal site) and has been draining into a 320,000 gallon (1,200,000 liters [L]) lined holding pond since November 1989 (Figures A3.1 through A3.4). To proceed with licensing the disposal site, the holding pond closure plan must be documented so that when the administrative decision is made to permanently shut off the toe drain, the decommissioning plan may be followed to allow for the removal of the contaminated sludge, liner, and contaminated soil to a suitable repository. The decision is based upon the observation that sufficient water has been drained from the cell to preclude the possibility of the seeps reappearing or producing unacceptable hydrostatic pressures on the slope of the cell. Once this has been established, the toe drain system will be discontinued. A flow chart of the toe drain closure and holding pond decommissioning plan is shown in Figure A3.5. All regulatory and permitting requirements in effect at the time the closure plan is initiated will be applied to the removal of contaminated materials and closure of the site. Subsequent to the removal of contaminated materials, the toe drain will be permanently sealed, the site will be regraded, and suitable erosion protection measures will be incorporated into the existing design features of the disposal cell.

BACKGROUND

The toe drain and holding pond were installed after extensive seepage appeared on the eastern slope of the disposal cell during construction in the fall of 1988. The toe drain enabled cell closure to proceed by allowing for the proper placement of the clay cover on unsaturated tailings in the area where the seep appeared. This procedure also prevented hydrostatic pressure from developing against the inside surface of the sideslope. Other alternatives for dewatering the cell were considered, such as deep wells, an ejector system, and horizontal drains. The toe drain was selected because it allowed the disposal cell construction to proceed with minimal effect on the original completion schedule.

Because the seep initially appeared just above the top of the low-permeability liner (at an elevation of 7052 feet (ft) (2149 meters [m]), just above the top of the clean fill dike, the tailings were thought to be saturated from the base of the cell to the top of the clean fill dike. The source of the water likely resulted from the significant volumes of water used for dust control (80,000 gallons [300,000 L] per day) and the water added for compaction requirements. A phreatic surface was recorded in monitor wells that were installed in the tailings material. Assuming full saturation to the base of the cell, 15,000,000 gallons (57,000,000 L) of drainable water were estimated to reside in the cell. However, when test pits were excavated for the construction of the toe drain, water was observed to be perched above a vicinity property (VP) low-permeability layer. Extensive areas below the VP material were not saturated. Additional evidence for the perched zone of saturation above the VP layer was given by the flow rates recorded from the dewatering wells, which were installed to construct the trench and to dewater the cell as much as possible. The flow rates were directly proportional to a saturated thickness corresponding to the thickness between the top of the VP layer and the measured phreatic surface. Additional lab testing of soil samples above and below the VP layer confirmed the perched zone of saturation within the tailings (DOE, 1991).

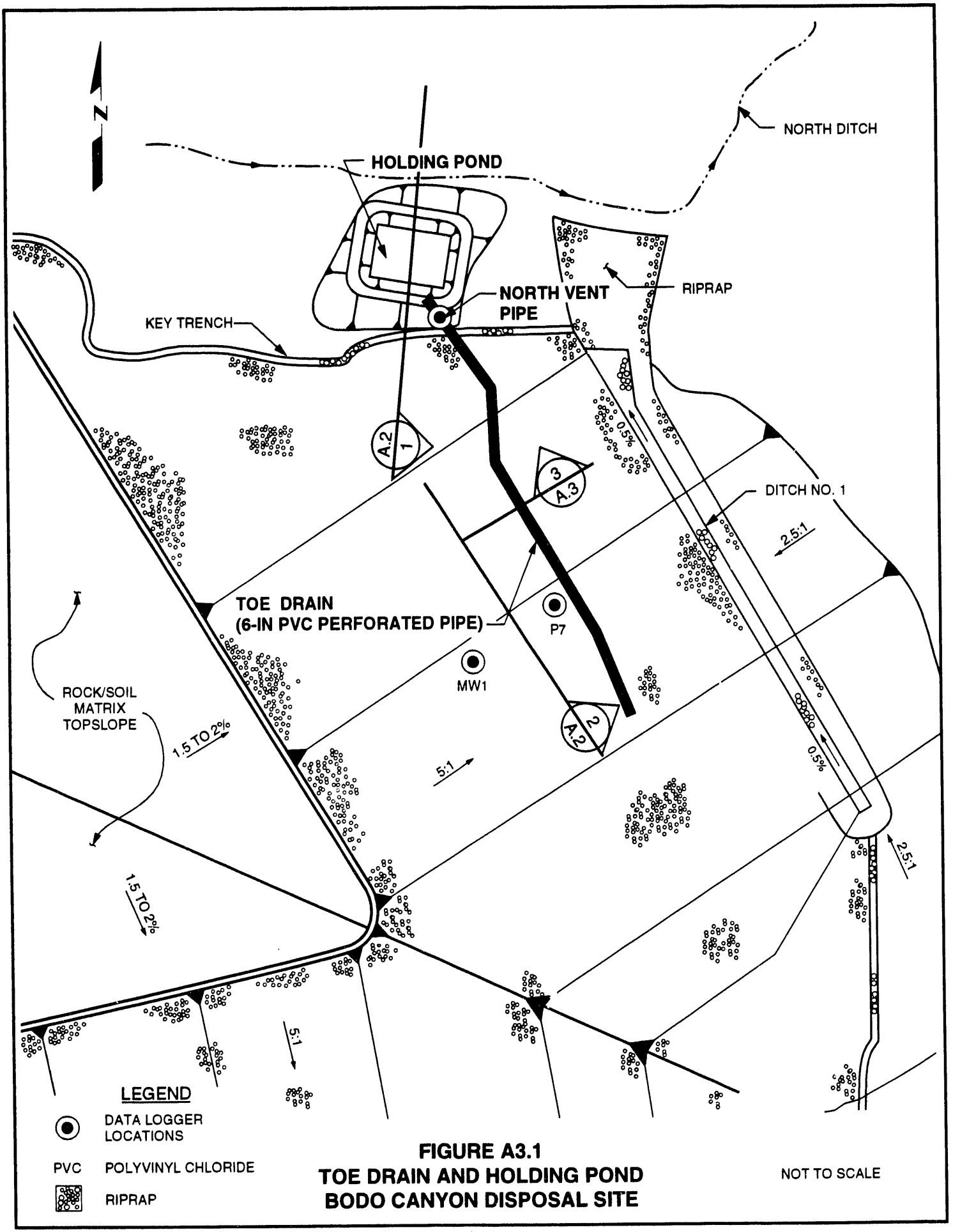


FIGURE A3.1
TOE DRAIN AND HOLDING POND
BODO CANYON DISPOSAL SITE

NOT TO SCALE

MAC: SITE/DUR/LTSP/TOEDRAIN&HOLDPOND

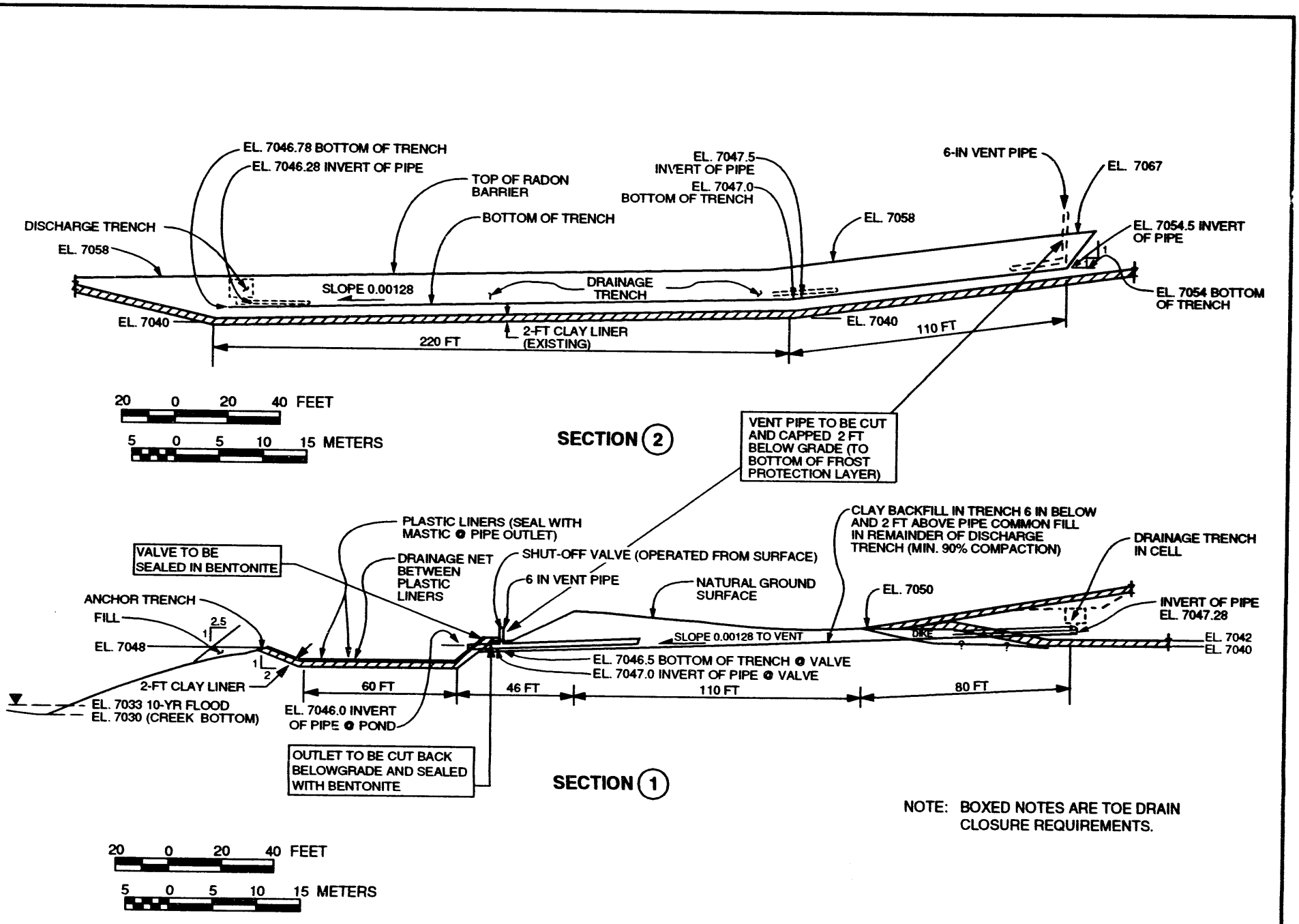
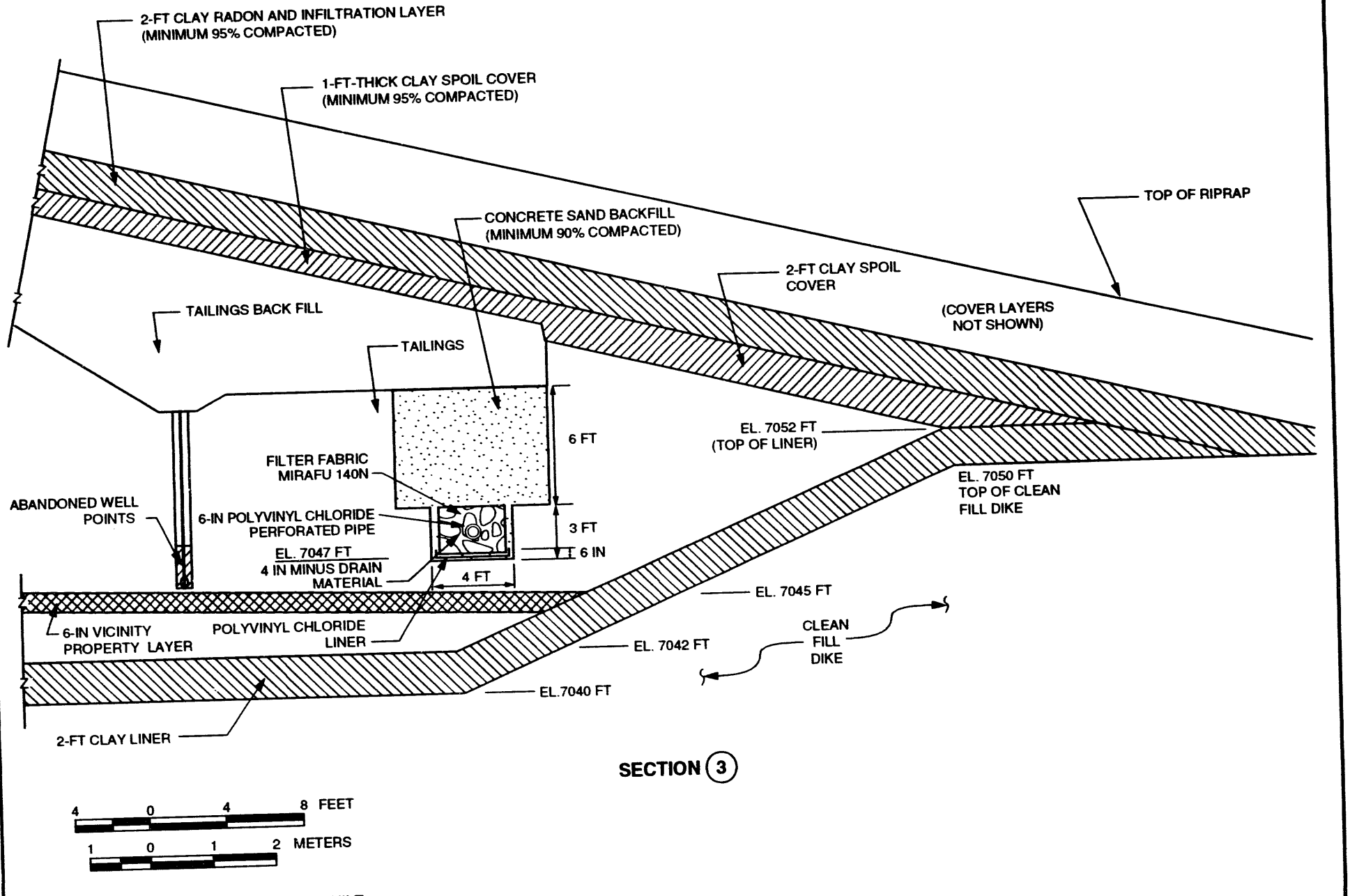


FIGURE A3.2
PROFILE OF DISCHARGE TRENCH

MAC: SITE/DUR/LTSP/XSECT1

DURLTSP

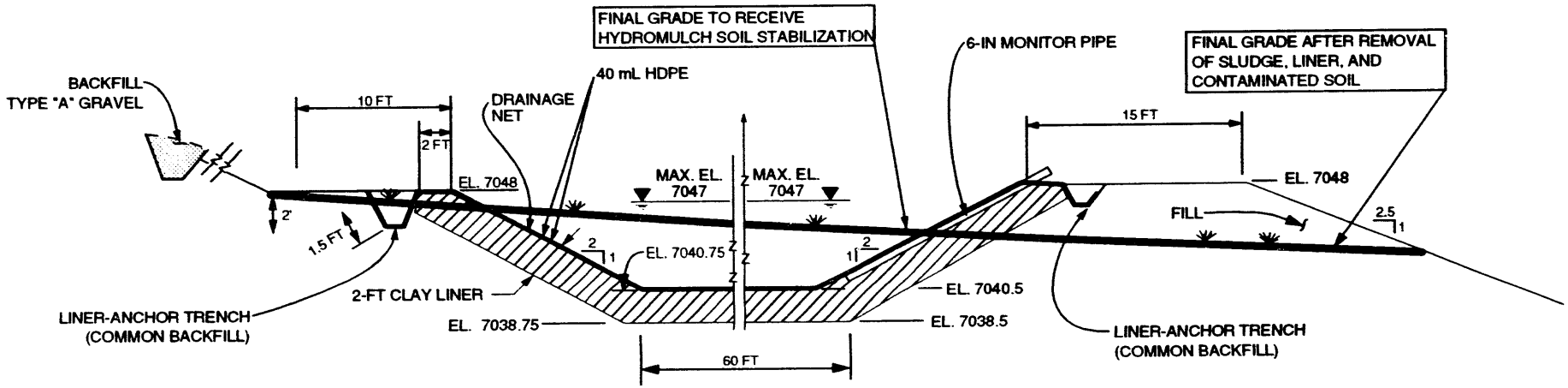


NOTE: ALL DESCRIPTIONS ARE AS-BUILT.

FIGURE A3.3
TYPICAL CROSS SECTION OF DRAINAGE TRENCH

DURLTSP

MAC: SITE/DUR/LTSP/TYPSECDRN2



NOT TO SCALE

NOTE: BOXED NOTES ARE HOLDING POND DECOMMISSIONING PLAN REQUIREMENTS.

LEGEND

HDPE	HIGH-DENSITY POLYETHYLENE
mL	MILLILITER
▼	WATER LEVEL

FIGURE A3.4
HOLDING POND - SITE RESTORATION

MAC: SITE/DUR/LTSP/XSECT2

DURLTSP

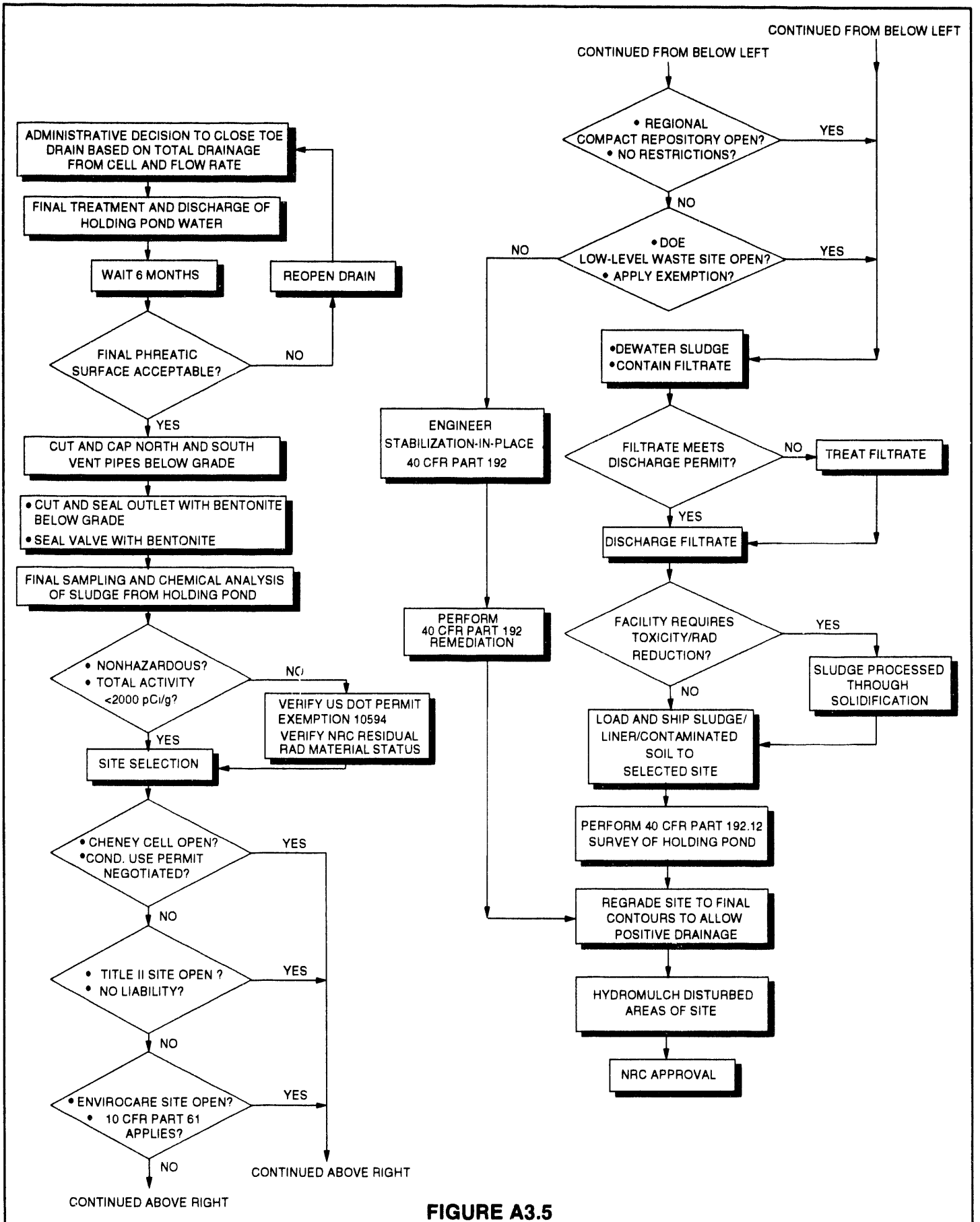


FIGURE A3.5
TOE DRAIN CLOSURE AND HOLDING POND DECOMMISSIONING FLOW CHART

The VP layer creating the perched condition was installed at the end of the 1987 construction season as a protective cover through the winter shutdown. The average thickness of the layer was 6 inches (in) (15 centimeters [cm]) and consisted primarily of clay. The extent of the VP layer was estimated from an aerial photo taken during the winter shutdown and from quality assurance records taken during the fall of 1987. The VP layer dipped to the northeast from a maximum elevation of 7070 ft (2150 m), to an elevation of 7045 ft (2147 m) at the clean fill dike. The VP layer was encountered along the entire length of the excavation for the toe drain, from north to south (DOE, 1991).

The perched zone of saturation significantly reduced the estimated volume of drainable water within the pile. Using a saturated thickness from the top of the VP layer to the recorded phreatic surface, some 2,000,000 gallons (7,600,000 L) of drainable water were estimated to be in the cell. A 17-well dewatering system pumped an estimated 630,000 gallons (2,400,000 L) of water during the summer and fall of 1989. Well points used to dewater the excavation for the toe drain trench had removed another 100,000 gallons (380,000 L). Thus, once the toe drain was operational, it was estimated that 1,300,000 gallons (4,900,000 L) of pore water would potentially drain from the cell if the drain were to remain open indefinitely (DOE, 1991). The flow rate from the toe drain has been recorded at fairly regular intervals since its opening in November 1989, and approximately 2 million gallons (7,600,000 L) of pore water has been treated and discharged from the holding pound through the fall of 1993. In addition, an estimated 325,000 gallons (1,230,000 L) of pore water have evaporated from the pond, based on an evaporation rate of 42 in (107 cm) per year and an average precipitation rate of 19 in (48 cm) per year. Therefore, an estimated 2,300,000 gallons (8,800,000 L) of water have been drained from the cell up to the fall of 1993.

Models developed using the drainage properties of the tailings and conditions at the site predicted flow from the toe drain would continue for a period of up to 10 years from the initial opening of the drain (JEG, 1990). Average flow rates from the drain are somewhat higher than predicted after 4 years of operation.

The drained water is retained in the holding pond and is treated approximately every 6 months before discharge into the north arroyo, some 150 yards (140 m) northeast of the site. Lime is added to the water to precipitate the dissolved solids, metals, and uranium, which then settle out as a sludge on the bottom of the pond. Sulfuric acid is then applied to the remaining water, to return the pond to an acceptable pH balance. Pond samples are tested to ensure that the treated water is within National Pollutant Discharge Elimination System discharge limits. Once the laboratory report shows the water is safe for discharge, the water is siphoned into the north arroyo through a polyvinyl chloride (PVC) outlet line.

2.0 CONTAMINANT CHARACTERIZATION

Of primary importance to the decision-making process for decommissioning the holding pond is the characterization of the contaminants in the precipitated sludge and pond water. Samples from the pond water, sludge retained on a Buchner funnel, and filtrate from sludge dewatering were analyzed. Reviewing the chemical analyses of the sludge and of the pond water samples resulted in (TAC, 1992) the following conclusions:

- The sludge would not be classified as a Resource Conservation and Recovery Act (RCRA) (42 USC §3251 (1976)) hazardous waste because no samples exceeded the maximum toxicity concentration levels based on the toxicity characteristic leaching procedure.

- The mean total radioactivity of the sludge samples was less than the 2000 picocuries per gram (pCi/g) limit that classifies shipments as radioactive hazardous material according to U.S. Department of Transportation (DOT) hazardous material regulations.

- Concentration of organic constituents were below detection limits.

- Inorganic constituents were within the discharge limitations set by the discharge permit issued by the state of Colorado for the holding pond.

- The maximum concentration limits (MCL) of U.S. Environmental Protection Agency (EPA)-proposed ground water standards (52 FR 36000 (1987)) were exceeded for molybdenum, selenium, uranium, and gross alpha from both waters sampled. Arsenic exceeded its MCL in some of the filtrate samples. Sulfate was high in both waters, with concentrations greater than 1600 milligrams per liter (mg/L).

- The high sulfide concentrations indicate that the oxidation-reduction potential is reducing. Thus, if the sludge became oxidized, the molybdenum, uranium, and vanadium could be mobilized with solution concentrations exceeding those measured from the samples themselves.

This characterization has been consistent for two different sampling periods (TAC, 1992; MK-E, 1993). The potential for significant changes in the contaminant characterization of the sludge and holding pond water is small, except for possible seasonal fluctuations, caused by equilibrium conditions predominate over time and the flow continues to decrease. However, before pond closure, a final sampling round will be conducted. The sludge will be analyzed to confirm that the characteristics changed significantly, and to ensure that the proper administrative and regulatory decisions are made for final disposal of the sludge.

These characteristics will allow shipping the sludge and holding pond liner in bulk, without triggering DOT hazardous material restrictions. The current DOT Exemption 10594 for shipping low-level radioactive mill tailings and materials contaminated with radionuclides from these tailings would apply to sludges that exceed 2000 pCi/g. Further, the U.S. Nuclear Regulatory Commission (NRC) classifies the sludge as a residual radioactive

material (RRM), which requires that the sludge be disposed of in a facility that provides perpetual care under long-term licensing agreements with the NRC (MK-E, 1991). Title I and Title II sites licensed by the NRC under 10 CFR Part 40 (1993) qualify as facilities that may receive the sludge for permanent disposal. U.S. Department of Energy (DOE) Order 5820.2A, *Radioactive Waste Management*, allows small quantities of RRM to be disposed of as low-level radioactive waste.

2.1 SLUDGE DISPOSAL ALTERNATIVES

Various alternatives may be available for disposal of the sludge, liner, and contaminated soil when the administrative decision is made to decommission the toe drain and holding pond. The following locations will most probably be available to receive the holding pond contaminated materials when the toe drain and holding pond are decommissioned:

- An UMTRA Project disposal cell still open.
- A Title II site still open.
- A commercial radioactive waste disposal facility (such as the Envirocare site at Clive, Utah).
- A regional compact repository licensed under 10 CFR Part 61 (1993).
- A DOE low-level waste disposal site.

Each option is discussed below, with the conditions and restrictions that may be in effect when the toe drain and holding pond are decommissioned.

2.1.1 UMTRA Project disposal cell

The Cheney disposal cell near Grand Junction, Colorado, has the capability of receiving 500,000 cubic yards (yd^3) (380,000 cubic meters [m^3]) of VP materials until at least 1998. This is the UMTRA Project site most likely to be open to receive the Bodo Canyon sludge. All other sites in Colorado are scheduled for completion well before closure of the Cheney disposal cell. One possible restriction to using the Cheney cell as the repository for the sludge is the Mesa County Conditional Use Permit, which precludes the disposal of out-of-county material. Negotiations would need to be initiated with Mesa County to gain an exclusion to this restriction for the Bodo Canyon contaminated materials.

2.1.2 Title II sites

If the Cheney disposal cell or any other UMTRA Project disposal cell is unable to receive the sludge, Title II sites may be acceptable repositories because they are perpetual care facilities licensed under 10 CFR Part 40 (1993). The closest site is the UMETCO Minerals site at Uravan, Colorado. However, potential

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (42 USC §9601 (1980)) liability concerns must be resolved before this site could be pursued as the receptor of the sludge. Other Title II sites without potential CERCLA liability may be more likely options; however, transportation costs would be higher.

2.1.3 Commercial radioactive waste disposal facility

The Envirocare site at Clive, Utah, may qualify as an acceptable repository for the Bodo Canyon contaminated materials. Along with other commercial radioactive waste disposal facilities licensed under 10 CFR Part 61 (1993) by the NRC or agreement states, the Envirocare site has the necessary long-term requirements for stability and institutional controls. This site can accept radioactive materials with less than 2000 pCi/g; the mean total activity of the sludge is within this limit, as indicated by the most recent sampling and analysis activities (TAC, 1992; MK-ES, 1993).

2.1.4 Regional compact repository

With the exception of Envirocare, commercial disposal facilities currently in operation are likely to be closed and replaced by regional compact repositories by the time the toe drain and holding pond are decommissioned. These facilities are being developed to accept civilian low-level radioactive waste and may be operating by the time the holding pond is decommissioned. Because none of these sites is operational, potential waste acceptance restrictions are not known. Minimum requirements identified for these sites by the NRC in 10 CFR §61.56 (1993) would not preclude the acceptance of contaminated materials from the holding pond as it has been characterized to date.

2.1.5 DOE low-level waste disposal site

The Nevada Test Site or the Idaho National Engineering Laboratory are possible DOE facilities that may receive low-level radioactive waste from the holding pond. DOE Order 5820.2A identifies the minimum waste acceptance criteria for DOE low-level waste disposal sites. Individual DOE facilities and state regulators may have site-specific acceptance criteria that would require the UMTRA Project to apply for a special exemption. For example, the Nevada Test Site accepts only radioactive and mixed waste from DOE defense programs.

2.1.6 40 CFR Part 192 remediation

If none of the alternative sites above are able to receive the sludge and contaminated materials from the holding pond, an on-site remediation plan will be implemented under EPA 40 CFR Part 192 (1993) regulations. A small containment cell that meets these standards will be engineered and constructed within the boundary of the disposal site, so that long-term surveillance of the small cell is conducted in conjunction with long-term surveillance of the main disposal cell.

2.2 PREPARING SLUDGE FOR SHIPMENT

The volume of sludge to be shipped is dependent on the duration and rate at which the pore water continues to drain from the cell. An estimated 44 yd^3 (34 m^3) of sludge (of which 85 to 90 percent is water) was precipitated out during the first year of operation (MK-ES, 1991). Since the toe drain flow rate is decreasing, it may be reasonable to estimate that 40 yd^3 (30 m^3) of sludge is deposited per year over the service life of the holding pond. Assuming a 10-year total operating life of the pond, approximately 400 yd^3 (300 m^3) of sludge could be dewatered and shipped to the selected permanent repository.

The sludge will be dewatered on the site. The filtrate water would be contained and analyzed for compliance with the discharge permit in effect at that time. If necessary, the filtrate will be retreated before discharge into the arroyo. Assuming the volume of the dried sludge is 30 percent of the wet volume, approximately 120 yd^3 (90 m^3) of dried sludge could be transported at the end of 10 years.

The dewatered sludge will be reanalyzed for toxicity characteristics and for total activity to confirm its suitability for shipment as a nonhazardous material and to maintain its RRM status. Analysis of the dewatered sludge is not expected to show significant variation from analyses performed to date.

If the sludge is classified as expected, the dried sludge can be hauled to the permanent repository. The high density polyethylene liner will be cut into sections that may be hauled with the sludge. After the liner is removed from the holding basin, the exposed subgrade soil will be inspected for any signs of leakage and spillage. Upon removal and shipment of the contaminated material, a radiological verification survey of the holding pond area will be conducted to confirm removal of contamination to within the allowable RRM standard as defined in 40 CFR §192.12 (1993). Soil samples will also be analyzed for toxicity characteristic for organic and inorganic contaminants. Any soil that does not meet the standards for activity or toxicity will be removed and shipped to a designated permanent repository site.

If the facility accepting the sludge requires toxicity and/or radiological reduction, the sludge could be processed through solidification technology using portland cement or fly ash. The high-efficiency solids contractor will produce a uniform mixture of cement, sludge, and water that will be transferred to a permanent mold for curing the mass. The mold also will serve as the container for shipment. After the mixture sets up, it will be tested for physical integrity and chemical stability before shipment.

2.3 TRANSPORTING SLUDGE AND CONTAMINATED MATERIALS

Current characterization data indicate the sludge and related contaminated material will not need to be shipped as hazardous material. The mean total activity of the dried or processed sludge and related materials is expected to be

less than 2000 pCi/g. As transported material it will not require classification as radioactive hazardous material according to DOT regulations. As such, no restrictions or special precautions will be required to transport the contaminated material from the holding pond, except as covered by normal federal and state transportation regulations. If the activity of the sludge and contaminated materials exceeds 2000 pCi/g, they will be shipped under DOT Exemption 10594 for shipping low-level radioactive mill tailings, as material contaminated with radionuclides from the tailings.

The contaminated materials will be hauled with vehicles that will prevent spillage along the haul route. Haulers will be fully enclosed so that material will not be stripped from the vehicle during transport. Before leaving the loading area, the haulers will be inspected for any contaminated material that may have spilled on the exterior of the vehicle during loading. All such material will be removed and that area of the vehicle will be washed down. Wash-down water will be contained and, if necessary, treated with filtrate water from the sludge dewatering process. At the receiving repository, the vehicle will undergo decontamination requirements as established by the receiving facility.

3.0 TOE DRAIN CLOSURE

The toe drain will be permanently closed when it has been determined that the remaining volume of drainable pore water from the cell will not develop unacceptable hydrostatic pressures within the cell or produce seepage at the cell boundary. A 6-month waiting period after the initial closing of the drain will be needed to confirm that the steady-state phreatic surface of the pore water within the tailings pile is below the elevation of 7052 ft (2150 m). This elevation is based on a measurement of the top of the clean fill dike at the northeast edge of the cell foundation, and of the 2-ft (0.6-m)-thick, low-permeability layer placed on its top. If the phreatic surface rises above this level within the 6-month waiting period or has not achieved a steady-state condition, the drain will be reopened and the drainage/treatment cycle will continue until maximum steady-state conditions are met. To permanently seal the drain after closing the valve, the valve box will be sealed with a bentonite plug and the outlet of the PVC drain into the holding pond will be cut back to belowgrade. The outlet pipe then will be packed with bentonite and the end of the pipe will be encased in concrete. The vent pipes at the valve box and at the upper southern end of the drain in the disposal cell slope will be cut to 2 ft (0.6 m) below existing grade; the top of each stem then will be capped and sealed and the surface areas around the vent pipes will be restored to their original conditions.

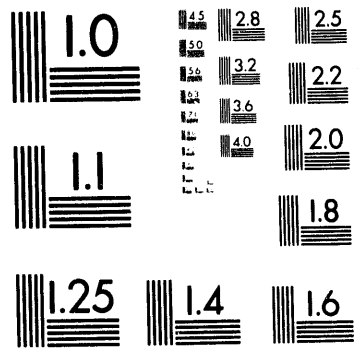
3.1 SITE RESTORATION

After all sludge and contaminated materials are removed from the holding pond area of the disposal site, the remaining soil berm of the holding pond will be regraded to allow for proper drainage and to minimize the development of high velocity or concentrated flows. The holding pond site receives sheet flow runoff from the northeast face of the disposal cell and will be regraded to allow the sheet flow to drain naturally to the north and east, into the adjacent arroyo and outfall structure of ditch no. 1. Specifications require compacting the fill material to 90 percent Standard Proctor Density (American Society for Testing and Materials D698) (ASTM, 1988).

When the area is regraded, erosion protection measures will be implemented. Primarily, the disturbed areas will be seeded with a specified hydromulch solution to promote rapid development of a native grass cover. The hydromulch specification will be identical to that used during the remedial action of the disposal cell and processing site. If it is required by engineering calculations, durable riprap will be placed to prevent gullying of outfall drainage from the restored site.

3.2 NRC APPROVAL

The NRC will perform a final site inspection of the restored site. All issues regarding the restoration will be resolved to the satisfaction of the NRC. When all issues are resolved, NRC administrative approval will be recorded and the restored site will fall under the long-term surveillance program of the Bodo Canyon disposal site.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1.1
1.25
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2.8
3.2
3.6
4.0
4.5
5.0
5.6

2 of 2

4.0 REFERENCES

ASTM (American Society for Testing and Materials), 1988. *1988 Annual Book of ASTM Standards*, Volume 04.08 Soil and Rock, Building Stones; Geotextiles, Standard D 698-78, Method A, "Standard Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 4.4-lb (2.49-kg) Rammer and 12-in (305-mm) Drop," ASTM, Philadelphia, Pennsylvania.

DOE (U.S. Department of Energy), 1991. *Remedial Action Plan and Site Design for Stabilization of the Inactive Uranium Mill Tailings Site at Durango, Colorado, Attachment 5, Dewatering Report*, UMTRA-DOE/AL-050503.0000, DOE UMTRA Project Office, Albuquerque Operations Office, Albuquerque, New Mexico.

MK-E (Morrison Knudsen-Engineers, Inc.), 1993. "Durango Seep Water Sludge Analysis," MK-E Document Number 3885-DUR-I-01-05094-01, available at the DOE Project Office, Albuquerque Operations Office, Albuquerque, New Mexico.

MK-E (Morrison Knudsen-Engineers, Inc.), 1991. "Toe Drain Pond Operation and Decommissioning," MK-E Letter Number 91-3050-B02, available at the DOE Project Office, Albuquerque Operations Office, Albuquerque, New Mexico.

TAC (Technical Assistance Contractor), 1992. "TAC Action Memo #378; Results of Sludge Analyses," Jacobs Engineering Group Inc., Document Number JEGA/UMT/1192-0637, available at the DOE UMTRA Project Office, Albuquerque Operations Office, Albuquerque, New Mexico.

TAC (Technical Assistance Contractor), 1990. "Modeling of Transient Drainage," Jacobs Engineering Group Inc., Calculation Number DUR-09-90-12-01-00, available at the DOE UMTRA Project Office, Albuquerque Operations Office, Albuquerque, New Mexico.

DOE ORDERS

Order 5820.2A, *Radioactive Waste Management*, September 26, 1988, U.S. Department of Energy, Washington, D.C., UMTRA Project Office, Albuquerque Operations Office, Albuquerque, New Mexico.

FEDERAL REGISTER

52 FR 36000, "Standards for Remedial Actions at Inactive Uranium Processing Sites; Proposed Rule," September 24, 1987.

UNITED STATES CODES

10 CFR Part 40, "Domestic Licensing of Source Material," U.S. Nuclear Regulatory Commission (1993).

10 CFR Part 61, "Licensing Requirements for Land Disposal of Radioactive Waste," U.S. Nuclear Regulatory Commission (1993).

40 CFR Part 192, "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings," U.S. Environmental Protection Agency (1993).

ATTACHMENT 4

PERMANENT SITE FILE INDEX

DURANGO PERMANENT SITE FILE INDEX

LICENSING DOCUMENTATION

A. Long-term Surveillance Plan (LTSP) (final)

B. Prelicensing Custodial Care

C. U.S. Nuclear Regulatory Commission Acceptance of LTSP

D. General License Takes Effect

DOCUMENTATION OF DOE TITLE/CUSTODY

A. Documentation:

- State
- Federal
- Tribal

B. Legal Description

C. Custodial Care Agreements

NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) DOCUMENTATION

A. Environmental Impact Statement/Environmental Assessment

B. Record of Decision/Finding of No Significant Impact

C. Additional NEPA

D. Mitigation Action Plan

REMEDIAL ACTION DOCUMENTATION

A. Disposal Site Characterization Report

B. Remedial Action Plan/Remedial Action Selection Report

- Concurrence Pages (signed)

C. Draft/Final Technical Evaluation Report

D. Final Design for Construction

E. Additional Design/Construction Documents/Drawings

F. Final close-out Inspection Report

G. Site Certification Report/Package

- U.S. Department of Energy Certification/Summary
- Final Completion Report
- Final Audit Report
- Completion Report Review
- Certification Pages (signed)

AS-BUILT CONSTRUCTION

- Drawings and maps

PHOTOGRAPHS

A. Construction Photographs

B. Aerial Photographs

C. Close-out/Inspection Photographs

D. Verification and Orientation/Initial Prelicensing Inspection Photographs

MONITORING DOCUMENTATION

A. Active monitoring wells

B. Location of inactive (abandoned) monitor wells

C. Monitoring Station Records

D. Monitoring Reports

E. Programmatic Procedures

AGREEMENTS

A. Interagency

B. Individual/Private

UMTRA PROJECT DOCUMENT CONTROL CENTER SITE FILE INDEX

ATTACHMENT 5

SITE INSPECTION PHOTO LOG

Page ___ of ___

SITE INSPECTION PHOTO LOG

Site: _____ Site Activity: _____

Date: _____ Time of Day: From _____ to _____

Weather Conditions: _____

Roll Number: _____ Film Type: _____ Number of Exposures _____

Photo Number	Location (Azimuth[a])	Description

Photographer: _____ _____

Printed Name Signature

[a]Declination angle: 14.7 degrees east of true north.

ATTACHMENT 6

INITIAL SITE INSPECTION CHECKLIST

INITIAL SITE INSPECTION CHECKLIST FOR THE BODO CANYON DISPOSAL SITE

Date of Last Inspection: _____ Reason for Last Inspection: _____

Responsible Agency*: U.S Department of Energy (DOE), Grand Junction Projects Office (GJPO)

Address: P.O. Box 2567, Grand Junction, Colorado 81502-2657

Responsible Agency Official: _____

Inspection Start Date and Time: _____

Weather Conditions at Site: _____

Inspection Completion Date and Time: _____

Chief Inspector: _____
Name Title Organization

Assistant Inspector: _____
Name Title Organization

A. GENERAL INSTRUCTIONS

1. All checklist items must be completed, and detailed comments made, to document the results of the site inspection. The completed checklist will be incorporated as part of the field record of the inspection. Additional pages should be used, as necessary, to ensure that a complete record is made, and should be numbered and attached upon completion of the inspection.

2. Inspectors are to provide an up-to-date résumé or vitae for inclusion in the inspection report.

3. Any checklist line item marked by an "*" that is checked by an inspector must be fully explained or an appropriate reference to previous reports provided. The purpose of this requirement is to provide a written explanation of the inspector's observations and rationale for conclusions and recommendations. Explanations are to be placed on additional attachments and cross-referenced appropriately. Explanations, in addition to a narrative, will take the form of sketches, measurements, and annotated site atlas overlays.

*Responsibility for site inspections assigned by DOE UMTRA Project Office, Albuquerque, to DOE GJPO, November 6, 1990.

4. The site inspection will be a walking inspection of the entire site, including the perimeter and sufficient transects to inspect the entire surface and all features specifically described in this checklist. Every monument, site marker, sign, monitoring well, and erosion control marker will be inspected.

5. A set of color print 35-mm photographs is required. Sufficient photographs will be taken to compare to baseline photographs, to determine if there are any significant differences in site appearance. In addition, all anomalous features or new features (such as changes in adjacent area land use) are to be photographed. A photo log entry will be made for each photograph taken.

6. Field notes taken to assist in completion of this checklist will become part of the inspection record. No form is specified; the field notes must be legible and of sufficient detail to enable review by succeeding inspectors and the responsible agency.

B. PREPARATION (to be completed prior to site visit)

	Yes	No
1. License (includes long-term surveillance and maintenance plan) reviewed.		
2. Site as-built plans reviewed and base map, with copies of the following site atlas overlays obtained:		
a. Adjacent off-site features and land use; fences, gates, and signs; access roads and paths.		
b. Survey boundary monuments, site markers, settlement plates, aerial photo ground controls, ground photo locations.		
c. Monitoring wells, site drainage, diversion channels.		
d. Planned inspection transects and vegetation cover.		
e. Others.		
These overlays will be used to identify site features and record, as appropriate, field data.		
3. Previous inspection reports reviewed.		
a. Were anomalies or trends in modifying processes detected on previous inspections?		
b. Was a Phase II inspection conducted?		
c. Was custodial maintenance performed?		

	Yes	No
d. Was contingency repair work done as a result of the Phase II inspection?		

4. Site custodial maintenance and contingency repair records reviewed.

	Yes	No
a. Has site contingency repair resulted in a change from as-built conditions?		
b. Are reviewed as-builts available that reflect contingency repair changes?		

	Yes	No
5. Adjacent property entry approval obtained (attach signed access agreement).		

6. Aerial photos, if taken since last inspection, reviewed. For each set, enter date taken, scale, and if interpreted.

Set	Date	Scale	Interpreted Yes	Interpreted No
1.	_____	_____	—	—
2.	_____	_____	—	—
3.	_____	_____	—	—

	Yes	No
7. Were any of the following suggested by examination of aerial photographs (if yes, give photo set date and indicate if item noted by interpreter or inspector):		
a. Intrusion by man?		
b. Intrusion by animals?		
c. Channelized erosion on slopes?		
d. Change in area drainage?		
e. Landslides?		
f. Creep on slopes?		
g. Obstruction of diversion channels?		

	Yes	No
h. Bank erosion of diversion channels?		
i. Seepage?		
j. Cracking?		
k. Change in vegetative cover?		
l. Displacement of fences, site markers, boundary markers, or monuments?		
m. Change in adjacent land use?		
n. Evidence of radioactive sands exposure or transport?		

8. From as-builts, or subsequent inspection reports, note distance and azimuth from designated site location, such as a monument, to adjacent off-site features that could eventually affect integrity of site.

Off-site feature	Site monument no.	Distance	Azimuth
1. _____	_____	_____	_____
2. _____	_____	_____	_____
3. _____	_____	_____	_____

9. Assemble and check out the following equipment, as needed, to conduct inspections:

   a. Cameras, film, and miscellaneous support equipment.
   b. Binoculars.
   c. Tape measure.
   d. Optical ranging device.
   e. Brunton compass.
   f. Photo scale stick.
   g. Erasable board.
   h. Plant press, plastic bags for vegetation.
   i. Keys to locks.
   j. Bolt cutters.
   k. Hand lens.
   l. Clipboard.
   m. Others.

C. SITE INSPECTION

	Yes	No
1. Adjacent off-site features (within 0.25 mile [0.4 kilometer] of site boundary)		
a. Have there been any changes in use of adjacent areas (grazing, construction, agriculture)?		
b. Are there any new roads or trails?		
c. Has there been a change in the position of nearby stream channels?		
d. Has there been headward erosion of nearby gullies?		
e. Are there new drainage channels?		
f. Others?		
2. Access roads and paths, fences, gates, and signs.		
a. Is there a break in the fence?		
b. Have any posts been damaged or their anchoring weakened?		
c. Is there evidence of erosion or digging beneath the fence?		
d. Does the gate show evidence of tampering or damage?		
e. Is there any evidence of human intrusion?		
f. Is there any evidence of large animal intrusion?		
g. Have any signs been damaged or removed? (Number of signs replaced: ____)		
h. Are access roads and paths passable?		
i. Others?		

	Yes	No

3. Monuments and other permanent features.

   a. Have the survey or boundary monuments been defaced or disturbed?

   b. Have the site markers been disturbed by man or natural processes?

   c. Do natural processes threaten the integrity of any monument or site marker?

   d. Others?

4. Crest.

   a. Is there evidence of uneven settling (depressions, scarps)?

   b. Is there cracking?

   c. Has the outer cover layer been breached?

   d. Is there evidence of erosion?

      1) By water (rills, rivulets)?

      2) By wind (pedestal rocks, ripple marks)?

   e. Is there evidence of animal burrowing?

   f. Others?

5. Slopes.

   a. Is there evidence of gradual downslope movement creep (terraces, deflection of plants)?

   b. Is there cracking?

   c. Can depressions or bulges on the slope be seen?

   d. Has the outer cover layer been breached?

	Yes	No

e. Is there evidence of erosion:

   1) By water?

   2) By wind?

f. Has water runoff become channelized (rivulets, gullies)?

g. Is there evidence of seepage (moisture, color, vegetation)?

h. Is there evidence of animal burrowing?

i. Is there evidence of deterioration of riprap or gravel cover?

j. Others?

6. Periphery (within site boundaries).

   a. Is there evidence of seepage, such as wet areas or localized change of vegetation?

   b. Is there evidence of sediment transport from the uranium mill tailings by water or wind?

   c. Is the vegetative cover as described in the as-builts?

   d. Is the drainage as described in the as-builts?

   e. Others (burrowing animals, erosion)?

7. Diversion channels.

   a. Is there evidence of bank erosion?

   b. Has the integrity of riprap structures been disturbed by people or natural processes?

   c. Is there evidence of channel erosion?

   d. Is there evidence of sedimentation in the channel?

Yes No

e. Is the channel obstructed in any way?

f. Is there any evidence that the diversion channels are not performing their function?

g. Others?

8. Photography.

a. Have all photos required by the site atlas photo overlay been taken?

b. Has a photo log sheet been prepared for each roll of film exposed?

c. Number of rolls of film exposed: ____

d. Others?

9. Monitor wells.

a. Have any monitor wells been disturbed by man or natural processes?

b. Does any natural process threaten the integrity of any monitor well?

c. Are all monitor wells capped and locked?

d. Others?

D. FIELD CONCLUSIONS

Yes No

1. Is there an imminent hazard to the integrity of the uranium mill tailings (immediate report required)?
   Person: _____
   Agency to whom report made: _____

2. Are more frequent Phase I inspections required?

3. Are existing contingency repair actions satisfactory?

4. Is a Phase II inspection required?

5. Is a contingency report or custodial maintenance required?

	Yes	No
6. Rationale for field conclusions are documented as the text of this report.		

E. CERTIFICATION

I have conducted a prelicensing inspection of the Durango uranium mill tailings site in accordance with the procedures of the license (includes the site-surveillance plan) as recorded on this checklist, attached sheets, field notes, photo log sheets, and photos.

Chief Inspector's Signature	Printed Name
Title	Date

ATTACHMENT 7

AGENCY NOTIFICATION AGREEMENTS

DRAFT

Bill Gardner
La Plata County Sheriff's Dept.
742 Turner Drive
Durango, CO 81301

Dear Mr. Gardner:

The U.S. Department of Energy (DOE) Uranium Mill Tailings Remedial Action Project Office is requesting notification in the event of any unusual activities or events in La Plata County, Colorado, or around the Bodo Canyon disposal site located 3.5 miles (5.6 kilometers) southwest of Durango, Colorado.

The purpose of the notification request is to assist the DOE in surveying and maintaining the integrity of its disposal site and to ensure public safety.

If during the course of routine activities, anything out of the ordinary is observed by your staff or reported to your office, we would appreciate notification to the DOE Grand Junction Projects Office's 24-hour phone line at (303) 248-6070. If the notification request discussed above is agreeable to you, please sign and return the attached reply letter for our records as soon as possible.

Should you have any questions, please contact Jay Pape of my staff at (505) 845-4022. Thank you for your attention in this matter.

Albert R. Chernoff
Project Manager
Uranium Mill Tailings Remedial Action Project Office

ARC/CS/pmg
Enclosure

cc: w/o enclosure

E. Artiglia,	TAC
F. Bosiljevac,	UMTRA
C. Jones,	GJPO
J. Pape,	UMTRA
C. Silva,	TAC
J. Virgona,	GJPO

DRAFT

Albert R. Chernoff
UMTRA Project Manager
U.S. Department of Energy
Uranium Mill Tailings Remedial Action Project Office
2155 Louisiana N.E., Suite 4000
Albuquerque, NM 87110

Dear Mr. Chernoff:

This letter is to concur with the U.S. Department of Energy (DOE) request for notification as set forth in the DOE's letter. As requested in your letter, this office will contact the DOE's Grand Junction Projects Office at (303) 248-6070 if any unusual event or anomaly is observed or reported at the Bodo Canyon disposal site, Durango, Colorado.

Sincerely,

Mr. Bill Gardner
La Plata County Sheriff
La Plata County Sheriff's Department
742 Turner Drive
Durango, Colorado 81301

MB/CS/pg

cc:	E. Artiglia,	TAC
	F. Bosiljevac,	UMTRA
	S. Hamp,	UMTRA
	C. Jones,	GJPO
	J. Pape	UMTRA
	C. Silva	TAC
	J. Virgona,	GJPO

DRAFT

Jim Webb
San Juan National Forest
701 Camino Del Rio
Durango, CO 81301

Dear Mr. Webb:

The U.S. Department of Energy (DOE) Uranium Mill Tailings Remedial Action Project Office is requesting notification of any unusual activities or events in or around the Bodo Canyon disposal site located approximately 3.5 miles (5.6 kilometers) southwest of Durango, Colorado. The purpose of this notification request is to assist the DOE in surveying and maintaining the integrity of its disposal site and to ensure public safety. If, during the course of routine activities, anything out of the ordinary is observed by your staff or reported to your office, we would appreciate immediate notification to the DOE Grand Junction Projects Office's 24-hour phone line (303) 248-6070.

If the notification request discussed above is agreeable to you, please sign and return the enclosed reply letter for our records as soon as possible.

Should you have any questions, please contact Jay Pape of my staff at (505) 845-4022. Thank you for your attention in this matter.

Albert R. Chernoff
Project Manager
Uranium Mill Tailings Remedial Action Project Office

ARC/CS/pg
Enclosure

cc: w/o enclosure

E. Artiglia,	TAC
F. Bosiljevac,	UMTRA
C. Jones,	GJPO
J. Pape	UMTRA
C. Silva	TAC
J. Virgona,	GJPO

DRAFT

Albert R. Chernoff
UMTRA Project Manager
U.S. Department of Energy
Uranium Mill Tailings Remedial Action Project Office
2155 Louisiana N.E., Suite 4000
Albuquerque, NM 87110

Dear Mr. Chernoff:

This letter is to concur with the U.S. Department of Energy (DOE) request for notification as set forth in the DOE's letter. As requested in your letter, this office will contact the Grand Junction Projects Office at (303) 248-6070 if any unusual event or anomaly is observed or reported at the Bodo Canyon disposal site, Durango, Colorado.

Sincerely,

Mr. Jim Webb
San Juan National Forest
701 Camino Del Rio
Durango, Colorado 81301

MH/CS/pg

cc:	E. Artiglia	TAC
	F. Bosiljevac,	UMTRA
	C. Jones,	GJPO
	J. Pape	UMTRA
	C. Silva	TAC
	J. Virgona,	GJPO

DRAFT

Mr. Larry Mooney
Area Manager
National Weather Service Office
10230 Smith Road
Denver, Colorado 80239

Dear Mr. Mooney:

The U.S. Department of Energy (DOE) Uranium Mill Tailings Remedial Action Project is requesting notification in the event of issuance of flash flood or tornado warnings in La Plata County, Colorado. We would appreciate notification to the DOE Grand Junction Projects Office's 24-hour phone line at (303) 248-6070 within 8 hours of issuance of a warning or episode of warnings.

The purpose of this warning is to assist the DOE in surveying and maintaining the integrity of its disposal site located 3.5 miles (5.6 kilometers) southwest of Durango, Colorado.

If the notification request discussed above is agreeable to you, please sign and return the enclosed reply letter for our records as soon as possible.

Should you have any questions, please contact Jay Pape of my staff at (505) 845-4022. Thank you for your attention in this matter.

Sincerely,

Albert R. Chernoff
Project Manager
Uranium Mill Tailings Remedial Action Project Office

ARC/CS/pg
Enclosure

cc: w/o enclosure

E. Artiglia,	TAC
F. Bosiljevac,	UMTRA
C. Jones,	GJPO
J. Pape	UMTRA
C. Silva,	TAC
J. Virgona,	GJPO

DRAFT

Albert R. Chernoff
UMTRA Project Manager
U.S. Department of Energy
Uranium Mill Tailings Remedial Action Project Office
2155 Louisiana N.E., Suite 4000
Albuquerque, NM 87110

Dear Mr. Chernoff:

This letter is to concur with the U.S. Department of Energy (DOE) request for notification as set forth in the DOE's letter. As requested in your letter, this office will contact the Grand Junction Projects Office at (303) 248-6070 in the event of issuance of a flash flood or tornado warning in La Plata County, Colorado.

Sincerely,

Mr. Larry Mooney
National Weather Service Office
10230 Smith Road
Denver, Colorado 80239

JJ/CS/pg

cc:	E. Artiglia,	TAC
	F. Bosiljevac,	UMTRA
	C. Jones,	GJPO
	J. Pape	UMTRA
	C. Silva	TAC
	J. Virgona,	GJPO

DATE
FILMED
6/3/94
END