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Western New York Nuclear Service Center

Sitewide Close-In-Place Alternative Technical Report

Prepared for the

U.S. Department of Energy

West Valley, New York

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ACRONYMS AND ABBREVIATIONS

02 Building	Former Low-Level Waste Treatment Facility Building
ALARA	as low as reasonably achievable
CDDL	Construction and Demolition Debris Landfill
CLSM	Controlled Low-Strength Material
Cs	cesium
DCGLs	derived concentration guideline levels
DCSA	Dry Cask Storage Area
DOE	U.S. Department of Energy
EIS	Environmental Impact Statement
GTCC	Greater Than Class C
HEPA	high-efficiency particulate air
HLW	high-level waste
HSM	horizontal storage module
LLW2	Low-Level Waste Treatment Building
LSA 1	Lag Storage Addition 1
LSA 2	Lag Storage Addition 2
LSA 3	Lag Storage Addition 3
LSA 4	Lag Storage Addition 4
LTF	Leachate Treatment Facility
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
NDA	Nuclear Regulatory Commission-Licensed Disposal Area
NFS	Nuclear Fuel Services, Inc.
NPP	North Plateau Plume
NRC	Nuclear Regulatory Commission
NTS	Nevada Test Site
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYSERDA	New York State Energy Research and Development Authority
PMF	Probable Maximum Flood
PMP	Probable Maximum Precipitation
PRB	Permeable Reactive Barrier
PVS	Permanent Ventilation System
PTW	Permeable Treatment Wall
RHWF	Remote-Handled Waste Facility

ACRONYMS AND ABBREVIATIONS *(concluded)*

SDA	State-Licensed Disposal Area
SPDES	State Pollutant Discharge Elimination System
STS	Supernatant Treatment System
TRU	Transuranic
USEPA	United States Environmental Protection Agency
WMA	Waste Management Area
WNYNSC	Western New York Nuclear Service Center
WTF	Waste Tank Farm
WVDP	West Valley Demonstration Project

UNITS

Ci	curie
dB	decibel
ft^2	square feet
ft^3	cubic feet
g	gram
gpd	gallons per day
hr	hour
kg	kilogram
kW-hr	kilowatt per hour
MCF	million cubic feet
mL	milliliter
mrem	0.001 Roentgen equivalent man
mR/hr	milliroentgen per hour
µCi	1.0E-06 curie
µCi/ml	microcuries per milliliter
pCi	1.0E-12 curie
R	Roentgen
R/hr	Roentgen per hour
yd^3	cubic yards

1.0 INTRODUCTION

The Western New York Nuclear Service Center (WNYNSC) occupies 3,338 acres of land in northern Cattaraugus County and southern Erie County, NY, as shown on Figure 1-1. Primary drainage at the WNYNSC is via Buttermilk Creek, which joins Cattaraugus Creek at the northern end of the property. Cattaraugus Creek flows in a northwest direction into Lake Erie about 30 miles south of Buffalo, NY.

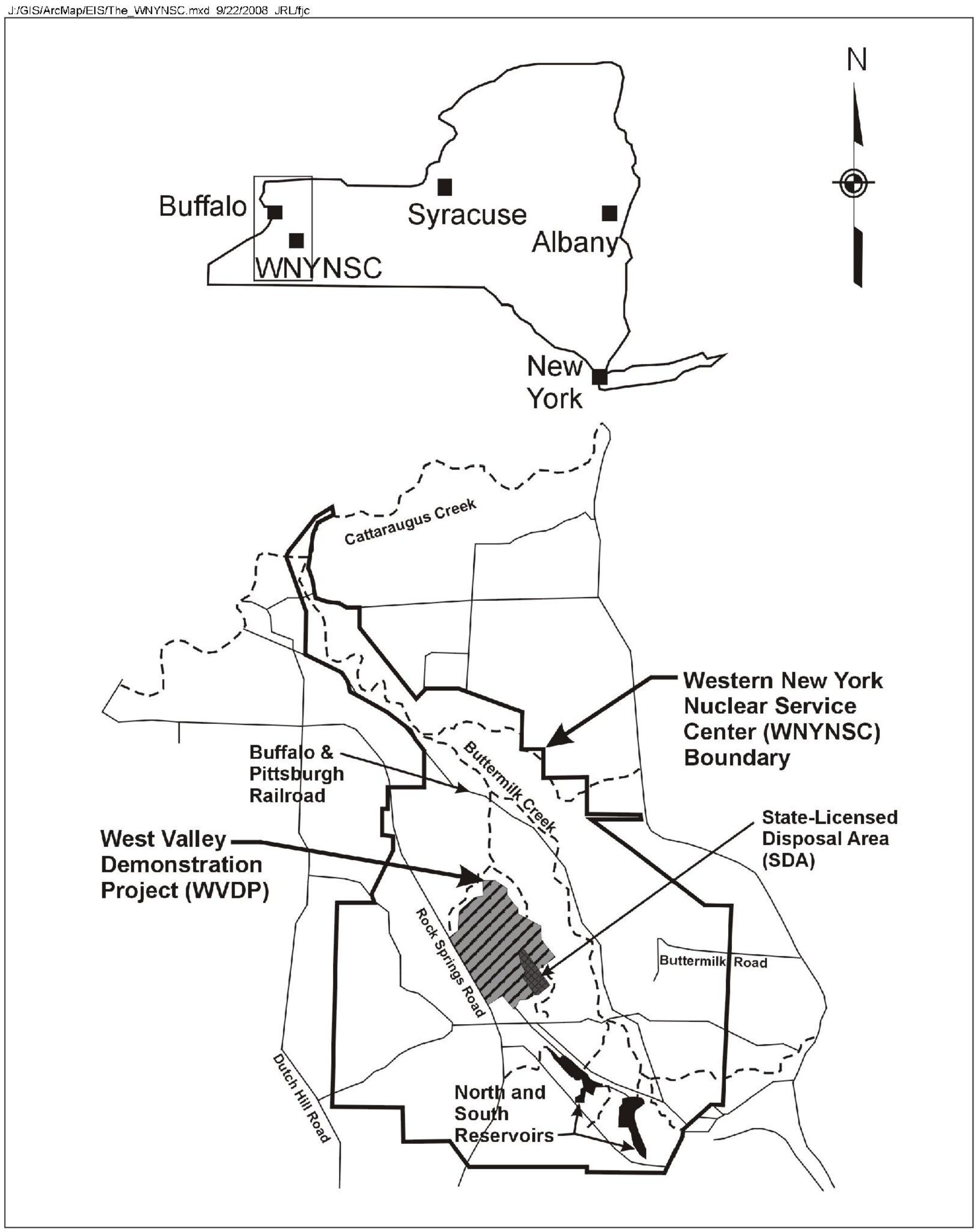


Figure 1-1. The Western New York Nuclear Service Center

The primary facilities at the WNYNSC consist of:

- A former irradiated nuclear fuel reprocessing plant;
- Four underground radioactive waste storage tanks; and
- Two radioactive waste disposal areas.

One of the radioactive disposal areas is licensed by the NRC and the other is licensed by the New York Department of Health (NYSDOH) and permitted by the New York State Department of Environmental conservation (NYSDEC).

The WNYNSC has been divided into 12 Waste Management Areas (WMAs) listed below and the locations of WMA 1 through WMA 10 and WMA 11 and WMA 12 are shown on Figures 1-2 and 1-3, respectively.

- WMA 1: Main Plant Process Building and Vitrification Facility Area;
- WMA 2: Low-Level Waste Treatment Facility Area;
- WMA 3: Waste Tank Farm Area;
- WMA 4: Construction and Demolition Debris Landfill;
- WMA 5: Waste Storage Area;
- WMA 6: Central Project Premises;
- WMA 7: NRC-Licensed Disposal Area (NDA) and Associated Facilities;
- WMA 8: State-Licensed Disposal Area (SDA) and Associated Facilities;
- WMA 9: Radwaste Treatment System Drum Cell;
- WMA 10: Support Services Area;
- WMA 11: Bulk Storage Warehouse and Hydrofracture Test Well Area; and
- WMA 12: Balance of Site

The Technical Reports (TRs) are being prepared as data inputs to the draft Decommissioning and/or Long-Term Stewardship Environmental Impact Statement (EIS). The TRs describe several site-wide closure alternatives and potential conceptual engineering approaches to implement closure alternatives. All engineered approaches presented are conceptual, typical designs that could be applied to the WNYNSC facilities and are considered to be representative of the alternative being evaluated.

The remedial approach described in this report is for the Sitewide Close-In-Place Alternative for the WVDP and the WNYNSC. Under this alternative, the major facilities would be closed in place. The residual radioactivity in facilities with long-lived radionuclides would be isolated by specially-designed closure structures and engineered barriers. The Main Plant Process Building, the four waste storage tanks, and the North Plateau Plume source area would be closed in place in an integrated manner. The NRC-Licensed Disposal Area and the State-Licensed Disposal Area would be capped and managed in place under appropriate license or permit. No further remediation would be undertaken for the Cesium Prong, or for other contaminated soil, groundwater, or streambed sediments. A smaller number of aboveground structures would be torn down to the concrete pads to eliminate maintenance costs, and the demolition debris would be shipped off site.

Baseline assumptions of the status of various WMA elements at the starting point of the EIS, prior to the implementation of in-place closure activities are presented in Table 1-1.

Table 1-1. Status of WNYNSC Facilities at EIS Starting Point and Sitewide Close-In-Place Alternative Actions

Area	Facility	EIS Starting Point Assumption	Close-In-Place Alternative Action[1]
WMA 1	Main Plant Process Building	Deconned to Demolition-Ready	Remove to Floor Slab, Rubble Remains, Install Engineered Multi-Layered Cap
	Plant Office Building	Operational	Remove to Floor Slab, Rubble Remains
	01-14 Building	Gutted, Deconned to Demolition-Ready	Remove to Floor Slab, Rubble Remains
	Load-In/Load-Out Facility	Operational	Remove to Floor Slab, Rubble Remains
	Recirculation Vent System Building	Removed to Floor Slab	No Action Planned
	Contact Size-Reduction Facility	Removed to Floor Slab	No Action Planned
	Emergency Vehicle Shelter	Removed to Floor Slab	No Action Planned
	Radwaste Process (Hittman) Bldg.	Removed to Floor Slab	No Action Planned
	Underground Tanks 35104, 7D-13, 15D-6	In Place	Grout In Place
	Off-Gas Trench	In Place	Grout In Place
	Utility Room and URE	Operational	Remove to Floor Slab, Rubble Remains
	Fire Pump House & Storage Tank	Operational	Remove to Floor Slab, Rubble Remains
	Laundry Room	Removed to Floor Slab	Leave In Place
	Electrical Substation	Operational	Remove Off-Site (Equipment), On-Site (Rubble)
	Vitrification Facility	Deconned to Demolition-Ready	Remove to Floor Slab, Rubble Remains
	MSM Repair Shop Floor Slab	In Place	No Action Planned
	Cold Chemical Facility Floor Slab	In Place	No Action Planned
WMA 2	02 Building Floor Slab	In Place	No Action Planned
	Low-Level Waste Treatment Building (LLW2)	Operational	Remove to Floor Slab
	Lagoon 1	Inactive	Install Barrier Wall, Clay Cap
	Lagoons 2–3	Operational	Backfill, Clay Cap
	Lagoon 4–5	Operational	Remove Liner, Backfill, Clay Cap
	Neutralization Pit	Operational	No Action Planned
	Old and New Interceptors	Operational	Remove Liner, Backfill
	Test and Storage Building Floor Slab	In Place	No Action Planned
	Solvent Dike	Inactive	No Action Planned
	Vitrification Test Facility	Removed to Floor Slab	No Action Planned
	Maintenance Shop Floor Slab	In Place	No Action Planned

Table 1-1. Status of WNYNSC Facilities at EIS Starting Point and Sitewide Close-In-Place Alternative Actions

Area	Facility	EIS Starting Point Assumption	Close-In-Place Alternative Action[1]
	Maintenance Storage Area	Removed to Floor Slab	No Action Planned
	Vehicle Maintenance Shop	Removed to Floor Slab	No Action Planned
	Maintenance Shop Leach Field	Inactive	No Action Planned
	Vitrification Hardstand	Removed to Grade	No Action Planned
	Fire Brigade Training Area	Inactive	No Action Planned
	Industrial Waste Storage Area	Removed to Grade	No Action Planned
	Well Purge Water Storage Locations	Inactive	No Action Planned
	Wastewater Pipelines	Operational/Inactive	Grout In Place
WMA 3[1]	Tank 8D-1,8D-2, 8D-3, 8D-4	Isolated, with tank and vault drying system in place and operational to evaporate remaining liquids	Grout In Place, Install Engineered Multi-Layered Cap
	High-Level Waste Tank Pump Storage Vaults	Transfer Pipelines, and pumps remaining	Grout Piping and Vaults In Place, Section, Remove and Dispose of MOB Pumps Off Site
	High-Level Waste Transfer Trench	Inactive	Fill Trench with Rubble
	Permanent Ventilation System Building	Operational	Remove to Floor Slab, Rubble Remains
	Supernatant Treatment System Support Building	Operational	Remove to Floor Slab, Rubble Remains
	WTF Equipment Shelter & Condensers	Inactive	Remove to Floor Slab, Rubble Remains
	Con-Ed Building	Inactive	Remove to Floor Slab, Rubble Remains
WMA 4	Construction and Demolition Debris Landfill	Inactive, (previously closed)	No Action Planned
WMA 5	Remote-Handled Waste Facility	Deactivated, Awaiting Demolition	Remove to Floor Slab, Rubble to be Disposed Off Site
	Lag Storage Building	Removed to Floor Slab	No Action Planned
	Lag Storage Area 1	Removed to Floor Slab	No Action Planned
	Lag Storage Area 2 Hardstand	Removed to Grade	No Action Planned
	Lag Storage Area 3	Removed to Floor Slab	No Action Planned
	Lag Storage Area 4/Shipping Depot	Operational	Remove to Floor Slab, Rubble to be Disposed Off Site
	Hazardous Waste Storage Lockers	Removed to Grade	No Action Planned
	Chemical Process Cell Waste Storage Area	Removed to Grade	No Action Planned
	Cold Hardstand Area	Removed to Grade	No Action Planned

Table 1-1. Status of WNYNSC Facilities at EIS Starting Point and Sitewide Close-In-Place Alternative Actions

Area	Facility	EIS Starting Point Assumption	Close-In-Place Alternative Action[(1)]
	Construction and Demolition Area	Inactive	No Action Planned
	Vitrification Vault and Empty Container Hardstand	Removed to Grade	No Action Planned
	Old/New Hardstand Storage Area	Removed to Grade	No Action Planned
WMA 6	Rail Spur	Operational	No Action Planned
	Old Warehouse	Removed to Floor Slab	No Action Planned
	Sewage Treatment Plant	Operational	Remove to Floor Slab, Rubble to be Disposed Off Site
	Cooling Tower	Removed to Foundation	Demo Basin, Remove Contaminated Soil for Off-Site disposal, Backfill
	Equalization Basin	Operational	Remove Liner, Grout Influent Pipes, Backfill
	Equalization Tank	Operational	Demo Vault, Backfill
	Demineralizer Sludge Ponds	Inactive	Backfill
	WTF Test Towers	North Tower Removed, South Tower Operable	Remove South Tower, Remove Both Slabs. Rubble to be Disposed Off Site
	Road-Salt & Sand Storage Shed	Removed to Asphalt	No Action Planned
	Product Storage Area	Inactive	No Action Planned
	Low-Level Waste Rail Packaging and Staging Area	Operable, Waste Removed	No Action Planned
WMA 7[(1)]	NDA Interceptor Trench	Operational	Grout In Place
	SDA Leachate Transfer Pipeline	Operational	Abandoned and Left In -Place
	Liquid Pretreatment System	Operable	Remove to Floor Slab, Rubble to be Disposed Off Site
	NDA Hardstand Staging Area	Removed to Grade	No Action Planned
	NFS Deep Holes	Inactive, Geomembrane Cap, and Barrier Wall	Grout Disposal Holes, Install Engineered Multi-Layered Cap
	NFS Special Holes	Inactive, Geomembrane Cap, and Barrier Wall	Grout Disposal Holes, Install Engineered Multi-Layered Cap
	Former NDA Lagoon	Inactive, Geomembrane Cap, and Barrier Wall	Install Engineered Multi-Layered Cap
	WVDP Disposal Area Removal (trenches/cassions)	Inactive, Geomembrane Cap, and Barrier Wall	Grout Disposal Holes, Install Engineered Multi-Layered Cap

Table 1-1. Status of WNYNSC Facilities at EIS Starting Point and Sitewide Close-In-Place Alternative Actions

Area	Facility	EIS Starting Point Assumption	Close-In-Place Alternative Action[1]
WMA 8 [1]	Mixed Waste Storage Facility	Operational	Remove to Grade, Rubble Disposed of Off Site
	SDA Disposal Trenches	Inactive, Geomembrane Cap and Barrier Wall (Trench 14)	Grout Trenches and Install Engineered Multi-layered Cap
	Former Filled SDA Lagoons	Inactive, Geomembrane Cap	Install Engineered Multi-layered Cap
WMA 9	Radwaste Treatment System Drum Cell	Operable	Remove to Floor Slab, Rubble to be Disposed of Off Site
	Subcontractor Maintenance Area	In Place	No Action Planned
	NDA Trench Soil Container Area	Removed	No Action Planned
WMA 10	Administration Building	Removed to Floor Slab	No Action Planned
	Expanded Environmental Lab	Removed to Floor Slab	No Action Planned
	New Warehouse	Operational	Remove to Floor Slab, Rubble to be Disposed of Off Site
	Meteorological Tower	Operational	No Action Planned
	Security Gatehouse and Fences	Operational	No Action Planned
	Construction Fabrication Shop	Removed to Floor Slab	Remove During Erosion Control Construction
	Vitrification Diesel Fuel Oil Storage Tank and Building	Removed to Floor Slab	No Action Planned
WMA 11	Scrap Material Landfill	Inactive	No Action Planned
WMA 12	Dams and Reservoirs	Operational	Partial Removal
	Stream Sediments on Project Premises	In Place	Monitor and Maintain
	Parking Lots and Roadways	Inactive	No Action Planned
	Contaminated Soil on Project Premises	In Place	Monitor and Maintain
	Railroad Spur Beyond WMA 6	In Place	No Action Planned
NPP	North Plateau GW Recovery System	Operational	Remove and Demolish, Rubble to be Disposed of Off Site
	North Plateau Plume (Non-Source Area)	In Place	Leave In Place, Allowed to Naturally Attenuate and Flow through PTW
	Pilot-Scale Permeable Treatment Wall	Operational	No Action Planned
	Full-Scale Permeable Treatment Wall	Operational	Periodically Replace Full-Scale Permeable Treatment Wall
MISC	Cesium Prong	Inactive	No Action Planned

(1) Debris in WMAs 1, 3, 7, and 8 will remain on site, covered by an engineered, multi-layered cap.

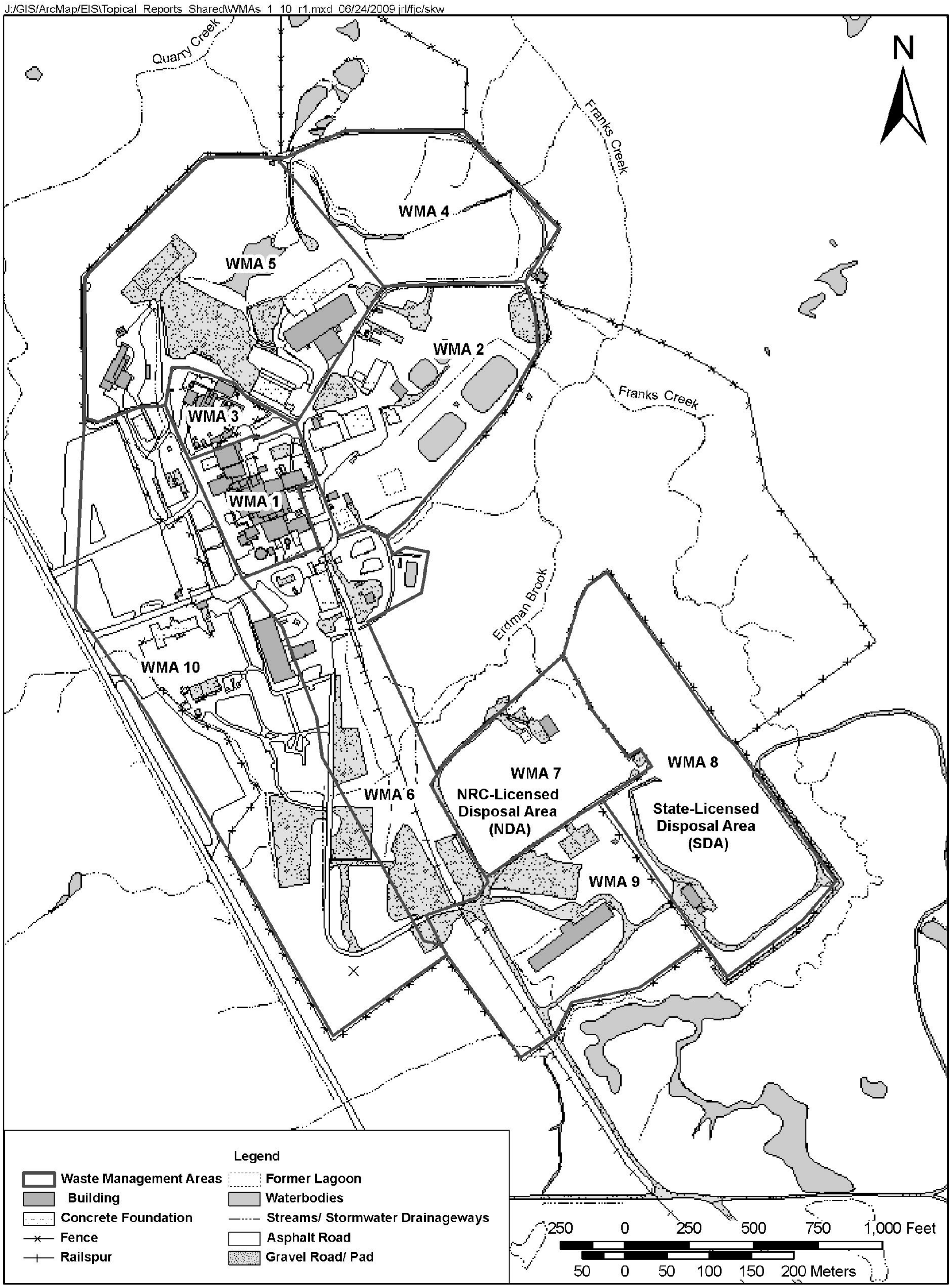


Figure 1-2. Location of Waste Management Areas 1 through 10

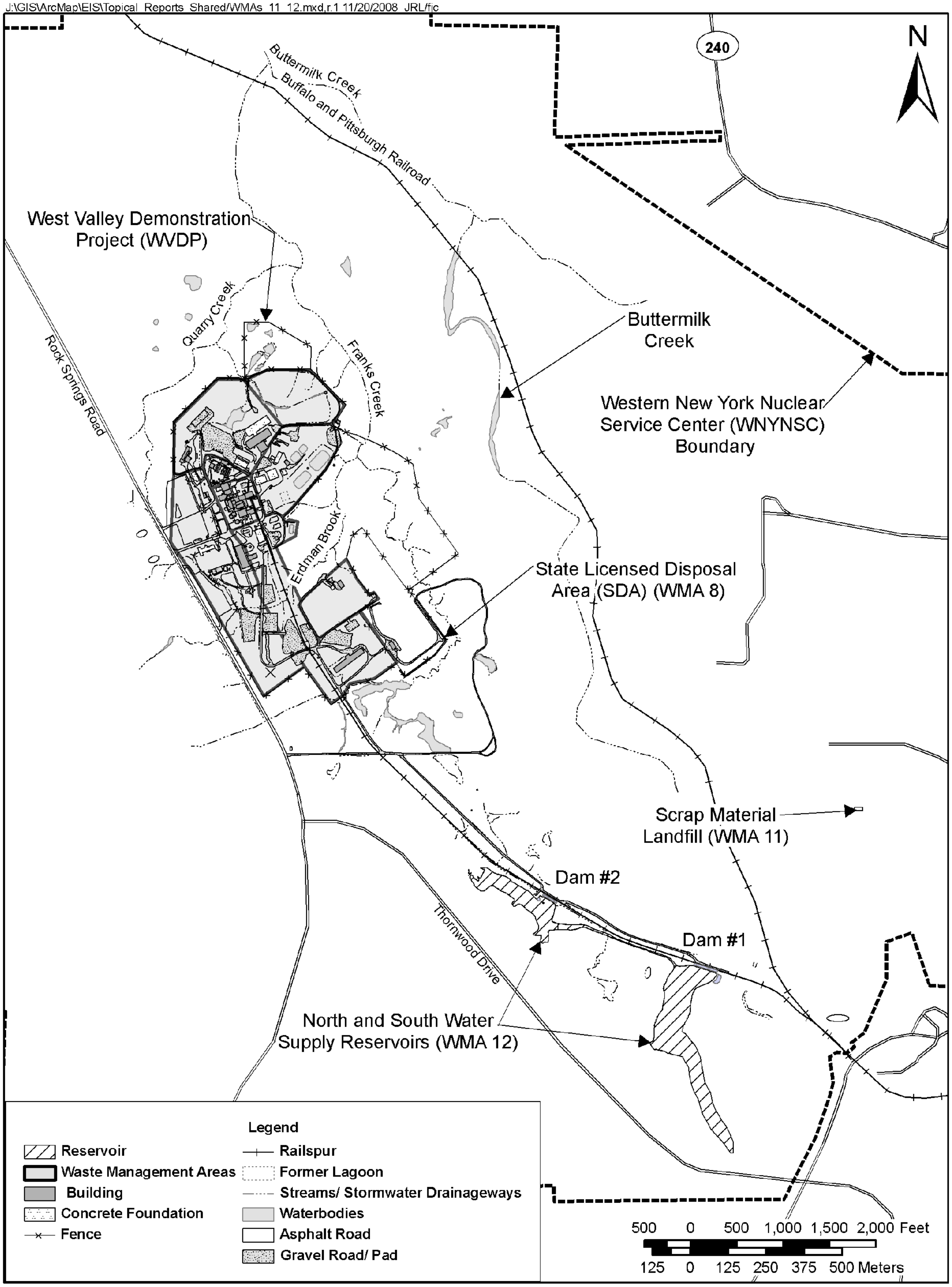


Figure 1-3. WMA 11 and 12 – Bulk Storage Warehouse and Hydrofracture Test Well Area and Balance of Site

2.0 IMPLEMENTATION ACTIVITIES

2.1 WMA 1: Main Plant Process Building and Vitrification Facility Area

Waste Management Area (WMA) 1 consists of the buildings and structures shown in Figures 2-1 and 2-2. Due to its complexity, the Sitewide Close-In-Place Alternative for this area can be separated into significant support activities, four primary remediation activities, and several closeout activities. In general, the aboveground structures and facilities would be decontaminated (as necessary) and demolished, and the demolition debris would be used as fill and placed in the subgrade cells beneath a final cap. Excess demolition debris would also be used to construct an aboveground engineered rubble pile, establishing pregrade elevations, upon which the final cap would then be constructed. Components that would be disposed of off site would include roofing materials suspected to be asbestos-containing material (ACM), lead components of the process area shield windows, and mercury-containing electrical components. The final cap and barrier walls (North Plateau Final Cap) would be constructed following the in-place closure of the Waste Tank Farm in WMA 3, therefore discussion of the activities involved in capping these areas is presented in Section 2.3. The suspected source of the North Plateau Sr-90 plume would not be removed, but would be closed in-place in an integrated manner. In addition, buried tanks in WMA 1 (i.e., 7D-13) would be left in place and filled with CLSM.

It is anticipated that the majority of the structures within WMA 1 would be demolition-ready at the beginning of the site closure, and that the demolition activities would be performed without need for confinement. However, it is possible that a number of surveying and decontamination activities may be necessary for some cells and structures. If necessary, these actions would include radiation and chemical surveying, vacuuming, and applying a spray fixative.

Radiation surveys would be performed, as needed, to assess residual radiation levels associated with equipment, piping, and structural components remaining in the cells. These surveys would include sampling and analysis of residual materials for safety planning and material characterization purposes. Ultimately, the survey efforts would assess whether or not subsequent demolition activities could continue under unconfined conditions. Any removable contamination that remains after surveying would be either vacuumed or sprayed with a fixative to secure the radioactivity prior to demolition. Material collected through vacuuming would be managed on site and incorporated into the engineered rubble pile.

2.1.1 Remediation Support Activities

Prior to decontamination or demolition, a number of preparatory activities would be completed, including:

- Acquisition of specialized equipment;
- Modification of the Load-In/Load-Out Facility;
- Dry Cask Storage Area (DCSA) construction; and
- HLW canister transfer.

All other conventional setup efforts would be completed as well, such as characterization and design measures, applications for necessary regulatory approvals, and storm water controls installed and maintained around the construction site.

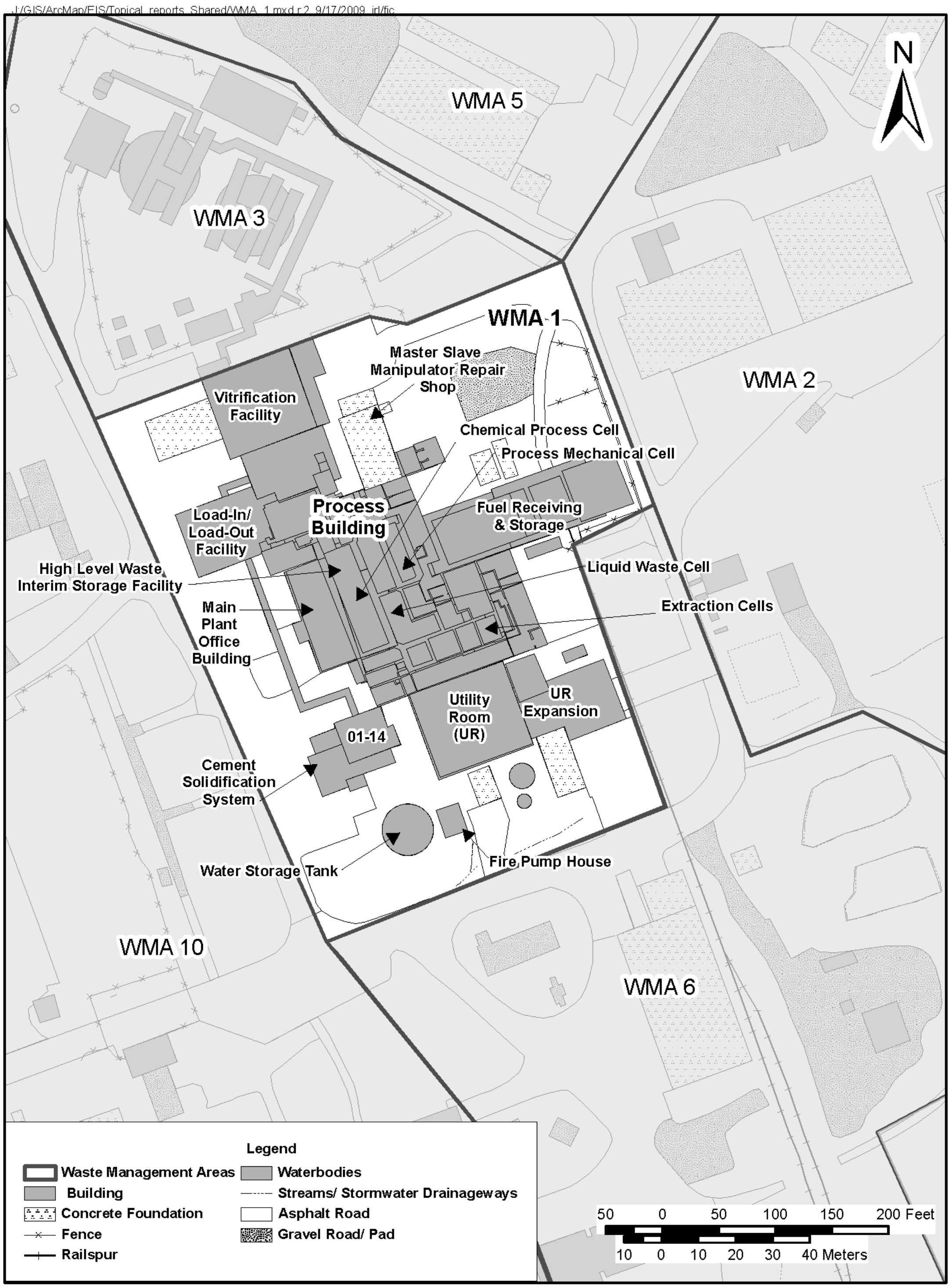


Figure 2-1. WMA 1 - Main Plant Process Building and Vitrification Facility Area

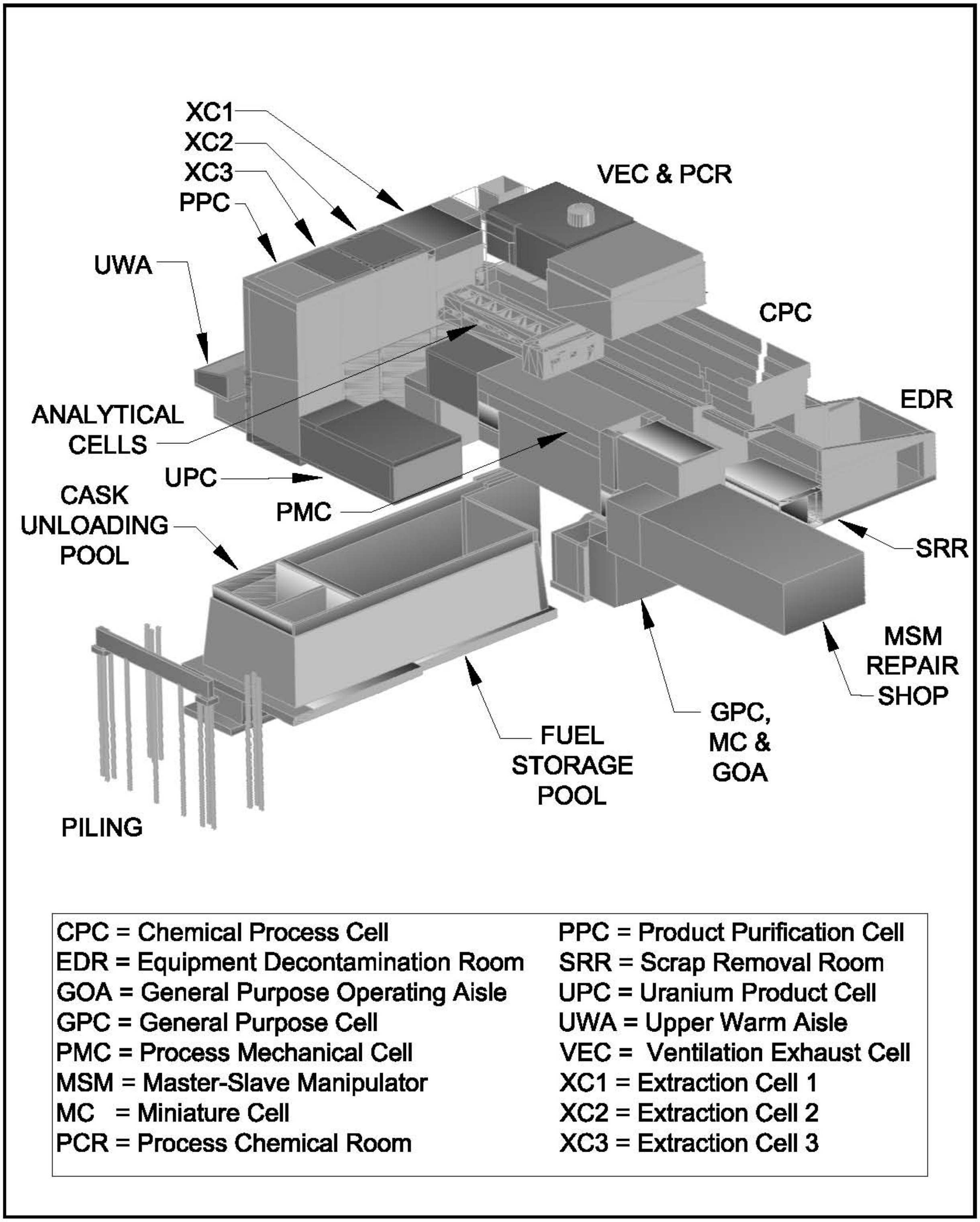


Figure 2-2. Isometric View of the Main Plant Process Building

Load-In/Load-Out Facility Modification

The Load-In/Load-Out Facility (LILO) would be modified to support the removal of the HLW canisters from the Main Plant Process Building to an on-site Dry Cask Storage Area. Equipment that would be installed to modify the facility includes a shielded transfer cell, a canister-handling system, a ventilation system, and a high-capacity crane.

A shielded transfer cell would be used for performing canister surface decontamination and swipe sampling without exposing workers to high doses of radiation. A canister-handling system would assist in the transfers of the canisters from the cell into the storage casks. Incidental equipment would also be needed for additional canister handling, weighing, and size verification.

These modifications are based on a truck-mounted, transportation and storage cask that holds at least four stainless-steel canisters filled with vitrified high-level radioactive waste. The canisters would be decontaminated, loaded in their storage casks, and transported to an on-site cask storage area, awaiting off-site disposal.

Canister Relocation and Storage – DCSA

A Dry Cask Storage Area would be constructed within WMA 6 on the South Plateau near the rail spur. Figure 2-3 illustrates the proposed location for construction of the DCSA and interim storage of the HLW canisters. The configuration of the storage area was based on the geometry of Horizontal Storage Modules (HSMs) from Transnuclear, Inc. (refer to Figure 2-4). The Transnuclear HSM complies with the requirements of 10 CFR 50 Appendix B, 10 CFR 71 Subpart H, and 10 CFR 72 Subpart G. The conceptual layout of the DCSA assumes that the Transnuclear HSM or an HSM of similar size and capacity would be used as storage modules for the HLW canisters while providing radiation shielding and mechanical protection.

The modification of existing facilities was considered in lieu of new construction of the DCSA. One existing facility that appeared to be a candidate for the long-term storage of the HLW canisters was the Vitrification Cell of the Vitrification Facility. However, use of the Vitrification Cell was deemed impractical and would delay the decommissioning of these facilities. Use of the Radwaste Treatment System Drum Cell was also considered. This existing facility was thought to require major work in order to complete a retrofit. Also, since the layout/dimensions (375 feet by 60 feet by 20 feet high) were not wide enough, and the foundation of the facility is insufficient in terms of providing seismic stability of the storage modules, the drum cell was also no longer considered to be a candidate. Additionally, the desired location of the new facility would be on the South Plateau close to the rail line and away from the facilities and decommissioning activities on the North Plateau. With no other existing facilities demonstrating a good match for the necessary characteristics of the DCSA, a new facility was assumed.

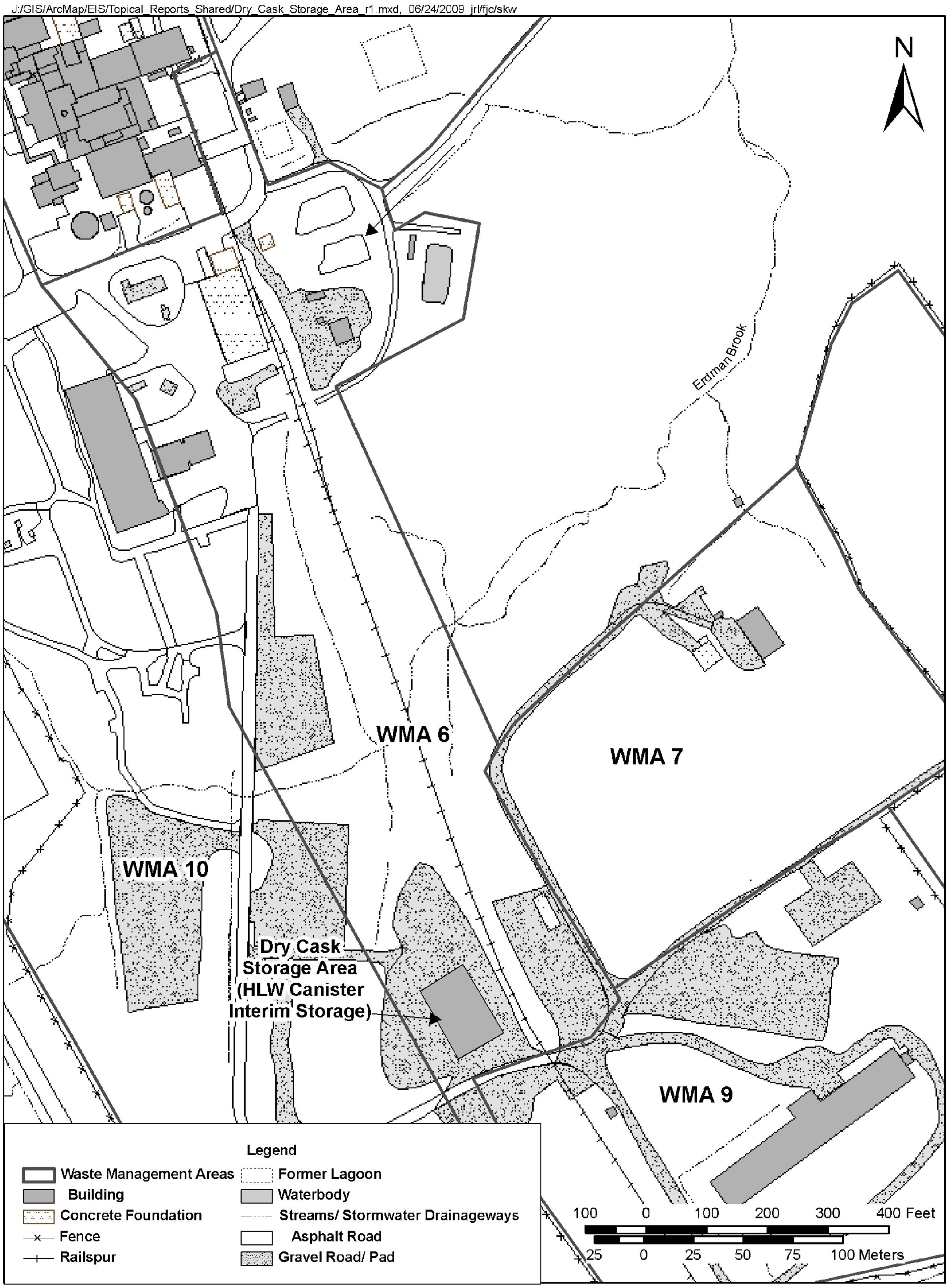
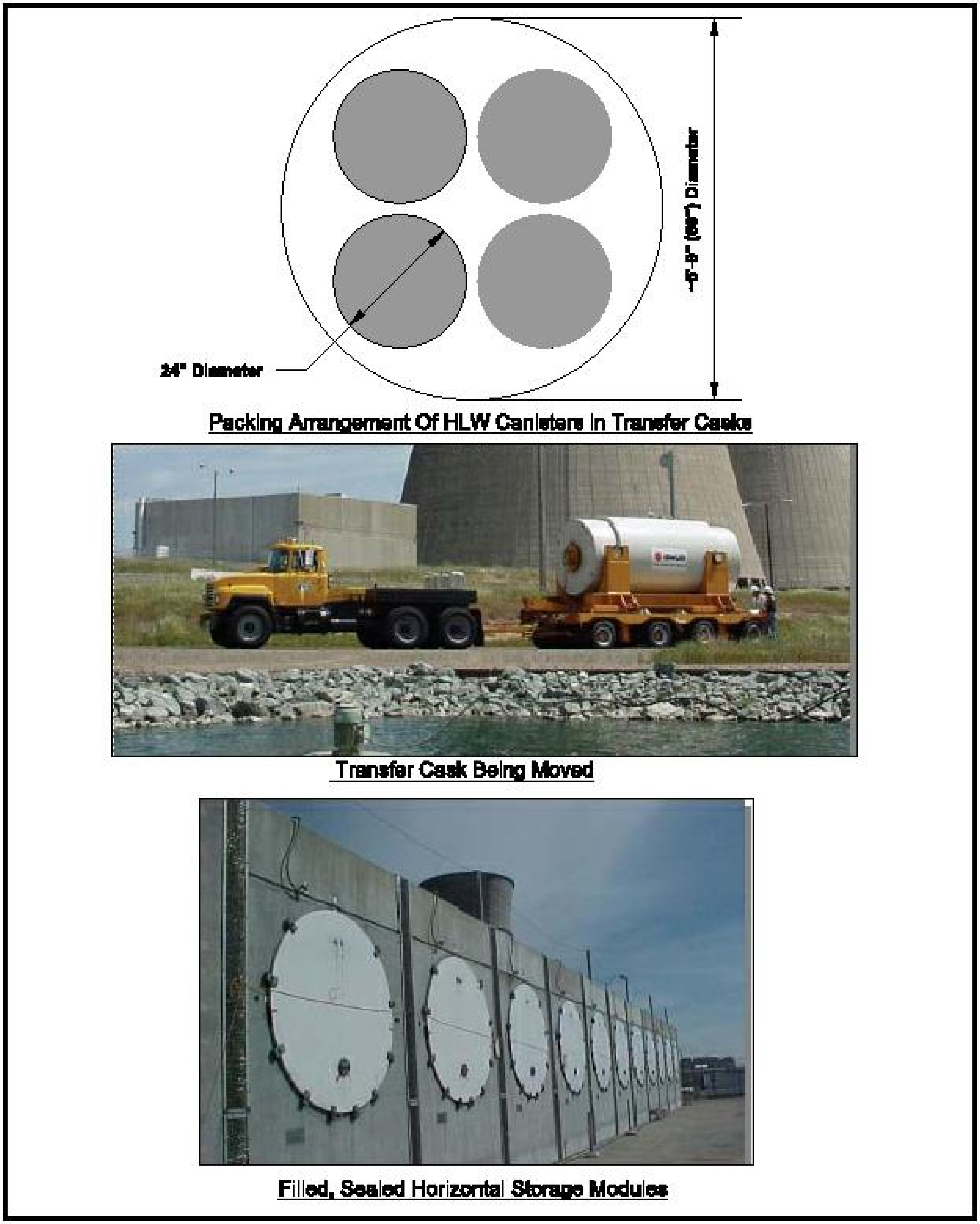


Figure 2-3. Dry Cask Storage Area Location



Packing Arrangement Of HLW Canisters In Transfer Casks

Transfer Cask Being Moved

Filled, Sealed Horizontal Storage Modules

Figure 2-4. High-Level Waste Transportation and Storage

The DCSA footprint would be optimized by placing the HSMs back-to-back, allowing common aisle access for loading and unloading of the modules. Loading "skirts" and approximately 90-foot-wide aisles would provide adequate space for truck and trailer maneuverability. Since the HSMs can hold at least four canisters each, a total of 69 HSMs would be used to store the 275 vitrified HLW canisters. Based upon these specifications, the DCSA would measure approximately 370 feet by 110 feet.

This report contains an estimate of one high-level radioactive waste canister being removed from the Load-In/Load-Out Facility, transferred to the Interim Storage Facility (Dry Cask Storage Area), and unloaded into a storage unit in an eight-hour shift. Although this estimate is presented in terms of one canister, the canisters would be moved in groups of four; each group would be moved completely within a period of approximately 40 hours of work. This estimate is based on experience gained during the removal and placement of material with high and very high dose experience gained during the removal and placement of material with high and very high dose rates (greater than 100 milliroentgen per hour) contained in lead-shielded containers at Brookhaven National Laboratory and Oak Ridge National Laboratory and compares favorably with the *Diablo Canyon Independent Spent Fuel Storage Installation Safety Analysis Report* estimate of time required for similar activities (17 hours for transferring a loaded cask to the Independent Spent Fuel Storage Installation). While these events are similar to those proposed for the high-level radioactive waste canister transfer, there are differences in loading configuration and waste disposition that could affect duration and cost estimates.

The conceptual DCSA pad is designed based on recommendations from the module vendor. The recommendations are consistent with installations currently in operation in the eastern U.S.:

- Monticello Nuclear Generating Plant – 18-inch-thick and 24-inch-thick concrete pads;
- Point Beach Units 1 and 2 (Wisconsin Electric Company) – 36-inch-thick concrete pad; and
- Carolina Power and Light, HB Robinson Unit – 36-inch-thick concrete pad.

In addition, based upon discussions with Transnuclear and NRC personnel, design features required for a DCSA containing these types of wastes would also require the following:

- Inner and outer security fencing; and
- Storage modules and cask similar to those currently being used for the storage of spent nuclear fuel.

Uncontaminated surface soil excavated during pad construction would be used to create earthen berms around the storage area to provide storm water controls and security. Drains would be installed on the berms to allow storm water runoff to flow from the pad. A two-foot-thick engineered base would be placed under a three-foot-thick reinforced concrete pad. Two sets of security fencing would be installed around the perimeter to control access to the area.

Operational requirements for the area would be minimal. These storage units, which are commonly used throughout the U.S. for interim storage of spent nuclear fuel, would be totally passive, requiring little, if any, maintenance over the storage lifetime. Labor would be limited to security and HSM inspections and repairs.

Specialized Equipment

Structures within WMA 1 would be demolished using hydraulic machines with interchangeable tools, such as hammers, grapples, and shears. For example, the Brokk BM330 is an electric demolition machine manufactured in Sweden by Holmhed Systems AB that is track-mounted and can be remotely operated (Figure 2-5). A number of these machines, or equivalent, would be used during demolition activities throughout WMA 1.

Because of the extensive amount of reinforcement, piping, and steel in the structures within WMA 1, a diamond wire saw would also be used during demolition activities (Figure 2-6). This technology, which uses diamonds bonded to a wire to cut concrete, has been used to cut stone blocks in quarries for many decades, and more recently, has been used to disassemble radiologically contaminated facilities. Two small holes would be drilled at opposite ends of a proposed cut, and the diamond wire would be placed under tension through the holes and drawn by a motor-driven pulley system. As the section is cut, concrete dust and debris is removed using water. Blocks created using the diamond wire saw would be lowered in the below-grade cells of the Main Plant Process Building beneath the North Plateau final cap.

2.1.2 Vitrification Facility Remediation

Since the Vitrification Facility is connected to the Main Plant Process Building, demolition activities on this structure would be coordinated with the status of the Main Plant Process Building to ensure safety and stability. Similar to all structures within WMA 1, the Vitrification Facility would be demolished to grade level using a method that involves interior gutting followed by an outside-in demolition approach. All of the demolition debris would be managed on site and incorporated into the engineered rubble pile.

Equipment and piping remaining in the Vitrification Facility would be demolished, segmented, and compacted in place. The demolition debris would be placed in the below-grade areas, such as the Melter Pit. The Vitrification Facility is not expected to contain any asbestos wastes.

Stainless-steel liners that cover certain floors and walls found in radioactive process areas are typically 304L stainless-steel plate. Liners that are below grade would be left in place. Liners that are in above-grade cells would be removed from the concrete walls and floor to facilitate concrete demolition. The liners would be removed (manually or remotely depending on the radiological conditions), segmented, and placed in the below-grade areas. Contamination controls, such as portable containment tents and HEPA ventilation units, would be installed in liner removal and management areas.

Figure 2-5. Brokk BM330 Demolition Machine

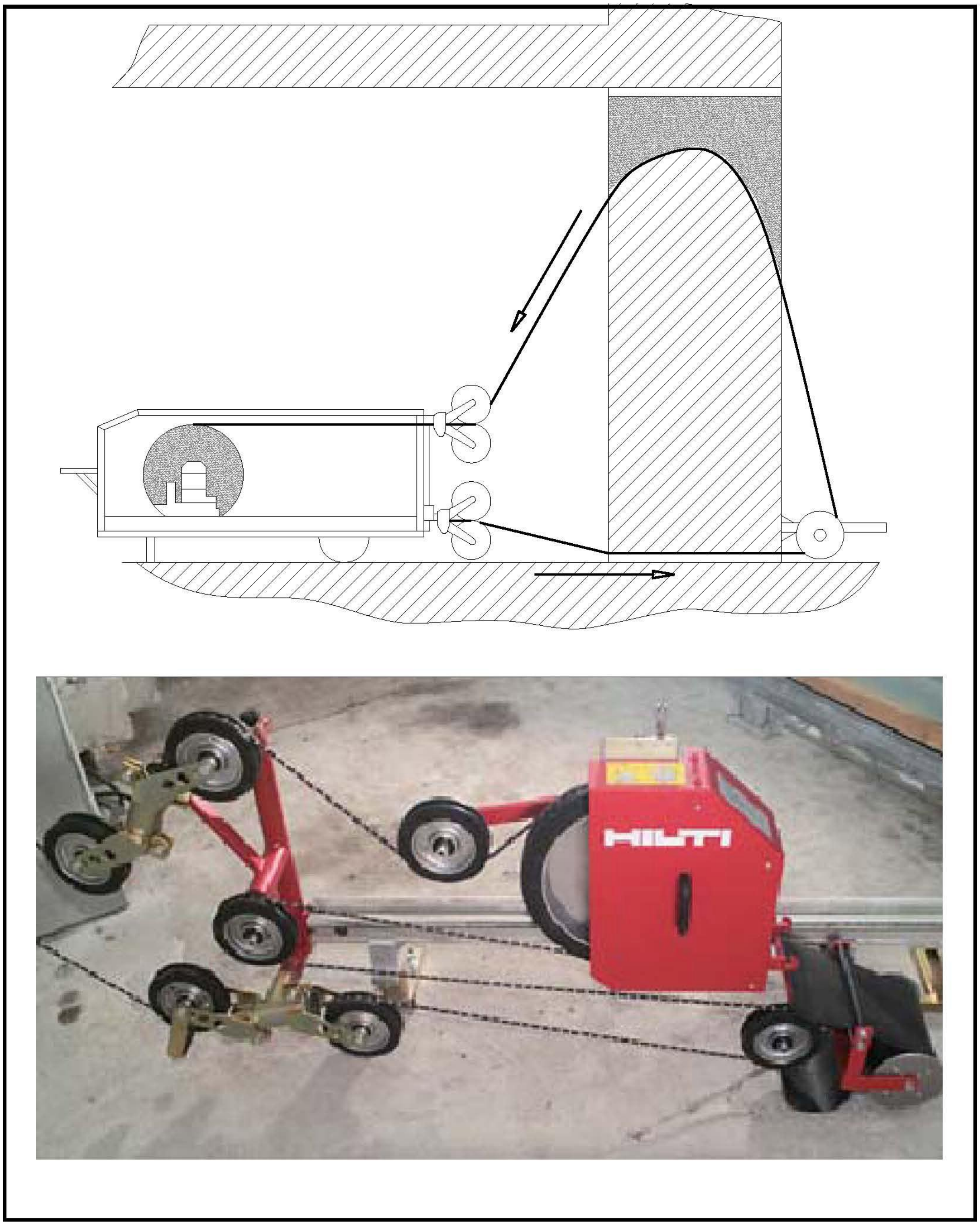


Figure 2-6. Diamond Wire Saw

Building demolition would be the final stage in Vitrification Facility removal, and it would be performed without confinement, but using restrictive, controlled methods to minimize airborne releases. The nine lead-glass viewing windows, containing approximately 3,000 pounds of lead, would be removed from the building before demolition of the structure and managed as hazardous or mixed waste.

The steel frame and sheet metal elements of the structure would be demolished first, followed by the reinforced concrete Vitrification Cell. Conventional equipment, together with fog sprays and specialized equipment as discussed above, would be used to dismantle and segment the thick concrete structures. The steel shield doors would also be segmented as necessary. Concrete debris from the Vitrification Cell would be further processed using a concrete crusher, allowing proper filling and compaction of the below-grade cells. Once the below-grade cells are filled, the remaining demolition debris would be incorporated and compacted into the engineered rubble pile.

2.1.3 Miscellaneous Facilities Remediation

The more significant support facilities within WMA 1 include the Load-In/Load-Out Facility, 01-14 Building, Utility Room, Utility Room Expansion, and the Main Plant Office Building. These buildings possess less radioactive contamination compared to the Vitrification Facility and Main Plant Process Building, and would therefore be demolished using more conventional methods. It is anticipated that these structures would be demolished after the Vitrification Facility but prior to or simultaneously with the Main Plant Process Building. Since, under the Sitewide Close-In-Place Alternative, only the above-grade structures in WMA 1 are demolished, several floor slabs and pads remaining from the Recirculation Vent System Building, the MSM Repair Shop, the Contact Size-Reduction Facility, the Emergency Vehicle Shelter, Fuel Receiving and Storage/High-Integrity Container (HIC) Storage Area, and the Radwaste Process (Hittman) Building would be left in place.

For each building, a characterization survey would be performed to quantify the residual contamination for safety planning and material characterization. Where necessary, utilities would be isolated, equipment would be removed, drains and sumps would be sealed, and vacuuming/applying spray fixative activities would be performed. Hydraulic excavators equipped with shear, grapple, and hammer attachments would mainly be used for demolition of the buildings. Equipment and concrete debris, similar to the Vitrification Facility, would be segmented and placed within below-grade cells, or incorporated into the engineered rubble pile.

Load-In/Load-Out Facility

The Load-In/Load-Out Facility would be demolished once the HLW canisters have been relocated to the DCSA. Standard construction equipment would be used once again, as the internal wall surfaces of the structure should not be contaminated. The demolition debris, as well as the dismantled shielded transfer cell, canister-handling system, and high-capacity crane, would be segmented and placed within the below-grade cells.

01-14 Building

The 01-14 Building contains a single lead-glass viewing window containing approximately 500 pounds of lead. This window would be removed from the building before demolition of the structure and managed as hazardous or mixed waste. The Vitrification Off-Gas System and the Cement Solidification System would have been removed prior to the implementation of remedial activities. The corrugated steel within the 01-14 Building would be removed before the concrete structure. Removal of the concrete would involve methods similar to those used for the Load-In/Load-Out Facility, and the building debris would be processed and placed within below-grade cells or incorporated into the engineered rubble pile.

Utility Room, Utility Room Expansion, and the Main Plant Office Building

The Utility Room, Utility Room Expansion, and the Main Plant Office Building are also relatively simple structures, and would be demolished using conventional equipment after they are no longer needed for support activities. Asphalt roofing material would be removed first, using equipment such as light hydraulic and hand tools. Wastes would be packaged according to regulations, decontaminated (as necessary), and removed by crane to ground level. Components determined to be asbestos-containing material (ACM) would be managed in accordance with applicable regulations. The steel superstructure underlying the roofing material would then be removed, segmented, and placed in the below-grade cells or in the engineered rubble pile.

Masonry and concrete walls would also be demolished using demolition machines equipped with shears and/or demolition hammers. The hammer would be used to pulverize the concrete, and the shears would be used to cut through the steel reinforcement in the concrete and structural steel members. In addition, a concrete crusher plant would be employed at the site on a full-time basis to assist in concrete crushing and rebar removal. Water mists would be used, as needed, to mitigate airborne dusts. The concrete and steel demolition debris from these three facilities would be placed in the below-grade cells of the Main Plant Process Building or incorporated into the engineered rubble pile beneath the final cap.

2.1.4 Main Plant Process Building Demolition

The Main Plant Process Building (Figures 2-2, 2-7, and 2-8) demolition would be performed using similar techniques to Vitrification Facility demolition.

Rooms/cells containing loose, residual radioactivity would be vacuumed, and equipment and piping would be demolished, segmented, and placed within the area to be covered by the multi-layered, engineered cap. Asbestos-containing insulation would be removed and managed by certified workers according to applicable regulations.

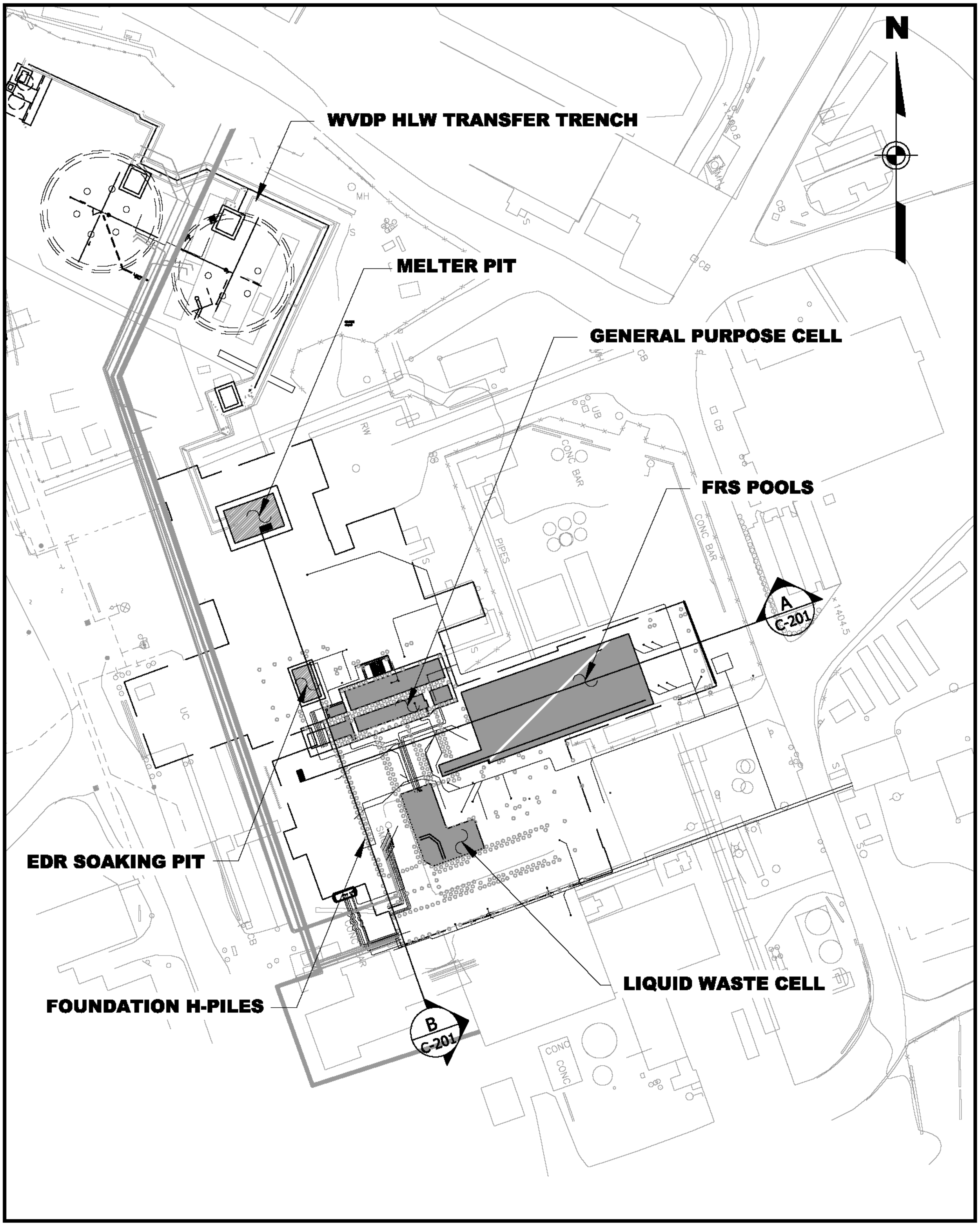


Figure 2-7. Main Plant Process Building Area Subgrade Facilities

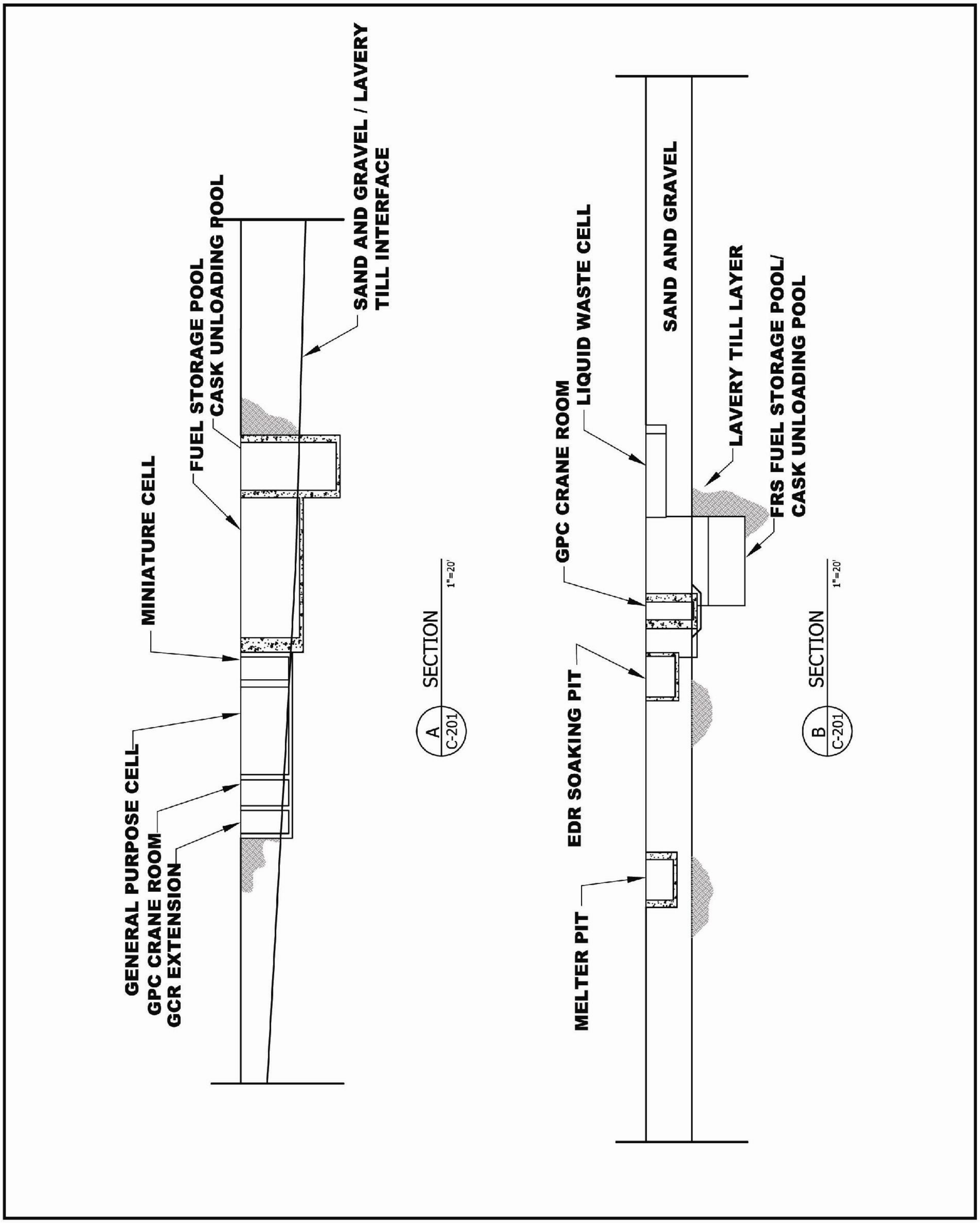


Figure 2-8. Main Plant Process Building Subgrade Facility Sections

Stainless-steel liners similar to those in the Vitrification Facility would be surveyed and decontaminated (as necessary) and removed manually or with remotely-operated equipment in high-radiation cells. Portable containment tents and HEPA ventilation units would be used to control contamination. The liners would be segmented and placed within the area to be covered by the multi-layered, engineered cap.

The 32 lead-glass viewing windows, containing a total of approximately 22,000 pounds of lead, would be removed from the building before demolition of the structure, processed to remove the lead and lead-containing components, which would then be managed as hazardous or mixed waste.

In order to mitigate environmental emissions and personnel exposures, the Main Plant Process Building superstructure would undergo selective demolition. The steel frame and sheet metal structures would be demolished first, followed by concrete and reinforced concrete cells. Conventional demolition equipment and diamond wire cutting machines would be used to demolish the Main Plant Process Building in an unconfined but controlled manner to minimize radioactive airborne releases.

Demolition of the Main Plant Process Building would be performed using an exterior-to-interior methodology, where the support structures would be demolished first, followed by the larger, self-supporting buildings. The multitude of room/cells could be separated into four types of structures, which would be demolished differently: miscellaneous facilities, framework cells, reinforced concrete framework cells, and tower cells.

Miscellaneous Facilities

The balance of facilities within the Main Plant Process Building area include structures such as the Stack, the Fire Pump House, the Laundry Room Concrete Floor Slab, and the Electrical Substation. The Stack structure is about 160 feet tall, varying four to ten feet in diameter, and composed of Type 304L stainless steel. This structure would be removed in sections, and the pieces would be lowered to the ground by a crane. To prevent the spread of contamination, the sections would be temporarily wrapped with plastic sheeting, and eventually segmented, and placed within the area to be covered by the multi-layered, engineered cap.

Removal of the equipment and piping from the Fire Pump House, and demolition of the superstructure itself, would be accomplished by conventional methods. The steel water storage tank would be drained, segmented using conventional cutting equipment, and placed within the area to be covered by the multi-layered, engineered cap.

The transformer within the electrical substation would be disconnected and removed by the electrical utility company. Uncontaminated salvageable equipment might be removed from the site. Electrical equipment containing hazardous materials (e.g., PCB oil in transformers) would be disposed of off site in accordance with federal, state, and local laws. Demolition debris would be placed in the engineered rubble pile.

Framework Cells

The Framework Cells (e.g., Acid Recovery Cell; Head End Ventilation, Off-Gas Cell; Operation, Viewing, and Analytical Aisles, Laboratories, etc.) were designed and constructed with masonry or concrete supported by a structural steel framework and decking. The asphalt roofing material, which is thought to be ACM, would be removed first, similar to the Vitrification Facility using light-duty hydraulic equipment and hand tools. The roof debris would be packaged and managed according to the local, state, and federal laws.

The steel superstructure would then be removed simultaneously with the concrete structure. Steel components would be segmented with a shear attached to a demolition machine. The masonry and concrete walls would also be demolished with a demolition machine equipped with a demolition hammer. The hammer would break the concrete, while the shear would cut through the steel reinforcement and structural members. A fog spray or similar dust-suppression technique would be used during concrete demolition. Debris removed from high elevations would be lowered to the ground using a crane, and then compacted in place in the below-grade cells or the engineered rubble pile.

Reinforced Concrete Framework Cells

The Reinforced Concrete Framework Cells (Analytical Cells 1–5, Sample Cell, and Sample Storage Cell) were constructed with high-density concrete up to three feet thick to provide shielding from high activity radiation. The cells are located within and above the framework cells, and thus, would be demolished concurrently with the framework cells.

The five analytical cells, sample cell, and sample storage cell are located at a plant elevation of 131 feet. Similar to the other framework cells at this height, the concrete and steel would be removed using demolition machines, lowered to the ground with a crane, and placed into the below-grade cells or engineered rubble pile.

Tower Cells

The Tower Cells (e.g., Chemical Process Cell and Process Mechanical Cell, Extraction Cells 1–3, Product Purification Cell, etc.) are the fundamental and most robust structures of the Main Plant Process Building. These structures are made of reinforced concrete and are structurally self-sufficient. In general, the walls, floors, and ceilings consist of high-density reinforced concrete up to 5.5 feet thick. These components would be demolished using controlled techniques with diamond wire saws, as discussed in Section 2.1.1.

The ceilings of tower cells would be segmented and removed first with a diamond wire saw that would cut through the concrete and steel. A crane would be used to support each ceiling segment and safely lower it to the ground level. The walls would be demolished in a similar fashion, sizing the pieces as needed to provide a tight fit in the below-grade cells of the Main Plant Process Building. Demolition would extend until the proposed top of the engineered rubble pile is reached. Floor slabs would remain in place under the Sitewide Close-In-Place Alternative.

2.1.5 Subsurface Remediation

Although there is no major excavation work planned for subsurface facility remediation under this alternative, the waste transfer pipelines running between the Main Plant Process Building and the Waste Tank Farm would be grouted and abandoned in place. Only sections that interfere with the proposed barrier wall alignments (refer to Section 2.3) would be removed as needed.

Piping in the subsurface of WMA 1 would vary in levels of contamination from highly radioactive off-gas and waste transfer pipelines (e.g., 7P120-3) to non-radioactive utility pipelines and equipment. High-activity pipelines, such as the NFS high-level waste piping (7P113 and 7P120) and the piping existing in the off-gas trench, would be filled with cement-based grout to encapsulate any residual contamination and minimize voids. Following process pipe grouting (including the high-activity off-gas pipeline), the off-gas trench would be backfilled with soil fill.

The three underground tanks (35104, 7D-13, 15D-6) in the immediate vicinity of the MPPB, which contain relatively low levels of radioactivity, would be also be filled with cement grout or flowable fill, regardless of the degree of contamination. Again the primary purpose with the tank grouting is to minimize subsurface voids remaining beneath the final cap.

2.1.6 Remediation Completion and Closeout Activities

With the future availability of an appropriate disposal site, the HLW canisters at the DCSA would be removed from the HSMs, placed on a Cask Transfer Trailer, and transported to the rail spur. It is anticipated that the canisters would be shipped to the disposal facility via rail. The HSMs that housed the canisters in storage would be removed from the DCSA and disposed of as CDD. A backhoe loader or similar equipment would be used to remove the fencing around the DCSA, while the reinforced concrete pad would remain. This debris is not expected to be radiologically contaminated, and so it would be managed as CDD waste. The pad would be left in place, and the area (including the berms and barriers) would be graded and seeded.

2.1.7 Mitigative Measures

Many actions would be adopted during remediation of WMA 1 to reduce or eliminate impacts to human health and the environment. Sediment controls and dust suppression would be employed during construction and demolition of the DCSA and tent confinement structures to provide protection against human and ecological exposure to contaminants. Health and safety planning and PPE use would be instituted as required. The access controls that would be established from the installation of the DCSA fencing and subsurface barrier walls would also provide some protection to human health and safety.

2.2 WMA 2: Low-Level Waste Treatment Facility Area

The work planned at WMA 2 consists of the following activities:

- In-situ solidification and stabilization of the Lagoon 1 soil;
- Construction of a subsurface hydraulic barrier wall around Lagoon 1;
- Solidification of sediments in Lagoons 2 and 3, and supply and placement of backfill to bring the lagoons to grade;
- Removal and in-place management of the liners in Lagoons 4 and 5, and supply and placement of backfill to bring the lagoons to grade;
- Demolition of Low-Level Waste Treatment Building (LLW2);
- Removal of Old and New Interceptors (aboveground portions);
- Grouting of wastewater pipelines; and
- Construction of a multi-layer cap over the footprint of the lagoon area.

Layout of the lagoons and associated facilities of WMA 2 is presented in Figure 2-9. Detailed discussion of the proposed remedial activities is presented in the following subsections.

2.2.1 Remediation Support Activities

The work planned for this WMA under the Sitewide Close-In-Place Alternative is relatively routine in terms of construction complexity. In general, all of the work is expected to be completed without need for confinement. In addition, remediation support activities would be limited to implementation of the site-specific health and safety procedures, sediment and erosion control procedures, and similar standard construction preparation activities.

2.2.2 Remediation of Lagoon 1

Since the wastes currently contained within Lagoon 1, including Class C waste, would be left in place, certain steps would be undertaken to stabilize the material, and minimize groundwater contact with, and transport of, contaminants. A subsurface soil-bentonite barrier wall would be installed to divert groundwater around the portion of the lagoon that is below the groundwater table, and in-place soil mixing would be used to help stabilize the remaining contaminants.

Lagoon 1 Waste Stabilization/Solidification

Mechanical soil mixing would be used to stabilize the shallow subsurface contaminated soils in Lagoon 1. A hydraulic drill rig would be used to advance an appropriate mixing/drilling tool into the soil. As the mixing/drilling head advances, a cement grout would be injected into the soil through the mixing head with the intent of filling voids, mixing soils with grout, and creating a solidified columnar mass. Asphalt debris that is encountered would not be mixed, but would be encapsulated. Treatment would extend from the ground surface to the approximate depth of the Lavery till layer. Each advancement of the mixing/drilling tool creates columns of uniformly treated soil. The columns, in this application, would be tightly spaced to create a uniformly stabilized soil mass.

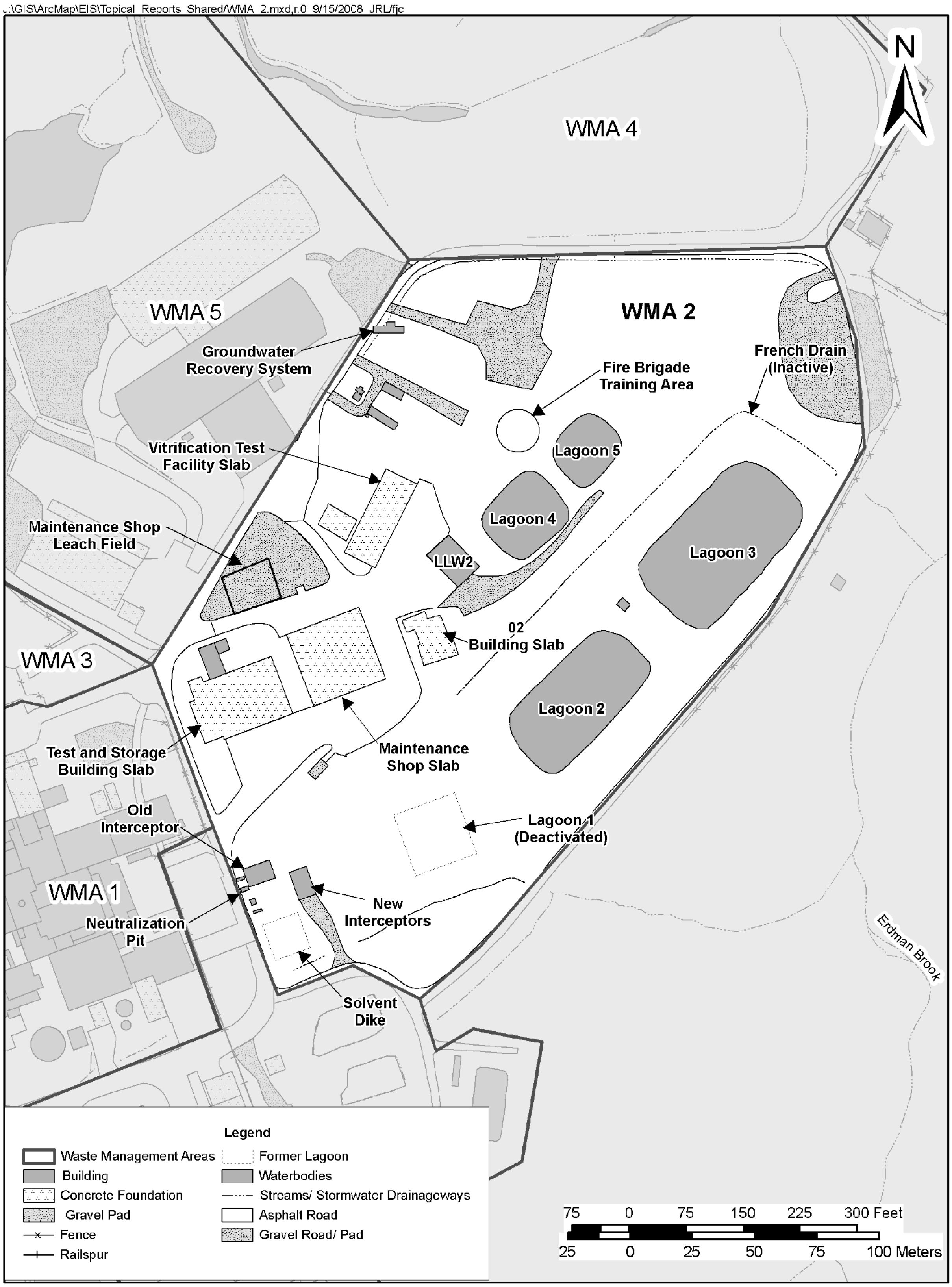


Figure 2-9. WMA 2 - Low-Level Waste Treatment Facility Area

Lagoon 1 Perimeter Soil-Bentonite Barrier Wall

A soil-bentonite barrier wall would be installed to divert groundwater around the portion of the Lagoon 1 that is below the groundwater table (Figure 2-10). The wall would be keyed into the underlying till by approximately three feet in depth, and would extend vertically at least above the seasonal high groundwater table elevation in that area. The assumed depth of the trench is approximately 17 feet. In order to completely encapsulate the Lagoon 1 area, the barrier wall trench would be approximately 102 feet on a side, for a total perimeter length of 408 feet. A hydraulic excavator would be used to excavate the trench for eventual installation of the soil-bentonite backfill material. Hydrated bentonite slurry would be prepared using a shear mixer and contained in earthen containment berms until such time that it is needed for trench construction. The slurry prepared during excavation would contain approximately 10% bentonite by weight. During the excavation process, the trench would be kept filled with the bentonite slurry to provide the necessary stability of the trench walls.

The soil-bentonite backfill would contain up to 7% bentonite by weight. The downgradient portion of the wall would contain 25% phosphatic ore that contains apatite. The remaining volume of backfill would be made up of a specified soil with sufficient fines. The soil-bentonite backfill material would be mixed using heavy equipment (excavator, bulldozer, or loader) on a concrete mixing pad. During the mixing process, the dry ingredients and dry bentonite would be mixed together, and then the bentonite slurry would be added to create a thick mud-like consistency. Prepared backfill material would then be loaded into dump trucks, or moved directly to the trench site using loaders or cranes, and finally placed in the trench. The backfill would displace the slurry, which would then be used to continue the trench excavation. Once the wall is complete and begins to set up, the upper three-foot section would be backfilled with soil or structural backfill. Traffic areas would be backfilled with stone to allow heavy equipment to bridge the wall. The resulting barrier wall would have an in-place saturated hydraulic conductivity of approximately $1x10^{-7}$ to $1x10^{-8}$ centimeters per second (cm/s).

2.2.3 Remediation of Lagoons 2 and 3

Lagoons 2 and 3 are unlined lagoons constructed into the Lavery till, with estimated accumulated depths of sediment of 4 feet and 1.6 feet, respectively. Under the Sitewide Close-In-Place Alternative, this sediment would be solidified in place using Portland cement, and the lagoons would be backfilled. The Lagoon 2 and 3 solidification process would be conducted within the open lagoon structures, facilitating uniform treatment of the impacted sediment and mitigating the need for the construction of a soil-bentonite barrier wall around the structures. In addition, the pump shed and ancillary piping at Lagoon 2, and the stainless-steel weir structure at Lagoon 3 would be demolished and incorporated into the lagoon backfill. Radioactive contamination is known to be present in Lagoon 2 sediment.

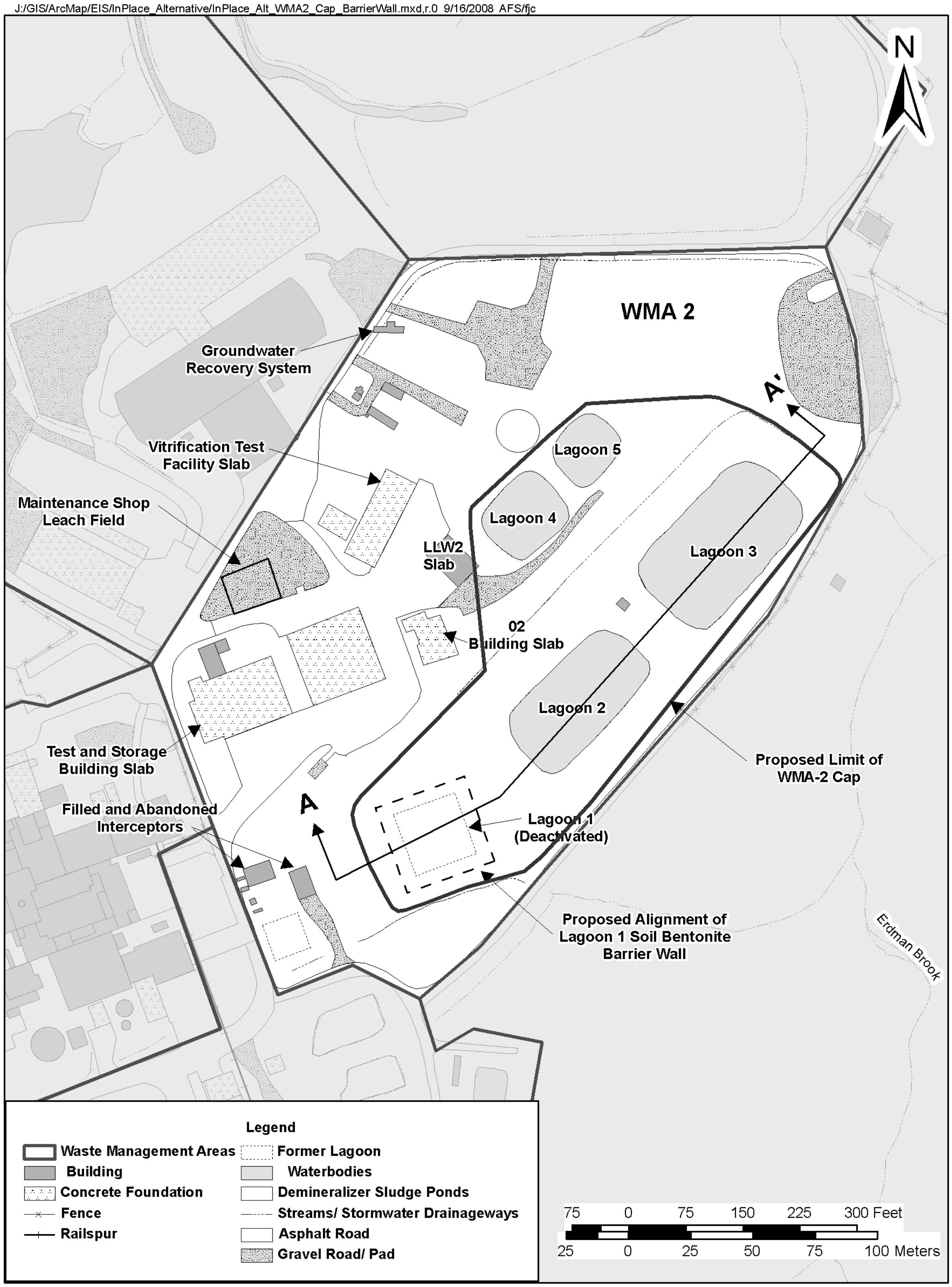


Figure 2-10. WMA 2 Cap and Barrier Wall

The sediment solidification task would be accomplished using standard construction equipment (hydraulic excavator). Prior to in-place solidification, a ramp would be constructed down to the lagoon bottom, and a small working platform would be constructed at the base using imported fill or material cut from the access ramp. This material would essentially be pushed into place, displacing the sediment in the corner of the lagoon, creating an area for the hydraulic excavator to sit.

Cement would likely be delivered to the site in one- or two-ton supersacks. These bulk packages would be lifted over the first area of sediment to be worked, using the excavator, and slowly released into the sediment. The cement would be mixed into the sediment using the excavator, until a desirable consistency is achieved, keeping in mind that the properties of the cement would cause further solidification and stability over time. Once the sediment in the vicinity of the excavator is solidified, the working platform would be extended and solidification would continue into a nearby area. Backfilling of the lagoon would be performed once the sediment solidification is complete. The Lagoon 2 transfer pump shed would also be demolished at this time. The demolition debris is expected to be managed as CDD.

2.2.4 Remediation of Lagoons 4 and 5

Lagoons 4 and 5 are lined lagoons, with little or no accumulated sediment mitigating the need to install a soil-bentonite barrier wall around the structures, or stabilization of residual waste materials. These lagoons would be backfilled with appropriate backfill material, following removal of the lagoon liners. When used in this report, "appropriate backfill material" is defined as earth materials (unimpaired by chemical or radiological contaminants) used to refill an excavated area in conformance with applicable engineering specifications. The lagoon liners are constructed of XR-S ethylene interpolymer alloy-reinforced (EIA-R) material with welded seams, placed over concrete grout. The liners would be removed using the excavator or bulldozer during backfilling. Basically, the heavy equipment would be used to place a thin lift of material over the liner, while additional effort is made to demolish the liner during soil placement. The liner fragments would be incorporated into the first few lifts of backfill. Liner demolition is expected to limit subsurface ponding or perched groundwater.

2.2.5 Removal and Closure of Miscellaneous Facilities

LLW2 Facility

The treatment components of the LLW2 treatment facility would be demolished and removed. The ion-exchange media would be managed as LSA waste. The remaining wastewater processing equipment and piping from the building would be removed and size-reduced, as appropriate, and managed as LSA waste. The waste packaging area would be demolished using appropriate controls, such as fog spray. The demolition debris, including the sump liner, would be managed as LSA waste. The remainder of the LLW2 Facility and its floor slab would then be demolished by conventional methods without confinement and the demolition debris would again be managed as LSA waste.

New and Old Interceptors

The New and Old Interceptor roofs would be removed from the subsurface structures, demolished, and containerized for disposal. The roof debris is expected to be managed as LSA waste. The subsurface structures would be demolished in place, by using an excavator with a hydraulic hammer to punch holes in the liner (if present) and concrete walls/base, minimizing the potential for water to become trapped within the subsurface structure. Since the Old Interceptor concrete floor is expected to have high levels of residual contamination between layers of concrete, the floor would not be demolished. Rather, the concrete walls above the floor surface would be penetrated to ensure trapped water is minimized. The vaults would then be backfilled with imported fill. During backfilling, other remaining depressions, such as the neutralization pit, would be backfilled also.

Wastewater Pipeline Grouting

Wastewater pipelines in the vicinity of the interceptors will be excavated, severed, and plugged with grout. The excavations would be performed immediately outside of the interceptors, and there would be no waste generated in relation to this activity. Grouting of the pipelines is intended to minimize the preferential groundwater flow through inactive sewers, pipes, and other conduits.

2.2.6 WMA 2 Cap

The WMA 2 Cap follows a modified RCRA Type C design basis intended to limit access to residual waste. The WMA 2 Cap design includes a three-foot-thick intruder barrier consisting of cobbles (roughly 3 inches in diameter) to mitigate damage from burrowing animals. The residual waste in Lagoon 1, Lagoon 2, and Lagoon 3 will be stabilized with cement prior to backfilling and cap installation. The WMA 2 radiological inventory supports the installation of a somewhat less robust cap than planned for other areas of the site.

The final lifts of backfill in the lagoons would be graded to provide a minimum slope of 5% (top cap areas) and a maximum slope of 33% (side slope areas). These final lifts of backfill would form the WMA 2 Cap pregrade (Figures 2-10 and 2-11). The cap cross-section (including the pregrade material) would consist of:

- Lagoon Backfill/Common Fill Layer – Backfill would be placed in Lagoons 2–5, to fill the lagoons up to the surrounding ground surface. Additional volumes of common fill would also be used to create the pregrade slopes (5% to 33%). The common fill layer would be mined from a local source and might consist of sand and gravel material, similar in characteristics to the Sand and Gravel Aquifer. Common fill would be placed and compacted using bulldozers and sheepsfoot rollers.

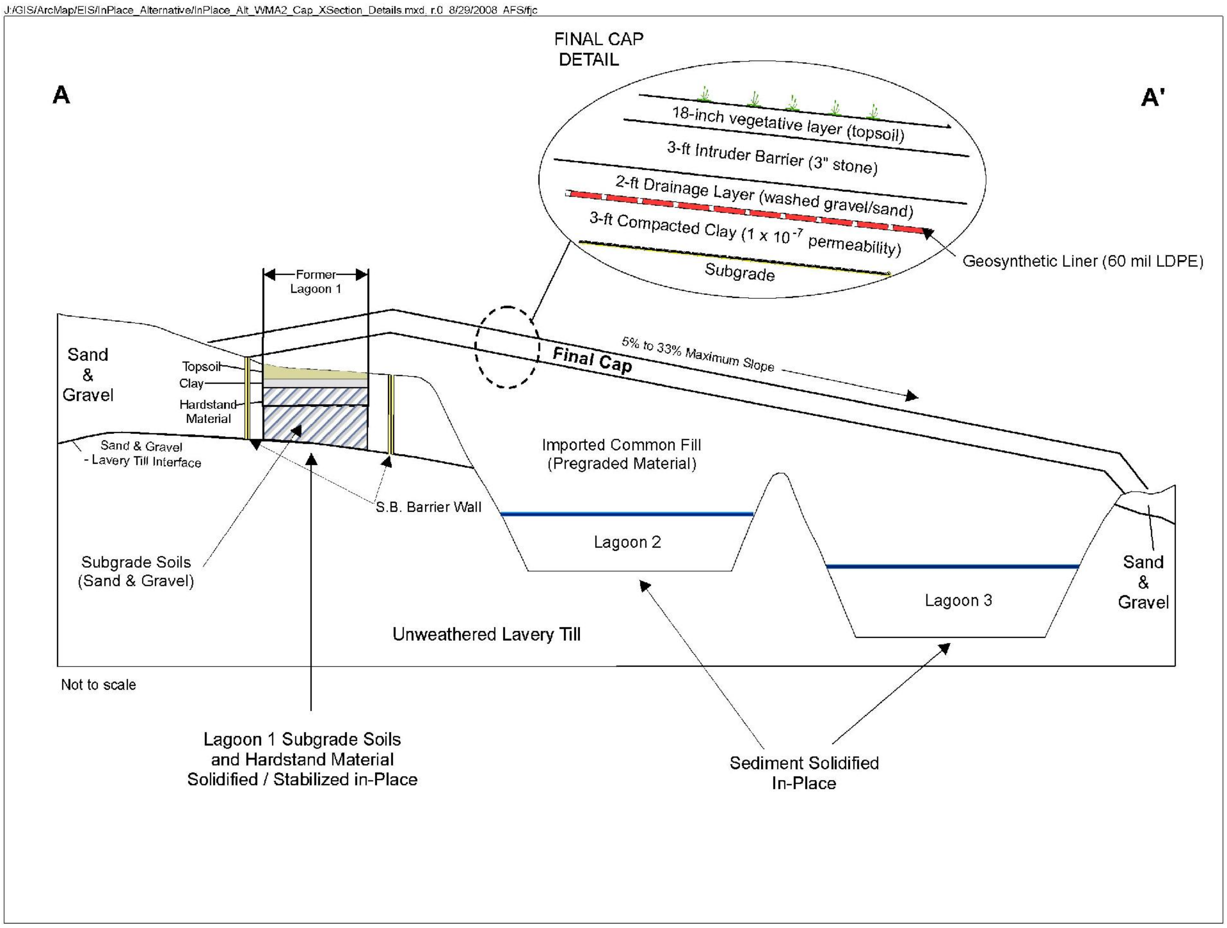


Figure 2-11. WMA 2 Cap Cross-Section and Details

- Compacted Clay Layer – A three-foot-thick layer of compacted clay would be installed directly above the common fill layer, following the grades and slopes established during pre-grade. Since the compacted clay layer would be considered a secondary infiltration barrier (primary barrier provided by the geosynthetic liner), a maximum in-place hydraulic conductivity of $1x10^{-7}$ cm/sec would be specified. The clay layer would be placed and compacted in controlled lifts (approximately six inches in thickness), using bulldozers and sheepsfoot rollers, to ensure adequate compaction. The liner would also undergo in-place compaction and permeability testing to ensure it meets the required placement specifications.

- Geosynthetic Liner – A 60-mil low-density polyethylene membrane would serve as the primary infiltration barrier and would be installed over the entire compacted clay layer. At the edges of the cap, an anchor trench would be constructed where the liner would terminate. The anchor trench would eliminate uplift during construction, and would provide additional protection against runoff migration beneath the liner. The liner would be deployed and continuously seamed to create a uniform, contiguous waterproof barrier. The liner seaming would be subject to stringent quality control checks, in accordance with common cap construction practices.

- Drainage Layer – A two-foot-thick drainage layer of poorly graded, clean, washed gravel would be placed using a bulldozer in a single lift of two feet, to avoid damage to the liner. The drainage layer would drain to the toe of the landfill cap (around the perimeter).

- Intruder Barrier – A three-foot-thick intruder barrier would be installed over the drainage layer. The main purpose of the intruder barrier would be to eliminate or mitigate burrowing animals from impacting the drainage layer or liner. This barrier would consist of cobbles (roughly three inches in diameter) and would be placed over the drainage layer using a front-end loader or bulldozer. Design considerations for the intruder barrier and drainage layer would include a stability analysis. If deemed necessary by design, a filter layer may be needed between the intruder barrier and the drainage layer to provide stability between the layers. As an alternative to a sand- or soil-based filter layer, a geotextile filter fabric could be considered.

- Vegetation Layer – The primary protection against erosion of the WMA 2 cap would be provided by a vegetative cover. In order to establish healthy vegetation, an 18-inch layer of imported topsoil would be placed over the entire landfill cap. The topsoil would extend to the toe of the landfill perimeter, and a small rock apron would be installed. The rock apron would provide an avenue for the drainage layer to seep moisture from above the liner, as well as additional protection against erosion of the landfill toe. Seed and mulch would be applied to the cap in a single process referred to as hydroseeding.

2.2.6 Remediation Completion and Closeout

Once the cap installation is complete, and vegetative cover is established, temporary erosion and sediment controls would be removed and general site restoration would be performed. Successful vegetative growth is of key importance to the success of the cap performance, therefore, there would be a significant effort directed toward maintaining the vegetative cover over the initial growing season.

2.2.7 Mitigative Measures

There are several mitigative measures employed during the WMA 2 remediation intended to limit human and ecological exposure to the chemicals and radionuclides of concern. The mitigative measures employed in the form of engineering controls include:

- Installation of temporary sediment and erosion controls; and
- Mixing of the Lagoon 1 waste soils in situ, eliminating a waste-handling step and minimizing inherent exposures

In addition, several mitigative measures are incorporated into the works in the form of administrative measures, such as:

- Implementation of safety procedures including consideration of ALARA as the radiation exposure goal for all remedial work; and
- Constant monitoring of the work in progress to ensure that engineering controls and health and safety measures are effective.

2.3 WMA 3: Waste Tank Farm Area

WMA 3 is in close proximity to WMA 1 and both areas would be closed in conjunction with one another (see Figure 2-12). Many structures exist within the area, and therefore many different activities would occur, such as demolition of buildings, removal of piping and pumps, stabilization of underground tanks, and installation of vertical and horizontal barriers. As complex as the implementation activities would be for WMA 3, little to no support and closeout activities would be needed for the remediation of this area.

A Tank and Vault Drying System will be installed before the starting point of this EIS to dry the residual liquids present in the waste tanks. Equipment for the system will include a dehumidifier and heater for air forced into the vaults. The exhaust air leaving the vaults will pass through HEPA filters. An additional enhancement to reduce corrosion inside the tanks would be to reconfigure the Tank and Vault Drying System to dry both inside the vaults and inside the tanks.

2.3.1 Remediation Support Activities

The work planned for this WMA under the Sitewide Close-In-Place Alternative is relatively routine in terms of construction complexity. In general, most of the work is expected to be completed without need for confinement. Pump removal and packaging would be performed within a containment tent. In addition, remediation support activities would be limited to implementation of the site-specific health and safety procedures, sediment and erosion control procedures, and similar standard construction preparation activities.

2.3.2 Demolition of Surface Structures

Prior to addressing below-grade contamination and structures, and before installation of the North Plateau cap and barrier walls, several surface facilities would be demolished, pulverized, and compacted in place.

Equipment Shelter and Condensers

The WTF Equipment Shelter is a concrete building that is 40 feet long by 18 feet wide by 12 feet tall. The Shelter sits on a one-foot-thick concrete pad. There is a 9-foot by 7-foot by 5-foot-high addition that is attached to the shelter. This addition sits on a two-foot-thick concrete pad. The shelter housed the WTF Ventilation System that was formally used to ventilate the four Waste Storage Tanks. This equipment would be removed and the building interior walls and ceiling would be sprayed with a fixative. The building and addition would be demolished, pulverized, and incorporated into the engineered rubble pile beneath the cap.

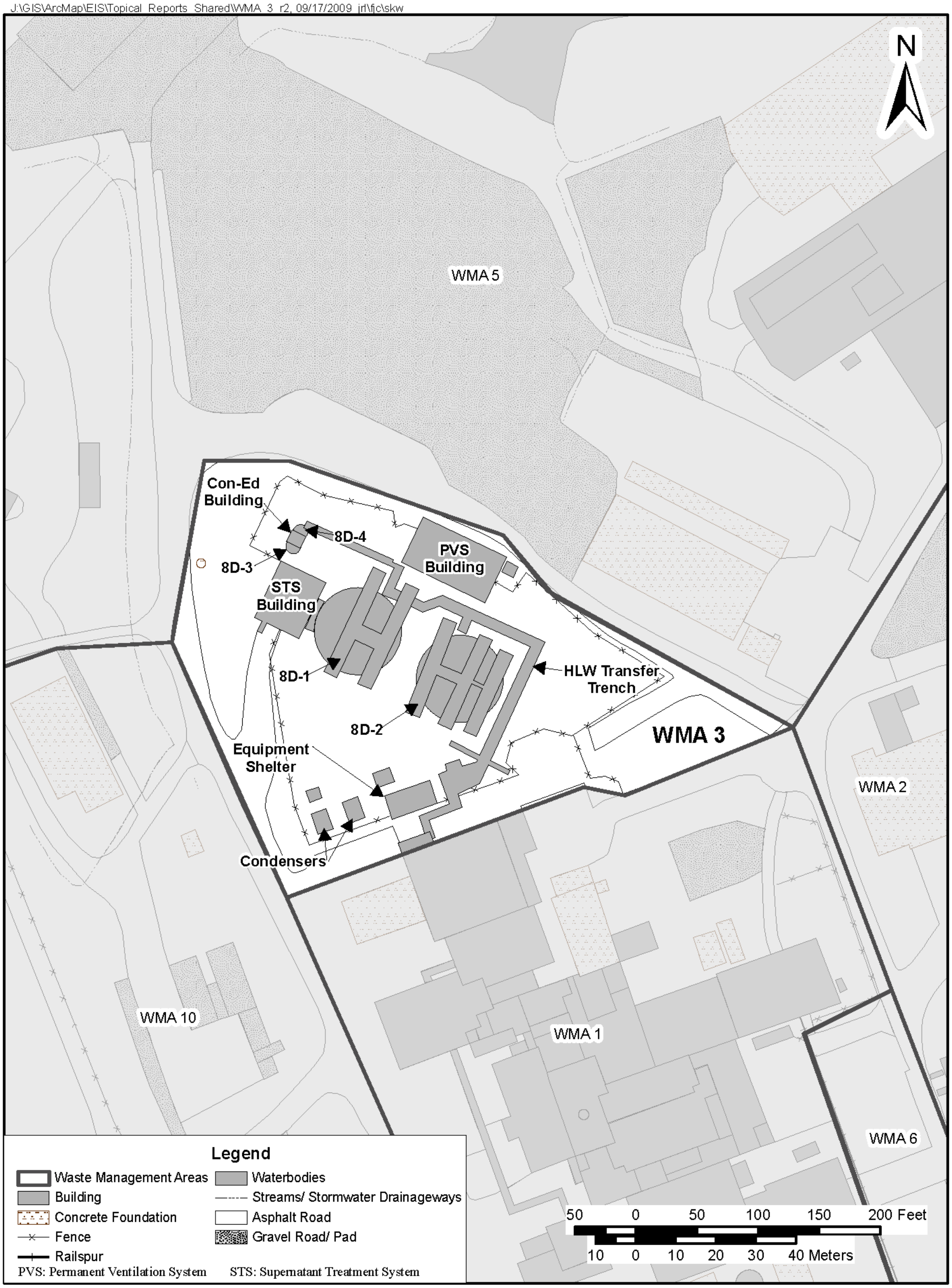


Figure 2-12. WMA 3 - Waste Tank Farm Area

Con-Ed Building

The Con-Ed Building is a concrete block building located on top of the concrete vault containing Tanks 8D-3 and 8D-4. This building, which is 10 feet wide, 13 feet long, and 11 feet high, houses the instrumentation and valves used to monitor and control the operations of Tanks 8D-3 and 8D-4. The Con-Ed Building is radiologically contaminated. The majority of the contamination is believed to be contained within the piping and equipment inside the building. A fixative would be applied to the exterior of all piping and equipment to lock down contamination, before the piping and equipment are removed. The building structure would be demolished. The piping and equipment would also be dismantled, and all building and concrete debris would be pulverized and incorporated into the engineered rubble pile beneath the cap.

Permanent Ventilation System Building

The PVS Building would be in operation at the start of remediation activities. The equipment inside the building would be dismantled, and the building would be sprayed with a fixative and demolished by conventional methods without confinement using a demolition machine and front-end loader. The stack, including the metal and concrete walls and roofing, would be sectioned also using a demolition machine with a shear and hammer. These structures and equipment would all be demolished down to grade, and the debris would be managed in place, pulverized as necessary, and incorporated into the engineered rubble pile beneath the cap.

Supernatant Treatment System Building

The Supernatant Treatment System Building (STS) Support Building is a two-story structure that contains equipment and support systems needed to operate the STS. The upper level is approximately 22 feet high, made up of a steel frame covered with steel siding. The lower level of the STS Support Building is approximately 15 feet high. This lower level was constructed with reinforced concrete floors and ceiling. This building, with the exception of the Valve Aisle, is radiologically clean. All non-contaminated equipment and building materials located outside of the Valve Aisle would be dismantled, pulverized, and incorporated into the engineered rubble pile beneath the cap.

Following CDD removal, spray fixative would be applied to the interior surface areas of the Valve Aisle. The steel shield walls and roof of the Valve Aisle would be removed using the same procedures discussed in the Main Plant Process Building Removal. All demolition debris would be segmented, as necessary and incorporated into the engineered rubble pile beneath the cap.

2.3.3 Removal of Process Pumps and Piping

High-Level Waste Transfer Trench and Piping

The HLW Transfer Trench is approximately 500 feet long and varies from six feet to 20 feet wide and six to nine feet high. The walls are made of 18- to 24-inch reinforced concrete and the roof is two-foot-thick pre-cast concrete. The floor slab is one foot thick, and piping in the trench is double-walled and equipped with a leak-detection system. The trench itself would be left in place and simply backfilled with common borrow, as it is not expected to be radiologically contaminated. The process pipelines, which may contain significant radionuclide contamination, would be grouted to stabilize contamination and minimize void spaces. The grout would consist of either a controlled low-strength material (CLSM) or a sodium silicate-based grout, depending upon the diameter and length of the line. CLSM is a self-compacting, cement-based material that can be pumped or poured through pipes or other small voids. CLSM is typically used in lieu of structural fill when compaction is not practical or possible. Once grouted, the pipelines would be left in place within the backfilled trench.

High-Level Waste Transfer and Mobilization Pumps

There are five high-level radioactive waste mobilization pumps in Tank 8D-1 and four mobilization pumps in Tank 8D-2. These centrifugal mixer pumps are approximately eight feet long and are supported by a 10-inch stainless-steel pipe column. These pumps extend to the bottom of the tanks (approximately 50 feet in length for 8D-1 and 8D-2, and approximately 20 feet in length for 8D-3 and 8D-4). Tanks 8D-1, 8D-2, and 8D-4 also each contain a transfer pump. These centrifugal multi-stage turbine pumps are supported by 14-inch pipe columns, which are similar in length to the mobilization pumps.

All of the pumps are radiologically contaminated and would be removed under appropriate radiological controls (e.g., containment, shielding, remote operation, etc) established for the previous removal of pumps from the HLW tanks. A type of sleeve system would be used to secure and wash the pumps prior to dismantlement. Once washed, the pumps would be cut into sections during removal and packaged for disposal. For estimating purposes, the pumps are assumed to be classified as follows:

- seven pumps from Tank 8D-1 (five mobilization pumps, one transfer pump, one STS suction pump) are assumed to be managed as Class C waste;
- six pumps from Tank 8D-2 (four mobilization pumps, one transfer pump, one STS suction pump) are assumed to be managed as Transuranic (TRU) waste, as defined in 40 CFR 191;
- one pump from Tank 8D-3 is assumed to be managed as Class B waste; and
- one pump from Tank 8D-4 is assumed to be managed as TRU waste.

Support structures that are removed in conjunction with pump removal would be cut into sections and laid on grade with the other demolition debris to form the base of the cover. The support structures are not expected to be radiologically contaminated; therefore no special radiological controls would be needed.

2.3.4 Stabilization of HLW Tanks

Tanks 8D-1, 2, 3, and 4, and Associated Vaults

The tanks and vaults would be filled to the height of the top of the tanks with CLSM, which contains sorbents and reducing materials to retard radionuclide migration. The CLSM mixture consists of Portland cement, fly ash, granulated blast furnace slag, phosphatic ore, and water. The blast furnace slag (reducing agent) and phosphatic ore (contains sorbent mineral, apatite) would limit the mobilization of long-lived radioactive isotopes, such as technetium, plutonium, uranium, and neptunium. The CLSM would also help to minimize subsidence, while its low compressive strength would allow future excavation, if necessary. The CLSM mixture would be placed as self-leveling slurry with a compressive strength of 50 to 200 lb/in^2 depending upon the application. Higher strength CLSM (200 lb/in^2) might be used if future excavation is unlikely.

The CLSM would be pumped simultaneously into the tanks and vaults, maintaining equivalent heights to prevent floatation of the tanks. Multiple pipes installed in the tank risers would be used to inject the CLSM. Tanks 8D-1 and 8D-2 would be filled with multiple lifts because of their size. Remote closed-circuit television (CCTV) cameras would be installed on the risers to monitor the progress of CLSM placement. Air displaced during the placement of CLSM would be routed through portable HEPA ventilation units and portable gas monitors. Other miscellaneous tanks, ion-exchange columns, cooling coils, etc. in the subsurface of the WTF would be filled with CLSM using a grout pump and feed tube. The STS equipment inside of Tank 8D-1 would remain in place and would be filled and encapsulated by CLSM. Spent zeolite would remain in the ion-exchange columns encapsulated by CLSM.

A strong grout with a compressive strength in excess of 2,000 lb/in^2 would be used to stabilize the head space between the top of the tanks and the vault ceilings. The pump risers located above the top of the tanks would also be filled with strong grout up to the riser expansion joints. Figures 2-13 and 2-14 show the configuration of the Tanks 8D-1, 8D-2, 8D-3, and 8D-4 following tank closure.

2.3.5 Installation of Barrier Walls and Cap

Barrier Walls

A double-barrier wall system would be installed in the subsurface at the North Plateau. A circumferential barrier wall would be constructed around the stabilized facilities in WMA 1 and WMA 3 to control groundwater infiltration. In addition, a separate upgradient barrier wall would be constructed at an angle to redirect groundwater flow and prevent mounding against the circumferential wall (Figure 2-15).

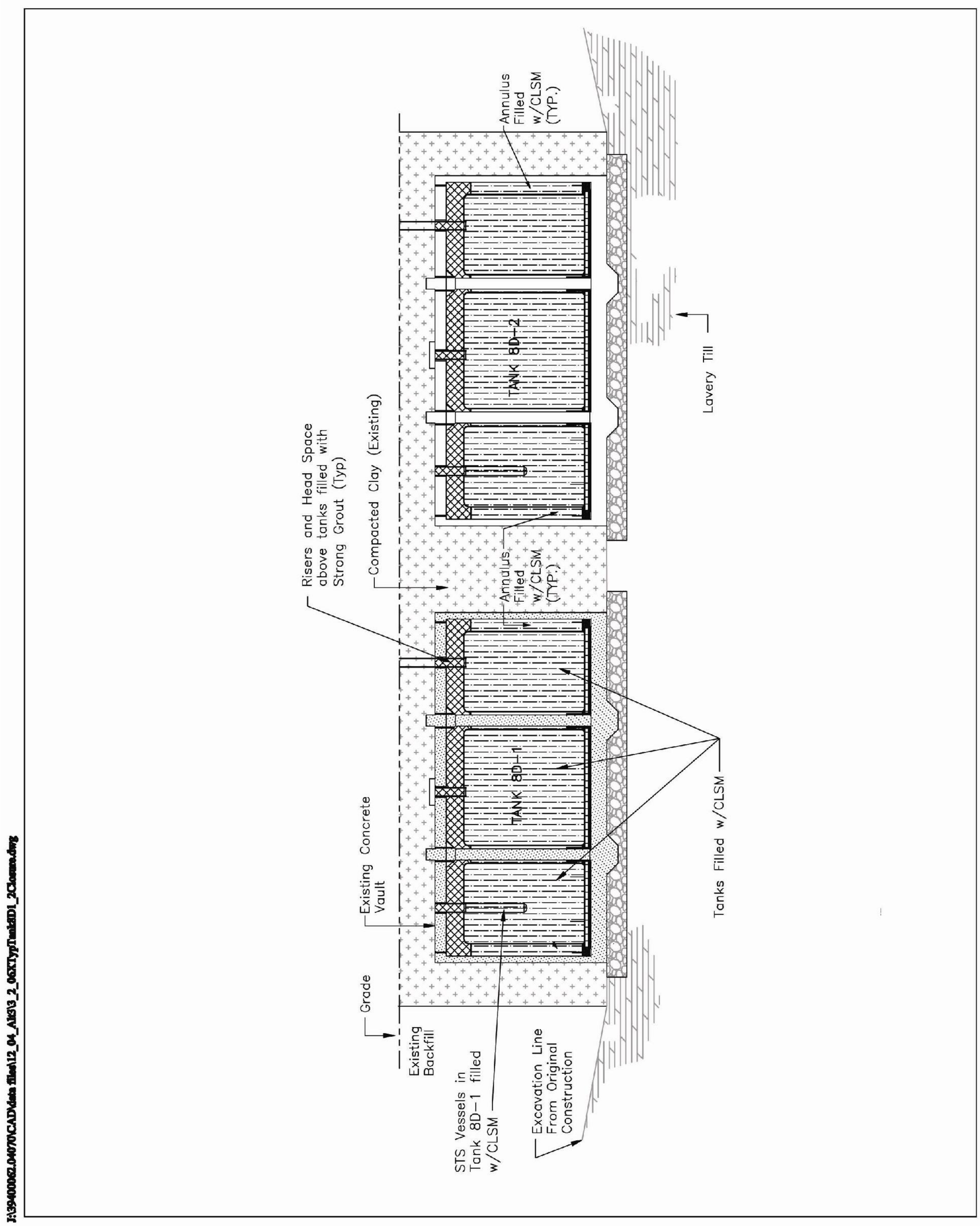


Figure 2-13. Configuration of Tanks 8D-1 and 8D-2 Following Tank Closure

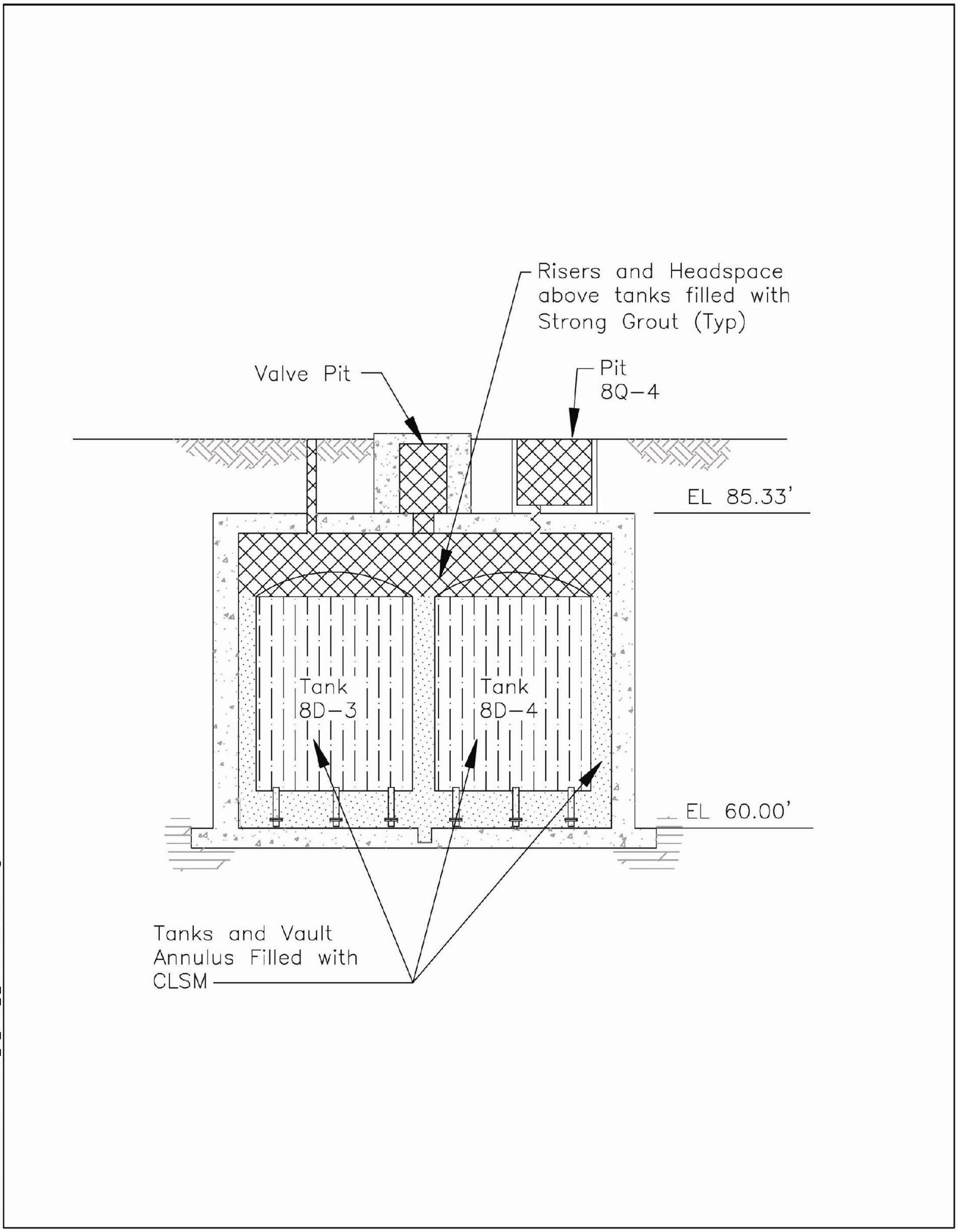


Figure 2-14. Configuration of Tanks 8D-3 and 8D-4 Following Tank Closure

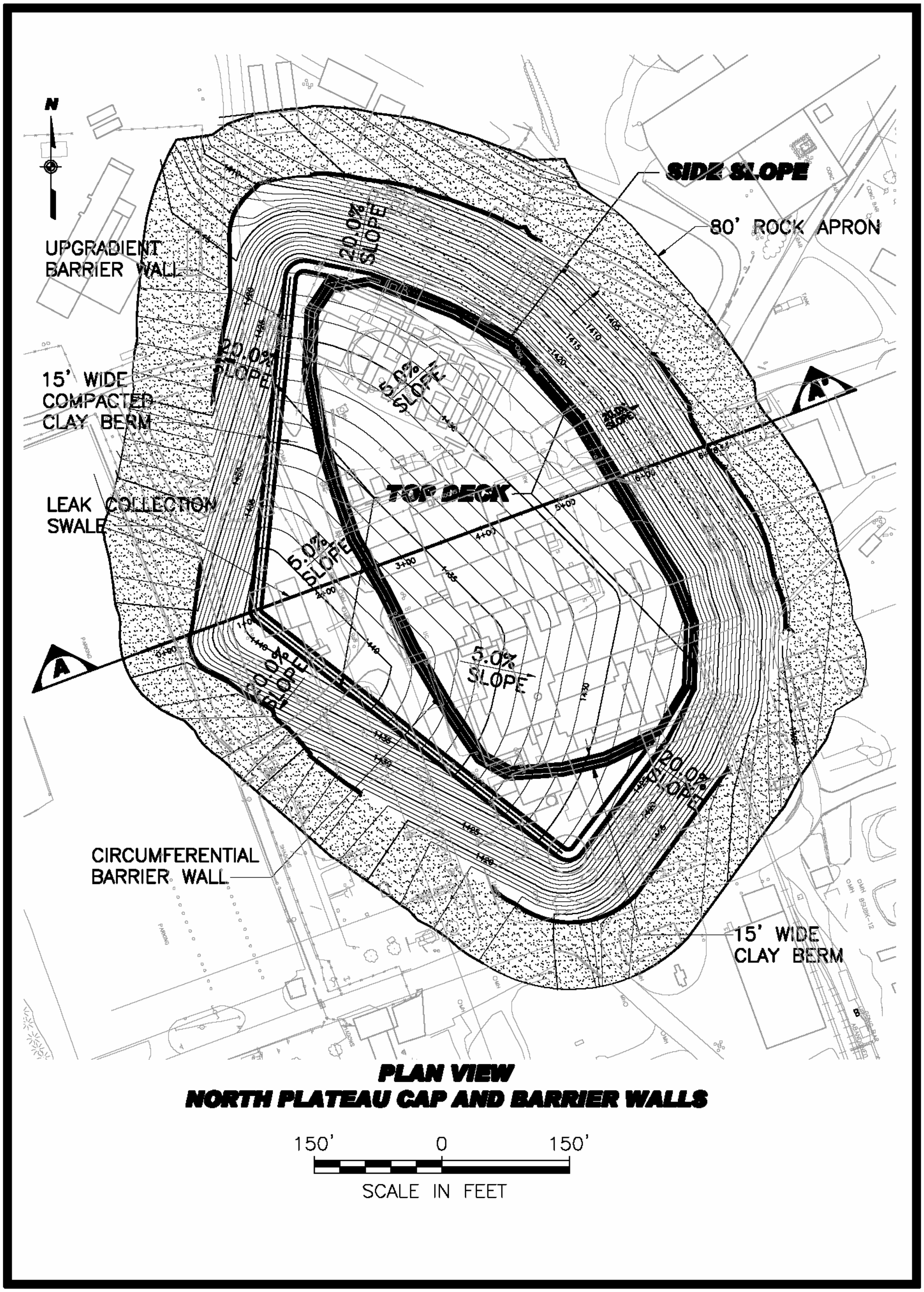


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Figure 2-15. North Plateau Cap and Barrier Walls

The barrier walls would be constructed with soil-bentonite slurry technology, which has been used extensively and successfully for similar situations. The upgradient barrier wall would be a low-permeability soil-bentonite wall that would divert groundwater flow around the circumferential barrier wall surrounding the stabilized facilities within WMAs 1 and 3. The circumferential barrier wall would also maintain a low permeability (i.e., $1x10^{-8}$ cm/sec), but it would consist of two distinct sections. The upgradient segment would be identical to the upgradient barrier wall, but the downgradient portion of the wall would contain a percentage of processed phosphatic ore (containing the sorbent, apatite) in addition to soil and bentonite. The addition of the ore would provide sorptive capabilities for capturing certain radionuclides that could dissolve in groundwater making them more mobile. This downgradient section would also be slightly more permeable (i.e., $1x10^{-7}$ cm/sec) than the upgradient barrier walls to minimize the possibility of groundwater mounding within the circumferential barrier wall.

The barrier walls would be constructed in the sand and gravel on the North Plateau, and keyed into the unweathered Lavery till to minimize the formation of seepage paths beneath the walls. Other important factors regarding barrier wall installation include the following (see Figures 2-15 and 2-18):

- Construction of earthen, bermed mixing basins to prepare requisite slurry mixtures;
- Use of hydraulic excavator or trencher for trench excavation three feet into the Lavery till;
- Keep three-foot-wide trenches filled with bentonite slurry during excavation for wall support;
- Bentonite slurry forced into the wall soil pore spaces provides additional hydraulic barrier;
- Backfilling operations with loader or dozer simultaneous to excavation operations;
- Soil-bentonite or soil-bentonite-sorbent backfill displaces slurry, which is reused as trenching continues and eventually removed from excavation entirely;
- Upgradient wall would be approximately 18 feet deep and 1,000 feet long; and
- Circumferential wall would be approximately 25 feet deep and 1,600 feet long.

Multi-Layer Cap

A closure cap would be constructed within WMAs 1 and 3 so that it would extend beyond the subsurface barrier walls. The multi-layer cap would cover approximately 10 acres and extend up to approximately 15 to 20 feet above ground surface. The actual constructed height above ground surface may vary some from this estimate. The 5% sloped top deck would have a surface area of approximately 5.7 acres, while the side slope with a 20% grade would cover approximately 4.5 acres. A cross section of the cover and barrier wall is shown on Figure 2-16, and the details of the cap components are shown on Figure 2-17.

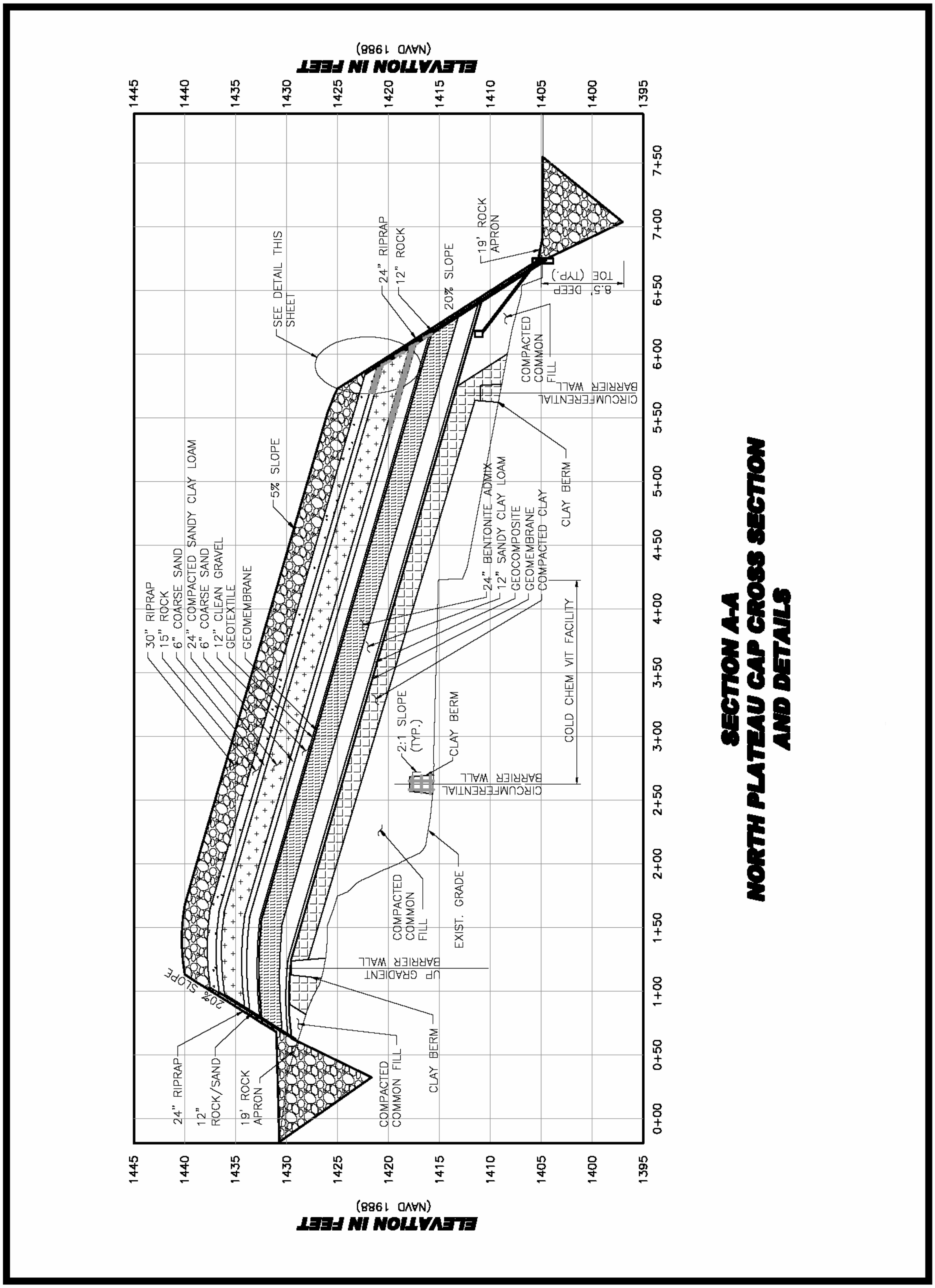

Figure 2-16. North Plateau Cap Cross-Section A-A’

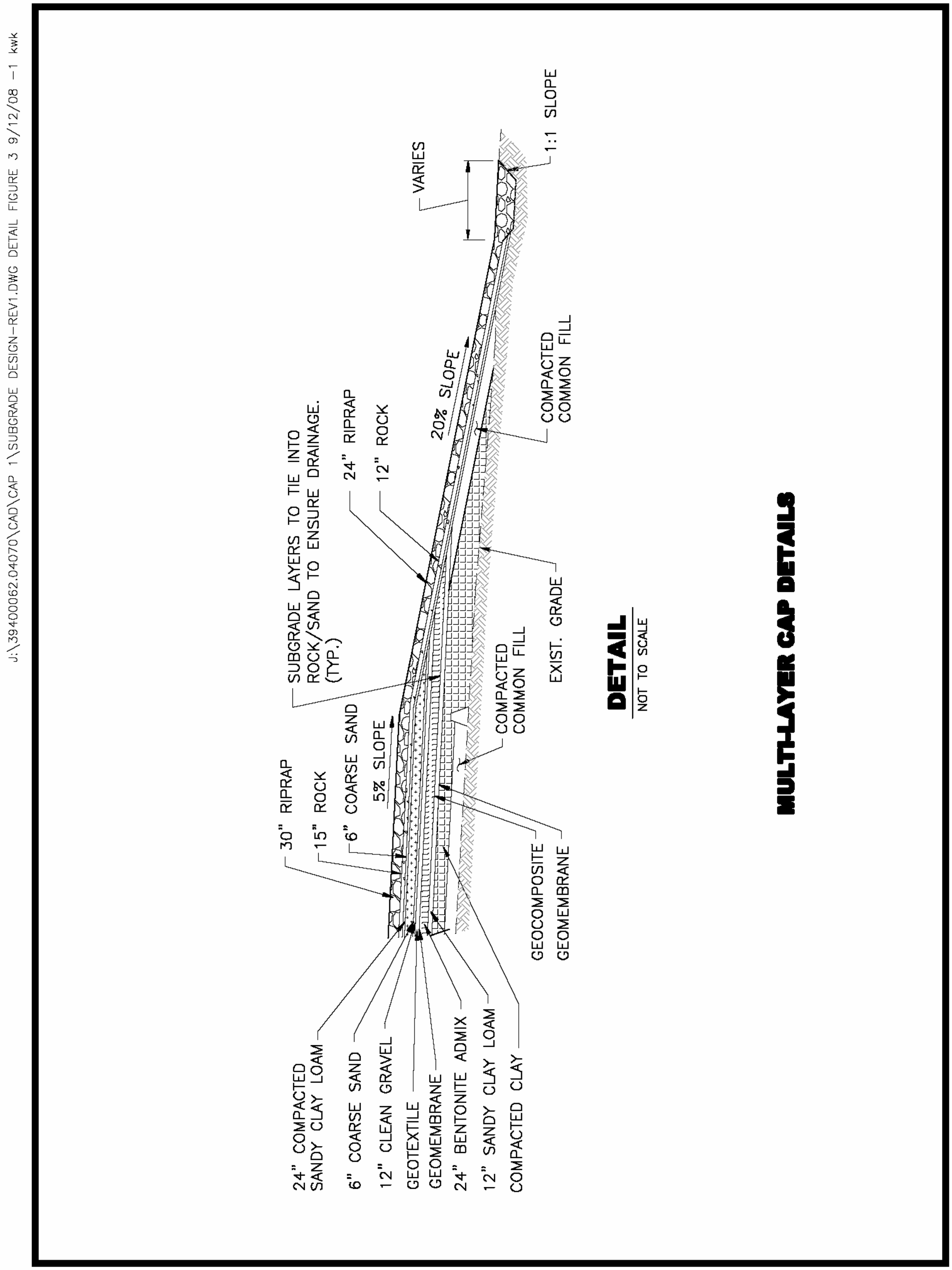

Figure 2-17. Multi-Layer Cap Details

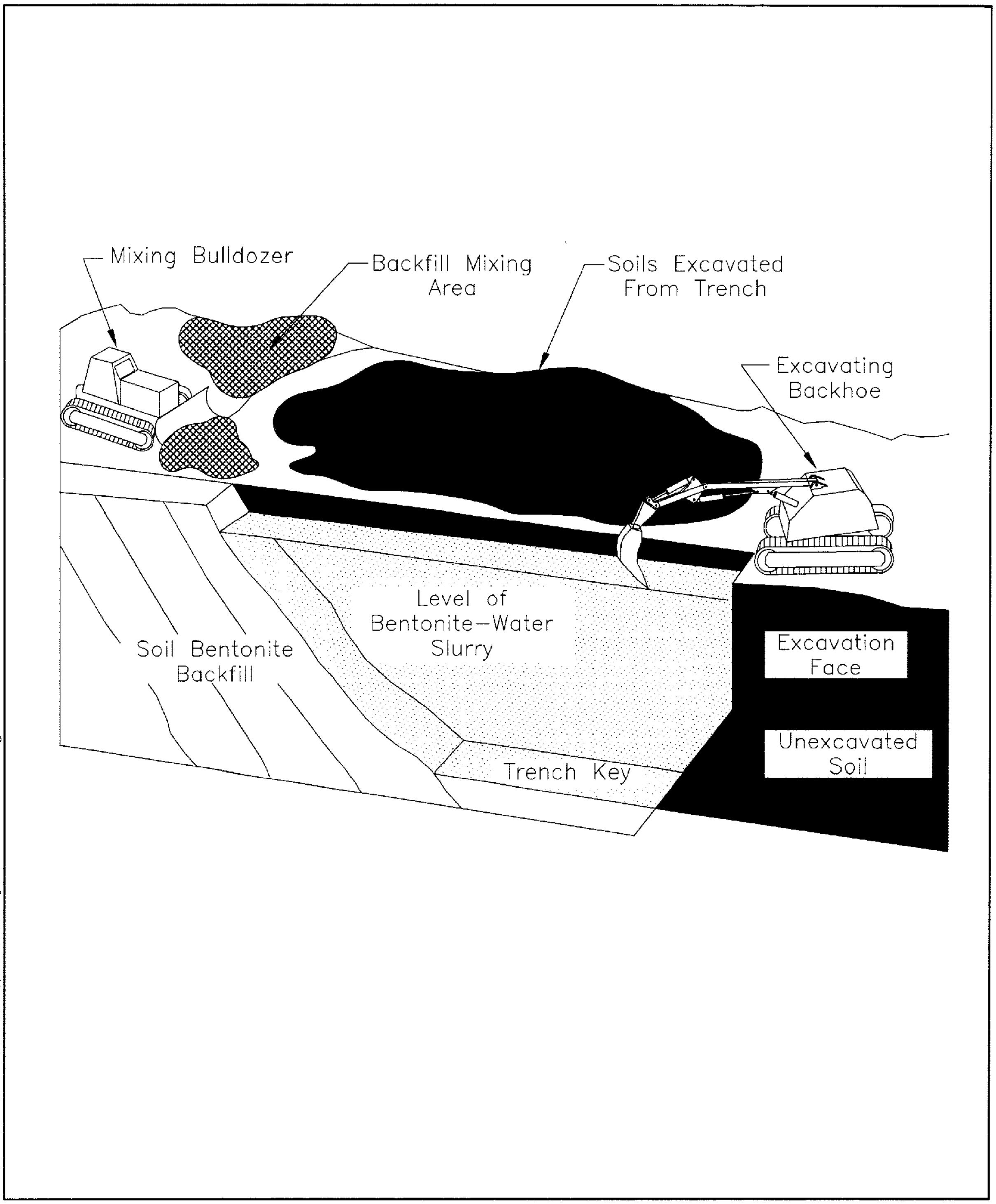

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Figure 2-18. Barrier Wall Installation Schematic

The 13-layer top deck would be approximately 12.25 feet thick and consist of the following components, from top to bottom:

- Riprap – 2.5 feet thick with a D_{50} of approximately three inches – provide erosion protection and function as a bio-intrusion barrier;
- Rock Filter/Bedding – 1.25 feet thick with a D_{50} of approximately 1.5 inches – function as bedding to riprap and filter to underlying layers and provide additional erosion protection;
- Coarse Sand Filter – six inches thick - serve as granular filter to prevent degradation of underlying loam layer;
- Compacted Loam – two-foot-thick sandy clay soil – provide water storage and freeze/thaw protection;
- Coarse Sand Filter – six inches thick – prevent clogging of underlying drainage layer;
- Gravel Drainage Layer – one foot thick with a K of approximately 10^{-3} cm/sec – serve as the primary drain for removing water that percolates into the cap;
- Geotextile – marginal thickness, non-woven cushion, 8 to 12 oz/SY – protect the underlying geomembrane from puncture and excessive wear from drainage gravel;
- Geomembrane Liner – 40- to 60-mil LLDPE or HDPE – serve as infiltration barrier in short term;
- Bentonite/Additive Mixture – two-foot-thick bentonite sand mixture with K of approximately $5x10^{-9}$ cm/sec – function as low-permeability barrier layer in long term;
- Sandy Clay Loam – one-foot-thick compacted layer – provide structural support for bentonite layer and function as secondary water storage and freeze/thaw protection;
- Geocomposite – marginal thickness, geonet with geotextile fabric – serve as leak detection layer in short term;
- Geomembrane Liner – same as above – function as secondary infiltration barrier; and
- Compacted Clay – 1.5 feet thick with K of approximately $7x10^{-7}$ cm/sec – provide foundation and structural support, in addition to redundant infiltration protection;

A base layer consisting of compacted common fill and demolition debris from the surface structures within WMAs 1 and 3 would be constructed on grade over the stabilized structures in the subsurface. This material would be graded to provide adequate configuration for the installation of the cap.

The cap sideslope would extend outward from the top deck located outside the limits of the barrier wall. It would be approximately three feet thick and consist of the following two components:

- Riprap – two feet thick with a D_{50} of approximately 10 inches – provide erosion protection and function as a barrier from bio-intrusion; and

- Rock Filter/Bedding – identical to the rock filter/bedding layer in the top deck – placed on top of each layer of the top deck forming a 20% slope down to grade

The last component of the cover system to be constructed would be the rock apron at the toe of the sideslope. Riprap with an approximate D_{50} of 15 inches would be placed around the circumference of the cap in a typical triangular toe design extending down to approximately eight feet and outward approximately 80 feet (Figure 2-17). The apron would be the primary attribute for protection against erosional gullies and scouring. Lastly, large boulders would surround the apron of the cap as a preventative measure against human intrusion. These boulders would be 125 ft^3 massive stones placed at approximately 10-foot intervals so that any machinery, equipment, or other intrusive entity would be prevented from disturbing the integrity of the cap and barrier walls.

The cap design was prepared to ensure that the conceptual cover system layers would remain stable under expected static, seepage, and seismic loading conditions and incorporates the guidance of documents such as NUREG 1623, "Design of Erosion Protection for Long-Term Stabilization." NUREG 1623 provides design practices that NRC staff found acceptable for providing protection for 200 to 1,000 years with minimal maintenance activities. The horizontal seismic coefficient for the seismic analyses was developed based on site-specific information and DOE guidance. A site-specific bedrock acceleration equal to 20% of gravitational acceleration (0.2 g) was assumed for these analyses.

In addition, the drainage layer design was checked to ensure that saturated conditions above the primary barrier are prevented. Avoiding a saturated condition, in this cap design, was achieved by balancing the estimated flow through the upper layers of the cap, with the designed flow capacity in the drainage layer. The toe of the landfill was used for the drainage layer design case (typically the location of the highest drainage layer flow), and the required drainage layer thickness was applied over the entire landfill area.

Appropriate minimum factors of safety for the cap design were determined based on technical guidance developed for use by the Uranium Mill Tailings Remedial Action (UMTRA) projects that address stability of uranium mill tailings embankments. The proposed closure cover has been evaluated for veneer (layer) stability under static, seepage, and seismic conditions. Evaluation results indicate that the proposed materials would provide the necessary shear strength to maintain stability under static conditions with a safety factor of 1.5 and to survive an earthquake inducing a theoretical maximum horizontal ground acceleration equal to 0.20 g with a safety factor of at least 1.1. The factors of safety contained in the cap design are 1.5 for static stability, 1.2 for seepage stability, and 1.1 for seismic stability.

The cover and barrier wall system would incorporate features that are designed to minimize degradation as a result of exposure to environmental and geomechanical processes. Potential degradation processes would include wind and water erosion, biological disruption by plants and animals, geochemical processes, seismic events, freeze/thaw mechanisms, and inadvertent human intrusion. The cover design would include redundant barrier components to help preserve the long-term effectiveness of the cover systems. The Close-In-Place Alternative includes an annual cap maintenance program that will replace approximately 3% (100% in 30 years) of the rip rap rock annually. In conclusion, the barrier system on the North Plateau would be designed to resist degradation, limit infiltration of precipitation and groundwater, exhibit slope stability, be cost effective, and require minimum maintenance.

2.3.6 Remediation Completion and Closeout Activities

Minimal activities would be anticipated after completion of cap and barrier wall construction. Characterization information gathered on WMA 3 facilities during demolition activities would be used to develop an inventory estimate of the contamination closed in-place. This information would be incorporated into performance assessment modeling to demonstrate that closure criteria would be met.

The limited waste generated from the HLW pumps and miscellaneous debris would be characterized, packaged, surveyed, and delivered to an off-site disposal facility. A final status survey would be performed in the areas impacted by the remedial activities to establish that residual radioactivity levels do not exceed the established DCGLs. Additional backfill would be placed around the completed cap as necessary to restore a natural grade. Lastly, barrier wall and cap monitoring efforts would be established, and these actions would continue into the future along with any cover maintenance activities.

2.3.7 Mitigative Measures

Since the in-place closure of WMA 3 would entail new construction in addition to demolition activities, actions would be taken to reduce environmental impacts during implementation as well as in the long-term. Human health and safety would be protected by the use of proper PPE. Sediment control and dust-suppression measures would be employed to reduce the amount of dust that would be airborne or would be carried away by storm water runoff. Equipment used to support construction and demolition activities would be equipped with mufflers. In addition, typical vehicle washing areas and construction surface water runoff measures would be established to protect water and ecological resources, as well as geology and soils. However, the installation of the barrier walls and closure cap and long-term monitoring would also be considered as actions that would protect not only human health and safety but also the ecological resources, water resources, and surrounding soils.

2.4 WMA 4: Construction and Demolition Debris Landfill

WMA 4, which comprises of the Construction and Demolition Debris Landfill (CDDL), is a 10-acre area in the northeast portion on the North Plateau of the WVDP (see Figure 2-19). The WVDP terminated its disposal operations in the CDDL in December 1984 and closed the landfill in accordance with applicable New York State regulations specified in 6 NYCRR Part 360 7.6. The NYSDEC approved and certified the closure of the CDDL in October of 1986. It is assumed that the North Plateau Plume has migrated to portions of the CDDL. If further actions are undertaken for the North Plateau Plume, they may directly impact the CDDL.

There are no planned remedial activities at WMA 4 under the Sitewide Close-In-Place Alternative.

2.4.1 Installation of Monitoring Equipment

Environmental monitoring in the WMA 4 area would be conducted under the North Plateau groundwater monitoring program as discussed in Section 2.15.

2.5 WMA 5: Waste Storage Area

2.5.1 Remediation Support Facilities

The work planned for this WMA (Figure 2-20) under the Sitewide Close-In-Place Alternative is relatively routine in terms of construction complexity. In general, all of the work is expected to be completed without need for confinement. In addition, remediation support activities would be limited to implementation of the site-specific health and safety procedures, sediment and erosion control procedures, and similar standard construction preparation activities.

2.5.2 Removal of Surface Structures

Remote-Handled Waste Facility

The location of this facility is shown on Figure 2-21. The RHWF is assumed to be in a demolition-ready condition at the EIS starting point and would be demolished as part of this alternative. It is assumed that the RHWF would be demolished without the need for confinement.

The equipment inside of the RHWF Work and Process Cells would be removed using a cutting torch and the existing building crane and forklift. The liners on the floor and walls of the Work Cell would be removed and sectioned using a demolition hammer, shears, and cutting torches. The liner would be segmented and disposed of as LSA waste. The shield door between the Work Cell and the Buffer Cell would also be sectioned and removed, as would the shield door between the Buffer Cell and the Receiving Area. The shielding and shield door debris would be packaged and disposed of as LSA waste. The 30-ton bridge crane that services the Work Cell would be removed using a cutting torch and a hydraulic crane. The crane would be removed in sections, packaged, and disposed of as LSA waste.

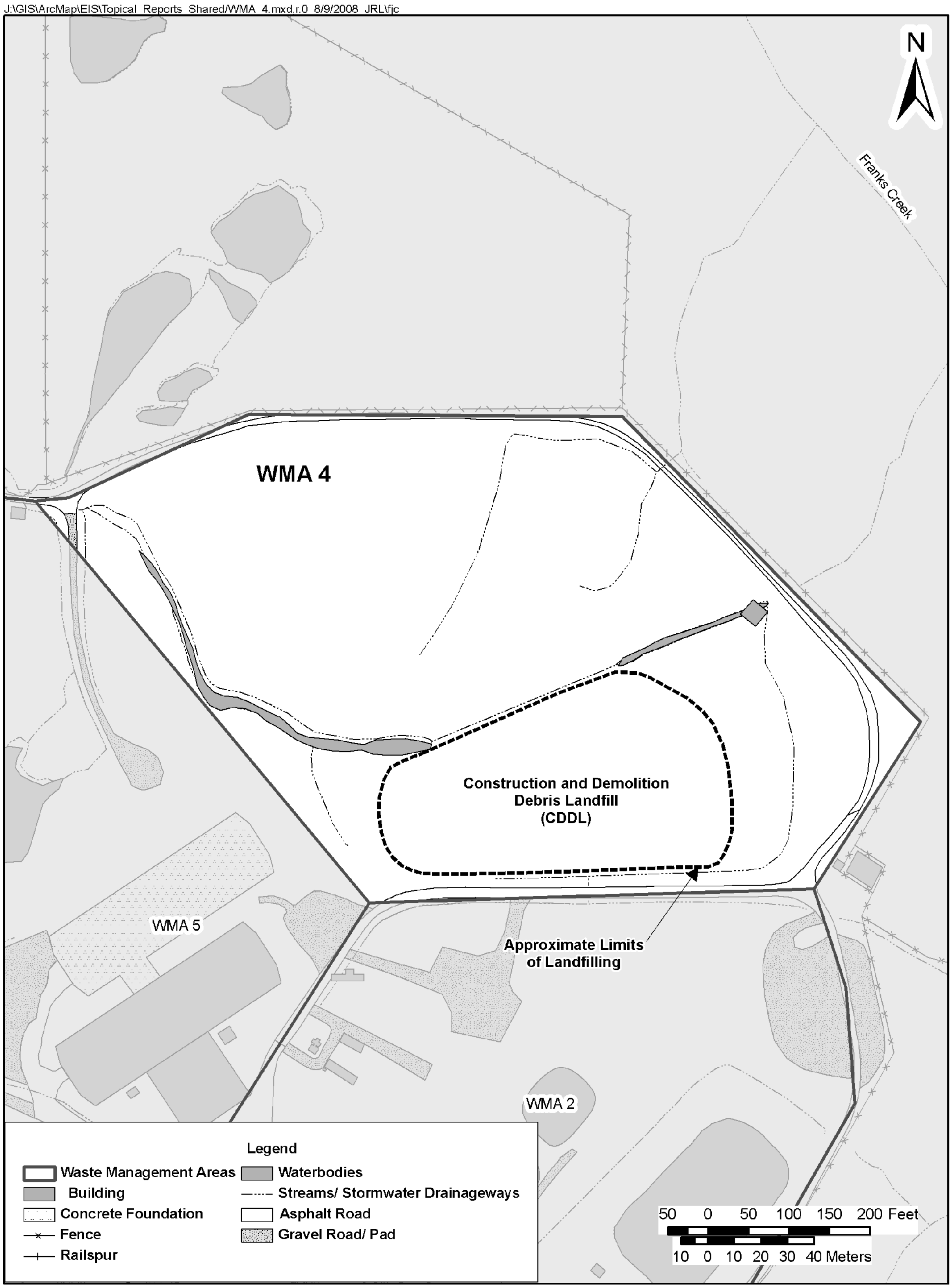

Figure 2-19. WMA 4 - Construction and Demolition Debris Landfill

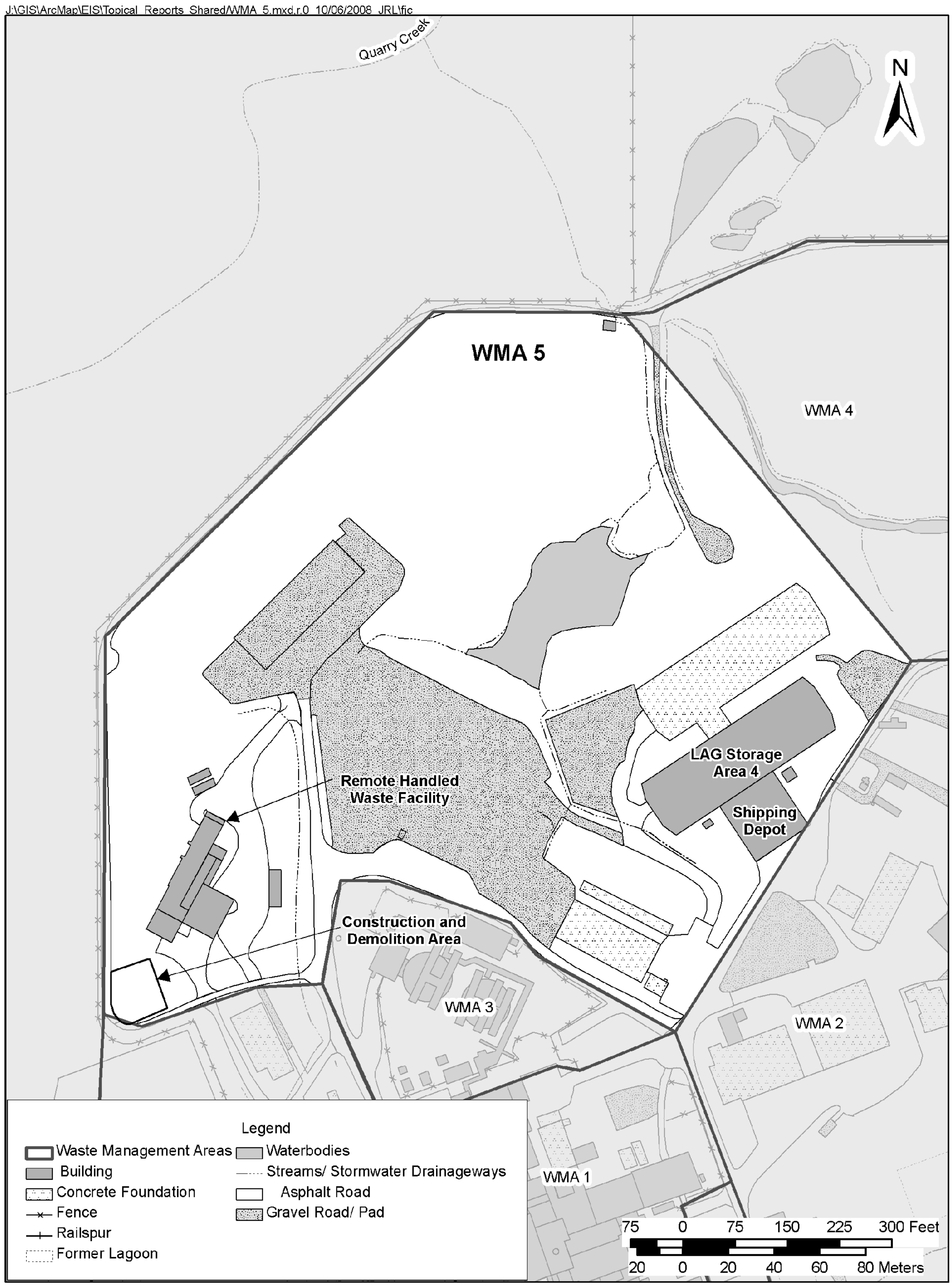

Figure 2-20. WMA 5 - Waste Storage Area

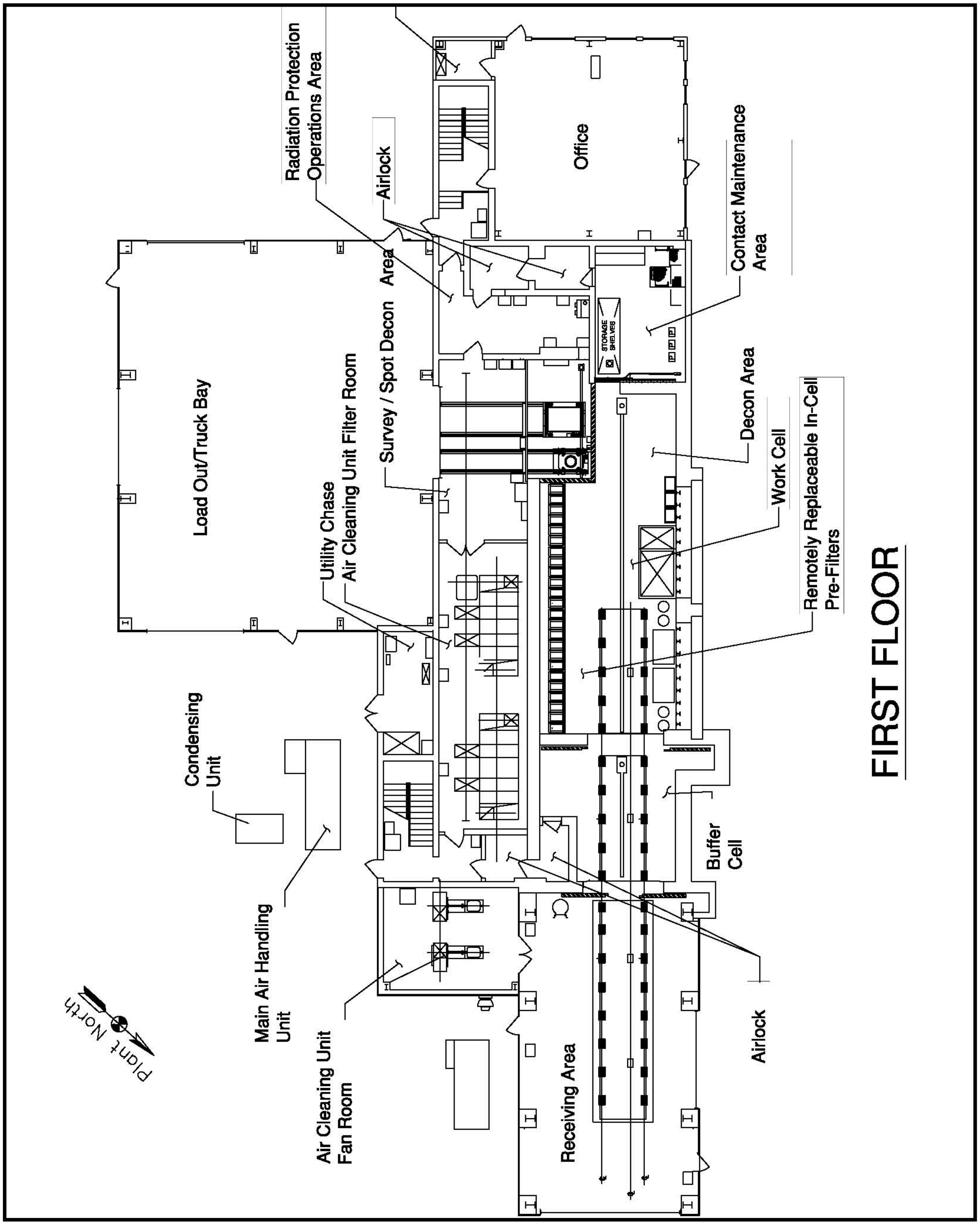

Figure 2-21. Remote-Handled Waste Facility Plan View, First Level

The facility would be decontaminated from areas of higher levels of contamination to areas of lower levels of contamination. Debris would be remotely removed from the Work and Buffer Cells. A spray fixative would be applied to the interior surfaces of the Work and Buffer Cells to lock-down any remaining contamination.

Following decontamination, radiological characterization surveys would be performed to assess the levels and extent of contamination on the remaining building materials. The survey results would be used in modeling to verify that the building structure and foundation can be demolished without the use of containment.

The building structure would be taken down using a hydraulic crane and front-end loader, as would the adjacent office building structure. Both the RWHF and the office building foundations would be left in place. The RHWF building demolition debris would be disposed of as LSA waste. The office building demolition debris would be disposed of as CDD. Approximately 34,000 ft^3 of Class A waste would be generated during the WMA 5 closure activities.

The underground waste transfer pipelines that run from the Batch Transfer Tank in the Wash Down Collection Tank Room to Tank 8D-3 would be grouted and left in place.

LAG Storage Area 4 and Shipping Depot

The Shipping Depot is directly connected to the LAG Storage Area 4. Both building structures would be demolished with hydraulic cranes and front-end loaders. The debris from both of these structures would be collected and disposed of as CDD. The LAG Storage Area 4 foundation, as well as the Shipping Depot foundation and adjacent shipping dock, would be left in place.

2.5.3 Remediation Completion and Closeout

A MARSSIM Final Status Survey would be performed following the removal of surface structures, to verify that residual radioactivity levels do not exceed the established DCGLs. An independent verification survey may also be required by the overseeing agencies.

After the verification survey is complete and regulatory approval is received, the area would be backfilled with clean soil and graded. Finally, seed and mulch would be applied over the graded area.

Once vegetation is established over the area, temporary facilities such as erosion and sediment controls would be removed.

2.5.4 Mitigative Measures

Due to the concrete-demolition work proposed for WMA 5, sediment control and dust-suppression measures would be employed to reduce the amount of dust that would be airborne or would be carried away in storm water runoff. Work in the contaminated areas of the RHWF would require the use of PPE and contamination controls. Equipment used to support the demolition activities would be equipped with mufflers.

2.6 WMA 6: Central Project Premises Area

The Central Project Premises Area, consists of a variety of site support structures, as shown on Figure 2-22, many of which would be removed under the Sitewide Close-In-Place Alternative. The following section discusses the extent of remediation in WMA 6.

2.6.1 Remediation Support Activities

The work planned for this WMA under the Sitewide Close-In-Place Alternative is relatively routine in terms of construction complexity. In general, all of the work is expected to be completed without need for confinement. In addition, remediation support activities would be limited to implementation of the site-specific health and safety procedures, sediment and erosion control procedures, and similar standard construction preparation activities.

2.6.2 Removal of Surface Structures

Sewage Treatment Plant

The treatment plant would be removed in two stages. The first stage removes the wood frame, metal siding, and roof, through the use of a front-end loader and crane. The second stage would remove the base of the facility, which is made up of stone and concrete. The base would be demolished through the use of a demolition hammer, backhoe and front-end loader. All demolition debris from the treatment plant would be collected and disposed of as CDD.

Cooling Tower

The New Cooling Tower and its support basin would be removed as part of this alternative. The tower itself is expected to have been removed prior to the starting point of the EIS. The basin is radiologically and chemically contaminated with water treatment chemicals. A spray fixative would be applied to the concrete. The basin would be demolished using a demolition hammer and front-end loader. The concrete debris would be packaged and disposed of as bulked-managed LSA waste.

Equalization Basin and Equalization Tank

For the basis of this estimate, it is assumed that the Equalization Basin would have to be closed and backfilled. The membrane liner would be removed using hand tools and disposed of as CDD. After liner removal, the 12-inch influent pipeline would be filled with concrete. The entire basin would then be filled with compacted soil, using an excavator and drum roller compactor.

The Equalization Tank would be partially demolished using conventional methods to prevent accumulation of water. A Final Status MARSSIM survey would be performed in the area and arrangements made for any independent verification surveys requested by the regulators. After completion of the surveys, the tank would be filled with clean backfill.

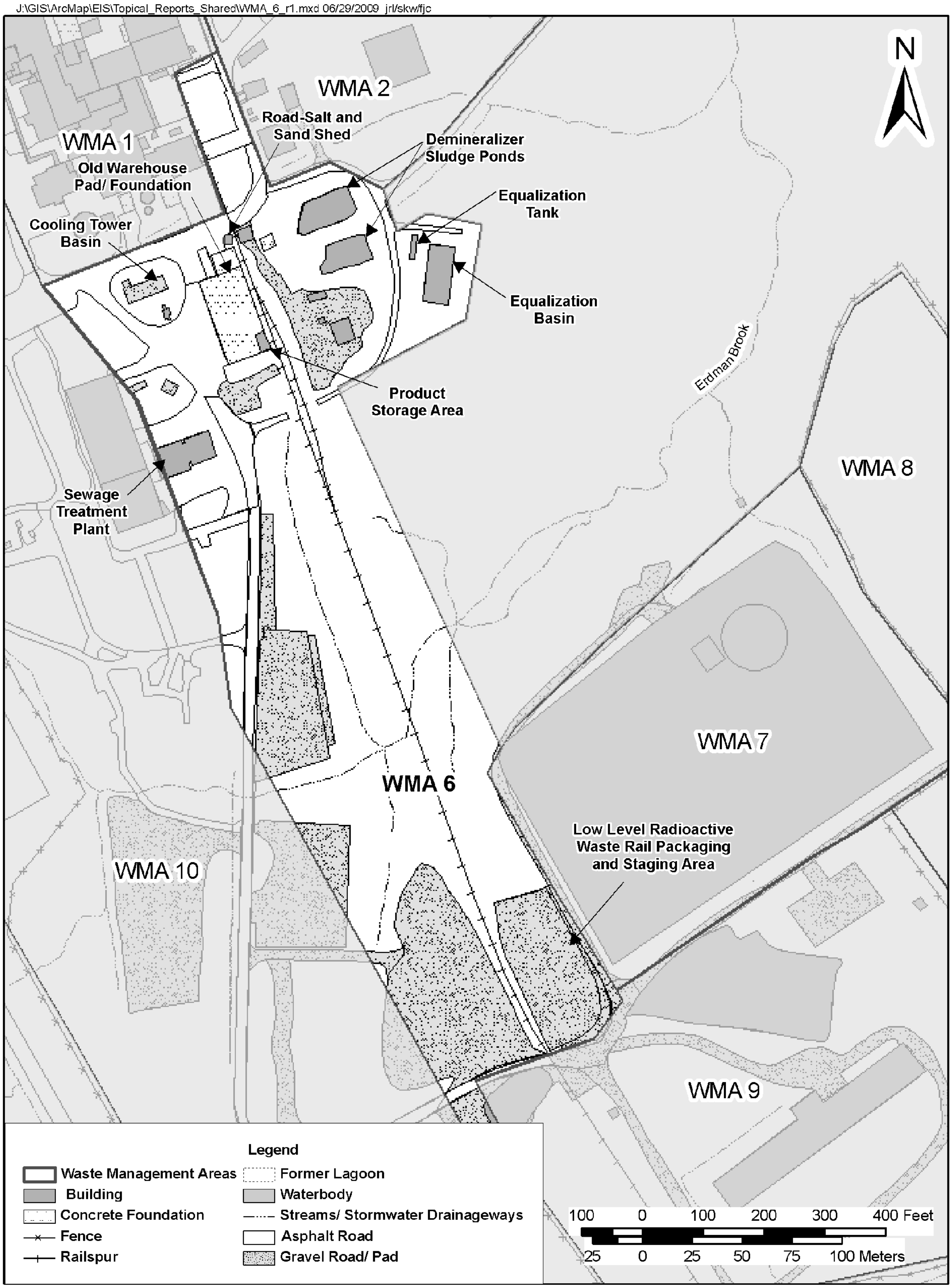

Figure 2-22. WMA 6 - Central Project Premises

Demineralizer Sludge Ponds

The North and South Demineralizer Sludge Ponds are separate unlined basins excavated in the sand and gravel unit. Each pond is approximately 100 feet long and 50 feet wide and about 5 feet deep. Under the Close-In-Place Alternative, the Demineralizer Sludge Ponds will be backfilled with compacted soil using an excavator and drum roller in coordination with other similar WMA 6 activities.

South WTF Test Tower

The south tower and the support pads would be removed as part of this alternative. The north tower has already been removed but the support pad remains in place. The south tower would be removed with a hydraulic crane. The concrete support pads would be demolished using a hydraulic hammer and front-end loader. The tower and concrete debris would be collected and disposed of as CDD.

2.6.3 Remediation Completion and Closeout

A MARSSIM Final Status Survey would be performed following the removal of the WMA 6 facilities, to verify that residual radioactivity levels do not exceed the established DCGLs. An independent verification survey may also be required by the overseeing agencies.

After the verification survey is complete and regulatory approval is received, the area would be backfilled with clean soil and graded. Finally, seed and mulch would be applied over the graded area.

2.6.4 Mitigative Measures

Due to the demolition work proposed for WMA 6, sediment control and dust-suppression measures would be employed to reduce the amount of dust that would be airborne or would be carried away in storm water runoff. Work in the contaminated areas (such as the contaminated portion of the rail spur) would require the use of PPE and contamination controls, as well as the use of contamination reduction zones and buffer areas.

2.7 WMA 7: NRC-Licensed Disposal Area and Associated Facilities

The work planned at WMA 7 consists of the removal of surface structures, grouting of interceptor trench and various disposal holes and trenches, and installation of a multi-layer closure cap over the NRC-Licensed Disposal Area (NDA). The goal of the in-place closure approach to WMA 7 is to minimize groundwater and precipitation infiltration into the disposal area, while also preventing erosion and restricting access to the stabilized closure cap. The upgradient NDA Barrier wall was completed in July 2008 and will be left in place beneath the final WMA 7 cap. The geomembrane cover was completed in November 2008 and is similar to the cover installed at WMSA 8. The layout of the NDA is illustrated in Figure 2-23. The remedial activities planned at WMA 7 under the Sitewide Close-In-Place Alternative are discussed in detail in the following sections.

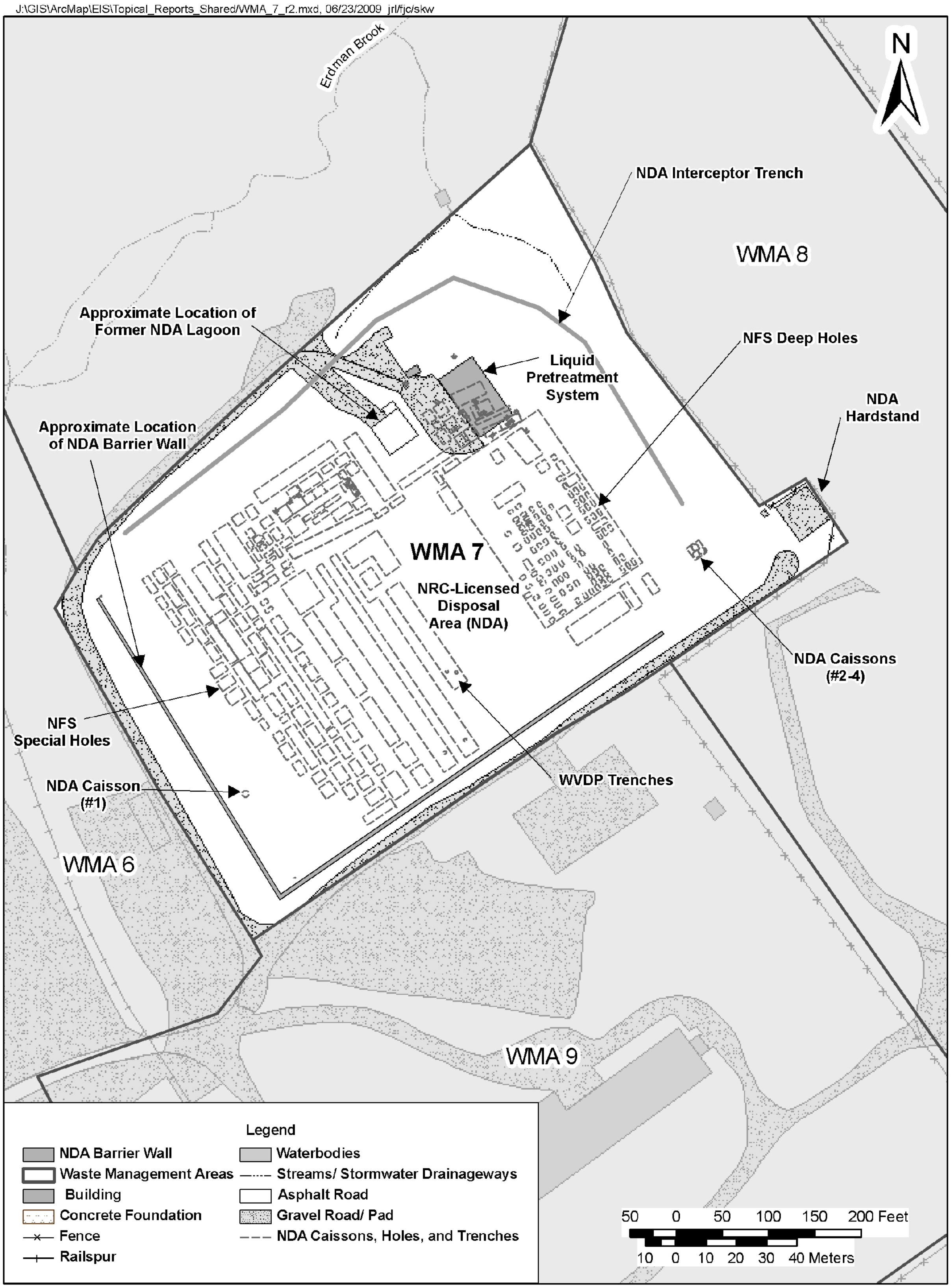

Figure 2-23. WMA 7 – NDA and Associated Facilities

2.7.1 Remediation Support Activities

Preliminary actions to support the NDA closure would be minimal under the Sitewide Close-In-Place Alternative. The grouting, demolition, and cover construction would all be a component of the remedy itself. Typical design work and obtaining regulatory permits and approvals would be performed as necessary. Precise locations of the subsurface disposal holes and trenches would need to be mapped; therefore a detailed geophysical investigation of the NDA would be completed using ground-penetrating radar or similar technology.

A Leachate Treatment Facility would be constructed to treat (or pre-treat) leachate displaced from the NDA during grouting operations or other intrusive activities. Since this facility would also service the SDA, it would be constructed as a stand-alone facility near SDA Trench 14 (Figure 2-24). The facility would be capable of removing organic chemicals by biological degradation and adsorption, removing entrained solids by filtration, and removing dissolved radionuclides by ion exchange. The effluent would either be transferred to the Low-Level Waste Treatment Facility (LLWTF) for additional treatment or directly discharged through a SPDES-permitted outfall. The process employed in this facility would not be able to remove tritium from the leachate, and may require a RCRA permit to operate.

This facility would be operated on demand and would be expected to process an average of 1,000 gallons of leachate per day. The treatment process would include a leachate hold tank, a bioreactor, a mechanical filter, an activated carbon polisher, and ion-exchange columns. The components of the facility that are used to manage raw leachate, such as the raw leachate storage tank and the primary process equipment, would be constructed inside of a 1,900-ft^2 building for protection against the environment. Raw leachate storage and treated water storage tanks would also be housed in small buildings, approximately 400 ft^2 and 2,250 ft^2 in size, respectively. The treated water storage building is also expected to house a small laboratory. The Conceptual Leachate Treatment Facility Layout and Process Flow Diagram are illustrated in Figures 2-25 and 2-26. The principal components of the Leachate Treatment Facility are:

- Raw Leachate Hold Tank – leachate pumped from the hold tank would be filtered using mechanical filtration prior to introduction to the treatment train.
- Bioreactor – used to treat the organic chemicals and operated on a batch basis. It would use aeration with agitation, settling, and decanting. The sludge from the bioreactor would be transferred to a sludge hold tank for packaging and disposal.
- Ion-Exchange Columns – used to remove most of the dissolved radionuclides from the leachate, and would contain an inorganic material to remove the two principal radionuclides of concern, Cs-137 and Sr-90.
- Mechanical Filter and Carbon Beds – filters would be used to remove entrained solids in the decanted leachate from the hold tank prior to the activated carbon polisher beds, which would be used to remove any remaining organic material.

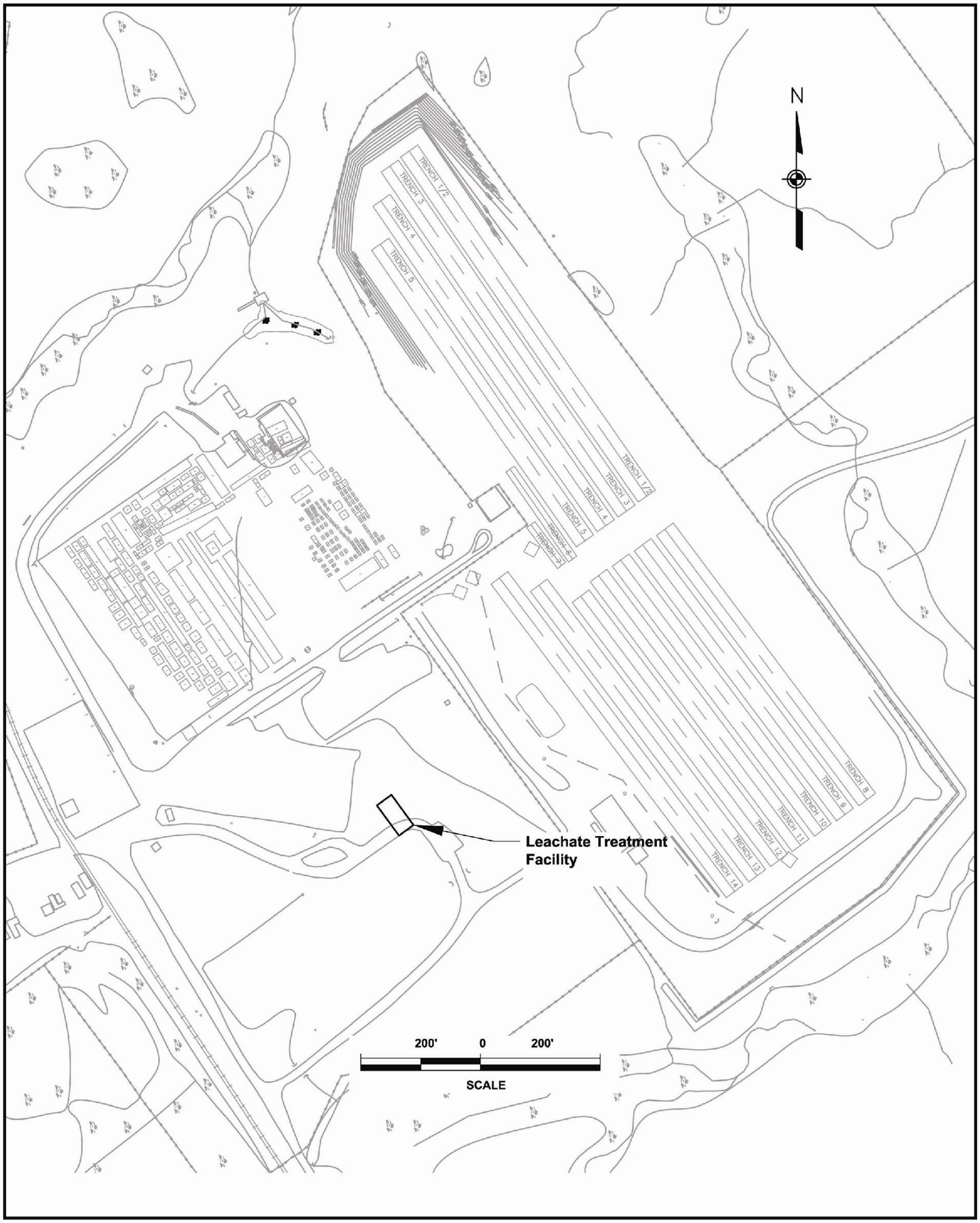

Figure 2-24. Plot Plan of Proposed Facilities to Support Closure of WMAs 7 and 8

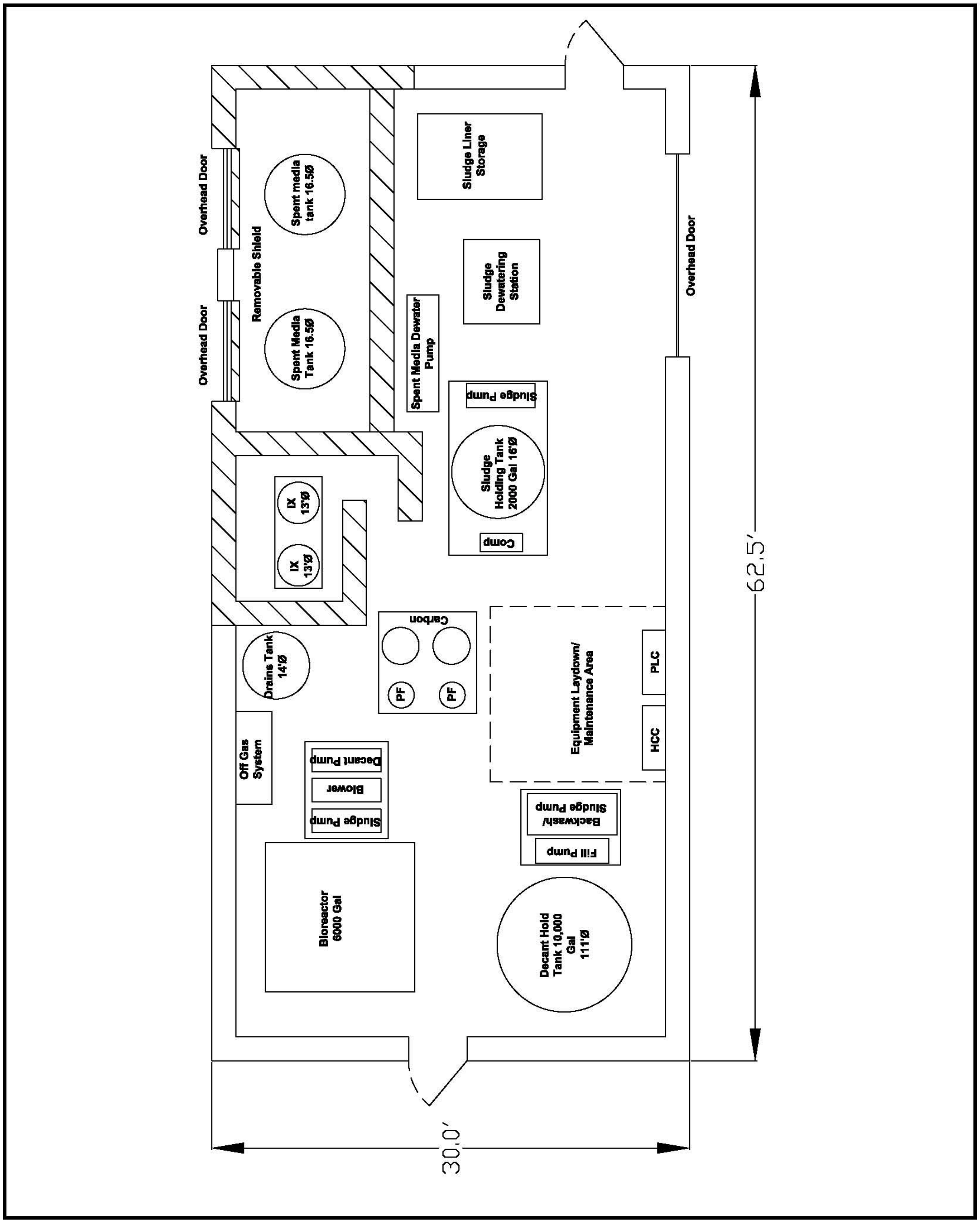

Figure 2-25. Conceptual Leachate Treatment Building Layout

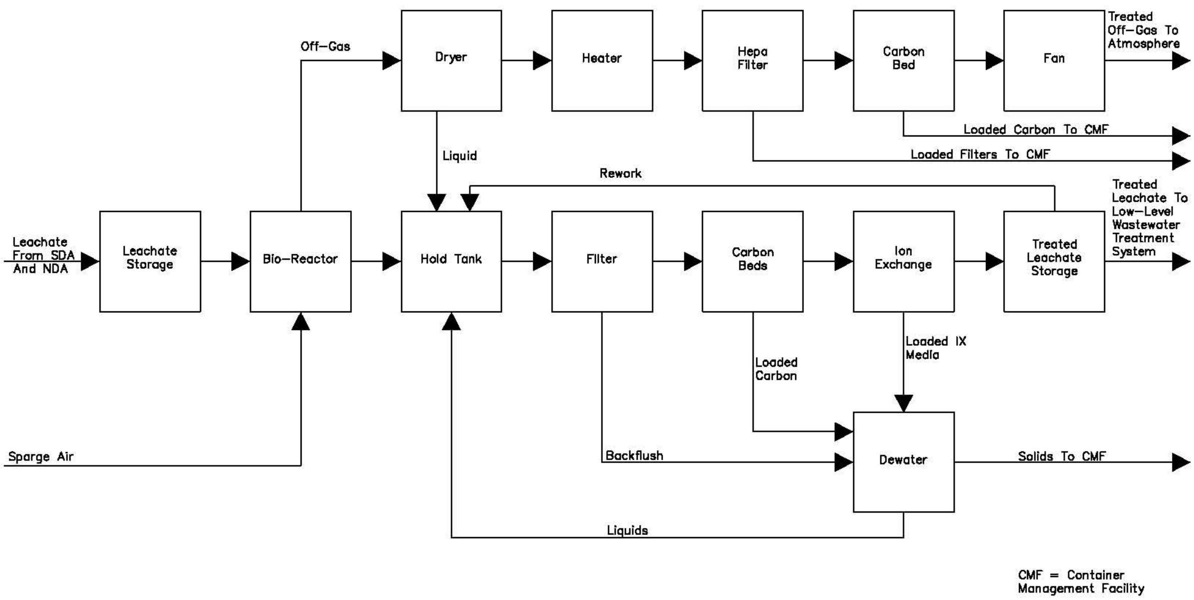

Figure 2-26. Conceptual Leachate Treatment Facility Process Flow Diagram

- Treated Water Storage Tanks – treated leachate would be sampled and analyzed before it is directed to the LLWTF lagoons for final treatment and discharge or back into the LTF to be treated again.

- Off-Gas Treatment – (1) mist elimination to remove entrained droplets; (2) heating to reduce the relative humidity for purposes of protecting downstream equipment; (3) HEPA filtration to remove radiologically contaminated particulate matter; and (4) carbon adsorption to remove organic vapors. An off-gas blower would keep the process that is attached to the bioreactor under negative pressure for contamination control.

The Leachate Treatment Facility would be decommissioned and demolished upon completion of the WMA 7, WMA 8, and/or other potential emergent site activities that require its support. The treatment system would be flushed to purge the system of residual leachate and wastewater. The zeolite ion-exchange media would be removed from the vessels and managed as Class C waste. The treatment equipment would be removed, segmented, and managed as Class A waste. The Leachate Treatment Facility Building would be demolished using typical site protocols and the structural components of the building, including concrete, would be managed as LSA waste.

2.7.2 Demolition of Surface Structures

The surface facilities that would be removed include the remaining office trailers and the Liquid Pretreatment System. The two office trailers to be removed are considered semi-portable offices, approximately 16 feet and 60 feet in length, respectively. The Liquid Pretreatment System consists of a Quonset style building, approximately 40 feet in width by 60 feet in length, and 20 feet in height, housing several treatment tanks of varying capacities. The building, equipment, and trailers would be demolished and segmented as necessary using standard construction equipment and practices. Demolition debris generated would be packaged in bulk and disposed of off site at a construction and demolition debris landfill.

2.7.3 Stabilization of Interceptor Trench and Disposal Holes/Trenches

To create a stable subsurface at the NDA for the cap foundation and to impede potential migration of groundwater contamination, the interceptor trench and various disposal holes/trenches would be filled with either a cementitious grout mixture or a flowable fill. Leachate would be managed prior to and during the grouting activities, as warranted. The interceptor trench, which is approximately 850 feet long and approximately 14 feet deep, would be grouted with a standard cementitious grout mixture. However, the seven manholes that allow access to the trench would be grouted with a flowable or “loose” fill having high slump characteristics. The manholes are approximately 4.5 feet in diameter and approximately 15 feet deep. The cement grout mixture would be introduced into the trench through a series of injection lances or tremie pipes using pressure grouting apparatus. The manholes would be grouted with the flowable fill using a similar technique.

A cement/fly ash grout would be injected to fill the voids and strengthen the disposal holes and disposal trenches before the closure cover is installed. The six disposal holes and trenches having a surface dimension greater than or equal to 20 feet would be grouted. This assumption is supported by the fact that no significant settlement/subsidence has been observed in Trench WVDP-1 at the NDA (7-foot x 15-foot surface dimensions), whereas field inspections indicate subsidence occurring in Trenches WVDP-7, 8, 9, 11, and 12, and Special Hole 9, all of which have at least one surface dimension greater than 20 feet.

Grout would be injected into the disposal areas through sleeve port tubes. These tubes would be driven into the subsurface using a modified pile driver rig on a grid spacing of approximately five feet. The total number of grout sleeve ports was estimated assuming an area of trench to be grouted of 27,100 ft^2. Given a sleeve port area of influence of approximately 20 ft^2 per injection and the average sleeve port tube length of 29 feet, the total length of grout sleeve ports would be approximately 40,000 VLF. The total volume of grout needed was calculated to be approximately 13,000 ft^3 and 235,000 ft^3 for the disposal holes/trenches and Interceptor Trench, respectively, based on a subsurface porosity of 0.30. The waste generated as a result of grouting efforts at the NDA is assumed to be CDD waste, which would be allowed to dry on site prior to loading.

2.7.4 Installation of Cap

The closure cap placed over the NDA would be an identical design to the cap installed on the North Plateau, which is discussed in Section 2.3.5. This cap would extend beyond the subsurface contamination and the existing barrier wall, although in a much different configuration. The NDA cap would also cover approximately 10 acres and extend up to approximately 35 feet above ground surface. The 5% sloped top deck would have a surface area of approximately four acres, while the side slope with a 20% grade would cover approximately 4.5 acres. A plan view of the cover and layout of the area is shown on Figure 2-27, and the cross section with the details of the cap components are shown on Figure 2-28. The existing impermeable membrane would be destroyed during the initial cap construction activity and integrated into the first few layers of fill.

The 13-layer top deck of the NDA cap would be approximately 12.25 feet thick and would consist of the same-layered components as the WMA 1/3 cap from the riprap on top to the compacted clay on the bottom. However, the base layer would consist of compacted common fill delivered from an off-site source, and debris and soil from demolished structures and other remedial activities in WMA 12 and from erosion control construction. The cap sideslope would also have the same design as the sideslope on the North Plateau.

The apron at the toe of the sideslope would have the same size rock (approximately D_{50} of 15 inches), but the configuration would be slightly different and designed based on the impact of area runoff. The typical triangular toe design would be the same extending down to approximately eight feet, but the apron would only extend outward approximately 20–25 feet (Figure 2-27). Lastly, approximately 125-ft^3 boulders would also surround the perimeter of the NDA cap and placed at approximately 10-foot intervals to prevent any negative impacts on the integrity of the cap and barrier walls.

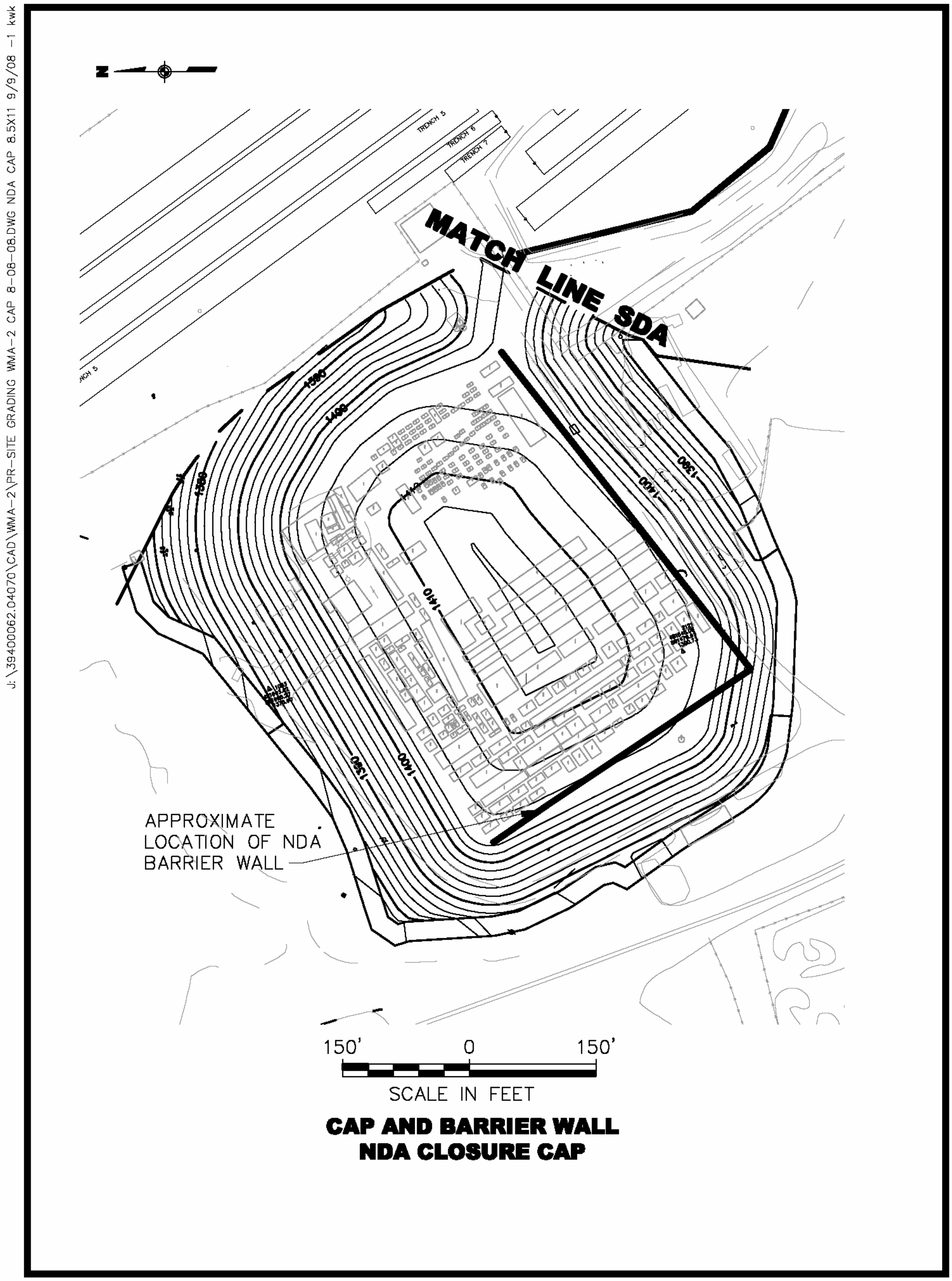

Figure 2-27. WMA 7 Cap and Barrier Wall

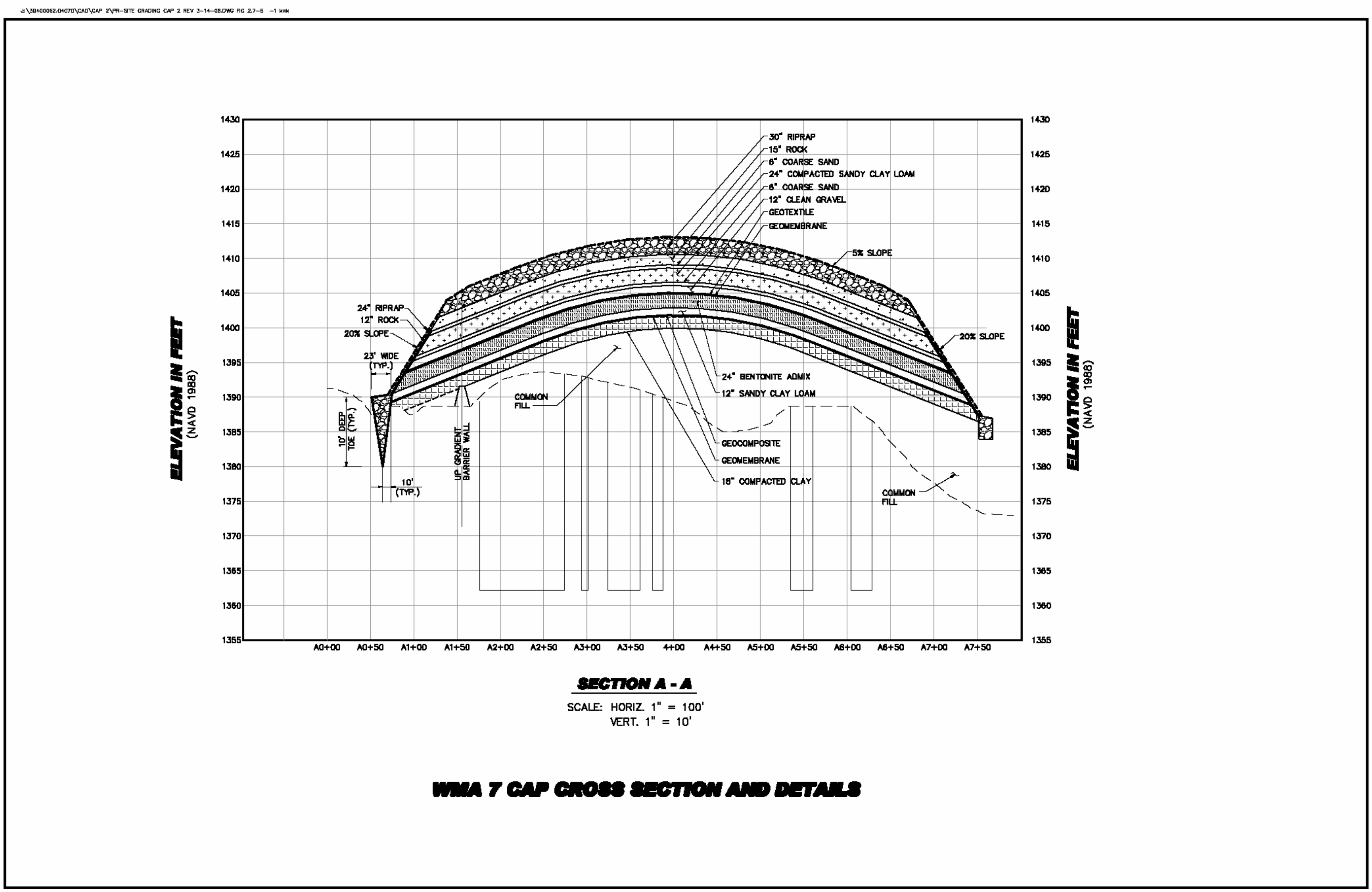

Figure 2-28. WMA 7 Cap Cross-Section

Cap construction activities would be coordinated with the installation of stream regrading and erosional controls, as discussed in Section 2.14, to mitigate the impacts of the cap construction on adjacent stream banks.

2.7.5 Remediation Completion and Closeout

Minimal activities would be anticipated after completion of cap construction. Any waste generated during NDA remediation would be packaged and disposed of off site as CDD or LSA waste. Additional backfill would be placed around the completed cap as necessary to restore a natural grade to WMA 7. Fencing would be installed to isolate the closure cap from unwanted intrusion. Lastly, barrier wall and cap monitoring equipment and efforts would be established, and these actions would continue into the future along with any cover maintenance activities.

2.7.6 Mitigative Measures

Measures to reduce environmental impacts associated with the in-place closure of WMA 7 would be performed during new construction, demolition activities, facility operations, and in the long-term. Human health and safety would be protected by the use of proper PPE. Sediment control and dust-suppression measures would be employed to reduce the amount of dust that would be airborne or would be carried away by storm water runoff. Equipment used to support construction and demolition activities would be equipped with mufflers. In addition, typical vehicle washing areas, the LTF, and fundamental surface water runoff measures would be established to protect water, soil, and ecological resources. However, the installation of the closure cap, grouting of the subsurface areas, and long-term monitoring would also be considered protective not only of human health and safety but also the ecological resources, water resources, and surrounding soils.

2.8 WMA 8: State-Licensed Disposal Area (SDA) and Associated Facilities

The work planned at WMA 8 includes the removal of surface structures, grouting of disposal trenches, and installation of a multi-layer closure cap over the State-Licensed Disposal Area (SDA). The goal of the in-place closure approach to WMA 8 is to minimize groundwater and precipitation infiltration into the disposal area, while also preventing erosion and restricting access to the stabilized closure cap. The layout of the SDA is illustrated in Figure 2-29. The closure activities planned at WMA 8 under the Sitewide Close-In-Place Alternative are discussed in detail in the following sections.

2.8.1 Remediation Support Activities

Preliminary actions to support the SDA remediation under the Sitewide Close-In-Place Alternative would be identical to those for the NDA. Grouting, demolition, and cover construction activities would all be a component of the remedy, however, design work and obtaining regulatory permits and approvals would be performed as necessary. In addition, a detailed geophysical investigation of the SDA would be completed using ground-penetrating radar or similar technology to locate the precise locations of the subsurface disposal trenches. Lastly, the Leachate Treatment Facility discussed in Section 2.7.1 would be constructed to also service the SDA and treat (or pre-treat) any leachate emitted from the SDA during grouting operations or other intrusive activities.

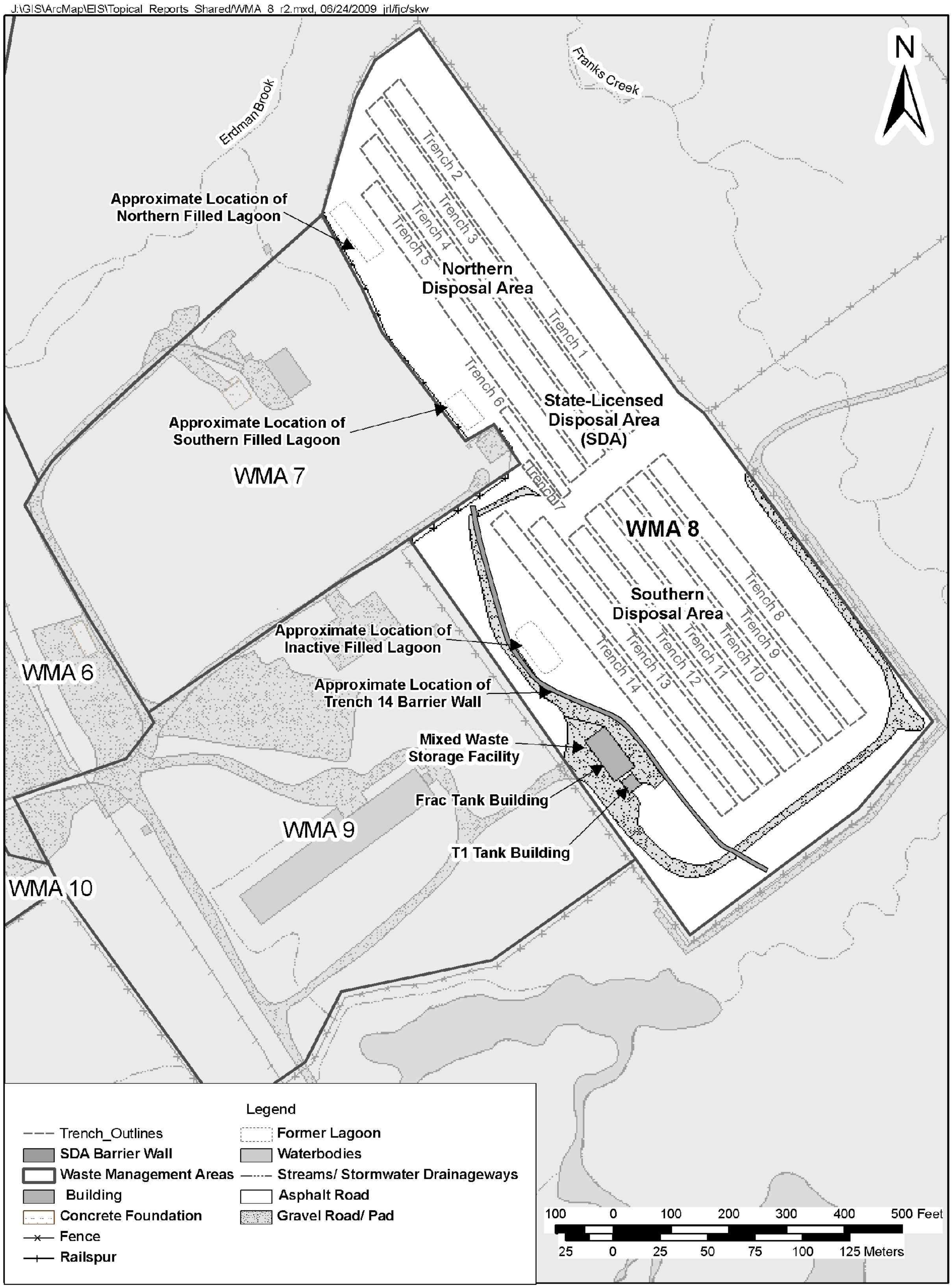

Figure 2-29. WMA 8 - SDA and Associated Facilities

2.8.2 Demolition of Surface Structures

The only surface facility that would be removed is the Mixed Waste Storage Facility. If not previously removed, the liquid presently stored in Tank T-1 would be transferred and treated in the Leachate Treatment Facility. After the liquid has been removed, Tank T-1 and associated equipment in the facility would be segmented and managed as LSA waste. Tanks T-2 and T-3 would be removed and managed as CDD. A spray fixative would be applied to the interior surfaces of the facility and it would be demolished with the debris managed as LSA waste. Any non-contaminated demolition debris would be packaged in bulk and disposed of off site at a construction and demolition debris landfill.

2.8.3 Stabilization of Disposal Trenches

The SDA disposal trenches would be stabilized in much the same manner as the disposal trenches at the NDA. A cement/fly ash grout would be injected to fill the voids and strengthen selected disposal trenches 1 though 5 and 8 though 14. Leachate would be managed prior to and during the grouting process, as warranted. Trench 6 is a series of small-diameter (i.e., less than six feet) holes, and trench 7 was previously backfilled with concrete (WVNS, 1993). As a result, it is anticipated that these two trenches would not undergo significant settlement/subsidence and would not need grouting.

Grout would be injected into the subsurface through sleeve port tubes. These tubes would be driven into the subsurface using a modified pile driver rig on a grid spacing of approximately five feet. Given a sleeve port area of influence of approximately 20 ft^2 per injection and the average sleeve port tube length of 21 feet, the total length of grout sleeve ports was estimated to be approximately 238,000 VLF. The total volume of grout needed was calculated to be approximately 1.4 million ft^3 based on a subsurface porosity of 0.30. The volume of CDD waste resulting from the grouting operation was assumed to be equal to 5% of the total volume of grout injected into the disposal trenches (approximately 70,000 ft^3).

2.8.4 Installation of Cap

The closure cap that would be placed over the SDA would be an identical design to the caps installed on the North Plateau (Section 2.3.5) and the NDA (Section 2.7.4). This cap would extend beyond the subsurface contamination and the existing barrier wall, but with a much larger configuration than either of the other caps. The SDA cap would cover approximately 28 acres with a 5% sloped top deck having a surface area of approximately 10 acres, and a side slope with a 20% grade covering approximately 17 acres. A plan view of the cover and layout of the area is shown on Figure 2-30, and the cross section with the details of the cap components are shown on Figure 2-28. The existing impermeable membrane would be destroyed during the initial cap construction activities and integrated into the first few layers of fill.

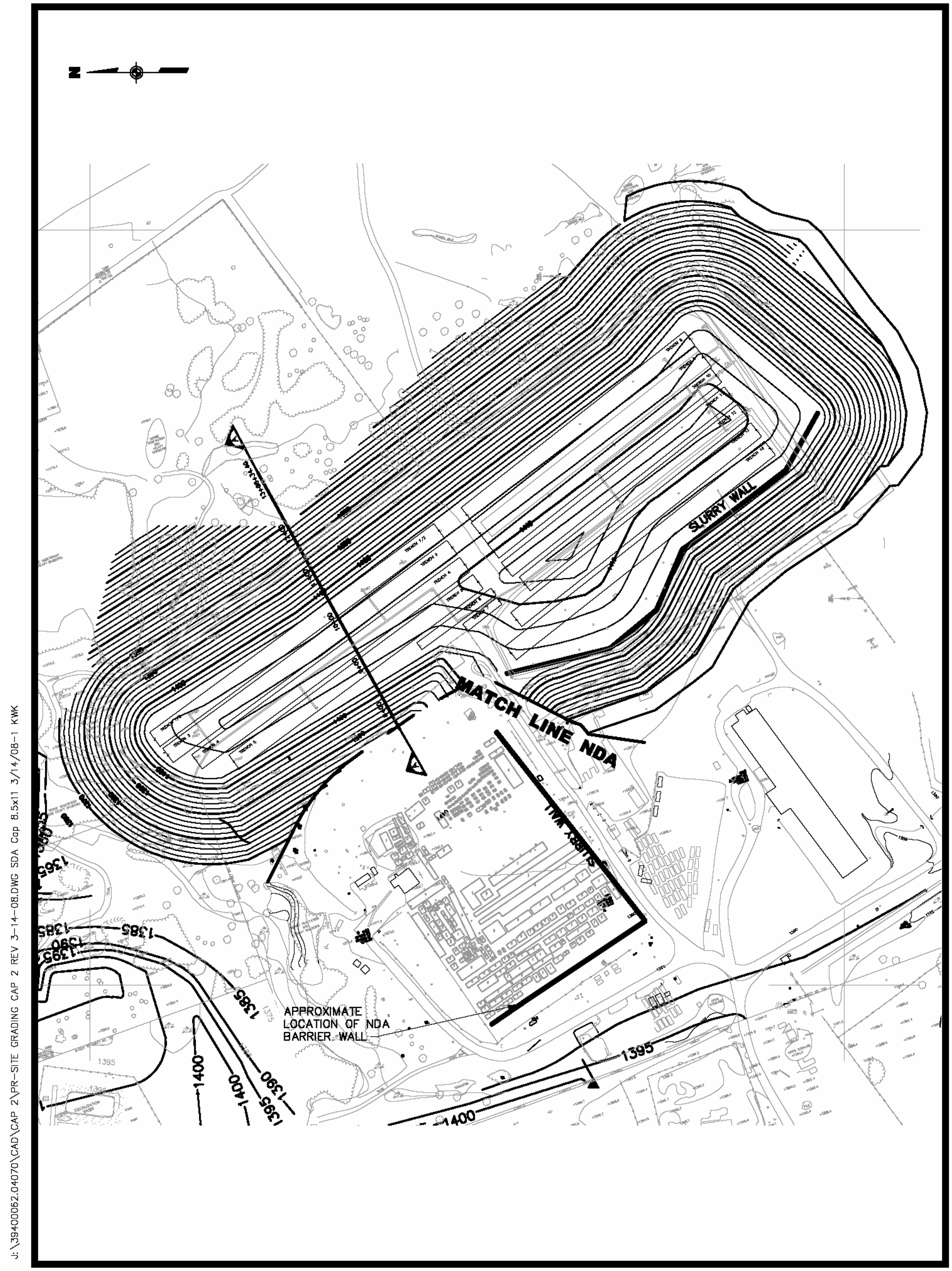

Figure 2-30. WMA 8 Cap and Barrier Wall

The 13-layer top deck of the SDA cap would be approximately 12.25 feet thick and would consist of the same-layered components as the NDA and North Plateau caps, from the riprap on top to the compacted clay on the bottom. However, the base layer would consist of compacted common fill that would be excess material from the construction of erosion controls throughout the site. The cap side slope would also have the same design as the side slope on both of the other caps.

The apron at the toe of the side slope would have the same size rock (approximately D_{50} of 15 inches) as the other caps, but the configuration would be slightly different and designed based on the impact of area runoff. The typical triangular toe design would extend down to approximately 15 feet, and the apron would extend outward approximately 40 feet. Lastly, approximately 125 ft^3 boulders would also surround the perimeter of the SDA cap and placed at approximately 10-foot intervals to prevent any negative impacts on the integrity of the cap and barrier walls.

Cap construction activities would be coordinated with the installation of stream regrading and erosional controls, as discussed in Section 2.14, to mitigate impacts of the cap construction on adjacent stream banks.

2.8.5 Remediation Completion and Closeout Activities

The same activities performed at WMA 7 would be anticipated after completion of the SDA cap. Any waste generated during remediation would be packaged and disposed of off site as CDD or LSA waste. Additional backfill would be placed around the completed cap as necessary to restore a natural grade. Fencing would be installed to isolate the closure cap from unwanted intrusion, and barrier wall and cap monitoring equipment and efforts would be established. The monitoring and cap maintenance actions would continue into the future, as needed.

2.8.6 Mitigative Measures

Measures to reduce environmental impacts associated with the in-place closure of WMA 8 would be identical to those measures performed at WMA 7. Preventative actions would be installed throughout the remedial process from new construction to operations and long-term maintenance. Human health and safety would be protected by the use of proper PPE. Sediment control and dust-suppression measures would be employed to reduce the amount of dust that would be airborne or would be carried away by storm water runoff. Equipment used to support construction and demolition activities would be equipped with mufflers. Typical vehicle washing areas, the LTF, and fundamental surface water runoff measures would be established to protect water, soil, and ecological resources. Lastly, installation of the closure cap, grouting of the subsurface areas, and long-term monitoring would also be considered protective not only of human health and safety but also the ecological resources, water resources, and surrounding soils.

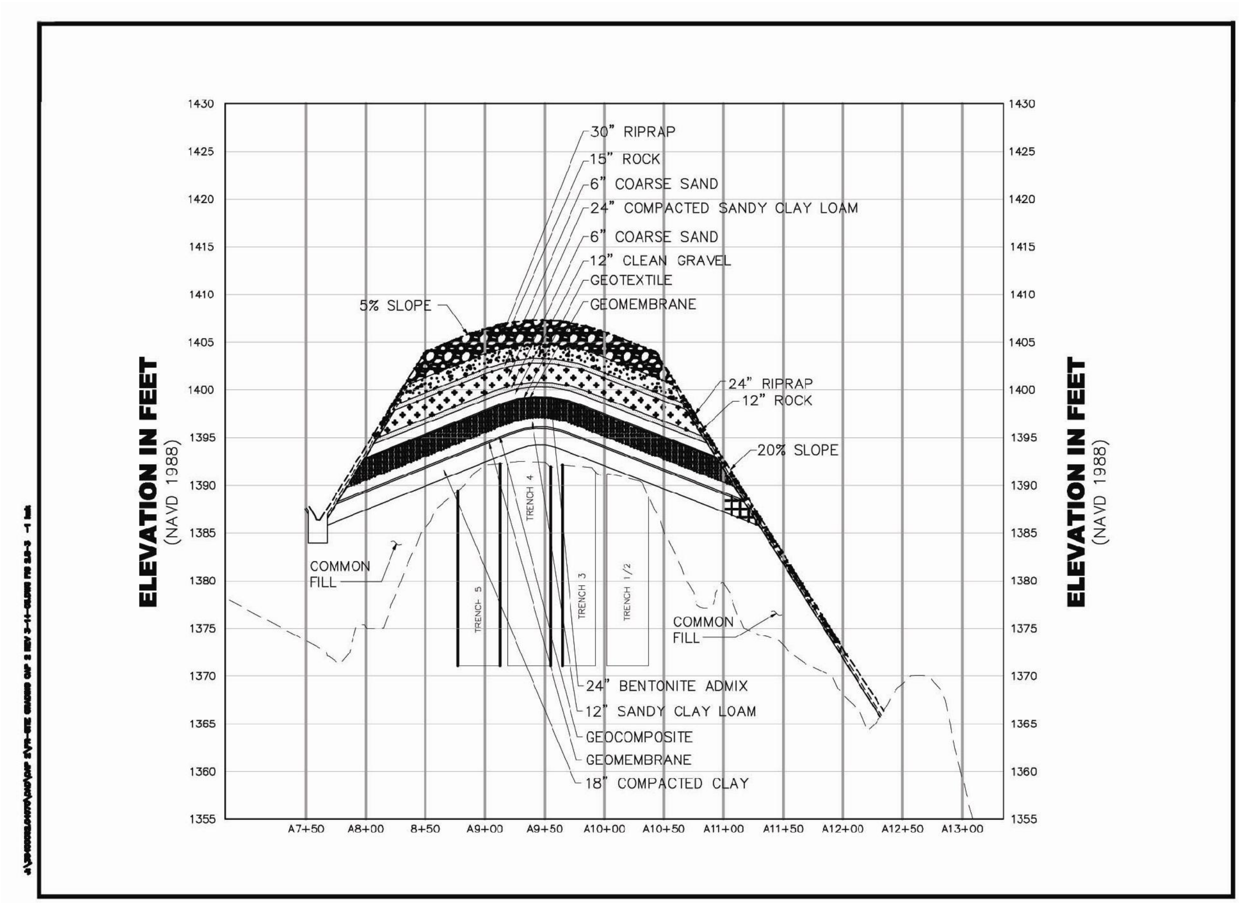

Figure 2-31. WMA 8 Cap Cross-Section

2.9 WMA 9: Radwaste Treatment System Drum Cell Area

The location of the Radwaste Treatment System Drum Cell Area (Drum Cell) is shown on Figure 2-32. The Drum Cell building would be removed along with the associated instrumentation and monitoring shed. There are no planned activities for the Subcontractor Maintenance Area under the Sitewide Close-In-Place Alternative.

2.9.1 Remediation Support Activities

The work planned for this WMA under the Sitewide Close-In-Place Alternative is relatively routine in terms of construction complexity. In general, all of the work is expected to be completed without need for confinement. In addition, remediation support activities would be limited to implementation of the site-specific health and safety procedures, sediment and erosion control procedures, and similar standard construction preparation activities.

Remediation support elements for the Drum Cell remediation would be limited to standard engineering controls that would be put in place to ensure minimal impact on the surrounding environment. Engineering controls would consist of items such as sediment and erosion controls, dust-suppression systems, and surface water management.

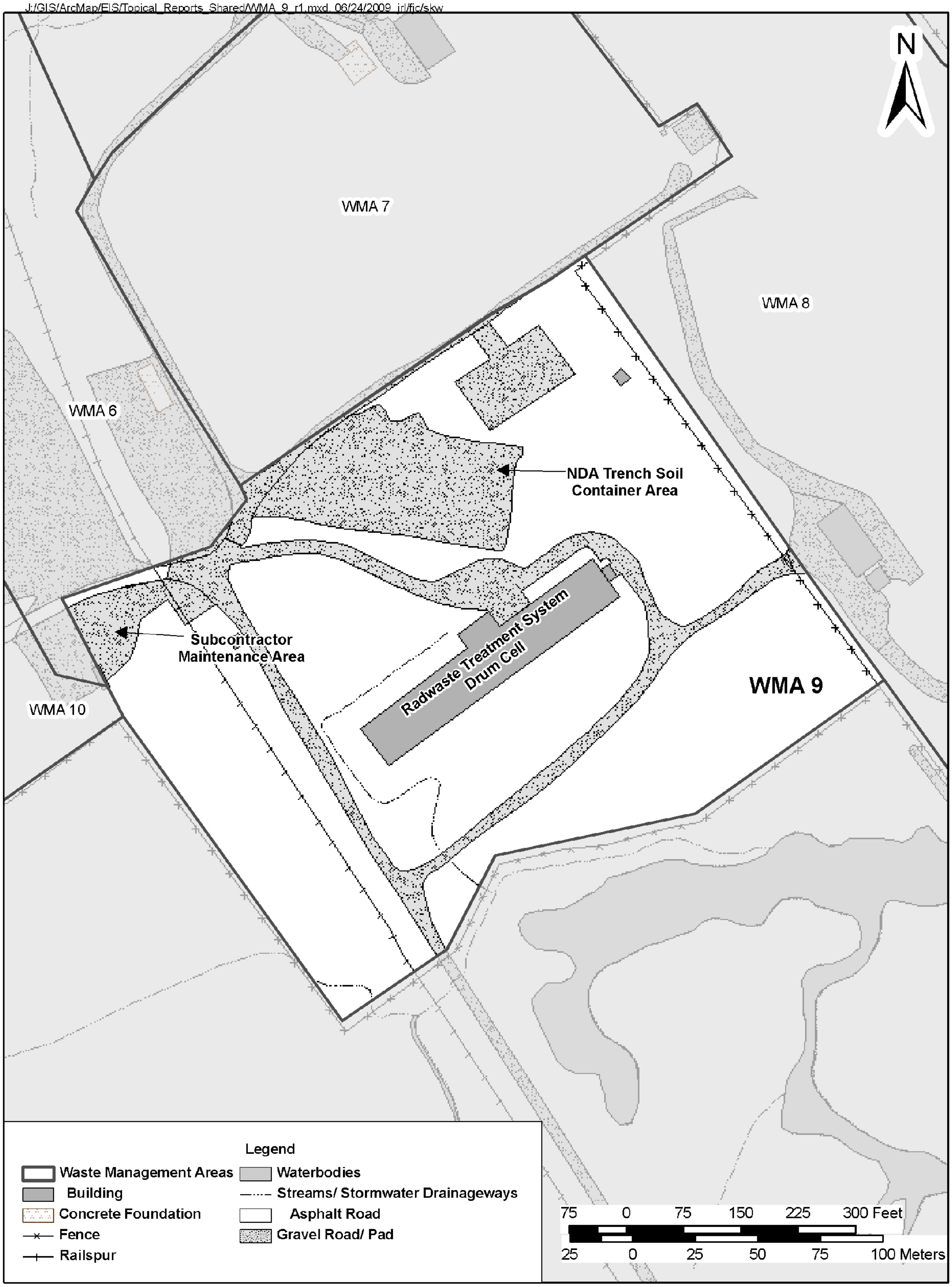

Figure 2-32. WMA 9 - Radwaste Treatment System Drum Cell

2.9.2 Demolition of RTS Drum Cell Building

The Drum Cell building would be demolished, along with the above-grade portions of the concrete drum supports. Since the structure is believed to be uncontaminated, demolition would be performed using standard demolition equipment without any type of secondary confinement. The building superstructure, constructed mainly of steel, would be dismantled, and the components segmented using a shear attachment on an excavator. The concrete drum supports would be demolished using an excavator with a demolition hammer attachment. The demolition debris would then be removed using a front-end loader, or similar equipment. The demolition debris would be directly loaded into waste containers and managed as CDD waste.

2.9.3 Remediation Completion and Closeout Activities

A MARSSIM Final Status Survey would be performed following the removal of the Drum Cell to ensure that residual radioactivity levels do not exceed the established DCGLs. An independent verification survey may also be required by the overseeing agencies.

After the verification survey is complete and regulatory approval is received, the area would be restored with clean soil and graded. Finally, seed and mulch would be applied over the graded area.

2.9.4 Mitigative Measures

Engineering controls would be employed to mitigate airborne and aqueous emissions, and protect the workers, public, and environment from unnecessary exposure to contaminants. Some examples include the following:

- Dust-suppression measures would be employed during waste transportation activities, mitigating the dust generation during this work;
- Silt fencing would be installed prior to ground disturbance to ensure that sediment-laden surface waters are appropriately filtered prior to joining the perimeter streams and waterways; and
- Safety planning would be a prerequisite to all site tasks, ensuring that all workers are aware of the hazards involved in the work.

2.10 WMA 10: Support and Services Area

The location of the Support and Services Area and related facilities is shown on Figure 2-33. The remedial work that would be undertaken in WMA 10 consists of removal of the New Warehouse. Discussion of the remedial work planned is presented in the following subsections.

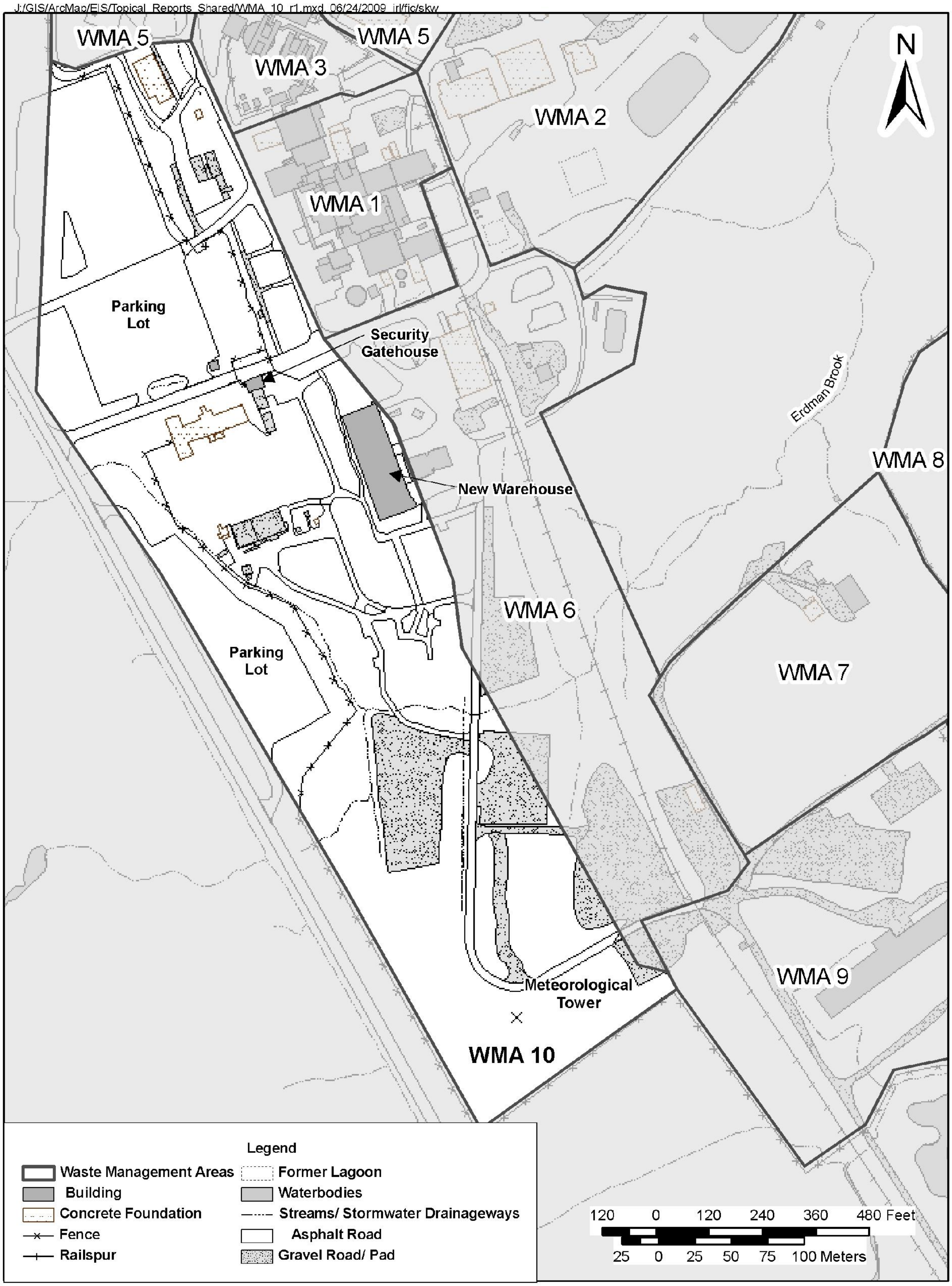

Figure 2-33. WMA 10 - Support and Services Area

2.10.1 Remediation Support Activities

The work planned for WMA 10 under the Sitewide Close-In-Place Alternative is relatively routine in terms of construction complexity. In general, all of the work is expected to be completed without need for confinement. In addition, remediation support activities would be limited to implementation of the site-specific health and safety procedures, sediment and erosion control procedures, and similar standard construction preparation activities.

Remediation support elements for the New Warehouse demolition and removal would be limited to standard engineering controls that would be put in place to ensure minimal impact on the surrounding environment. Engineering controls would consist of items such as sediment and erosion controls, dust-suppression systems, and surface water management.

2.10.2 Removal of the New Warehouse

The New Warehouse is expected to be standing at the start of work to this Close-In-Place Alternative. This structure would be demolished through the use of a hydraulic crane and front-end loader. The resulting demolition debris would be collected and disposed of as CDD. It is assumed that only the foundation wall would be removed, leaving the foundation, piers, and footings in place. The wall block would be demolished with demolition hammers and a front-end loader.

2.10.3 Remediation Completion and Closeout Activities

A MARSSIM Final Status Survey would be performed following the removal of the New Warehouse, to verify that residual radioactivity levels do not exceed the established DCGLs. An independent verification survey may also be required by the overseeing agencies.

After the verification survey is complete and regulatory approval is received, the area would be restored with clean soil and graded. Finally, seed and mulch would be applied over the graded area.

2.10.4 Mitigative Measures

Numerous standard engineering controls would be employed to mitigate airborne and aqueous emissions, and protect the workers, public, and environment from unnecessary exposure to contaminants. Some examples include the following:

- Dust-suppression measures would be employed during concrete and steel demolition and transportation activities, mitigating the dust generation during this work;

- Silt fencing would be installed prior to ground disturbance to ensure that sediment-laden surface waters are appropriately filtered prior to joining the perimeter streams and waterways; and

- Safety planning would be a prerequisite to all site tasks, ensuring that all workers are aware of the hazards involved in the work.

2.11 WMA 11: Bulk Storage Warehouse and Hydrofracture Test Well Area

The Scrap Material Landfill would remain as is and no additional work would be proposed for WMA 11 under this alternative.

There are no area-specific post-closure monitoring activities planned for the WMA 11. However, WMA 11 and similar areas where no closure or post-implementation activities are planned would still be included in the general long-term site stewardship and security program discussed in Sections 2.15 and 4.2.3.

2.12 WMA 12: Balance of Site

The location of facilities associated with WMA 12 that would be removed in the performance of this alternative is shown in Figure 2-34. There are no planned activities identified for the contaminated soils on Project premises for the Sitewide Close-In-Place Alternative. Stream sediments that are believed to be contaminated would be addressed under the Sitewide Erosion Controls installation, discussed in Section 2.14.4.

2.12.1 Remediation Support Activities

The work planned for this WMA under the Sitewide Close-In-Place Alternative is relatively routine in terms of construction complexity. In general, all of the work is expected to be completed without need for confinement. In addition, remediation support activities would be limited to implementation of the site-specific health and safety procedures, sediment and erosion control procedures, and similar standard construction preparation activities.

2.12.2 Removal of Reservoirs and Support Structures

There are two water supply reservoirs located in WMA 12: the South Reservoir and the North Reservoir. A 75-foot-high earthen dam confines the South Reservoir, while a 50-foot-high earthen dam confines the North Reservoir. The South Reservoir overflows to the North Reservoir through a short canal. The North Reservoir has a control structure and pump house to regulate water level. The dams and reservoirs would be closed in accordance with applicable state and federal regulations and approvals from the NYSDEC, the NYSDOH, and the USEPA. The reservoirs would be slowly drained or pumped to prevent unnecessary disturbance of sediment downstream. After the water level has been lowered, the control structure, pump house, and pipe would be demolished.

After the water level has been lowered, Dam 1 would be excavated first to allow for truck traffic over Dam 2. Both dams would be excavated through the use of a hydraulic excavator and front-end loader. All excavated soil would be transported to an on-site lay down area. For the purposes of this alternative, only the middle third section of the dams would be removed. This should allow the streams to pass through these areas unobstructed.

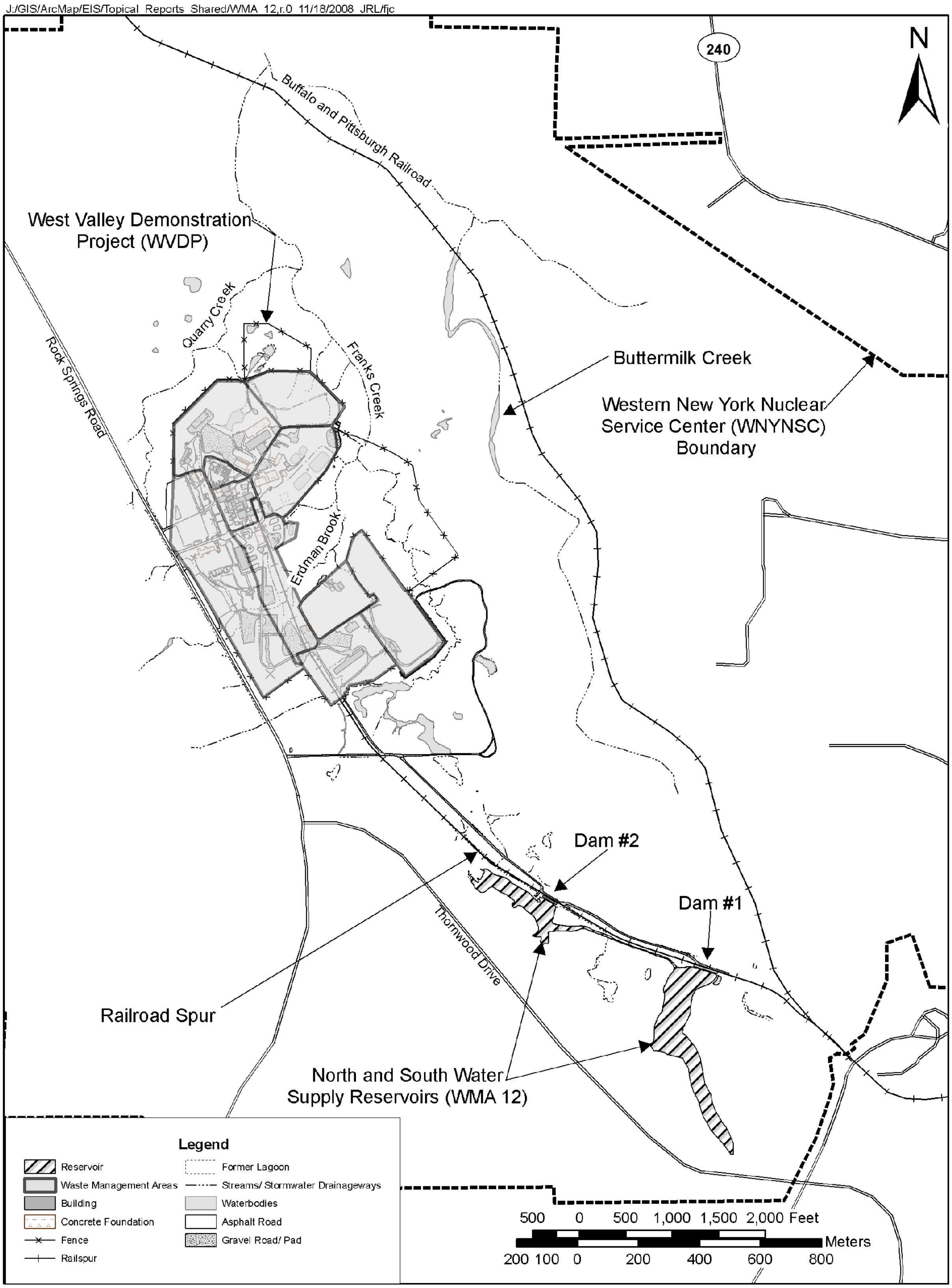

Figure 2-34. WMA 12 - Balance of Site

The steel bridge that spans across Reservoir 2 would also be removed for this alternative. The bridge would be sectioned through the use of a cutting torch. These sections would be collected and disposed of as CDD.

Removal of the steel bridge and dam sections would not occur until after the HLW canisters have been removed from the site. The rail spur may be needed to transport the canisters off site.

2.12.3 Remediation Completion and Closeout Activities

A MARSSIM Final Status Survey would be performed following the removal of the dams and reservoirs, to verify that residual radioactivity levels do not exceed the established DCGLs. An independent verification survey may also be required by the overseeing agencies.

After the verification survey is complete and regulatory approval is received, the area would be restored with erosion resistant materials, according to common construction practices. The area is not within a potential zone of impact for the disposal areas, therefore design of the in-stream erosion controls would be done in accordance with local and state guidances. Finally, seed and mulch would be applied over the remainder of the disturbed areas.

Successful vegetative growth is of key importance to the success of the Sitewide Close-In-Place Alternative; therefore, there would be a significant effort directed toward maintaining the vegetative cover over the initial growing season. Once significant vegetative cover is established, temporary engineering controls, such as sediment traps and silt fences, would be removed.

2.12.4 Mitigative Measures

Due to the nature of the demolition work proposed for WMA 12, sediment control and dust-suppression measures would be employed to reduce the amount of exposed soil that would be airborne or would be carried away in storm water runoff. The restoration of the stream area would also include the installation of geotextiles and erosion resistant armoring, which would minimize future stream erosion.

2.13 North Plateau Groundwater Plume (Non-Source Area)

Groundwater in portions of the sand and gravel unit in the North Plateau of the WNYNSC is radiologically contaminated as a result of past NFS operations. The North Plateau Groundwater Plume (NPP) is an approximate 200-foot-wide by 850-foot-long zone of groundwater contamination that extends northeastward from the Main Plant Process Building in WMA 1 toward the CDDL in WMA 4, where it splits into western and eastern lobes. Strontium-90 and its decay product, yttrium-90 are the principal radionuclides in this plume. Under the Sitewide Close-In-Place Alternative, the North Plateau Groundwater Plume would be addressed in two components, as follows:

- Source Area – The source area of the NPP, located in the southeast corner of the Main Plant Process Building and would be included within the WMA 1 remedial actions. The NPP source area would be isolated from the downgradient portions of the NPP through the installation of two barrier walls and an engineered multi-layered cover, as discussed in Sections 2.1 and 2.3; and

- Non-Source Area – The non-source area of the plume would be mitigated passively through the continued monitoring and maintenance of a permeable treatment wall system, installed prior to the EIS starting point.

2.13.1 Remediation Support Activities

Prior to implementation of the in-place closure activities, typical project setup efforts would be completed. Supplementary activities, which would include characterization and design measures, applications for necessary regulatory approvals, and installation of storm water controls would also be performed.

2.13.2 Replacement of the Permeable Treatment Wall

Prior to implementation of the Sitewide Close-In-Place Alternative, a full-scale permeable treatment wall (PTW) would be installed near the leading edge of the North Plateau Plume (NPP). The PTW is anticipated to be at least 500 feet long and oriented in a northwest-southeast manner. The PTW structure would be orientated approximately perpendicular to the direction of groundwater flow so as to capture this flow. The PTW is estimated to be about two to four feet thick, and 25 feet deep and extend down into the unweathered Lavery till.

The PTW would be replaced, as needed on an estimated 20-year interval, as part of the Sitewide Close-In-Place Alternative. Replacement of the PTW would consist of excavating and disposal of the spent PTW media, and restoration of the PTW function with installation of fresh media. Disposal estimates are based on the spent PTW media being disposed of as LSA waste.

2.13.3 Removal of Surface Structures

Under the Sitewide Close-In-Place Alternative, the existing North Plateau Groundwater Recovery System and associated appurtenances would be decommissioned, the equipment demolished, and the rubble would be appropriately disposed at an off-site facility. The existing groundwater monitoring network wells and piezometers would be abandoned in place by grout injection. In addition, the Seepage Face PRB would eventually be removed and the Swamp Ditch drainage channel would be restored. The demolition debris and the PRB material are assumed to be managed as LSA waste.

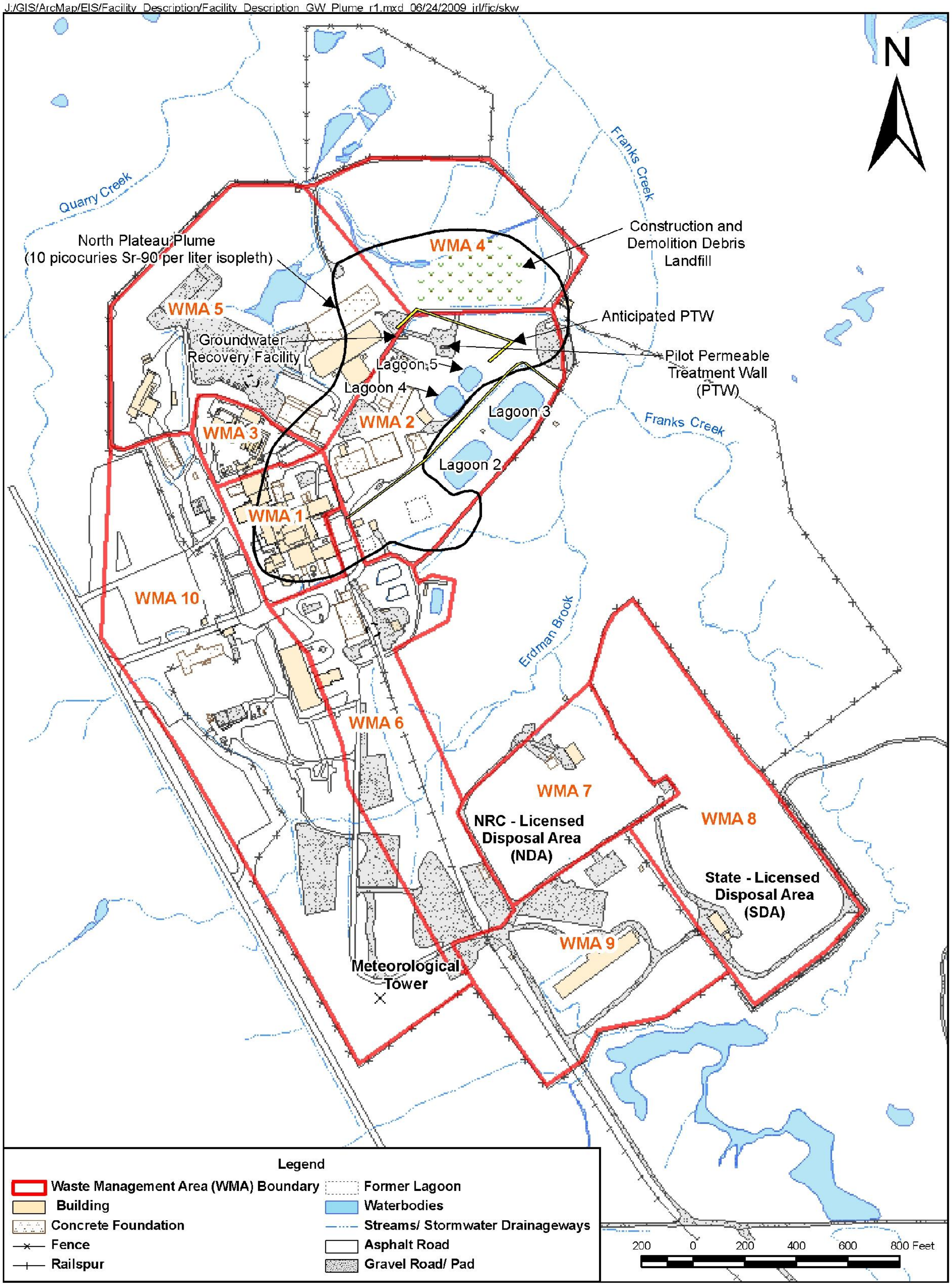

Figure 2-35. North Plateau Groundwater Plume Remediation Concept

2.13.4 Remediation Completion and Closeout Activities

Following completion of PTW replacement and demolition of ancillary facilities, disturbed areas would be fully restored and vegetative cover established. Once the vegetation is established, the temporary construction facilities and engineering controls would be removed. Passive treatment of groundwater using the full-scale PTW is anticipated to continue for the foreseeable future. The NPP would be included in the monitoring and long-term stewardship programs discussed in Section 2.15 and Section 4.0. The groundwater monitoring network and/or PTW would undergo periodic maintenance or refurbishment/replacement, as necessary.

2.13.5 Mitigative Measures

Construction activities under the Sitewide Close-In-Place Alternative for this task are limited. Health and Safety protocols would largely focus on common construction procedures. Sediment control and dust-suppression measures would be employed, where appropriate, to reduce the amount of exposed soil that would be airborne or would be carried away in storm water runoff. The equipment used for well/piezometer installations, removal of the Swamp Ditch PRB, replacement of the PTW zeolite ion-exchange media, or other construction or maintenance activities would also be equipped with mufflers. Work in the contaminated areas would require the use of PPE and contamination controls and, as warranted, the use of contamination reduction zones and buffer areas.

2.14 Sitewide Erosion Controls Construction

Without mitigation, long-term erosion may negatively impact several WMAs under the Sitewide Close-In-Place Alternative. Successful in-place closure and long-term management of these WMAs would therefore depend on stabilization of the site streams, gullies, and other waterways to control erosion over time. In accordance with NUREG-1623, the erosion control system would be designed to accommodate the probable maximum flood, and would be consistent with other applicable Federal, State, and local regulations and guidance. All of the erosion control features would be designed to operate independent of a long-term maintenance program, although periodic inspections would normally be performed. In addition, several existing medium- to large-scale erosion control installations through the southwestern New York region were reviewed to gain a better understanding of the various types of structures used, the successes and failures, and the mechanisms for failure, for these structures.

The conceptual long-term erosion control plan is illustrated in Figure 2-36. The components of this erosion control concept would include the following:

- Diversion berms and ditches;
- Water control structures; and
- Streambed armoring.

The proposed erosion control scheme focuses on larger-scale issues. There could be some minor localized erosion issues that develop as well. These smaller-scale issues would be maintained/mitigated as part of the post-implementation phase monitoring and maintenance activities.

Details of these erosion control concepts are presented in the following subsections.

2.14.1 Remediation Support Activities

The work planned for this WMA under the Sitewide Close-In-Place Alternative is relatively routine in terms of construction complexity. In general, all of the work is expected to be performed in unimpacted soils (except for a minor amount of stream sediment), without need for confinement. In addition, remediation support activities would be limited to implementation of the site-specific health and safety procedures, sediment and erosion control procedures, and similar standard construction preparation activities. Sediment and erosion control would be a significant effort based on the amount of land disturbance that would occur.

2.14.2 Construction of Diversion Berms and Ditches

The primary purpose of installing diversion berms is to control the sheet flow of runoff on the north and south plateaus, and direct the flow to the areas that are appropriately protected against erosion. Diversion berms installed in these cases are intended to mitigate the free flow of runoff over the edge of the plateaus in unprotected areas. This construction would reduce or mitigate erosion due to new headcuts. Diversion berms are necessary and would be installed on the North Plateau in locations shown in Figure 2-36. The diversion berms running along the top of the Quarry Creek and Franks Creek banks would direct flow to Water Control Structure 1 (WCS-1) and WCS-2. The diversion berms running along the top of the Erdman Brook banks would direct flow to either WCS-3, or on the south plateau, WCS-4 and WCS-5.

Although the principle component of the diversion berm is a raised mound, linear in shape, that cross-cuts the normal sheet flow direction, there is sometimes a secondary component, a parallel ditch. In some cases, the berm is constructed using earth excavated from the ditch component. This arrangement may be utilized in some areas of the site. However, the primary diversion berms on site would likely be constructed entirely of imported soil (fine-grained soils to prevent infiltration) with imported stone and rip-rap layers to achieve long-term resistance to erosion.

The size and extent of the diversion berms that are envisioned for the site were based on the extent of the Probable Maximum Flood (PMF). During such a flood, significant backwater flooding would occur over the North Plateau, and under unprotected conditions, there would be many instances of uncontrolled flow over the edges of the plateau. Considering the current design, water would crest the Water Control Structures at depths of between three and four feet. The perimeter diversion berms would therefore be at least five feet in overall height to include significant freeboard protection. The overall dimensions of these berms would be at least five feet in height, 10- to 20-foot top width (constructed using heavy equipment), and bottom widths of 40 to 50 feet.

To minimize long-term erosion of the berms they would be constructed using rock armoring, similar in composition to the water control structures. Beneath the armoring, the primary diversion berm would be constructed of compacted silty-clay soil. The armoring would then consist of coarse sand (to serve as a filter layer to create stability between the soil and the rock layers), a layer of rock bedding, and finally a layer of riprap rock.

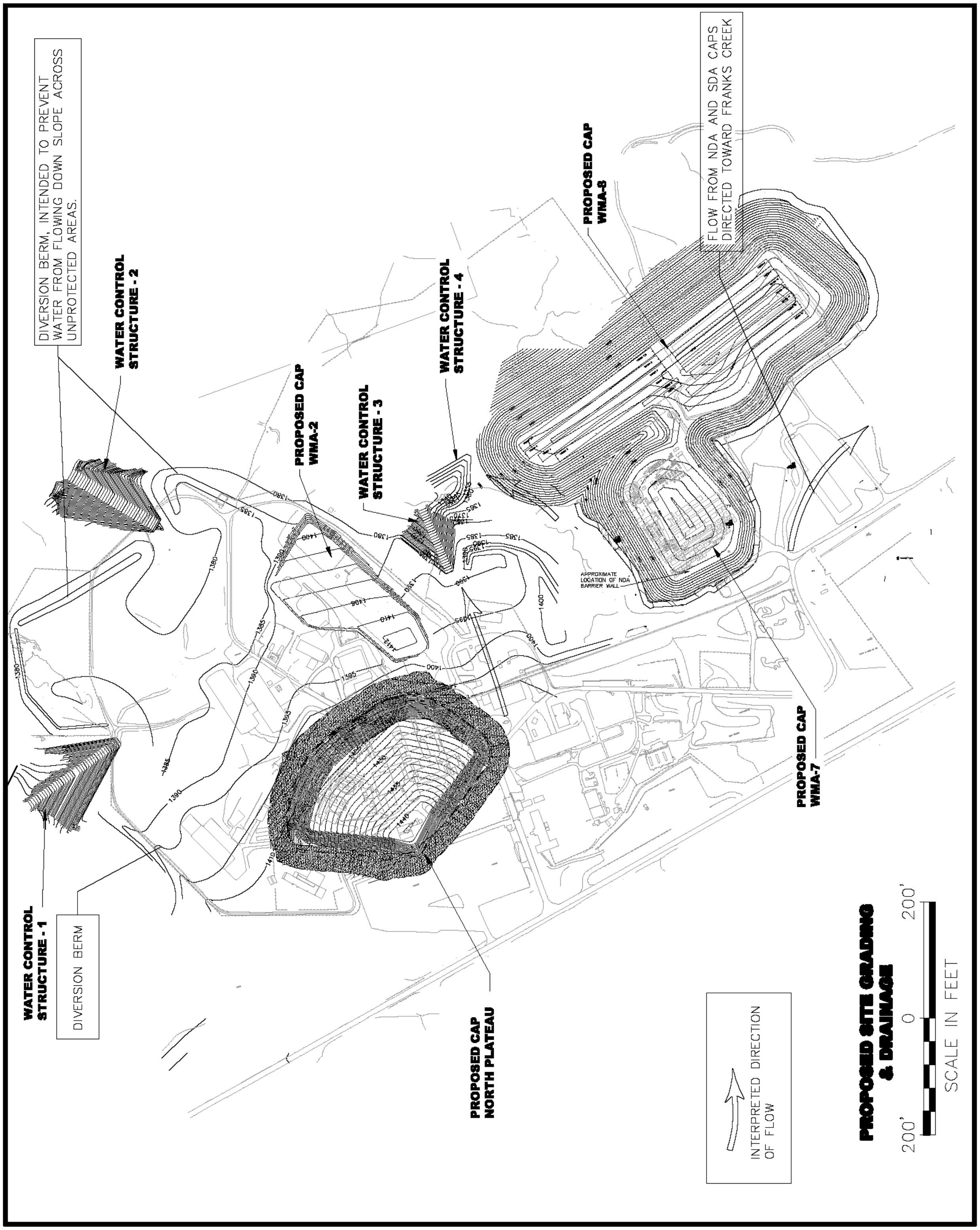

Figure 2-36. Conceptual Plan for Sitewide Erosion Controls

2.14.3 Construction of Water Control Structures

At least four, and possibly five, water control structures would be installed at locations selected base on the current preferential flow to these areas. The general locations where water control structures would be installed are:

- NP1 Gully;
- NP2 Gully;
- Lagoon Creek Gully;
- SDA Gully; and
- (Possibly) NDA Gully.

The basic location of each of these structures is illustrated in Figure 2-36. The general arrangement of each structure would be similar to that shown in Figures 2-37 and 2-38.

The water control structures would be designed and constructed to respond to the common storm flows and the PMF flows in two different ways. The common storm flows (up to and including the 100-year rainfall runoff) would be transmitted from the plateau surface down to the creek bottom within a concrete pipe. Concrete fill would be poured around the piping to promote long-term durability, and the inlet structure, as well, would be constructed of cast-in-place reinforced concrete. The piping would be sized to accommodate the 100-year rainfall runoff without significant surcharge.

Storms exceeding the 100-year recurrence interval would naturally cause the inlet structure to become surcharged, and water would begin to pond. Increasingly long duration storms, exceeding the 100-year storm, up to the Probable Maximum Precipitation (PMP) and the resulting flood (PMF) would cause significant ponding behind the diversion berms and above the concrete inlet structure. At approximately two feet of depth, the ponded water would begin to spill over a broad-crested weir, and would flow down an armor protected overflow spillway. Both the spillway and the pipe discharges would be protected using discharge aprons. These structures would be reinforced with rip-rap rock armoring following the guidance of NUREG-1623 (NRC, 2002).

Based on the cap configurations and arrangement relative to Erdman Brook, the NDA Gully may be fully protected against erosion, beneath the NDA and SDA caps. Under these conditions, a water control structure would not be necessary. However, as an estimate, five of these structures are assumed for construction and maintenance costs.

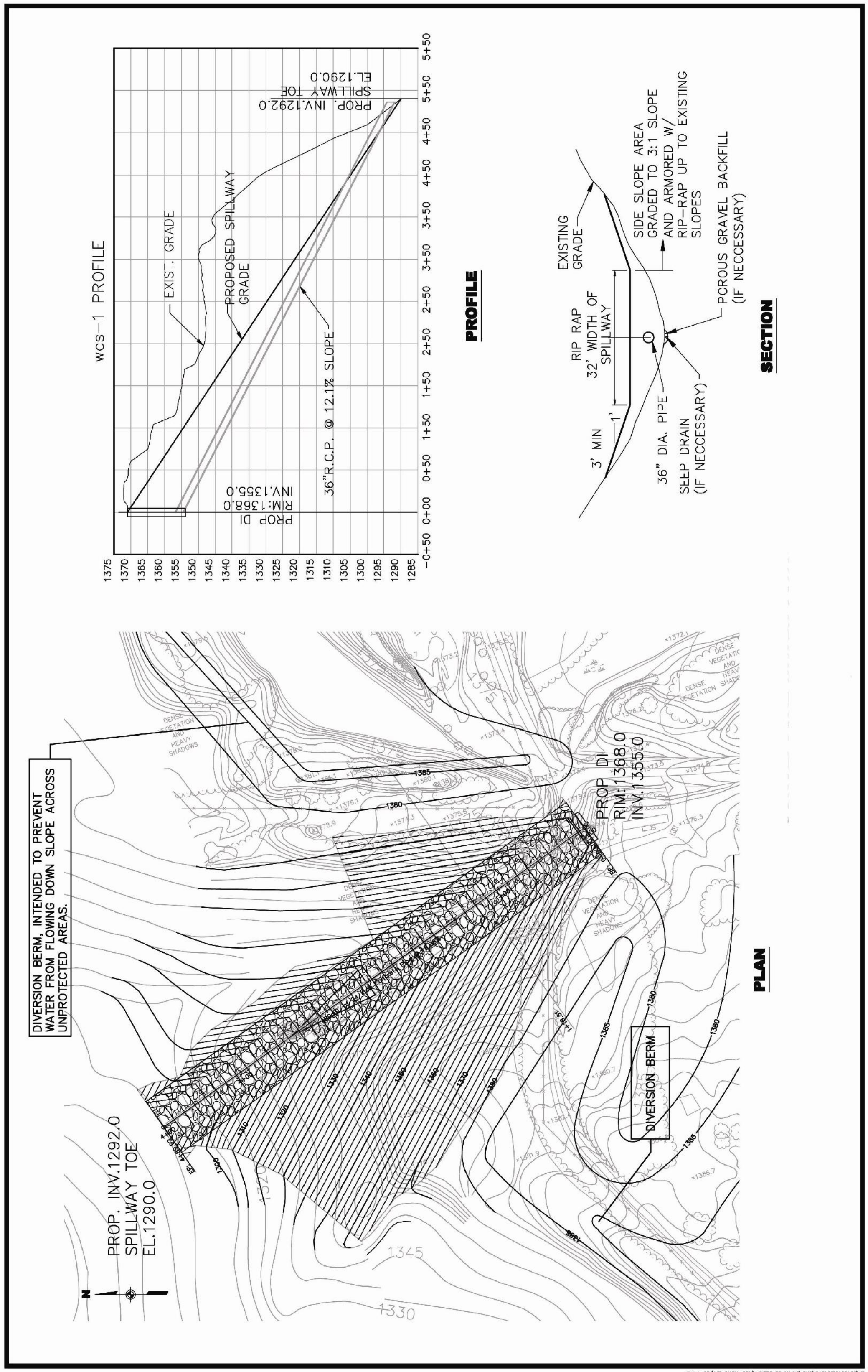

Figure 2-37. Conceptual Water Control Structure Details (WCS-1)

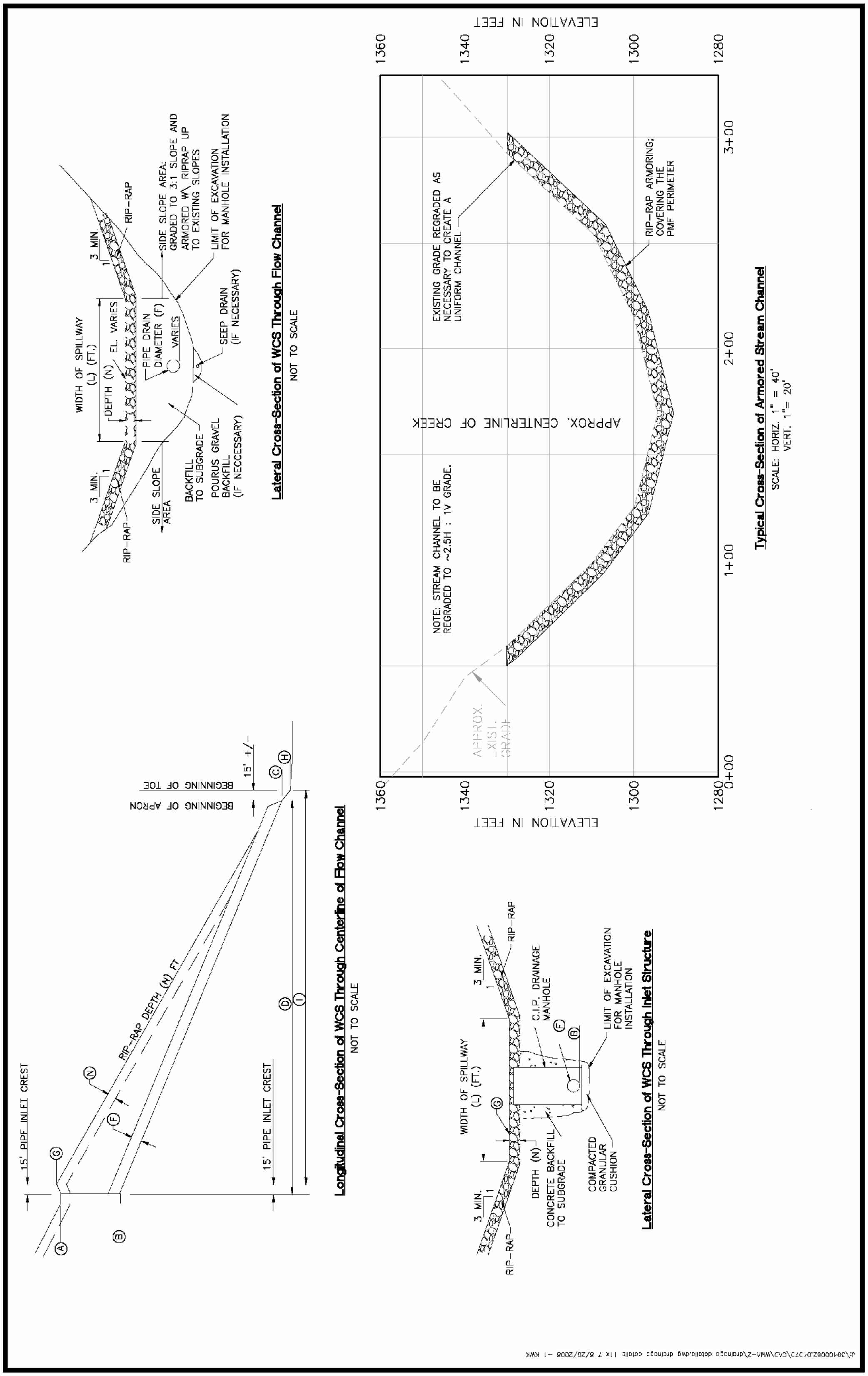

Figure 2-38. Erosion Control Details

2.14.4 Installation of Streambed Armoring

Stone armoring would be installed in the beds of Quarry Creek, Erdman Brook, and Franks Creek from upstream of the SDA to its confluence with Buttermilk Creek to provide protection against the erosive forces of surface water. This armoring would ensure that erosive forces do not continue to lower the streambed elevation. The total armored length of these streams would be approximately ~~4,300~~12,900 linear feet.

Planning for excavation of streambed material for installation of the riprap armor would take into account the results of the streambed characterization surveys. Excavation necessary to install the riprap armor would likely include removal of contaminated streambed sediment along with other uncontaminated material. Under the Sitewide Close-In-Place Alternative, all of the excavated material would be used for grading fill beneath the caps at WMA 1/3, WMA 7, and WMA 8.

The process to be used for each stream would begin with clearing trees and undergrowth from both sides of the stream and establishing a temporary haul road along each side. Stumps removed from the streambeds would be managed as CDD material and disposed of off site. Bypass pumping would be utilized, as necessary, to support flow-diversion during streambed construction activities. Excavation would be accomplished using conventional equipment, such as excavators and bulldozers, to provide uniform streambed geometry and slope. The streambed may be straightened in some cases as the new bed is shaped.

After flow-diversion, clearing, and excavation, a filter layer consisting of coarse sand would be graded in the excavated streambed. A layer of rock bedding would be placed on top of the sand. Then a layer of riprap would be placed over the rock bedding to form a dense, well-graded mass of stone with minimum voids. Finally, the stream flow diversion would be removed and flow would be restored to the armored streambed.

2.14.5 Remediation Completion and Closeout Activities

Once the Erosion Control system installation is complete, temporary erosion and sediment controls, bypass pumping system, surface water diversion systems, and other temporary construction facilities would be removed. Restoration, and in particular, establishment of vegetation in disturbed areas, would be a critical component to the success of the erosion controls systems. Successful vegetative growth is of key importance to the success of the remedy, therefore there would be a significant effort directed toward maintaining the vegetative cover over the initial growing season. The scoped erosion control elements are intended to provide control of existing large-scale site issues. Minor erosion control issues that develop at the site in the future would be maintained and mitigated during the post-implementation phase.

2.14.6 Mitigative Measures

There are several mitigative measures employed during construction of the erosion controls intended to limit the release of sediment in storm water. The mitigative measures employed in the form of engineering controls included:

- Installation of temporary sediment and erosion controls; and
- Setup and operation of pumping system that bypasses the stream sections being worked;

In addition, several mitigative measures are incorporated into the works in the form of administrative measures, such as:

- Controlling dust levels by ensuring that working surfaces are kept damp, truck and heavy equipment speeds are maintained at a reasonable level; and
- Constant monitoring of the work in progress to ensure that engineering controls and health and safety measures are in place and effective.

2.15 Installation of Sitewide Security and Environmental Monitoring Systems

During the implementation of the Sitewide Close-In-Place Alternative, the existing WNYNSC site monitoring and institutional controls would continue to function. Subsequently, post-implementation monitoring and institutional security controls would transition into a multi-faceted, long-term monitoring and maintenance function that would be instituted for the foreseeable future.

Construction activities would include: the abandonment of the existing groundwater monitoring well and piezometer network in place by overdrilling and removal; and installation of a series of new monitoring devices, including groundwater monitoring wells and piezometers, inclinometers, and erosion monitors, installed to monitor selected environmental and geotechnical parameters following the completion of the decommissioning actions.

The instrumentation would be used to monitor the following site elements:

- Hydraulic barrier walls;
- Engineered, multi-layered cover systems;
- Erosion controls installed on Quarry Creek, Erdman Brook, and Franks Creek; and
- Surface water and groundwater quality.

Institutional controls, facilitated by fences, signage, and video surveillance and/or motion detectors (where warranted) would be put into place for portions of the site that are not released from the NRC and NYS licenses.

2.15.1 Remediation Support Activities

The groundwater, surface water, site caps, and erosion control systems are elements of the Sitewide Close-In-Place Alternative that would remain in place following completion of the remedial construction work. These aspects of the remediation would be subject to long-term monitoring programs, the requirements of which would be well represented in work plans and reports. These work plans would form the basis of the long-term monitoring and maintenance program and would be fully implemented during all monitoring and maintenance efforts.

2.15.2 Monitoring and Maintenance

Surface Water Monitoring Program

Surface waters draining the North and South Plateaus would be routinely monitored for radionuclide indicator parameters at 11 locations on Franks Creek, Erdman Brook, and Quarry Creek on a semi-annual schedule. Another four sampling locations would be located upstream and downstream of the WNYNSC along Buttermilk Creek and Cattaraugus Creek near the perimeter of the WNYNSC. The locations of the surface water sampling sites are presented on Figure 2-39.

Groundwater Quality Monitoring

A total of 52 groundwater wells would be installed to monitor groundwater elevations and groundwater quality in the North and South Plateaus, Figure 2-39. Another eight off-site residential water supply wells would be included in the site-monitoring program to monitor off-site groundwater. Monitoring tasks would include measurement of water levels, well purging, sampling, and inspection of each well followed by any maintenance or repairs required to maintain them in proper working condition would be performed as needed.

Hydraulic Barrier Walls

Pairs of groundwater piezometers would be installed along the upgradient and downgradient sides of subsurface hydraulic barrier walls installed on the North and South Plateaus to evaluate the performance of these features. In total, approximately 64 piezometers would be installed under the Sitewide Close-In-Place Alternative. These piezometers would be routinely inspected during the course of the monitoring program and maintenance or repairs required to maintain them in proper working condition would be performed, as needed.

Engineered Multi-Layered Cover Systems

Engineered multi-layered cover systems would be installed over the combined WMA 1 and WMA 3 areas, NDA, and SDA, as discussed in Sections 2.1, 2.3, 2.7, and 2.8, respectively. The multi-layered cover system instrumentation network would be monitored and the systems would undergo routine inspections for signs of deterioration or damage resulting from subsidence, erosion, and/or vegetation growth. The monitoring and inspection process would be followed by routine maintenance and repair, as necessary, to maintain the integrity of the engineered cover systems.

Erosion Control Structures

The objectives of the erosion control structures are to control surface water runoff to mitigate gully erosion progress and to reduce streambed erosion (Figures 2-36 through 2-38). Erosion control elements would include the following:

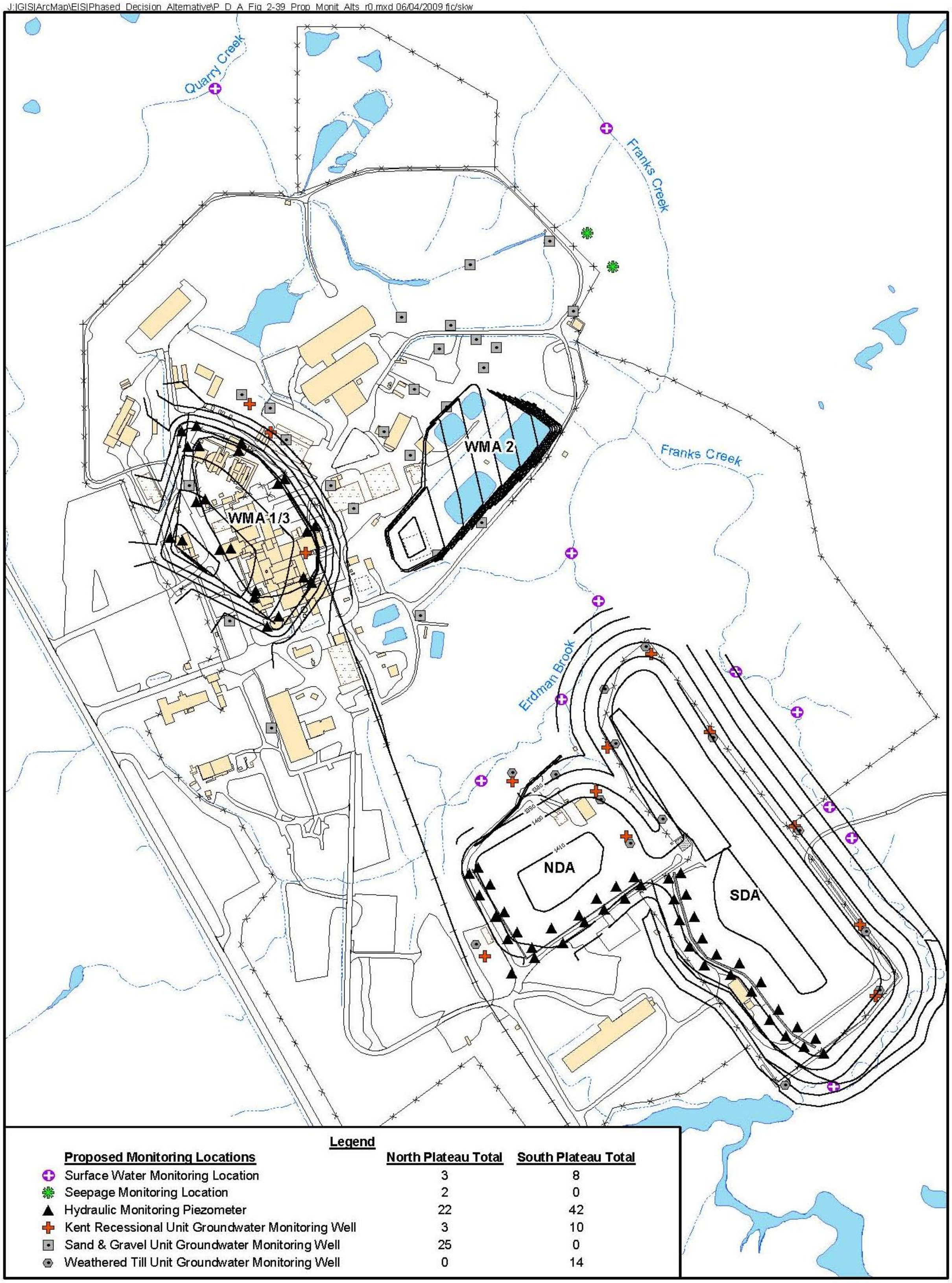

Figure 2-39. Sitewide Environmental Monitoring Locations

- Diversion berms;
- Diversion ditches;
- Water control structures; and
- Streambed armoring.

The erosion control structures would be regularly inspected to ensure that they are functioning as designed and to identify signs of blockage and/or physical damage. Corrective maintenance would be performed in response to the inspections and would include clearing debris and silt-blocking erosion-control structures and performance of local regrading, where necessary.

2.15.3 Sitewide Security

Access to the closed facilities in the North Plateau and South Plateau would be restricted by installing an eight-foot-high chain-link fence around these facilities. The fence would have one or more access points with locked gates. Motion sensors and video cameras would be installed at intervals along these security fences. These sensors would be wired to activate alarms at local law enforcement facilities.

Signs would be placed around the perimeter, as well as near the main WNYNSC access point, providing appropriate information identifying the nature of the site and the existence of residual radioactive inventories in the North Plateau and of buried radioactive wastes at WMA 7 and WMA 8. These signs would also list current telephone numbers to call to obtain additional information regarding the property. These signs would be maintained for the duration of the post-closure stewardship.

The security systems constructed around the closed facilities would be routinely inspected for signs of distress or damage resulting from normal wear from natural elements or from vandalism. Repairs of minor damage would be performed during these inspections, as needed.

2.15.4 Remediation Completion and Closeout

The monitoring and site security elements discussed within Section 2.15 are anticipated to remain operational for the foreseeable future and, as such, would be evaluated/maintained through implementation of a routine operational and maintenance program, as discussed in Sections 2.15.2 and 2.15.3. Support elements requiring maintenance, including groundwater monitoring wells, piezometers, or geotechnical monitoring devices, would be repaired or would be abandoned, using appropriate procedures and replaced, as necessary.

The security systems, including fencing, are assumed to require complete replacement once every 35 years. Advancements in motion detector and camera technologies are assumed to be addressed by the annual monitoring and maintenance program, within which equipment using current technologies would be procured and installed whenever equipment would need to be replaced.

2.15.5 Mitigative Measures

Construction activities for installation of monitoring and security systems are limited. Health and Safety protocols would focus on common construction procedures. Sediment control and dust-suppression measures would be employed, where appropriate, to reduce the amount of exposed soil that would be airborne or would be carried away in storm water runoff. Work in the contaminated areas would require the use of PPE and contamination controls and, as warranted, the use of contamination reduction zones and buffer areas.

3.0 DATA SUMMARY

NOTE: *The Section 3.0 tables and figures have all been replaced to reflect updates and revisions to the supporting calculations packages.*

This section presents the data generated from the calculations that were completed to estimate the resource demand (e.g., cost, personnel, environmental releases, etc.) to implement the Close-In-Place Alternative at the WNYNSC. The data are presented in both tabular and figure form, and address four primary categories of information regarding in the in-place closure of site facilities: Resource Requirements, Environmental Impacts, Generated Waste, and Costs. The project schedule is presented in addition to these categories to provide a clear understanding of the timing of the different tasks, and the annual demand of resources within these categories.

Approximately 19 tables and 14 figures were created in these four categories, and each is discussed in more detail below. It should be noted that the tabular results are presented as they were calculated without regard for significant figures (i.e., the number of figures does not reflect the precision of the results). Accordingly, if the results are used in subsequent calculations and presented as final, then the results should be rounded to two significant figures to mitigate false precision.

3.1 Schedule

The Sitewide Close-In-Place Alternative Implementation Schedule is represented in Figure 3-1. The active remediation at the site would be completed within about 7 years, while the long-term monitoring and maintenance activities are assumed to continue perpetually. The DCSA is assumed to be maintained for a period of approximately 30 years, at which time the waste would be shipped to a repository. The duration of active remediation corresponds to a budget driven schedule, assuming a budget of $100 million per year and waste disposal primarily at the Nevada Test Site (NTS). This schedule was also based on the assumption that no storage of orphan waste would exist. The critical path tasks on the schedule are either the remediation at WMA 1 (including WMA 1/3 cap construction), or the remedial work at WMA 7 and 8 (including cap construction). Each of these tasks requires approximately seven years for completion.

The schedule shown is one of an almost infinite number of schedules that could be developed with the information that is available. It should be understood that this is not a proposed or recommended schedule, but is simply a representative schedule to demonstrate the duration and complexity that would result from implementing the Sitewide Close-In-Place Alternative. Should this alternative be selected, further refinement of the schedule would occur after detailed design, as necessary.

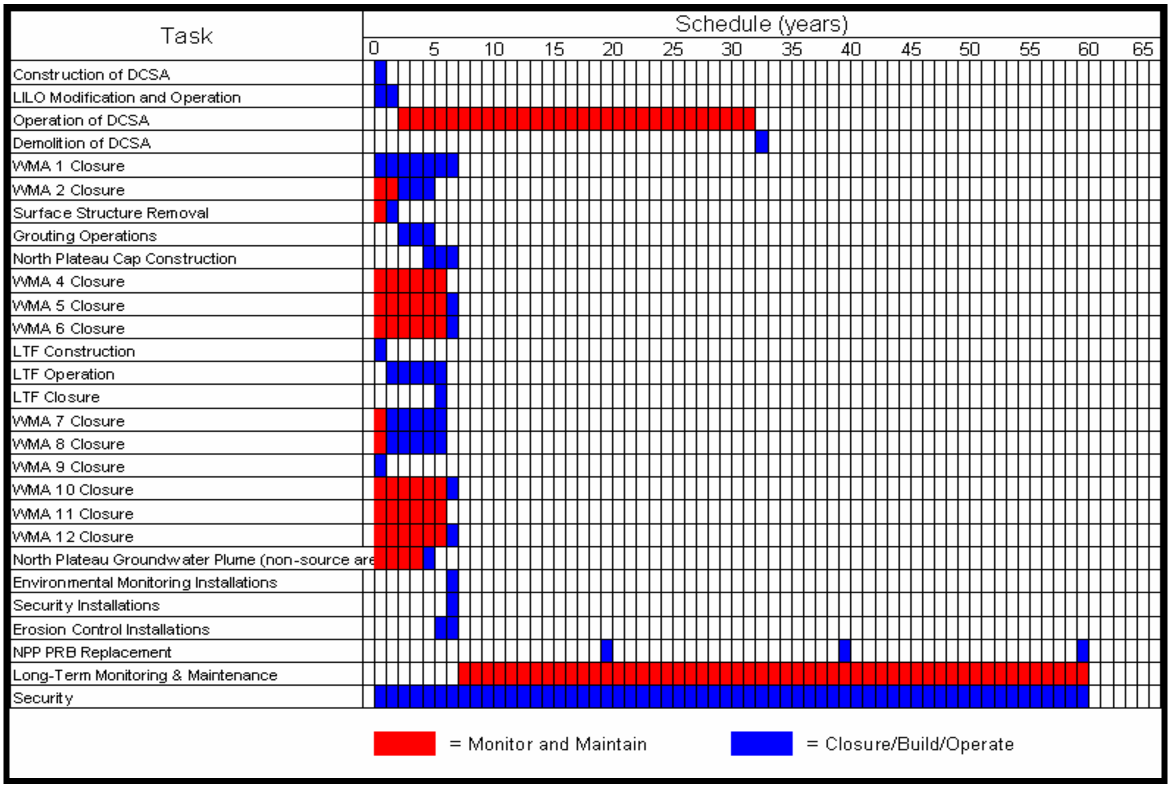

Figure 3-1. Close-In-Place Alternative Implementation Schedule

3.2 Resource Requirements

The resources required for the activities necessary to complete the Close-In-Place Alternative, such as demolition and construction of the engineered multi-layered covers, are presented in the following tables and figures. Each table is delineated into the different facilities and WMAs that make up the WNYNSC, which are presented in individual rows. The columns of each table represent the various categories of goods or services that have been estimated and summarized, such as capital purchases, waste containers, utilities, and personnel. The figures contain a standard format of an X-Y graph, with the X-axis illustrating the schedule in work-years, and the Y-axis illustrating the subject of the data table.

Implementation of the Close-In-Place Alternative would require the purchase of materials to support the decommissioning and demolition process and for related construction purposes. Table 3-1 presents estimated quantities of materials that would be consumed during the Close-In-Place Alternative.

Table 3-1. Consumable Materials

Material	Quantity	Units
Structural Steel and Rebar:	101	tons
Sheet Piling:	366	tons
Concrete:	9,078	CY
Cement:	192	CY
Soil:	1,199,254	CY
Clay:	194,241	CY
Sand, Gravel, and Crushed Stone:	1,436,974	CY
Grout:	73,681	CY
Bentonite:	35,249	CY
Fixing Agent:	1,457	SY
Fencing:	20,000	LF
Geomembrane:	3,951,617	SF
Geotextile:	157,631	SY
Pipe:	290,287	LF
Boulders	434	EA
Seed/Mulch/Fertilizer:	2,483	MSF
Zeolite:	2,200	CY
Apatite	649	CY

Table 3-2 summarizes the capital purchases planned at each WMA during implementation of the alternative. Not every area within the WNYNSC would require resources to be purchased, but some WMAs and support facilities are estimated to need significant capital purchases to support the construction of the engineered multi-layered cover systems.

Table 3-2. Capital Purchases

WMA/Area	Action	Description	Units	Number	Unit Cost	Total Cost
HLW Canister Removal	Equipment	Horizontal Storage Module	each	69	$300,000	$20,700,000
HLW Canister Removal	Equipment	Transfer Cask Trailer	each	1	$800,000	$800,000
HLW Canister Removal	Facility Construction	Building Construction Material Cost	ls	1	$467,488	$467,488
HLW Canister Removal	Equipment	50-ton Crane & assoc. equipment	ea	1	$360,000	$360,000
HLW Canister Removal	Equipment	Shielded Transfer Cell components	ea	1	$3,125,000	$3,125,000
HLW Canister Removal	Equipment	Canister Handling Equipment	ea	1	$1,800,000	$1,800,000
HLW Canister Removal	Equipment	Impact Limiters	sets	5	$150,000	$750,000
HLW Canister Removal	Equipment	Skid and Tie-down system	sets	5	$80,000	$400,000
HLW Canister Removal	Equipment	Lifting Yoke	each	5	$40,000	$200,000
HLW Canister Removal	Equipment	Leak Detection System	each	5	$40,000	$200,000
WMA 1	Equipment	Diamond wire saw	each	8	$75,000	$600,000
WMA 1	Equipment	Brokk unit	each	4	$122,000	$488,000
WMA 1	Equipment	Brokk Crusher	each	2	$22,500	$45,000
WMA 1	Equipment	Brokk Grapple	each	2	$10,500	$21,000
WMA 1	Equipment	Bobcat Skid-Steer	each	4	$23,000	$92,000
WMA 1	Equipment	Diamond Saw Blades	each	85,020	$25.00	$2,125,500
WMA 1	Equipment	Lifting/Hoisting Hardware	each	1,734	$100	$173,400
WMA 1	Equipment	Concrete Core Bits	each	130	$123	$15,990
WMA 1	Equipment	Crushing Plant	ls	1	$250,000	$250,000
WMA 1	Equipment	Diamond Wire Saw	each	2	$51,000	$102,000
WMA 1	Equipment	Diamond Wire	each	29,500	$25	$737,500
WMA 3	Equipment	HEPA Fitlered Ventilation System	each	1	$10,000	$10,000
WMA 3	Equipment	PVU and Air Monitors	each	5	$14,749	$73,745
WMA 3	Equipment	CCTV System	each	2	$17,800	$35,600
LTF	Equipment	Raw Leachate Treatment Equip.	ls	1	$564,200	$564,200
LTF	Equipment	CNS 10-160B RH Casks (including maint)	each	2	$1,625,000	$3,250,000
LTF	Equipment	Leachate Treatment Utilities	ls	1	$27,500	$27,500
LTF	LTF Building Construction	Building Construction Material Cost	ls	1	$70,124	$70,124
LTF	SDA Leachate Treatment	Process Materials	ls	1	$246,560	$246,560
LTF	SDA Leachate Treatment	Maintenance Hardware	ls	1	$160,000	$160,000
LTF	WVDP Trenches	Process Materials	ls	1	$57,017	$57,017
LTF	WVDP Trenches	Maintenance Hardware	ls	1	$37,000	$37,000
LTF	NFS Holes	Process Materials	ls	1	$29,279	$29,279
LTF	NFS Holes	Maintenance Hardware	ls	1	$19,000	$19,000
NPP Cap	Equipment	Water Management System	each	1	$15,654	$15,654
Sitewide	Security Installations	Camera and Video System	ls	1	$39,105	$39,105
Sitewide	Security Installations	Chain Link Industrial Fence	ls	1	$130,260	$130,260

Tables 3-3 and 3-4 present the sum of the various types of containers that would be purchased to transport waste to NTS and commercial facilities or commercial facilities only. There would be primarily five different containers (e.g., rolloffs to HICs) for approximately 10 different categories of waste (e.g., CDD to Mixed Waste) that would be generated from the different WMAs or Facilities during Close-In-Place Alternative activities. Rolloff containers and Sealand containers are assumed to be used 20 times prior to being disposed. All other containers are assumed to have a single use.

Table 3-3. Waste Containers for DOE/Commercial Facilities Disposal

Effort	20 CY Rolloffs (each)	Sealand Containers (each)	Lift Liners (each)	55-gal Drums (each)							B-25 Boxes Stong/Tight (each)		B-25 Boxes, Type A (each)		HICs (each)	
	CDD	**LSA**	**LSA**	**Hazardous**	**Class A**	**Class B**	**CH Class C**	**RH Class C**	**TRU**	**GTCC**	**Class A**	**Mixed**	**Class B**	**CH Class C**	**Class B**	**Class C**
HLW Canister Removal																
Construction of DCSA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LILO Modification and Operation	0	1	10	0	0	0	0	0	0	0	22	0	0	0	0	0
Operation of DCSA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demolition of DCSA	39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WMA 1 Closure	0	4	144	11	0	0	0	0	0	0	429	14	0	0	0	0
WMA 2 Closure	1	4	130	0	0	0	0	0	0	0	7	0	0	0	0	0
WMA 3 Closure																
Surface Structure Removal	0	0	0	0	0	14	0	177	165	0	21	0	0	0	0	0
Grouting Operations	0	0	0	0	0	0	0	0	0	0	14	0	0	0	0	0
North Plateau Cap Construction	0	6	218	0	0	0	0	0	0	0	7	0	0	0	0	0
WMA 4 Closure																
WMA 5 Closure	6	5	198	0	6	0	0	0	0	0	320	0	0	0	0	0
WMA 6 Closure	2	1	6	0	0	0	0	0	0	0	1	0	0	0	0	0
Leachate Treatment Facility																
LTF Construction	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LTF Operation	0	0	0	0	0	0	0	131	0	0	284	126	0	0	0	0
LTF Closure	0	1	47	0	0	0	0	0	0	0	54	0	0	0	0	0
WMA 7 Closure	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WMA 8 Closure	13	0	41	0	130	0	0	0	0	0	4	0	0	0	0	0
WMA 9 Closure	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WMA 10 Closure	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WMA 11 Closure																
WMA 12 Closure	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
North Plateau Groundwater Plume (non-source area)	0	0	12	0	0	0	0	0	0	0	1	0	0	0	0	0
Existing Facility Maintenance	1	0	0	5	189	0	0	0	0	0	139	0	0	0	0	0
Security*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Environmental Monitoring Installations	0	1	20	0	0	0	0	0	0	0	14	0	0	0	0	0
Security Installations	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Erosion Control Installations	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Long-Term Monitoring and Maintenance*	0	0	0	0	0	0	0	0	0	0	106	0	0	0	0	0
NPP PTW Replacement*	0	0	834	0	0	0	0	0	0	0	9	0	0	0	0	0
TOTALS*	**108**	**23**	**1660**	**16**	**325**	**14**	**0**	**308**	**165**	**0**	**1432**	**140**	**0**	**0**	**0**	**0**

* Over 60 years

Table 3-4. Waste Containers for Commercial Facilities Disposal

Effort	20 CY Rolloffs (each)	Sealand Containers (each)	Lift Liners (each)	55-gal Drums (each)							B-25 Boxes, Strong/Tight (each)		B-25 Boxes, Type A (each)		HICs (each)	
	CDD	**LSA**	**LSA**	**Hazardous**	**Class A**	**Class B**	**CH Class C**	**RH Class C**	**TRU**	**GTCC**	**Class A**	**Mixed**	**Class B**	**CH Class C**	**Class B**	**Class C**
HLW Canister Removal																
Construction of DCSA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LILO Modification and Operation	0	0	10	0	0	0	0	0	0	0	22	0	0	0	0	0
Operation of DCSA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demolition of DCSA	39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WMA 1 Closure	0	0	144	11	0	0	0	0	0	0	429	14	0	0	0	0
WMA 2 Closure	1	0	130	0	0	0	0	0	0	0	7	0	0	0	0	0
WMA 3 Closure																
Surface Structure Removal	0	0	0	0	0	14	0	177	165	0	21	0	0	0	0	0
Grouting Operations	0	0	0	0	0	0	0	0	0	0	14	0	0	0	0	0
North Plateau Cap Construction	0	0	218	0	0	0	0	0	0	0	7	0	0	0	0	0
WMA 4 Closure																
WMA 5 Closure	6	0	198	0	6	0	0	0	0	0	320	0	0	0	0	0
WMA 6 Closure	2	0	6	0	0	0	0	0	0	0	1	0	0	0	0	0
Leachate Treatment Facility																
LTF Construction	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LTF Operation	0	0	0	0	0	0	0	131	0	0	284	126	0	0	0	0
LTF Closure	0	0	47	0	0	0	0	0	0	0	53	0	0	0	0	0
WMA 7 Closure	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WMA 8 Closure	13	0	41	0	130	0	0	0	0	0	4	0	0	0	0	0
WMA 9 Closure	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WMA 10 Closure	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WMA 11 Closure																
WMA 12 Closure	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
North Plateau Groundwater Plume (non-source area)	0	0	12	0	0	0	0	0	0	0	1	0	0	0	0	0
Existing Facility Maintenance	1	0	0	5	189	0	0	0	0	0	139	0	0	0	0	0
Security*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Environmental Monitoring Installations	0	0	20	0	0	0	0	0	0	0	14	0	0	0	0	0
Security Installations	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Erosion Control Installations	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Long-Term Monitoring and Maintenance*	0	0	0	0	0	0	0	0	0	0	106	0	0	0	0	0
NPP PTW Replacement*	0	0	834	0	0	0	0	0	0	0	9	0	0	0	0	0
TOTALS*	**108**	**0**	**1660**	**16**	**325**	**14**	**0**	**308**	**165**	**0**	**1431**	**140**	**0**	**0**	**0**	**0**

* Over 60 years

Utility demands estimated for the Close-In-Place Alternative are presented in Table 3-5. The rows are delineated by facility or WMA, while the columns represent the seven possible utilities that could be used during remediation activities under this alternative: electricity (kw-hr), natural gas (cf), diesel fuel (gal), gasoline (gal), non-potable water (gal), augmentation water (gal), and potable water (gal). Some of the areas or facilities with high utility demands include WMA 1, WMA 7, WMA 8, Leachate Treatment Facility operation, and the Long-Term Stewardship aspects, including security and environmental monitoring.

Table 3-5. Utilities

Effort	Electricity (kw-hr)	Natural Gas (CF)	Diesel Fuel (gal)	Gasoline (gal)	Non-Potable Water (gal)	Augmentation Water (gal)	Potable Water (gal)
HLW Canister Removal							
Construction of DCSA	1,429,549	8,034,689	58,752	3,473	1,480,418	0	326,083
LILO Modification and Operation	2,234,442	12,558,544	3,105	0	2,313,952	0	509,681
Operation of DCSA	4,216,830	23,700,429	0	0	4,366,881	0	961,868
Demolition of DCSA	1,672,831	9,402,041	64,662	0	1,732,357	0	381,576
WMA 1 Closure	20,833,493	117,093,354	891,415	110,977	21,574,831	0	4,752,165
WMA 2 Closure	2,088,838	11,740,187	150,521	3,977	2,163,168	0	476,469
WMA 3 Closure							
Surface Structure Removal	2,033,194	11,427,439	43,938	0	2,105,543	0	463,776
Grouting Operations	668,883	3,759,417	28,620	0	692,685		152,574
North Plateau Cap Construction	3,838,737	21,575,381	319,151	10,577	3,975,334	0	875,624
WMA 4 Closure							
WMA 5 Closure	844,440	4,746,125	147,187	340	874,489	0	192,619
WMA 6 Closure	79,197	445,123	4,507	640	82,015	0	18,065
Leachate Treatment Facility							
LTF Construction	415,139	2,333,263	1,375	3,502	429,911	0	94,694
LTF Operation	13,588,675	76,374,304	0	0	14,072,213	2,827,000	3,099,606
LTF Closure	462,015	2,596,726	9,622	2,765	478,455	0	105,387
WMA 7 Closure	6,199,404	34,843,367	470,999	80,481	6,420,004	0	1,414,098
WMA 8 Closure	25,567,926	143,702,940	1,776,916	443,169	26,477,733	0	5,832,100
WMA 9 Closure	1,447,077	8,133,207	84,126	49	1,498,570	0	330,081
WMA 10 Closure	146,317	822,365	13,191	0	151,524	0	33,375
WMA 11 Closure							
WMA 12 Closure	28,313	159,129	4,974	0	29,320	0	6,458
North Plateau Groundwater Plume (non-source area)	13,221	74,310	583	233	13,692	0	3,016
Existing Facility Maintenance	3,866,557	21,731,746	840	2,313	4,004,145	0	881,970
Security*	36,168,000	203,280,000	0	21,639	37,455,000	0	8,250,000
Environmental Monitoring Installations	670,572	3,768,908	122,783	0	694,434	0	152,959
Security Installations	301,288	1,693,370	17,811	5,432	312,009	0	68,724
Erosion Control Installations	12,381,386	69,588,813	2,566,380	49,664	12,821,965	0	2,824,221
Long-Term Monitoring and Maintenance*	30,109,190	169,226,837	2,647,686	373,869	31,180,594	0	6,867,972
NPP PTW Replacement*	674,793	3,792,632	31,528	0	698,805		153,922
TOTALS*	**171,980,300**	**966,604,600**	**9,460,700**	**1,113,100**	**178,100,000**	**2,827,000**	**39,229,100**

* Over 60 years

Tables 3-6 and 3-7 quantify the time in work-years that personnel would be needed to complete the necessary tasks within a specific WMA or at a specific facility. Table 3-6 presents the time requirements based upon category of employee, such as indirect, direct, subcontract, professional, etc.; whereas, Table 3-7 presents the data in terms of closure activity or effort, such as operations, construction, or preparation and planning. The tables are similar in that the total number of work years for each facility or WMA should produce identical subtotals in the final column.

Figure 3-2 illustrates the personnel required for implementation of the Close-In-Place Alternative by implementation year. This figure was developed assuming that remediation at most of the WMAs would occur simultaneously. A work force of 310 to 350 would be required from the start of site closure to approximately year 8, at which time the site would enter long-term stewardship.

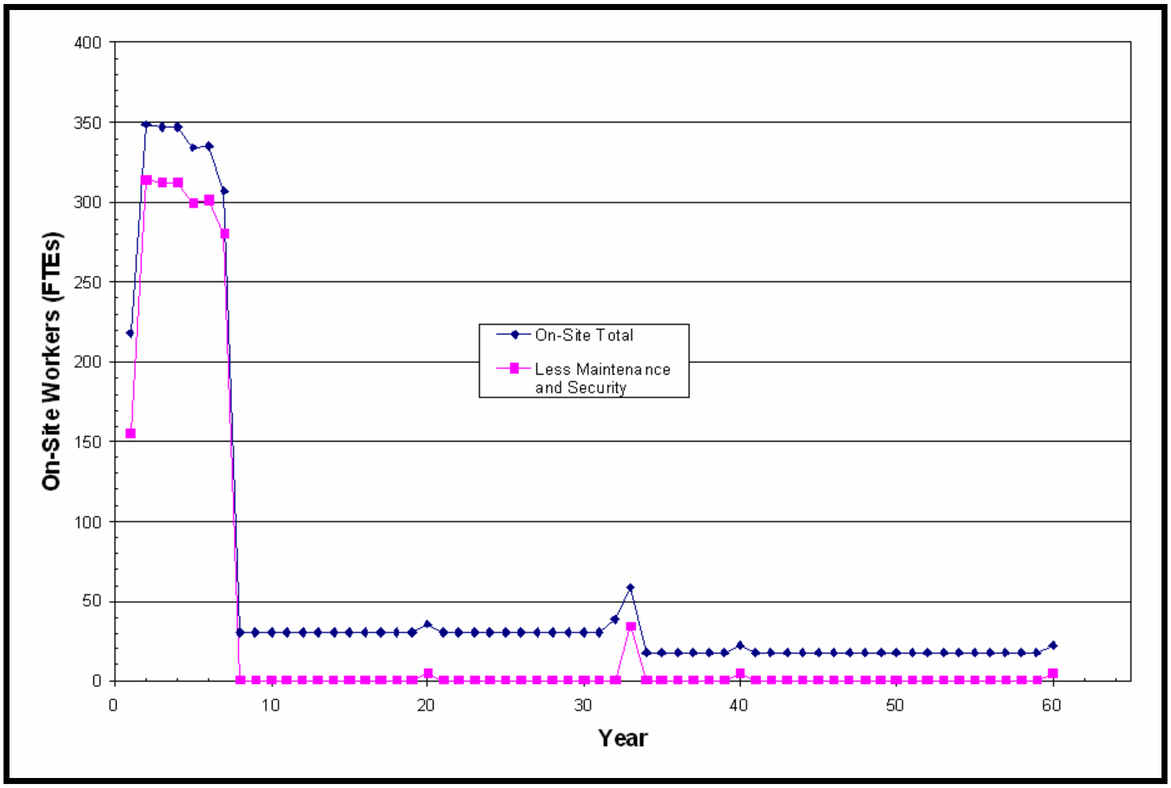

Figure 3-2. Personnel Requirements by Implementation Year

Table 3-6. Personnel Required by Job Category

Effort	Direct Hourly (wk-yrs)	Indirect Hourly (wk-yrs)	Non-Exempt (wk-yrs)	Management and Professional (wk-yrs)	Sub-Contract Direct Hourly (wk-yrs)	Total (wk-yrs)
HLW Canister Removal						
Construction of DCSA	9.38	0.36	4.78	12.34	2.79	29.64
LILO Modification and Operation	10.76	2.74	10.43	20.93	1.47	46.33
Operation of DCSA	0.00	1.06	14.09	36.41	35.88	87.44
Demolition of DCSA	4.70	0.42	5.59	14.44	9.53	34.69
WMA 1 Closure	169.83	5.25	69.60	179.90	7.44	432.02
WMA 2 Closure	3.29	0.53	6.98	18.04	14.49	43.32
WMA 3 Closure						
Surface Structure Removal	9.00	0.51	6.79	17.56	8.30	42.16
Grouting Operations	5.69	0.17	2.23	5.78	0.00	13.87
North Plateau Cap Construction	0.00	0.97	12.82	33.15	32.66	79.60
WMA 4 Closure						
WMA 5 Closure	4.55	0.21	2.82	7.29	2.64	17.51
WMA 6 Closure	0.18	0.02	0.26	0.68	0.49	1.64
Leachate Treatment Facility						
LTF Construction	1.91	0.10	1.39	3.58	1.62	8.61
LTF Operation	115.63	3.43	45.39	117.34	0.00	281.78
LTF Closure	2.93	0.12	1.54	3.99	1.01	9.58
WMA 7 Closure	0.00	1.56	20.71	53.53	52.75	128.55
WMA 8 Closure	0.00	6.45	85.41	220.78	217.56	530.19
WMA 9 Closure	12.06	0.36	4.83	12.50	0.25	30.01
WMA 10 Closure	0.52	0.04	0.49	1.26	0.73	3.03
WMA 11 Closure						
WMA 12 Closure	0.18	0.01	0.09	0.24	0.06	0.59
North Plateau Groundwater Plume (non-source area)	0.00	0.00	0.04	0.11	0.11	0.27
Existing Facility Maintenance	20.89	1.83	12.27	43.35	1.83	80.18
Security*	0.00	0.00	0.00	210.00	540.00	750.00
Environmental Monitoring Installations	0.00	0.17	2.24	5.79	5.71	13.91
Security Installations	0.00	0.08	1.01	2.60	2.56	6.25
Erosion Control Installations	0.00	3.12	41.36	106.91	105.35	256.75
Long-Term Monitoring and Maintenance*	125.15	7.59	100.58	259.99	131.04	624.36
NPP PTW Replacement*	0.00	0.17	2.25	5.83	5.74	13.99
TOTALS*	**496.65**	**37.27**	**456.01**	**1,394.34**	**1,182.00**	**3,566.28**

* Over 60 years

Table 3-7. Personnel Required by Activity

Effort	Preparation and Planning (wk-yrs)	Construction (wk-yrs)	Operation (wk-yrs)	Closure (wk-yrs)	Total
HLW Canister Removal					
Construction of DCSA	3.42	26.22	0.00	0.00	29.64
LILO Modification and Operation	6.27	7.72	32.35	0.00	46.33
Operation of DCSA	10.10	0.00	77.34	0.00	87.44
Demolition of DCSA	4.01	0.00	0.00	30.68	34.69
WMA 1 Closure	49.90	0.00	79.68	302.44	432.02
WMA 2 Closure	5.00	1.23	0.00	37.09	43.32
WMA 3 Closure					
Surface Structure Removal	4.87	0.00	0.00	37.29	42.16
Grouting Operations	1.60	0.00	0.00	12.27	13.87
North Plateau Cap Construction	9.19	0.00	0.00	70.41	79.60
WMA 4 Closure					
WMA 5 Closure	2.02	0.00	0.00	15.49	17.51
WMA 6 Closure	0.19	0.00	0.00	1.45	1.64
Leachate Treatment Facility					
LTF Construction	0.99	7.61	0.00	0.00	8.61
LTF Operation	32.55	0.00	249.24	0.00	281.78
LTF Closure	1.11	0.00	0.00	8.47	9.58
WMA 7 Closure	14.85	0.00	0.00	113.71	128.55
WMA 8 Closure	61.24	0.00	0.00	468.95	530.19
WMA 9 Closure	3.47	0.00	0.00	26.54	30.01
WMA 10 Closure	0.35	0.00	0.00	2.68	3.03
WMA 11 Closure					
WMA 12 Closure	0.07	0.00	0.00	0.52	0.59
North Plateau Groundwater Plume (non-source area)	0.03	0.00	0.00	0.24	0.27
Existing Facility Maintenance	0.00	0.00	80.18	0.00	80.18
Security*	0.00	0.00	750.00	0.00	750.00
Environmental Monitoring Installations	1.61	12.30	0.00	0.00	13.91
Security Installations	0.72	5.53	0.00	0.00	6.25
Erosion Control Installations	29.65	227.09	0.00	0.00	256.75
Long-Term Monitoring and Maintenance*	72.11	77.83	269.77	204.64	624.36
NPP PTW Replacement*	1.62	0.00	0.00	12.37	13.99
TOTALS*	**315.87**	**365.53**	**1,538.56**	**1,337.00**	**3,566.28**

* Over 60 years

Labor efforts that were summarized in the previous table according work years were also quantified based upon cost. Therefore, the headings in the rows and columns are identical for Tables 3-7 and 3-8; however, this table encapsulates the preparation, construction, operation, and closure efforts in 2008 dollars according to WMA or Facility.

Table 3-8. Labor Costs Required by Activity (2008 Dollars)

Effort	Preparation and Planning (dollars)	Construction (dollars)	Operation (dollars)	Closure (dollars)	Total (dollars)
HLW Canister Removal					
Construction of DCSA	$727,959	$6,450,841	$0	$0	$7,178,800
LILO Modification and Operation	$1,298,745	$1,181,728	$6,041,712	$238,415	$8,760,600
Operation of DCSA	$2,149,136	$0	$14,083,864	$0	$16,233,000
Demolition of DCSA	$850,973	$0	$0	$5,590,727	$6,441,700
WMA 1 Closure	$10,565,792	$0	$14,476,618	$55,087,590	$80,130,000
WMA 2 Closure	$1,063,414	$138,703	$0	$6,887,282	$8,089,400
WMA 3 Closure					
Surface Structure Removal	$1,033,568	$0	$0	$6,924,732	$7,958,300
Grouting Operations	$339,164	$0	$0	$2,222,636	$2,561,800
North Plateau Cap Construction	$1,956,010	$0	$0	$12,991,190	$14,947,200
WMA 4 Closure	$0	$0	$0	$0	$0
WMA 5 Closure	$429,321	$0	$0	$3,034,579	$3,463,900
WMA 6 Closure	$40,330	$0	$0	$267,670	$308,000
Leachate Treatment Facility					
LTF Construction	$211,018	$1,400,182	$0	$0	$1,611,200
LTF Operation	$6,890,142	$0	$45,152,958	$0	$52,043,100
LTF Closure	$235,169	$0	$0	$1,970,831	$2,206,000
WMA 7 Closure	$3,158,780	$0	$0	$20,921,520	$24,080,300
WMA 8 Closure	$13,027,480	$0	$0	$86,257,220	$99,284,700
WMA 9 Closure	$733,827	$0	$0	$4,809,173	$5,543,000
WMA 10 Closure	$74,537	$0	$0	$575,163	$649,700
WMA 11 Closure	$0	$0	$0	$0	$0
WMA 12 Closure	$14,442	$0	$0	$125,458	$139,900
North Plateau Groundwater Plume (non-source area)	$6,777	$0	$0	$44,623	$51,400
Existing Facility Maintenance	$0	$0	$7,900,800	$0	$7,900,800
Security*	$0	$0	$40,102,500	$0	$40,102,500
Environmental Monitoring Installations	$341,826	$2,378,474	$0	$0	$2,720,300
Security Installations	$153,560	$1,034,840	$0	$0	$1,188,400
Erosion Control Installations	$6,308,942	$42,022,658	$0	$0	$48,331,600
Long-Term Monitoring and Maintenance*	$13,668,265	$14,752,288	$51,131,414	$38,786,432	$118,338,400
NPP PTW Replacement*	$343,937	$0	$0	$2,330,263	$2,674,200
TOTALS*	**$65,623,115**	**$69,359,714**	**$178,889,866**	**$249,065,504**	**$562,938,200**

* Over 60 years

The primary support facility that would be operated to effectively perform the Close-In-Place Alternative, is limited to the Leachate Treatment Facility (LTF). The LTF would sustain in-place closure operations at WMA 7 and WMA 8. The percentage of total facility throughput is calculated based upon the total volume of treated material, Table 3-9.

Table 3-9. Distribution of Support Facility Operations

Effort	Leachate Treatment Facility
WMA 7 Closure	25.8%
WMA 8 Closure	74.2%

3.3 Implementation Effects

In order to understand the emissions data presented in the next section, it is important to understand the construction equipment use by implementation year, illustrated in Figure 3-3. This figure represents the total use (in hours) of heavy equipment (diesel or gasoline burning) over the duration of the implementation. The peak heavy construction use occurs during removal of the North Plateau Groundwater Plume, which also causes related peak construction equipment dust and emissions during this task.

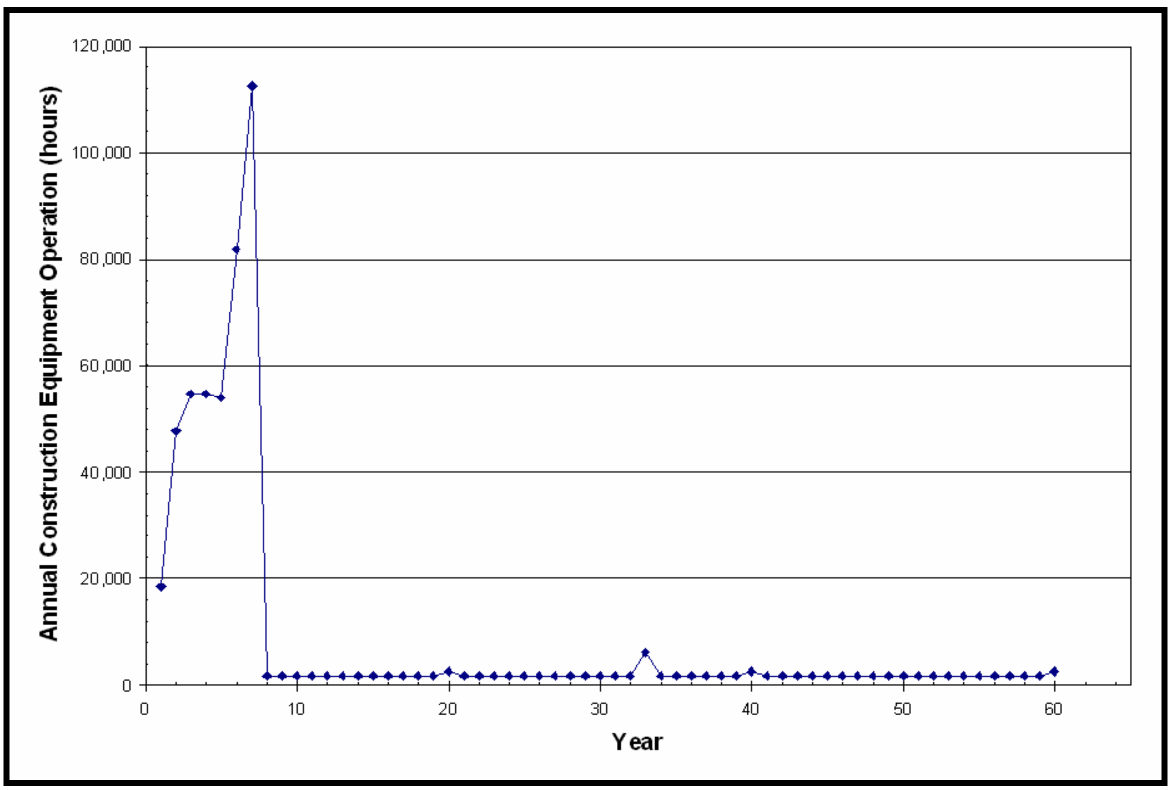

Figure 3-3. Construction Equipment Use by Implementation Year

A consequence to performing remedial work is the potential effects to human health and the environment as a result of implementation activities. The following tables and figures quantify these potential effects in terms of impacts to personnel and releases to the environment.

Based upon statistics generated from previous and similar construction work, the injuries and fatalities of personnel during the implementation of the Close-In-Place Alternative were estimated. Table 3-10 presents these impacts for each WMA or Facility in the form of total reportable injuries, and the work days lost and deaths as a result of the injury. The duration of the activities conducted at each location is a primary factor in these calculations.

Table 3-10. Personnel Injuries and Fatalities

Effort	Total Reportable Cases	Lost Work-Day Cases	Deaths
HLW Canister Removal			
Construction of DCSA	1.13	0.55	5.47E-04
LILO Modification and Operation	1.69	0.81	6.64E-04
Operation of DCSA	2.83	1.33	7.48E-04
Demolition of DCSA	1.32	0.64	6.40E-04
WMA 1 Closure	16.44	7.97	7.97E-03
WMA 2 Closure	1.65	0.80	7.99E-04
WMA 3 Closure			
Surface Structure Removal	1.60	0.78	7.77E-04
Grouting Operations	0.53	0.26	2.56E-04
North Plateau Cap Construction	3.03	1.47	1.47E-03
WMA 4 Closure			
WMA 5 Closure	0.67	0.32	3.23E-04
WMA 6 Closure	0.06	0.03	3.03E-05
Leachate Treatment Facility			
LTF Construction	0.33	0.16	1.59E-04
LTF Operation	10.72	5.20	5.20E-03
LTF Closure	0.36	0.18	1.77E-04
WMA 7 Closure	4.89	2.37	2.37E-03
WMA 8 Closure	20.18	9.78	9.78E-03
WMA 9 Closure	1.14	0.55	5.53E-04
WMA 10 Closure	0.12	0.06	5.60E-05
WMA 11 Closure			
WMA 12 Closure	0.02	0.01	1.08E-05
North Plateau Groundwater Plume (non-source area)	0.01	0.01	5.06E-06
Existing Facility Maintenance	2.55	1.20	7.45E-04
Security*	24.66	11.58	5.81E-03
Environmental Monitoring Installations	0.53	0.26	2.56E-04
Security Installations	0.24	0.12	1.15E-04
Erosion Control Installations	9.77	4.73	4.73E-03
Long-Term Monitoring and Maintenance*	23.76	11.51	1.15E-02
NPP PTW Replacement*	0.53	0.26	2.58E-04
TOTALS*	**130.76**	**62.89**	**0.06**

* Over 60 years

Exposure estimation for personnel during remedial efforts is developed consistent with the methodology in the Facilities Description Technical Report, and is highly variable throughout the site, as expected. Table 3-11 summarizes the total exposure in worker-rem for each WMA or Facility. Similar to the previous table, these values were primarily based on work effort duration, which was factored to an approximate area dose rate based on historical TLD readings. The sum-total exposure is also estimated in the table, but this value represents all areas over the life of the Close-In-Place Alternative.

Figure 3-4 illustrates the personnel radiation exposure by implementation year, and combines the schedule (Figure 3-1) with the Personnel Radiation Exposure data listed in Table 3-11. These doses are assumed to be from whole-body exposure to gamma radiation. The peaks in the chart coincide with the activity or activities that result in higher risk of worker exposure. Closure activities at WMA 1, as well as the leachate management during WMA 7 and WMA 8 stabilization are expected to contribute the majority of worker dose received during implementation.

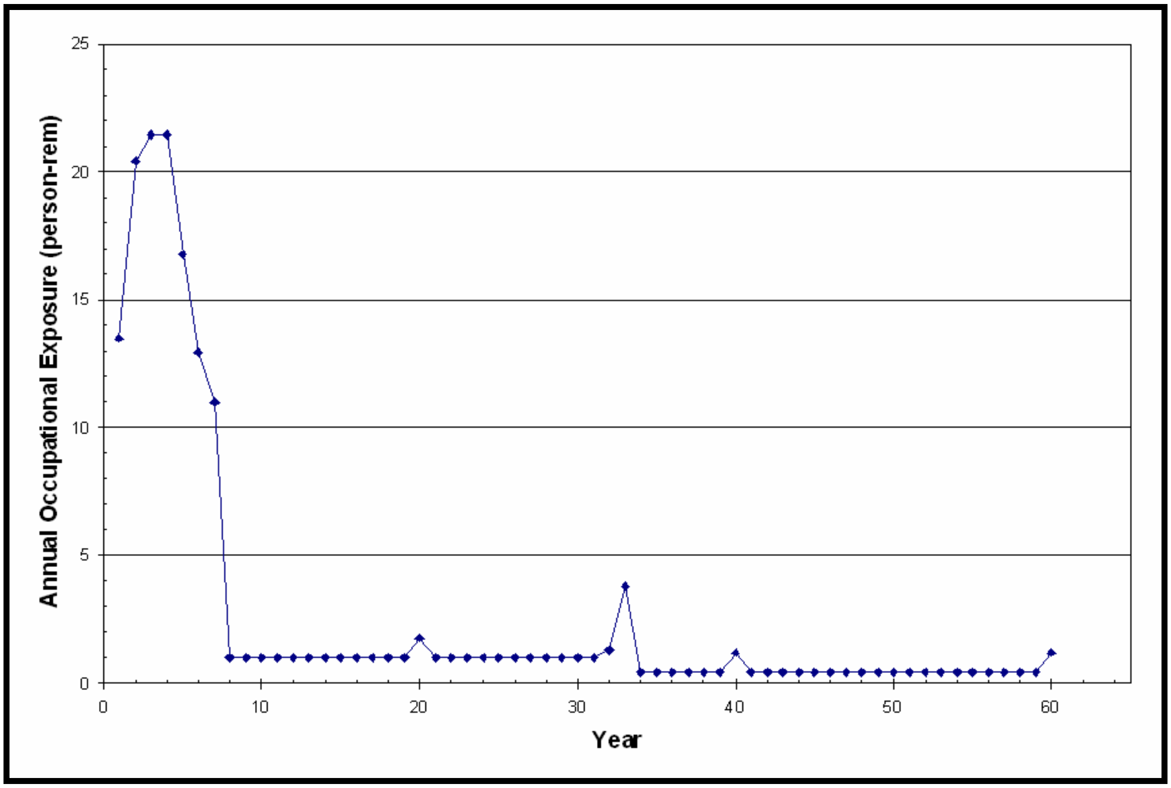

Figure 3-4. Personnel Radiation Exposure by Implementation Year

Table 3-11. Personnel Radiation Exposure

Effort	Total Exposure (person-rem)
HLW Canister Removal	
Construction of DCSA	1.19
LILO Modification and Operation	1.73
Operation of DCSA	6.11
Demolition of DCSA	3.14
WMA 1 Closure	39.15
WMA 2 Closure	3.92
WMA 3 Closure	
Surface Structure Removal	3.98
Grouting Operations	1.26
North Plateau Cap Construction	2.09
WMA 4 Closure	0.00
WMA 5 Closure	1.59
WMA 6 Closure	0.15
Leachate Treatment Facility	
LTF Construction	0.31
LTF Operation	14.72
LTF Closure	0.70
WMA 7 Closure	5.71
WMA 8 Closure	23.55
WMA 9 Closure	2.79
WMA 10 Closure	0.27
WMA 11 Closure	0.00
WMA 12 Closure	0.05
NPP Equipment Removal	0.01
Existing Facility Maintenance	9.11
Security*	27.98
Environmental Monitoring Installations	0.43
Security Installations	0.16
Erosion Control Installations	3.41
Long-Term Monitoring and Maintenance*	10.21
NPP PTW Replacement*	0.76
TOTALS*	**164.5**

* Over 60 years

Tables 3-12 and 3-13 display the quantity of the six major radionuclides released to the environment at the WNYNSC through the air and water, respectively. Each source area is listed in rows and the release quantity in curies is shown down each column with a sum-total of each radionuclide release at the bottom. A screening guideline is also presented in the table to represent 1/1000 times the total release quantity for each radionuclide. All tabular values less than this guideline appear as “neg” or are negligible to the sum total, which allows the table to show the areas or facilities with the most significant contribution to the total.

Airborne releases, presented in Table 3-12, are illustrated versus time in Figure 3-5. These airborne releases are largely based on the dust generated during the various activities. Since heavy equipment is the main contributor to dust generation, the airborne releases appear consistent with Figure 3-3, Construction Equipment Use by Implementation Year.

Aqueous releases, presented in Table 3-13, are illustrated versus time in Figure 3-6. This figure presents the post-treatment release in terms of total curies for the five principal radionuclides.

Table 3-12. Airborne Releases (Curies)

Effort	H-3	Co-60	Sr-90	Cs-137	TRU	I-129
HLW Canister Removal						
Construction of DCSA	neg	neg	neg	neg	neg	neg
LILO Modification and Operation	neg	neg	neg	neg	neg	neg
Operation of DCSA	neg	neg	neg	neg	neg	neg
Demolition of DCSA	neg	neg	neg	1.07E-05	1.06E-06	neg
WMA 1 Closure	neg	neg	3.49E-02	2.68E-02	neg	2.22E-06
WMA 2 Closure	neg	5.80E-04	2.99E-03	7.12E-03	1.55E-03	4.05E-08
WMA 3 Closure						
Surface Structure Removal	neg	neg	neg	2.90E-05	2.89E-06	neg
Grouting Operations	7.12E-05	neg	neg	neg	neg	1.09E-05
North Plateau Cap Construction	neg	2.38E-05	3.60E-05	5.61E-04	8.95E-05	1.81E-07
WMA 4 Closure						
WMA 5 Closure	neg	2.59E-07	6.93E-05	7.51E-05	4.43E-05	neg
WMA 6 Closure	neg	neg	neg	neg	neg	neg
Leachate Treatment Facility						
LTF Construction	neg	neg	neg	neg	neg	neg
LTF Operation	neg	neg	neg	neg	neg	neg
LTF Closure	neg	neg	neg	neg	neg	neg
WMA 7 Closure	neg	4.94E-07	neg	1.04E-05	1.35E-06	neg
WMA 8 Closure	neg	1.20E-05	4.69E-05	6.91E-05	9.05E-06	neg
WMA 9 Closure	neg	neg	neg	neg	neg	neg
WMA 10 Closure	neg	neg	neg	neg	neg	neg
WMA 11 Closure						
WMA 12 Closure	neg	neg	neg	neg	neg	neg
NPP Equipment Removal	neg	neg	4.24E-05	neg	neg	neg
Existing Facility Maintenance	neg	neg	neg	neg	neg	neg
Security*	neg	neg	neg	neg	neg	neg
Environmental Monitoring Installations	neg	2.42E-07	neg	neg	1.21E-06	neg
Security Installations	neg	4.69E-07	neg	neg	2.35E-06	neg
Erosion Control Installations	neg	1.30E-05	4.35E-05	4.60E-04	6.54E-05	8.78E-08
Long-Term Monitoring and Maintenance*	neg	neg	neg	neg	neg	neg
NPP PTW Replacement*	neg	neg	1.27E-04	neg	neg	neg
TOTALS*	**7.12E-05**	**6.31E-04**	**3.83E-02**	**3.52E-02**	**1.77E-03**	**1.34E-05**

* Over 60 years

Table 3-13. Aqueous Releases (Curies)

Effort	H-3	Co-60	Sr-90	Cs-137	TRU
HLW Canister Removal					
Construction of DCSA	neg	neg	neg	neg	neg
LILO Modification and Operation	neg	neg	neg	neg	neg
Operation of DCSA	neg	neg	neg	neg	neg
Demolition of DCSA	neg	neg	neg	neg	neg
WMA 1 Closure	neg	neg	neg	neg	neg
WMA 2 Closure	neg	neg	neg	neg	neg
WMA 3 Closure					
Surface Structure Removal	neg	neg	neg	neg	neg
Grouting Operations	neg	neg	neg	neg	neg
North Plateau Cap Construction	neg	neg	neg	neg	neg
WMA 4 Closure					
WMA 5 Closure	neg	neg	neg	neg	neg
WMA 6 Closure	neg	neg	neg	neg	neg
Leachate Treatment Facility					
LTF Construction	neg	neg	neg	neg	neg
LTF Operation	2.86E+02	2.51E-06	3.02E-01	1.51E-02	3.41E-04
LTF Closure	neg	neg	neg	neg	neg
WMA 7 Closure	neg	neg	neg	neg	neg
WMA 8 Closure	neg	neg	neg	neg	neg
WMA 9 Closure	neg	neg	neg	neg	neg
WMA 10 Closure	neg	neg	neg	neg	neg
WMA 11 Closure					
WMA 12 Closure	neg	neg	neg	neg	neg
NPP Equipment Removal	neg	neg	1.19E-03	neg	neg
Existing Facility Maintenance	neg	neg	neg	neg	neg
Security*	neg	neg	neg	neg	neg
Environmental Monitoring Installations	neg	neg	neg	neg	neg
Security Installations	neg	neg	neg	neg	neg
Erosion Control Installations	neg	neg	neg	neg	neg
Long-Term Monitoring and Maintenance*	neg	neg	neg	neg	neg
NPP PTW Replacement*	neg	neg	neg	neg	neg
TOTALS*	**2.86E+02**	**2.51E-06**	**3.03E-01**	**1.51E-02**	**3.41E-04**

* Over 60 years

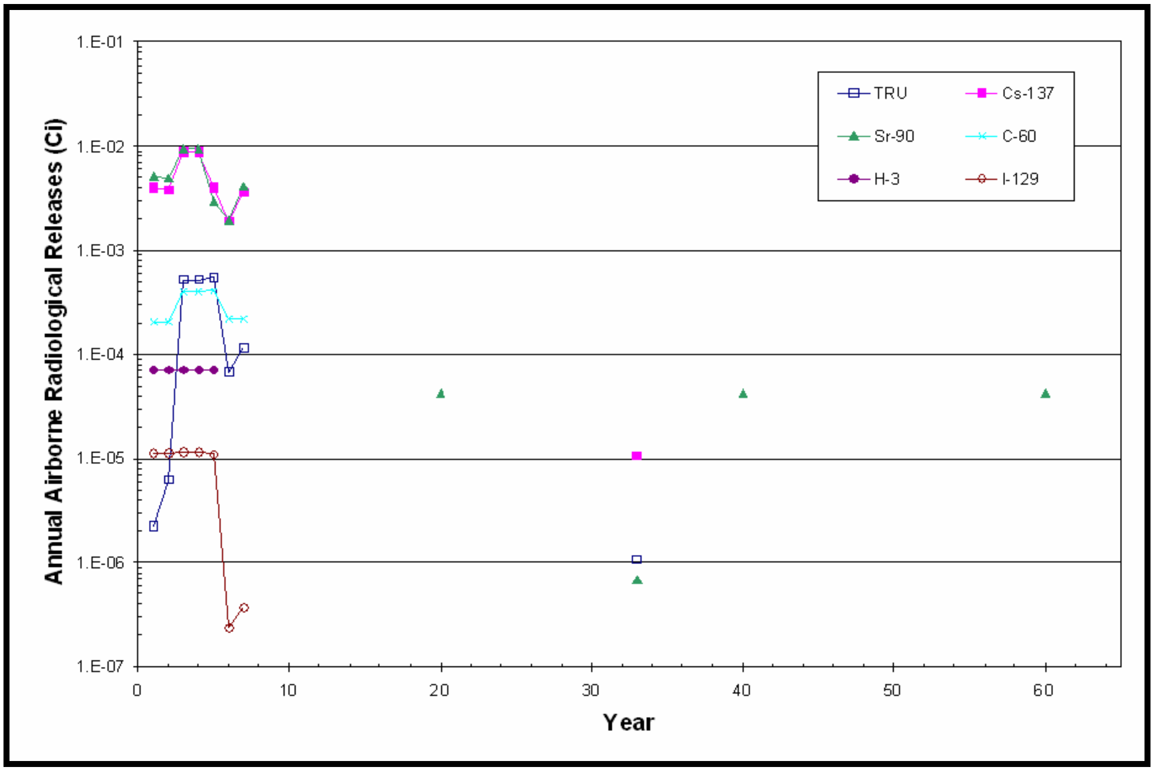

Figure 3-5. Environmental Airborne Releases by Implementation Year

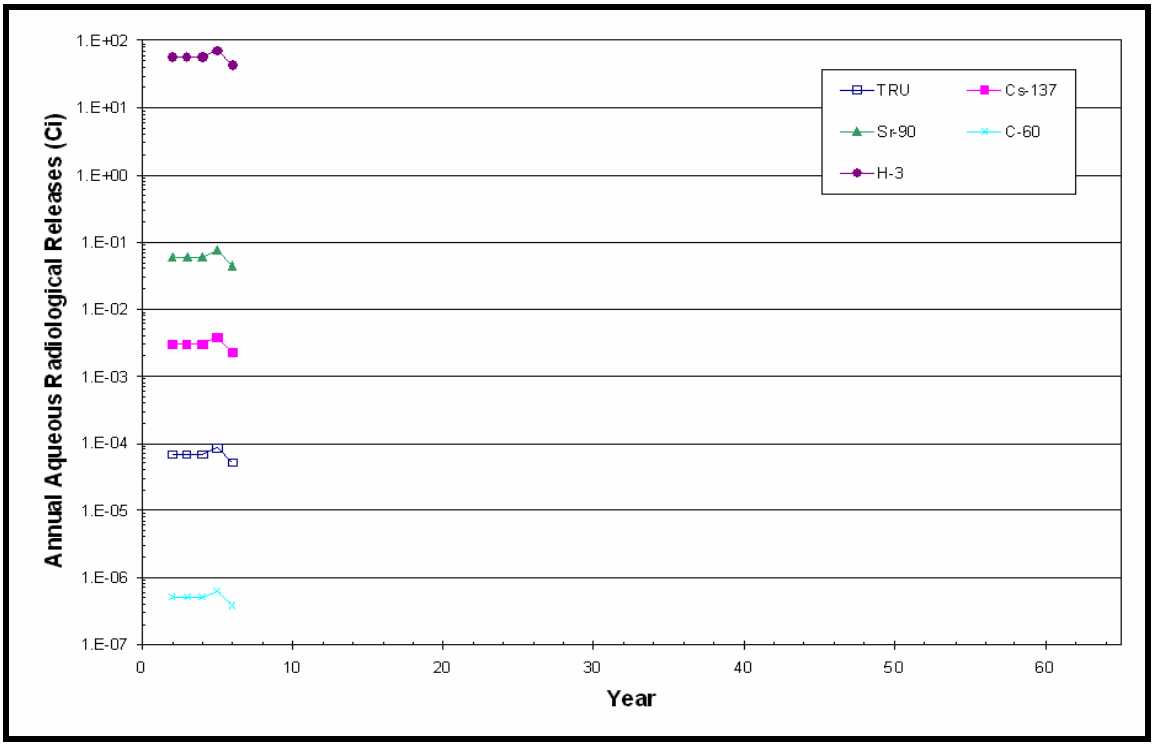

Figure 3-6. Environmental Aqueous Releases by Implementation Year

Nonradiological releases were also estimated for the Sitewide Close-In-Place Alternative. The next two tables quantify these releases, which would be the result of operation and maintenance activities. Table 3-14 presents the flue gas release in tons associated with natural gas usage at each WMA and Facility. These values were generated based upon worker labor hours and the estimated use of natural gas for either heating purposes or operations.

Two of the flue gases, carbon monoxide and nitrogen oxide, releases by implementation year are charted in Figures 3-7 and 3-8. In addition to flue emissions, these gases are also related to the heavy equipment use, and therefore follow the same pattern illustrated in Figure 3-3. The flue gas emissions during the implementation (due to burning natural gas) are also plotted on this figure.

Table 3-14. Flue Gas Releases

Effort	NO_x (tons)	CO (tons)	CO_2 (tons)	PM_{10} (tons)	TOC (tons)	VOC (tons)	Benzene (tons)	Toluene (tons)	Methane (tons)	SO_2 (tons)	Lead (tons)
HLW Canister Removal											
Construction of DCSA	0.40	0.34	482	0.03	0.04	0.02	8.44E-06	1.37E-05	9.24E-03	2.41E-03	2.01E-06
LILO Modification and Operation	0.63	0.53	754	0.05	0.07	0.03	1.32E-05	2.13E-05	1.44E-02	3.77E-03	3.14E-06
Operation of DCSA	1.19	1.00	1422	0.09	0.13	0.07	2.49E-05	4.03E-05	2.73E-02	7.11E-03	5.93E-06
Demolition of DCSA	0.47	0.39	564	0.04	0.05	0.03	9.87E-06	1.60E-05	1.08E-02	2.82E-03	2.35E-06
WMA 1 Closure	5.85	4.92	7026	0.44	0.64	0.32	1.23E-04	1.99E-04	1.35E-01	3.51E-02	2.93E-05
WMA 2 Closure	0.59	0.49	704	0.04	0.06	0.03	1.23E-05	2.00E-05	1.35E-02	3.52E-03	2.94E-06
WMA 3 Closure											
Surface Structure Removal	0.57	0.48	686	0.04	0.06	0.03	1.20E-05	1.94E-05	1.31E-02	3.43E-03	2.86E-06
Grouting Operations	0.19	0.16	226	0.01	0.02	0.01	3.95E-06	6.39E-06	4.32E-03	1.13E-03	9.40E-07
North Plateau Cap Construction	1.08	0.91	1295	0.08	0.12	0.06	2.27E-05	3.67E-05	2.48E-02	6.47E-03	5.39E-06
WMA 4 Closure	0.00	0.00	0	0.00	0.00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WMA 5 Closure	0.24	0.20	285	0.02	0.03	0.01	4.98E-06	8.07E-06	5.46E-03	1.42E-03	1.19E-06
WMA 6 Closure	0.02	0.02	27	0.00	0.00	0.00	4.67E-07	7.57E-07	5.12E-04	1.34E-04	1.11E-07
Leachate Treatment Facility											
LTF Construction	0.12	0.10	140	0.01	0.01	0.01	2.45E-06	3.97E-06	2.68E-03	7.00E-04	5.83E-07
LTF Operation	3.82	3.21	4582	0.29	0.42	0.21	8.02E-05	1.30E-04	8.78E-02	2.29E-02	1.91E-05
LTF Closure	0.13	0.11	156	0.01	0.01	0.01	2.73E-06	4.41E-06	2.99E-03	7.79E-04	6.49E-07
WMA 7 Closure	1.74	1.46	2091	0.13	0.19	0.10	3.66E-05	5.92E-05	4.01E-02	1.05E-02	8.71E-06
WMA 8 Closure	7.19	6.04	8622	0.55	0.79	0.40	1.51E-04	2.44E-04	1.65E-01	4.31E-02	3.59E-05
WMA 9 Closure	0.41	0.34	488	0.03	0.04	0.02	8.54E-06	1.38E-05	9.35E-03	2.44E-03	2.03E-06
WMA 10 Closure	0.04	0.03	49	0.00	0.00	0.00	8.63E-07	1.40E-06	9.46E-04	2.47E-04	2.06E-07
WMA 11 Closure	0.00	0.00	0	0.00	0.00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WMA 12 Closure	0.01	0.01	10	0.00	0.00	0.00	1.67E-07	2.71E-07	1.83E-04	4.77E-05	3.98E-08
North Plateau Groundwater Plume (non-source area)	0.00	0.00	4	0.00	0.00	0.00	7.80E-08	1.26E-07	8.55E-05	2.23E-05	1.86E-08
Existing Facility Maintenance	1.09	0.91	1304	0.08	0.12	0.06	2.28E-05	3.69E-05	2.50E-02	6.52E-03	5.43E-06
Security*	10.16	8.54	12197	0.77	1.12	0.56	2.13E-04	3.46E-04	2.34E-01	6.10E-02	5.08E-05
Environmental Monitoring Installations	0.19	0.16	226	0.01	0.02	0.01	3.96E-06	6.41E-06	4.33E-03	1.13E-03	9.42E-07
Security Installations	0.08	0.07	102	0.01	0.01	0.00	1.78E-06	2.88E-06	1.95E-03	5.08E-04	4.23E-07
Erosion Control Installations	3.48	2.92	4175	0.26	0.38	0.19	7.31E-05	1.18E-04	8.00E-02	2.09E-02	1.74E-05
Long-Term Monitoring and Maintenance*	8.46	7.11	10154	0.64	0.93	0.47	1.78E-04	2.88E-04	1.95E-01	5.08E-02	4.23E-05
NPP PTW Replacement*	0.19	0.16	228	0.01	0.02	0.01	3.98E-06	6.45E-06	4.36E-03	1.14E-03	9.48E-07
TOTALS*	**48.33**	**40.60**	**57,996**	**3.67**	**5.32**	**2.66**	**1.01E-03**	**1.64E-03**	**1.11E+00**	**2.90E-01**	**2.42E-04**

* Over 60 years

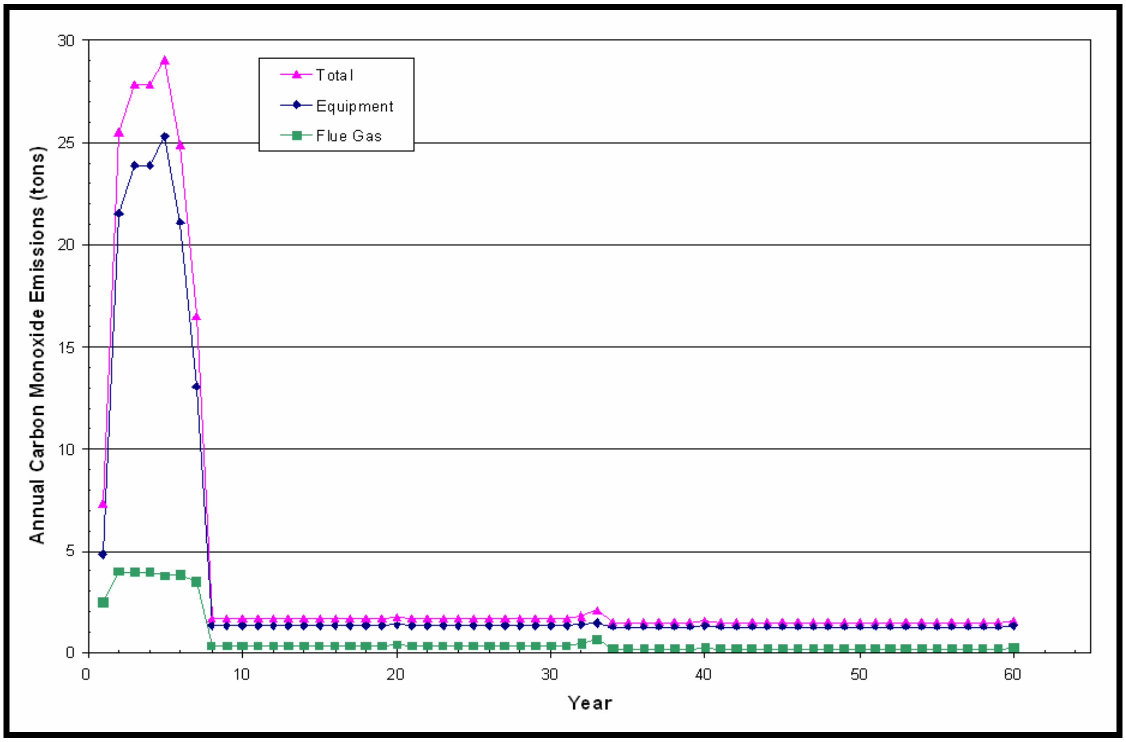

Figure 3-7. Carbon Monoxide Equipment and Flue Gas Releases by Implementation Year

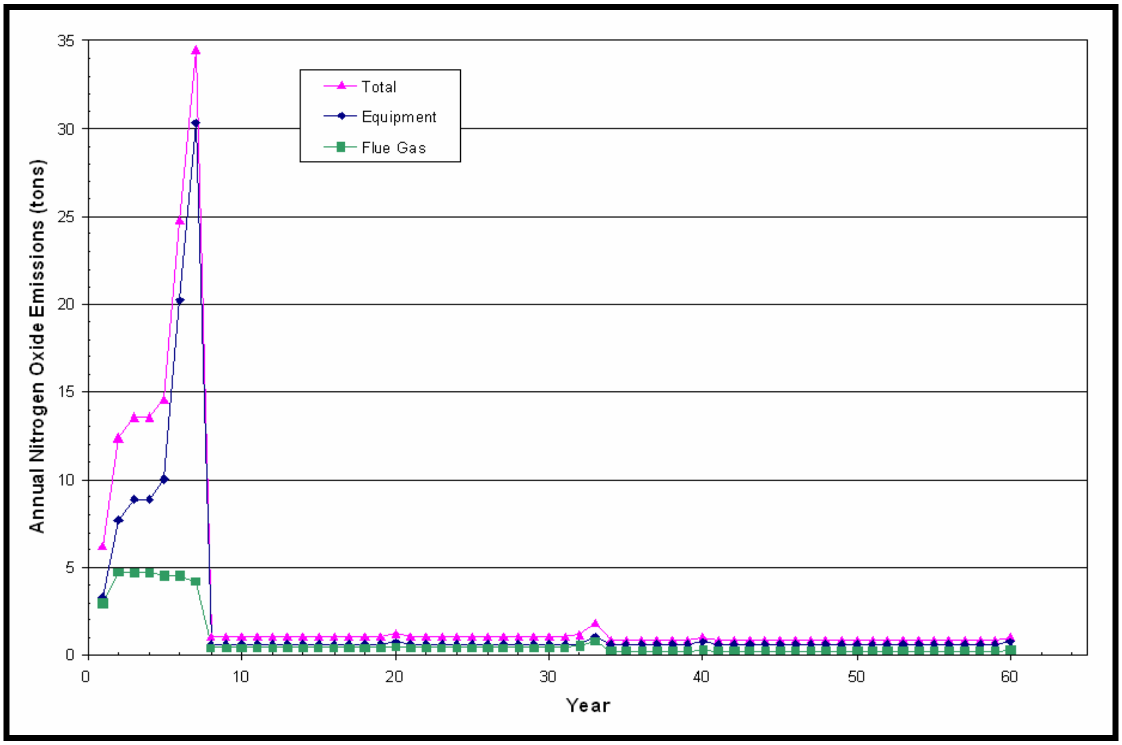

Figure 3-8. Nitrogen Oxide Equipment and Flue Gas Releases by Implementation Year

Table 3-15 is similar to the previous table in that is summarizes the nonradiological releases in tons based on labor hours during remedial activities. This table, however, strictly presents the releases as a result of operating construction equipment, which also includes other potential airborne contaminants.

Figures 3-9 and 3-10 illustrate the timed release of PM_{10} material and fugitive dust total releases by implementation year. The generators of particulate material include both heavy equipment and flue gas exhausts, which are separately illustrated in the figure. Fugitive dust is directly related to the heavy equipment use, and once again, follows the same pattern as that illustrated in Figure 3-3, Construction Equipment Use by Implementation Year.

Table 3-15. Construction Equipment/Operational Releases

Effort	CO (tons)	HCs (tons)	NO_x (tons)	CO_2 (tons)	Benzene (tons)	Particulates (tons)	Dust (tons)
HLW Canister Removal							
Construction of DCSA	6.76E-01	1.55E-01	1.02E+00	6.86E+02	7.70E-04	1.99E-02	4.89E-01
LILO Modification and Operation	5.82E-03	7.30E-03	1.95E-02	3.44E+01	0.00E+00	5.20E-04	0.00E+00
Operation of DCSA	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Demolition of DCSA	1.22E-01	1.52E-01	4.12E-01	7.17E+02	0.00E+00	1.08E-02	0.00E+00
WMA 1 Closure	2.04E+01	2.54E+00	8.37E+00	1.10E+04	2.46E-02	3.03E-01	1.38E+01
WMA 2 Closure	9.79E-01	3.73E-01	2.16E+00	1.71E+03	8.82E-04	4.11E-02	2.18E+01
WMA 3 Closure							
Surface Structure Removal	1.10E-01	1.02E-01	4.81E-01	4.87E+02	0.00E+00	8.58E-03	1.07E+00
Grouting Operations	6.80E-02	7.01E-02	2.66E-01	3.18E+02	0.00E+00	7.16E-03	7.38E-01
North Plateau Cap Construction	2.35E+00	8.06E-01	4.58E+00	1.03E+02	2.34E-03	9.35E-02	2.78E+01
WMA 4 Closure							
WMA 5 Closure	3.92E-01	3.52E-01	1.36E+00	1.64E+03	7.53E-05	3.19E-02	4.44E-01
WMA 6 Closure	1.17E-01	1.31E-02	5.79E-02	6.20E+00	1.42E-04	1.77E-03	1.25E-01
Leachate Treatment Facility							
LTF Construction	5.86E-01	1.64E-02	4.30E-02	4.92E+01	7.76E-04	4.02E-03	1.04E-02
LTF Operation	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
LTF Closure	4.82E-01	3.37E-02	1.31E-01	1.34E+02	6.13E-04	5.37E-03	8.69E-02
WMA 7 Closure	1.44E+01	1.44E+00	6.61E+00	6.01E+03	1.78E-02	2.06E-01	3.38E+01
WMA 8 Closure	7.76E+01	5.98E+00	2.34E+01	4.29E+03	9.82E-02	9.23E-01	2.72E+02
WMA 9 Closure	1.93E-01	2.05E-01	9.16E-01	9.34E+02	1.08E-05	2.12E-02	1.08E+00
WMA 10 Closure	2.52E-02	3.15E-02	1.81E-01	1.46E+02	0.00E+00	3.25E-03	9.27E-02
WMA 11 Closure							
WMA 12 Closure	8.74E-03	1.19E-02	7.78E-02	5.52E+01	0.00E+00	1.31E-03	5.87E-02
North Plateau Groundwater Plume (non-source area)	3.98E-02	2.27E-03	1.16E-02	8.73E+00	5.16E-05	4.05E-04	8.78E-03
Existing Facility Maintenance	4.49E-01	3.43E-02	1.23E-02	3.61E+01	5.96E-04	2.44E-03	0.00E+00
Security*	3.60E+00	2.75E-01	9.89E-02	2.89E+02	4.77E-03	1.96E-02	0.00E+00
Environmental Monitoring Installations	2.11E-01	2.95E-01	2.05E+00	1.36E+03	0.00E+00	3.36E-02	1.25E+00
Security Installations	9.33E-01	6.34E-02	3.55E-01	2.50E+02	1.20E-03	1.08E-02	2.43E+00
Erosion Control Installations	1.27E+01	6.34E+00	3.70E+01	2.90E+04	1.10E-02	6.96E-01	1.57E+02
Long-Term Monitoring and Maintenance*	6.71E+01	5.13E+00	1.84E+00	5.39E+03	8.89E-02	3.65E-01	2.71E+02
NPP PTW Replacement*	7.06E-02	5.40E-03	1.94E-03	5.68E+00	9.36E-05	3.84E-04	2.75E-01
TOTALS*	**2.04E+02**	**2.44E+01**	**9.15E+01**	**6.46E+04**	**2.53E-01**	**2.81E+00**	**8.05E+02**

* Over ~~64~~ 60 years

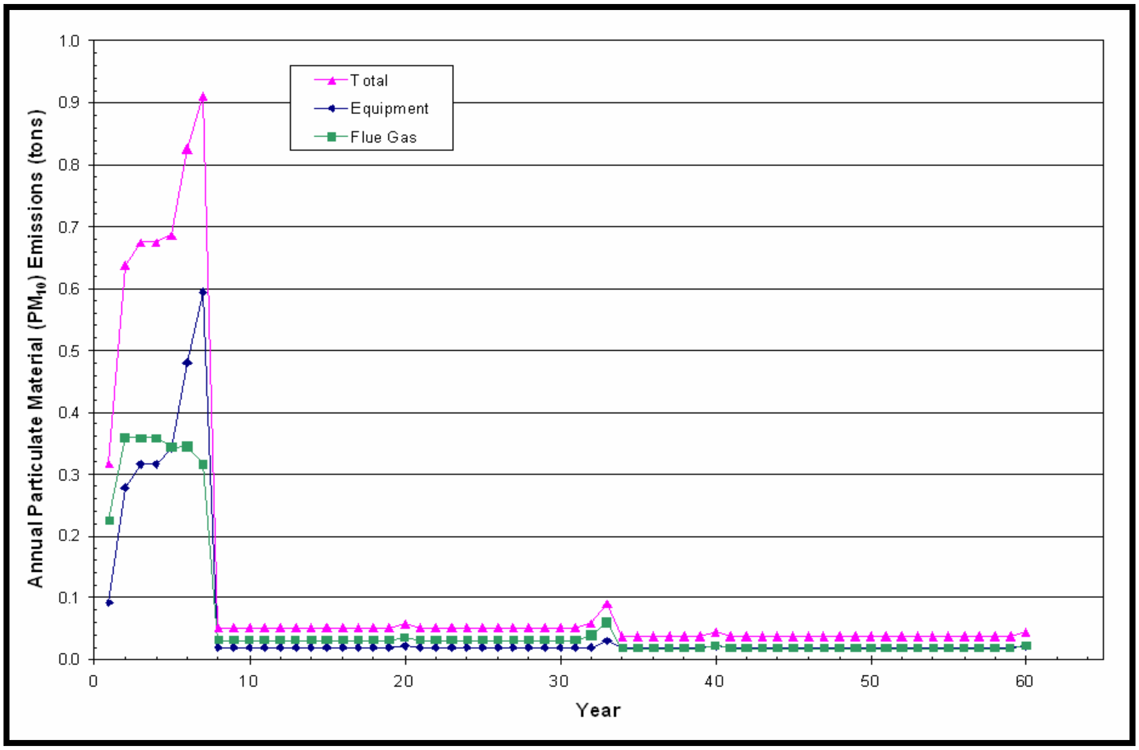

Figure 3-9. Particulate Material (PM_{10}) Release by Implementation Year

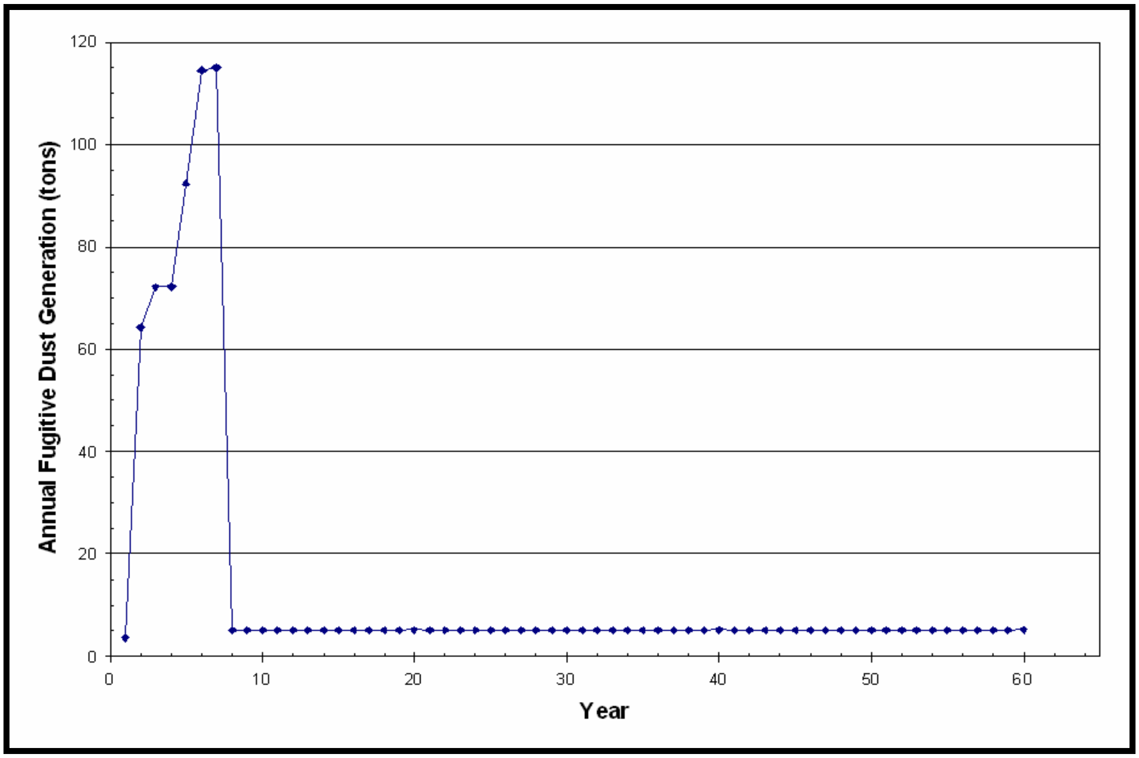

Figure 3-10. Fugitive Dust Generation by Implementation Year

3.4 Generated Waste

A limited volume of waste would be generated during the In-Place Closure activities under this alternative, and the data in this section facilitates an understanding of the off-site disposal options for waste packages that would be classified into one of nine different categories. Estimates of waste classification were based upon regulatory criteria (i.e., federal and disposal facility standards) and existing site data on radionuclide content in the waste material. Trash and other municipal waste that would be generated from routine personnel activities are not included in the following two tables.

Tables 3-16 and 3-17 are delineated by WMA in rows and disposal facility location in columns based on commercial facilities only or DOE facilities combined with commercial facilities. The packaged waste volumes are further defined by one of the following classifications: CDD, hazardous, LSA, Class A, Class B, Class C, Greater Than Class C ([GTCC] low-level radioactive waste that exceeds the concentration limits of radionuclides established for Class C waste in 10 CFR 61.55), TRU, or mixed wastes. Table 3-16 combines those LSA/Class A and Class B/C wastes that would not go to a DOE facility (i.e., NTS), but rather the commercial facilities of Energy Solutions and Barnwell, respectively. Waste disposal volumes can vary due to different packaging requirements at different facilities. For example, disposal of 50 ft^3 of a Class B waste at NTS would require the waste to be packaged in B-25 boxes. Although the waste volume is only 50 ft^3, the disposal volume or "packaged volume" is 103 ft^3, based on the outside dimension of the box. In comparison, disposal of the same material at Energy Solutions might require the waste to be packaged in HICs, with a disposal volume or "packaged volume" of 205 ft^3. This can be observed in a few of the rows in the sum-total column along the right side of both tables.

The estimated volume of construction and demolition debris generated at the site by implementation year is illustrated by Figure 3-11. The figure illustrates peak debris generation during construction and clean demolition activities.

The volume of packaged waste for disposal at DOE and commercial facilities, charted by implementation year, is illustrated by Figure 3-12. This figure is based on the data presented in Table 3-16, Packaged Volume for Disposal at DOE/Commercial Facilities, using the implementation schedule, Figure 3-1 as a timeline. This table is useful in understanding the waste management and shipping efforts that would be required throughout the implementation, as well as identifying and understanding the peak shipping periods during the project. Similarly, Figure 3-13 illustrates the Volume of Packaged Waste for Commercial Disposal by Implementation Year.

3.4.1 Waste Volume Uncertainties

The assumptions applied to the developed of the Sitewide Close-In-Place Alternative have been developed in a conservative manner based on the interpretation of conditions that will likely exist during implementation. Under the Sitewide Close-In-Place Alternative, off-site shipments of waste are limited with most of the waste being retained on site underneath the engineered multi-layered caps.

One of the key remedial elements under the Sitewide Close-In-Place Alternative is the passive mitigation of the North Plateau groundwater plume by the permeable treatment wall (PTW). The PTW will use zeolite to passively adsorb radioactive constituents of concern. The zeolite media will require periodic replacement, currently planned for an approximate 20-year cycle. It is anticipated that the spent zeolite media will be managed and disposed of as LSA waste. However, depending on adsorption efficiencies, the loaded zeolite could exceed the LSA waste criteria limits requiring reclassification of approximately 71,280 ft^3 LSA waste to Class A waste.

Table 3-16. Packaged Volumes for DOE/Commercial Facilities Disposal

Effort	Waste Volume (ft^3)											
	Commercial		NTS				TBD[1]	WIPP	Energy Solutions		Commercial[2]	TOTAL
	Construction Demolition Debris	Hazardous	LSA	Class A	Class B	Class C	GTCC	TRU	LSA/ Class A	Mixed	Class B/C	
HLW Canister Removal												
Construction of DCSA	0	0	0	0	0	0	0	0	0	0	0	0
LILO Modification and Operation	0	0	2,172	2,266	0	0	0	0	0	0	0	4,438
Operation of DCSA	0	0	0	0	0	0	0	0	0	0	0	0
Demolition of DCSA	208,333	0	0	0	0	0	0	0	0	0	0	208,333
WMA 1 Closure	0	83	36,659	44,187	0	0	0	0	0	1,442	0	82,371
WMA 2 Closure	549	0	33,106	721	0	0	0	0	0	0	0	34,376
WMA 3 Closure												0
Surface Structure Removal	0	0	0	2,163	105	1,328	0	1,238	0	0	0	4,833
Grouting Operations	0	0	0	1,442	0	0	0	0	0	0	0	1,442
North Plateau Cap Construction	0	0	56,052	721	0	0	0	0	0	0	0	56,773
WMA 4 Closure												0
WMA 5 Closure	24,172	0	50,717	33,005	0	0	0	0	0	0	0	107,894
WMA 6 Closure	7,317	0	1,226	103	0	0	0	0	0	0	0	8,647
Leachate Treatment Facility												0
LTF Construction	2,196	0	0	0	0	0	0	0	0	0	0	2,196
LTF Operation	0	0	0	5,047	0	173	0	0	24,205	12,978	810	43,213
LTF Closure	0	0	1,765	834	0	0	0	0	14,728	0	0	17,328
WMA 7 Closure	14,948	0	0	0	0	0	0	0	0	0	0	14,948
WMA 8 Closure	70,021	0	0	0	0	0	0	0	11,860	0	0	81,881
WMA 9 Closure	88,924	0	0	0	0	0	0	0	0	0	0	88,924
WMA 10 Closure	23,060	0	0	0	0	0	0	0	0	0	0	23,060
WMA 11 Closure												0
WMA 12 Closure	5,465	0	0	0	0	0	0	0	0	0	0	5,465
North Plateau Groundwater Plume (non-source area)	0	0	0	0	0	0	0	0	2,981	0	0	2,981
Existing Facility Maintenance	1,304	36	0	13,869	0	0	0	0	0	0	0	15,209
Security*	0	0	0	0	0	0	0	0	0	0	0	0
Environmental Monitoring Installations	0	0	4,815	1,442	0	0	0	0	0	0	0	6,257
Security Installations	22,267	0	0	0	0	0	0	0	0	0	0	22,267
Erosion Control Installations	69,660	0	0	0	0	0	0	0	0	0	0	69,660
Long-Term Monitoring and Maintenance*	0	0	0	10,918	0	0	0	0	0	0	0	10,918
NPP PTW Replacement*	0	0	0	0	0	0	0	0	214,767	0	0	214,767
TOTALS*	**538,216**	**118**	**186,511**	**116,718**	**105**	**1,500**	**0**	**1,238**	**268,541**	**14,420**	**810**	**1,128,177**

* Over 60 years
(1) Disposal facility for GTCC waste to be determined once a disposal facility for GTCC waste becomes available.
(2) Barnwell packaging requirements were used in this estimate, but the waste may be disposed of at a different facility.

Table 3-17. Packaged Volumes for Commercial Facilities Disposal

Effort	Commercial		Energy Solutions			Commercial[(1)]		TBD[(2)]		Total
	Construction Demolition Debris	Hazardous	LSA	Class A	Mixed	Class B	Class C	TRU	GTCC	
HLW Canister Removal										
Construction of DCSA	0	0	0	0	0	0	0	0	0	0
LILO Modification and Operation	0	0	2,172	2,266	0	0	0	0	0	4,438
Operation of DCSA	0	0	0	0	0	0	0	0	0	0
Demolition of DCSA	208,333	0	0	0	0	0	0	0	0	208,333
WMA 1 Closure	0	83	36,659	44,187	1,442	0	0	0	0	82,371
WMA 2 Closure	549	0	33,106	721	0	0	0	0	0	34,376
WMA 3 Closure										
Surface Structure Removal	0	0	0	2,163	0	105	1,328	1,238	0	4,833
Grouting Operations	0	0	0	1,442	0	0	0	0	0	1,442
North Plateau Cap Construction	0	0	56,052	721	0	0	0	0	0	56,773
WMA 4 Closure										
WMA 5 Closure	24,172	0	50,717	33,005	0	0	0	0	0	107,894
WMA 6 Closure	7,317	0	1,226	103	0	0	0	0	0	8,647
Leachate Treatment Facility										
LTF Construction	2,196	0	0	0	0	0	0	0	0	2,196
LTF Operation	0	0	0	29,252	12,978	0	983	0	0	43,213
LTF Closure	0	0	11,766	5,459	0	0	0	0	0	17,225
WMA 7 Closure	14,948	0	0	0	0	0	0	0	0	14,948
WMA 8 Closure	70,021	0	10,473	1,387	0	0	0	0	0	81,881
WMA 9 Closure	88,924	0	0	0	0	0	0	0	0	88,924
WMA 10 Closure	23,060	0	0	0	0	0	0	0	0	23,060
WMA 11 Closure										
WMA 12 Closure	5,465	0	0	0	0	0	0	0	0	5,465
North Plateau Groundwater Plume (non-source area)	0	0	2,878	103	0	0	0	0	0	2,981
Existing Facility Maintenance	1,304	36	0	13,869	0	0	0	0	0	15,209
Security*	0	0	0	0	0	0	0	0	0	0
Environmental Monitoring Installations	0	0	4,815	1,442	0	0	0	0	0	6,257
Security Installations	22,267	0	0	0	0	0	0	0	0	22,267
Erosion Control Installations	69,660	0	0	0	0	0	0	0	0	69,660
Long-Term Monitoring and Maintenance*	0	0	0	10,918	0	0	0	0	0	10,918
NPP PTW Replacement*	0	0	213,840	927	0	0	0	0	0	214,767
TOTALS*	**538,216**	**118**	**423,703**	**147,965**	**14,420**	**105**	**2,310**	**1,238**	**0**	**1,128,074**

* Over 60 years
(1) Barnwell packaging requirements were used in this estimate, but the waste may be disposed of at a different facility.
(2) Disposal facility for GTCC waste to be determined once a disposal facility for GTCC waste becomes available.

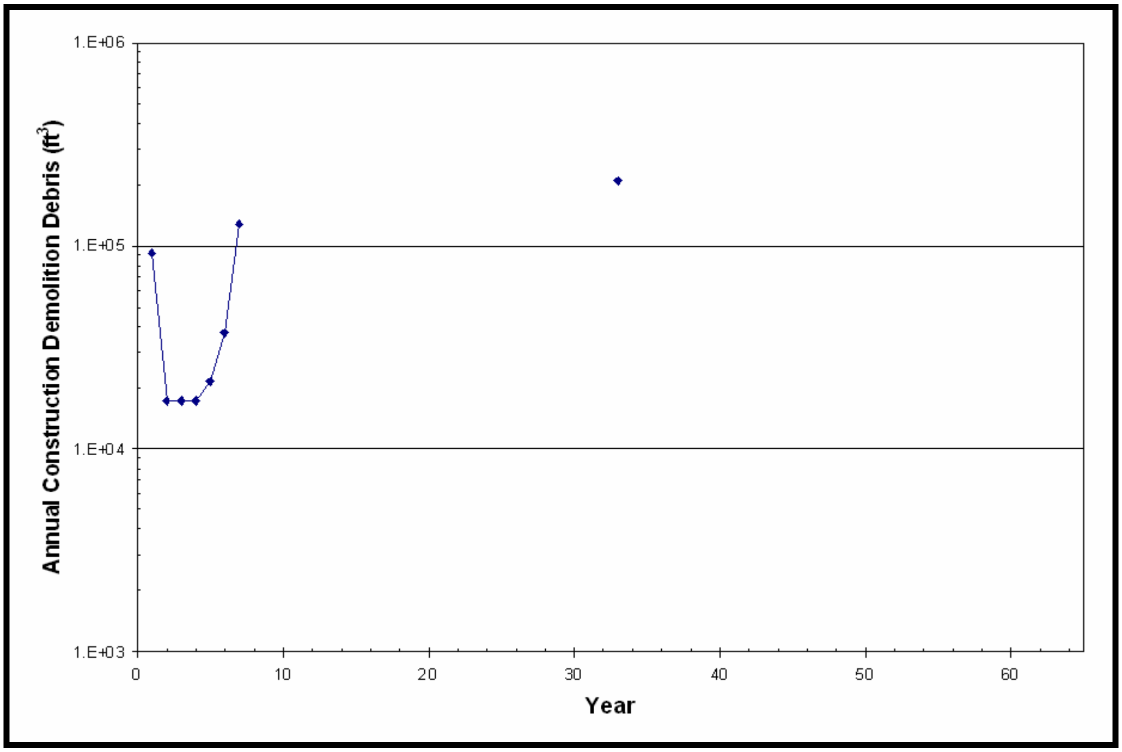

Figure 3-11. Volume of Construction and Demolition Debris by Implementation Year

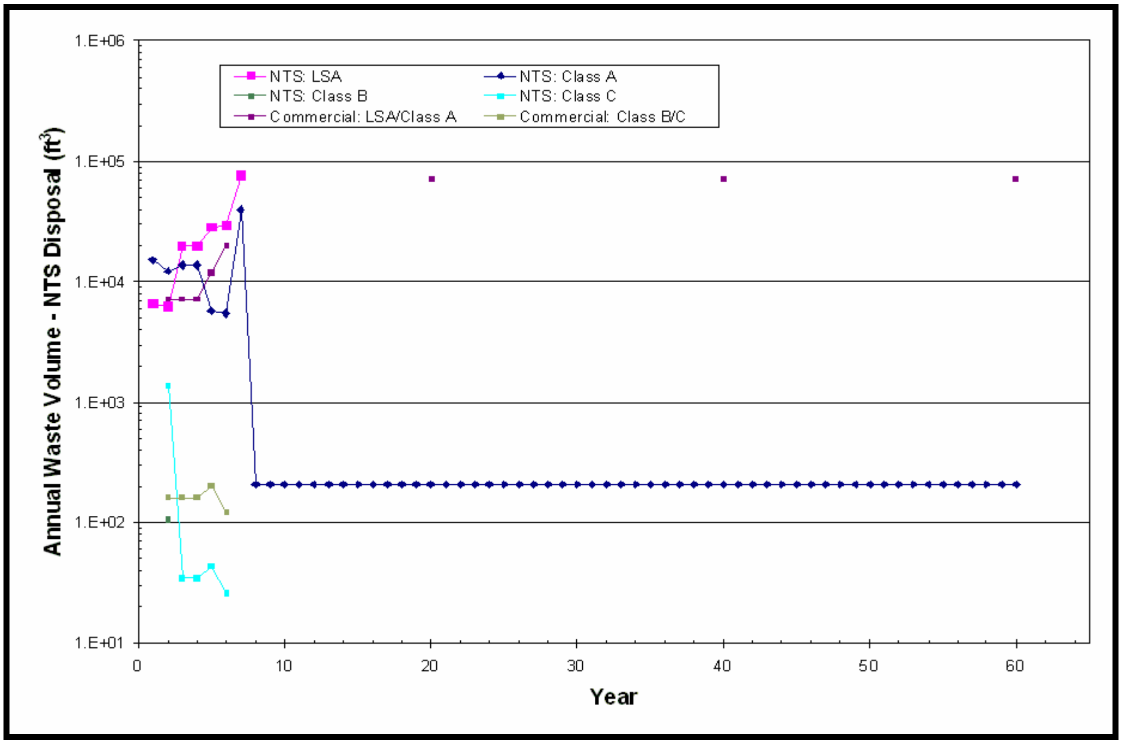

Figure 3-12. Volume of Packaged Waste for DOE/Commercial Facilities Disposal by Implementation Year

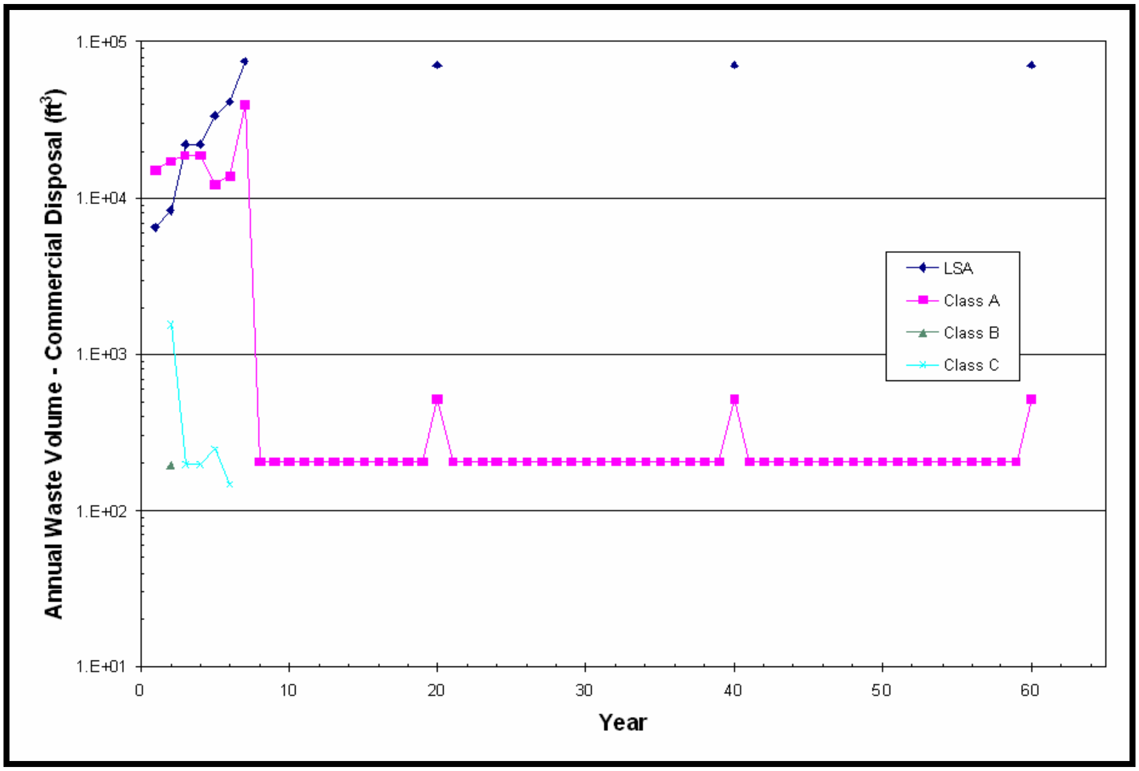

Figure 3-13. Volume of Packaged Waste for Commercial Facilities Disposal by Implementation Year

3.5 Costs

For purposes of these estimates, cost was separated into the four major categories of materials, labor, waste disposal, and contingencies, which were generated for each WMA or Facility.

The two cost tables produced in the report are nearly identical with the exception of the location where the waste would be disposed. For example, Table 3-18 displays the costs for each WMA and Facilities as represented by waste transported to DOE and commercial facilities; whereas, Table 3-19 presents the costs related to waste transported to Commercial facilities only. Since the disposal facilities are different under each scenario, a few ancillary costs are different as well, such as waste packaging, transportation, and subsequent contingency costs. The distinctions are most noticeable in the sum-total costs in the last row, where labor costs are identical and waste disposal costs are different by approximately $3.4 million.

Figure 3-14 illustrates the annual breakdown in spending of the assumed annual $100 million site budget, using a stacked bar chart.

3.5.1 Cost Uncertainties

The focus of the Close-In-Place Alternative will be directed toward the on-site retention and management of impacted media. Most of the uncertainty surrounding the impacts of the areal and vertical distribution of impacted media and the related extent of removal activities is effectively eliminated under this alternative. However, uncertainties under this alternative arise in the future as mid-term life cycle costs associated with O&M.

For example, the containment of the North Plateau groundwater plume is contingent on the continued effectiveness of the PTW. While replacement of the PTW zeolite media is anticipated at an approximate 20-year frequency, the rate of radioactive constituent adsorption onto the zeolite media remains largely unknown. It is anticipated that the spent zeolite would be managed and disposed of as LSA waste. In the event that contaminant loading exceeds that anticipated, the 71,280 ft^3 of spent zeolite may require management and disposal as a Class A waste adding upwards of 2.2 million dollars of additional waste disposal cost.

Similarly, the longevity and specific maintenance requirements of the engineered caps and surface water control structures remain largely unknown, subject to the test of time. As such, the realized expenditures necessary to maintain and/or replace these structures will remain unknown until evidenced as time progresses.

Table 3-18. DOE/Commercial Facilities Waste Disposal (2008 Dollars)

Effort	Total Materials Cost	Total Labor Cost	Total Waste Disposal Cost	Total Contingency Cost	Total Cost
HLW Canister Removal					
Construction of DCSA	$32,015,800	$7,178,800	$0	$5,403,100	$44,597,700
LILO Modification and Operation	$9,547,000	$8,760,600	$153,000	$6,114,800	$24,575,400
Operation of DCSA	$42,000	$16,233,000	$0	$4,074,000	$20,349,000
Demolition of DCSA	$1,858,800	$6,441,700	$1,938,500	$2,559,900	$12,798,900
WMA 1 Closure	$14,460,200	$80,130,000	$2,275,700	$24,216,900	$121,082,800
WMA 2 Closure	$5,978,200	$8,089,400	$1,196,800	$3,816,200	$19,080,600
WMA 3 Closure					
Surface Structure Removal	$570,600	$7,958,300	$124,600	$2,163,600	$10,817,100
Grouting Operations	$7,036,800	$2,561,800	$31,300	$2,407,600	$12,037,500
North Plateau Cap Construction	$8,689,000	$14,947,200	$1,941,700	$6,394,500	$31,972,400
WMA 4 Closure					
WMA 5 Closure	$1,586,100	$3,463,900	$2,726,800	$1,944,400	$9,721,200
WMA 6 Closure	$119,100	$308,000	$135,800	$140,900	$703,800
Leachate Treatment Facility					
LTF Construction	$5,365,300	$1,611,200	$22,600	$1,085,500	$8,084,600
LTF Operation	$3,421,400	$52,043,100	$2,446,800	$14,478,100	$72,389,400
LTF Closure	$176,800	$2,206,000	$356,700	$684,900	$3,424,400
WMA 7 Closure	$10,508,100	$24,080,300	$140,700	$8,682,300	$43,411,400
WMA 8 Closure	$34,070,900	$99,284,700	$838,000	$33,548,500	$167,742,100
WMA 9 Closure	$608,900	$5,543,000	$828,700	$1,745,200	$8,725,800
WMA 10 Closure	$208,200	$649,700	$216,000	$268,600	$1,342,500
WMA 11 Closure					
WMA 12 Closure	$39,200	$139,900	$52,800	$58,000	$289,900
North Plateau Groundwater Plume (non-source area)	$17,600	$51,400	$52,800	$30,500	$152,300
Existing Facility Maintenance	$1,813,300	$7,900,800	$349,700	$2,499,800	$12,563,600
Security*	$0	$40,102,500	$0	$10,025,600	$50,128,100
Environmental Monitoring Installations	$1,333,400	$2,720,300	$209,500	$1,065,800	$5,329,000
Security Installations	$342,500	$1,188,400	$208,500	$434,900	$2,174,300
Erosion Control Installations	$17,938,600	$48,331,600	$647,900	$16,729,700	$83,647,800
Long-Term Monitoring and Maintenance*	$53,084,800	$118,338,400	$710,200	$43,057,200	$215,190,600
NPP PTW Replacement*	$5,341,200	$2,674,200	$2,590,800	$2,651,700	$13,257,900
TOTAL PROJECT COST*	**$216,173,800**	**$562,938,200**	**$20,195,900**	**$196,282,200**	**$995,590,100**
GTCC Waste Disposal			$0		$0
TRU Waste Disposal			$2,847,000		$2,847,000
HLW Canister Disposal			$137,500,000		$137,500,000
Total Non-Project Cost			$140,347,000		$140,347,000
TOTAL ALTERNATIVE COST	$216,173,800	$562,938,200	$160,542,900	$196,282,200	$1,135,937,100

* Over 60 years

Table 3-19. Commercial Facilities Waste Disposal (2008 Dollars)

Effort	Total Materials Cost	Total Labor Cost	Total Waste Disposal Cost	Total Contingency Cost	Total Cost
HLW Canister Removal					
Construction of DCSA	$32,015,800	$7,178,800	$0	$5,403,100	$44,597,700
LILO Modification and Operation	$9,537,600	$8,760,600	$99,200	$6,099,000	$24,496,400
Operation of DCSA	$42,000	$16,233,000	$0	$4,074,000	$20,349,000
Demolition of DCSA	$1,858,800	$6,441,700	$1,938,500	$2,559,900	$12,798,900
WMA 1 Closure	$14,423,800	$80,130,000	$1,421,500	$23,994,300	$119,969,600
WMA 2 Closure	$5,937,100	$8,089,400	$455,100	$3,620,500	$18,102,100
WMA 3 Closure					
Surface Structure Removal	$570,600	$7,958,300	$1,316,700	$2,461,600	$12,307,200
Grouting Operations	$7,036,800	$2,561,800	$39,400	$2,409,600	$12,047,600
North Plateau Cap Construction	$8,635,000	$14,947,200	$692,600	$6,068,700	$30,343,500
WMA 4 Closure					
WMA 5 Closure	$1,540,700	$3,463,900	$934,900	$1,485,000	$7,424,500
WMA 6 Closure	$109,700	$308,000	$111,000	$132,300	$661,000
Leachate Treatment Facility					
LTF Construction	$5,365,300	$1,611,200	$22,600	$1,085,500	$8,084,600
LTF Operation	$3,421,400	$52,043,100	$2,584,300	$14,512,500	$72,561,300
LTF Closure	$166,200	$2,206,000	$277,500	$662,500	$3,312,200
WMA 7 Closure	$10,508,100	$24,080,300	$140,700	$8,682,300	$43,411,400
WMA 8 Closure	$34,070,900	$99,284,700	$838,000	$33,548,500	$167,742,100
WMA 9 Closure	$608,900	$5,543,000	$828,700	$1,745,200	$8,725,800
WMA 10 Closure	$208,200	$649,700	$216,000	$268,600	$1,342,500
WMA 11 Closure					
WMA 12 Closure	$39,200	$139,900	$52,800	$58,000	$289,900
North Plateau Groundwater Plume (non-source area)	$17,600	$51,400	$52,800	$30,500	$152,300
Existing Facility Maintenance	$1,813,300	$7,900,800	$349,700	$2,499,800	$12,563,600
Security*	$0	$40,102,500	$0	$10,025,600	$50,128,100
Environmental Monitoring Installations	$1,324,000	$2,720,300	$102,600	$1,036,800	$5,183,700
Security Installations	$342,500	$1,188,400	$208,500	$434,900	$2,174,300
Erosion Control Installations	$17,938,600	$48,331,600	$647,900	$16,729,700	$83,647,800
Long-Term Monitoring and Maintenance*	$53,084,800	$118,338,400	$710,200	$43,057,200	$215,190,600
NPP PTW Replacement*	$5,341,200	$2,674,200	$2,590,800	$2,651,700	$13,257,900
TOTAL PROJECT COST*	**$215,958,100**	**$562,938,200**	**$16,632,000**	**$195,337,300**	**$990,865,600**
GTCC Waste Disposal			$0		$0
TRU Waste Disposal			$2,847,000		$2,847,000
HLW Canister Disposal			$137,500,000		$137,500,000
Total Non-Project Cost			$140,347,000		$140,347,000
TOTAL ALTERNATIVE COST	$215,958,100	$562,938,200	$156,979,000	$195,337,300	$1,131,212,600

* Over 60 years

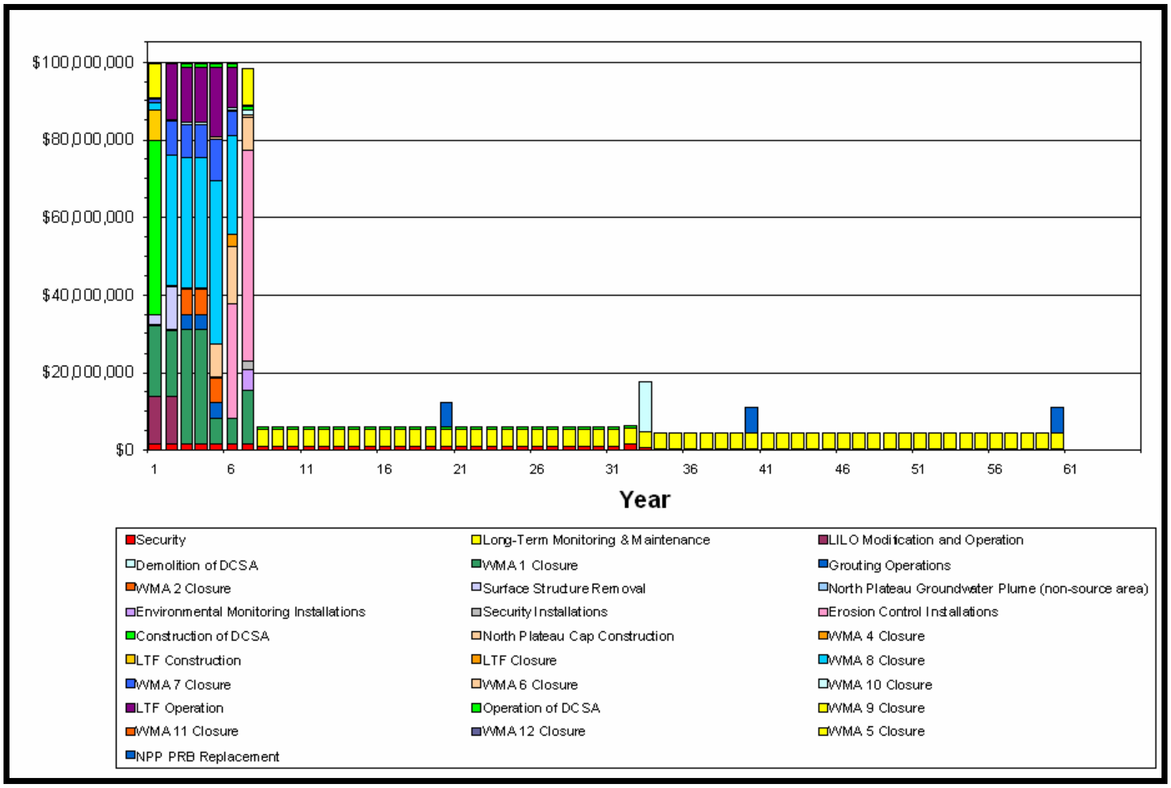

Figure 3-14. Total Costs (Y2008) by Implementation Year

4.0 POST-IMPLEMENTATION IMPACTS

NOTE: *The Section 4.0 tables have all been revised to reflect updates and revisions to the supporting calculations packages.*

4.1 Introduction

This section addresses longer-term issues related to Environmental Impact Statement (EIS) alternative analyses and selection, but which are outside the typical activities associated with implementing an EIS alternative. The primary issue addressed here is the implementation of long-term, post-implementation environmental monitoring, facility maintenance, and security.

4.1.1 Post-Implementation Long-Term Stewardship

Following the completion of the In-Place Closure activities, a long-term stewardship program would be implemented to monitor and maintain the closed facilities in the North Plateau and South Plateau. The stewardship program would include environmental monitoring and inspections, and monitoring and maintenance of engineered barriers and erosion control systems. A long-term site security program would also be implemented, which would include maintenance of security system installations. Monitoring data would be routinely evaluated and access to the closed areas re-assessed as part of the performance evaluations.

4.2 Post-Implementation Environmental Monitoring and Facility Maintenance

The environmental monitoring and inspection program would include groundwater and surface water monitoring to evaluate water quality conditions associated with the closed facilities in the North Plateau and South Plateau. This program would also include site-wide inspections of engineered barriers and erosion control structures. The monitoring and inspection program would contain the following elements:

- Semi-annual measurement of groundwater levels in groundwater monitoring wells and piezometers to evaluate groundwater flow patterns and long-term performance and effectiveness of engineering-controls.

- Semi-annual groundwater sampling and analysis to evaluate groundwater quality.

- Periodic hydraulic conductivity testing and redevelopment of groundwater monitoring wells and piezometers.

- Periodic decommissioning and replacement of groundwater monitoring wells and piezometers, as warranted.

- Annual site inspections that evaluate the condition of the engineered multi-layer covers, erosion control structures and security systems in the North and South Plateaus. Issues identified during the inspection process would be corrected as part of routine site maintenance activities.

- Reporting of the inspection, testing, sampling, and analytical results into periodic Site-Wide Long-Term Monitoring Program Reports.

4.2.1 General Environmental Monitoring and Inspections

4.2.1.1 Groundwater Monitoring

A total of 52 groundwater wells and 64 piezometers would be installed to monitor groundwater elevations and groundwater quality in the North and South Plateaus, as discussed in Section 2.15. Another eight off-site residential water supply wells would be included in the site monitoring program to monitor off-site groundwater quality.

The North Plateau groundwater monitoring network would include the following elements:

- Installation of 11 pairs of piezometers (22 total piezometers) to monitor the performance of the circumferential and upgradient hydraulic barrier walls at WMA 1 and WMA 3.

- Installation of 28 monitoring wells for long-term groundwater monitoring. These would include 25 screened in the Sand and Gravel Unit and three screened in the Kent Recessional Unit.

The groundwater monitoring network around WMA 7 in the South Plateau would include the following elements:

- The existing 21 NDA piezometers will be incorporated into the monitoring program.
- Installation of nine monitoring wells for long-term groundwater monitoring. These would include five screened in the weathered Lavery till and four screened in the Kent Recessional Unit,

The groundwater monitoring network around WMA 8 in the South Plateau would include the following elements:

- Installation of 21 piezometers to monitor the performance of the SDA hydraulic barrier wall.
- Installation of 15 monitoring wells for long-term groundwater monitoring. These would include nine screened in the weathered Lavery till and six screened in the Kent Recessional Unit

Groundwater Monitoring and Sampling

Groundwater monitoring wells would be routinely monitored during the long-term stewardship program. Monitoring tasks would include measurement of water levels, well purging, sampling, and inspection of each well. Groundwater would be routinely collected and analyzed for site-specific radiological and chemical parameters on a semi-annual schedule for the radiological indicator parameters gross alpha, gross beta, and tritium. Selected wells would also be sampled and analyzed for site-specific radionuclides by gamma spectroscopy or other appropriate method. Chemical parameters would include contamination indicator parameters. Selected wells would also be sampled and analyzed for metals, volatile organic compounds (VOCs), and semi-volatile organics compounds (SVOCs). Quality assurance/quality control samples would also be collected as part of sampling activities. The groundwater monitoring wells would also be routinely inspected during the course of the monitoring program and any repairs or maintenance required to maintain these wells in proper working condition would be performed.

Piezometer Monitoring

Pairs of groundwater piezometers would be installed along the upgradient and downgradient sides of subsurface barrier walls installed on the North and South Plateaus to evaluate the performance of these features. These piezometers would be routinely inspected during the course of the monitoring program and any repairs or maintenance required to maintain them in proper working condition would be performed as needed.

Hydraulic Conductivity Testing and Well Redevelopment

Hydraulic conductivity testing would be performed routinely on groundwater monitoring wells to evaluate their hydraulic performance. It is also anticipated that 25% of the wells would be tested each year, with 100% of the wells tested every four years. It is assumed that 25% of the monitoring wells would be redeveloped every year, with 100% of the wells redeveloped every four years.

Groundwater Monitoring Well and Piezometer Decommissioning and Replacement

It is anticipated that groundwater monitoring wells and piezometers would be decommissioned and replaced once every 25 years. Decommissioned wells would either be removed or grouted and abandoned in place.

4.2.1.2 Surface Water Monitoring

Surface waters draining the North and South Plateaus would be routinely monitored for radionuclide indicator parameters at 11 locations on Franks Creek, Erdman Brook, and Quarry Creek on a semi-annual schedule, as discussed in Section 2.15. Another four sampling locations would be located upstream and downstream of the WNYNSC along Buttermilk Creek and Cattaraugus Creek near the perimeter of the WNYNSC.

4.2.1.3 Report Preparation

Annual environmental monitoring and inspection reports and multi-year review reports would be prepared as part of the environmental monitoring program. The report would provide data summaries and trends, highlight data points above regulatory or site-specific action levels, and include conclusions, and recommendations for interim action, if appropriate. Annual reporting would be conducted up to each scheduled Multi-Year Review cycle (anticipated to range from 5 to 10 years). The Multi-Year Review would contain summarized data and evaluations from the annual reports, as well as additional analysis, and recommendations for modification to the stewardship program or further remedial action, if necessary.

4.2.2 Monitoring and Maintenance of Caps and Erosion Controls

A long-term monitoring and maintenance program would be implemented to monitor the performance and condition of the engineered barriers and erosion control structures installed in the North and South Plateaus. This program would include routine inspections of the barrier walls, engineered covers, and erosion control structures for signs of decreased performance or degradation. Actions would be implemented to correct any observed defects or irregularities with these systems. This section describes the proposed long-term monitoring and maintenance program for the engineered barriers and erosion control systems in the North and South Plateau areas.

Multi-Layer Cover Systems

The multi-layer cover systems would be routinely inspected for signs of deterioration or damage resulting from subsidence, erosion, or the growth of deep-rooted vegetation. Routine repairs to the covers, such as reseeding or backfilling small depressions, would be performed as needed. Additional maintenance activities would include periodic mowing of the vegetated portions of the covers, trimming of vegetation, and removal of vegetation with root depths in excess of one foot to prevent deep root growth into the multi-layer covers.

Hydraulic Barrier Walls

The hydraulic barrier walls in the North Plateau and South Plateau would be installed under a documented QA/QC construction program. The barrier walls would be designed to minimize long-term degradation and the need for long-term maintenance. Pairs of piezometers installed upgradient and downgradient of the barrier walls would be monitored to evaluate the performance of these hydraulic barriers

Erosion Control Structures

The erosion control structures would be regularly inspected to ensure that they are functioning as designed and to identify signs of blockage and/or physical damage. Maintenance would be performed in response to the inspections and would include clearing debris and silt blocking erosion control structures and performing local regrading where necessary. Although these erosion control structures have been conceptually designed according to NUREG-1623, considering the PMP as the design storm creating a robust design that does not rely on regular maintenance for effectiveness, routine maintenance is still assumed to be necessary. Maintenance repairs are assumed to be limited to the upper layers of the caps and erosion controls. In general, these upper layers are assumed to be refurbished annually, incorporating $1/30^{th}$ of the original construction volume into the annual material budget.

4.2.3 Long-Term Security

Access to the closed facilities in the North Plateau and South Plateau would be restricted by installing an eight-foot-high chain link fence around these facilities. The fence would have one or more access points with locked gates. Motion sensors and video cameras would be installed at intervals along these security fences. These sensors would be wired to activate alarms at local law enforcement facilities.

Signs would be placed around the perimeter as well as near the main WNYNSC access point providing appropriate information identifying the nature of the site and the existence of residual radioactive inventories in the North Plateau and of buried radioactive wastes at WMA 7 and WMA 8. These signs would also list current telephone numbers to call to obtain additional information regarding the property. These signs would be maintained for the duration of the post-closure maintenance period.

The security systems constructed around the closed facilities would be routinely inspected for signs of distress or damage resulting from normal wear from natural elements or from vandalism. Repairs of minor damage would be performed during these inspections, as needed.

The security systems, including fencing, are assumed to require complete replacement once every 35 years. Advancements in motion detector and camera technologies are assumed to be addressed by the annual monitoring and maintenance program, within which equipment using current technologies would be procured and installed whenever equipment would need to be replaced.

4.3 Data Summary

The total resource requirements, impacts, and costs associated with the post-implementation environmental monitoring, facility maintenance and security program are summarized in Tables 4-1 through 4-15.

Table 4-1. Resource Requirements - Consumable Materials – PPE and HP Supplies

Effort	PPE (sets)	Sample Bags (each)	Bioassay Containers (each)	Filter Papers (each)	Smears (each)	Tygon Tubing (ft)
North Plateau Cap Maintenance	0	0	0	0	0	0
WMA 7 Cap Maintenance	0	0	0	0	0	0
WMA 8 Cap Maintenance	0	0	0	0	0	0
Erosion Controls Maintenance	0	0	0	0	0	0
NPP PTW Replacement	207	300	1	300	600	30
Annual Environmental Monitoring	178	260	1	260	600	30
Security System Replacement	0	0	0	0	0	0
Annual Security Labor	0	0	0	0	0	0

Effort	TLDs (each)	Plastic Sheeting (rolls)	HEPA Filters (each)	Tape (rolls)	Herculite Sheeting (rolls)	Small Tools (each)
North Plateau Cap Maintenance	0	0	0	0	0	0
WMA 7 Cap Maintenance	0	0	0	0	0	0
WMA 8 Cap Maintenance	0	0	0	0	0	0
Erosion Controls Maintenance	0	0	0	0	0	0
NPP PTW Replacement	1	6	1	30	6	12
Annual Environmental Monitoring	1	6	1	26	6	11
Security System Replacement	0	0	0	0	0	0
Annual Security Labor	0	0	0	0	0	0

NPP PTW Replacement (20-year frequency) quantities and costs are for 1 replacement, not annual expenses
Security System Replacement (35-year frequency) quantities and costs are for 1 replacement, not annual expenses
All other items are strictly annual quantities and costs

Table 4-2. Resource Requirements - Consumable Materials – Containers for DOE/Commercial Disposal

Effort	Lift Liners (each)	Roll-Off/Sealand Containers (each)	55-gal Drums (each)	B-25 Boxes, strong/tight (each)	B-25 Boxes, Type A (each)
North Plateau Cap Maintenance	0	0	0	0	0
WMA 7 Cap Maintenance	0	0	0	0	0
WMA 8 Cap Maintenance	0	0	0	0	0
Erosion Controls Maintenance	0	0	0	0	0
NPP PTW Replacement	277	0	0	3	0
Annual Environmental Monitoring	0	0	0	2	0
Security System Replacement	0	5	0	0	0
Annual Security Labor	0	0	0	0	0

NPP PTW Replacement (20-year frequency) quantities and costs are for 1 replacement, not annual expenses
Security System Replacement (35-year frequency) quantities and costs are for 1 replacement, not annual expenses
All other items are strictly annual quantities and costs

Table 4-3. Resource Requirements - Consumable Materials - Containers for Commercial Disposal

Effort	Lift Liners (each)	Roll-Off/Sealand Containers (each)	55-gal Drums (each)	B-25 Boxes, strong/tight (each)	B-25 Boxes, Type A (each)
North Plateau Cap Maintenance	0	0	0	0	0
WMA 7 Cap Maintenance	0	0	0	0	0
WMA 8 Cap Maintenance	0	0	0	0	0
Erosion Controls Maintenance	0	0	0	0	0
NPP PTW Replacement	277	0	0	3	0
Annual Environmental Monitoring	0	0	0	2	0
Security System Replacement	0	5	0	0	0
Annual Security Labor	0	0	0	0	0

NPP PTW Replacement (20-year frequency) quantities and costs are for 1 replacement, not annual expenses
Security System Replacement (35-year frequency) quantities and costs are for 1 replacement, not annual expenses
All other items are strictly annual quantities and costs

Table 4-4. Resource Requirements - Utilities

Effort	Electricity (kw-hr)	Natural Gas (CF)	Diesel Fuel (gal)	Gasoline (gal)	Raw Water (gal)	Augmentation Water (gal)	Potable Water (gal)
North Plateau Cap Maintenance	18,325	102,995	2,106	41	18,977	0	4,180
WMA 7 Cap Maintenance	27,488	154,493	3,375	32	28,466	0	6,270
WMA 8 Cap Maintenance	95,484	536,659	8,586	75	98,881	0	21,780
Erosion Controls Maintenance	149,494	840,224	17,876	0	154,814	0	34,100
NPP PTW Replacement	224,724	1,263,046	10,509	0	232,720	0	51,260
Annual Environmental Monitoring	277,770	1,561,190	18,014	6,906	287,654	0	63,360
Security System Replacement	301,288	1,693,370	17,811	5,432	312,009	0	68,724
Annual Security Labor	289,344	1,626,240	0	173	299,640	0	66,000

NPP PTW Replacement (20-year frequency) quantities and costs are for 1 replacement, not annual expenses
Security System Replacement (35-year frequency) quantities and costs are for 1 replacement, not annual expenses
All other items are strictly annual quantities and costs

Table 4-5. Resource Requirements - Personnel Required by Job Category

Effort	M & O Direct (wk-yrs)	M & O Maint (wk-yrs)	M & O Hourly Overhead (wk-yrs)	M & O Exempt Overhead (wk-yrs)	Sub-Contract Direct (wk-yrs)	Total (wk-yrs)
North Plateau Cap Maintenance	0.00	0.00	0.06	0.16	0.16	0.38
WMA 7 Cap Maintenance	0.00	0.01	0.09	0.24	0.23	0.57
WMA 8 Cap Maintenance	0.00	0.02	0.32	0.83	0.81	1.98
Erosion Controls Maintenance	0.00	0.04	0.50	1.29	1.27	3.10
NPP PTW Replacement	0.00	0.06	0.75	1.94	1.91	4.66
Annual Environmental Monitoring	2.36	0.07	0.93	2.40	0.00	5.76
Security System Replacement	0.00	0.08	1.01	2.60	2.56	6.25
Annual Security Labor	0.00	0.00	0.00	1.68	4.32	6.00

NPP PTW Replacement (20-year frequency) quantities and costs are for 1 replacement, not annual expenses
Security System Replacement (35-year frequency) quantities and costs are for 1 replacement, not annual expenses
All other items are strictly annual quantities and costs

Table 4-6. Resource Requirements - Personnel Required by Activity

Effort	Preparation and Planning (wk-yrs)	New Construction (wk-yrs)	Operations Decontamination (wk-yrs)	Demolition and Restoration (wk-yrs)	Total (wk-yrs)
North Plateau Cap Maintenance	0.04	0.00	0.00	0.34	0.38
WMA 7 Cap Maintenance	0.07	0.00	0.00	0.50	0.57
WMA 8 Cap Maintenance	0.23	0.00	0.00	1.75	1.98
Erosion Controls Maintenance	0.36	1.47	0.00	1.27	3.10
NPP PTW Replacement	0.54	0.00	0.00	4.12	4.66
Annual Environmental Monitoring	0.66	0.00	5.10	0.00	5.76
Security System Replacement	0.72	5.53	0.00	0.00	6.25
Annual Security Labor	0.00	0.00	6.00	0.00	6.00

NPP PTW Replacement (20-year frequency) quantities and costs are for 1 replacement, not annual expenses
Security System Replacement (35-year frequency) quantities and costs are for 1 replacement, not annual expenses
All other items are strictly annual quantities and costs

Table 4-7. Resource Requirements - Labor Costs Required by Activity (2008 Dollars)

Effort	Preparation and Planning (dollars)	Construction (dollars)	Operation (dollars)	Closure (dollars)	Total (dollars)
North Plateau Cap Maintenance	$7,832	$0	$0	$66,568	$74,400
WMA 7 Cap Maintenance	$13,214	$0	$0	$94,386	$107,600
WMA 8 Cap Maintenance	$43,723	$0	$0	$332,677	$376,400
Erosion Controls Maintenance	$71,013	$289,969	$0	$250,518	$611,500
NPP PTW Replacement	$103,295	$0	$0	$788,105	$891,400
Annual Environmental Monitoring	$0	$0	$1,062,900	$0	$1,062,900
Security System Replacement	$153,600	$1,034,800	$0	$0	$1,188,400
Annual Security Labor	$0	$0	$320,800	$0	$320,800

NPP PTW Replacement (20-year frequency) quantities and costs are for 1 replacement, not annual expenses
Security System Replacement (35-year frequency) quantities and costs are for 1 replacement, not annual expenses
All other items are strictly annual quantities and costs

Table 4-8. Estimated Personnel Injuries and Fatalities

Effort	Total Reportable Cases	Lost Work-Day Cases	Fatalities
North Plateau Cap Maintenance	0.01	0.01	7.03E-06
WMA 7 Cap Maintenance	0.02	0.01	1.04E-05
WMA 8 Cap Maintenance	0.08	0.04	3.66E-05
Erosion Controls Maintenance	0.12	0.06	5.71E-05
NPP PTW Replacement	0.18	0.09	8.60E-05
Annual Environmental Monitoring	0.22	0.11	1.06E-04
Security System Replacement	0.24	0.12	1.15E-04
Annual Security Labor	0.20	0.09	4.65E-05

NPP PTW Replacement (20-year frequency) quantities and costs are for 1 replacement, not annual expenses
Security System Replacement (35-year frequency) quantities and costs are for 1 replacement, not annual expenses
All other items are strictly annual quantities and costs

Table 4-9. Estimated Personnel Radiation Exposure

Effort	Worker-Rem
North Plateau Cap Maintenance	0.01
WMA 7 Cap Maintenance	0.01
WMA 8 Cap Maintenance	0.03
Erosion Controls Maintenance	0.05
NPP PTW Replacement	0.24
Annual Environmental Monitoring	0.09
Security System Replacement	0.16
Annual Security Labor	0.22

NPP PTW Replacement (20-year frequency) quantities and costs are for 1 replacement, not annual expenses
Security System Replacement (35-year frequency) quantities and costs are for 1 replacement, not annual expenses
All other items are strictly annual quantities and costs

Table 4-10. Environmental Nonradiological Flue Gas Releases

Effort	NO_x (tons)	CO (tons)
North Plateau Cap Maintenance	0.005	0.004
WMA 7 Cap Maintenance	0.008	0.006
WMA 8 Cap Maintenance	0.027	0.023
Erosion Controls Maintenance	0.042	0.035
NPP PTW Replacement	0.063	0.053
Annual Environmental Monitoring	0.078	0.066
Security System Replacement	0.085	0.071
Annual Security Labor	0.081	0.068

NPP PTW Replacement (20-year frequency) quantities and costs are for 1 replacement, not annual expenses
Security System Replacement (35-year frequency) quantities and costs are for 1 replacement, not annual expenses
All other items are strictly annual quantities and costs

Table 4-11. Construction Equipment/Operational Releases

Effort	Particulates (tons)	CO (tons)	HCs (tons)	NO_x (tons)
North Plateau Cap Maintenance	4.83E-04	0.011	5.15E-03	0.021
WMA 7 Cap Maintenance	7.16E-04	0.012	8.11E-03	0.028
WMA 8 Cap Maintenance	1.91E-03	0.030	0.021	0.077
Erosion Controls Maintenance	3.13E-03	0.033	0.042	0.129
NPP PTW Replacement	2.15E-03	0.024	0.025	0.099
Annual Environmental Monitoring	1.25E-02	1.179	0.069	0.372
Security System Replacement	1.08E-02	0.933	0.063	0.355
Annual Security Labor	1.57E-04	0.029	0.002	7.91E-04

NPP PTW Replacement (20-year frequency) quantities and costs are for 1 replacement, not annual expenses
Security System Replacement (35-year frequency) quantities and costs are for 1 replacement, not annual expenses
All other items are strictly annual quantities and costs

Table 4-12. Volume of Packaged Waste - Includes Radioactive Waste Disposal at DOE/Commercial Facilities(1)

Effort	Waste Volume (ft³)											
	Commercial		NTS				Unknown	WIPP	Energy Solutions		Commercial	TOTAL(9)
	Construction Demolition Debris(2)	Hazardous(3)	LSA	Class A	Class B	Class C	GTCC(4)	TRU(5)	LSA/A(6)	Mixed(7)	Class B/C(8)	
North Plateau Cap Maintenance	0	0	0	0	0	0	0	0	0	0	0	0
WMA 7 Cap Maintenance	0	0	0	0	0	0	0	0	0	0	0	0
WMA 8 Cap Maintenance	0	0	0	0	0	0	0	0	0	0	0	0
Erosion Controls Maintenance	0	0	0	0	0	0	0	0	0	0	0	0
NPP PTW Replacement	0	0	0	0	0	0	0	0	71,589	0	0	71,589
Annual Environmental Monitoring	0	0	0	206	0	0	0	0	0	0	0	206
Security System Replacement	22,267	0	0	0	0	0	0	0	0	0	0	22,267
Annual Security Labor	0	0	0	0	0	0	0	0	0	0	0	0

(1) Includes CDD and Hazardous waste disposal at permitted commercial CDD and hazardous waste disposal facilities.
(2) Construction Demolition Debris disposed at a regional permitted construction demolition debris landfill.
(3) Hazardous Waste disposed at a regional permitted hazardous waste disposal facility.
(4) Currently no disposal facility available. DOE Yucca Mountain is the assumed disposal location.
(5) Waste Isolation Pilot Plant (WIPP) is the assumed disposal location.
(6) Totals reflect the volumes of LSA and Class A waste sent to Energy Solutions.
(7) All Mixed Waste Disposed of at Energy Solutions.
(8) Totals reflect the volumes of Class B and Class C waste.
(9) Quantities expressed are based on each replacement, not annual expenditure

Table 4-13. Volume of Packaged Waste - Includes Radioactive Waste Disposal at Commercial Facilities

Effort	Waste Volume (ft^3)									
	Commercial		Energy Solutions			Commercial		WIPP	Unknown	TOTAL
	Construction Demolition Debris[(2)]	Hazardous[(3)]	LSA	Class A	Mixed[(4)]	Class B	Class C	TRU[(5)]	GTCC[(6)]	
North Plateau Cap Maintenance	0	0	0	0	0	0	0	0	0	0
WMA 7 Cap Maintenance	0	0	0	0	0	0	0	0	0	0
WMA 8 Cap Maintenance	0	0	0	0	0	0	0	0	0	0
Erosion Controls Maintenance	0	0	0	0	0	0	0	0	0	0
NPP PTW Replacement[(7)]	0	0	71,280	309	0	0	0	0	0	71,589
Annual Environmental Monitoring	0	0	0	206	0	0	0	0	0	206
Security System Replacement	22,267	0	0	0	0	0	0	0	0	22,267
Annual Security Labor	0	0	0	0	0	0	0	0	0	0

Notes:
(1) Includes CDD and Hazardous waste disposal at permitted commercial CDD and hazardous waste disposal facilities.
(2) Construction Demolition Debris disposed at a regional permitted construction demolition debris landfill.
(3) Hazardous Waste disposed at a regional permitted hazardous waste disposal facility.
(4) All Mixed Waste Disposed of at Envirocare.
(5) Waste Isolation Pilot Plant (WIPP) is the assumed disposal location.
(6) Currently no disposal facility available. DOE Yucca Mountain is the assumed disposal location.
(7) Quantities expressed are based on each replacement, not annual expenditure

Table 4-14. Estimated Costs - Includes Radioactive Waste Disposal at DOE/Commercial Facilities (2008 Dollars)

Effort	Total Materials Cost	Total Labor Cost	Total Waste Disposal Cost	Total Contingency Cost	Total Cost
North Plateau Cap Maintenance	$88,000	$74,400	$0	$40,700	$203,100
WMA 7 Cap Maintenance	$105,600	$107,600	$0	$53,400	$266,600
WMA 8 Cap Maintenance	$342,000	$376,400	$0	$179,700	$898,100
Erosion Controls Maintenance	$297,700	$611,500	$0	$227,300	$1,136,500
NPP PTW Replacement(1)	$1,780,400	$891,400	$863,600	$883,900	$4,419,300
Annual Environmental Monitoring	$168,400	$1,062,900	$13,400	$311,300	$1,556,000
Security System Replacement	$342,500	$1,188,400	$208,500	$434,900	$2,174,300
Annual Security Labor	$0	$320,800	$0	$80,200	$401,000

NPP PTW Replacement (20-year frequency) quantities and costs are for 1 replacement, not annual expenses
Security System Replacement (35-year frequency) quantities and costs are for 1 replacement, not annual expenses
All other items are strictly annual quantities and costs

Table 4-15. Estimated Costs - Includes Radioactive Waste Disposal at Commercial Facilities (2008 Dollars)

Effort	Total Materials Cost	Total Labor Cost	Total Waste Disposal Cost	Total Contingency Cost	Total Cost
North Plateau Cap Maintenance	$88,000	$74,400	$0	$40,700	$203,100
WMA 7 Cap Maintenance	$105,600	$107,600	$0	$53,400	$266,600
WMA 8 Cap Maintenance	$342,000	$376,400	$0	$179,700	$898,100
Erosion Controls Maintenance	$297,700	$611,500	$0	$227,300	$1,136,500
NPP PTW Replacement(1)	$1,780,400	$891,400	$863,600	$883,900	$4,419,300
Annual Environmental Monitoring	$168,400	$1,062,900	$13,400	$311,300	$1,556,000
Security System Replacement	$342,500	$1,188,400	$208,500	$434,900	$2,174,300
Annual Security Labor	$0	$320,800	$0	$80,200	$401,000

NPP PTW Replacement (20-year frequency) quantities and costs are for 1 replacement, not annual expenses
Security System Replacement (35-year frequency) quantities and costs are for 1 replacement, not annual expenses
All other items are strictly annual quantities and costs

Sitewide Close-In-Place Alternative Technical Report
WSMS-WV-08-0004
Revision 1, December 2009

Revision Log

- Augment Acronyms and Abbreviations to reflect expanded text supporting WMA 3.
- Minor Revisions to Table 1-1 to update anticipated conditions at the EIS Starting Point.
- Rename all occurrences of "slurry wall" to "barrier wall".
- Added text to Section 2.2.6 to clarify how the WMA 2 Cap will be different from the other caps.
- Removed any references to the Permeable Reactive Barrier.
- Added gravel roads to maps showing the NDA and similar background elements to figure base maps to provide better uniformity with other EIS figures.
- The demolition debris associated with Tanks T-2 and T-3 in WMA 7 will be disposed of as CDD, not LSA as in the previous revision.
- Added a more robust Erosion Control plan to the current version of the TR, to mitigate potential erosion due to headcuts. This plan includes the installation of 3 times the original amount of streambed armor.
- Updated the quantity of piezometers and groundwater monitoring wells listed in Section 2.15 and Section 4.2.1. These updates reflect revisions made to the groundwater monitoring plan.
- Figure 2-39 has been updated to show the changes made in the groundwater monitoring plan.
- Table 3-1 has been updated to show new quantities of Construction Materials.
- Table 3-2 has been updated to show new quantities of Capital Purchases and to eliminate items that are short term use or less than $5,000.
- New sections added – Section 3.4.1 Waste Volume Uncertainties and Section 3.5.1 – Cost Uncertainties added.
- Updated Section 4.0 Tables. All tables now have footnotes indicating that the NPP PTW Replacement is based on each replacement and not annual expenditure.
- Section 3 table footnotes have been updated to say "Over 60 years" instead of "Over 64 years".
- Updated WNYNSC acreage to 3,338 to match other EIS documents.
- Expanded Section 2.1.1 regarding assumptions made in the movement and loading of canisters at the DCSA.
- Added a definition of "appropriate backfill material" and revised "clean material" to "appropriate backfill material" throughout text.
- Added discussion to Section 2.3.1 clarifying the installation and operation of a Tank and Vault Drying system at WMA 3 at the starting point of the EIS.
- Provided additional details in Section 2.7.1 on the sizing and components of the Leachate Treatment Facility support buildings.
- Added discussion of by-pass pumping to Section 2.14.4 in support of the installation of streambed armoring.