Department of Energy
Office of Legacy Management

October 29, 2007

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Dear Mr. Fischer, Mr. Schneider, and Mr. Devault:

SUBJECT: **Transmittal of the Revised Comprehensive Legacy Management and Institutional Controls Plan, Revision 2**

References:
1) Letter, J. Powell to D. Devault, J. Saric, and T. Schneider, "Transmittal of Responses to Comments on Comprehensive Legacy Management and Institutional Controls Plan (LMICP), Revision 1 Change Pages and Additional Change Pages," dated March 29, 2006

2) Letter, J. Powell to D. Devault, J. Saric, and T. Schneider, "Transmittal of Second Round of Responses to Comments on Comprehensive Legacy Management and Institutional Controls Plan (LMICP), Revision 1," dated June 9, 2007

This letter transmits to the U.S. Environmental Protection Agency (EPA) and Ohio Environmental Protection Agency (OEPA) the Final Comprehensive Legacy Management and Institutional Controls Plan (LMICP), Revision 2, January 2008.

The revised LMICP incorporates the response to comments (References 1 and 2), and revisions resulting from the annual review. Updates to the documents (Volume I, Volume II, and Volume II attachments) are identified in the significant changes summary, which is included as an enclosure to this transmittal letter.

DOE would like to meet with each of you to discuss any comments and how they can be resolved in a mutually beneficial manner before formal receipt of any comments.

Upon EPA and OEPA approval, it is anticipated that the LMICP will be final each year by January to correspond with calendar year monitoring and reporting, EPA and OEPA comments will be addressed between October and January.

The summary report and appendices will be available to all stakeholders through the Public Environmental Information Center. The summary report will be made available on the Department of Energy Office of Legacy Management's internet site (http://www.lm.doe.gov) under the Legacy Management Sites icon. The revised LMICP will also be presented at the next LM Quarterly Community Meeting scheduled for December 5, 2007.

As you have any questions regarding this matter, please call me at 513-648-3148.

Sincerely,

Jane Powell

Jane Powell
Fernald Preserve Manager
DOE-LM-20.1

Enclosure

cc w/ enclosures:
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DOE–LM/1526–2008

Fernald Preserve, Fernald, Ohio

Comprehensive Legacy Management and Institutional Controls Plan Volumes I and II

January 2008

DRAFT

U.S. Department of Energy

Office of Legacy Management

Work Performed Under DOE Contract No. DE–AC01–02GJ79491 for the U.S. Department of Energy Office of Legacy Management.
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Comprehensive Legacy Management and Institutional Controls Plan, Revision 2
Significant Changes Summary

Section	Description of Modification	Driver/Technical Information
	Volume I	
Section 1	Added information concerning the implementation of the DOE-LM Environmental Management System to Section 1.2.	Executive Order 13423. DOE Order 450.1, Environmental Protection Program.
Section 2	Updated Section 2.2.3 Current Conditions.	July 2007 response to OEPA comment 1.
	Updated Figure 1 with current flyover picture.	
	Corrected line spacing of indented paragraph.	March 2007 response to OEPA comment 4.
	Updated Figure 2 with current flyover picture.	
	Updated Section 2.4.4 Uncertified Areas to discuss 60-Main Drainage Corridor culvert and adjacent 18-inch culvert.	March 2007 response to OEPA comment 5.
	Corrected reference to Figure 4 on Figure 3.	March 2007 response to OEPA comment 7.
	Inserted Figure 4 - Uncertified Subsurface Utilities.	July 2007 response to OEPA comments 2 and 3.
Section 3	No significant changes.	
Section 4	No significant changes.	
Section 5	Corrected typographical error.	March 2007 response to OEPA comment 8.
	Clarified the information provided.	March 2007 response to OEPA comment 9.
	Updated the LM website address.	March 2007 response to OEPA comment 11.
Section 6	Simplified the funding information provided.	
Appendix A	Removed the Summary Legacy Management Budget Estimate table.	
	Volume II	
Section 1	No significant changes.	
Section 2	Updated Figure 1 with current flyover picture.	March 2007 response to OEPA comment 15 and 16.
	Discussed the Interim Residual Risk Assessment Report.	
	Corrected line spacing of indented paragraph.	March 2007 response to OEPA comment 4.
	Inserted text concerning the inspection of the 60-Main Drainage Corridor culvert and adjacent 18-inch culvert.	March 2007 response to OEPA comment 14.
	Revised the site inspection process.	Inspection approach revised following one year of quarterly inspection experience and following OEPA comment on the March and June 2007 quarterly site inspections.
Section 3	Revise mowing and baling frequency from annually to a 3-year rotation for established cell caps. Updated text to reflect revised inspection process.	Inspection approach revised following one year of quarterly inspection experience and following OEPA comment on the March and June 2007 quarterly site inspections.

Comprehensive Legacy Management and Institutional Controls Plan, Revision 2
Significant Changes Summary

Section	Description of Modification	Driver/Technical Information
Volume II (cont.)		
Section 4	No significant changes.	
Section 5	Added Fernald Community Alliance to Section 5.2.1.	March 2007 response to OEPA comment 20.
	Updated information regarding the status of FRESH.	March 2007 response to OEPA comment 21.
	Added text describing the University of Cincinnati's role in the Visitors Center design.	March 2007 response to OEPA comment 23.
Appendix A	Revised Figure 3-1.	March 2007 response to OEPA comment 24.
	Revised Figure 3-3.	March 2007 response to OEPA comment 25.
Appendix B	No changes.	
Appendix C	Updated Fernald Preserve contact information.	
Appendix D	Revised OSDF Inspection Checklist.	Checklist was developed prior to closure. Revisions are more applicable to current inspection and reporting conditions.
Attachment A - OMMP		
Section 1	Revised 1st paragraph to indicate the OMMP became part of the LMICP in January 2006.	
Section 2	No changes.	
Section 3	Minor text edits, Figure 3-7 updated through 2006.	
Section 4	Section 4.1.1: Revised text to reflect current leachate flow volume.	Flow volume has decreased since last revision.
	Table 4-1: Corrected Ops Well IDs for Waste Pits extraction wells.	
Section 5	Section 5.2.1: Updated to reflect current ion exchange resin changeout practice.	Previous resin changeout practice no longer appropriate given the plant's excess treatment capacity.
	Section 5.7: Updated to reflect current practice of reviewing sample results.	
Section 6	Section 6.2.3.1: Updated to reflect current maintenance tracking method.	Previous tracking method was no longer cost effective.
	Section 6.3: Updated based on current information.	
	Section 6.3.2: Updated to reflect current information.	
Section 7	Updated to reflect the Site's current organizational responsibilities.	
Attachment B - PCCIP		
Section 1	Incorporate PCCIP into the LMICP. It will no longer be referred to as a stand alone document.	Not required to be a stand-alone plan.
Section 2	No significant changes.	
Section 3	No significant changes.	
Section 4	No significant changes.	
Section 5	No significant changes.	
Section 6	No significant changes.	
Section 7	No significant changes.	

Comprehensive Legacy Management and Institutional Controls Plan, Revision 2
Significant Changes Summary

Section	Description of Modification	Driver/Technical Information
	Attachment B - PCCIP (cont.)	
Section 8	Revise mowing and baling frequency from annually to a 3-year rotation for established cell caps. Updated text to reflect revised inspection process.	Revised mowing approach more accurately mimics a prescribed burn rotation.
Section 9	No significant changes.	
Section 10	No significant changes.	
Section 11	Deleted modification process.	Modifications will be conducted through LMICP review.
Section 12	No significant changes.	
	Attachment C - GWLMP	
Section 1	No significant changes.	
Section 2	No significant changes.	
Section 3	Temporary exclusion of control charts from SER reports.	Letter to EPA/OEPA dated April 19, 2007, "Exclusion of the Control charts for the Onsite Disposal Facility Leak Detection Program from the 2006 Site Environmental Report. OEPA concurrence, letter dated May 21, 2007.
	Proposal: End annual Appendix I and PCB sampling at LCS, pending EPA/OEPA approval of the Common Ion Study and finalization of a refined baseline.	OSDF is not operating, Common Ion Study is ending, refined baseline will be finalized soon.
Section 4	No significant changes.	
Section 5	No significant changes.	
Section 6	No significant changes.	
Appendix A	No changes.	
Appendix B	Cessation of sampling for common ions.	Eight round of sampling were required, which were met at the end of 2007.
	Proposal: Reduce sampling frequency for LCS, LDS, HTW, and GMA Wells from quarterly to semi annual beginning Jan 1, 2008.	Sufficient samples have been collected to support the Common Ion Study.
	Sampling for 1,1-dichloroethene in Cell 3 LCS will continue until results have been further evaluated using new method proposed in 2006 SER. Sampling of 1,1-dichloroethene in Cell 3 LDS has stopped.	Based on sampling results reported in 2006 SER.
	Revised requirements for filtering of groundwater samples.	Review of historical data indicated no significant concentration difference between filtered and unfiltered sample results.
	Eliminated the collection of field blanks.	Not required by the LM QAPP.

Comprehensive Legacy Management and Institutional Controls Plan, Revision 2
Significant Changes Summary

Section	Description of Modification	Driver/Technical Information
Attachment C - GWLMP (cont)		
Appendix C	No significant changes.	
Appendix D	Section 2.0: Updated to reflect current system operation.	Facility closure in 2006.
	Section 3.0 & Table 1: Updated to reflect current inspection and maintenance activities that have changed since the facility was closed in 2006. The most significant change is that the annual LCS/LDS line camera inspection will no longer be done as the regulation requiring the inspection is no longer applicable, since the facility closed in 2006.	Facility closure in 2006.
	Section 5.0: Cell specific leachate flow rates and associated days to accumulate the volume that equals 1 foot of head on primary liner were updated to reflect current conditions.	Leachate flow rates have decreased since the last LMICP revision.
Appendix E	Included two new figures presenting a strategy for statistical evaluation of sampling results.	Figures and new strategy presented in 2006 SER.
Attachment D - IEMP		
Section 1	Incorporate IEMP into the LMICP. It will no longer be referred to as a stand alone document.	Not required to be a stand-alone plan.
Section 2	No significant changes.	
Section 3	Replaced 10-year time of travel footprint with Waste Storage Area (Phase II) Remediation footprint.	Current aquifer remedy system design based on the Waste Storage Area (Phase II) Design.
	Removed Direct Push Locations 12367 and 12371 from annual direct-push sampling program.	Locations are no longer located in the 30 ug/L total U plume.
	Field filter samples from Waste Storage Area Monitoring Well 2010.	Monitoring well has a historical record of being biofouled.
	Updated tense of text throughout section to reflect post closure status.	Site is currently in post closure.
Section 4	Added 5 additional surface water sampling locations. Updated Figure 4-2 to include the 5 locations.	July 2007 response to OEPA comment 4.
	Proposal: Remove radionuclides from sampling for IEMP characterization requirements.	Review of historical data indicated these constituents' concentrations have always been well below the FRL.
	For low level mercury analysis, all sampling equipment is sent to an offsite laboratory for decontamination and certification of cleanliness.	To clarify and align the IEMP with the analytical method requirements.
Section 5	No significant changes.	
Section 6	Update list of regulatory drivers to those that are applicable post-closure.	
Section 7	No significant changes.	
Appendix A	Replaced 10-year time of travel footprint with Waste Storage Area (Phase II) Remediation footprint.	Current aquifer remedy system design based on the Waste Storage Area (Phase II) Design.
	Updated tense of text throughout section to reflect post closure status.	Site is currently in post closure.

Comprehensive Legacy Management and Institutional Controls Plan, Revision 2
Significant Changes Summary

Section	Description of Modification	Driver/Technical Information
Attachment D - IEMP (cont.)		
Appendix B	No changes.	
Appendix C	No significant changes.	
Appendix D	Added one year of wetland mitigation monitoring to the A-6PI wetlands.	Extended monitoring due to drought conditions experienced in 2007.
Attachment D.1	Deleted Attachment D.1, Sloan's Crayfish Management Plan.	Plan is no longer anticipated to be needed, since remedial activities are complete.
Attachment E - CIP		
NA	Updated Section 4.2 - Interested Community Members, Local, City, and State Elected Officials.	March 2007 response to OEPA comment 37.
NA	Updated CIP Appendix A with the most current information.	March 2007 response to OEPA comment 38.

DOE–LM/1526-2008

Comprehensive Legacy Management and Institutional Controls Plan

Volumes I and II

Fernald Preserve
Fernald, Ohio

January 2008

VOLUME I
Legacy Management Plan

Volume I

Legacy Management Plan

January 2008

U.S. Department of Energy

Revision 2
Draft

Emergency Contact

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Table

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Acronyms and Abbreviations

AEC	Atomic Energy Commission
AR	Administrative Record
CAWWT	converted advanced waste water treatment facility
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CIP	Community Involvement Plan
DOE	U.S. Department of Energy
DOE-LM	U.S. Department of Energy Office of Legacy Management
EMS	Environmental Management System
EPA	Environmental Protection Agency
FCP	Fernald Closure Project
ft	feet/foot
FFCA	Federal Facilities Compliance Agreement
FIU	Florida International University
FMPC	Feed Materials Production Center
FRL	final remediation level
IC Plan	Institutional Controls Plan
IEMP	Integrated Environmental Monitoring Plan
LCS	leachate collection system
LDS	leak detection system
LMICP	Comprehensive Legacy Management and Institutional Controls Plan
NARA	National Archives and Records Administration
OEPA	Ohio Environmental Protection Agency
OMMP	Operations and Maintenance Master Plan
OSDF	on-site disposal facility
PCCIP	Post-Closure Care and Inspection Plan
PDF	portable document file
ppb	parts per billion
RCRA	Resource Conservation and Recovery Act
RI/FS	remedial investigation/feasibility study
ROD	record of decision
SEP	Site-Wide Excavation Plan
UF4	uranium tetrafluoride
UNH	uranyl nitrate hexahydrate
UO3	uranium trioxide
WAC	waste acceptance criteria

End of current text

Executive Summary

This Comprehensive Legacy Management and Institutional Controls Plan (LMICP) was developed to document the planning process and the requirements for the long-term care, or legacy management, of the Fernald Preserve. The LMICP became effective when the Department of Energy (DOE) Office of Environmental Management made its determination of reasonableness on Fluor Fernald Inc.'s declaration of physical completion. It serves the same function as the Long-Term Surveillance and Maintenance Plan used at other DOE Legacy Management sites. The LMICP is a two-volume document with supporting documents included as attachments to Volume II. Volume I provides the planning details for the management of the Fernald Preserve that go beyond those identified as institutional controls in Volume II. Primarily, Volume II is a requirement of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), providing institutional controls that will ensure the cleanup remedies implemented at the Fernald Preserve will protect human health and the environment. The format and content of Volume II follows U.S. Environmental Protection Agency (EPA) requirements for institutional controls. Volume II is enforceable under CERCLA authority.

Volume I is the Legacy Management Plan. This plan is not a required document under the CERCLA process; it is not a legally enforceable document. It provides the DOE Office of Legacy Management's (DOE-LM's) management plan for maintaining the Fernald Preserve and fulfilling DOE's commitment to maintain the Fernald Preserve following closure. The plan discusses how DOE, specifically DOE-LM, will approach the legacy management of the Fernald Preserve. It describes the surveillance and maintenance of the entire site, including the on-site disposal facility (OSDF). It explains how the public will continue to participate in the future of the Fernald Preserve. Also included in the Legacy Management Plan is a discussion of records and information management. The plan ends with a discussion of funding for legacy management of the site.

Volume II is the Institutional Controls Plan (IC Plan). The IC Plan is required under the CERCLA remediation process when a physical remedy does not allow for full, unrestricted use or when hazardous materials are left on site. The plan is a legally enforceable CERCLA document and part of the remedy for the site (an EPA requirement). The plan outlines the institutional controls that are established for and enforced across the entire site, including the OSDF, to ensure that human health and the environment continue to be protected following the completion of the remedy. The IC Plan has five attachments that lend support to and provide details regarding the established institutional controls. The attachments provide further information on the continuing groundwater remediation (pump-and-treat) system (Attachment A); the OSDF cap and cover system (Attachment B); the leak detection and leachate management systems for the OSDF (Attachment C); and the environmental monitoring that will continue following closure (Attachment D). Prior to transition, these four attachments were stand-alone documents with their own review and revision cycle. These documents have since been incorporated into the LMICP and will follow the review and revision cycle identified below. Also attached to Volume II is the Community Involvement Plan (CIP) (Attachment E), a CERCLA-required document, developed by DOE. The CIP explains in detail how DOE will ensure that the public has appropriate opportunities for involvement in post-closure activities.

Upon approval, it is anticipated that the LMICP will be finalized by January each year, to correspond with calendar-year monitoring and reporting. Between October and January, EPA and Ohio Environmental Protection Agency comments will be addressed.

The future LMICP schedule will be as follows:

- Each June, the annual site environmental report will be submitted. It will make recommendations based on the previous year's monitoring information.
- Each October, an annual review of the LMICP will be submitted. It will identify updates as necessary.
- Each January, the LMICP will be finalized to correspond with the monitoring and reporting schedule.

Pertinent information associated with the CERCLA 5-year reviews will be included in the LMICP revisions as needed.

1.0 Introduction

Legacy management is required at the Fernald Preserve to ensure that the remedial actions implemented at the site continue to be effective and protective of human health and the environment following site closure. This Comprehensive Legacy Management and Institutional Controls Plan (LMICP) outlines the Department of Energy's (DOE's) approach to, and documents the requirements for, the long-term care of the Fernald Preserve. The LMICP serves the same function as the Long-Term Surveillance and Maintenance Plan used at other DOE sites. It is DOE's intent to continue to review and refine the LMICP, with the involvement of community and regulators, to ensure that legacy management activities meet stakeholder and regulatory requirements. All revisions will be subject to Regulatory Agency review and will be made available to the community. Revisions can always be made on an as-needed basis, if the results of site and on-site disposal facility (OSDF) inspections and monitoring require them. The term "legacy management" is used throughout this LMICP and is intended to encompass all activities defined as such in DOE policy and guidance. Legacy management activities were formerly referred to as "stewardship" activities, a term that this LMICP uses interchangeably.

The DOE Office of Legacy Management (DOE-LM) is responsible for ensuring that DOE's post-closure responsibilities are met and for providing DOE programs for long-term surveillance and maintenance, records management, workforce-restructuring and benefits continuity, property management, land-use planning, and community assistance. Additional information regarding DOE-LM can be found at http://www.lm.doe.gov.

DOE policy and guidance clearly identify protectiveness of the remedies carried out at the Fernald Preserve (e.g., groundwater, OSDF, institutional controls) as the top priority for legacy management. Specifically, the OSDF requires regular monitoring and maintenance to ensure its integrity and performance. The restored areas of the site also require monitoring to ensure that applicable laws and regulations are followed. Departmental policy and funding priorities regarding legacy management emphasize supporting the remedies as described in Fernald's records of decision (RODs).

1.1 Purpose and Organization of the LMICP

The LMICP provides an overview of the defined end-state maintenance and monitoring requirements as well as the contingencies that are in place to address any changes made to the end state.

The Fernald LMICP has been developed as a two-volume set. This volume—the first—is the Legacy Management Plan, which outlines DOE's approach to legacy management, including such issues as community involvement, records management, and funding. The second volume, the Institutional Controls Plan (IC Plan), outlines the specific surveillance and maintenance requirements for the Fernald Preserve.

There are five support plans included in the LMICP as attachments:

- Attachment A—Operations and Maintenance Master Plan for Aquifer Restoration and Wastewater Treatment (OMMP)

- Attachment B—Post-Closure Care and Inspection Plan (PCCIP)
- Attachment C—Groundwater/Leak Detection and Leachate Monitoring Plan
- Attachment D—Integrated Environmental Monitoring Plan (IEMP)
- Attachment E—Community Involvement Plan (CIP)

These support plans outline the operational requirements associated with the ongoing groundwater remedy (Attachment A); the surveillance and maintenance requirements for the OSDF (Attachment B); surveillance and maintenance for the leachate and groundwater associated with the OSDF (Attachment C); the environmental monitoring requirements necessary to ensure the completion and effectiveness of the remedies (Attachment D); and how DOE will continue to stay in communication with and involve the public in legacy management activities at the Fernald Preserve (Attachment E).

DOE is required to conduct legacy management activities at facilities that have achieved completion of site remediation (refer to Section 1.2). The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) requires that institutional controls be part of selected remedies where land-use restrictions are placed on the property. The Fernald Preserve remedies include use restriction, an undeveloped park, waste disposal (the OSDF), and continuing groundwater extraction and treatment. DOE has followed U.S. Environmental Protection Agency (EPA) guidance on institutional controls (refer to Section 1.2). Existing laws, regulations, policies, and directives provide broad requirements for DOE to conduct legacy management activities. These activities include monitoring, reporting, record keeping, and long-term surveillance and maintenance for various facilities and media, including engineered waste disposal units, surface water, and groundwater.

Taking into consideration the future use plans for the Fernald Preserve, the scope of legacy management activities can be divided into three categories: (1) the operation and maintenance of the remedies, (2) surveillance and maintenance in restored areas (areas outside of the OSDF), and (3) public involvement. Legacy management activities related to the maintenance of the remedies include monitoring and maintaining the OSDF, the converted advanced wastewater treatment facility (CAWWT) and supporting infrastructure, the extraction wells and associated piping, and the active outfall line to the Great Miami River. The decontamination and dismantling of the aquifer remediation infrastructure (CAWWT, well system, etc.) is also included in legacy management activities.

The PCCIP (Attachment B) includes detailed information about the OSDF, and the OMMP includes detailed information about the monitoring and maintenance of the CAWWT, groundwater restoration systems, and the active outfall line. Legacy management activities, covering both categories, also include ensuring that remedy-driven restrictions on access to and use of the Fernald Preserve are enforced (for example, records management and education). Surveillance and maintenance in restored areas will focus on protecting natural and cultural resources in accordance with applicable laws and regulations. Legacy management activities related to public involvement include ongoing communication with the public regarding the continuing groundwater remediation, legacy management activities, and the future of the Fernald Preserve. Emphasis will also be placed on educating the public regarding the site's former production activities, its remediation, and its land-use restrictions. Displays and programs at the Visitors Center and outreach programs at local schools and organizations will help DOE-LM meet this objective.

This Legacy Management Plan (Volume I) is organized into the following sections. It describes planned legacy management activities at the Fernald Preserve as well as issues related to stewardship.

Section 1.0 (Introduction)—Provides an introduction to this plan and discusses the purpose and necessity of legacy management at DOE facilities.

Section 2.0 (Site Background)—Provides the history of the Fernald Preserve, beginning with the site's construction in the 1950s. A discussion of production activities, remediation, and the conditions at the time of closure is also presented.

Section 3.0 (Scope of Legacy Management at the Fernald Preserve)—Discusses the scope of legacy management at the Fernald Preserve, including the management of site property, legacy management of the OSDF, and surveillance and maintenance of restored areas.

Section 4.0 (Oversight of Legacy Management at the Fernald Preserve)—Describes the breakdown of responsibilities for legacy management activities at the Fernald Preserve, including DOE-LM, contractors, regulators, the CERCLA 5-year review, and reporting requirements.

Section 5.0 (Records Management)—Describes the importance of records management and preservation and how they are applicable to legacy management. This section also describes various avenues for records management during legacy management.

Section 6.0 (Funding)—Discusses the funding needed to implement and sustain a legacy management program at the Fernald Preserve.

1.2 Purpose of Legacy Management

In recent years, DOE has increased focus on the need for legacy management following completion of remediation activities. DOE orders and policies that provide the framework for legacy management include the documents listed below. The term "stewardship" is used in the following descriptions. When these documents were prepared, the term "stewardship" was used instead of "legacy management." As stated above, both terms are used in this Legacy Management Plan and refer to the same process.

- DOE Policy P 454.1, *Use of Institutional Controls* (DOE 2005a), establishes a consistent framework for the use of institutional controls throughout the DOE complex.
- DOE Order 450.1, *Environmental Protection Program* (DOE 2005b), requires the implementation of sound stewardship practices that are protective of the air, the land, water, and other natural and cultural resources affected by DOE operations.
- DOE Order 200.1, *Information Management Program* (DOE 1996a), provides a framework for managing information, information resources, and information technology investment.
- DOE Order 430.1, *Life Cycle Asset Management* (DOE 1995a), and DOE Order 4320.1B, *Site Development Planning* (DOE 1992a), identify the analyses that must be conducted in

order to determine whether a particular portion of DOE real property is considered to be excess and available for transfer to another entity.

- DOE Order 435.1, *Radioactive Waste Management* (DOE 2001a), requires DOE radioactive waste management activities to be systematically planned, documented, executed, and evaluated in a manner that protects workers and the public as well as the environment.
- DOE Order 1230.2, *American Indian Tribal Government Policy* (DOE 1992b), requires DOE sites to consult with potentially affected tribes concerning the effects of proposed DOE actions (including real property transfers), and to avoid unnecessary interference with traditional religious practices.
- DOE Order 5400.5, *Radiation Protection of the Public and the Environment* (DOE 2003), establishes acceptable levels for the release of property on which any radioactive substances or residual radioactive material was present.
- The Secretary of Energy's Land and Facility Use Policy (DOE 1994) and DOE Policy 430.1, *Land and Facility Use Planning Policy* (DOE 1996b), state that DOE sites must consider how best to use DOE land and facilities to support critical missions and to stimulate the economy while preserving natural resources, diverse ecosystems, and cultural resources.
- Executive Order 13423, "Strengthening Federal Environmental, Energy, and Transportation Management" (George W. Bush, January 24, 2007), establishes goals in the areas of energy efficiency, acquisition, renewable energy, toxics reduction, recycling, renewable energy, sustainable buildings, electronics stewardship, fleets, and water conservation.

Below are other documents and reports that address legacy management issues across the DOE complex and help to better define the activities that may be required for legacy management purposes. (As mentioned previously, the term "stewardship," instead of "legacy management," is used in the descriptions.)

- *From Cleanup to Stewardship* (DOE 1999a) addresses the nature of long-term stewardship at DOE sites, anticipated long-term stewardship at DOE sites, and planning for long-term stewardship.
- *A Report to Congress on Long-Term Stewardship* (DOE 2001b), required by the fiscal year 2000 National Defense Authorization Act, represents the most comprehensive compilation of DOE's expected long-term stewardship obligations to date, and it provides summary information for site-specific, long-term stewardship scopes, costs, and schedules. The report provides a snapshot of DOE's current understanding of stewardship activities and highlights areas where significant uncertainties still remain.
- *Managing Data for Long-Term Stewardship* (ICF 1998) represents a preliminary assessment of how successfully information about the hazards that remain at DOE sites will be preserved and made accessible for the duration of long-term stewardship.
- *Long-Term Stewardship Study* (DOE 2000a) describes and analyzes several significant national or crosscutting issues associated with long-term stewardship and, where possible, options for addressing these issues. The principal purposes are to promote the exchange of

information and to provide information on the decision-making processes at the national level and at individual sites.

- *The Long-Term Control of Property: Overview of Requirements in Orders DOE 5400.1 and DOE 5400.5* (DOE 1999b) summarizes DOE requirements for radiation protection of the public and environment, with the intent of assisting DOE elements in planning and implementing programs for the long-term control (or, stewardship) of property.
- The Memorandum, "Long-Term Stewardship Guiding Principles" (DOE 2000b) identifies broad concepts pertaining to stewardship and elements that Ohio stakeholders identified as critical to the success of stewardship planning.
- *Institutional Controls in RCRA and CERCLA Response Actions at Department of Energy Facilities* (DOE 2000c) provides DOE environmental restoration project managers with the information on institutional controls that they need to make environmental restoration remedy decisions under the Resource Conservation and Recovery Act (RCRA) and CERCLA.
- *Institutional Controls: A Site Manager's Guide to Identifying, Evaluating and Selecting Institutional Controls at Superfund and RCRA Corrective Action Cleanups* (EPA 2000) provides an overview of the types of institutional controls that are commonly available, including their relative strengths and weaknesses. It also provides a discussion of the key factors to consider when evaluating and selecting institutional controls in Superfund and RCRA corrective-action cleanups.

The applicable laws and regulations provide a foundation for legacy management practices, but each site is different. Each facility will have to work in conjunction with those laws and regulations, using them as guidelines, to develop suitable legacy management plans. Part of the legacy management planning at the Fernald Preserve included a study, conducted by Florida International University (FIU), that resulted in the creation of a database of state and federal laws, regulations, orders, and the like that pertain to legacy management. The database includes titles and summaries of the requirements, including a discussion of their applicability to the Fernald Preserve. A summary report describes the project and the development of the database (FIU 2002).

DOE guidance identifies why it was necessary to address legacy management before the completion of remediation and site closure (DOE 1999a):

- To provide a smooth transition from cleanup to legacy management.
- To emphasize that, in many cases, the cleanup goal was to reduce and control, not eliminate, risk and cost.
- To ensure that Congress, the community, and regulators had a clear understanding of the cleanup mission and to clarify that there was an endpoint.
- To set realistic expectations and show interim successes and results as remediation progressed.
- To identify technology research and development needs.
- To assure regulators and the public that DOE would not walk away from its post-remediation obligations.

DOE defines stewardship as "all activities required to protect human health and the environment from hazards remaining after remediation is completed" (DOE 1999a). Three categories, or levels, of stewardship are recognized: "active," "passive," and "no stewardship required." Active stewardship is defined as "the direct performance of continuous or periodic custodial activities such as controlling access to the site; preventing releases from a site; performing maintenance operations; or monitoring performance parameters." Passive stewardship is defined as "the long-term responsibility to convey information warning about the hazards at a site or limiting access to, or use of, a site through physical or legal mechanisms." No stewardship is required "where cleanup has been completed to levels that will allow for unrestricted or residential future use" (DOE 1999a). The Fernald Preserve will have a combination of active and passive measures during the legacy management of the site. This plan describes both active and passive measures, ranging from regular monitoring and maintenance to land use restrictions and postings.

The implementation of the DOE-LM Environmental Management System (EMS) will ensure that sound stewardship practices protective of the air, the land, water, and other natural and cultural resources potentially affected by operations are employed throughout the project. EMS is a systematic process for reducing the environmental impacts that result from DOE-LM and contractor work activities, products, and services and for directing work to occur in a manner that protects workers, the public, and the environment. The process adheres to "Plan-Do-Check-Act" principles, mandates environmental compliance, and integrates green initiatives into all phases of work, including scoping, planning, construction, subcontracts, and operations. Proposed site maintenance activities will be assessed for opportunities to improve environmental performance and sustainable environmental practices. Some areas for consideration include reusing and recycling products or wastes, using environmentally preferable products (i.e., products with recycled content, such as office furniture, concrete, asphalt; products with reduced toxicity; and energy-efficient products), using alternative fuels, using renewable energy, and making environmental habitat improvements.

Considering the input of regulators and the public throughout the legacy management process and granting the public access to site information during legacy management are also fundamental components of the long-term care of the Fernald Preserve. Public involvement and access to information during legacy management are emphasized in all DOE policy and guidance, and this Legacy Management Plan is intended to clearly outline DOE's commitment to those aspects of legacy management.

1.3 Approach to Legacy Management at the Fernald Preserve

At the Fernald Preserve, completing remediation to levels acceptable for unrestricted use was not feasible. As a result, legacy management is necessary to ensure that all remedial efforts continue to be effective and protective of human health and the environment. The OSDF was constructed to contain waste materials that will remain on the Fernald Preserve. This facility must be monitored and maintained to ensure its integrity and the public's safety.

1.3.1 Inspections per IC Plan Requirements

Site inspections include inspections of the OSDF cap, the leachate collection system (LCS) and the leak detection system (LDS), the CAWWT, extraction wells and associated piping, the active outfall line, and restored areas of the site. Inspections can be scheduled or unscheduled as needed. These inspections are further defined in the IC Plan.

1.3.2 Increase Monitoring as Needed

DOE-LM has the option of increasing monitoring at any time, as needed. However, any proposed decrease in the frequency of monitoring activities included in the IC Plan will require approval by EPA.

1.3.3 DOE Management of the Legacy Management Program

The mission of the DOE-LM program includes (1) providing sustained human and environmental protection through the mitigation of residual risks and (2) protecting natural and cultural resources at DOE facilities. DOE-LM provides overall departmental policy, direction, and program guidance on matters affecting legacy management.

End of current text

2.0 Site Background

2.1 Site Description

2.1.1 Fernald Preserve Description

The Fernald Preserve is situated on a 1,050-acre tract of land, approximately 18 miles northwest of Cincinnati, Ohio. The Fernald Preserve is located near the unincorporated communities of Ross, Fernald, Shandon, New Haven, and New Baltimore (Figure 1). The former production area occupies approximately 136 acres in the center of the site. The former waste pit area and the former silos area were located adjacent to the western edge of the production area. Paddys Run flows from north to south along the Fernald Preserve's western boundary and empties into the Great Miami River approximately 1.5 miles south of the site. The Fernald Preserve lies on a terrace that slopes gently between vegetated bedrock outcroppings to the north, southeast, and southwest. The site is situated on a layer of glacial overburden, consisting primarily of clay and silt with minor amounts of sand and gravel, that overlies the Great Miami Aquifer. Paddys Run and the Storm Sewer Outfall Ditch, which empties into Paddys Run, have eroded the glacial overburden, exposing the sand and gravel that make up the Great Miami Aquifer.

2.1.2 Fernald Preserve and Surrounding Area

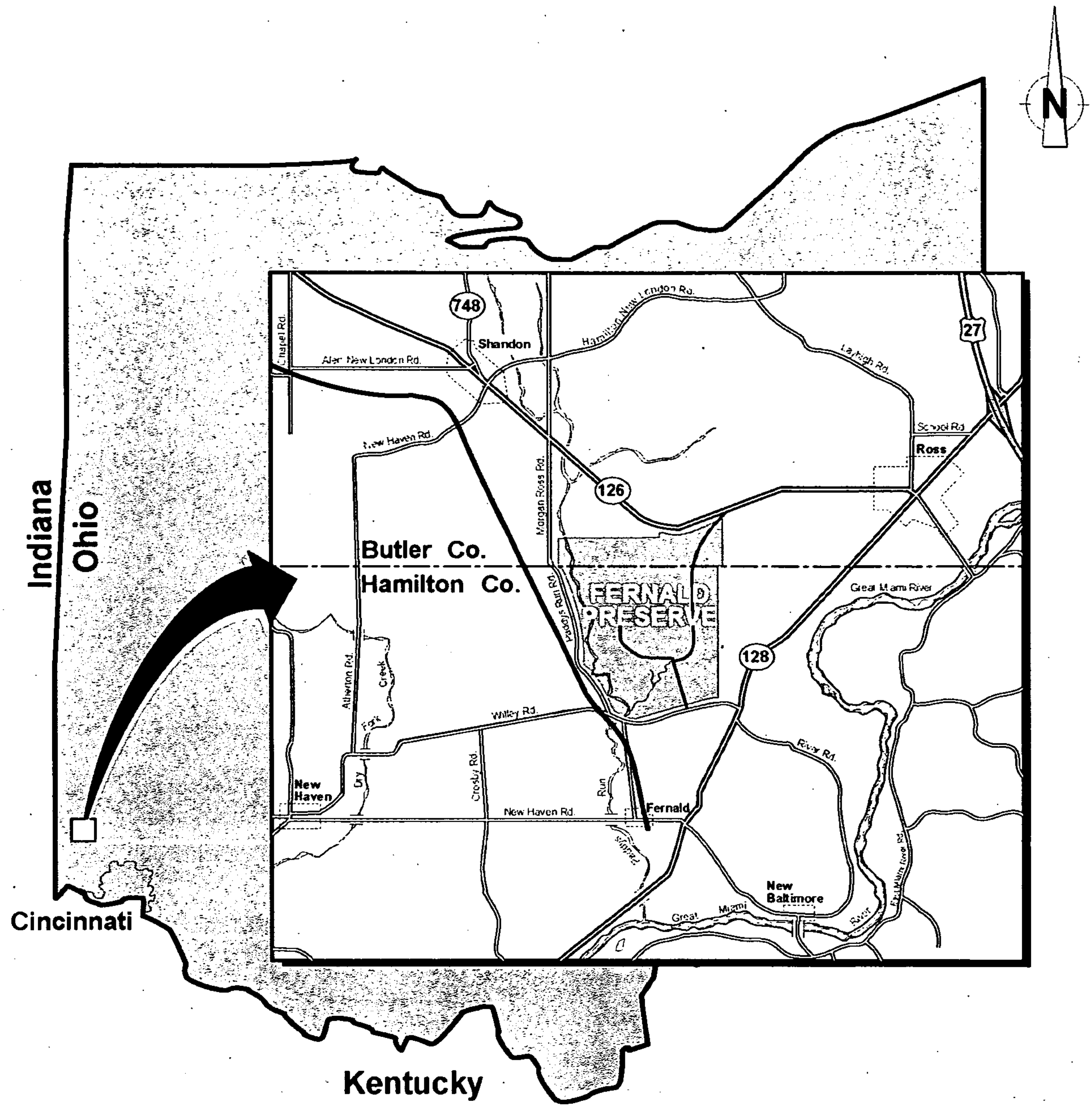
In the vicinity of the Fernald Preserve are the communities of Shandon (northwest), Ross (northeast), New Baltimore (southeast), Fernald (south), and New Haven (southwest) (Figure 1). Land use in the area consists primarily of residential use, farming, and gravel excavation operations. Some land in the vicinity of the Fernald Preserve is dedicated to housing development, light industry, and park land. The Great Miami River is located to the east, and like Paddys Run and the Storm Sewer Outfall Ditch, it has eroded away significant portions of the glacial overburden, exposing the sand and gravel that make up the Great Miami Aquifer.

2.2 Site History

2.2.1 Feed Materials Production Center

The Feed Materials Production Center (FMPC) was the original name given to what is now the Fernald Preserve. The Atomic Energy Commission (AEC) constructed the FMPC in the early 1950s for the purpose of producing high-purity uranium metal from ores and process residues for use at other government facilities involved in the production of nuclear weapons for the nation's defense.

A variety of materials were utilized throughout the production process, including ore concentrates and recycle materials that were dissolved in nitric acid to produce a uranyl nitrate hexahydrate (UNH) feed solution. The UNH was then concentrated and thermally denitrated to uranium trioxide (UO3), or orange oxide. The orange oxide was either shipped to the gaseous diffusion plant in Paducah, Kentucky, or was converted to uranium tetrafluoride (UF4), or green salt. The green salt was blended with magnesium-metal granules and placed in a closed reduction pot to produce a mass of uranium metal called a derby. Some derbies were shipped to other facilities, but the remainder were melted and poured into preheated graphite molds to form ingots.



The Fernald site covers about 1,050 acres (425 hectares).

Figure 1. Fernald and Vicinity

Some ingots were rolled or extruded to form billets. Small amounts of thorium were also produced at the site from 1954 to 1975. The site then served as a thorium repository for DOE. Two reports that explain in greater detail the role of the Fernald Preserve within the DOE complex and the processes that took place at the Fernald Preserve are *Historical Documentation of the Fernald Site and Its Role within the U.S. Department of Energy Weapons Complex* (DOE 1998a), and *Historical Documentation of Facilities and Structures at the Fernald Site* (DOE 1998b).

High-purity uranium metal was produced at the site from 1952 through 1989. During that time, more than 500 million pounds of uranium metal products were shipped from Fernald to other sites. During these production operations, uranium was released into the environment, resulting in the contamination of soil, surface water, sediment, and groundwater on and around the site.

2.2.2 Change in Site Mission from Production to Remediation

In July 1986, DOE and EPA signed a Federal Facilities Compliance Agreement (FFCA), addressing impacts to the environment that were associated with the site. DOE agreed to conduct the FFCA investigation as a remedial investigation/feasibility study (RI/FS) in accordance with CERCLA guidelines. In 1989, production ceased at the FMPC due to a decrease in the demand for the feed materials and an increase in environmental restoration efforts. The site was subsequently included on the EPA National Priorities List. In 1991, the site was renamed the Fernald Environmental Management Project, and it was officially closed as a production facility. DOE's management of the site switched from the Defense Programs division to the Environmental Restoration and Waste Management division. The National Lead Company of Ohio operated the site during most of the production years under contracts with AEC and DOE. The Westinghouse Environmental Management Company became the site's prime contractor in 1986. In 1992, after the conversion of the site's mission to environmental cleanup, DOE awarded an Environmental Restoration Management Contract to the Fernald Environmental Restoration Management Corporation, which later became known as Fluor Fernald Inc. DOE awarded a new contract to Fluor Fernald Inc. in November 2000 to complete the facility's remediation. In 2003, DOE changed the site name to the Fernald Closure Project (FCP). The site-wide remediation effort was conducted pursuant to CERCLA. Waste management was conducted according to RCRA.

2.2.3 Current Conditions

The Declaration of Physical Completion occurred on October 29, 2006. All contaminated soils have been excavated and certified to meet final remediation levels (with the exception of certain areas associated with utility corridors and groundwater infrastructure discussed in Section 2.4.4); the OSDF is complete; all required groundwater infrastructure is installed, operational, and secured; and restoration activities have been completed within all excavated areas, including achieving final grade and completing the necessary plantings. The *Certification Report for Area 6 Waste Pits 1, 2, and 3, the Burn Pit, the Clearwell, and the Areas West and North of the Waste Pits* (DOE 2006a) is awaiting agency approval. The areas associated with this certification report will be considered uncertified until the report is approved.

Upon EPA and Ohio Environmental Protection Agency (OEPA) approval, it is anticipated that the LMICP will be finalized by January each year to correspond with calendar-year monitoring and reporting. Comments from EPA, OEPA, and the community will be addressed between October and January.

The future LMICP schedule will be as follows:

- Each June, the annual site environmental reports will be submitted and will include recommendations based on the previous year's monitoring information.
- Each October, an annual review of the LMICP will take place, and updates will be identified as necessary.
- Each January, the revised LMICP will be submitted to correspond with the monitoring and reporting schedule.

Pertinent information associated with the CERCLA 5-year reviews will be included in the LMICP revisions as needed.

2.3 Remediation Process

2.3.1 Summary of Remediation Efforts

CERCLA is the primary driver for the environmental remediation of the Fernald Preserve. The site was divided into five operable units (OUs) as follows:

- OU1—Waste Pits Area
- OU2—Other Waste Units
- OU3—Production Area
- OU4—Silos 1 through 4
- OU5—Environmental Media

An RI/FS was conducted for each of the five OUs listed above. Based on the results of the RI/FS, RODs outlining the selected remedy for each OU were issued. A summary of the remedies follows.

The remedy for OU1 included removing all material from the waste pits, stabilizing the material by drying it, and shipping it off site for disposal. This process was completed in summer 2005.

The remedy for OU2 included removing material from the various units, disposing of material that met the on-site waste acceptance criteria (WAC) in the OSDF, and shipping all other material off site for disposal. DOE and regulators, in consultation with the community, developed the WAC to strictly control the type of waste disposed of on site.

The OU3 remedy included decontaminating and decommissioning all contaminated structures and buildings, recycling waste materials if possible, disposing of material that met the on-site WAC in the OSDF, and shipping all other material off site for disposal.

The OU4 remedy included removing and treating all material from the silos, dismantling the silos, and shipping the waste materials and silo debris off site for disposal.

OU5 includes all environmental media, such as soil, sediment, surface water, groundwater, and vegetation. *The Site-wide Excavation Plan* (SEP) (DOE 1998d) describes the remediation of soils. First, material exceeding the WAC for the OSDF was disposed of by one of the following methods: (1) transporting material to an off-site disposal facility for treatment and disposal, (2) treating material on site and transporting it to an off-site disposal facility, or (3) treating material on site and disposing of it in the OSDF. Details and exceptions for the methods listed above are outlined in the SEP.

Soils and sediments that exceeded final remediation levels (FRLs), which are defined in the SEP, but were below the OSDF WAC were excavated and placed in the OSDF. Soil certification processes were performed to ensure that excavation has removed all impacted material, as outlined in the SEP. Several sub-grade utility corridors that are being used to support the continuing groundwater remediation were not certified at closure, but they will be certified following the completion of remediation and their discontinued use (see Section 2.4.4).

The OU5 ROD (DOE 1996c) describes the approved remediation method of pump-and-treat for groundwater. The OU5 ROD (DOE 1996c) also committed to continual evaluation of remediation technologies to allow for the improvement of the remedy with new technologies. As a result, an enhanced groundwater remedy, which could reduce groundwater remediation by 10 years, was suggested and subsequently approved. The enhanced remedy includes additional extraction wells.

The primary constituent of concern for groundwater is uranium. Other constituents have been identified and will be removed during the remediation of the uranium. A complete list of all of the constituents identified in groundwater can be found in the OU5 ROD (DOE 1996c). The FRL for uranium in groundwater is 30 parts per billion (ppb). In the original ROD, the FRL for uranium in groundwater was 20 ppb. After EPA changed the drinking water standard, and after EPA and OEPA approved of the *Explanation of Significant Differences for Operable Unit 5* (DOE 2001c), the FRL was raised to 30 ppb. DOE and regulators based the target cleanup levels for groundwater on the use of the aquifer as a potable water supply and incorporated Safe Drinking Water Act standards for all constituents for which these standards were available.

Ecological restoration followed remediation and was the final step in completing the site's cleanup. The goal for ecological restoration of the Fernald Preserve was to enhance, restore, and construct (as feasible, given post-excavation landforms and soils) the early stages of vegetative communities native to pre-settlement southwestern Ohio. Figure 2 illustrates the ecological restoration of the Fernald Preserve. The restoration of the Fernald Preserve involved four major components:

- Expanding and enhancing the riparian corridor along Paddys Run.
- Expanding and enhancing the wooded areas in the northern portion of the Fernald Preserve.
- Restoring a contiguous prairie in the central and eastern portions of the Fernald Preserve (including the OSDF).
- Creating open water areas and wetlands throughout the site as topography and hydrology allow.

2.3.2 Completion of Site Remediation

In January 2003, the site's name was changed to the FCP. DOE's closure contract with Fluor Fernald Inc. outlined the scope of remediation activities required for closure. The process of legacy management or long-term stewardship began immediately following DOE's Determination of

Reasonableness, or acceptance, of Fluor Fernald Inc.'s Declaration of Physical Completion (the point commonly referred to as "closure"). The Declaration of Physical Completion occurred on the day that remediation of the site (with the exception of groundwater) as outlined in Fluor Fernald Inc.'s Comprehensive Exit Transition Plan was completed. DOE-LM assumed legacy management responsibilities for the site on that date.

2.4 Site Conditions at Closure

What follows is an overview of the site conditions after remediation. It is clear that some remediation (i.e., continuing groundwater remediation) will be ongoing during legacy management.

2.4.1 OSDF

Based on a pre-design investigation, the most suitable location for the OSDF was determined to be on the eastern side of the Fernald Preserve (Figure 2). The details of the investigation are in the *Pre-design Investigation and Site Selection Report for the On-site Disposal Facility* (DOE 1995b). This location was considered the best because of the thickness of the gray clay layer that overlies the Great Miami Aquifer.

Construction on Cell 1 of the OSDF was initiated in December 1997, and the permanent cap for Cell 1 was complete in late 2001. The OSDF consists of eight individual cells covered by a continuous permanent cap. The final dimensions are approximately 950 feet (ft) east to west and 3,600 ft north to south, with a maximum height of 65 ft. It was anticipated that 2.5 million cubic yards of impacted materials would be placed in the facility. Approximately 80 percent of the material would be impacted soil, and the remaining 20 percent would consist of building demolition rubble, fly ash, lime sludge, and small amounts of miscellaneous materials. The PCCIP (Attachment B) provides a summary of the materials permitted to be placed in the OSDF. The volumes and percentages mentioned above were subject to change during the actual remediation process. Final volumes are included with the as-built drawings.

The design approach for the OSDF can be found in both the OU2 ROD (DOE 1995c) and the *Final Design Calculation Package; On-site Disposal Facility* (GeoSyntec 1997). The design includes a liner system, impacted-material placement, a final cover system, a leachate management system, a surface water management system, and other ancillary features.

The footprint of the actual disposal facility is approximately 75 acres. A buffer area and perimeter fence surrounds the disposal facility. The OSDF, including the buffer, covers approximately 120 acres. Institutional controls are described in further detail in the IC Plan (Volume II) with additional details included in the PCCIP (Attachment B), OU2 ROD (DOE 1995c), and OU5 ROD (DOE 1996c).

2.4.2 Restored Areas

Approximately 900 acres of the Fernald Preserve were ecologically restored. Restored areas are those parts of the site that have been graded following remedial excavation, amended, planted, or enhanced to create the early stages of ecosystems comparable to native pre-settlement southwestern Ohio. The specific habitats restored include upland forest; riparian forest; tallgrass

FERNALD LEGACY MANAGEMENT

Future Use

LAND USE

- 395 acres of Woodlots
- 332 acres of Prairie
- 120 acres of OSDF
- 81 acres of Wetlands
- 60 acres of Open Water
- 33 acres of Savanna
- 29 acres of Infrastructure

Figure 2

Fernald Preserve

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prairie and savanna; and wetlands and open water (Figure 2). In addition, previously existing habitats (such as the pine plantations) were enhanced.

What follows are brief summaries of the habitat restorations. Details of the actual projects and further information on the restored areas are described in the *Natural Resources Restoration Plan* (DOE 2002).

<u>Upland Forest</u>: Upland forest areas existed in a northern portion, in a southern portion, and on the western perimeter of the site. Restoration activities were conducted to expand these forested areas. The *Site-wide Characterization Report* (DOE 1993) describes the Fernald Preserve as existing in a transition zone between the Oak–Hickory and Beech–Maple sections of the Eastern Deciduous Forest province. That is, a mosaic of both Oak–Hickory and Beech–Maple forest types can be found in southwestern Ohio. Forest communities at the Fernald Preserve would gradually move toward one of these forest types, depending on site-specific factors such as topography and hydrology. Therefore, the restoration of upland forests at the Fernald Preserve focused on the establishment of this Beech–Maple/Oak–Hickory transition zone. The trees used are native to southwestern Ohio and are listed in the NRRP, Table 3-1.

<u>Riparian Forest</u>: Riparian corridors existed along Paddys Run and the Storm Sewer Outfall Ditch. Restoration activities were conducted to expand these corridors through revegetation. The selected species of trees were those that can withstand periodic inundation, and they are listed in the NRRP. The Paddys Run floodplain was expanded as part of the long-term management plan for Paddys Run.

<u>Tallgrass Prairie and Savanna</u>: The waste pit, production, OSDF, and borrow (east field) areas were restored as a contiguous prairie. Some prairies and savannas were established along the western perimeter of the site, but the concentration was primarily in formerly disturbed areas. Prairie restoration involved amending soil, if necessary, and seeding grasses and forbs (wildflowers). All seeded grasses and forbs were native to the area. Savannas were established by planting a sparse mix of trees and shrubs, and seeding the area with native grasses.

While not considered a part of the restored prairies on site, the OSDF, located adjacent to both the former production area and the borrow area, is also being seeded with native prairie grasses to provide vegetative cover. The native grasses are being used because of their ecological benefits, drought tolerance, and ability to provide soil stability.

<u>Wetlands and Open Water</u>: Wetlands and open water areas were established throughout the site where topography permitted. The former production area has open water areas as a result of deep excavations, and wetlands will be established throughout the site. DOE is responsible for providing 17.8 acres of mitigated wetlands under Section 404 of the Clean Water Act. In addition to mitigating wetlands, upland and riparian forest revegetation in various areas was designed to restore wet woods. Details and drivers for wetland mitigation are described in the NRRP.

2.4.3 Groundwater

Groundwater remediation and monitoring will continue until the FRL of 30 ppb for uranium has been achieved. Groundwater monitoring will be required following the completion of remediation to ensure continued protectiveness of the remedy and to support the CERCLA 5-year reviews. The OMMP is included as Attachment A to the LMICP and describes the groundwater extraction system (well fields, treatment facility, etc.) used to complete the remedy. Additional information is included in Section 3.1.3 of the IC Plan. Long-term monitoring of groundwater will be required around the OSDF. The exact approach to groundwater monitoring has been continuously refined, with input from the community and regulators.

2.4.4 Uncertified Areas

There are two facilities on site where the soils have yet to be certified: the CAWWT and the South Field Valve House (Figure 3). There are also sub-grade utility corridors that were not certified at closure (Figure 4). These facilities and utilities primarily support the ongoing groundwater remedy and are located below certified areas.

The 60-inch Main Drainage Corridor culvert and an adjacent 18-inch culvert were left in place even though there is fixed contamination within the culverts. Both culverts are located directly below the OSDF leachate conveyance system and the main effluent line running between the CAWWT and the Great Miami River. Due to their location, these culverts could not have been removed without potentially impacting ongoing CAWWT and OSDF operations. The 18-inch culvert is completely buried, and grating was installed on the ends of the 60-inch culvert to prevent access.

The certification of the sub-grade utility corridors will occur following the completion of groundwater remediation, when these systems are no longer needed and are removed. Certification of the soils within the footprints of the CAWWT and South Field Valve House will occur when these facilities are no longer needed, are removed from service, and are decommissioned and dismantled. Due to the uncertainty of the groundwater remediation end date, no firm schedule for soil certification in the corridors can be established at this time.

In the case of the existing paved roads, the roadways themselves cannot be certified; however, the soil beneath them is certified.

2.4.5 Existing Infrastructure and Facilities

A few facilities remain on site. These include the CAWWT and supporting infrastructure, extraction wells and associated piping and utilities, the outfall line to the Great Miami River, the restoration storage shed, the former Communications Building, and the former Silos Warehouse.

DOE is in the process of establishing a Visitors Center on site; the center is expected to be completed in June 2008. The former Silos Warehouse is being refurbished for use as the Visitors Center. The center will contain information and context on the remediation of the Fernald Preserve, including information on site restrictions, ongoing maintenance and monitoring, and residual risk. It will also provide historical information and photographs, a meeting place, and other educational resources as appropriate. A primary goal of the Visitors Center is to fulfill an informational and educational function within the surrounding community. The information made available at the center serves as an institutional control. The center will serve to maintain awareness of site history and conditions and help prevent unsafe disturbances and uses of the site.

The Visitors Center will be maintained and operated under the direction of DOE-LM. On a periodic basis, DOE will evaluate the use of the Visitors Center, and the programming provided there, with community input. Upon the Visitors Center's completion, DOE will obtain community input on decisions regarding changes to and the ongoing operation of the center.

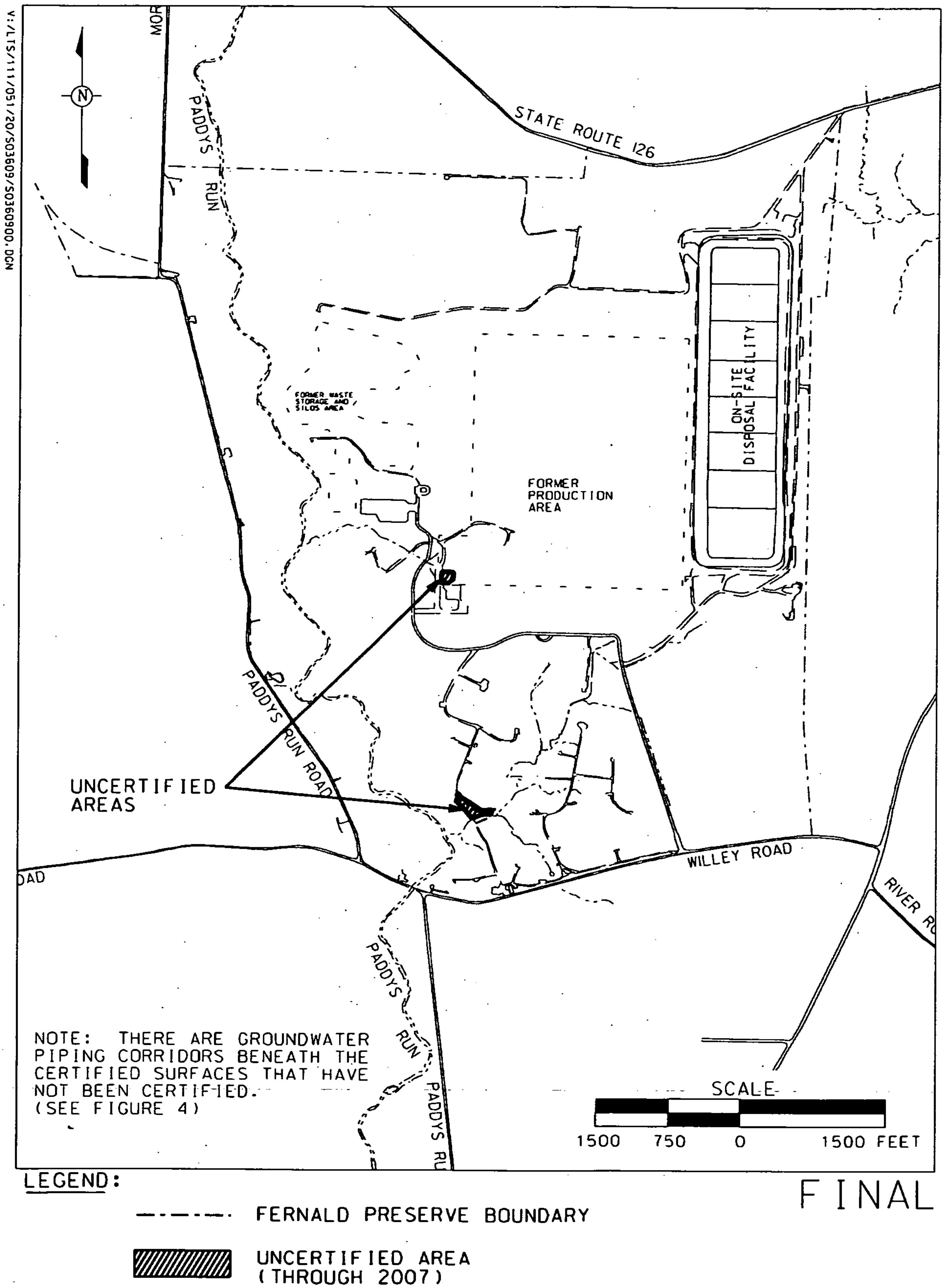

Figure 3. Uncertified Areas

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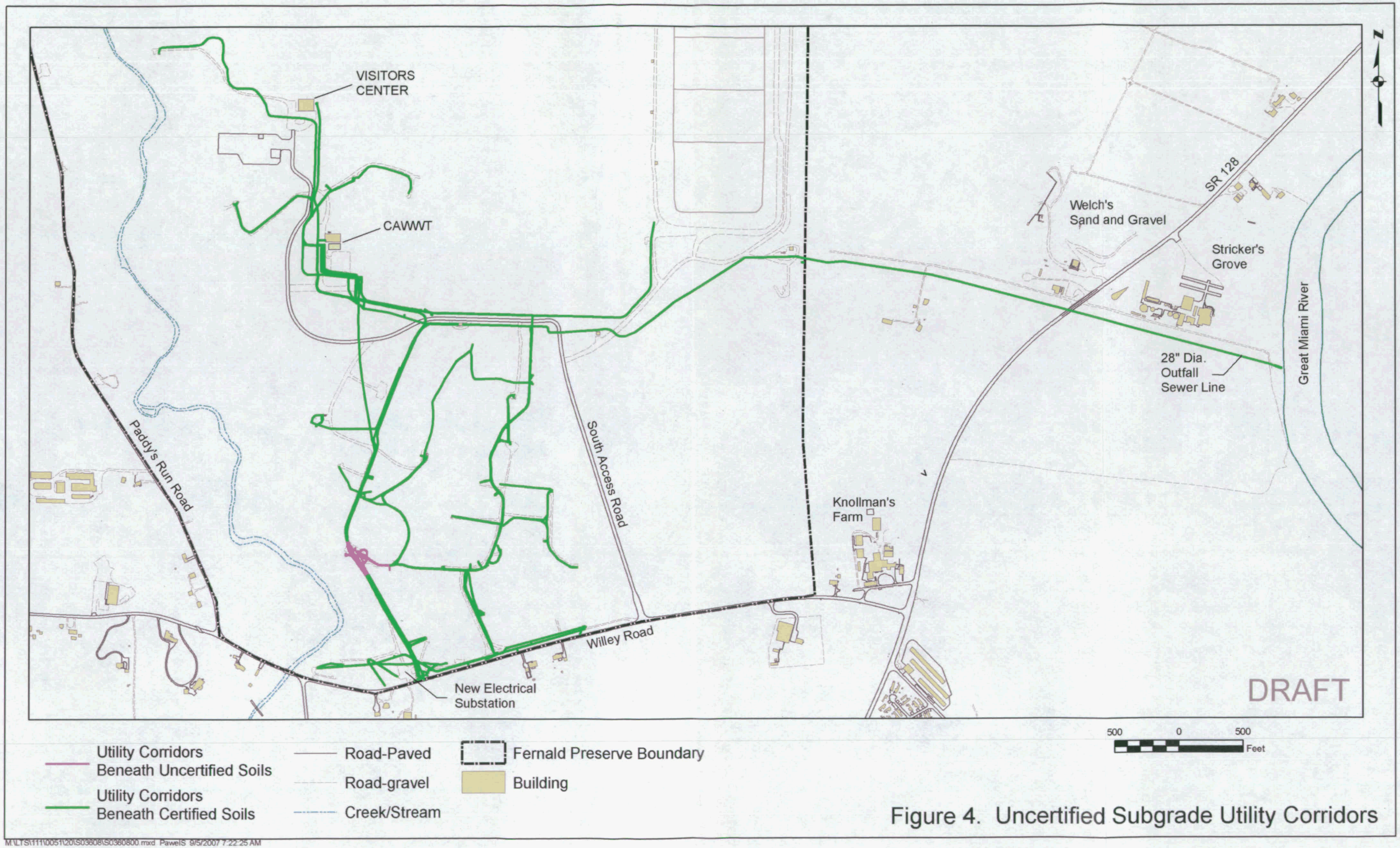

Figure 4. Uncertified Subgrade Utility Corridors

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3.0 Scope of Legacy Management at the Fernald Preserve

Post-closure requirements include maintaining the remedies and ensuring the protectiveness of human health and the environment. Other post-closure activities include monitoring and maintaining the Fernald Preserve property, facilities, and structures that remain. Post-closure requirements at the Fernald Preserve are the responsibility of DOE-LM. Within DOE-LM, the Office of Site Operations (LM-20) is responsible for ongoing surveillance and maintenance at the Fernald Preserve and the continuation of the groundwater remedy.

The commitments in the RODs relevant to legacy management include the following:

- DOE will achieve the FRLs for all contamination attributed to the Fernald Preserve. Site-wide cleanup levels for soil are documented in the OU2 ROD (DOE 1995c) and in the OU5 ROD (DOE 1996c) based on a recreational-use and undeveloped-park (i.e., greenspace) scenario. The FRLs do not allow unrestricted use of the Fernald Preserve, and institutional controls are required.
- Per the OU2 ROD (DOE 1995c), the Fernald Preserve will remain under federal ownership. Therefore, any final land-use alternative and legacy management planning must include DOE's commitment to continued federal ownership.
- Commitments for other environmental monitoring will be carried out as long as appropriate per the existing RODs.

Maintaining institutional controls at the Fernald Preserve is a fundamental component of legacy management and includes ensuring that no residential or agricultural uses and only limited recreational uses occur on the property. Activities such as swimming, hunting, fishing, and camping are prohibited. Additional information regarding prohibited activities is included in the IC Plan, Section 2.1. The intent of this Legacy Management Plan is to provide an overview of institutional controls required for the Fernald Preserve to support legacy management. The separate IC Plan is required for the Fernald Preserve per the DOE's commitment to EPA in the OU5 ROD (DOE 1996c). The IC Plan is included as Volume II of this LMICP. DOE and EPA guidance were used to identify planned institutional controls at the Fernald Preserve. The IC Plan will continue to be updated annually, as necessary, based on changing site conditions and input from the community and regulators. Section 4.4 discusses the 5-year review process and how it relates to legacy management, including institutional controls.

The scope of legacy management activities at the Fernald Preserve can be divided into three categories: (1) the operation and maintenance of the remedies, (2) surveillance and maintenance in restored areas, and (3) public involvement. Legacy management activities related to the maintenance of the remedies include monitoring and maintaining the OSDF, the CAWWT and supporting infrastructure, the extraction wells and associated piping, and the active outfall line to the Great Miami River. Also included is the decontamination and dismantling of the aquifer remediation infrastructure (CAWWT, well system, etc.). The OMMP includes the details of the monitoring and maintenance of the CAWWT, groundwater restoration systems, and the active outfall line. Legacy management activities also include ensuring that remedy-driven restrictions on access to and use of the Fernald Preserve are enforced, that aquifer remediation is continued, and that information is properly managed.

Legacy management in restored areas includes ensuring that natural and cultural resources are protected in accordance with applicable laws and regulations. Any amenities supporting access to and use of the Fernald Preserve will be kept in a safe configuration. The cleanup levels established for the Fernald Preserve ensured that the site was remediated to a level consistent with recreational use.

The potential reburial of Native American remains is another initiative that has been considered at the Fernald Preserve since 1999. DOE agreed to make land available for the reinterment of Native American remains with the following understandings:

- The land remains under federal ownership.
- DOE will not take responsibility for, or manage, the reinterment process. DOE will neither fund nor implement maintenance and monitoring.
- The remains must be culturally affiliated with a modern-day tribe. The National Park Service had no objections to the reinterment process as long as the "repatriations associated with the reburials comply with the Native American Graves Protection and Repatriation Act as applicable."
- Records must be maintained for all repatriated items reinterred under this process. DOE is not responsible for these records.

Thus far, several federally recognized tribes have been contacted regarding this offer of land for reinterment purposes. To date, DOE has received only one response from a modern-day tribe with repatriated remains under the Native American Graves Protection and Repatriation Act. The Miami Tribe of Oklahoma has informed DOE that they are not interested in using the site. No other responses from modern-day tribes have been received, and DOE is no longer pursuing the effort. The proposal may be reconsidered in the future if other modern-day tribes with repatriated remains come forward.

Legacy management activities related to public involvement include ongoing communication with the public regarding continuing groundwater remediation, legacy management activities, and the future of the Fernald Preserve. Emphasis will also be placed on educating the public about the site's former production activities, its remediation, and its land use restrictions. Displays and programs at the Visitors Center and outreach programs at local schools and organizations will help DOE-LM meet this objective.

3.1 Legacy Management of the OSDF

The OU2 ROD (DOE 1995c) states that the Fernald Preserve will remain under federal ownership. DOE has committed to the goal of ensuring legacy management activities of the OSDF in perpetuity. The PCCIP (Attachment B) for the OSDF outlines the routine legacy management activities for the initial 30 years. The activities include routine inspections and ongoing monitoring of the LCS, the LDS, and groundwater in the vicinity of the OSDF. DOE will conduct CERCLA reviews every 5 years and will issue a report summarizing the results of the review to the appropriate regulatory agencies. Periodic monitoring and maintenance of the LCS and the vegetative cap of the OSDF will be necessary, as will the occasional maintenance of signs, fencing, and the buffer zone around the OSDF. The inspections and monitoring are discussed in greater detail in the IC Plan.

The extent of legacy management activities will continue to be defined based on regulatory requirements, community and regulatory input, and agreements between DOE, EPA, and OEPA. More information about the maintenance and monitoring requirements for the LCS, the capping and cover system, and the support systems for the OSDF are included in the IC Plan and supporting documents.

3.2 Surveillance and Maintenance of Restored Areas

Per the OU5 ROD (DOE 1996c), DOE will protect the existing natural resources at the Fernald Preserve. The monitoring and maintenance of restored areas focus on ensuring that natural resources are protected in accordance with appropriate laws and regulations, such as the Clean Water Act and the Endangered Species Act. Wetlands and threatened and endangered species are examples of natural resources that will be monitored. Existing cultural resource areas will also have to be monitored to ensure that their integrity is not threatened.

Restored areas will be inspected to ensure that protected natural resources are maintained in accordance with applicable laws and regulations. The physical disturbance of restored areas will not be permitted unless it is authorized by DOE-LM (if necessary, in consultation with EPA). Soil and vegetation will not be removed from the Fernald Preserve unless DOE-LM authorizes their removal.

Existing cultural resource areas, including the reinterment area that resulted from the public water supply project, is a part of the undeveloped park and requires inspections to ensure their preservation and to determine if natural forces, vandalism, or looting are affecting the resources. Actions will be implemented if there is evidence that the integrity of a site is threatened due to natural or human forces.

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4.0 Oversight of Legacy Management at the Fernald Preserve

4.1 Office of Legacy Management Responsibilities

DOE-LM is responsible for the oversight of the Fernald Preserve during legacy management. They will ensure that all legacy management activities are conducted as required. They are the decision-making body regarding changes in surveillance, maintenance, engineering, access, public use, and the like. DOE-LM also manages any contractors hired to perform work required for legacy management purposes and ensures that the contractors have the skills necessary to perform the work. Additionally, DOE-LM is responsible for communicating with regulators and the public regarding the legacy management of the Fernald Preserve.

4.2 Role of the Site Contractor and Use of Subcontracts

A site contractor, or contractors, will support DOE-LM, will work closely with and communicate regularly with DOE-LM, and will be the physical presence at the site. Contractor personnel will be responsible for operating the groundwater remediation systems, conducting inspections, monitoring, and sampling. They will collect all data, develop the reports, and make those reports available to the community and the public. Maintenance activities for the OSDF will be their responsibility as well. The contractors will notify DOE-LM in the event of an emergency and will take action to prevent damage to the site.

Operation and maintenance tasks may be carried out by additional subcontractor services. Examples include minor repairs to fencing, gates, signs, or components of the groundwater infrastructure. Repairs that require earthwork, erosion control, seeding, mowing, clearing, herbicide application, or repair to pumps and piping will be completed by subcontractor services.

Goods and services will be procured according to DOE-approved procurement policies and procedures. These procedures use the best commercial practices and are in compliance with the requirements and intent of the federal acquisition regulations and DOE acquisition regulations. The terms and conditions in subcontracts incorporate the required flow-down clauses from the prime contract.

As requirements are identified by technical leads, a scope of work will be developed, and a solicitation package will be initiated. The package will generally include statements of work, health and safety requirements, estimated costs, and required approvals. The written contracts will also include the appropriate restrictions and prohibited activities for the work to be performed on site. In cases where there are similar existing subcontracts, the existing work scope may be used as a framework for a new subcontract. New subcontracts may be developed through a competitive bid process or through the negotiation of a sole-source procurement. The type of procurement will be determined by analyzing the unique nature of the work scope, the critical nature of the services, and the importance of historical information known only by the previous contractor. Although DOE-LM intends to maximize the use of new subcontracts for most services, there may be a need to request the assignment of an existing subcontract in unique circumstances to ensure continuation of a service.

4.3 Role of Regulators

DOE-LM is required to implement the requirements outlined in the IC Plan subject to enforcement by EPA. The regulators will ensure that DOE is performing the required legacy management operations, surveillance, and maintenance activities at the Fernald Preserve, as agreed upon by the DOE and EPA, in consultation with the OEPA, in the LMICP. Both EPA and OEPA will be provided with all reporting on the legacy management activities at the Fernald Preserve. Both EPA and OEPA will be notified of any institutional control breaches as outlined in Section 4.0 of the IC Plan. Both EPA and OEPA will be involved in overseeing the legacy management activities at the Fernald Preserve.

4.4 CERCLA 5-Year Reviews

Under CERCLA, if use of a site is limited because a certain level of contamination remains there, then a review of the remedy at that site is required every 5 years. The CERCLA 5-year reviews at the Fernald Preserve will focus on the protectiveness of the remedies associated with each of the five OUs. Summaries of the inspections conducted for the OSDF, the CAWWT facility, the groundwater restoration system, and the active outfall line to the Great Miami River will also be included. To facilitate the review, a report addressing the ongoing protectiveness of the remedies will be prepared and will be submitted to EPA and OEPA. The institutional controls portion of the report will include the data collected from monitoring and sampling; summaries of inspections of the Fernald Preserve, the OSDF site, and the OSDF cap conducted during the 5-year period; and a discussion of the effectiveness of the institutional controls. If it is determined that a particular control is not meeting its objectives, then required corrective actions will be included. The review may lead to revisions to the monitoring and reporting protocols. The last CERCLA 5-year review was completed in August 2006. Therefore, the next review is due in 2011.

4.5 Reporting Requirements

The annual site environmental report will continue to be submitted to EPA, OEPA, and distributed to key stakeholders on June 1 of each year. It will provide information on institutional controls, monitoring, maintenance, site inspections, and corrective actions while continuing to document the technical approach and summarizing the data for each environmental medium, along with summarizing CERCLA, RCRA, and waste management activities. The report will also include water quality and water accumulation rate data from the OSDF monitoring program. The summary report serves the needs of both the regulatory agencies and other key stakeholders. The detailed appendixes accompanying the site environmental report are intended for a more technical audience, including the regulatory agencies, and will serve to fulfill National Emissions Standards for Hazardous Air Pollutants reporting requirements, as necessary. Additionally, there will be continued reporting requirements as required under other regulatory programs, which will be addressed outside the annual site environmental reports (e.g., National Pollutant Discharge Elimination System monthly discharge reports).

5.0 Records Management

The long-term retention of records and dissemination of information is another critical aspect of legacy management. DOE-LM will manage records that are needed for legacy management purposes. Records will be dispositioned in accordance with DOE requirements at the National Archives and Records Administration (NARA) or a federal records center for their required retention period. Records that have reached the scheduled retention period will be reviewed and approved by management for final destruction or rescheduled for additional retention. For legacy management purposes, DOE-LM will retain copies of selected records documenting past remedial activities (e.g., CERCLA Administrative Record [AR]) in the public reading room located at the Delta Building, 10995 Hamilton-Cleves Highway, Harrison, Ohio 45030. Additionally, the CERCLA AR and frequently requested documents are available to stakeholders at http://www.lm.doe.gov/land/sites/oh/fernald/fernald.htm.

Stewards and stakeholders, whether located in the surrounding community or in remote locations, will require easy access to copies of the CERCLA AR. The Visitors Center, which is anticipated to be open to the public in June 2008, will house computing facilities for acquisition and access. Fernald environmental data are available to the public through DOE-LM's Geospatial Environmental Mapping System at http://www.lm.doe.gov/land/sites/oh/fernald /fernald.htm. The system to support legacy management addresses the following:

- On-site data transmission, telecommunications, and computing-resource requirements.
- Data acquisition standards and protocols for newly collected data and for historical data and images to be transferred to the repository.
- Analysis tools, integration with other data sources, and notification services to assist remotely located users.
- Electronic data storage requirements.
- Data management and validation practices sufficient to ensure defensible information.
- Plans for periodic storage infrastructure reviews and upgrades to ensure that electronic information is continually available as technology advances.
- Integration with any DOE or federally mandated central repository for electronic records or data, as appropriate.
- Web-based retrieval, search, and reporting capabilities.

Examples of electronic data include environmental sampling and monitoring data, OSDF monitoring data, and soil certification data as well as electronic images, design drawings, and electronic records. This information is required for the purposes of generating required reports, including the CERCLA 5-year review, for the efficient management of the data collection process, and for public use.

Within 60 days of EPA's approval of this LMICP, the Fernald LM website will be updated to include the most recent version of the LMICP.

5.1 Types of Data Required for Legacy Management

Data determined critical for legacy management purposes have been divided into four categories: historical data, RI/FS process and results, remediation data, and post-site closure data. Table 5–1 presents the types of information that fall into each category.

Based on the four categories, DOE personnel, working with stakeholders, identified records considered critical for legacy management. Interface with stakeholder groups was initiated in the fall of 2002 to ensure that the appropriate types of information and records were being retained to support legacy management. The ongoing interface with stakeholders will allow DOE to retain the appropriate information to support future legacy management needs.

5.2 Legacy Management Records Custodian

DOE-LM assumed custodianship of the Fernald records when the site was transitioned to Legacy Management. Site records fall under the DOE retention schedules and will remain in DOE custody for the required, pre-established retention period.

5.3 Records Storage Location

Fernald records are currently stored at two locations: the National Archives, Great Lakes Region, in Dayton, Ohio, and the National Archives, Great Lakes Region, in Chicago. Their respective websites are http://www.archives.gov/great-lakes/dayton/ and http://www.archives.gov/great-lakes/chicago/. Fernald records will be transferred to a facility located in Morgantown, West Virginia, when construction is completed; additional information regarding the Morgantown facility will be available then. The facility's completion is scheduled for fall 2009.

5.4 Public Access Requirements

The CERCLA AR documents for the Fernald Preserve were scanned into industry-standard searchable Adobe Acrobat portable document file (PDF) format for viewing over the Internet. Document meta-data is stored in a FileMaker Pro database. The database also contains pointers to the PDF images of the documents. These files are available on the Fernald Preserve LM website (http://www.lm.doe.gov/land/sites/oh/fernald/fernald.htm).

Features of the public-access website include a search engine that allows users to search by document number, document date, document title, and description. Additionally, users can search for text contained within the document. Search results can be sorted by document number, document date, or document title. Document content is displayed using the Adobe Acrobat Reader software. The CERCLA AR will be updated as new documents are created.

Table 5–1. Types of Data Needed to Support Legacy Management Activities

Data Category	Summary of Information Required
Historical Data	• Real estate records • Information pertaining to the acquisition of property • Process documents/reports (summary level) • Cultural-resource records • Photographs (significant for legacy management purposes)
RI/FS Process and Results	• Risk assessments • Public comments • RI/FS reports for each OU • RODs for each OU • ROD amendment documents
Remediation Data	**For soil:** • Design and excavation plans • Documentation of the certification process for each area/phase • Certification reports* **For groundwater:** • Pump-and-treat system design documents • Groundwater monitoring data • Groundwater extraction data • Design and monitoring data for the CAWWT **For Environmental Monitoring:** • IEMP reports* • Regular updates* **For buildings and structures:** • Plans for decommissioning and dismantling buildings and structures **For OSDF:** • Design, construction, material placement and closure documentation • Leak detection/leachate monitoring data • Cover/cap monitoring data **For Restoration:** • Design plans • Implementation documentation • Completion reports • Monitoring data* **General:** • RD/RA Reports • Aerial photographs taken during remediation processes
Post-Closure Data	• Decision documents on land use • Documents on public-use decisions • All monitoring and maintenance data for the OSDF • All monitoring and maintenance data for the restored areas* • All institutional control data • Drawings of remaining facilities (including the OSDF)

*Will require retention of electronic data.

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6.0 Funding

DOE will need to secure funding for legacy management in future budget requests for the years after site closure. Currently, it is anticipated that Office of Legacy Management funds will be available for monitoring and maintaining the OSDF, managing leachate, remediating the aquifer, and ensuring that applicable laws and regulations are adhered to in restored areas. DOE will keep the public informed of its plans to fund legacy management activities as new information becomes available.

Currently, legacy management activities at the various DOE facilities are funded through the annual appropriations process. Funding for sites in the long-term surveillance and maintenance program is maintained in a separate line item in the DOE-LM budget. For the time being, this process for funding legacy management will continue; however, DOE will continue to investigate other funding and management options.

End of current text

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VOLUME II
Institutional Controls Plan

Volume II

Institutional Controls Plan

January 2008

U.S. Department of Energy

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Emergency Contact

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Appendix A Records of Decision and Associated Documents
Appendix B Institutional Control Requirements as Stated in the Records of Decision
Appendix C Fernald Preserve Contact Information
Appendix D Example of OSDF and Fernald Preserve Inspection Forms

Attachments

Attachment A Operations and Maintenance Master Plan for Aquifer Restoration and Wastewater Treatment
Attachment B Post-Closure Care and Inspection Plan
Attachment C Groundwater/Leak Detection and Leachate Monitoring Plan
Attachment D Integrated Environmental Monitoring Plan
Attachment E Community Involvement Plan

Acronyms and Abbreviations

ARARs	applicable or relevant and appropriate requirements
CAWWT	converted advanced wastewater treatment facility
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CIP	Community Involvement Plan
CFR	*Code of Federal Regulations*
CRARE	Comprehensive Remedial Action Risk Evaluation
DAAP	University of Cincinnati College of Design, Art, Architecture, and Planning
D&D	decontamination and demolition
DOE	U.S. Department of Energy
EM	Office of Environmental Management
EPA	U.S. Environmental Protection Agency
FCAB	Fernald Citizens Advisory Board
FEMP	Fernald Environmental Management Project
FRESH	Fernald Residents for Environmental Safety and Health
FRL	final remediation level
GWLMP	Groundwater/Leak Detection and Leachate Monitoring Plan
IC Plan	Institutional Controls Plan
IEMP	Integrated Environmental Monitoring Plan
LCS	leachate collection system
LDS	leak detection system
LM	Office of Legacy Management
LMICP	Comprehensive Legacy Management and Institutional Controls Plan
NPDES	National Pollutant Discharge Elimination System
OAC	Ohio Administrative Code
OEPA	Ohio Environmental Protection Agency
OMMP	Operations and Maintenance Master Plan for the Aquifer Restoration and Wastewater Project
OSDF	on-site disposal facility
OU	operable unit
PCCIP	Post-Closure Care and Inspection Plan
PDF	portable document file
ppb	parts per billion
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/Feasibility Study
ROD	record of decision
SEP	Site-Wide Excavation Plan
WAC	waste acceptance criteria

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Executive Summary

This Comprehensive Legacy Management and Institutional Controls Plan (LMICP) was developed to document the planning process and the requirements for the long-term care, or legacy management, of the Fernald Preserve. The LMICP became effective when the U.S. Department of Energy (DOE) Office of Environmental Management (EM) made its determination of reasonableness on Fluor Fernald Inc.'s declaration of physical completion. It serves the same function as the Long-Term Surveillance and Maintenance Plan used at other DOE Office of Legacy Management (DOE-LM) sites. The LMICP is a two-volume document with supporting documents included as attachments to Volume II. Volume I provides planning details for the management of the Fernald Preserve that go beyond those identified as institutional controls in Volume II. Primarily, Volume II is a requirement of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), providing institutional controls that will ensure the cleanup remedies implemented at the Fernald Preserve will protect human health and the environment. The format and content of Volume II follows U.S. Environmental Protection Agency (EPA) requirements for institutional controls. Once approved, Volume II becomes enforceable under CERCLA authority.

Volume I is the Legacy Management Plan. This plan is not a required document under the CERCLA process; it is not a legally enforceable document. It provides DOE-LM's management plan for maintaining the Fernald Preserve and fulfilling DOE's commitment to maintain the Fernald Preserve following closure. The plan discusses how DOE, specifically DOE-LM, will approach the legacy management of the Fernald Preserve. It describes the surveillance and maintenance of the entire site, including the on-site disposal facility (OSDF). It explains how the public will continue to participate in the future of the Fernald Preserve. Also included in the Legacy Management Plan is a discussion of records and information management. The plan ends with a discussion on funding for the legacy management of the site.

Volume II is the Institutional Controls Plan (IC Plan). The IC Plan is required under the CERCLA remediation process when a physical remedy does not allow for full, unrestricted use or when hazardous materials are left on site. The plan is a legally enforceable CERCLA document and part of the remedy for the site (an EPA requirement). The plan outlines the institutional controls that are established for and enforced across the entire site, including the OSDF, to ensure that human health and the environment continue to be protected following the completion of the remedy. The IC Plan has five attachments that lend support to and provide details regarding the established institutional controls. The attachments provide further information on the continuing groundwater remediation (pump-and-treat) system (Attachment A); the OSDF cap and cover system (Attachment B); the leak detection and leachate management systems for the OSDF (Attachment C); and the environmental monitoring that will continue following closure (Attachment D). Prior to transition, these four attachments were stand-alone documents with their own review and revision cycle. These documents have been incorporated into the LMICP and no longer have their own review and revision cycle. They will follow the review and revision cycle identified below. Also attached to Volume II is the Community Involvement Plan (CIP) (Attachment E), a CERCLA-required document, developed by DOE. The CIP explains in detail how DOE will ensure that the public has appropriate opportunities for involvement in post-closure activities.

Upon approval, it is anticipated that the LMICP will be finalized by January each year, to correspond with calendar-year monitoring and reporting. Between October and January, EPA and Ohio Environmental Protection Agency comments will be addressed.

The future LMICP schedule will be as follows:

- Each June, the annual site environmental reports will be submitted. They will make recommendations based on the previous year's monitoring information.
- Each October, an annual review of the LMICP will be submitted. It will identify updates as necessary.
- Each January, the LMICP will be finalized to correspond with the monitoring and reporting schedule.

Pertinent information associated with the CERCLA 5-year reviews will be included in the LMICP revisions as needed.

1.0 Introduction

The U.S. Department of Energy (DOE) manages the Fernald Preserve, owned by the federal government, which is situated on a 1,050-acre tract of land approximately 18 miles northwest of Cincinnati, Ohio. The Fernald Preserve is located near the unincorporated communities of Ross, Fernald, Shandon, and New Haven. Land use in the area consists primarily of residential areas, farming, gravel excavation operations, light industry, and parks.

The Comprehensive Environmental Response Compensation and Liability Act (CERCLA) is the primary driver for the environmental remediation of the Fernald Preserve. The site was divided into five operable units (OUs), and a Remedial Investigation and Feasibility Study (RI/FS) was conducted for each unit. Based on the results of the RI/FS, Records of Decision (RODs) were issued outlining the selected remedy for each OU.

- **Record of Decision for OU1, Waste Pits Area**—The remedy for OU1 included removing all material from the waste pits, stabilizing the material by drying it, and shipping it off site for disposal. OU1 field activities ended June 2005.
- **Record of Decision for OU2, Other Waste Units**—The remedy for OU2 included removing material from the various units, disposing of material that meets the on-site waste acceptance criteria (WAC) in the on-site disposal facility (OSDF), and shipping all other material off site for disposal. The WAC were developed by DOE and regulators, with input from the stakeholders and the public, to strictly control the type of waste disposed on site. The WAC are documented in the *Waste Acceptance Criteria Attainment Plan for the On-site Disposal Facility* (DOE 1998a). OU2 field activities ended November 2003.
- **Final Record of Decision for OU3, Production Area**—The OU3 remedy included decontaminating and decommissioning all contaminated structures and buildings, recycling waste materials whenever possible, disposing of material that meets the on-site WAC in the OSDF, and shipping all other material off site for disposal. OU3 field activities ended October 2006.
- **Record of Decision for OU4, Silos 1–4**—The OU4 remedy included removing and treating all material from the silos, dismantling the silos, and shipping the waste materials and silo debris off site for disposal. OU4 field activities ended May 2006 (final disposal of the Silo 1 and 2 waste is to be determined; field activities relate to the final shipment of OU4 waste off of the Fernald site).
- **Record of Decision for OU5, Environmental Media**—OU5 includes all environmental media, such as soil, sediment, surface water, groundwater, and vegetation. The *Site-Wide Excavation Plan* (SEP) (DOE 1998b) describes the remediation of soils, which includes the excavation of soils that exceed the risk-based final remediation levels (FRL) for a list of constituents of concern as listed in the SEP. The OU5 ROD (DOE 1996) describes the approved remediation method of pump-and-treat for groundwater until levels of uranium in groundwater are less than 30 parts per billion (ppb). In the original ROD, the FRL for uranium in groundwater was 20 ppb. After the U.S. Environmental Protection Agency (EPA) and the Ohio Environmental Protection Agency (OEPA) approved the change, the FRL was raised to 30 ppb, as written in the *Explanation of Significant Differences for Operable Unit 5* (DOE 2001). OU5 field activities related to care and maintenance of the OSDF and aquifer restoration are ongoing.

A list of the ROD and all associated documents is included in Appendix A of this volume.

The Declaration of Physical Completion, or closure, occurred on October 29, 2006. The construction of the OSDF and all site cleanup activities—with the exception of the ongoing actions necessary to achieve the final cleanup of the Great Miami Aquifer—were completed. Once the aquifer is restored, the converted advanced wastewater treatment facility (CAWWT) and associated infrastructure will be decommissioned and dismantled, and the utility corridors and the CAWWT footprint will be remediated (see Volume I, Figure 4). Based on modeling, the projected date of completion of aquifer restoration is 2026.

Ecological restoration followed remediation and was the final step to completing the cleanup of the site. Ecological restoration activities at the site were also being implemented to address wetland mitigation requirements under the Clean Water Act and to stabilize and revegetate areas impacted during remediation.

The OSDF, located on the eastern side of the Fernald Preserve, is complete. The OSDF consists of eight disposal cells, the footprint of which covers an area of approximately 75 acres. A buffer area and a perimeter fence are established around the disposal facility, and the total OSDF area is approximately 120 acres. Approximately 900 acres of the Fernald Preserve have been ecologically restored, having been graded following excavations, amended, seeded, planted, or otherwise enhanced to create ecosystems comparable to native pre-settlement southwestern Ohio. A few facilities remain on site. These include the CAWWT and supporting infrastructure, extraction wells and associated piping and utilities, the outfall line to the Great Miami River, the former Dissolved Oxygen Building, the Restoration storage shed, the former Communications Building, and the former Silos Warehouse. Figure 1 shows the Fernald Preserve's land use.

The DOE Office of Environmental Management (DOE-EM) was responsible for the remediation of the Fernald Site. Post-remediation responsibilities have transitioned to the DOE Office of Legacy Management (DOE-LM). DOE-LM is responsible for the post-remediation operations (including decontaminating and dismantling the aquifer remediation infrastructure), maintenance, and enforcement of institutional controls at the site.

1.1 Purpose and Organization of This Institutional Controls Plan

This Institutional Controls Plan (IC Plan) outlines the institutional controls established and enforced since remediation was completed, with the exception of the groundwater remediation at the Fernald Preserve. This IC Plan documents DOE's approach to maintaining institutional controls as required by EPA under CERCLA. The institutional controls outlined in this plan are designed to ensure the continued protection of human health and the environment following closure of the site. DOE-LM is responsible for monitoring, maintaining, reporting on, and implementing institutional controls at the Fernald Preserve. This IC Plan will be reviewed annually to determine if revisions are required. All revisions will be subject to Regulatory Agency review and will be made available to the community. The IC Plan will also be reviewed every 5 years in conjunction with the CERCLA 5-year review, and revisions will be made as necessary. Revisions can always be made on an as-needed basis if the results of site and OSDF inspections and monitoring require them.

FERNALD LEGACY MANAGEMENT
Future Use

LAND USE

- 395 acres of Woodlots
- 332 acres of Prairie
- 120 acres of OSDF
- 81 acres of Wetlands
- 60 acres of Open Water
- 33 acres of Savanna
- 29 acres of Infrastructure

Figure 1

Office of Legacy Management

Fernald Preserve

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In addition, changes to any of the support plans attached to this IC Plan may trigger revisions to the IC Plan. The approved IC Plan is part of the CERCLA remedy for the Fernald Preserve.

The documents attached to this IC Plan provide further detail and more subject-specific information regarding institutional controls and other post-closure activities. These documents include:

- Attachment A—Operations and Maintenance Master Plan for the Aquifer Restoration and Wastewater Treatment (OMMP)
- Attachment B—Post-Closure Care and Inspection Plan (PCCIP)
- Attachment C—Groundwater/Leak Detection and Leachate Monitoring Plan (GWLMP)
- Attachment D—Integrated Environmental Monitoring Plan (IEMP)
- Attachment E—Community Involvement Plan (CIP)

After approval, the five support documents also become part of the CERCLA remedies.

1.2 Summary of Attachments

The OMMP (Attachment A) establishes the design logic and priorities for the major flow and water treatment decisions needed to maintain compliance with the Fernald Preserve's National Pollutant Discharge Elimination System (NPDES) permit and ROD (OU5) surface water discharge limits. The OMMP is designed to guide and coordinate the extraction, collection, conveyance, treatment, and discharge of all groundwater and leachate (from OSDF). A summary of the information contained in the OMMP is included in Section 3.1.3, "Groundwater Remedy and Monitoring."

The PCCIP (Attachment B) addresses the inspection, monitoring, and maintenance activities necessary to ensure the continued proper performance of the OSDF. Key concepts addressed include ownership, access controls and restrictions, deed and use restrictions, environmental monitoring, OSDF cap and buffer area inspections, custodial maintenance, contingency repair, corrective actions, emergency notifications, reporting, and public involvement. Additional details from this plan are included in Section 3.2.1, "OSDF Inspection and Maintenance."

The GWLMP (Attachment C) specifies the frequencies and parameters being monitored in four horizons for each cell of the OSDF. These horizons are the leachate collection system (LCS), the leak detection system (LDS), perched water in the glacial overburden, and the Great Miami Aquifer (both up-gradient and down-gradient of each cell). Cell-specific data from these four horizons are evaluated holistically in order to verify the integrity of the cells. To date, the data from this comprehensive leak detection program indicate that the liner systems for all of the cells are performing within the specifications established in the OSDF design documentation. The GWLMP will be reviewed with the LMICP annually until the next CERCLA 5-year review. Any modifications to the plan will be based on analysis of the data collected from the ongoing leak detection sampling. The GWLMP governs the post-closure leak detection and leachate monitoring program for the OSDF. Further details from the GWLMP are included in Section 3.2.2, "Leak Detection/Leachate Management."

The IEMP (Attachment D) directs environmental monitoring program elements that support site remediation activities. The document outlines all regulatory requirements for site-wide monitoring, reporting, and remedy performance tracking activated by the applicable or relevant and appropriate requirements (ARARs) identified in the remedy selection documents. The various elements of environmental monitoring that are addressed include groundwater monitoring (Section 3.0), surface water and treated effluent (Section 4.0), sediment (Section 5.0), and air (Section 6.0). Section 7.0 provides a review and summary of the various programs and reporting requirements.

The CIP (Attachment E) documents how DOE will ensure that the public has appropriate opportunities for involvement in site-related decisions, including site controls, management, and monitoring.

1.3 Definition and Purpose of Institutional Controls

Institutional controls are important to help minimize the potential for exposure to, and the release of, residual contaminants, ensuring the protection of human health and the environment. Institutional controls are also important in helping to protect engineered remedies, by providing a means to ensure that the remedy remains effective, is not showing signs of failure, or is not being vandalized or damaged by outside elements (natural or human) in any way. (Section 1.4 describes the types of institutional controls at the site.)

EPA, in *Institutional Controls: A Site Manager's Guide to Identifying, Evaluating, and Selecting Institutional Controls at Superfund and RCRA Corrective Action Cleanups* (EPA 2000), has defined institutional controls as administrative or legal controls (i.e., non-engineered) that help to minimize the potential for human exposure to contamination or protect the integrity of a remedy. Institutional controls work by limiting land or resource use by providing information to modify or guide human behavior at the site.

DOE has defined institutional controls as mechanisms designed to appropriately limit access to or uses of land and facilities, to protect cultural and natural resources, to maintain the physical security of DOE facilities, and to prevent or limit inadvertent human and environmental exposure to residual contaminants. Institutional controls include methods to preserve knowledge and to inform current and future generations of hazards and risks (DOE 2000).

Although the DOE and EPA definitions differ slightly—DOE includes physical controls, such as fences and gates, as institutional controls—they both focus on the same goal: to protect human health and the environment from residual hazards.

1.4 Types of Institutional Controls

The types of institutional controls being used at the Fernald Preserve during legacy management, which are outlined in this plan, serve two functions: (1) to eliminate the disturbance and monitor the use of the Fernald Preserve, and (2) to minimize human and environmental exposure to residual contaminants, as described below. The site was divided into two subsections for institutional control purposes: the Fernald Preserve and the OSDF. The OSDF includes the disposal facility and its buffer area. This area is enclosed by a fence and locked at all times, unless authorized personnel require access. The Fernald Preserve is all of the remaining property on site.

The Fernald Preserve is accessible to employees and the escorted public, having only very small, fenced-off, restricted areas. Currently there is no unescorted public access at the Fernald Preserve. When the Visitors Center opens in 2008, it is anticipated that unescorted public access will be limited to the Visitors Center and associated trails and overlooks. The two sections of the site are treated separately because of the greater restrictions that apply to the OSDF.

- **Controls to Eliminate Disturbance and Monitor Use of the Fernald Preserve (Section 2.0)**—Describes institutional controls, applicable to both the Fernald Preserve and the OSDF, that are designed to limit access and land use. These controls focus on ensuring that the Fernald Preserve remains in a configuration consistent with the designated land use and that unauthorized uses of the Fernald Preserve do not occur. These include proprietary controls; governmental controls; and the prevention of unauthorized use by means of informational devices, security, physical barriers, and routine inspections. As part of the informational devices, a Visitors Center to house site information is being established. Also discussed are the methods of controlling, restricting, or prohibiting recreational activities. (Refer to Table 1–1 and Table 1–2 for a summary of these controls.)

- **Controls to Minimize Human and Environmental Exposure to Residual Contaminants (Section 3.0)**—Describes the institutional controls (i.e., monitoring and sampling) used to ensure the continued protection of human health and the environment. These controls focus on maintaining engineered systems and infrastructure that are designed to protect human health and the environment. This category also includes the use of the Visitors Center to provide educational information on the site remedy and measures required to monitor and maintain the remedy. These include routine inspections, permits, continuing groundwater remedial activities, routine maintenance and monitoring, and leachate management practices.

1.5 Agency Requirements for Institutional Controls

The need for institutional controls is described in the OU2 and OU5 RODs (Appendix B). On page 9–16, the OU5 ROD states: "One element of the selected remedy that will be used to ensure protectiveness is institutional controls, including continued access controls at the site during the remediation period, alternative water supplies to affected residential and industrial wells, continued federal ownership of the disposal facility and necessary buffer zones, and deed restrictions to preclude residential and agricultural uses of the remaining regions of the Fernald Environmental Management Project (FEMP) property." The intent of the IC Plan is to describe the institutional controls, both physical and administrative, used at the Fernald Preserve. This IC Plan was submitted to EPA and OEPA under the OU5 ROD as a primary document and is part of the remedy for the Fernald Preserve.

Table 1–1. Controls on Disturbance and Use of the Fernald Preserve

Control	Requirement	Frequency	Scope
PROPRIETARY CONTROLS 1. Establish points of contact	1. DOE–LM guidance	1. Initially and when updates are needed	1. Provide primary and backup points of contact for emergencies. Points of contact will be updated in the Legacy Management Plan as needed. The DOE-LM 24-hour emergency line is 877-695-5322.
2. Ownership	2. OU2 ROD OU5 ROD DOE–LM guidance	2. N/A	2. The federal government will maintain ownership of site property. Management is the responsibility of DOE-LM.
GOVERNMENTAL CONTROLS 1. Notations on land records or real estate restrictive license	1. OU2 ROD OU5 ROD	1. Annual verification	1. If management of portions of the Fernald Preserve (outside of the disposal facility area) is transferred to another federal entity at any time, all zoning and real estate restrictions will be communicated to the appropriate parties, and proper notifications will be provided as required.
PREVENTING UNAUTHORIZED USE OF THE FERNALD PRESERVE 1. Informational devices	1. OU2 ROD OU5 ROD	1. N/A	1. Informational devices • A Visitors Center will provide information on site remediation, site restrictions, ongoing maintenance and monitoring, and residual risks. • In order to maintain the integrity of the site, access may need to be limited or restricted in some areas. Signs indicating restricted access will require monitoring and maintenance to ensure their legibility and integrity.
2. Security of the site	2. OU2 ROD OU5 ROD	2. Daily	2. Security • There will be routine patrols of the Fernald Preserve and perimeter postings to prevent unauthorized access and use of the site. • Site facilities and structures will be locked when personnel are not present during nonbusiness hours. • Some site facilities and structures will be fenced and locked at all times, and only authorized access will be permitted.
3. Routine site inspections	3. OU2 ROD OU5 ROD	3. Annually	3. Formal inspections will be conducted to ensure that infrastructure, signs and postings, fences and gates, perimeter areas, and access points are in a secure and safe configuration per the Fernald Preserve Area Post-Closure Inspection Checklist (refer to Appendix D).

Table 1–2. Controls on Disturbance and Use of the On-Site Disposal Facility

Control	Requirement	Frequency	Scope
PROPRIETARY CONTROLS 1. Establish points of contact	1. OAC 3745-27-11(B)(3) OAC 3745-66-18(c)(3) OAC 3745-68-10 40 CFR Sec. 258.61(c)(2) 40 CFR Sec. 265.118(c)(3) 40 CFR Sec. 264.118(b)(3)	1. Initially and when updates are needed	1. Provide primary and backup points of contact to ensure authorized and emergency access. Points of contact are provided in Table 4–2 of the PCCIP. Updates will be provided as needed. The DOE-LM 24-hour emergency number is 877-695-5322.
2. Ownership	2. OU2 ROD OU5 ROD	2. N/A	2. The federal government will maintain property ownership of the area comprising the OSDF and associated buffer areas. Management is the responsibility of the DOE-LM.
GOVERNMENTAL CONTROLS 1. Notations on land records or real estate restrictive license	1. OU2 ROD OU5 ROD	1. Annual review	1. If in place, annually verify that real estate restrictions are still in place. Restrictions will be provided in the deed, and proper notifications will be provided as required.
PREVENTING UNAUTHORIZED ACCESS TO THE OSDF 1. Informational devices	1. OU2 ROD	1. N/A	1. Signs and postings include information on restrictions, access information, contact information, and emergency information.
2. Engineered barriers	2. OU2 ROD	2. N/A	2. Access to the OSDF is physically restricted by means of fences, gates, and locks.
3. Routine OSDF inspections	3. OU2 ROD OU5 ROD	3. Quarterly	3. Inspect the OSDF as specified in the PCCIP.

1.6 Updates to the Institutional Controls Plan

The future LMICP schedule will be as follows:

- Each June, the annual site environmental reports will be submitted. They will make recommendations based on the previous year's monitoring information.
- Each October, an annual review of the LMICP will be submitted. It will identify updates as necessary.
- Each January, the document will be finalized to correspond with the monitoring and reporting schedule.

Upon EPA and OEPA approval, it is anticipated that the LMICP will be finalized by January each year to correspond with calendar-year monitoring and reporting. Between October and January, EPA and OEPA comments will be addressed.

2.0 Controls to Eliminate Disturbance and Monitor Use of the Fernald Preserve

2.1 Fernald Preserve

The primary institutional controls for the disturbance and use of the Fernald Preserve include continued federal ownership, real estate restrictions (if necessary), and using access controls and inspections to prevent the unauthorized use of the Fernald Preserve. The institutional controls for the disturbance and use of the Fernald Preserve are summarized in Table 1–1.

2.1.1 Proprietary Controls and Points of Contact

Proprietary controls are those controls that originate from the responsibilities associated with the ownership of property. These controls are established to ensure that the Fernald Preserve remains in a configuration consistent with the designated land use and that unauthorized uses do not occur. In the case of the Fernald Preserve, the federal government will maintain ownership, as stated in the OU2 ROD (DOE 1995). Primary and secondary points of contact have been established for emergency purposes, to ensure authorized access, and to ensure open communication (Appendix C). If an on-site emergency occurs, if unacceptable behavior is observed, or if someone has questions, the points of contact should be contacted.

The actions listed below are prohibited to ensure the ongoing protection of the site and for anyone using the site. Prohibited actions will be clearly posted at site access points. The following list applies to all unauthorized personnel:

- No alcohol or illegal drugs.
- No firearms.
- No removal or intentional damage of plants.
- No mushroom gathering.
- No soil excavation.
- No removal or intentional damage of archaeological materials (as defined in the Archaeological Resources Protection Act).
- No swimming or wading.
- No camping.
- No hunting, trapping, or fishing.
- No dumping.
- No smoking in prohibited areas, fires, or other open flames.
- No tampering, manipulating, or damaging of structures, fences, signs, water control devices, or other federal property.
- No deviation from designated roadways.

An interim residual risk assessment was performed to evaluate post-closure risks associated with the Fernald Preserve. The risk assessment was carried out in two phases. Phase I focused on the development of a geographic-information-system-based risk assessment tool to evaluate the final land use receptors identified in the OU5 ROD (i.e., undeveloped park user, expanded trespasser, and off-site farm resident) using certification data available in early 2006. This phase was completed in early 2007, and subsequent planning activities determined that there was no long-term need to maintain this tool for future risk assessment work. Phase II produced the *Interim Residual Risk Assessment Report*, which was released as Revision 1 in July 2007 (DOE 2007). This report demonstrates that the incremental lifetime cancer risk to seven receptors (undeveloped park user, museum visitor, museum worker, groundskeeper, building maintenance personnel, and construction workers) that visit or work at the site is less than 1E-04 lifetime cancers, which is consistent with CERCLA guidance. The receptors are exposed to residual contamination in the air, soil, and surface-water pathways. Food and groundwater pathways will be evaluated after the completion and certification of the groundwater remedial actions.

Land use restrictions may be modified or terminated in consultation with EPA and OEPA.

2.1.2 Governmental Controls

A part of the governmental controls at the Fernald Preserve will be the use of real estate notations and restrictions, should they become necessary (i.e., another organization would have the responsibility of managing the property). Notations on land records or similar restrictive real estate licenses will be in place for the Fernald Preserve and off-site property that is impacted by Fernald Preserve activities. DOE-LM will ensure that real estate notations remain in place as long as they are needed. In addition, if the management of any part of the site should be transferred from DOE to another federal entity, DOE will ensure that the controls remain in place. Per the OU2 and OU5 RODs, DOE-LM will annually review deed restrictions, if implemented, to ensure that they remain in effect with the local authorities. A review of notations or real estate restrictions and other institutional controls will also be part of the CERCLA 5-year review process.

In the event that DOE leases or transfers the management of the property to an entity other than DOE, the appropriate regulatory approvals will be secured, and restrictions and limitations will be communicated and implemented (e.g., zoning restrictions). In such cases, DOE will work with the agency to ensure that institutional controls for the active site will remain effective. This may be documented in a memorandum of understanding or other appropriate instrument. A description of the various types of institutional controls pertaining to the ownership or transfer of DOE land is included in the *Institutional Controls in RCRA and CERCLA Response Actions at Department of Energy Facilities* (DOE 2000).

2.1.3 Preventing Unauthorized Use of the Fernald Preserve

2.1.3.1 Informational Devices

The "No Trespassing" signs that are currently posted along the perimeter of the Fernald Preserve will remain to discourage access to the site at locations other than designated access points. These signs state the following:

No Trespassing by Order of the United States Department of Energy

The unauthorized entry upon any facility, installation, or real property subject to the jurisdiction, administration, or in the custody of the Department of Energy, which has been designated as a subject to the provisions contained in Title 10, Code of Federal Regulations (CFR), Part 860, is prohibited. The unauthorized carrying, transporting, or otherwise introducing or causing to be introduced, any dangerous weapon, explosive or other dangerous instrument or material likely to produce substantial injury or damage to persons or property, into or upon such facility, installation or real property is likewise prohibited.

Whoever willfully violates these regulations, shall, upon conviction, be punishable by a fine of not more than $5,000. Whoever willfully violates these regulations with respect to any facility, installation, or real property enclosed by a fence, wall, floor, roof, or other structural barrier, shall be guilty of a misdemeanor and, upon conviction, shall be punished by a fine not to exceed $100,000 or imprisonment for not more than one year, or both. (Title 42, United States Code § 2278; Title 18, United States Code § 3571)

By authority of Section 229 of the Atomic Energy Act of 1954, as amended (Title 42, United States Code § 2278(a)) and Title 10, CFR, Part 860 of the rules and regulations of the Department of Energy, this facility, installation, or real property has been designated as subject to these regulations by the United States Department of Energy. Trespassers may be subject to the provisions stated above.

Final site configuration includes postings at access points and other strategic locations indicating prohibited activities and site contact information. The same applies to the OSDF restricted area, the CAWWT, and fenced extraction wells (Figure 2).

DOE will establish a Visitors Center on site in the former Silos Warehouse, which will be refurbished. The Visitors Center is expected to be completed in June 2008. It will contain information on and context for the remediation of the Fernald Preserve, including information on site restrictions, ongoing maintenance and monitoring, and residual risks. The Visitors Center will also house computers (so that visitors may access electronic copies of documents and records), a meeting place, and other educational information as appropriate. A primary goal of the Visitors Center is to fulfill an informational and educational function within the community. The information in the Visitors Center will serve as an institutional control, make visitors aware of the Fernald Preserve's history and condition, and help prevent unsafe disturbances and uses of the site.

The Visitors Center will be maintained and operated under the direction of DOE-LM. With stakeholder input, DOE will periodically evaluate the use of the Visitors Center and the programming provided there. The conceptual design of the Visitors Center was completed by the University of Cincinnati, with input from stakeholders. Upon the completion of the Visitors Center, DOE will obtain stakeholder input on decisions regarding changes to the Visitors Center or its ongoing operation.

Realizing that certain structures needed to remain at the Fernald Preserve to support the continued management of the site, DOE reconciled the OU 3 ROD via a fact sheet (DOE 2006e).

The structures subject to the OU3 ROD reconciliation were those that were present solely to support the legacy management of the site. There are other facilities at the site, under the authority of OU5, that are required for the continued implementation of the ongoing groundwater remedy, the maintenance of the OSDF, and environmental monitoring.

2.1.3.2 Security of Site Facilities and Infrastructure

During nonbusiness hours, site facilities and structures will be locked when personnel are not present. A gate installed at the main site access location, the south Willey Road Entrance, will be locked during nonbusiness hours. Other access points (for example, those along Paddys Run Road) are protected with access controls consisting of cables mounted on posts. Some site infrastructure, such as the OSDF restricted area, the CAWWT, and unhoused extraction wells, have fences constructed around them and will remain locked to prevent unauthorized access. Controls also include enforcing the land use restrictions, maintaining fences and other infrastructure (as needed), and replacing or updating postings as needed to ensure the site's security (Figure 2).

An on-site DOE-LM presence is responsible for routine patrols and inspections of the Fernald Preserve. The patrols will ensure that no unauthorized use of the site is occurring and that facilities and structures are secure. Any unauthorized activity should be reported to the site contact immediately (Appendix C).

The public also plays a role in ensuring the security and safety of the site. As a result of the presence of an on-site Visitors Center (see Section 2.1.3.1), there will be community traffic and a public presence on the site. The final site configuration includes postings at access points and other strategic locations (visible to the public), containing contact information; members of the community may call any time they notice anything out of the ordinary or suspicious, or if they just have questions.

2.1.3.3 Routine Inspection of Property

In 2007, formal inspections of site property and infrastructure were conducted quarterly. In general, this process provided an effective means of ensuring that institutional controls were in place. However, depending on the time of year, some portions of the site are difficult to access due to vegetation, water, and the like. Therefore, inspections will take place when areas are accessible. All portions of the Fernald Preserve will be inspected annually. Area-specific walkthroughs will occur on a more frequent basis as activities (e.g., maintenance projects, ecological monitoring) warrant. Results of the annual site inspection will be included in an appendix to the *Annual Site Environmental Report*.

The formal site inspections include such things as fences; signs and postings; roadways and pathways; general interior, restored, and perimeter areas of the property; and access points (Figure 2). Also included in the inspections are the CAWWT and the groundwater restoration system (details are included in Attachment A). Grating that was installed to prevent access to the 60-inch Main Drainage Corridor culvert will be inspected as well. This culvert, along with an adjacent 18-inch culvert that is completely buried, has remained in place even though it has fixed radiological contamination. These culverts are located directly below the OSDF leachate

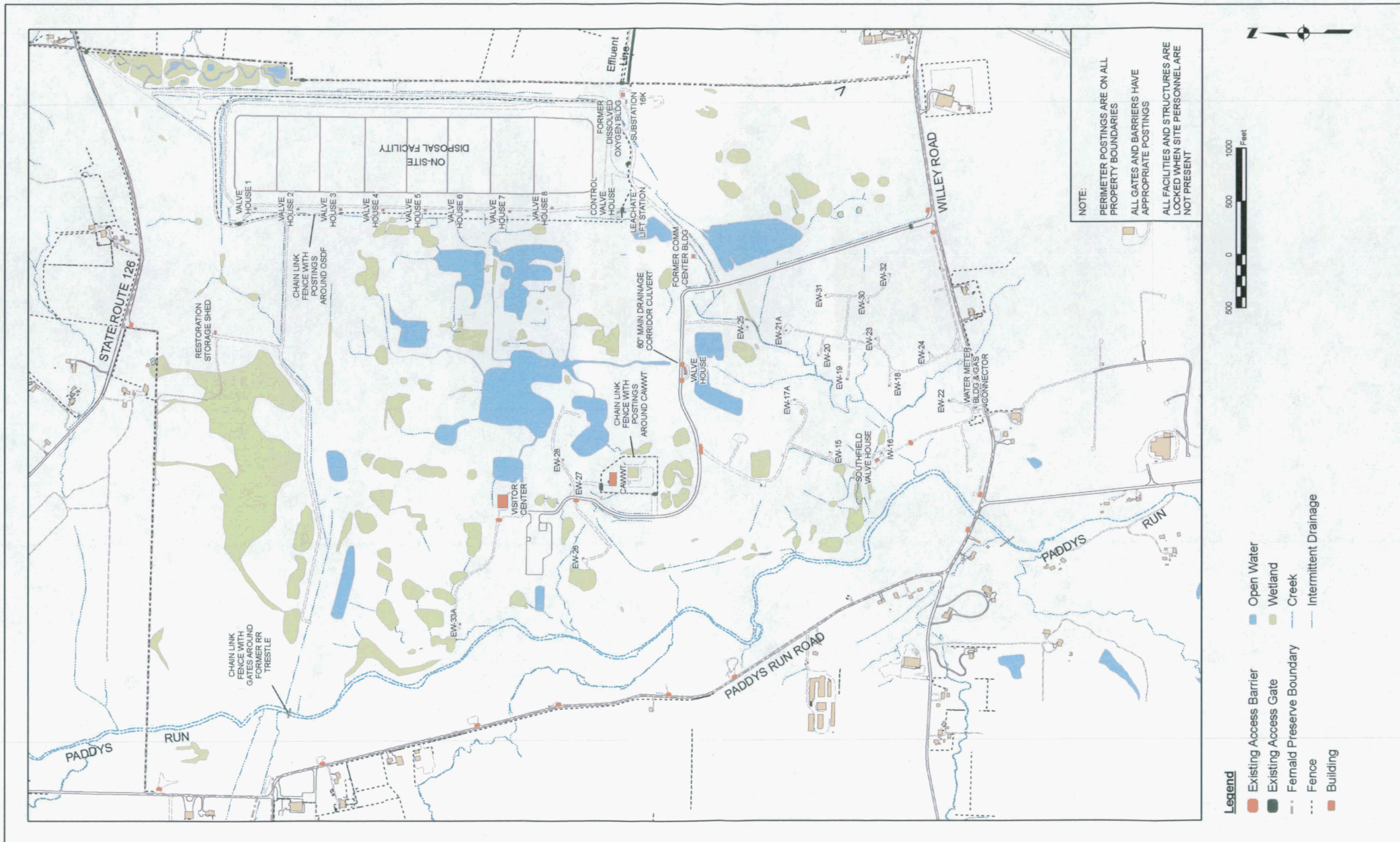

Figure 2. Fernald Preserve Site Configuration

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conveyance system and the main effluent line running between the CAWWT and the Great Miami River. Due to their location, these culverts could not have been removed without potentially impacting ongoing CAWWT and OSDF operations. Instead, metal grating was installed to prevent access to the 60-inch culvert. Site inspections will ensure that the 60-inch culvert grating is in place and is serviceable, and that the 18-inch culvert is not exposed through erosion or other ground disturbance. The fact sheet identifying clean buildings and structures for beneficial reuse under legacy management provides additional information regarding these culverts (DOE 2006e).

The attached example inspection checklist (Appendix D) outlines important components of all inspections for the Fernald Preserve (all areas outside the OSDF). The inspections focus on essential parameters to ensure that the primary institutional controls for the Fernald Preserve are being maintained. The inspections also include ensuring that prohibited activities are not taking place on site and that restrictions are being adhered to. Consultation with the public, regulatory agencies, local emergency-response personnel, and other key stakeholders is also part of the annual inspections.

DOE has a voting membership with the Ohio Utility Protection Service. With this membership, DOE will be notified any time an entity will be digging within a quarter of a mile of the site. DOE will then be able to contact the contractor or company doing the work to ensure that they are not impacting the Fernald Preserve property.

DOE-LM has an on-site manager who is responsible for the management and monitoring of the site post-closure, along with other duties. The manager's duties include managing the organization and conducting formal inspections of site property. DOE-LM exercises a portion of this responsibility through various subcontracts.

2.1.4 OSDF

The primary institutional controls for the disturbance and use of the OSDF include continued federal ownership, real estate restrictions (if necessary), and the prevention of unauthorized use of the OSDF and its associated buffer area. Engineered barriers, such as fencing, gates, and locks, are also important institutional controls (Figure 2). The institutional controls for the OSDF are summarized in Table 1–2. The table includes descriptions of the institutional controls, places where the institutional controls are referred to, and the requirements that drive the institutional controls. Primary and secondary points of contact have been established for emergency purposes, to ensure authorized access, and to ensure open communication (Appendix C). The OSDF will continue to be inspected quarterly, as specified in the PCCIP.

2.1.5 Proprietary Controls and Points of Contact

Proprietary controls are those controls that originate from the responsibilities associated with the ownership of property. The first is that the federal government will maintain ownership of the OSDF property in perpetuity, as stated in the OU2 ROD. The management of the OSDF (along with the management of the Fernald Preserve) transferred from DOE-EM to DOE-LM, but the OSDF and the site will always remain under federal ownership. The second is that primary and secondary points of contact have been established for emergency purposes, to ensure authorized access, and to ensure open communication.

2.1.6 Governmental Controls

A fundamental part of governmental controls will be the use of real estate notations and restrictions. Notations on land records or similar restrictive real estate licenses are in place for the land occupied by the OSDF. DOE-LM will ensure that real estate notations remain in place. DOE will also maintain the responsibility to manage and maintain the OSDF and all other activities needed to ensure that remedies remain effective. Any contract support required to implement specific aspects of maintenance and monitoring will be made aware of all restrictions regarding the use and disturbance of the OSDF.

2.1.7 Preventing Unauthorized Use

Physical barriers to restrict access to the OSDF and its surrounding buffer area include exclusion fencing, gates, and locks, which will be maintained. Signs and postings include information on restrictions, access information, contact information, and emergency information (Figure 2). Weather-resistant signs around the OSDF say the following:

CAUTION,
Underground Radioactive Material,
Contact Site Manager Prior to Entry
513-910-6107

Signs on the access gates to the OSDF contain slightly different information. The gate signs contain the following information:

- The name of the site.
- The international symbol indicating the presence of radioactive material.
- A notice that trespassing is forbidden on this U.S. government-owned site.
- A local DOE telephone number and a 24-hour DOE emergency telephone number; this telephone number will be recorded in agreement with local agencies to notify DOE in the event of an emergency or breach of site security or integrity.

The final configuration of the OSDF includes monuments installed at the corners of the engineered disposal facility, and markers placed on the top and the east and west toes of the cell caps (indicating the boundaries between the cells). The corner monuments consist of concrete cylinders 12 inches in diameter and 48 inches long. They are installed to a depth of 42 inches, with 6 inches of concrete remaining above the surface. A brass plate with pertinent identification and location information is flush-mounted to the top surface of the concrete. The individual cell markers are brass plates with pertinent identification and location information attached to a brass rod and flush-mounted to the ground surface.

3.0 Controls to Minimize Human and Environmental Exposure to Residual Contaminants

3.1 Fernald Preserve

The preliminary interim residual risk assessment performed for the second CERCLA 5-year review of the Fernald Preserve showed that residual constituents remain protective of human health and the environment. Section 6.4.4, "Review of Post-Remedial Action Contaminant Toxicity Assumptions," in the *Second Five-Year Review Report for the Fernald Closure Project* (DOE 2006a) explains the assessment process for residual constituents. Table 6–3, "Comparison of the CRARE and Present Risk for All Pathways," illustrates that the risks are below CERCLA limits. This preliminary interim residual risk assessment has been replaced by the final *Interim Residual Risk Assessment Report* (DOE 2007) as discussed in Section 2.0.

Institutional controls have been established for the Fernald Preserve to minimize the potential for human and environmental exposure to residual contaminants, ensuring that it is below acceptable limits. These controls include the inspection and maintenance of engineered systems and infrastructure designed to protect human health and the environment, and monitoring and sampling to ensure continued protection from exposure. Additional information about these controls can be found below and in Table 3–1.

3.1.1 Fernald Preserve Inspections

In 2007, DOE conducted formal quarterly inspections of the Fernald Preserve to ensure that institutional controls were being maintained and were functioning as intended, and that there were no activities being conducted on site that would pose a threat to human health or the environment, including any prohibited activities (Section 2.1.1). After a year, the frequency of the inspections was to be reevaluated. Beginning in 2008, the Fernald Preserve inspection will be conducted annually. Section 2.1.3.3 describes the inspection process for the Fernald Preserve in more detail.

A list of prohibited activities is posted at the primary site access points. Inspections of the area outside the OSDF will be performed per the Fernald Preserve Area Post-Closure Inspection Checklist (refer to the example in Appendix D) to ensure that there is no digging or soil removal of any kind (including wind or water erosion), and that infrastructure designed and in place for protecting against human exposure to contaminants, such as fences and signs, are in good condition and functioning as intended. Inspections also include the CAWWT, the groundwater restoration system, and the active outfall line. The inspection of the active outfall line includes ensuring sufficient soil coverage over the pipeline in an area where the soil is cultivated by a local farmer. A proper check of the soil cover on the outfall line involves locating the line in the area of concern (with surveying) and using of a hand probe to check the depth of the line to ensure that there are at least 30 inches of cover. The soil cover check will be completed annually in the fall, after the harvest. In the event there is insufficient soil cover over the pipeline, DOE will notify the landowner and the regulators. DOE will then take the necessary corrective actions, in consultation with the landowner. The inspection of uncertified areas (Volume I, Figure 3) includes ensuring that there is no digging or disturbance of the soils and no tampering with any signs that may be posted to define the areas. Grating that was installed to prevent access to

Table 3–1. Controls to Minimize Human and Environmental Exposure to Residual Contaminants at the Fernald Preserve

Control	Requirement	Frequency	Scope
FERNALD PRESERVE INSPECTIONS	OU2 ROD OU5 ROD	Annually. Frequency will be reevaluated through the CERCLA 5-year review process.	Inspect infrastructure in place for the protection against human exposure to contaminants, such as fences and postings, to ensure their proper condition and function. • Ensure that there is no removal of soil by wind or water erosion. Inspect water control structures, swales, and discharge points. • Inspect access control grating on the 60-inch Main Drainage Corridor culvert. • Conduct an inspection to ensure that prohibited activities, such as digging, off-road travel, camping, or hunting, are not taking place on site.
SURFACE WATER DISCHARGE INSPECTIONS	NPDES	Annually	• Inspect surface water drainages and discharge to ensure water is not being impacted by other means, and that drainages are functioning properly. • Discharge points to Paddys Run will be inspected for general water quality conditions (e.g., presence or absence of scum, foam, oil sheen, turbidity, color, other putrescent or unusual material). Up gradient drainage channels may be inspected for excessive erosion and obstructions. • Inspect active outfall line to ensure sufficient soil cover is present. • The Great Miami River will be inspected at the point of the Fernald Preserve discharge for the same general water quality conditions identified above.
GROUNDWATER REMEDY SAMPLING AND MONITORING	IEMP	Frequency of sampling and monitoring of groundwater is dependent upon the effectiveness of the remediation efforts and will vary over time.	• Monitor groundwater to ensure remedy is functioning properly until remedy certification is complete. Details are provided in the IEMP.

the 60-inch Main Drainage Corridor Culvert will be inspected as well. More frequent inspections may be required under certain circumstances (a pattern of unauthorized activities or uses). If warranted, more frequent inspections will be carried out to ensure that site restrictions are being maintained. Upon the completion of the Visitors Center, a workforce will be present on site daily. It will be part of the workforce's responsibilities to help ensure that prohibited activities are not taking place.

3.1.2 Surface Water Discharge

Until the groundwater remedy is complete, and as long as there is surface water discharge to the Great Miami River, a NPDES permit or similar permit mechanism needs to be in place. Monitoring and reporting to maintain compliance with the permit requirements will be part of post-closure responsibilities at the Fernald Preserve. Once there is no longer any surface water discharge to the river, the permit for surface water discharge may be closed out. Prior to the completion of the remedy, if it is decided that monitoring a particular outfall location is no longer necessary, DOE-LM may request that OEPA remove that particular location from the permit at that time. OEPA issues and maintains the NPDES permit.

3.1.3 Groundwater Remedy and Monitoring

The Institutional Controls to preclude the use of groundwater in the off-property area where groundwater contamination is greater than the 30 ppb uranium final remediation level consist of the following:

- The DOE funded public water system, which provided an alternate water supply for residents in the areas affected by groundwater contamination from the Fernald Preserve.
- The Hamilton County water well permitting process. Drinking water wells cannot be installed until a permit has been obtained from the Hamilton County Health Department. DOE will ensure that the Health Department is aware of the off-property areas where groundwater contamination is greater than 30 ppb uranium. DOE has sent a letter and map documenting the contaminated area to the Hamilton County Health Department and requested that no permits be issued in this area, given the contamination and the ongoing aquifer remediation (DOE 2006d). Additionally, the letter requests that DOE be notified of any proposed drilling activities in the vicinity of the plume. If DOE is made aware of any drilling activities in the area of the off-site plume, the regulators must be notified.
- Daily well field operational inspections and routine groundwater sampling. Operational personnel make daily rounds of the South Plume well field and will be instructed to notify management of any unusual activity in the area (e.g., well drilling). Groundwater sampling personnel will also be in the area of the South Plume for routine groundwater monitoring and will be instructed to notify management of any unusual activities.

Aquifer restoration operations and maintenance activities are part of an ongoing remedial action governed by the OU5 ROD. The requirements for the operations and maintenance activities are outlined in the OMMP (Attachment A). The OMMP, as originally written, defines the operating philosophy for the extraction and re-injection treatment systems (re-injection is not being used at this time), the establishment of operational constraints and conditions for given systems, and the establishment of the process for reporting and instituting corrective measures to address exceedances in discharge limits. How to address exceptional operating conditions is also addressed.

Section 2.0 of the OMMP discusses the general commitments of the aquifer restoration. Provided are details regarding the aquifer cleanup levels, discharge limits, groundwater treatment capacity, groundwater treatment decisions, extraction rates, and injection rate and quality (although injection is no longer used). Section 3.0 of the OMMP goes into more specific detail about the design of the groundwater remediation systems, well field designs, and pump details. Section 4.0 discusses the projected flow during remediation activities. Section 5.0 discusses the Operations Plan, Section 6.0 discusses operations and maintenance, and Section 7.0 discusses roles and responsibilities. Sections 6.0 and 7.0 provide information that pertains directly to institutional controls.

Groundwater will be treated to help meet uranium discharge limits specified in the OU5 ROD until discharge limits can be achieved by blending untreated water alone. Eliminating groundwater treatment will not be pursued (1) at the expense of compromising mass removal or (2) if significant deviations from desired aggressive pumping rates are required. The CAWWT will undergo decontamination and demolition (D&D) once it has been documented to EPA and OEPA that the facility is no longer needed to meet uranium discharge limits.

When DOE has certified the groundwater remedy complete (which is defined in the Fernald Groundwater Certification Plan [DOE 2006b]) and EPA has approved it, well field infrastructure will be decommissioned and dispositioned. All needed soil excavation and certification associated with the D&D of the CAWWT and the removal of well field infrastructure will be in accordance with SEP (DOE 1998b) requirements.

Post-remedy long-term groundwater monitoring will be conducted. Requirements are defined in the Fernald Groundwater Certification Plan and will be implemented through the IEMP (Attachment D). Post-remedy long-term groundwater monitoring will be evaluated as part of the CERCLA 5-year reviews.

3.2 On-Site Disposal Facility

Institutional controls are necessary for the OSDF and its buffer area to ensure the prevention of human and environmental exposure to residual contaminants. Further information about these controls is given below and is included in Table 3–2. Details regarding OSDF inspection and maintenance are included in the PCCIP (Attachment B). The OSDF was constructed to permanently contain impacted materials derived from the remediation of the OUs at the Fernald Preserve. All material placed in the OSDF was required to meet pre-established WAC. The WAC are presented in Table 3–1 of the PCCIP. Table 3–2 of the PCCIP provides a description of the types of material or material categories that were allowed in the OSDF. The design and construction of the OSDF is described in Section 3.0. Section 4.0 of the PCCIP discusses the institutional controls for the OSDF, which have been included and summarized in this IC Plan. Table 4–1 of the PCCIP shows institutional controls for the OSDF as they were identified in the OU2 and OU5 RODs.

Table 3–2. Controls to Minimize Human and Environmental Exposure to Residual Contaminants at the On-Site Disposal Facility

Control	Reference	Requirement	Frequency	Scope
OSDF INSPECTION AND MAINTENANCE 1. Routine OSDF cap inspection	1. PCCIP	1. OAC 3745-66-18(A) and (C) 40 CFR Sec. 264.118(b)(2) 40 CFR Sec. 265.118(c)(2) OU5 ROD	1. Quarterly for two years following completion of cells 7 and 8. The monitoring schedule will be reevaluated after the 2 years of quarterly monitoring	1. Detect and record any change in the following: • General health, density, and variety of vegetative cover. • Presence of deep-rooted woody species. • Evidence of burrowing animals on the cover. • Presence, depth, and extent of erosion or surface cracking, indicating possible cap deterioration. • Visibly noticeable subsidence, either locally or over a large area—any sufficient enough to pond water. • Presence and extent of any leachate seeps. • Integrity of run-on and runoff control features. • Integrity of benchmarks. The process for contingency planning and notification is provided in Section 4.0.
2. Unscheduled OSDF cap inspection	2. PCCIP	2. OU5 ROD	2. As needed	2. Unscheduled inspections will be carried out as needed under specific circumstances (e.g., follow-up of maintenance, after significant natural events). Follow-up or contingency inspections will be conducted no more than 30 days after repair (refer to Section 4.0) to investigate and quantify specific problems encountered during a routine scheduled inspection, a special study, or another DOE or regulatory agency activity. Follow-up inspections determine whether the cover/cap stability is threatened and evaluate the need for maintenance, repairs, or corrective actions. Contingency inspections may be situation-unique inspections ordered by DOE or regulatory agencies.

Table 3–2. Controls to Minimize Human and Environmental Exposure to Residual Contaminants at the On-Site Disposal Facility (continued)

Control	Reference	Requirement	Frequency	Scope
3. Routine OSDF cap custodial and preventative maintenance	3. PCCIP	3. OAC 3745-66-18(A) and (C) 40 CFR Sec. 264.118(b)(2) 40 CFR Sec. 265.118(c)(2) OU5 ROD OU2 ROD	3. As needed	3. Routine custodial and preventative maintenance consists of the following: upkeep of the vegetative cover, general mowing, clearing of debris, removal of woody weeds and seedlings, reseeding.
4. Routine OSDF site area inspection	4. PCCIP	4. OAC 3745-66-18(A) and (C) 40 CFR Sec. 264.118(b)(2) 40 CFR Sec. 265.118(c)(2) OU5 ROD OU2 ROD	4. Quarterly for 2 years following completion of cells 7 and 8. The monitoring schedule will be reevaluated after the 2 years of quarterly monitoring.	4. Inspect the adjacent area within approximately 0.25 miles of the OSDF buffer area. Describe evidence of land use changes. • Evaluate natural drainage courses in the immediate vicinity of the OSDF to determine whether there is a threat to the OSDF integrity. Walk approximately 1,000 feet of adjacent natural drainage courses and note unusual or changed sediment deposits, large debris accumulations, manmade or natural constrictions, and recent or potential channel changes. • Evaluate and record the development of gullies. • Evaluate growth of vegetation in channels. • Determine the condition and required maintenance of on-property roads. • Inspect and record the area adjacent to the OSDF for erosion channels, accumulations of sediment, evidence of seepage, and signs of animal or human intrusion.
5. Unscheduled OSDF site area inspection	5. PCCIP	5. OU5 ROD OU2 ROD	5. As needed	5. Investigate reports that site integrity may be compromised. Follow-up or contingency inspections will be conducted to investigate and quantify specific problems encountered during a routine scheduled inspection, special study, or other DOE or regulatory agency activity. Determine whether the support systems are threatened, and evaluate the need for maintenance, repairs, or corrective actions. Contingency inspections are situation-unique inspections ordered by DOE when it receives information indicating that site integrity has been or may be threatened.

Table 3–2. Controls to Minimize Human and Environmental Exposure to Residual Contaminants at the On-Site Disposal Facility (continued)

Control	Reference	Requirement	Frequency	Scope
6. Routine OSDF site area custodial and preventative maintenance	6. PCCIP	6. OAC 3745-66-18(A) and (C) 40 CFR Sec. 264.118(b)(2) 40 CFR Sec. 265.118(c)(2) OU5 ROD	6. As needed	6. • Repair/replace fencing, gates, locks, and signs due to normal wear, severe weather conditions, or vandalism. • Mow/clear undesired woody vegetation; reshape, reseed, and repair banks; unplug culverts; and clean out run-on/runoff diversion channels.
LEAK DETECTION/ LEACHATE MONITORING 1. OSDF leachate and environmental monitoring	1. GWLMP and IEMP	1. OAC 3745-27-6 OAC 3745-54-90 through 99 (applicable portions)[a] DOE 435.1	1. Varying frequencies depending on sampling stage (e.g., baseline)	1. • A routine monitoring program will be maintained for four zones within and beneath the OSDF. These zones include the LCS, the LDS, perched water within the glacial overburden, and the Great Miami Aquifer (GWLMP Section 3.2.1). Samples from the four zones are being collected and analyzed as specified in the GWLMP. • Environmental monitoring parameters and frequencies are identified in the IEMP.
LEACHATE MANAGEMENT	GWLMP	OU5 ROD GWLMP	As needed	Leachate will continue to be treated.

[a]OAC 3745-54-90 through 99 are not applicable in entirety (refer to the OSDF GWLMP, Appendix A).

Section 5.0 of the PCCIP discusses environmental monitoring activities that are necessary to continue during the post-closure care period, including air monitoring, groundwater monitoring, and the monitoring of other media (e.g., surface water, vegetation). Section 6.0 addresses routine inspections, which are important institutional controls. Section 3.2.1 of this IC Plan addresses these inspections in detail. Also addressed in the PCCIP are unscheduled inspections (Section 7.0), custodial monitoring and contingency repairs (Section 8.0), and emergency notifications (Section 10.0).

3.2.1 OSDF Inspection and Maintenance

DOE will conduct inspections and maintenance on the cap and cover system. Inspections will be conducted on a quarterly basis for a period of 2 years following the completion of cells 7 and 8. The frequency of inspections will be re-evaluated following the two years of quarterly monitoring. Custodial and preventative maintenance and unscheduled inspections will be conducted as needed. Table 3–2 provides current details on the required inspections and maintenance.

Routine inspections include monitoring the health of the vegetative cover; the presence of deep-rooted woody species; the existence of burrowing animals; the extent of surface erosion or cracking; subsidence, if any; the extent of any leachate seeps; the integrity of runoff controls; and the integrity of benchmarks. It also includes evaluating the condition of physical access controls (fences, gates, locks, and signs); observing adjacent properties for evidence of land use changes; evaluating natural drainage courses in the immediate vicinity; and inspecting the general area for erosion, excess sediment, seepage, and signs of human or animal intrusion. If determined necessary or appropriate, the frequency of the routine inspections may be revised through the CERCLA 5-year reviews. More-frequent monitoring, due to changes in the cap or surrounding areas, is always a possibility; however a decrease in frequency would require discussion, review, and approval at the time of the 5-year review. Routine custodial maintenance includes the upkeep of the vegetative cover; general mowing; the clearing of debris and woody plants; and reseeding.

The monitoring and management of the OSDF vegetative cover will be carried out to optimize the establishment and continued growth of the native grass mix specified and seeded on the OSDF cap. Monitoring will consist of the collection of data to determine the percentage of native cover on the OSDF cap. Data collection on the Cell 1 cap occurred in summer 2005, the fourth growing season after seeding. On the remaining cell caps, data collection will first occur four years after the seeding of each cap. The schedule for the first round of data collection on each cap will be as follows: Cell 2 in 2007, Cell 3 in 2008, Cells 4 through 7 in 2009, and Cell 8 in 2010. A grid will be established on each cell cap. Data will be collected from random sampling locations within the grid. Data will be collected at each sampling location to determine the overall percentage of native cover for the cap. Data will be collected one time during each sampling event in late summer. The results of data collection will be issued by DOE-LM to the regulatory agencies as soon as practical after the data have been compiled and processed, but no later than October 15 of the collection year.

Routine management of the OSDF cap includes mowing and baling in the spring to control woody vegetation. Mowing and baling will occur on a 3-year rotation. Cells 1, 2, and 3 were mowed in 2007. Cells 4, 5, and 6 will be mowed in 2008, and Cells 7 and 8 will be mowed in 2009. Additional mowing may take place in order to manage weeds and promote native-grass and forb establishment. In the event that the spring mowing is not possible, it will be postponed until the following fall. Baling of the cut grasses will remove thatch and promote prairie-grass growth. Selective herbicide will be used as needed to control invasive or nuisance plants that are identified on the cap. In order to maximize the growth of prairie grass, controlled burning of the cell cap would be the best management tool. Working with the community and regulators, DOE-LM will maintain the cap vegetation, including the possibility of burning to properly manage the selected seed mixture. Following the collection of data from the Cell 1 cap in the summer of 2005, a decision was made to mow the grass and reseed where necessary. Decisions regarding the management of the remaining cell caps will be made after percent-native-cover data is collected per the above schedule.

As stated above, the goal will be to optimize the establishment of native grasses on the OSDF cap. DOE and the regulatory agencies agree that the goal is not necessarily to establish a functioning prairie on the OSDF cap. Native grasses (e.g., Big Bluestem, Little Bluestem, Switch Grass) are more drought-tolerant than cool-season grasses and will provide additional stability due to their complex root structures. A pass/fail criterion will not be set for the performance of the native grasses on the OSDF cap. However, a goal of 50 percent native cover has been considered for restored prairies on the site and will be used as a goal for native grasses on the OSDF. If the concentration of native grasses remains at or above 50 percent, management and monitoring will continue as outlined above. If the concentration of native grasses falls below 50 percent, DOE-LM will work with the regulatory agencies to develop an appropriate plan to increase the concentration of native grasses. Steps taken may include, but are not limited to, selective reseeding, installing native grass plugs, increasing the use of selective herbicide, and further considering controlled burns on the cap, or some combination thereof. The requirement to maintain 90 percent cover at all times after seeding on the OSDF cap will remain unchanged to minimize cap erosion. The 90 percent cover requirement applies to all vegetation on the cap and is not specific to native grasses.

Unscheduled inspections will be conducted as needed if specific circumstances warrant. An example would include following up on the completion of a maintenance action or conducting a cap inspection after an unusually large storm event. Based on the results and determinations made from the inspections, DOE will take appropriate actions to address any identified problems.

The maintenance and monitoring of the general support systems for the OSDF will include ensuring that physical access controls and restrictions are maintained, conducting routine inspections of the OSDF and surrounding area, performing routine maintenance activities, and monitoring the environment. Table 3–1 provides additional information on the required monitoring and maintenance.

The federal government will remain the property owner, and access to the OSDF and associated buffer area will continue to be restricted in perpetuity by means of fences, gates, locks, and warning signs (Figure 2). Access will be limited to personnel conducting inspections, custodial maintenance, and corrective action, and will be authorized by the federal government only.

3.2.2 Leak Detection/Leachate Monitoring

Routine OSDF leak detection and leachate monitoring is currently governed by the GWLMP (Attachment C). Table 3–2 includes some of the details. Section 3.0 of the GWLMP provides the regulatory analysis and strategy for the OSDF monitoring. The regulatory drivers come from the ARARs identified in the OU2, OU3, and OU5 RODs. Section 4.0 of the plan provides a significant amount of information on the OSDF leak detection monitoring program. The text includes the program elements, monitoring frequencies, selection of analytical parameters, and data evaluation. Section 5.0 is a discussion of the leachate management monitoring program. It covers the management approach and monitoring needs. Section 6.0 provides the reporting requirements, and notification and response actions for when flow in the leak detection system exceeds action levels, which could be an indication of a failure in the cap or liner and could pose a threat to human health or the environment. Table 6–1 of the GWLMP outlines these actions in detail.

3.2.3 Leachate Management

Also involved in the maintenance and monitoring of the OSDF system is the management of the leachate that enters the LCS. Additional information regarding leachate management is also found in Appendix D of the GWLMP. Leachate will be treated through the CAWWT until the CAWWT is no longer available (anticipate that the CAWWT will be required at least until the 2010–2011 timeframe). A passive leachate treatment system is an option after the CAWWT is no longer available. Long-term treatment needs for the OSDF leachate during the period after the CAWWT is decommissioned will be reevaluated in 2009 (prior to the shutdown and D&D of the CAWWT). It is anticipated that by 2009, approximately 3 years after the last cell is capped, the leachate flow will be stabilized at a low level, and the leachate chemistry will be stable and well defined. The quantity of leachate collected, treated, and discharged will continue to be documented. Leachate will be sampled and analyzed as specified in the OSDF GWLMP.

4.0 Contingency Planning

Site inspections, monitoring activities, and maintenance activities are designed to identify problems before they develop into a need for corrective action. In the unlikely case that a natural event, vandalism, or other event threatens the integrity or operation of the OSDF or remainder of the site, corrective actions will be carried out to mitigate the problem. In addition, DOE will evaluate the factors that caused the problem and ensure that the possibility of recurrence is minimized or avoided.

To the extent that contingency actions can be anticipated or planned, they have been, and will continue to be, incorporated into the LMICP or attached support plans. Unanticipated contingency actions will be subject to CERCLA processes prior to implementation. Stakeholders, regulatory agencies, and the public will be notified of any unanticipated contingency actions under CERCLA that have to be implemented.

4.1 Unacceptable Disturbances or Use

In the event that an unacceptable condition or disturbance occurs at the Fernald Preserve during legacy management, corrective actions will be employed, and appropriate notifications will occur. Unacceptable conditions regarding the disturbance or use of the Fernald Preserve may include unauthorized access to the site (e.g., off-road vehicles), attempts to use soil or water on the site in an inappropriate manner, attempts to access the OSDF, or damage to fencing, gates, or postings. Section 2.1.1 provides an extensive listing of those actions that are prohibited and apply to all unauthorized personnel. Unacceptable conditions related to exposure to residual contaminants could include damage or disruption to the OSDF or attempts to utilize groundwater still undergoing remediation.

Contingency inspections are unscheduled situation-unique inspections ordered by DOE when it receives information indicating that site integrity has been or may be threatened. Events that could trigger contingency inspections include severe vandalism, intrusion by humans or livestock, severe rainstorms, or unusual events of nature such as tornadoes or earthquakes. If any unacceptable activities were found to be occurring on site, DOE-LM would implement the appropriate corrective actions, both to repair damage, if required, and to prevent or reduce the chances of reoccurrence. Some of the possible corrective actions DOE-LM may consider are increasing the frequency of surveillances by site personnel, requesting patrols by local law enforcement personnel, adding surveillance cameras, evaluating and possibly revising current postings at the site, and prosecuting individuals caught engaging in prohibited, destructive, or disruptive behavior.

Events that have caused severe damage to the OSDF or that pose an immediate threat to human health and the environment will be immediately reported to EPA and OEPA. Detailed information regarding OSDF contingency inspections, corrective actions, and reporting are contained in Attachment B.

Minor maintenance actions such as seeding small areas, minor erosion repairs on the OSDF or other parts of the site, the replacement of postings and signs, minor fence and gate repairs, and minor maintenance of site infrastructure will not be subject to the notification process described above. The need for minor maintenance will be identified on routine inspection forms issued to EPA and OEPA and will be subject to follow-up inspections as discussed above.

4.2 Contaminated Soil and/or Debris

In the event that suspect debris or small areas of isolated soil that could present radiological issues are discovered, DOE will isolate the area and begin investigative activities. A radiological control technician will conduct a scanning survey of the debris or soil. For debris, DOE-approved limits for contamination from residual radioactive material will be used to determine the proper disposal method. For soils, areas where instrument readings indicate a presence of uranium, thorium, or radium above a value corresponding to three times its FRL will be marked for additional investigation. Debris that does not meet the unrestricted release criteria and soils that exceed the cleanup criteria will be transported to an off-site disposal facility for disposal in accordance with the terms of the ACA and EPA's Off-site Rule. If unexpected large-scale soil contamination is identified, the protocol in the SEP (DOE 1998b) will be followed, which is the same protocol that will be used for the uncertified areas as described in Volume I, Section 2.4.4.

The disposal of any contaminated debris or soil will be handled on a case-by-case basis once adequate historical knowledge of the soil is compiled and any additional characterization is complete. Until then, temporary storage in covered stockpiles or drums (depending on volume) will be established, and a path forward through final disposition will be developed for review and approval by appropriate agencies as necessary.

Although not expected, any tagged Fernald property items or items suspected to be from Fernald that are found on site or off site are to be reported by calling either the Fernald Preserve manager at 513-910-6109 during business hours or the 24-hour DOE-LM emergency number at 877-695-5322.

4.3 Unexpected Cultural Resource Discoveries

Although limited excavation activities on the Fernald Preserve are expected to occur, there will be excavations associated with the Visitors Center construction, for erosion repair, and in the future when the time comes to remove the CAWWT and associated aquifer restoration infrastructure. If unexpected cultural resources are identified within an excavation, the site procedure for handling unexpected cultural resource discoveries will be followed. This includes isolating the affected area until the on-call subcontractor can perform the necessary investigation. This follows the same process used during remediation and restoration activities. DOE will continue to consult with the appropriate parties, such as the State of Ohio Historic Preservation Office, to determine an appropriate course of action as necessary.

4.4 Notification Process

Upon discovering any institutional control breaches, DOE-LM will notify EPA and OEPA of the breaches and of DOE's plan for correcting them. Stakeholder notifications will be handled as deemed appropriate by DOE. Any activity that is inconsistent with the institutional control objective or use restrictions will be addressed by DOE-LM as soon as practical, but in no case will the process be initiated later than 10 days after DOE-LM becomes aware of the violation.

DOE will notify EPA and OEPA regarding how it has addressed or will address the breach within 10 days of the initial notification. A follow-up inspection will occur within 30 days of the completion of any corrective action. The results of follow-up inspections will be provided to EPA and OEPA.

4.5 Coordination with Other Agencies

DOE-LM sent letters to the Hamilton County Sheriff's Department; the Butler County Sheriff's Department; and Ross, Crosby, and Morgan Township police and fire officials requesting that they notify DOE-LM in the event they observe any unauthorized human intrusion or unusual natural event.

DOE-LM sent a letter to the Ohio Earthquake Information Center, located at Alum Creek State Park in Delaware County, Ohio, requesting that they notify DOE-LM in the event of an earthquake in the vicinity of the Fernald Preserve.

DOE-LM will monitor emergency weather notification system announcements and has requested notification from the National Weather Service (either Wilmington or Cincinnati) of severe weather alerts.

To notify DOE-LM of site concerns, the public may use the 24-hour security telephone numbers monitored at the DOE facility in Grand Junction, Colorado. The 24-hour security telephone numbers will be posted at site access points and other key locations on the site.

THE 24-HOUR EMERGENCY NUMBER
877-695-5322

End of current text

5.0 Information Management and Public Involvement

5.1 Information Management

The long-term retention of records and dissemination of information is another critical aspect of legacy management. DOE-LM will manage records that are needed for legacy management purposes. Records will be dispositioned in accordance with DOE requirements at the National Archives and Records Administration or a federal records center for their required retention period or destroyed once they have reached the required retention. Copies of selected records documenting past remedial activities (e.g., CERCLA Administrative Record [AR]) will be retained by DOE-LM for legacy management purposes on the site at the Visitors Center. In addition, newly acquired CERCLA AR records will be available to stakeholders.

DOE-LM will also manage any centralized system to provide stakeholders with access to information. Copies of selected information or data documenting past remedial activities (e.g., soil certification) and the design and contents of the OSDF will be retained and managed by DOE-LM for institutional control purposes. In addition, newly acquired information or data related to remedy performance will be readily available to stakeholders and the public. DOE-LM currently uses the Geospatial Environmental Mapping System, a Web-based application, to manage and provide stakeholders, the agencies, and the public with Internet access to electronic data.

Administrative Record documents for the Fernald Preserve have been scanned into industry-standard searchable Adobe Acrobat portable document file (PDF) format for viewing over the Internet. Document metadata is stored in a FileMaker Pro database. The database also contains pointers to the PDF images of the documents.

Features of the public-access website include a search engine that allows users to search by document number, document date, document type, document title, description, and site. Additionally, users can search for text contained within the document. Search results can be sorted by document number, document date, or document type. Document content is displayed using the Adobe Acrobat Reader software.

5.1.1 Fernald Preserve Data and Information

Inspection data will include information from inspections of the general site area, perimeter, access points, infrastructure, and signs and postings. The Fernald Preserve Area Post-Closure Inspection Checklist (Appendix D) will be used to collect the data and document the inspection.

The IEMP (Attachment D) defines environmental monitoring requirements for the Fernald Preserve. Monitoring data will include all environmental monitoring data associated with the site, including groundwater remediation data and ecological restoration monitoring data.

5.1.2 OSDF Data and Information

Inspection data will include information from inspections of the OSDF cap, infrastructure (e.g., LCS/LDS pipe networks), perimeter fencing, buffer area, and signs and postings. The

OSDF Cell Post-Closure Inspection Checklist (Appendix D) and the LCS/LDS Inspection Checklists will be used to collect the data and document the inspections.

Monitoring data will include the monitoring of the LCS, groundwater monitoring, and any other environmental monitoring data that pertains to the OSDF and its function.

5.1.3 Reporting

The annual site environmental report will continue to be submitted to EPA, OEPA, and the community on June 1 of each year. It will provide information on institutional controls, monitoring, maintenance, site inspections, and corrective actions while continuing to document the technical approach and summarizing the data for each environmental medium. It will also summarize CERCLA, Resource Conservation and Recovery Act (RCRA), and waste management activities. The report will include water quality and water accumulation rate data from the on-site disposal facility monitoring program. The summary report serves the needs of the regulatory agencies and other key stakeholders. The accompanying detailed appendixes of the site environmental report are intended for a more technical audience, including the regulatory agencies, and will serve to fulfill National Emissions Standards for Hazardous Air Pollutants reporting requirements, as necessary. Additionally, there will be continued reporting requirements, as required under other regulatory programs that will be addressed outside the annual site environmental reports (e.g., NPDES monthly discharge reports).

Once it is determined that the institutional controls are functioning, the remedy is performing as intended, and the groundwater remediation is effective, the reporting frequency may be reevaluated. In the event of unacceptable conditions or disturbance, more-frequent notification and reporting will be required as defined in Section 4.0.

Under CERCLA, a review of the remedy is required every 5 years at sites where the level of remaining contaminants limits site use. The CERCLA 5-year reviews at the Fernald Preserve will focus on the protectiveness of the remedies associated with each of the five OUs. Also included will be summaries of the inspections conducted for the OSDF, the CAWWT facility, the groundwater restoration system, and the active outfall line to the Great Miami River. To facilitate the review, a report addressing the ongoing protectiveness of the remedies will be prepared and will be submitted to the EPA and OEPA. The institutional controls portion of the report will include the data collected from monitoring and sampling, summaries of the inspections conducted of the Fernald Preserve and OSDF site and cap during the 5-year period, and a discussion of the institutional controls' effectiveness. If it is determined that a particular control is not meeting its objectives, then required corrective actions will be included. The review may lead to revisions to the monitoring and reporting protocols.

5.2 Public Involvement

The public played a very important role in the remediation process at the Fernald Preserve, and the community remains very involved in legacy management. DOE has written the CIP (Attachment E) to document how DOE will ensure the public's continued involvement in a wide variety of site-related decisions and activities, including post-closure monitoring. The CIP is a CERCLA-required document, replacing the current Community Relations Plan, also required under CERCLA. Although the CIP contains all of the requirements for public involvement under

CERCLA, it also includes DOE's policy for public involvement, which extends beyond CERCLA requirements. Therefore, the CIP clearly identifies those elements that are not enforceable.

5.2.1 Current Public Involvement via Groups and Organizations

Several groups followed the remediation and cleanup process at the Fernald Preserve, including the Fernald Citizens Advisory Board (FCAB), Fernald Residents for Environmental Safety and Health (FRESH), and the Fernald Living History Project. The FCAB was established to formulate cleanup policy and to help guide the cleanup activities at the site. Representatives, including local residents, governments, businesses, universities, and labor organizations, constituted the advisory board membership. In 1995, the FCAB issued recommendations to DOE on remedial action priorities, cleanup levels, waste disposition alternatives, and future uses for the Fernald Preserve property. The FCAB was actively involved in the final remediation and restoration activities for the Fernald Preserve, with monthly full-board meetings and meetings of the FCAB Stewardship Committee. DOE worked closely with the FCAB until September 2006, when the FCAB held its final meeting.

FRESH was formed by local residents in 1984 and has played an important role in providing community input on the characterization and remediation of the Fernald Preserve. The group held its final public meeting in November 2006, after 22 years of environmental activism.

The FCAB had cosponsored (along with FRESH, the Community Reuse Organization, and the Fernald Living History Project) four "Future of Fernald" workshops. The workshops were open to the public and gave the community input on the final public-use decisions as described in the Master Plan for Public Use of the FEMP (DOE 2002). The later workshops led to the recommendation of a Multi-use Education Facility at the site.

The Fernald Community Alliance, also known as Fernald Living History Inc., is dedicated to ensuring that the history of Fernald is available for future generations. The group remains active and is looking to expand its member base.

A list of other stakeholders considered to be critical for legacy management planning at the Fernald Preserve is given below. Additional stakeholders may be identified in the future.

- Local government and enforcement agencies.
- Local volunteer organizations.
- Local residents.
- Universities.
- Local school groups.
- Environmental organizations.
- Native American Tribes.
- Native American organizations.
- Natural Resource Trustees.
- Regulatory agencies.

- Fernald Community Alliance.
- Local Historical Societies.
- Local businesses.

5.2.2 Ongoing Decisions and Public Involvement

The regulatory requirements that drive legacy management activities at the Fernald Preserve will continue to be evaluated. A database developed by Florida International University (FIU 2002) is a starting point in the identification of applicable requirements, but additional review and decision making are still needed.

The Visitors Center is expected to be completed in June 2008.The design phase of the Visitors Center was completed in 2007 and included community involvement from the very beginning. In 2006, a faculty/student team from the University of Cincinnati (College of Design, Art, Architecture, and Planning [DAAP], Center for Design Research and Innovation) conducted a series of meetings with the community to produce a conceptual design for the reuse of an existing warehouse on the Fernald property. The plan for the new Visitors Center also included opportunities in landscape, sustainability, graphics, exhibits, branding, and delivering documentation of ideas suitable for transfer to a commercial architect–builder team for implementation.

From June to September 2007, a University of Cincinnati summer studio from DAAP worked to deliver a conceptual design specifically for the exhibits within the Fernald Preserve Visitors Center. Two subsequent presentations were given to the community with their final recommendations.

Input on future legacy management planning decisions will occur through formal document reviews, community meetings, roundtables, workshops, and other forums. Currently, DOE holds quarterly briefings for interested stakeholders. DOE anticipates continuing these updates using a similar forum/format throughout legacy management. The CIP (Attachment E) also discusses methods of reporting to the public.

Another process involving the public is the CERCLA 5-year review. The 5-year reviews are performed pursuant to CERCLA §121, "The National Contingency Plan" (40 CFR Part 300), and the Comprehensive 5-Year Review Guidance, June 2001. These regulations state that a public comment and review period will be provided so that interested persons may submit comments. Input from the public regarding the legacy management of the site and the ongoing groundwater remediation will always be considered, just as it had during the remediation of the site.

5.2.3 Public Access to Information

DOE-LM will continue to make available to the public documents pertaining to the Fernald Preserve. A public reading room is located at the Delta Building, 10995 Hamilton-Cleves Highway, Harrison, Ohio, 45030. Selected documents about the Fernald Preserve and public computer access will be available at the Fernald Preserve Visitors Center. The CERCLA AR will be available in both hard-copy and digitized formats.

AR documents for the Fernald closure site will be scanned into industry-standard searchable Adobe Acrobat PDF format for viewing over the Internet. Document metadata is stored in a FileMaker Pro database. The database also contains pointers to the PDF images of the documents.

Features of the public-access website include a search engine that allows users to search by document number, document date, document type, document title, description, and site. Additionally, users can search for text contained within the document. Search results can be sorted by document number, document date, or document type. Document content is displayed using the Adobe Acrobat Reader software. The CERCLA AR will be updated as new documents are created.

End of current text

6.0 References

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Appendix A

Appendix A

Records of Decision and Associated Documents

Records of Decision and Associated Documents

Federal Facility Compliance Agreement	1986
Work Plan (identifies specific units of the site for RI/FS)	1988
Consent Agreement	1990
Amended Consent Agreement	1991
Record of Decision for Operable Unit 4	1994
Interim Record of Decision for Operable Unit 3	1994
Record of Decision for Operable Unit 1	1995
Record of Decision for Operable Unit 2	1995
Final Record of Decision for Operable Unit 3	1996
Record of Decision for Operable Unit 5	1996
Explanation of Significant Differences for Operable Unit 4 Silo 3 Recommendation that treatment of Silo 3 material be evaluated and implemented separately from treatment of Silos 1 and 2 material	1998
Final Record of Decision Amendment for Operable Unit 4 Silos 1 and 2	2000
Explanation of Significant Differences for Operable Unit 5 Resulted in change of FRL for uranium in groundwater from 20 ppb to 30 ppb	2001
Explanation of Significant Differences for Operable Unit 1 Recommendation for processing other FEMP waste streams through the Operable Unit 1 remediation facilities and processes	2002
Final Record of Decision Amendment for Operable Unit 1	2003
Final Record of Decision Amendment for Operable Unit 4 Silo 3	2003
Final Explanation of Significant Differences for Operable Unit 4 Silos 1 and 2	2003
Final Explanation of Significant Differences for Operable Unit 4	2005
Final Fact Sheet for Operable Unit 3	2006
Operable Unit 1 Final Remedial Action Report	2006
Operable Unit 2 Final Remedial Action Report	2006
Operable Unit 3 Final Remedial Action Report	2007

Operable Unit 4 Final Remedial Action Report	2006
Operable Unit 5 Interim Remedial Action Report	TBD
Preliminary Close Out Report (U.S. EPA Document)	2006

Appendix B

Appendix B

Institutional Control Records as Stated in the Records of Decision

Institutional Control Records as Stated in the Records of Decision

Operable Unit 2 Record of Decision (DOE 1995)

The selected remedy will include the following as institutional controls:

- Continued federal ownership of the OSDF site.
- OSDF access restrictions (fencing, gates, and warning signs) will be controlled by proper authorization and is anticipated to be limited to personnel for inspection, custodial maintenance, or corrective action.
- Restrictions on the use of property will be noted on the property deed before the property could be sold or transferred to another party.
- Groundwater monitoring following closure of the OSDF.

Operable Unit 5 Record of Decision (DOE 1996)

Long-term maintenance will be provided as part of the selected remedy. The selected remedy includes the following key components for institutional controls and monitoring:

- Continuation of access controls at the Fernald Preserve, as necessary, during the conduct of remedial actions. Property ownership will be maintained by the federal government and will comprise the disposal facility and associated buffer areas.
- Maintenance of remaining portions of the Fernald Preserve (outside the disposal facility area) under federal ownership or control (e.g., deed restrictions) to the extent necessary to ensure the continued protection of human health commensurate with the cleanup levels established by the remedy. If portions of the Fernald Preserve are transferred or sold at any future time, restrictions will be included in the deed, as necessary, and proper notifications will be provided as required by CERCLA. EPA must approve of all ICs, including types of restrictions and enforcement mechanisms, if the property is transferred or sold.
- Maintenance of the on-property disposal facility, to ensure its long-term performance and the continued protection of human health and the environment.
- An environmental monitoring program conducted during and following remedy implementation to assess the short- and long-term effectiveness of remedial actions.
- Provision of an alternative water supply to domestic, agricultural, and industrial users relying upon groundwater from the area of the aquifer exhibiting concentrations of contaminants exceeding the final remediation levels. The alternative water supply will be provided until such time as the area of the aquifer impacting the user is certified to have attained the final remediation levels.

End of current text

Appendix C

Appendix C

Fernald Preserve Contact Information

Fernald Preserve Contact Information

EMERGENCY CONTACT
Grand Junction 24-Hour Monitored Security Telephone Number 877-695-5322 Fernald Preserve Emergency Telephone Number 911 or 513-910-6107 Fernald OSDF Emergency Telephone Number 911 or 513-910-6107
OFFICE OF LEGACY MANAGEMENT–FERNALD
<u>Site Manager</u> Jane Powell Department of Energy Office of Legacy Management 513-648-3148 jane.powell@lm.doe.gov
S.M. Stoller–Fernald <u>Site Manager</u> Frank Johnston S.M. Stoller Corporation 513-648-5294 frank.johnston@lm.doe.gov

ENVIRONMENTAL AGENCIES

<u>Remedial Project Manager</u>
U.S. Environmental Protection Agency
Region V, SR-6J
77 West Jackson Boulevard
Chicago, Illinois 60604-3590
312-886-0992

<u>Fernald Project Coordinator</u>
Ohio Environmental Protection Agency
401 East Fifth Street
Dayton, Ohio 45402-2911
937-285-6357
www.epa.state.oh.us

U.S. Fish and Wildlife Service
Suite H
6950 American Parkway
Reynoldsburg, Ohio 43068

FERNALD PRESERVE COMMUNITY INVOLVEMENT COORDINATOR

<u>Community Relations Specialist</u>
Susan Walpole
S.M. Stoller, Corporation
513-648-4026

LOCAL POLICE AUTHORITY

Crosby Township/Hamilton County Police
Administration Office
513-825-1500

Morgan Township/Butler County Police
Administration Office
513-887-3010

Note: This information will be updated as necessary.

Appendix D

Appendix D

Example of OSDF and Fernald Preserve Inspection Forms

OSDF Cell Cap Post-Closure Inspection Checklist

Date of Inspection: Weather Conditions:

Time of Inspection:

Inspection By: Transect Direction**

Inspection Component	Condition of Each Cell Cap A* or U*								Comments	Addressed
	1	2	3	4	5	6	7	8		
1. Entrance Road/Monitoring Access Road										
1A. Verify that entrance gate, lock, and signage are intact and in good working order.										
1B. Verify that access gates are locked to prevent unauthorized entry.										
1C. Visually observe condition of access road for signs of erosion, ruts, standing water, proper drainage, and excess vegetation.										
1D. Verify that access road surfacing, cross slope, reflectors, and signage are intact and in good condition.										
2. Chain-Link Fence and Signage										
2A. Walk length of fence and ensure that fence, posts, etc., are intact and in good condition. Ensure that gates are closed/locked to prevent unauthorized entry.										
2B. Verify that the proper signage is intact and in good condition.										
2C. Check for vegetation growing over fences, barricades, and signs; any noxious vegetation per State of Ohio regulations; and invasive plants growing on or around OSDF perimeter.										
3. Surface Water Management										
3A. Check integrity of drainage channels around OSDF for erosion or debris restricting water flow (see attached map). Build up of debris/sedimentation in drainage ditch is not to exceed 6 in.										
3B. Visually check the integrity of riprap in drainage channels for signs of deterioration or removal of rock.										
3C. Visually check for the presence of woody vegetation growing in drainage channels and in riprap										
3D. Visually check the integrity of run-on- and runoff-control features, including ditch checks, gravity inlet structures, and culverts.										

* **A** = Satisfactory; **U** = Unsatisfactory (comments required)

** Transect direction should alternate each inspection (north to south and east to west)

OSDF Cell Cap Post-Closure Inspection Checklist

Date of Inspection: Weather Conditions:

Time of Inspection:

Inspection By: Transect Direction**

Inspection Component	Condition of Each Cell Cap A* or U*								Comments	Addressed
	1	2	3	4	5	6	7	8		
4. Final Cover										
4A. Walk cover and side slopes in 25-ft (±5-ft) transects, and visually inspect for the following items:**										
4A1. Erosion rills/channels greater than 3 in wide and 6 in deep or excessive erosion.										
4A2. Observable depressions, settlement/subsidence, slumping or desiccation cracks.										
4A3. Ponding or standing water.										
4A4. Evidence of burrowing animals or other bio-intrusion.										
4A5. Evidence of vehicle traffic on the OSDF cap.										
4B. Walk toe of slope and visually inspect for the following:										
4B1. Evidence of settlement/subsidence, erosion, and seepage.										
4B2. A 20-ft corridor at the toe for the presence of woody vegetation, siltation, and/or biointrusion.										
4B3. Any observable abnormalities in the riprap.										
4C. Inspect toe at final cover for evidence of freezing or siltation.										

* **A** = Satisfactory; **U** = Unsatisfactory (comments required)

** Transect direction should alternate each inspection (north to south and east to west)

OSDF Cell Cap Post-Closure Inspection Checklist

Date of Inspection: Weather Conditions:
Time of Inspection:
Inspection By: Transect Direction**

Inspection Component	Condition of Each Cell Cap A* or U*								Comments	Addressed
	1	2	3	4	5	6	7	8		
4D. Walk cover and side slopes in 25-ft (±5-ft) transects, and visually check vegetative cover for the following:										
4D1. General health of grass cover and signs of stressed or dead grass should be noted.										
4D2. Adequate grass coverage/density with no bares spots greater than 3 ft in diameter. Any areas with questionable vegetative coverage will be sampled for percent cover and type of vegetation using meter-square quadrants.										
4D3. Inspect the cover for the presence of woody vegetation (i.e., trees or shrubs) or noxious/invasive plants growing.										
4E. Visually inspect locations where Cell 1 monitoring equipment and infrastructure has been removed. Check for settling of fill material. Check for adequate vegetative cover.										
5. Groundwater Monitoring Wells										
5A. Visually inspect all groundwater wells for damage and integrity of well infrastructure.										
5A1. Groundwater monitoring wells										
5A2. Horizontal monitoring wells										

* **A** = Satisfactory; **U** = Unsatisfactory (comments required)
** Transect direction should alternate each inspection (North to South & East to West)

OSDF Cell Cap Post-Closure Inspection Checklist

Date of Inspection: Weather Conditions:

Time of Inspection:

Inspection By: Transect Direction**

Inspection Component	Condition of Each Cell Cap A* or U*								Comments	Addressed
	1	2	3	4	5	6	7	8		
6. Miscellaneous										
6A. Visually inspect the integrity of survey benchmarks, cell cap boundary markers, and corner monuments.										
6B. Visually inspect the integrity of the perched water interceptor trench (once installed).										
6C. Visually observe/inspect the corridor 50 ft outside of OSDF for signs of land use changes, settlement or subsidence, erosion, standing water, encroachment, livestock grazing, or noxious vegetation.										
6D. Visually inspect all infrastructures for any act of vandalism.										
6E. List any other observations not listed above.										

* **A** = Satisfactory; ***U** = Unsatisfactory (comments required)

** Transect direction should alternate each inspection (north to south and east to west)

Reference Sources for Post-Closure OSDF Inspections

1. Post-Closure Care and Inspection Plan, On-Site Disposal Facility
2. On-Site Disposal Facility Technical Specification #'s 02831, 02270, 02271, and 02930
3. On-Site Disposal Facility Drawing #'s 90X-5500-E-00851 and 90-5500-G-00577
4. Construction Drawing # 90X-6000-G-00073
5. Phase III Drawing #'s 90X-6000-G-00302 and 90X-6000-G-00310

Fernald Preserve Area Post[illegible]osure Inspection Checklist

Date of Inspection:________________ Weather Conditions: ______________________________

Time of Inspection:________________

Inspection By:____ Other Observations:______________________

Inspection Component		Condition A* or U*	Comments	Corrective Action(s) Proposed	Reference Source
1. Disturbance and Use of Fernald Preserve					
1A.	Inspect access points to ensure that site restrictions and contact information are clearly posted.				LMICP
1B.	Ensure that perimeter gates/fences/barriers are in proper working condition.				"
1C.	Visually inspect interior and perimeter areas to ensure that no unauthorized use or disturbance is occurring.				"
1D.	Note any change in adjacent off-property land use.				"
1E.	Visually inspect site wetlands to ensure no dredge/fill or other type of disturbance is occurring.				Clean Water Act
1F.	Visually inspect restored areas to ensure that prohibited noxious weeds are not present.				OAC
1G.	Visually monitor Paddys Run to ensure disturbance of Sloan's crayfish habitat is not occurring.				LMICP
1H.	Visually monitor along Paddys Run corridor to ensure disturbance of Indiana Bat habitat is not occurring.				Endangered Species Act
1I.	Visually inspect site for excessive erosion.				LMICP
1J.	Annually verify that all deed restrictions and other real estate use restrictions are in place and are applicable.				LMICP
2. Prevent Human and Environmental Exposure to Residual Contaminants					
2A.	Visually inspect infrastructure supporting aquifer remedy to ensure that no unauthorized access or disturbance is occurring.				LMICP
2B.	Visually inspect perimeter areas to verify that prohibited activities (e.g., digging, soil removal, swimming) are not occurring on Fernald Preserve.				"
2C.	Visually inspect uncertified areas to ensure that no digging, disturbance, or tampering with signs is occurring.				"
2D.	Visually inspect access control grating on the Main Drainage Corridor 60-in culvert.				LMICP
2E.	Annually (following harvest) inspect soil cover over outfall line to ensure that sufficient soil cover (30 in) is present.				LMICP
3. Information Management					
3A.	Verify that site information is available to the public and other stakeholders as planned.				LMICP
3B.	Verify that information on site inspections and maintenance is readily available.				LMICP
3C.	Verify that requests for site information are being addressed and fulfilled as planned.				LMICP
3D.	Verify that as-built drawings and information on OSDF contents and design are readily available.				LMICP

* A = Satisfactory; U = Unsatisfactory (comments and identification on site map required)

Fernald Preserve Area Post-Closure Inspection Checklist

Date of Inspection:__________ Weather Conditions: __________

Time of Inspection:__________

Inspection By:__________ Other Observations:__________

Inspection Component	Condition A* or U*	Comments	Corrective Action(s) Proposed	Reference Source
4. Site Interviews				
4A. Contracted Land Manager—Identify any unusual occurrences or problems at Fernald Preserve.				LMICP
4B. Site Information/Data Manager—Ensure that site data is available and information is being managed as planned.				"
4C. Aquifer Restoration Manager—Verify that aquifer remediation is progressing as planned, and identify any unusual occurrences.				"
4D. Other staff as appropriate—Identify any problems or site issues.				"
4E. Hamilton County/Butler County Sheriff—Identify any concerns or issues.				"
4F. Ross/Crosby Township Police/Fire Departments—Identify any concerns or issues.				"
4G. Ohio "Call Before You Dig" Program Office—Ensure that Fernald Preserve information is properly noted to prevent unauthorized excavation on the site.				"
4H. Stakeholder groups (e.g., FRESH, Post-Closure Coalition)—Identify any concerns or problems.				"
4I. Adjacent landowners – Identify any concerns or problems.				LMICP

* **A** = Satisfactory; **U** = Unsatisfactory (comments and identification on site map required)

Attachment A

Attachment A

Operations and Maintenance Master Plan for Aquifer Restoration and Wastewater Treatment

Fernald Preserve

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Acronyms and Abbreviations

ARARs	applicable or relevant and appropriate requirements
ARWWP	Aquifer Restoration Wastewater Project
ARWWT	Aquifer Restoration and Wastewater Treatment
AWWT	Advanced Wastewater Treatment Facility
BRSR	Baseline Remedial Strategy Report
CAWWT	Converted Advanced Wastewater Treatment Facility
D&D	decontamination and demolition
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
ESD	Explanation of Significant Differences
EW	extraction well
FFCA	Federal Facilities Compliance Agreement
FRL	Final Remediation Level
ft/sec	feet per second
gpm	gallons per minute
HMI	human-machine interface
IEMP	Integrated Environmental Monitoring Plan
lbs/yr	pounds per year
LM	Legacy Management
LMICP	Management and Institutional Controls Plan
LTS	Leachate Transmission System
NPDES	National Pollutant Discharge Elimination System
OAC	Ohio Administrative Code
OEPA	Ohio Environmental Protection Agency
OMMP	Operations and Maintenance Master Plan
OSDF	On-Site Disposal Facility
OU5	OU5
PCS	process control station
PLS	Permanent Lift Station
ppb	parts per billion
RA	remedial action
RD	remedial design
RD/RA	remedial design/remedial action
RI/FS	remedial investigation/feasibility study
RM	river mile
ROD	ROD
RW	recovery well
SWRB	Storm Water Retention Basin
µg/L	micrograms per liter
VFD	variable frequency drive
WSA	waste storage area

End of current text

1.0 Introduction

This document is the Operations and Maintenance Master Plan (OMMP) for Aquifer Restoration and Wastewater Treatment (ARWWT) at the U.S. Department of Energy's (DOE's) Fernald Preserve. The OMMP is a formal remedial design deliverable, originally prepared to fulfill Task 2 of the *Operable Unit 5* (OU5) *Remedial Design* (RD) *Work Plan* (DOE 1996a). It was first issued in November 1997. The OMMP has undergone several revisions and became part of the Legacy Management and Institutional Controls Plan (LMICP) in January 2006.

As noted in the Executive Summary, the OMMP has been integrated into this revision of the LMICP. The OMMP is no longer a stand-alone document with its own review and revision cycle. It will be reviewed and, if necessary, revised each October.

1.1 Scope of ARWWT and Objectives of OMMP

The scope of ARWWT includes the operation and maintenance of the site's groundwater and the On-Site Disposal Facility's (OSDF's) leachate management facilities.

The fundamental objectives of the OMMP are to guide and coordinate the extraction, collection, conveyance, treatment, and discharge of all groundwater and leachate during the post-closure period. Compliance with discharge limits includes a plan of the commitments, performance goals, operating schedule, treated water flow rates, direct discharge flow rates, and other operating priorities. This plan also provides the approach for the management of treatment residuals (e.g., backwash basin sediments, spent resins/filtration media) that are byproducts of the Fernald Preserve's wastewater treatment processes.

The OMMP serves as a comprehensive statement of management policy to ensure that planned modes of operation and maintenance for ARWWT are consistent with regulatory requirements and satisfy the Fernald Preserve's remedy performance commitments for groundwater restoration and wastewater treatment. The plan establishes the decision logic and priorities for the major flow and water treatment decisions needed to maintain compliance with the Fernald Preserve's National Pollutant Discharge Elimination System (NPDES) permit and Record of Decision (ROD)–based surface water discharge limits. The plan also provides the overall management philosophy and decision parameters to implement the day-to-day flow routing, critical-component maintenance, and treatment priority decisions. It is not intended to provide detailed, specific operating or maintenance procedures for ARWWT. The plan also serves to inform the U.S. Environmental Protection Agency (EPA) and the Ohio Environmental Protection Agency (OEPA) of the planned operational approaches and strategies that are intended to meet the regulatory agreements made during the OU5 Remedial Investigation/Feasibility Study (RI/FS) (DOE 1995b, DOE 1995a) process and documented in the OU5 decision documents: the OU5 ROD (DOE 1996b), the *OU5 Explanation of Significant Differences*, and the *OU5 Remedial Design Fact Sheet for Fernald Site Wastewater Treatment Updates* (DOE 2004).

The plan provides the basis for development of more-detailed internal operating procedure documents (e.g., standard operating procedures, standing orders, Preventive Maintenance Plans) that are required for execution of work at the Fernald Preserve. The existing detailed procedural documents that govern the performance of water-related operations and maintenance activities at the Fernald Preserve are expected to be updated (revised, combined, or eliminated) as required to conform to the general strategies, guidelines, and decision parameters defined in this plan.

1.2 Basis and Need

The need for the OMMP arose in the mid 1990s, as DOE and regulators realized that the various water and wastewater flows that originate from Fernald Site remediation activities were in direct competition with one another for treatment resources. The wastewater treatment capacities at the Fernald Site had to be prioritized so that (1) discharge limits could be maintained, (2) a range of flow conditions at various time intervals could be accommodated, and (3) the detrimental effects of exceptional operating circumstances could be effectively managed. The need for treatment (and the accompanying hierarchy of treatment priorities) has varied over the span of the site remedy as new projects came on line, other projects were completed, and aquifer restoration activities progressed.

During the development of the OU5 ROD, it was recognized that the monthly average concentration discharge limit for total uranium (established at 20 parts-per-billion [ppb] in the OU5 ROD and revised to 30 ppb in the *OU5 Explanation of Significant Differences*) could probably be met under average operating conditions, but that maintaining the limit may not be achievable during periods of exceptional operating conditions. It was further recognized that the application of the discharge limit was not considered as a required component of the remedy to ensure protectiveness, but rather as an appropriate performance-based objective that appeared reasonably attainable through the application of an appropriate level of water treatment. It was recognized that the performance-based discharge limit must be able to accommodate exceptional operating conditions expected to occur over the duration of the remedy. Two exceptional operating conditions were actually cited in the OU5 ROD; it would permit relief allowances from the total uranium monthly average concentration discharge limit, when necessary, for (1) storm water bypasses during high precipitation events and (2) periodic reductions in treatment plant operating capacity that are necessary to accommodate scheduled maintenance activities.

Since storm water treatment is no longer required (other than a portion of the Converted Advanced Wastewater Treatment [CAWWT] footprint), storm water bypasses are no longer required. At the time the ROD was signed, it was recognized that the OMMP would define the operating philosophy for (1) the extraction/re-injection and treatment systems, (2) the establishment of operational constraints and conditions for given systems, and (3) the establishment of the process for reporting and instituting corrective measures to address exceedances of discharge limits. The OMMP also contains detailed information about the manner in which exceptional operating conditions are to be accommodated and reported in the demonstration of discharge limit compliance.

The OMMP will be modified during the course of the remedy to accommodate changes to the treatment and well field systems or the retirement of individual restoration modules from service, once area-specific cleanup levels are achieved. The plan is intended to serve as a living guidance document to instruct operations staff in implementing required adjustments to the system over time. The OMMP will thus be evaluated periodically to ensure that the most recent instructions regarding treatment priorities and flow routing decisions are available to system operators. Proper notifications for reporting maintenance shutdowns of the system, and the reporting and application of corrective measures to address exceedances of discharge limits, are also identified in the OMMP.

Prior to site closure in 2006, water treatment flows were reduced to groundwater and leachate from the OSDF. Elimination of remediation wastewater, impacted storm water, and sanitary wastewater provided an opportunity to reduce the size of the water treatment facility remaining to service the aquifer restoration and leachate treatment after site closure. Reducing the size of the treatment facility prior to site closure in 2006 reduced the amount of impacted materials that may need future off-site disposal.

Between October 2003 and March 2004, DOE conducted a series of meetings with public stakeholders, EPA, and the Fernald Citizens Advisory Board to identify a more cost-effective water treatment facility that would serve as a long-term replacement for the existing Advanced Wastewater Treatment (AWWT) facility. The interactions led to support for a plan to carve down the AWWT facility to permit the 1,800-gallons-per-minute (gpm) Phase III expansion system to remain as the long-term groundwater treatment facility. The 1,800-gpm CAWWT facility provided a 1,200-gpm capacity for groundwater and about 600 gpm of storm water capacity (including carbon treatment) to handle the last remaining storm water and remediation wastewater flows prior to site closure. Since those flows have ceased, the CAWWT now provides a dedicated long-term groundwater treatment capacity of up to 1,800 gpm.

In addition to decreasing the size of the water treatment facility, operational approaches to the aquifer remedy were reevaluated and resulted in the elimination of well-based groundwater re-injection, since it was determined that this was not a cost-effective approach to aquifer restoration at Fernald. This OMMP reflects the aquifer restoration design provided in the *Waste Storage Area Phase II Aquifer Restoration Design Report.*

1.3 Relationship to Other Documents

The OMMP functions in tandem with several other major ARWWT design documents and support plans (i.e., Integrated Environmental Monitoring Plan [IEMP], various aquifer restoration module design packages, the *Remedial Action* [RA] *Work Plan* [DOE 1997b], and the *Fernald Groundwater Certification Plan* [DOE 2006c]).

The environmental monitoring and reporting activities conducted in support of aquifer restoration performance decisions are specified in the IEMP (DOE 2006b). Information obtained through the IEMP will be used to (1) appraise groundwater restoration progress, (2) assess the need for changing groundwater extraction flow rates, and (3) assess the durations of groundwater extraction activities over the life of the remedy.

The initial design flow rates, planned installation sequence, detailed design basis, and overall restoration strategy for the aquifer restoration modules comprising the groundwater remedy were developed in the *Baseline Remedial Strategy Report* (BRSR) *for Aquifer Restoration* (DOE 1997a). The overall restoration strategy has been modified as a result of information gained from the ongoing remedy performance/operations monitoring and predesign monitoring conducted in support of the Waste Storage Area (WSA) (Phases I and II) Modules and the South Field Extraction System (Phase II) Module.

The RA Work Plan (DOE 1997b) (submitted to EPA and OEPA as Task 10 of the OU5 RD Work Plan) conveyed the enforceable RA construction schedule for the initial restoration modules brought online in 1998 (the Re-injection Demonstration Module, the South Field Extraction System Module, and the South Plume Optimization Module). It also contained the planning-level RA construction schedule for the remaining modules to be brought online in later years. With the completion and startup of the Waste Storage Area Phase I Module in 2002 and the South Field Phase II Module in 2003, all of the schedules specified in the RA Work Plan have been met.

The Fernald Groundwater Certification Plan defines a programmatic strategy for certifying the completion of the aquifer remedy (DOE 2006c). The Certification Plan establishes the processes that will be used to achieve groundwater restoration and conduct certification. The preferred outcome is to certify that the OU5 ROD groundwater remediation goals have been achieved using the pump-and-treat remediation system that is currently operating at the site. The plan also covers other potential contingencies and exit scenarios. Any change to the operation of the aquifer remedy system needed to achieve certification will be controlled through the OMMP.

The OMMP has functioned in tandem with several other RD or design support plans prepared by other project organizations outside ARWWT. All the other site remediation projects have been completed; therefore, there is no longer a need to interface with other projects as only a small flow of leachate from the OSDF and groundwater remains to be treated.

1.4 Plan Organization

The plan is generally organized around the wastewater streams being managed by ARWWT. The sections and their contents are as follows:

Section 1.0	Introduction: Presents an overview of the plan, its objectives, its relationship to other documents, and its organization.
Section 2.0	Summary of Regulatory Drivers and Commitments: Discusses the applicable or relevant and appropriate requirements (ARARs) compliance crosswalk and provides a summary of the other commitments and guidelines that the OU5 ROD has activated for ARWWT.
Section 3.0	Description of ARWWT Major Components: Identifies the major collection, conveyance, and treatment components comprising the Fernald Preserve's system for managing groundwater and leachate, the treatment capacities that are available, and a schedule of major ARWWT activities throughout the aquifer restoration process.
Section 4.0	Projected Flows: Provides an estimate of flow generation rates and durations for groundwater and leachate.
Section 5.0	Operations Plan: Establishes the operations philosophy, treatment priorities and hierarchy, treatment operational decisions, well field operational objectives and decisions, maintenance priorities, controlling documentation, and the management and flow of operations information to successfully operate the groundwater and leachate transmission systems to achieve regulatory requirements and commitments.
Section 6.0	Operations and Maintenance Methods: Addresses the general methods, guidelines, and practices used in managing equipment operation and maintenance; discusses some of the dedicated organizational resources and management systems that will help to ensure that ROD requirements are met; describes the key

	parameters used to monitor the performance of the groundwater and wastewater facilities; and describes the principal features and maintenance needs of the overall operation.
Section 7.0	Organizational Roles, Responsibilities, and Communications: Presents the organizational roles and responsibilities with respect to implementation of this OMMP; also presents the communications protocol for coordinating with EPA and OEPA.

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2.0 Summary of Regulatory Drivers and Commitments

Regulatory drivers and commitments, as they pertain to the successful operation of the CAWWT and associated groundwater extraction systems, involve the specific effluent limits that need to be met and source water treatment requirements. There are other regulatory requirements, legal agreements, and agency commitments that apply to the site as a whole, and as such, they may apply to the CAWWT. However, these general Fernald Preserve drivers and commitments are not discussed further in this section.

2.1 Discharge Limits

The discharges from the Fernald Preserve to the Great Miami River are primarily associated with the groundwater remedy involving the treated effluent (primarily groundwater) from the CAWWT and extracted groundwater that is discharged without treatment. A small amount of leachate from the OSDF is also managed through the CAWWT facility. In addition, it is possible that from time to time, treatment may need to be applied to storm water runoff that has been collected in former excavations in the former production area and former waste storage area. The combined effluent from the CAWWT facility is discharged to the Great Miami River through the Parshall Flume Building, which is the final monitoring point prior to reaching the Great Miami River. The required effluent limits for this discharge are governed by the OU5 ROD for the uranium component of the discharge and by the NPDES Permit (Permit No. 1IO00004*GD) for the non-uranium parameters.

2.1.1 Operational Unit 5 Record of Decision

Treatment will be applied to all discharges to the Great Miami River, to the extent necessary, to limit the total mass of uranium discharged through the Fernald Preserve outfall to the Great Miami River to no more than 600 pounds per year (lbs/yr). This mass-based discharge limit became effective upon the issuance of the OU5 ROD. Additionally, the necessary treatment will be applied to limit the concentration of total uranium in the blended effluent to the Great Miami River to no greater than 30 ppb. The 30 ppb discharge limit for uranium will be based on a monthly flow-weighted average. This limit became effective December 1, 2001, based on the OU5 Explanation of Significant Differences, which replaced the original 20 ppb standard to which the Fernald site was subject beginning January 1, 1998.

There are specific circumstances stipulated in the OU5 ROD that necessitate relief from the concentration limit. Up to 10 days per year are allowed by the ROD for emergency bypass due to storm events. However, this allowance only applied when storm water was being collected in the Storm Water Retention Basin (SWRB), recognizing the SWRB's capacity limitations and the desire to prevent an overflow of the SWRB to the Storm Sewer Outfall Ditch and Paddys Run to the extent possible. The SWRB was taken out of service in February 2006. The other instance when relief can be requested involves maintenance activities. EPA approval must be obtained in advance by notification of these planned maintenance periods. The notification must be accompanied by a request for the uranium concentrations in the discharge not to be considered in the monthly averaging performed to demonstrate compliance with the 30 ppb total uranium limit. Uranium contained in these bypass events will only be counted in the annually discharged mass, not in the monthly average concentration calculations.

2.1.2 NPDES Permit:

Under the Clean Water Act, as amended, the Fernald Preserve is governed by NPDES regulations that require the control of discharges of non-radiological pollutants to waters of the State of Ohio. The NPDES permit, issued by the State of Ohio, specifies discharge and sample locations, sampling and reporting schedules, and discharge limits. The Fernald Preserve submits monthly reports on NPDES activities to OEPA. The Fernald Preserve's current NPDES permit, No. 1IO00004*GD, became effective on July 1, 2003.

2.2 Source Water Treatment Requirements

There are three sources of wastewater that have specific management requirements: groundwater, OSDF leachate, and storm water.

2.2.1 Groundwater

Groundwater treatment decisions are made based on individual well uranium concentrations. The higher-concentration wells go to treatment, and the lower-concentration wells bypass treatment and are discharged directly to the Great Miami River outfall line. The piping networks that convey on-property extracted groundwater have double headers, one connected to the main line to treatment and the other to the main discharge line. This design feature is not applicable to the off-property South Plume Module. The extracted groundwater from the South Plume Module is sent to either the treatment facilities or directly to the discharge outfall, based on the uranium concentration in the combined flow from the six wells comprising this module. The combined treated and untreated discharge will comply with the 30 ppb discharge limit and the 600-lb/yr mass-based limit as described above in Section 2.1, "Discharge Limits."

2.2.2 Storm Water

It is not anticipated that the treatment of any storm water will be required since soil remediation and certification has been completed. Storm water treatment can be provided on a limited basis, though, if it is needed, but the infrastructure to collect transfer and store storm water has been removed as a consequence of site remediation.

2.2.3 OSDF Leachate

Ohio Administrative Code (OAC) 3745-27-19, *Operational Criteria for a Sanitary Landfill Facility*, requires the treatment of leachate. Leachate is a minimal flow and will likely have no bearing on operational decisions. However, it is required that leachate be treated through the CAWWT prior to discharge to the Great Miami River until the CAWWT is no longer needed. Prior to the cessation of CAWWT operations, DOE will have proposed and negotiated the future management of leachate with EPA and OEPA.

3.0 Descriptions of Major ARWWT Components

The major operating system components required to accomplish aquifer remedy commitments and goals are described in this section. The site conveyance and treatment system components for managing the major wastewater streams are identified, as are treatment capacities. This section also describes key linkages between the components. Figure 3–1 depicts the facilities as well as groundwater wells on a projected view of the site. Figure 3–2 provides a timeline of major activities that have occurred and those that are projected to occur throughout the aquifer restoration process.

3.1 Groundwater Component

The remediation of the Great Miami Aquifer will be achieved by completing area-specific groundwater restoration modules. These modules were specified in the following documents:

- Remedial Design/Remedial Action (RD/RA) work plans for OU5.
- BRSR for aquifer restoration.
- *Design for the Remediation of the Great Miami Aquifer in the Waste Storage and Plant 6 Areas* (DOE 2001a).
- *Design for Remediation of the Great Miami Aquifer South Field (Phase II) Module* (DOE 2002).
- *Waste Storage Area (Phase II) Design Report* (DOE 2005).

During 2003, new information became available (refer to the *Comprehensive Groundwater Strategy Report* [Fluor Fernald Inc. 2003]) that allowed for more refined groundwater modeling predictions of when aquifer restoration would be completed. The updated modeling predictions and groundwater remedy performance monitoring data both indicated that the aquifer restoration timeframe would likely be extended beyond the dates previously predicted. The updated modeling also indicated that the use of groundwater re-injection via wells did not greatly reduce the time required to remediate the aquifer. As reflected in Figure 3–2, aquifer restoration activities are predicted to be necessary beyond the year 2020.

A programmatic strategy for certifying the completion of the aquifer remedy was approved by EPA in 2005 via the Fernald Groundwater Certification Plan. The Fernald Groundwater Certification Plan establishes the processes that will be used to achieve groundwater restoration and conduct certification of the aquifer remedy. The Certification Plan relies on the IEMP and the OMMP for implementation of that process.

3.1.1 Current Groundwater Restoration Modules

Groundwater restoration modules currently in operation are:

- South Plume
- South Field (Phases I and II)
- Waste Storage Area (Phases I and II)

The geographical locations of each of these modules and associated wells are provided in Figure 3–3. A description of each of the modules is provided in the following subsections.

3.1.1.1 South Plume Module

Five extraction wells were installed in 1993 at the leading edge of the off-property South Plume, as part of the South Plume removal action, to gain an early start on groundwater restoration. The South Plume removal action well system began pumping in August 1993. The primary intent of the original five-well system was to prevent further off-property migration of contamination within the groundwater plume. Two additional extraction wells came online in August 1998 for the active restoration of the central portion of the off-property plume. These two new wells, known as the South Plume Optimization Module have now been incorporated into the South Plume Module for the purposes of remedy performance tracking and reporting. Figure 3–3 shows the locations of the wells, and Table 3–1 provides the operating status of the South Plume Module.

3.1.1.2 South Field Module

The South Field Module was installed in two phases. South Field Extraction System Phase I Module includes 10 extraction wells. In 1996, as part of an EPA-approved early start initiative, the 10 extraction wells were installed on Fernald site property in the vicinity of the south field/storm sewer outfall ditch. These wells are removing groundwater contamination in an on-property area of the Southern Uranium Plume.

Since the installation of the 10 original extraction wells of the South Field Extraction (Phase I) Module three new extraction wells have been added to the module, three of the original wells have been shut down, and one of the original wells has been converted to a re-injection well. The three extraction wells that were shut down are all located in the upgradient area of the plume where total uranium concentrations in the Great Miami Aquifer are now below the Final Remediation Level (FRL). An additional consideration in removing two of these three wells was to accommodate soil remedial activities in the vicinity of the wells.

The three new wells added to the South Field Phase I Module were installed at locations where total uranium concentrations were considerably above the groundwater FRL, in the eastern, down-gradient portion of the South Field plume. Two of the three new wells were installed in late 1999 and began pumping in February 2000. The third well was installed in 2001 and became operational in 2002.

Phase II components of the South Field became operational in 2003. The components include:

- Four additional extraction wells, one in the southern waste unit area and three along the eastern edge of the on-property portion of the southern uranium plume.
- One additional re-injection well in the southern waste unit area. All re-injection wells have been removed from service.
- A converted extraction well, which was converted into a re-injection well. All re-injection wells have been removed from service.
- An injection pond, which is located in the western portion of the Southern Waste Units Excavations. The injection pond was removed from service along with all re-injection wells.

Table 3–1 provides the operational status of the currently configured South Field Extraction System Module (Phase I and Phase II components).

Extraction Wells
- Waste Storage Area Module
- South Field Module
- South Plume Module
- OSDF Valve House
1. CAWWT Facility
2. Stormwater Retention Basin Valve House
3. On-Site Disposal Facility
4. Permanent Lift Station
5. Parshall Flume
6. Underground Outfall Line to the Great Miami River
7. South Field Valve House

CAWWT Facility

South Plume Module Off-Site Wells

FIGURE 3-1 ARWWT FACILITIES LOCATIONS MAP

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AR[illegible] TIMELINE

Aquifer Restoration	Year	Year	Wastewater Treatment
		1952	STP
		1986	BSL/HNT
		1988	SWRB
		1992	IAWWT Facility
South Plume Extraction Wells	1993		
		1994	SPIT Facility
		1995	AWWT Phases I/II
		1996	SDF
Injection Demonstration Module South Plume Optimization Module South Field Extraction Module (Phase I)	1998	1998	AWWT Resin Regeneration System New STP Operational AWWT Expansion
		1999	BSL Pump and Piping Modifications / Sludge Removal System
Waste Storage Area Module (Phase I)	2002		
South Field Extraction Module (Phase II)	2003		
Shut Down Well-based Re-injection	2004	2004	Shut Down AWWT Expansion for Conversion to CAWWT – 9/04
		2005	Re-route of Leachate to SWRB – 3/05 Re-route WSA Storm Water to SWRB – 3/05 BSL is Shut Down for D&D and Excavation – 3/05 Begin Full-scale Operation of CAWWT – 3/05 Shut Down Sewage Treatment Plant for D&D and Excavation – 3/05 Shut Down SDF for D&D and Excavation – 3/05 Shut Down AWWT Phases I & II for Selective D&D and Excavation – 3-4/05 Shut Down SPIT/IAWWT for D&D and Excavation – 7/05 Re-route WSA Storm Water to CAWWT – 10/05 Shut Down West SWRB for D&D and Excavation – 10/05
Waste Storage Area Module (Phase II) Pilot Plant Replacement Well	2006	2006	Shut Down East SWRB for D&D and Excavation – 2/06 Re-route of OSDF Leachate/Storm Water Directly to CAWWT – 2/06 CAWWT Backwash Basin Operational – 2/06 OSDF Capped Sufficiently Such that OSDF Storm Water Can Be Routed to Free Release – 2006 Transfer of Site from the DOE Office of Environmental Management (DOE-EM) to the DOE Office of Legacy Management (DOE-LM).
		2007 2011	Groundwater Treatment to Meet Discharge Limits Projected to End Between 2007 and 2011
South Plume Module – Stop P&T Operations*	2015		
South Plume Module – Certified Clean	2018		
South Field Module – Stop P&T Operations*	2022		
Waste Storage Area – Stop P&T Operations*	2023		
South Plume Module – Remove Infrastructure South Field Module – Certified Clean	2025		
South Field Module – Remove Infrastructure Waste Storage Area – Certified Clean Waste Storage Area – Remove Infrastructure	2026		
Long-Term Monitoring Ends	2031		

Note: Certified clean dates assume best case (3.25 years).

* Stop P&T operations' dates are based on modeling reported in the WSA (Phase II) design report (Approach C).

Figure 3–2. ARWWT Timeline

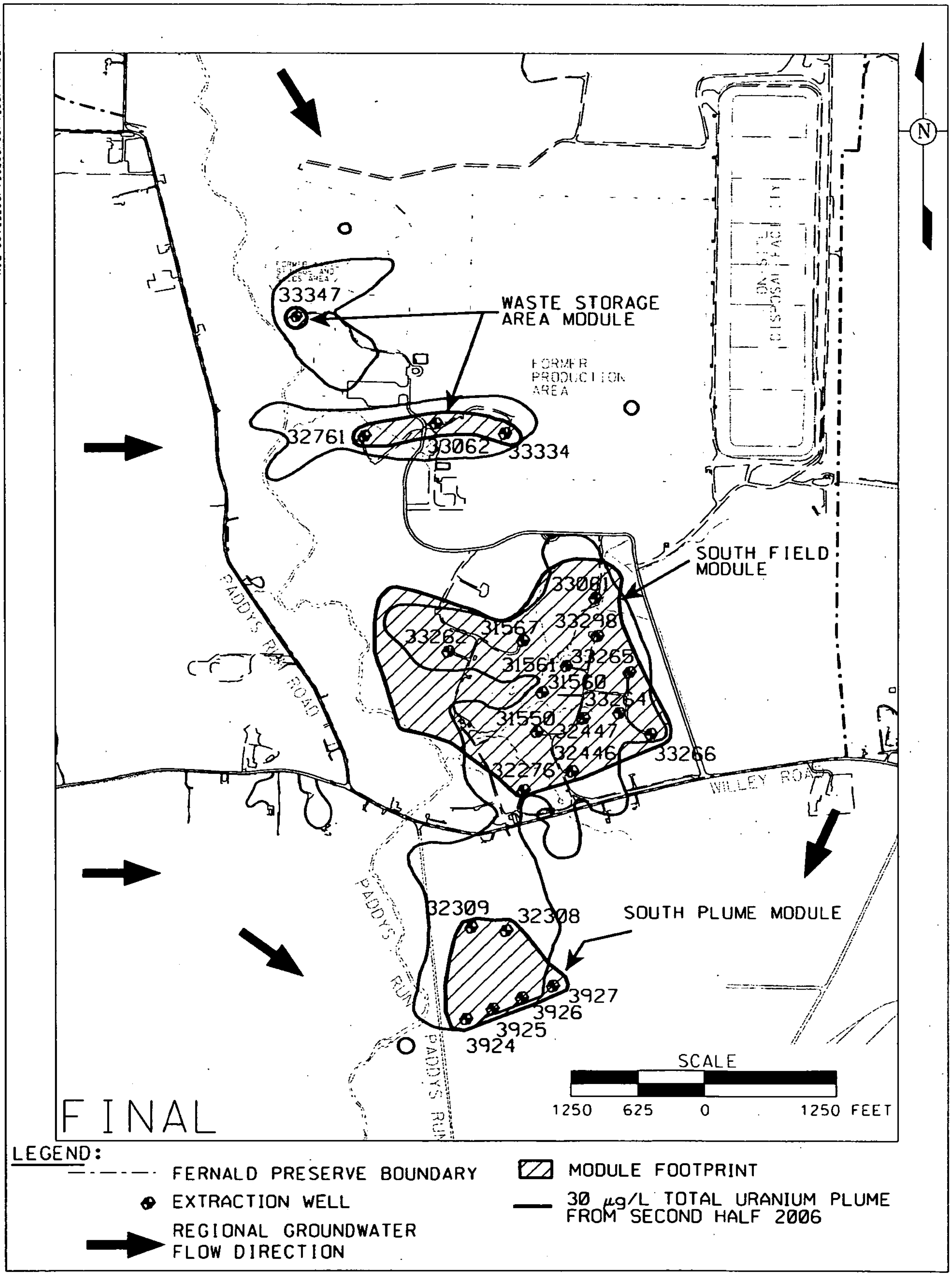


Figure 3–3. Extraction Wells for the Groundwater Remedy

Table 3–1. Well Field Operating Status

Module	Operations Identification	SED Identification	Date of Initial Operation	Current Status	Notes
South Plume	RW-1	3924	08/27/93	Active	
South Plume	RW-2	3925	08/27/93	Active	
South Plume	RW-3	3926	08/27/93	Active	
South Plume	RW-4	3927	08/27/93	Active	
South Plume	RW-5	3928	08/27/93	Inactive	Turned off 9/11/94, not needed
South Plume	RW-6	32308	08/09/98	Active	
South Plume	RW-7	32309	08/09/98	Active	
South Field	EW-13	31565	07/13/98	Inactive	Turned off 5/22/01
South Field	EW-14	31564	07/13/98	Inactive	Turned off 12/19/01
South Field	EW-15	31566	07/13/98	Inactive	Turned off 8/7/98, replaced by EW-15A
South Field	EW-15a	33262	07/26/03	Active	
South Field	EW-16	31563	07/13/98	Inactive	Turned off 12/19/02, Converted to IW16
South Field	EW-17	31567	07/13/98	Inactive	Turned off 9/6/05, replaced by EW-17A
South Field	EW-17a	33326	09/13/05	Active	
South Field	EW-18	31550	07/13/98	Active	
South Field	EW-19	31560	07/13/98	Active	
South Field	EW-20	31561	07/13/98	Active	
South Field	EW-21	31562	07/13/98	Inactive	Turned off 3/13/03, replaced by EW-21A
South Field	EW-21a	33298	07/29/03	Active	
South Field	EW-22	32276	07/13/98	Active	
South Field	EW-23	32447	02/02/00	Active	
South Field	EW-24	32446	02/02/00	Active	
South Field	EW-25	33061	05/07/02	Active	
South Field	EW-30	33264	07/25/03	Active	
South Field	EW-31	33265	07/25/03	Active	
South Field	EW-32	33266	07/25/03	Active	
WSA	EW-26	32761	05/08/02	Active	
WSA	EW-27	33062	05/08/02	Active	
WSA	EW-28	33063	05/08/02	Inactive	Turned off 7/01/05, P&Aed
WSA	EW-28a	33334	06/29/06	Active	
WSA	EW-33	33330		Inactive	Never installed, location moved
WSA	EW-33a	33347	10/05/06	Active	
Re-injection	IW-8	22107	09/02/98	Inactive	Turned off 12/31/01
Re-injection	IW-8A	33253	11/07/02	Inactive	Turned off 9/25/04
Re-injection	IW-9	22108	09/02/98	Inactive	Turned off 3/01/02
Re-injection	IW-9A	33254	11/07/02	Inactive	Turned off 9/25/04
Re-injection	IW-10	22109	09/02/98	Inactive	Turned off 9/25/04
Re-injection	IW-10A	33255	05/22/03	Inactive	Turned off 9/25/04
Re-injection	IW-11	22240	09/02/98	Inactive	Turned off 9/25/04
Re-injection	IW-12	22111	09/02/98	Inactive	Turned off 9/25/04
Re-injection	IW-16	31563	07/27/03	Inactive	Turned off 9/25/04
Re-injection	IW-29	33263	07/27/03	Inactive	Turned off 9/25/04
Re-injection	Inj. Pond	NA	07/27/03	Inactive	Turned off 9/25/04

3.1.1.3 Waste Storage Area Module

The Waste Storage Area Module was designed and installed in two phases. The Waste Storage Area Extraction System targets contaminants in the Great Miami Aquifer underlying the Waste Storage Area (OU1 and OU4). Figure 3–3 shows the geographical location of the Waste Storage Area Module. *The Design for Remediation of the Great Miami Aquifer in the Waste Storage Area and Plant 6 Areas* defines the Phase I design. Phase I addresses the plume of contamination defined in the vicinity of the Pilot Plant Drainage Ditch. The *Waste Storage Area (Phase II) Design Report* defines the Phase II design. Phase II addresses the plume of contamination defined in the vicinity of the former Waste Pit Areas.

Phase I of the Waste Storage Area Module consists of one 12-inch diameter well and two 16-inch-diameter extraction wells complete with submersible pumps with variable speed drives, well houses, electrical power, instrumentation and controls, fiber optic communications, and dual discharge headers (one for treatment and one for direct discharge). Initiation of operation of this phase of the module was May 8, 2002. The easternmost well in the Phase I design (Extraction Well [EW] 33063 or EW-28) was taken out of service, then plugged and abandoned in July 2004 to make way for soil remediation activities. The well was replaced in 2005 and was brought online in 2006 prior to the site's transition from the DOE Office of Environmental Management (DOE-EM) to the DOE Office of Legacy Management (DOE-LM).

The Design for Remediation of the Great Miami Aquifer in the Waste Storage Area and Plant 6 Area concluded that the uranium concentrations in the Great Miami Aquifer beneath Plant 6 had naturally attenuated to concentrations below 20 ppb. While the current data indicate that no extraction wells and infrastructure will be needed for the Plant 6 Area, monitoring of the Plant 6 Area will continue until aquifer restoration certification is completed and approved by EPA and OEPA.

Phase II of the Waste Storage Area Module consists of one 16-inch-diameter well with a submersible pump, a variable speed drive, a well house, electrical power, instrumentation and controls, fiber optic communications, and a dual discharge header.

3.1.2 Groundwater Collection and Conveyance

An extensive system of collection and conveyance piping is required for the remediation of the Great Miami Aquifer. These piping systems were specified in the various module-specific design documents. Figure 3–4 provides an overview of the current well field piping.

As described in Section 2, the piping network that conveys on-property extracted groundwater from the individual extraction wells has double headers, one connected to the main line to treatment and the other to the main discharge line as shown in Figure 3–4. The double headers allow for treatment/bypass decisions to be made on an individual-well basis for the on-property wells.

This design feature is not applicable to the off-property South Plume Module, which was largely in place prior to the design of the on-property piping network. Since individual well bypass/treatment lines are not available on the South Plume wells, treatment/bypass decisions for the six wells comprising this system are made based on the uranium concentration in the combined flow from all of the wells as indicated in Figure 3–4.

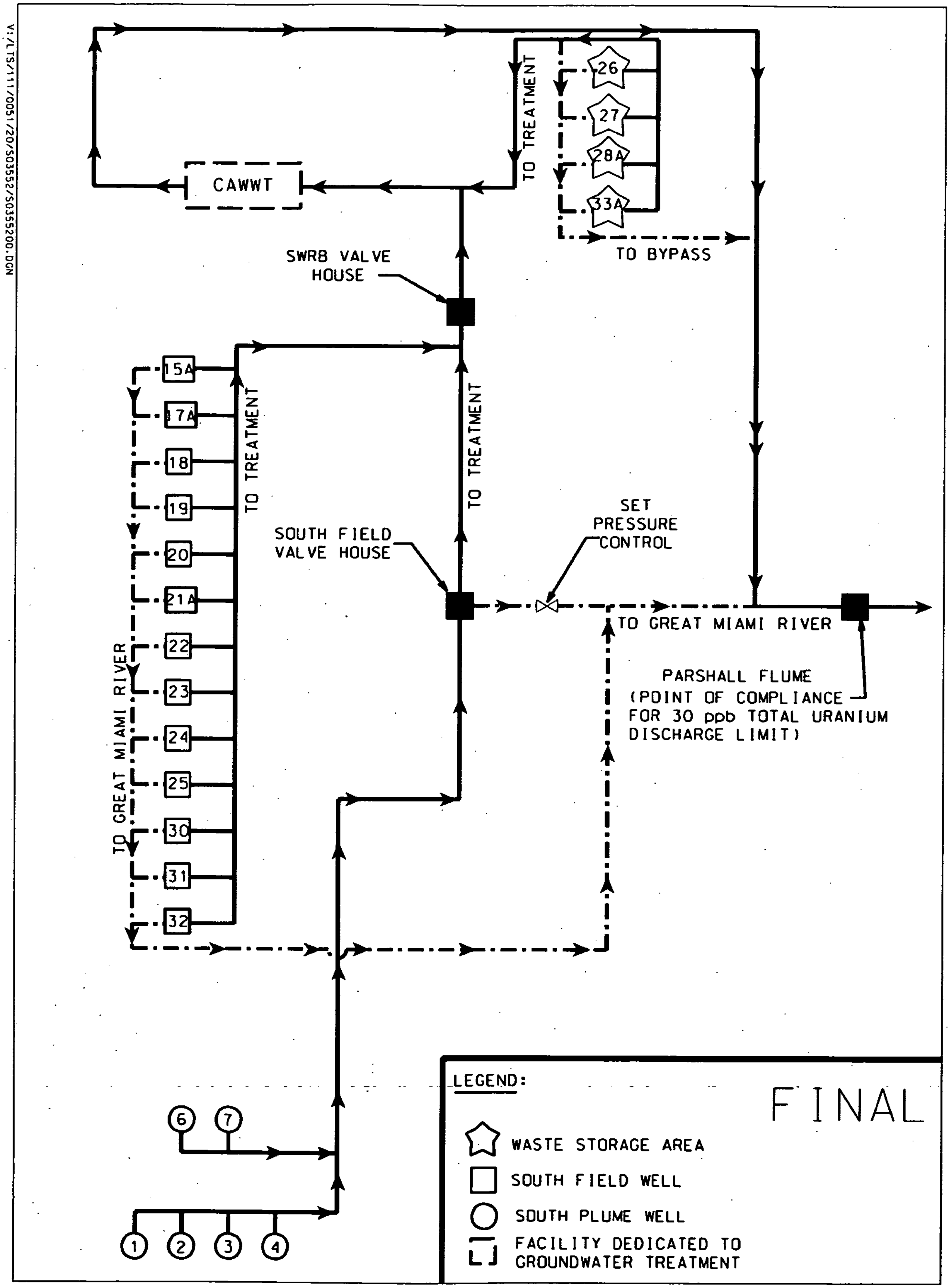


Figure 3–4. Current Groundwater Remediation/Treatment Schematic

3.1.3 Great Miami Aquifer Remedy Performance Monitoring

Section 3 of the IEMP provides for the routine remedy-performance monitoring of the Great Miami Aquifer. Details of how the remedy performance data are being evaluated and the associated decision-making process are located in Section 3.7 of the IEMP. Figure 3–5 illustrates the groundwater certification process for the aquifer remedy. As illustrated in Figure 3–5, remedy performance monitoring is being conducted to assess the efficiency of mass removal and to gauge performance in meeting remediation objectives. If it is determined that aquifer restoration program expectations (as identified in the IEMP) are not being met, then the design and operation of the aquifer restoration system will be evaluated to determine if a change needs to be implemented. A change to the operation of the aquifer restoration system would be implemented by a modification to this OMMP. A groundwater monitoring change, if found to be necessary, would be implemented through the IEMP review and approval process. If additional characterization data is needed (e.g., to determine the nature of a newly detected FRL exceedance), a modification to the IEMP would be implemented, or a new sampling plan would be prepared, depending on the anticipated size of the activity.

Prior to operating any required new extraction wells, additional monitoring wells are installed to help monitor the performance of the new wells. The new extraction wells are also monitored for uranium concentration on a frequent basis just after startup. The site-wide groundwater data collected via the IEMP is utilized to assess the performance of the site-wide groundwater remedy. The data derived from the additional monitoring wells and new extraction well uranium monitoring is integrated with the IEMP groundwater monitoring such that area-wide interpretations can be made. Changes to the scope of the routine monitoring identified in the IEMP may be necessary based on the findings of the sampling conducted in the new monitoring and extraction wells. These changes would be accommodated as necessary through the prescribed IEMP review process.

The details of the annual reporting of groundwater remedy performance information are also provided in the IEMP, Section 3.7. The reporting subsection provides the specific information to be reported in the comprehensive annual report.

3.2 Other Site Wastewater Sources

Leachate from the OSDF is the only other significant source of wastewater to be treated. Small amounts of wastewater from the extraction well rehabilitation process are generated periodically. This wastewater is also treated. A small amount of storm water from portions of the CAWWT footprint will be collected and treated as necessary.

3.3 Treatment Systems

As noted in Section 1, with site closure in 2006, several water treatment flows were eliminated or greatly reduced (i.e., remediation wastewater, sanitary wastewater, storm water runoff) from the scope of the treatment operation. The elimination or reduction of these flow streams provided an opportunity to reduce the size of the water treatment facility that will remain to service the aquifer restoration after site closure. The various facility shutdown dates are provided in Figure 3–2.

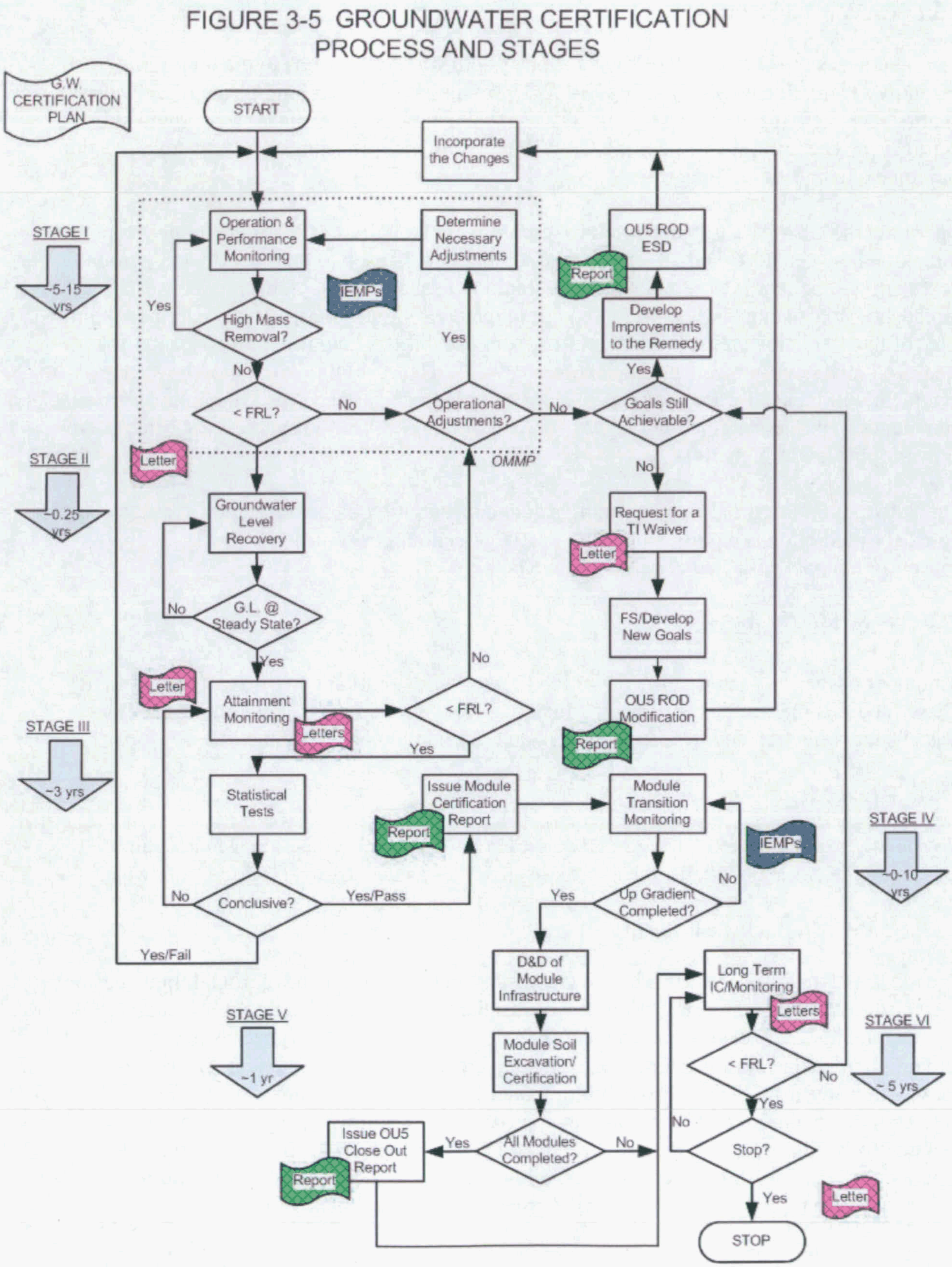


Figure 3–5. Groundwater Certification Process and Stages

3.3.1 CAWWT Facility

As noted in Section 1, the AWWT expansion system was "converted" to the long-term groundwater treatment facility. The CAWWT provides a dedicated long-term groundwater treatment capacity of up to 1,800 gpm. The CAWWT process flow diagram is provided in Figure 3–6. The unit processes of the CAWWT system include granular multimedia filtration and ion exchange on all three trains.

Operating the CAWWT to meet uranium discharge limits will most likely no longer be required sometime between 2007 and 2011. The test pump model is used to predict how long groundwater treatment will be required in order to meet uranium discharge limits. This model uses a spreadsheet to calculate a flow-weighted discharge concentration, based on predefined pumping rates of the extraction wells, predefined treatment capabilities, and uranium concentrations measured in water pumped from the extraction wells. The current prediction of how long treatment will be needed is based on constant pumping rates defined for Modeling Approach C, treatment capabilities defined in the OMMP, and uranium concentration data collected at the extraction wells through 2004.

The 2007 prediction is based on trending actual concentration data collected at extraction wells. The 2011 prediction is based on trending the 95 percent upper confidence level of actual concentration data collected at extraction wells.

3.4 Ancillary Facilities

A number of facilities support the operation of aquifer restoration and the treatment system. These facilities include headworks for equalizing flow, groundwater flow routing facilities, wastewater collection and transfer facilities, and discharge monitoring facilities.

3.4.1 Great Miami Aquifer

No specific headworks exist for groundwater. However, because this flow can be adjusted by regulating the extraction wells, the aquifer itself serves as the headworks for groundwater.

3.4.2 CAWWT Backwash Basin

The CAWWT facility includes a backwash basin. This basin is an aboveground, lined basin measuring 100 ft × 100 ft × 6 ft deep. It was installed December 2005 through January 2006 and became operational the week of January 30, 2006. The basin was designed to contain the last remaining impacted storm water prior to site closure and to serve as the facility to contain backwash water from the CAWWT multimedia filters and ion exchange vessels for the duration of CAWWT operations. The basin has an approximate working capacity of up to 400,000 gallons to allow for a minimum of 6 inches of freeboard at all times. The basin contains a baffle to separate the influent from the effluent and allow any solids backwashed from the filters and IX vessels to settle prior to discharge back into the CAWWT treatment system.

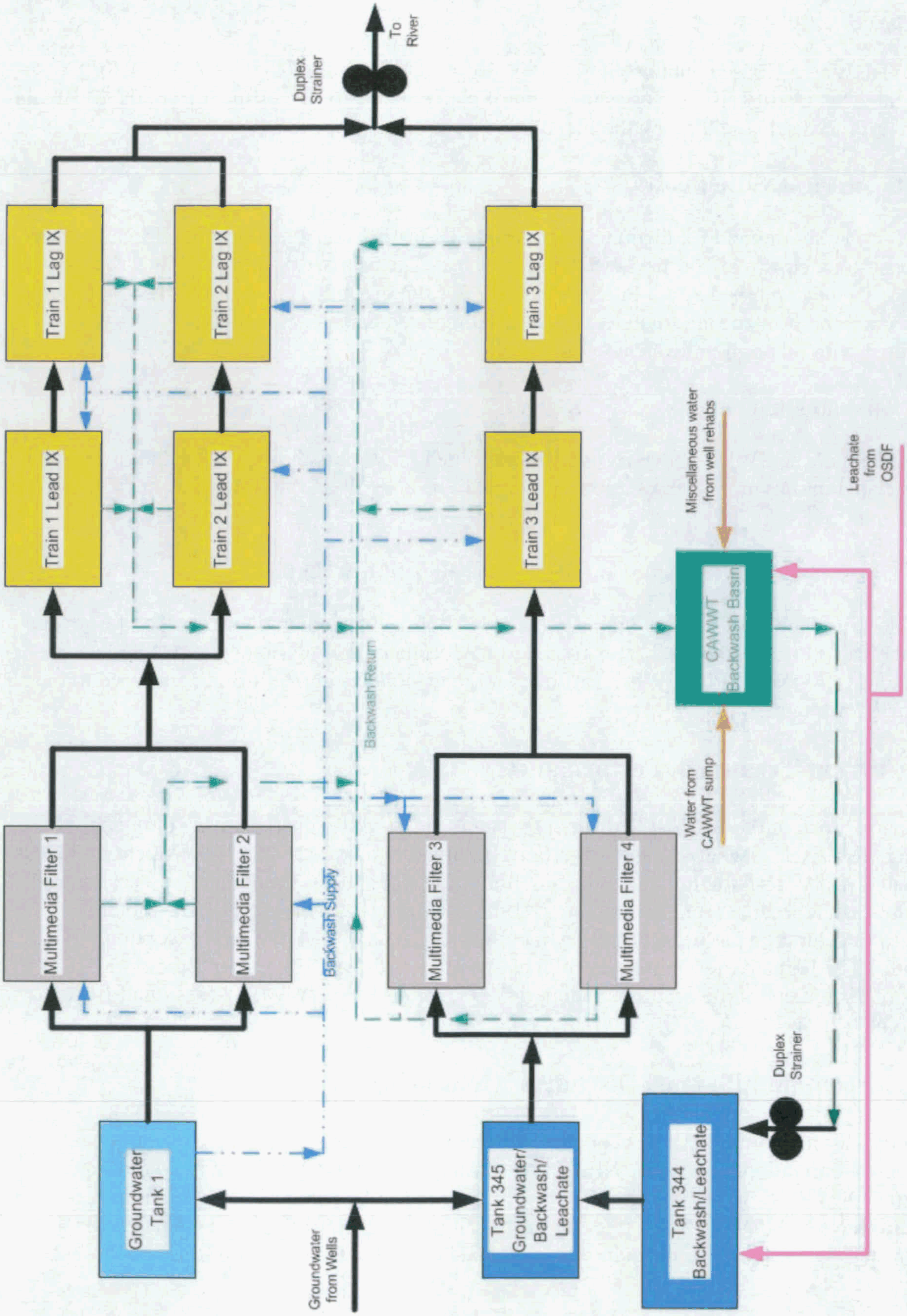


Figure 3–6. CAWWT Process Flow Diagram

3.4.3 SWRB Valve House

The SWRB Valve House contains pipes that direct groundwater flow to the CAWWT for treatment. This facility also serves as the point of convergence for the effluent from the treatment system prior to discharge through the Fernald Preserve outfall pipeline.

3.4.4 South Field Valve House

As part of the South Field Extraction System Phase I construction, a new south field valve house was constructed, upstream of the SWRB Valve House. The primary purpose of this valve house is to receive the combined South Plume Recovery System groundwater. It directs all or portions of the combined flow toward treatment or toward untreated discharge prior to its being combining with other groundwater flows.

3.4.5 Parshall Flume

Downstream of the SWRB Valve House, the combined flows pass through a Parshall flume and an associated outfall monitoring station for Fernald Preserve discharge flow measurement and monitoring.

3.4.6 OSDF Leachate Transmission System Permanent Lift Station

Leachate from the OSDF gravity drains to the valve houses located on the west side of each cell. From the valve houses, the leachate is routed to the leachate transmission system (LTS) Permanent Lift Station (PLS). When sufficient leachate collects in the PLS, it is pumped to the CAWWT for treatment.

3.5 Current Treatment Performance

The performance of the ARWWT treatment systems measured against the overriding goal of meeting OU5 ROD discharge standards relative to uranium as well as NPDES effluent limits has been satisfactory. The uranium mass loading limit of 600 lbs/yr has been met every year since the requirement became effective in January 1998. As depicted in Figure 3–7, the monthly average concentration has been met every month since January 1998 with the exception of 5 months. The Fernald Preserve has been in compliance with NPDES effluent limits well in excess of 99 percent of the time since January 1995, the date the AWWT Phases I and II were placed into service.

3.6 Current and Planned Discharge Monitoring

Currently, discharge monitoring is completed under two sampling programs. Conventional pollutants are monitored under the NPDES. Radionuclides and total uranium are monitored under the OU5 ROD and the Federal Facilities Compliance Agreement (FFCA). These two programs have been incorporated into the IEMP sampling program as described in Section 4 of the IEMP. These monitoring programs are described briefly in the subsections below.

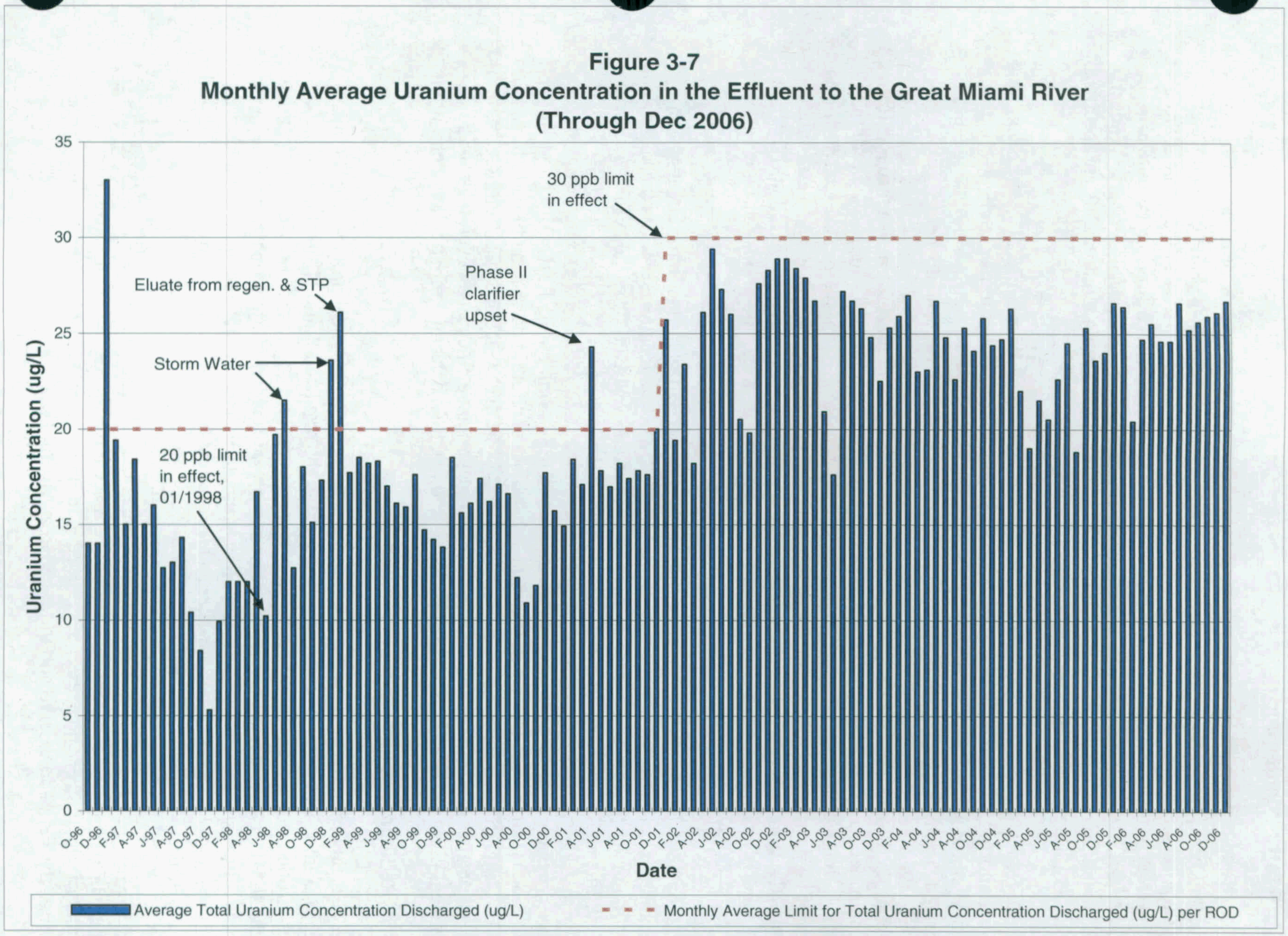


Figure 3–7. Monthly Average Uranium Concentration in the Effluent to the Great Miami River (through December 2006)

3.6.1 NPDES Monitoring

There are eight locations monitored under the current NPDES permit, six of which relate to permitted Fernald Preserve wastewater/storm water discharge outfalls to State of Ohio waters and two of which relate to upstream and downstream monitoring (relative to the Fernald Preserve outfall line) of the Great Miami River (see Figure 3–8). The permit (Ohio EPA Permit No. 1IO00004*GD) is administered by OEPA and granted to DOE at the Fernald Preserve. The effluent pollutant limitations, monitoring requirements, and reporting requirements are specified in the permit for each of the eight monitored locations.

Discharges through Outfall 4001 enter the Great Miami River at River Mile 24.73. The sampling and monitoring location for this outfall is the Parshall Flume chamber immediately downstream from Manhole 176B. This outfall is the primary Fernald Preserve wastewater discharge outfall consisting of discharges from the CAWWT facilities and untreated groundwater.

Discharges through Outfalls 4003, 4004, 4005, and 4006 are untreated storm water runoff from uncontrolled drainage basins into Paddys Run. Runoff from eastern and southern areas of the site drains through Outfall 4003, which is just north of Willey Road. Runoff from the area north and west of the former inactive flyash pile drains through Outfall 4004, which is just west of the former flyash pile. Runoff from the western area of the site drains through Outfall 4005, which is just south of the former K-65 Silos. Runoff from areas north of the site drains through Outfall 4006, which is north of former Waste Pit 5.

Location 4801 is a location upstream of the Fernald Preserve outfall line in the Great Miami River and is collected from the Venice Bridge (RM 26.2). This location serves as the background location under the IEMP. Location 4902 is the location downstream from the Fernald Preserve outfall line and is collected from the New Baltimore Bridge (RM 21.4).

There are two outfalls that remain in the current NPDES Permit but no further discharge through these points will occur. These points will be the subject of a future permit modification. Outfall 4002 (SWRB Spillway) will no longer see flow as the SWRB has been removed. Outfall 4601 was associated with the sewage treatment plant effluent; however, the sewage treatment plant has been removed from service and undergone decontamination and demolition.

3.6.2 Radionuclide and Uranium Monitoring

The Fernald Preserve conducts a surface water sampling and analytical program for certain specific radionuclides that are potentially present in the regulated liquid effluent and in the uncontrolled storm water runoff from the site. Details of this program are provided in Section 4 of the IEMP. The program consists of uranium analysis of a daily flow-proportional composite sample of the site effluent and grab sampling at quarterly intervals. The monthly samples are analyzed for total uranium, radium-228, and technetium-99; the quarterly samples are analyzed for lead-210, radium-226, and strontium-90.

The daily total uranium analysis of the site effluent to the Great Miami River is used to track compliance with OU5 ROD established limits. Since the issuance of the OU5 ROD in January 1996, the Fernald Preserve is obligated to limit the total mass of uranium discharged through the Fernald Preserve outfall to the Great Miami River to 600 lbs/yr.

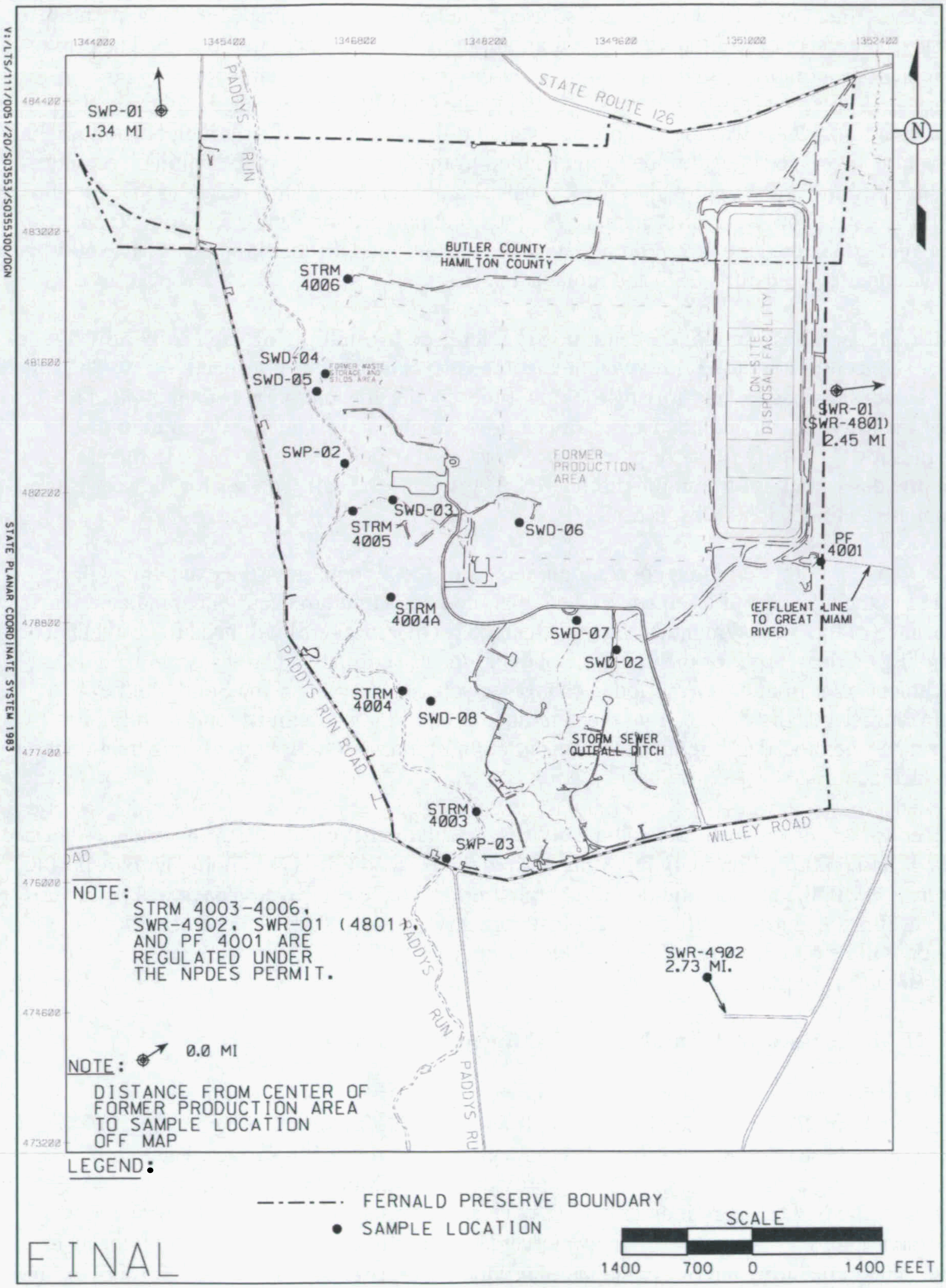


Figure 3–8. IEMP Surface Water and Treated Effluent Sample Locations

This daily effluent uranium analysis is also used to demonstrate compliance with the monthly average uranium concentration of 30 ppb uranium in the site discharge to the river. The original requirement for compliance with a monthly average concentration became effective on January 1, 1998, as established in the OU5 ROD. The OU5 ROD established this concentration at 20 ppb uranium, which was the compliance standard from January 1998 through November 2001. The monthly average concentration limit changed from 20 ppb to 30 ppb beginning December 1, 2001, as a result of EPA approval of the Explanation of Significant Differences (ESD) for OU5 in November 2001. This OU5 ESD changed the total uranium groundwater FRL from 20 ppb to 30 ppb and established the new monthly average concentration discharge standard. The 600-lbs/yr limit was unaffected by this ESD and remains in effect.

The average monthly uranium concentration is calculated by multiplying each daily flow by the uranium concentration of the flow-weighted composite sample for that respective day. The sum of the values obtained by multiplying the flow times by the concentration is then divided by the sum of the flows for the month. The result is a flow-weighted average monthly uranium concentration. The daily flow-weighted concentrations are then multiplied by 8.35 lb/gal to obtain the daily pounds of uranium discharged. The sum of the daily masses for the year is used to compare against the 600-lbs/yr limit.

If the average monthly uranium concentration exceeds the 30 ppb limit, the excursion will be reported to the agencies. If a sequence of months (i.e., not a random occurrence) indicates an exceedance of the 30-ppb monthly average, then corrective measures will need to be evaluated. Depending on the reason for the sequence of exceedances, corrective actions could include replacement of resin in CAWWT ion exchange vessels, segregation of the South Plume Optimization wells discharged from the combined South Plume Optimization/South Plume Recovery System header to reduce the concentration of uranium in flow bypassing treatment, or other such actions.

The need for corrective measures will be discussed with the EPA and OEPA in periodic meetings and reports. (Summary reporting of how the Fernald Preserve is doing with respect to compliance with the 30-ppb uranium discharge limit and the use of bypass days will be included in the meetings and reports.) In the event that corrective measures are deemed necessary, the situation will be outlined to the EPA and OEPA in order to reach consensus regarding what action (if any) is required.

3.6.3 IEMP Surface Water and Treated Effluent Monitoring Program

Significant portions of the current and past programs (NPDES and FFCA) have been incorporated into the IEMP. Section 4 of the IEMP describes these two programs in more detail and also how these two programs have been integrated into the IEMP surface water and treated effluent sampling program. The IEMP also provides for additional monitoring above that required by the NPDES permit and the FFCA. This additional monitoring is performed as a supplement in order to monitor surface water and treated effluent for potential site impacts to various receptors during aquifer remediation. Figure 3–8 shows the current NPDES, FFCA, and the IEMP treated-effluent and surface-water sampling locations. In addition to identifying the sampling program requirements, the IEMP provides a comprehensive data evaluation and associated decision-making and reporting strategy for surface-water and treated effluent.

4.0 Projected Flows

This section addresses the latest understanding of flows for groundwater and OSDF leachate.

4.1 Groundwater

Extracted groundwater is the only wastewater flow requiring treatment. Groundwater extraction rates can be controlled. Groundwater flows are defined such that discharge limits at the Parshall Flume, and capture of the 30 µg/L uranium plume, are achieved. The objective is to pump as aggressively as possible, without exceeding discharge limits. The individual groundwater remediation modules currently comprising the aquifer remedy are presented in Section 3.1. Figure 3–3 depicts the locations of all existing extraction wells. Table 4–1 provides the target extraction rate schedule for each of the wells currently operating. The combined modeled pumping rate is approximately 4,775 gpm.

Throughout the duration of groundwater remediation, the pumping rates may be modified within system design and operational constraints, as necessary. These rate modifications will be made to maintain, to the degree possible, the aquifer restoration objectives outlined in the remedy design. An operational rate of 10 percent over the modeled pumping rates is being targeted to provide for anticipated and unanticipated downtime.

4.1.1 OSDF Leachate

As of August 2007, the total leachate flow from all eight of the cells comprising the OSDF had declined to ~ 5,000 gallons per week or ~ 0.5 gpm. This flow stream is expected to continue to decline since the facility was completely capped in late 2006. The leachate collects in the PLS pump sump and from there is pumped to the CAWWT for treatment.

Table 4–1. Target Extraction Rate Schedule

System ID	Location	Ops. Well ID	SED Well ID	Target Extraction Rates (gpm) 11/06 to 04/01/15	Target Extraction Rates (gpm) 4/01/15 to End
I	Waste Pits	EW-26	32761	300	500
I	Waste Pits	EW-27	33062	200	200
I	Waste Pits	EW-28a	33334	200	200
I	Waste Pits	EW-33a	33347	300	300
	System Totals	Pumped		1000	1200
II	South Field	EW-15a	33262	200	300
II	South Field	EW-17	31567	175	175
II	South Field	EW-18	31550	100	100
II	South Field	EW-19	31560	100	100
II	South Field	EW-20	31561	100	400
II	South Field	EW-21a	33298	200	300
II	South Field	EW-22	32276	300	400
II	South Field	EW-23	32447	300	400
II	South Field	EW-24	32446	300	300
II	South Field	EW-25	33061	100	100
II	South Field	EW-30	33264	200	400
II	South Field	EW-31	33265	300	400
II	South Field	EW-32	33266	200	200
	System Totals	Pumped		2,575	3,575
IV	South Plume	RW-1	3924	200	0
IV	South Plume	RW-2	3925	200	0
IV	South Plume	RW-3	3926	200	0
IV	South Plume	RW-4	3927	200	0
IV	South Plume	RW-6	32308	200	0
IV	South Plume	RW-7	32309	200	0
	System Totals	Pumped		1200	0
	Total Extraction			4,775	4,775

5.0 Operations Plan

This section contains the operations philosophy, treatment priorities, hierarchy of decisions, management and flow of operations information, and management of treatment residuals necessary to successfully operate the groundwater extraction and treatment systems in order to achieve regulatory requirements and commitments.

5.1 Wastewater Treatment Operations Philosophy

The primary goals of wastewater treatment operations and maintenance are to (1) meet effluent discharge requirements, (2) provide sufficient treatment capacity such that the desired groundwater pumping rates can be maintained, and (3) provide for leachate treatment. In keeping with the principles of "as low as reasonably achievable," correct decisions in applying treatment are required to maximize the quantity of uranium removed from wastewater prior to its discharge to the Great Miami River. Maximizing uranium removal should result in compliance uranium discharge limits. Other regulatory discharge requirements, such as NPDES, must also be met. Influent streams to treatment and effluent streams from treatment as well as other process control sampling around specific unit operations (e.g., ion exchangers) is completed for uranium and other appropriate constituents as necessary to provide information needed to help ensure that the goals are met. Sampling under the NPDES permit and the IEMP is performed to verify requirements and effluent limits for discharges to the Great Miami River are met.

5.2 CAWWT Operation

As discussed in Section 3, the only remaining treatment system is the CAWWT. The effluent from this system and bypassed (untreated) groundwater combine at the Parshall Flume to form the Fernald Preserve's regulated discharge to the Great Miami River.

The priority for treatment will always be OSDF leachate and the extraction wells with the highest uranium concentrations. Groundwater sent to treatment typically contains a uranium concentration of 60 to 70 ppb. Groundwater is fed to two treatment systems at CAWWT. The 1,200-gpm system treats only groundwater. The 600-gpm system treats groundwater, leachate from the OSDF, and water from the CAWWT Backwash Basin.

The CAWWT Backwash Basin collects backwash from all CAWWT ion exchange vessels and multimedia filters, water from the CAWWT Sump, and miscellaneous water from well rehabilitations. Water from the basin will be pumped to the 600-gpm treatment system at a flow rate adequate to ensure that the basin level does not reach 5 ft. Groundwater flow to the 600-gpm system is reduced as necessary to maintain a low level in the basin. The basin will maintain at least 6 inches of freeboard at all times.

Shift supervision is provided as necessary, 365 days per year. As the supervisor of all operations and maintenance activities that occur on a particular shift, the shift supervisors are responsible for ensuring that treatment and monitoring equipment is operated, maintained, and repaired as necessary so that the necessary treatment throughput is achieved at all times. Operations and maintenance are performed in accordance with all appropriate standard operating procedures, standards, and specifications. Additionally, process engineering support personnel are on-call to provide assistance in problem solving.

5.2.1 Ion Exchange Vessel Rotation

The CAWWT ion exchange system has trains of two ion exchange vessels operating in series: lead and lag. When the ion exchange resin in both vessels is new, the majority of uranium is removed in the lead vessel. As the lead vessel becomes loaded with uranium, more passes through into the lag vessel. As the lag vessel becomes loaded, more uranium passes into the discharge stream. When the uranium concentration in the discharge from a lead ion exchange vessel approaches or equals the concentration of the influent, the resin will be removed from the vessel and replaced with new resin. The lag vessel is moved into lead, and the vessel containing new resin is place in lag.

5.3 Groundwater Treatment

The CAWWT provides up to 1,800 gpm treatment for groundwater. Wells are pumped to treatment or bypass as described in the next section. The setpointssetpoints at which the wells are pumped are typically set to approximately 10 percent more than the target set point in the groundwater remedy to account for downtime.

5.3.1 Groundwater Treatment Prioritization vs. Bypassing

Treatment of groundwater well discharges are prioritized in order of uranium concentration, with the highest uranium concentration wells routed to treatment until the treatment capacity necessary to maintain the site's uranium discharge limits is utilized. Remaining well discharges are bypassed around treatment to the Parshall Flume. As shown schematically in Figure 3–4, treatment/bypass decisions for the Southfield and Waste Storage Area extraction wells are made on a well-by-well basis. The existing four South Plume off-property, leading-edge wells combined with the two wells of the South Plume Optimization Project are routed as a group either for treatment, full bypass, or partial bypass since piping does not exist for well-by-well treatment/bypass decision. The off-property South Plume wells are typically routed directly to bypass at the South Field Valve House since their combined uranium concentration is very near or less than 30 ppb uranium.

5.4 Well Field Operational Objectives

Several objectives must be considered when well field operational decisions are made. These objectives are listed in Table 5–1 along with the anticipated actions required to achieve each objective. At times the objectives conflict; therefore, operational decisions are generally made by ARWWP management. Decisions that affect well field operations are communicated to EPA and OEPA in the IEMP reports. Changes in groundwater restoration well pumping setpoints are transmitted to shift supervisors by the ARWWP manager.

In addition to the objectives listed in Table 5–1, an annual measure of uranium concentration rebound will be conducted each year. Uranium contamination bound to aquifer sediments in the unsaturated portion of the Great Miami Aquifer has been identified under some source areas at the site. Uranium contamination bound to unsaturated aquifer sediments will remain bound unless water levels rise and saturate the sediments allowing the contamination to dissolve into the groundwater.

Table 5–1. Well Field Operational Objectives

Objectives	Actions Required
Operate individual wells within constraints imposed by system design and equipment. Key constraints include: • Pumping equipment is limited to a range of flows that will dictate the flexibility of extraction rates for individual wells. • Hydraulic capacity of the piping limits extraction rates. • Control range of flow control valves and variable frequency drives (VFDs) for pump motors bound the range of extraction rates for individual wells. • Capacity of existing electrical service to each well. • Average entrance velocity of water moving into the screen should not exceed 0.1 ft/sec.	Operate well pumps and motors per manufacturer recommendations. Operate extraction well systems within design constraints.
Perform necessary equipment/well maintenance in accordance with established schedules.	Per OMMP, Section 6.
Maintain compliance with the discharge limits of 30 μg/L monthly average uranium concentration and 600 lbs/yr for the combined site water discharged to the Great Miami River.	Monitor discharge concentrations. Modify well setpoints as necessary to maintain compliance with discharge limits. Evaluate well setpoints and treatment routing monthly. Use flow-weighted average-concentration calculations to predict how changes to setpoints and routing will effect discharge concentrations. Compare predictions with actual measurements to evaluate if/how predictions can be improved. Maintain well setpoints to the degree possible.
Minimize impact to the Paddys Run Road Site plume.	Pumping from Recovery Well 3924 (RW-1) should not exceed 300 gpm. Pumping from Recovery Well 3925 (RW-2) should not exceed 300 gpm (if well 3924 is pumping) and 400 gpm (if well 3924 is not pumping).
	Pumping from Recovery Well 3926 (RW-3) should not exceed 500 gpm if either Well 3924 or Well 3925 goes down. If the actual capture zone differs significantly from that defined via previous modeling, it may be determined that the pumping rates noted above require modification in order to maintain this objective. Required modifications will be made based on additional modeling projections and verified based on field data.
Maintain capture of the 30 μg/L uranium plume along the southern Administrative Boundary.	The following pumping rates for each South Plume Well provides for the capture (within system constraints) of the uranium plume along the administrative boundary: Recovery Well 3924 at 200 gpm Recovery Well 3925 at 200 gpm Recovery Well 3926 at 200 gpm Recovery Well 3927 at 200 gpm

Table 5–1. Well Field Operational Objectives (continued)

Objectives	Actions Required
	Adjust the pumping rates of the remaining operable wells in the South Plume module to maintain capture along the administrative boundary when (1) any single South Plume Module well outage for 1 week or more occurs or (2) multiple well outages occur for 3 days or more. If the actual capture zone differs significantly from that defined via previous modeling it may be determined that the pumping rates noted above require modification in order to maintain this objective. Required modifications will be made based on additional modeling projections and verified based on field data.
Maintain hydraulic capture of the remaining portions of the 30 µg/L uranium plume (within areas of active modules).	Establish pumping rates based on model predictions of required pumping rates to maintain a desired area of capture. Determine the actual area of capture created when the wells are operating at the modeled rates based on groundwater elevation contour maps derived from field measurements.
	Adjust pumping rates within system design and operational constraints, if warranted, when the actual area of capture is not consistent with the modeled area of capture. This will be done in an effort to establish an area of capture consistent with the desired area of capture, as modeled.
Minimize duration of cleanup time for off-property portion of the 30 µg/L uranium plume.	Give priority to keeping South Plume and South Plume Optimization Wells online when other wells have to be shut down. Maximize pumping rates within the following constraints and considerations: system design and equipment, hydraulic capacity of the aquifer, regulatory limits, interaction with other modules, and remedy performance.
Minimize duration of cleanup time for on-property portions of the uranium plume.	Maximize pumping rates within the following constraints and considerations: system design and equipment, hydraulic capacity of the aquifer, regulatory limits, interaction with other modules.
Minimize migration of on-property portion of the plume to off-property areas.	Balance pumping from the South Field Extraction and South Plume Modules such that the stagnation zone is at or south of Willey Road.
Minimize drawdown in off-property areas.	Do not exceed 110 percent of the points defined in Table 4–1 unless directed by ARWWP management.

Annual exercises are being planned to shut down all extraction wells (with the exception of the four leading-edge South Plume Recovery Wells) from June 15 to July 15 each year to allow water levels within the aquifer to rise. Based on evaluation of aquifer water levels collected since 1988, during June and July seasonal water levels are usually at their highest level. Shutting down the extraction wells during the same time period that seasonal water levels are high will maximize the saturation of as much of the aquifer sediments as possible. Water levels will be measured at key locations (by hand and downhole transducer/data logger) before, during, and after the shutdown to record the resulting water level change. The uranium concentration in the pumped groundwater immediately after the wells are restarted will be compared to pre-shutdown concentrations to determine the amount of concentration rebound that occurred. Shutdown times are subject to change based on results of the exercise.

The well field downtime period will also be utilized to conduct well field and water treatment system maintenance.

5.5 Operational Maintenance Priorities

Maintaining the treatment facilities online includes ensuring that all equipment is operating properly, that adequate personnel are assigned to operate the treatment systems safely, and that the combined treatment and bypassing systems are utilized to maintain uranium concentrations below 30 ppb as measured in the site effluent at the Parshall Flume. Following is a list of operational maintenance priorities in their order of importance:

- Keep the Parshall Flume discharge point and sampling system online. If the discharge monitoring system were to become nonoperational, discharge monitoring of effluent to the river from the Fernald Preserve would have to be collected manually. The sampling system must be operational so that accurate reports of uranium and NPDES contaminant levels can be made.
- Keep the CAWWT treatment trains operating at the capacity necessary to maintain compliance with the site's uranium discharge limits.
- Keep South Plume Wells 1 through 4 operating at desired setpoints.
- Keep all extraction wells operating at the desired setpoints.
- More specific details of managing equipment operation and maintenance are contained in Section 6.0.

5.6 Operations Controlling Documents

Operations at the wastewater treatment facilities are controlled directly by standing orders and standard operating procedures contained in the Legacy Management Fernald operating procedures (DOE 2006a). Standing orders translate the DOE orders, conduct of operations principles, guidelines, and procedures into performance requirements for personnel involved in operating the wastewater treatment facilities. The standing orders were written to ensure that all operations are conducted in full conformance with DOE conduct of operations requirements.

A more extensive discussion of standard operating procedures and standing orders is contained in Section 6.1.2. Standing orders and standard operating procedures implement the requirements of this plan. The OMMP is not intended to replace standing orders or standard operating procedures.

5.7 Management and Flow of Operations Information

Samples are taken from each of the CAWWT trains on a regular basis to ensure uranium is still being removed by the resin. The results of the sample analysis are reviewed as necessary by project personnel to review system performance and determine if any of the treatment system ion exchange vessels need to be removed from service for resin replacement.

The project issues weekly operations reports that summarize flow rates and flow totals as well as uranium concentrations from CAWWT and the wells. Information on required well pumping rates is communicated from the manager of the ARWWP to the operations personnel via the operating orders, as specified in the standing orders.

5.8 Management of Treatment Residuals

Treatment residuals consist of exhausted ion exchange resin and used multimedia filter media. These materials will be disposed of off site using a subcontractor qualified to handle radioactive materials.

6.0 Operations Performance Monitoring and Maintenance

This section describes the general methods, guidelines, and practices used in managing equipment operation and maintenance and presents planned maintenance and monitoring requirements for the groundwater restoration wells to support successful long-term operation of the groundwater restoration system.

Managing equipment operation and maintenance in the context of this document includes not only routine control panel monitoring and repair work, but also the preventive, predictive, and proactive actions used to maximize equipment operating efficiency and capacities. This section presents some of the management systems that will help to assure that the OU5 ROD requirements continue to be met, describes the key parameters used to monitor the performance of the groundwater and wastewater facilities, and describes the principal features and maintenance needs of the overall operation.

The treatment system and restoration well system performance parameters and maintenance requirements have unique differences. The treatment system is designed and built with many redundant features and equipment to reduce potential downtime (e.g., installed spare pumps and lead-lag ion exchange units). Those features are not economically practical for the well systems. The equipment in the treatment systems has more easily discernible indicators of equipment condition and is more easily accessed for monitoring by operating personnel walk-through than the underground well system. The methods used to measure the equipment condition and the specific measurable goals for the two systems also are different.

The activities described within this section also provide the basis for providing routine maintenance of the extraction wells comprising the various modules of the system and for monitoring system performance to determine if more extensive maintenance activities are required. Regularly scheduled maintenance of components of the restoration well system is required so that the difficulties associated with continuous operation will be minimized and thus manageable with the resulting system's online time maximized. Continuous operation of the well system, within practical limitations, is required to maintain groundwater restoration objectives at the Fernald Preserve.

This plan contains monitoring and maintenance activities, and frequencies thereof, based on current projections. The need for and frequency of these activities may change based on future experience gained through the operation, maintenance, and monitoring of the extraction wells that are currently operating. Parameter monitoring frequency may change as well. This plan will be revised as necessary during the life of the groundwater restoration process.

6.1 Management Systems

6.1.1 Maintenance and Support

A qualified subcontractor under the direction of LM personnel will provide maintenance for the well field and treatment system. Preventative maintenance will be performed on the schedule recommended by the equipment manufacturer.

The technical staff directly supports facility operation and maintenance. The technical staff members work together to resolve issues and improve operations. They also provide troubleshooting and technical assistance to the day-to-day operations and maintenance groups.

The facilities consist of standard high-capacity filter-packed water wells and conventional water and wastewater treatment unit processes that are typical for the industry. It is expected to continue to have good reliability and has well-documented maintenance guidelines. Routine maintenance practices, as documented by the original equipment manufacturer's maintenance manuals, have been used to provide the basis for maintenance procedures and practices. Maintenance feedback and component manufacturer suggestions have been used to develop a spare parts list and stock inventories of the most frequently used parts. The availability of spare parts will assist in minimizing downtimes associated with all maintenance activities.

6.1.2 Operations

Operating personnel play an important role in maximizing equipment operating efficiency and capacity. One significant duty of the facility operating personnel is to identify and report existing and potential future equipment problems. Operating personnel perform routine scheduled checks, inspections, and walkthroughs of the facilities and systems. Potential problems and maintenance needs are reported to supervision, and maintenance work orders are initiated. Operating personnel maintain shift logbooks that document activities and specific actions taken during each shift. Information in the logbooks is used as the basis for transfer of duty from one shift to the next. The logbooks are kept as a historical record of operational activities. Management and technical staff periodically review the logbooks and roundsheets as additional assurance that the systems are being effectively operated.

6.1.2.1 Process Control

Facilities are staffed by operating personnel daily. The operating personnel at CAWWT monitor the process using a computerized control system located in the control room. The control system receives input from process meters (e.g., tank level and process flow meters) and from devices that indicate equipment status (e.g., valve position limit switches and motor run relays). The control system outputs control signals to regulate the process (e.g., control valve positioning and motor start/stop control). The control system uses desktop-style computer equipment (monitors, keyboards, and pointing devices) to provide a graphic human-machine interface (HMI) for the process monitoring and control. The control system HMI includes various process graphics screens depicting portions of the treatment system in piping and instrumentation diagram format and providing real time process measurements and information. The control system has graphic process trending capabilities, process alert and alarm management, and a historical database of all operating personnel input and process alert/alarms. The control system also provides an interface with all well systems to provide enhanced real-time monitoring and remote controls. The operating personnel at CAWWT also access process and equipment information by making "walking rounds" of all equipment in the process.

6.1.2.2 Standard Operating Procedures

Each operation is performed in accordance with approved standard operating procedures that are developed by the technical staff with the assistance of operations personnel. Standard operating Procedures can be found in the *Legacy Management Fernald Operating Procedures*, Revision 0

(DOE 2006a). The standard operating procedures are reviewed periodically and revised as necessary for the safe and consistent operation of treatment processes.

Standard operating procedures provide step-by-step instructions for performing wastewater treatment operations activities. They also contain health and safety precautions that must be followed while performing the steps contained in the procedure. The procedures are written from the perspective of the operating personnel who will be performing the steps.

Standard operating procedures also contain instructions as to when management must be notified of non-routine operating conditions or events and to whom in management these conditions must be reported. Standard operating procedures include such activities as:

- Horiba Water Quality Meter Calibration, Operation, and Maintenance.
- IEMP Surface Water Sampling.
- NPDES Sampling.
- Daily Operations at the Parshall Flume.
- Enhanced Permanent LTS Operation.
- CAWWT System Operations.
- Recovery Well Field.
- DPD Method for Free and Total Chlorine Test.
- Soluble Uranium by Kinetic Phosphorescence Analyzer (KPA).
- Standing orders for Wastewater Treatment Operations.

6.1.2.3 Conduct of Operations

The DOE Conduct of Operations standards are implemented for operations and maintenance through standing orders. The standing orders spell out the specific methods used by the project for the implementation of all 18 chapters of DOE Order 5480.19 (DOE 2001b). The chapter titles (which are indicative of the important operational protocol) are "Operations, Organization, and Administration," "Shift Routines and Operating Practices," "Control Area Activities," "Communications," "Control of On-Shift Training," "Investigation of Abnormal Events," "Notifications," "Control of Equipment and System Status," "Lockouts and Tagouts," "Independent Verification," "Log Keeping," "Operations Turnover," "Operations Aspects of Facility Chemistry and Unique Processes," "Required Reading," "Timely Orders to Operators," "Operations Procedures," "Operator Aid Postings and Equipment," and "Piping Labeling." Implementation of the standing orders helps to ensure clarity, consistency, and a common purpose in the day-to-day activities.

6.1.2.4 Training

A training and qualification program exists to ensure that all operating personnel involved in treating wastewater are qualified and competent for their positions. The goal of the training and qualification program is to prepare personnel for the operations team and to continually improve the team's knowledge and capabilities.

6.2 Restoration Well Performance Monitoring and Maintenance

This section describes the key performance monitoring and maintenance guidelines for the groundwater restoration well systems. To complete the aquifer restoration within the model-predicted timeframes, a high level of on-stream time at the modeled pumping rates is needed for each individual well. Actual target pumping rates are targeted at around 110 percent of the modeled target pumping rates to provide for downtime. Some well downtime is expected and can be accommodated. However, lengthy outages can adversely impact the planned goals. An upgraded well maintenance program has been developed to address this issue. More frequent component preventive maintenance checks along with periodic formal performance testing and well chlorination were identified and included as major program elements to improve well operating efficiency.

6.2.1 Restoration Well Descriptions

This section provides a general description of the extraction wells comprising the active groundwater restoration modules. The active modules are the South Plume, South Field, and the Waste Storage Area.

6.2.1.1 South Plume Extraction Wells

The South Plume Module includes six wells that are used to pump groundwater from the off-property portion of the Great Miami Aquifer plume to the Fernald Preserve's South Field valve house. In the valve house, the flow from the south plume is routed to treatment or to the Great Miami River as necessary, to maintain compliance with discharge limitations. These wells are as follows:

Extraction Well ID	Common Well ID	Formal Site Well ID
EW 1	RW-1	3924
EW 2	RW-2	3925
EW 3	RW-3	3926
EW 4	RW-4	3927
EW 6	RW-6	32308
EW 7	RW-7	32309

Each of the South Plume extraction wells contains a submersible pump/motor assembly and has a pitless-type adapter near the ground surface that transitions the vertical pump discharge piping to the underground force main. The underground force main from wells RW-1, RW-2, RW-3, and RW-4 passes through individual underground valve pits. These valve pits contain several components of the individual wells control system. RW-6 and RW-7 do not utilize underground valve pits to contain any control system components. All control components for these two wells are located in the South Plume Valve House building.

The design of the flow control systems for each of these six wells is identical; flow is controlled by a flow control loop consisting of a magnetic flow meter, a process control station (PCS), and a motor operated flow control valve. Each well can be controlled locally by the PCS or remotely by the computerized control system located at CAWWT. The normal operational mode is to have the wells operated remotely from the CAWWT computer control system, via the local PCS.

Additionally, a local set point is input into the PCS so that the well can automatically revert to local control if communication with the CAWWT computer control system is interrupted.

The desired flow rate set point for each is entered into the computer control system and PCS at the CAWWT and the South Plume valve house respectively. This value is compared continuously to the actual flow measured by the magnetic flow meter. When required, the CAWWT computer control system or PCS adjusts the position of the flow control valve to maintain the desired flow. Pump "Start" and "Stop" can be controlled by the HMI or the PCS and can also be controlled from the pump starter panel. The starter panels for RW-1 through RW-4 are located at the individual wellheads while the starter panels for RW-6 and RW-7 are located in the South Plume valve house.

In addition, each of the South Plume extraction wells is equipped with isolation valves, check valves, air releases, and pressure-indicating transmitters. The pressure-indicating transmitters are tied to process interlocks that will shut the pumps down if high or low pressures are maintained for extended periods indicating a closed valve or catastrophic system leak, respectively. This interlock is intended to protect the pump/motor assemblies from damage due to closed discharge valves or to shut down the pumps if no system backpressure is sensed. Critical control components are protected by lightning/surge arresters to help prevent damage to the control system during electrical storms.

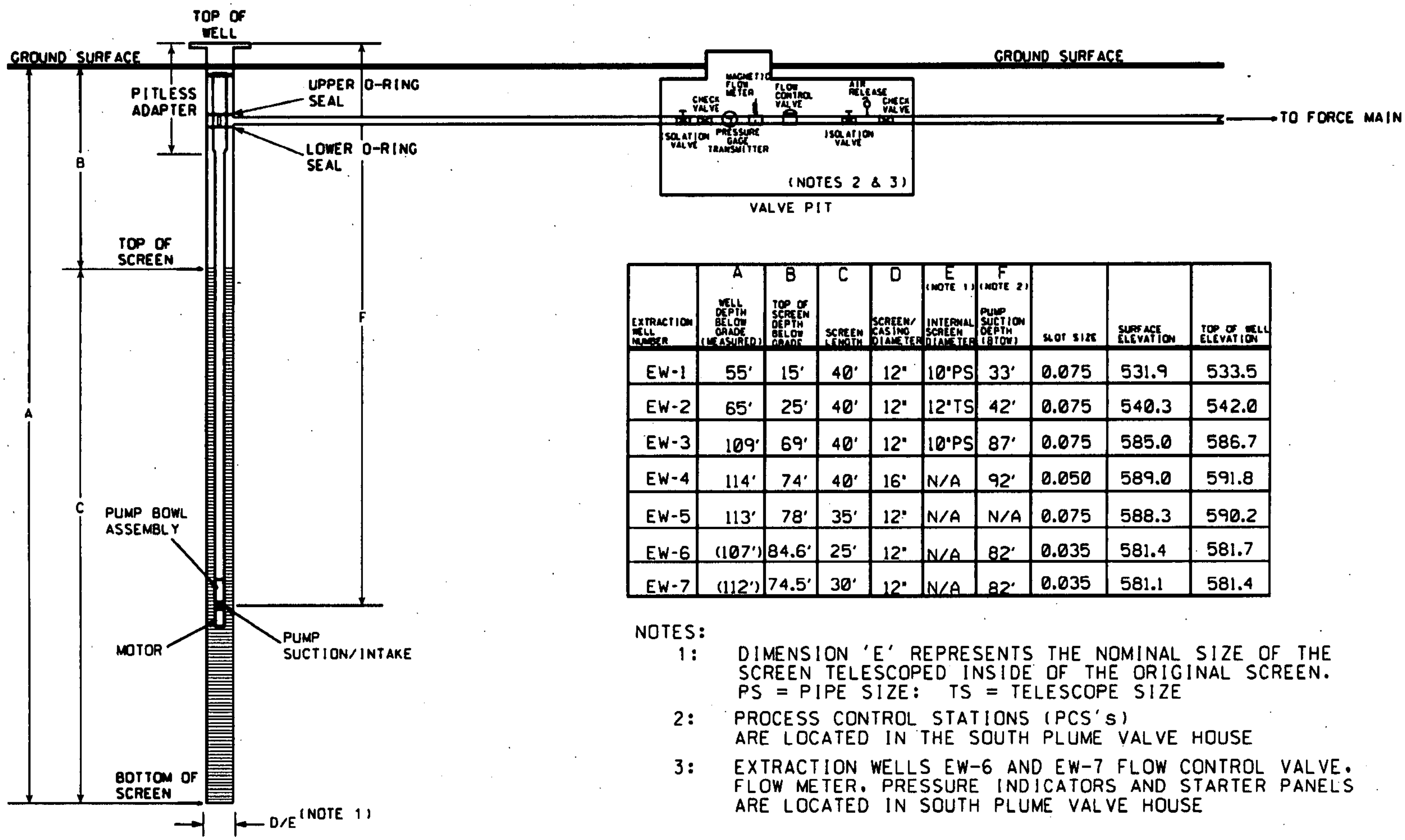
Routine water level monitoring within the well is performed during regularly scheduled performance monitoring or more frequently if required.

Installation details of the South Plume extraction wells are shown in Figure 6–1.

6.2.1.2 South Field and Waste Storage Area Extraction Wells

The South Field and Waste Storage Area Modules include 13 and 4 wells, respectively, which are used to pump groundwater from the Great Miami Aquifer to the Fernald Preserve water treatment facilities or to the Great Miami River if treatment is not required to achieve discharge limitations. These wells are as follows:

Extraction Well ID	Common Well ID	Formal Site Well ID
EW 15A	EW-15A	33262
EW 17A	EW-17A	31567
EW 18	EW-18	31550
EW 19	EW-19	31560
EW 20	EW-20	31561
EW 21A	EW-21A	31562
EW 22	EW-22	32276
EW 23	EW-23	32447
EW 24	EW-24	32446
EW 25	EW-25	33061
EW 30	EW-30	33264
EW 31	EW-31	33265
EW 32	EW-32	33266
WSA Well 26	EW-26	32761
WSA Well 27	EW-27	33062
WSA Well 28A	EW-28A	33334
WSA Well 33A	EW-33A	33347



EXTRACTION WELL NUMBER	A WELL DEPTH BELOW GRADE (MEASURED)	B TOP OF SCREEN DEPTH BELOW GRADE	C SCREEN LENGTH	D SCREEN/ CASING DIAMETER	E (NOTE 1) INTERNAL SCREEN DIAMETER	F (NOTE 2) PUMP SUCTION DEPTH (BTOW)	SLOT SIZE	SURFACE ELEVATION	TOP OF WELL ELEVATION
EW-1	55′	15′	40′	12"	10"PS	33′	0.075	531.9	533.5
EW-2	65′	25′	40′	12"	12"TS	42′	0.075	540.3	542.0
EW-3	109′	69′	40′	12"	10"PS	87′	0.075	585.0	586.7
EW-4	114′	74′	40′	16"	N/A	92′	0.050	589.0	591.8
EW-5	113′	78′	35′	12"	N/A	N/A	0.075	588.3	590.2
EW-6	(107′)	84.6′	25′	12"	N/A	82′	0.035	581.4	581.7
EW-7	(112′)	74.5′	30′	12"	N/A	82′	0.035	581.1	581.4

NOTES:

1: DIMENSION ‘E’ REPRESENTS THE NOMINAL SIZE OF THE SCREEN TELESCOPED INSIDE OF THE ORIGINAL SCREEN. PS = PIPE SIZE: TS = TELESCOPE SIZE

2: PROCESS CONTROL STATIONS (PCS’s) ARE LOCATED IN THE SOUTH PLUME VALVE HOUSE

3: EXTRACTION WELLS EW-6 AND EW-7 FLOW CONTROL VALVE, FLOW METER, PRESSURE INDICATORS AND STARTER PANELS ARE LOCATED IN SOUTH PLUME VALVE HOUSE

Figure 6–1. South Plume Module Extraction Well Installation Details

Each of the 13 South Field and four Waste Storage Area extraction wells is of similar design with the exception of the well depth, screen length, and screen slot size. Each contains a submersible pump/motor assembly. Groundwater is pumped from the below-grade pump to the wellhead at the ground surface via the vertical discharge piping. At the wellhead, this piping is routed horizontally through a magnetic flow meter and into the individual well houses. All of the individual well control components are located at these well houses.

The flow control system for each of the seventeen extraction wells is identical; flow is controlled by a flow-control loop consisting of a magnetic flow meter, a PCS, and a variable frequency drive (VFD). Each extraction well can be controlled locally by the PCS or remotely by the computerized control system located at CAWWT (HMI). The normal operational mode is to have the wells operated remotely from the CAWWT computer control system, via the local PCS. Additionally, a local set point is input to the PCS so that the well can automatically revert to local control if communication with the CAWWT computer control is interrupted.

The desired flow rate set point for each extraction well is entered into the HMI and PCS at the CAWWT and the individual well houses, respectively. This value is compared continuously to the actual flow rate measured by the magnetic flow meter. When required, the CAWWT HMI or PCS adjusts the pump motor speed via the VFD to maintain the desired flow. Pump "Start" and "Stop" can be controlled by the CAWWT HMI or the PCS and can also be controlled at the VFD.

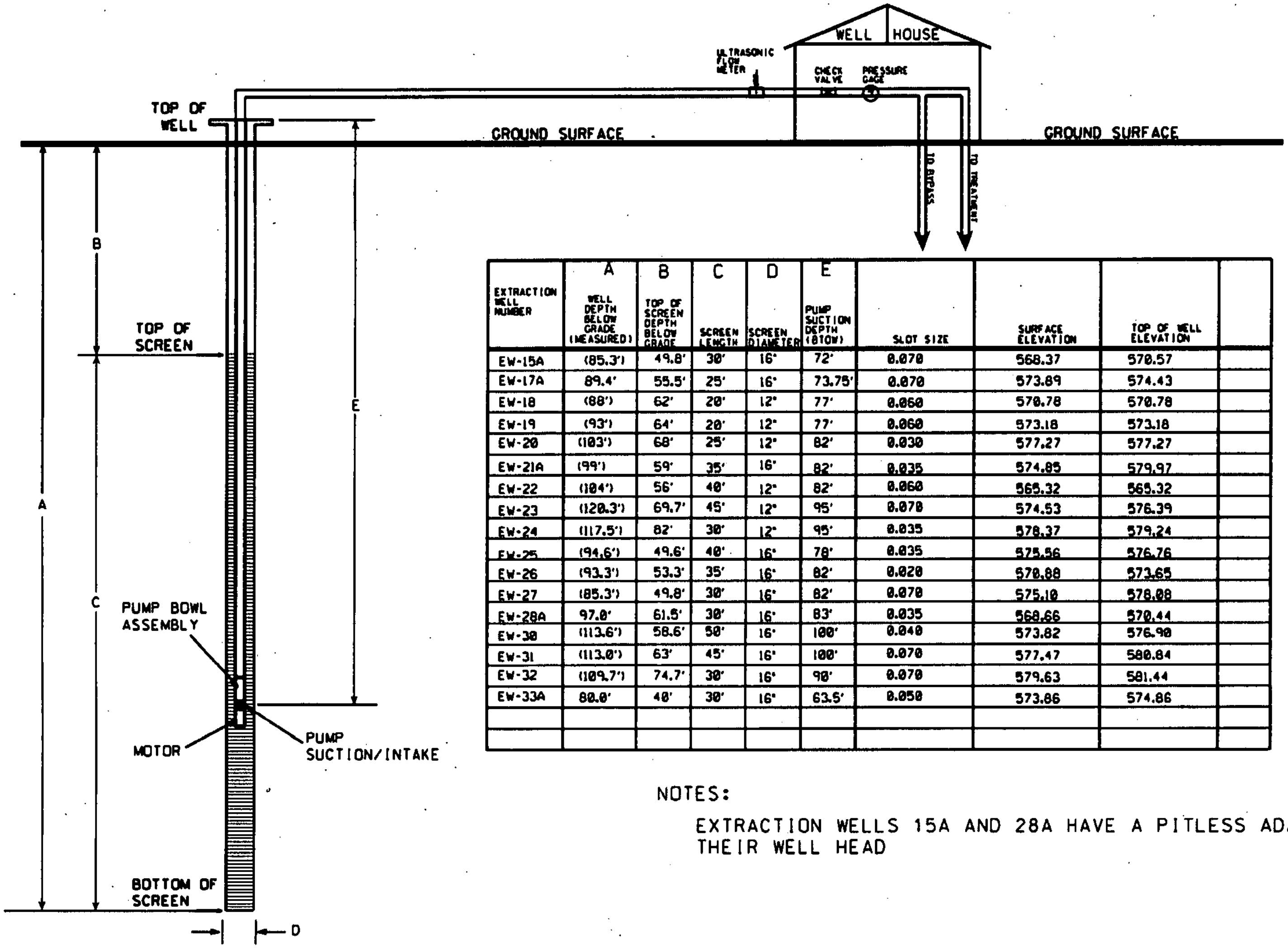
In addition, each extraction well is equipped with isolation valves, a check valve, air releases, and a pressure-indicating transmitter. Routine water level monitoring within the well is performed during regularly scheduled performance monitoring and more frequently if required.

Installation details of the South Field Extraction wells and Waste Storage Area wells are shown in Figure 6–2.

6.2.2 Factors Affecting System Operation

The original five extraction wells comprising the South Plume groundwater restoration module began operating in August 1993, as part of the OU5 South Plume Removal Action. In the intervening time period, valuable operational experience and knowledge has been gained that is being used to optimize long-term operation of extraction wells site wide. This experience base has resulted in identification of factors affecting operation life and efficiency, some of which were unknown at the start of pumping operations. These factors have either already been addressed or are incorporated into planned maintenance.

In order to better understand the factors affecting large-scale groundwater pumping operations, Moody's of Dayton, a water well maintenance and installation contractor, was consulted. Moody's has served the water well industry throughout the Great Miami Aquifer for more than 30 years and has extensive experience maintaining large-capacity wells for a number of major water supply systems. Frequencies for routine maintenance and monitoring activities were selected using input received from their evaluation of the South Plume Extraction well system and based on their experience working with systems of similar magnitude in the regional aquifer.



EXTRACTION WELL NUMBER	A WELL DEPTH BELOW GRADE (MEASURED)	B TOP OF SCREEN DEPTH BELOW GRADE	C SCREEN LENGTH	D SCREEN DIAMETER	E PUMP SUCTION DEPTH (BTOW)	SLOT SIZE	SURFACE ELEVATION	TOP OF WELL ELEVATION
EW-15A	(85.3')	49.8'	30'	16"	72'	0.070	568.37	570.57
EW-17A	89.4'	55.5'	25'	16"	73.75'	0.070	573.89	574.43
EW-18	(88')	62'	20'	12"	77'	0.060	570.78	570.78
EW-19	(93')	64'	20'	12"	77'	0.060	573.18	573.18
EW-20	(103')	68'	25'	12"	82'	0.030	577.27	577.27
EW-21A	(99')	59'	35'	16"	82'	0.035	574.85	579.97
EW-22	(104')	56'	40'	12"	82'	0.060	565.32	565.32
EW-23	(120.3')	69.7'	45'	12"	95'	0.070	574.53	576.39
EW-24	(117.5')	82'	30'	12"	95'	0.035	578.37	579.24
EW-25	(94.6')	49.6'	40'	16"	78'	0.035	575.56	576.76
EW-26	(93.3')	53.3'	35'	16"	82'	0.020	570.88	573.65
EW-27	(85.3')	49.8'	30'	16"	82'	0.070	575.10	578.08
EW-28A	97.0'	61.5'	30'	16"	83'	0.035	568.66	570.44
EW-30	(113.6')	58.6'	50'	16"	100'	0.040	573.82	576.90
EW-31	(113.0')	63'	45'	16"	100'	0.070	577.47	580.84
EW-32	(109.7')	74.7'	30'	16"	90'	0.070	579.63	581.44
EW-33A	80.0'	40'	30'	16"	63.5'	0.050	573.86	574.86

NOTES:

EXTRACTION WELLS 15A AND 28A HAVE A PITLESS ADAPTER AT THEIR WELL HEAD

FINAL

NOT TO SCALE

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Figure 6–2. South Field Module and Waste Storage Area Extraction Well Installation Details

Several factors affect the performance of the extraction wells. In addition, a number of other specific requirements of the Fernald Preserve's system complicate these factors. All of these factors and requirements were considered in developing this plan. First, all the Fernald Preserve's extraction wells are placed in and are extracting water from the upper-most portions of the Great Miami Aquifer. This fact complicates both pump/motor cooling and iron fouling of the extraction well screen. Normal water well practice would place the screened section of the well deeply in the aquifer and the pump/motor assembly would be placed above the screen in a submerged section of blank casing. Since the extraction wells are intended to intercept a plume of contamination located near the top of the aquifer, the screened sections begin near the normal water level. In order to provide the required submergence of the pump/motor assembly, this assembly must be placed within the screened section. The high flow rates required for plume capture combined with the "surgical" removal of the contamination plume have led to difficulties in ensuring that the flow of water passing the motor is adequate for cooling.

Placement of the pump/motor assembly within a screen that is located on the surface of the aquifer also complicates the impacts of iron-fouling. Moody's has confirmed that iron fouling is prevalent throughout the regional aquifer and that the details of the Fernald Preserve installation further enhance the problem. Combined with the fact that this region of the Great Miami Aquifer contains some of the highest concentrations of iron and iron-fouling bacteria, fouling of the well screens and other downstream equipment has been experienced.

Continuous operation of the extraction wells also exacerbates the factors noted above. Normal water well industry practice does not require pumping wells to operate continuously. Typical water supply well systems pump between 6 and 10 hours per day and have spare wells that can be rotated in and out as demand requires (especially when maintenance is required). The Fernald Preserve's extraction well system however, runs continuously and has no spare wells to compensate for wells taken out of service for maintenance. In fact, when a well is shut down for an extended period to perform maintenance, the remaining wells may need to increase their flow to continue the planned capture of the plume.

6.2.3 Maintenance and Operational Monitoring

Several routine activities are performed to optimize performance of the extraction wells comprising the South Plume, South Field, and Waste Storage Area groundwater restoration modules. The following maintenance and operational monitoring activities are described in this section:

- Routine system maintenance, which includes maintenance actions related to valves, instrumentation, and controls associated with each extraction well, and;
- Operational monitoring, which includes quarterly monitoring of extraction well capacity and pump/motor assembly performance.

Table 6–1 lists planned outages for the South Plume Module wells, and Table 6–2 lists planned outages for the South Field and Waste Storage Area wells. Routine well/screen maintenance (i.e., superchlorination) is no longer an activity of the OMMP. Advice from the site water well drilling and maintenance subcontractor coupled with lessons learned by operating extraction wells at the Fernald Preserve for over 13 years indicate that the superchlorination procedure is not effective and that full well rehabilitations are the best approach.

Table 6–1. Planned Outages of the South Plume Module Wells

Item	Description	Frequency	Duration per Event
1	Performance Testing	Quarterly	4 hours/well
2	Process Control Station	Annually	4 hours/well
3	Pressure Transmitter Calibration	Annually	2 hours/well
4	Magnetic Flow Meter Clean and Calibrate[a]	Semiannually	4 hours/well
5	Check Valve Inspect/Clean	Semiannually	4 hours/well
6	Flow Control Valve and Actuator Cleaning	Annually	8 hours/well
7	Rehabilitation	Variable	3 weeks

[a]Flow meter calibration may occur as a post maintenance test utilizing a portable flow meter.

Table 6–2. Planned Outages of the South Field and Waste Storage Area Module Wells

Item	Description	Frequency	Duration per Event
1	Performance Testing	Quarterly	4 hours/well
2	Process Control Station	Annually	4 hours/well
3	Pressure Transmitter Calibration	Annually	2 hours/well
4	Magnetic Flow Meter Clean and Calibrate[a]	Semiannually	8 hours/well
5	Check Valve Inspect/Clean	Semiannually	4 hours/well
6	Rehabilitation	Variable	3 weeks

[a]Flow meter calibration may occur as a post maintenance test utilizing a portable flow meter.

6.2.3.1 Maintenance of the Pumps, Piping, and Controls

These maintenance activities are directed primarily at the valves, instrumentation, and controls associated with each extraction well. These actions are incorporated into the ARWWT maintenance tracking spreadsheet. This spreadsheet helps to ensure that routine maintenance is performed when required. In addition to formal preventative maintenance activities, several routine system checks are performed by operations personnel, between scheduled preventative maintenance activities, to ensure that equipment is functioning properly.

The following is a list of preventative maintenance and operational checks that are routinely performed:

Process Control Station: Annual

The PCSs for each of the recovery and extractions wells are taken out of service annually. At this time, the operational setup parameters for the specific wells are verified and/or updated to reflect current operating conditions. This is anticipated to require an outage of 4 hours per well.

Flow Meters: Clean and Calibrate Semiannually

Cleaning and calibration of the flow meter is anticipated to require an outage of 4 hours per extraction well in the South Plume and 8 hours for each on-property extraction well.

Check Valves: Inspect and Clean Seat Semiannually

Inspection and cleaning of the check valve is anticipated to require an outage of 4 hours per extraction well.

The piping configuration for extraction wells RW-1 through RW-4 includes two check valves. The original check valve cannot be inspected or maintained without removal from the piping system and, because of its location at the extreme end of the piping run in the valve pit, requires that the entire South Plume extraction well system be shut down and drained. The redundant check valve was installed between isolation valves and is a "swing-check" valve that is equipped with a removable inspection plate. Inspection and cleaning of this check valve requires that the individual extraction well be shut down for approximately four hours. Extraction wells RW-6 and RW-7 and all of the on-property extraction wells have a single in line check valve that is removed, inspected and cleaned. This maintenance activity is anticipated to require each well to be shut down for approximately 4 hours.

Flow Control Valves and Actuators: Disassemble and inspect annually

Extraction wells RW-1 through RW-4, RW-6, and RW-7 each utilize motor-operated flow control valves. These are required to be inspected and cleaned annually to prevent the buildup of iron-fouling bacteria encrustation. This maintenance activity will require each well to be shut down for approximately 8 hours.

Pressure-Indicating Transmitters: Annual Calibration

Each extraction well has pressure-indicating transmitters that are used in performance testing to determine the pump's discharge head (pressure). Accurate pressure sensing in the full range of pumping pressures is required for accurate testing. Annual testing and calibration of these transmitters is anticipated to require an outage of 2 hours per well.

Operational Monitoring

The main system performance indicators for the South Plume and South Field extraction well modules are gathered and summarized in performance tests conducted quarterly. These tests monitor the specific capacity of each recovery/extraction well and the pump/motor assembly performance. The test results are used to determine the need for well cleaning/redevelopment or pump/motor rebuilding. The information will help minimize unscheduled, unplanned emergency maintenance and will shorten the duration of well outages. Several of the parameters measured may be monitored more frequently to develop additional system data for trending purposes.

Parameters to Be Monitored

Extraction well operating parameters that are required to be routinely monitored include the following:

- Water level—static and pumping
- Flow
- Discharge pressure
- Motor amperage draw

Water Level Monitoring

Water level, both static and pumping, is perhaps the most critical parameter measured and therefore needs to be measured routinely. The drawdown from static water level to the pumping water level is used to calculate a specific capacity for the well and is a direct indication of the degree of fouling of the well screen and the adjacent formation. The installation depth of the extraction well pump/motor assemblies has been established, based upon an anticipated worst-case drawdown of 10 ft below the seasonal low-static water levels. Historical data were reviewed to determine seasonal lows. While each setting has some added submergence to be conservative, pumping levels are monitored routinely to ensure that adequate pump/motor submergence is maintained and to prevent severe component damage.

If the pumping water level measured during the quarterly performance testing approaches the top of the pump's bowl assembly, rehabilitation efforts may be necessary. Rehabilitation efforts include cleaning of the well utilizing dual swab and airlift pumping to remove debris. After cleaning, the well will be acid-treated to break down encrustation on the well screen and within the local formation. This will then be followed by chlorination to inhibit future iron-fouling bacterial growth. These processes may, if necessary, be repeated several times to ensure that the well has been rehabilitated to its optimal condition.

Flow Monitoring

The ability of an extraction well pump/motor to sustain the desired flow is a key indicator of the health of the flow meter, controls, VFD, well, and pump/motor assembly. Specific testing to determine the ability of a pump/motor assembly to perform as expected will be completed quarterly. Additionally, individual extraction well flow is monitored continuously by the flow controller for each well. The actual flow verses the controller set point is checked by operations personnel from the HMI at CAWWT at least once per day. Any significant deviation from the flow set point is investigated and required maintenance actions are determined and carried out.

Discharge Pressure Monitoring

Pump discharge pressure, coupled with flow, is monitored quarterly to assess the pump/motor assemblies' performance against the manufacturers published performance.

Amperage

As with flow and pressure, amperage is a good indicator of how the pump/motor assembly is performing. During performance testing, motor amperage draw is measured on each of the three phases of the electrical supply. Amperage draw is compared to the motor manufacturer's published specifications. Amperage should be below the manufacturer's full-load amperage and should be approximately equal across the phases of the motor. An imbalance of greater than 20 percent across the phases indicates a motor or electrical supply situation that triggers more extensive diagnosis. Additional diagnostics and repairs are not within the scope of this plan.

Performance Testing

Performance testing of the extraction wells is conducted quarterly to assess their condition; this testing requires an outage of approximately 4 hours per well. Static water-level measurements are made prior to each performance test. This measurement serves as the basis for computing drawdown within the extraction well. System flow, discharge pressure, pumping level, and motor amperage per phase are measured at each of at least five different flows for the extraction well. These five flows include maximum flow (discharge valve fully open) and zero flow conditions (discharge valve closed).

The results of these measurements are used to determine the condition of the pump/motor and of the well. Results are summarized in two ways. First, the flow and discharge head is plotted and compared to extraction well pump manufacturer and previously developed head/flow curves. Second, the static water level and pumping levels are used to calculate drawdown and specific capacity within the extraction well at various flows. As plugging of the well screen due to iron fouling and encrustation progresses, it is expected that drawdown within the well will increase for a given flow rate. If the drawdown becomes excessive, well rehabilitation efforts will likely be required.

The static water level and pumping levels will be used to calculate drawdown and specific capacity (flow rate divided by drawdown) within the recovery/extraction well at various flows. As fouling and encrustation of the well progresses, drawdown within the well will increase for a given flow rate (the specific capacity will decrease). The need for well screen maintenance activities will be triggered by excessive drawdown. Maintenance work will be planned, scheduled, and performed to avoid costly damage to equipment such as well pump/motor assembly and to avoid lengthy outages.

Additionally, the amperage draw of the well at various flows is compared to previous readings and pump/motor manufacturers published information.

6.3 Treatment Facilities Performance Monitoring and Maintenance

This section describes the key performance monitoring parameters and maintenance needs for the wastewater treatment systems and their ancillary facilities. Based on past performance, meeting the Fernald Preserve effluent discharge uranium limit of 30 ppb on a monthly average basis is routinely achievable.

6.3.1 Treatment Facilities Performance Monitoring

The CAWWT uses strong base-anion exchange as the final unit process for uranium removal. The strong base-anion exchange resins have a very strong affinity for the uranyl carbonates in the Fernald Preserve's wastewater. The technology is reliable; however, treatment to the effluent levels required at the Fernald Preserve (i.e., <30 ppb) is not widely practiced in wastewater systems. An expected performance of the CAWWT system has been used in this plan to demonstrate the ability to meet the ROD effluent requirements. The performance expectations are, for the most part, based on historical Fernald site operating experience, utilizing new resin, as opposed to vendor performance guarantees or widely published data.

Measurable parameters for the CAWWT treatment system are the total volume of water treated, the influent and effluent uranium concentrations and mass, and the total mass of uranium removed by treatment. The Fernald Preserve total effluent flow rate is metered. Flow weighted composite samples of the effluent are analyzed daily for total uranium. Those two parameters are used to measure compliance with the OU5 ROD requirements for uranium discharge in the Fernald Preserve's effluent. Additionally, each individual CAWWT treatment train has flow measurement and control. The individual treatment systems are also routinely sampled at strategic process locations, including the inlet and outlet of each ion exchange vessel. The sample results and treatment flow rates are reported, tracked, and used to determine the need for troubleshooting, process adjustments, and corrective actions. All of the routine uranium analytical work is conducted in a laboratory located within the CAWWT, Building 51A.

6.3.2 Treatment Facilities Maintenance Practices

Most of the routine preventive maintenance and repair work in the treatment systems can be accomplished without a unit shutdown, because of the installed spare equipment and bypass piping and valving. There are some planned maintenance activities that will result in treatment system outages. The OU5 ROD provides for relief allowances from the effluent discharge limit of a monthly average of 30 ppb uranium concentration during periods of treatment plant scheduled maintenance. Decisions regarding well operations during treatment plant scheduled maintenance will be made on a case-by-case basis. For planned maintenance shutdowns, advanced EPA approval will be obtained for relief allowances that may be requested.
Some breakdowns will lead to system shutdowns. Loss of utilities or a failure in the CAWWT's computerized control system would result in a system shutdown. All treatment systems will fail safely on loss of a utility or a major component and are not very complicated to restart.

6.4 Regulatory Issues

Current extraction well rehabilitation efforts require the addition of chemicals to the well. Well rehabilitation efforts require the use of both sodium hypochlorite and hydrochloric acid. The hydrochloric acid is used to break down flow-limiting encrustation on the well screen. The sodium hypochlorite is used to disinfect the well and inhibit the growth of iron fouling bacteria. The sodium hypochlorite and hydrochloric acid are purged from the well by pumping to a tanker truck and discharging the dilute chemicals for subsequent treatment at the CAWWT and discharge to the Great Miami River via the Parshall Flume.

The use of these chemicals in well rehabilitation efforts to date has been monitored closely. Ohio EPA has been notified and has approved of the intended chemical additions and subsequent discharges. After the addition of these chemicals, the water pumped initially from the extraction well is turbid, contains iron residual and dissolved scale, and has a low pH.

Adequate dilution of this stream in the CAWWT Backwash Basin is anticipated so that chlorine, turbidity, and low pH will not exceed NPDES outfall limits. The chlorine residual is expected to fall to acceptable limits prior to pumping.

In order to discharge chlorinated water, the amount of chlorine residual and rate of discharge must not produce a detectable level (currently defined by OEPA as 0.038 milligrams per liter) of residual chlorine at the Parshall Flume (NPDES Outfall 4001).

7.0 Organizational Roles, Responsibilities, and Communications

This section presents the organizational roles and responsibilities with respect to implementation of this OMMP. Also presented are information needs and communications protocol for coordination with other Fernald Preserve project organizations, and interaction with EPA and OEPA.

7.1 Organization Roles and Responsibilities

7.1.1 DOE Office of Legacy Management Fernald

DOE is responsible for providing direction and oversight of all activities at the Fernald Preserve.

7.1.2 Operating Contractor

S.M. Stoller is the DOE Legacy Management (DOE-LM) contractor for the Fernald Preserve. The OMMP falls under the responsibility of the site's ARWWT project.

The ARWWT project is responsible for all engineering design and construction activities for the OMMP which include:

- Engineering functional requirements, design basis, and detailed design drawings and documents.
- Title III engineering support during construction.
- Startup Plans, System Operability Test procedures, and test supervision.
- Standard Startup Review Plans and coordinating resolution of operational issues.
- Technical support of well field and water treatment operations.
- Coordination of project-specific activities associated with procurement and management of construction contractors.

The ARWWT project is also responsible for all aquifer restoration planning and defining groundwater monitoring/reporting activities within the project, which include:

- Developing and maintaining the aquifer restoration strategy.
- Defining groundwater remedy performance monitoring requirements.
- Completing groundwater data evaluation, and reporting.
- Providing technical input to operations on recovery well operation and maintenance.
- Providing technical input to operations regarding compliance with discharge limits.
- Providing technical input to design and construction of site groundwater extraction systems.
- Preparing required CERCLA documentation (e.g., RA Work Plan, aquifer remedy design documents, the IEMP groundwater section, and various other required reports).

The ARWWT team is also responsible for all operations and maintenance activities within the project, which include:

- Operation of groundwater extraction well systems.
- Operation of all site wastewater conveyance and treatment systems and their ancillary facilities.
- Estimating, planning, and executing corrective and preventative maintenance.
- Training and qualification of operators and supervisors.
- Developing, reviewing, and revising standard operating procedures.
- Sampling of process streams for compliance with operational parameters and established regulatory limits.

Site Environmental Monitoring/Data Management and Reporting personnel are responsible for:

- Collection of groundwater monitoring samples and aquifer water level data.
- Coordination of sample analysis, data management and preparation of the annual site environmental report.
- Analysis of wastewater treatment operations process control samples.

Site Environmental Compliance personnel are responsible for:

- Fulfilling site NPDES reporting requirements.
- Analysis of state and federal regulations to identify project-specific regulatory requirements.

The site Safety and Health team, in conjunction with S.M. Stoller corporate safety personnel, are responsible for the following Safety and Health activities within the project:

- Development and revision of Safety and Health Project matrices for operations, maintenance, and construction.
- Radiological monitoring of activities.
- Industrial health monitoring of activities.
- Oversight of construction and operations safety programs.
- Safety design reviews and technical input.

Individual project team members are responsible for the safe execution of the work assigned to them and have the right to stop work if unsafe conditions are observed.

The S.M. Stoller Project Controls personnel, in conjunction with the ARWWT project manager, are responsible for:

- Project cost and schedule baseline development and maintenance.
- Cost performance and variance reporting.
- Estimate at completion funding analysis and reporting.
- Change proposal and cost savings coordination.
- Project quality assurance oversight.

7.2 Regulatory Agency Interaction

As noted in Sections 1.0 and 3.0, Attachment D (IEMP) provides for the collection and reporting of groundwater remedy performance (Section 3.0) and treated effluent (Section 4.0) information that supports operational decisions regarding groundwater restoration and water treatment. The current plan is that well field and treatment operational summaries are included in the annual site environmental report. These summaries allow for agency input as ARWWT progress. In addition, the NPDES reporting will continue as outlined in Section 4.0 of the Attachment D. The ARWWT participation in meetings and conference calls will continue as necessary.

End of current text

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Attachment B

Attachment B

Post-Closure Care and Inspection Plan

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Acronyms and Abbreviations

ARARs	applicable or relevant and appropriate requirements
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	*Code of Federal Regulations*
DOE	U.S. Department of Energy
EM	Office of Environmental Management
EPA	U.S. Environmental Protection Agency
FFCA	Federal Facility Compliance Agreement
ft	feet
GWLMP	Groundwater/Leak Detection and Leachate Monitoring Plan
HWMU	Hazardous Waste Management Unit
IC Plan	Institutional Controls Plan
IEMP	Integrated Environmental Monitoring Plan
LCS	leachate collection system
LDS	leak detection system
LM	Office of Legacy Management
LMICP	Comprehensive Legacy Management and Institutional Controls Plan
mg/kg	milligram per kilogram
NPL	National Priorities List
OAC	Ohio Administrative Code
ODNR	Ohio Department of Natural Resources
OEPA	Ohio Environmental Protection Agency
OSDF	on-site disposal facility
OU	operable unit
PCCIP	Post-Closure Care and Inspection Plan
pCi/g	picocuries per grams
PVC	polyvinyl chloride
RCRA	Resource Conservation and Recovery Act
RI/FS	remedial investigation/feasibility study
ROD	record of decision
TBC	to-be-considered criteria
WAC	waste acceptance criteria

End of current text

1.0 Introduction

This post-closure care and inspection plan (PCCIP) covers the long-term care of the Fernald Preserve's on-site disposal facility (OSDF) and its associated buffer area after the last cell of the OSDF has been closed and covered. This plan has been developed to address reasonably expected circumstances that may arise during the post-closure care period, or legacy management, of the Fernald Preserve. Other relevant key concepts addressed by this PCCIP are ownership, access controls and restrictions, deed and use restrictions, environmental monitoring, inspections (scheduled, unscheduled, and contingency), custodial maintenance, contingency repair, corrective actions, emergency notification and reporting, and public involvement.

As noted in the executive summary, the PCCIP has been integrated into this revision of the *Legacy Management and Institutional Controls Plan* (LMICP). The PCCIP is no longer a stand-alone document with its own review and revision cycle. It will be reviewed and revised each October.

1.1 Plan Scope and Duration

This PCCIP establishes the inspection, monitoring, and maintenance activities necessary to ensure the continued proper performance of the OSDF. The facilities and structures covered by this PCCIP include the following:

- Security system (e.g., fences, gates, warning signs)
- Permanently surveyed benchmarks, corner monuments, and cap survey anchors
- OSDF run-on/runoff controls
- OSDF final cover (referred to as the "cap")

As specified in the records of decision (RODs) and in accordance with appropriate regulations, the initially established duration of the post-closure care period is 30 years, subject to potential future modification, as discussed in Section 11.0 (Ohio solid waste rule Ohio Administrative Code (OAC) 3745-27-14(A) in lieu of federal solid waste regulation 40 *Code of Federal Regulations* (CFR) §258.61(a), and Ohio hazardous waste rules OAC 3745-66-17 and 3745-68-10 in lieu of federal hazardous waste regulations 40 CFR §§265.117(a)(1) and 264.117(a)(1), respectively). Care and maintenance of the OSDF will continue in perpetuity.

1.2 Plan Organization

The remainder of this plan is organized as follows:

- A description of the parties responsible for this plan and the support plans that are to be used in conjunction with this plan are presented in the remainder of Section 1.0.
- The requirements pertinent to this plan are addressed in Section 2.0.
- Final site conditions at closure of the OSDF are addressed in Section 3.0.
- Institutional controls and points of contact are addressed in Section 4.0.
- Environmental monitoring is addressed in Section 5.0.
- Routine scheduled inspections are addressed in Section 6.0.

- Unscheduled inspections are addressed in Section 7.0.
- Custodial maintenance and contingency repair are addressed in Section 8.0.
- Corrective actions are addressed in Section 9.0.
- Emergency notification and reporting are addressed in Section 10.0.
- Public involvement is addressed in Section 11.0.
- References are presented in Section 12.0.

1.3 Responsible Parties

The governing document for the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) response actions at the Fernald Preserve is the Amended Consent Agreement between the U.S. Department of Energy (DOE) and the U.S. Environmental Protection Agency (EPA) Region V, signed in September 1991. As such, responsibility for the implementation of the PCCIP lies with DOE as the lead agency responsible for CERCLA activities at the Fernald Preserve and with EPA as the oversight agency. The DOE Office of Legacy Management (DOE-LM) has the ultimate authority for ensuring that the post-closure care of the OSDF meets all the goals, standards, specifications, and requirements of this PCCIP.

1.4 Related Plans

Several other support plans have been prepared for the OSDF remedial action project and should be used in conjunction with this plan, or referred to for information on how impacted materials were placed into the OSDF. The other plans containing information relevant to this plan are listed below with a brief statement of the relationship to this plan. These plans are accessible, either electronically or in hard copy.

- *Permitting Plan and Substantive Requirements for the On-site Disposal Facility* (DOE 1998): Identifies the administrative and substantive requirements for the National Pollutant Discharge Elimination System Permit, and the substantive requirements for all of the operable units' (OUs')on-site disposal needs for the Wetlands Nationwide Permit, the Ohio Solid Waste Permit to Install, and the Resource Conservation and Recovery Act (RCRA) Permit; additionally, discusses how the requirements relate to the OSDF, presents the plan for compliance with the requirements, and discusses additional applicable or relevant and appropriate requirements (ARARs) that are not related to the issuance of a specific permit.
- *Construction Quality Assurance Plan; On-site Disposal Facility* (GeoSyntec 2001a): Contains procedures used to evaluate soils and other features of the OSDF liner and final cover system.
- *Final Design Criteria Package; On-site Disposal Facility* (GeoSyntec 1997): Provides the design of the OSDF and includes the *Final Remedial Design Work Plan*, which presents the design approach for the OSDF.
- *Impacted Materials Placement Plan; On-site Disposal Facility* (GeoSyntec 1996): Outlines waste acceptance criteria (WAC) for the OSDF and contains procedures used to place the impacted materials into the OSDF.

- *Surface Water Management and Erosion Control Plan On-site Disposal Facility* (GeoSyntec 2001b): Provides details of permanent erosion and sediment controls and surface water controls for the OSDF, including maintenance requirements for channels and sediment controls.
- *Groundwater/Leak Detection and Leachate Monitoring Plan*: Provides details on the leak detection monitoring program for the OSDF, addressing monitoring within the OSDF in the leachate collection system (LCS) and leak detection system (LDS), and the underlying groundwater in the till immediately underneath the OSDF and the groundwater in the Great Miami Aquifer (included as Attachment C to the LMICP).
- *Systems Plan, Collection and Management of Leachate for the On-site Disposal Facility* (DOE 2001): Describes the inspection, monitoring, and maintenance activities that will be undertaken at the Fernald Preserve to collect and manage leachate collected from the OSDF.
- *Integrated Environmental Monitoring Plan* (IEMP): Defines the environmental monitoring and reporting requirements, including those required post-closure (included as Attachment D to the LMICP).
- *Work Plan for Removal and In-Place Abandonment of the OSDF Cell 1 Final Cover Monitoring System* (GeoSyntec 2006): Explains the process used to remove and abandon in place the Cell 1 final cover monitoring system.

In addition, this PCCIP is used as a support document for the LMICP. The LMICP describes the long-term operations and maintenance of the Fernald Preserve during legacy management and discusses the institutional controls that are in place to help ensure the protectiveness of the remedy, thus ensuring the protectiveness of human health and the environment.

End of current text

2.0 Pertinent Requirements

2.1 Overview

Regulatory and other requirements pertinent to this plan primarily take the form of ARARs and to-be-considered criteria (TBC) as determined by the ROD for each of the various Fernald Preserve OUs, functional requirements, and general design criteria. These are addressed in the following subsections.

2.2 Pertinent Requirements

ARARs and TBC that should be addressed by this plan are provided in Table 2–1 as obtained from the *Final Record of Decision for Remedial Actions at Operable Unit 2* (DOE 1995a), the *Final Record of Decision for Remedial Actions at Operable Unit 5* (DOE 1996a), and the *Operable Unit 3 Record of Decision for Final Remedial Action* (DOE 1996b), as identified by the *X* in the appropriate column. Additional regulatory requirements that are appropriate guidance for development or maintenance of this plan have been identified and are indicated by an *X* in the *Permitting Plan and Substantive Requirements for the On-site Disposal Facility* (DOE 1998) column but no *X* in the previous columns.

2.3 Functional Requirements

The Final Design Criteria Package (GeoSyntec 1997) contains a variety of functional requirements that have been established for the OSDF. The functional requirements pertinent to this plan are to:

- Protect the OSDF from damage caused by precipitation and stormwater run-on and runoff.
- Route run-on and runoff to designated diversion channel locations for appropriate management.
- Discharge surface water to existing watercourses in accordance with applicable regulatory and DOE requirements.

The surface water management system should be maintained such that it will continue to perform in a manner that meets the project requirements for long-term conditions (i.e., after site physical completion). The system should prevent stormwater run-on to the OSDF and uncontrolled storm water runoff from the OSDF. Features of the long-term surface water management system were constructed to require minimal monitoring and maintenance. The system was integrated, to the extent possible, with existing topography, features, and facilities.

2.4 General Design Criteria

The OSDF Design Criteria Package also identifies a number of general design criteria for the OSDF. The general design criteria pertinent to this plan are:

- Long-term erosion and sediment control features for the OSDF were designed for the 2,000-year, 24-hour storm event (design criterion for assumption of a DOE Performance Category 2 facility).

- Long-term run-on/runoff control structures for the OSDF were designed to limit interruption and damage (i.e., washout) of the OSDF in the 2,000-year, 24-hour storm event (design criterion for assumption of a DOE Performance Category 2 facility); run-on should be controlled and diverted away from and around the OSDF using swales, channels, or diversion berms.

Table 2–1. Applicable or Relevant and Appropriate Requirements and To-Be-Considered Criteria

#	Title	Requirements	OU2 ROD	OU3 ROD	OU5 ROD	OSDF Permitting Plan
		PLANS				
1	Ohio Municipal Solid Waste Rules—Sanitary Landfill Facility Permit to Install Application OAC 3745-27-06(C)(7)	• Prepare a post-closure plan as detailed in OAC 374-27-11(B).	X	X	X	X
		• Prepare a leachate monitoring plan to ensure compliance with OAC 3745-27-19(M)(4).	X	X	X	X
		• Prepare a leachate contingency plan as required by OAC 3745-27-19(K)(6).	X	X	X	X
		• Prepare a groundwater detection monitoring plan as required by OAC 3745-27-10, and if applicable a groundwater quality assessment plan and/or corrective measures plan required by OAC 3745-27-10.	X	X	X	X
2	Ohio Municipal Solid Waste Rules—Final Closure of Sanitary Landfill Facility OAC 374-27-11(B)	The owner shall prepare a post-closure plan which shall contain: • The name and location of the facility and unit(s) included in the plan • A description of the post-closure activities • The name, address, and telephone number of the person or office to contact regarding the unit(s) of the facility during the post-closure care period. The Ohio Environmental Protection Agency (OEPA) shall be notified of any changes.			X	X
3	Ohio Hazardous Waste Interim Standards Rules—Post-Closure Plan: Amendment of Plan OAC 3745-66-18(A) and (C)	The owner of a hazardous waste disposal unit shall have a written post-closure plan, which shall identify the activities that will be carried on after closure of each unit and the frequency of those activities, and include at least: • A description of the planned monitoring activities and frequencies at which they will be performed. • A description of the planned maintenance activities and frequencies at which they will be performed, to ensure (a) the integrity of the cap and final cover or other containment systems, and (b) the function of the monitoring equipment. • The name, address, and telephone number of the person or office to contact about the hazardous waste disposal unit or facility during the post-closure period.				X

Table 2-1. Applicable or Relevant and Appropriate Requirements and To-Be-Considered Criteria (continued)

#	Title	Requirements	OU2 ROD	OU3 ROD	OU5 ROD	OSDF Permitting Plan
		CLOSURE AND POST-CLOSURE OBJECTIVES				
4	Ohio Municipal Solid Waste Rules—Final Closure of a Sanitary Landfill Facility OAC 3745-27-11(H)	At final closure of a landfill facility: • All land surfaces shall be graded to prevent ponding of water where solid waste has been placed. Drainage facilities shall be provided to direct surface water from the landfill facility. • A groundwater monitoring system shall be designed and installed in accordance with OAC 3745-27-10, if a system is not already in place.	X	X		X
5	Ohio Municipal Solid Waste Rules—Final Closure of a Sanitary Landfill Facility OAC 3745-66-11(O)	Closure of the sanitary landfill facility must be completed in a manner that minimizes post-closure formation and release of leachate to surface water to the extent necessary to protect human health and the environment.	X	X		X
6	Ohio Hazardous Waste Interim Standards Rules—Closure Performance Standard OAC 3745-66-11	The owner shall close his facility in a manner that: • Minimizes the need for further maintenance • Controls, minimizes, or eliminates to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated runoff, or hazardous waste decomposition products to the groundwater, or surface waters, or to the atmosphere. • Complies with closure requirements.		X	X	X
7	Ohio Hazardous Waste Landfill Rules—Closure and Post-closure OAC 3745-68-10(A) (in lieu of 40 CFR § 265.310(a))	At final closure of the landfill, the owner or operator must cover the landfill with a final cover designed and constructed to: • Provide long-term minimization of migration of liquids through the closed landfill. • Function with minimum maintenance. • Promote drainage and minimize erosion or abrasion of the cover. • Accommodate settling and subsidence so that the cover's integrity is maintained. • Have a permeability less than or equal to the permeability of any bottom liner system or natural subsoil present.		X	X	X

Table 2-1. Applicable or Relevant and Appropriate Requirements and To-Be-Considered Criteria (continued)

#	Title	Requirements	OU2 ROD	OU3 ROD	OU5 ROD	OSDF Permitting Pl
8	Ohio Municipal Solid Waste Rules—Operational Criteria for a Sanitary Landfill Facility OAC 3745-27-19-(J)(1) and (4)	Surface water shall be diverted from areas where solid waste has been deposited. The facility shall be designed, constructed, maintained, and provided with surface water control structures, as necessary, to control run-on and runoff of surface water to ensure minimal infiltration of water through the cover material and cap system, and minimal erosion of the cover material and cap system. If ponding or erosion occurs on areas of the landfill facility where solid waste had been deposited, action will be taken to correct the conditions causing the ponding or erosion.	X	X	X	X
9	Ohio Municipal solid Waste Rules—Operational Criteria for a Sanitary Landfill Facility OAC 3745-27-19(E)(26)	The integrity of the engineered components of the landfill facility shall be maintained and any damage to, or failure of, the components shall be repaired.	X	X	X	X
DURATION OF POST-CLOSURE CARE PERIOD						
10	Ohio Municipal Solid Waste Rules— Post-Closure Care of Sanitary Landfill Facilities OAC 3745-27-14(A) (in lieu of RCRA Subtitle D)	Following completion of final closure activities in accordance with OAC 3745-27-11, post-closure care activities shall be conducted at the sanitary landfill facility for a minimum of 30 years.	X	X	X	X
11	Ohio Hazardous Waste Interim Standards Rules— Post-Closure Care and Use of Property OAC 3745-66-17(A) (in lieu of 40 CFR §265.117(a)(1))	Post-closure care must begin after completion of the unit and continue for 30 years after that date, unless shortened or extended by the Ohio Director of Environmental Protection in accordance with OAC 3745-66-18(G) (40 CFR §265.117(a)(2)). Note: Identified in OU5 ROD as applicable only to existing Hazardous Waste Management Units (HWMUs).			X	
12	Ohio Municipal Solid Waste Rules— Post-Closure Care of Sanitary Landfill Facilities OAC 3745-27-14(A)(1) and (2) (in lieu of RCRA Subtitle D)	Post-closure care activities for all sanitary landfill facilities shall include, but are not limited to: • Continuing operation and maintenance of the leachate management system, surface water management system... and the groundwater monitoring system. • Maintaining the integrity and effectiveness of the cap system, including making repairs to the cap system as necessary to correct the effects of erosion and preventing run-on and runoff from eroding or otherwise damaging the cap system.	X	X	X	X

Table 2-1. Applicable or Relevant and Appropriate Requirements and To-Be-Considered Criteria (continued)

#	Title	Requirements	OU2 ROD	OU3 ROD	OU5 ROD	OSDF Permitting Plan
13	Ohio Hazardous Waste Interim Standards Rules—Post-Closure Care and Use of Property OAC 3745-66-17(A)(1) (in lieu of 40 CFR §265.117(a)(1))	Post-Closure care must consist of at least the following: • Monitoring and reporting. • Maintenance and monitoring of waste containment systems. Note: Identified in OU5 ROD as applicable only to existing HWMUs.			X	
14	Ohio Hazardous Waste Landfill Rules—Closure and Post-Closure OAC 3745-68-10(B) (in lieu of 40 CFR §265.310(b)	After final closure, the owner or operator must comply with post-closure requirements, including maintenance and monitoring throughout the post-closure care period. The owner or operator must: • Maintain the integrity and effectiveness of the final cover, including making repairs to the cap as necessary to correct the effects of settling, subsidence, erosion, or other events. • Continue to operate the leachate collection and removal system until leachate is no longer detected. • Maintain and monitor the LDS. • Maintain and monitor the groundwater monitoring system. • Prevent run-on and runoff from eroding or otherwise damaging the final cover. • Protect and maintain surveyed benchmarks.		X	X	X
15	Ohio Hazardous Waste Landfill Rules—Closure and Post-Closure OAC 3745-68-10(D) (in lieu of 40 CFR §265.310(b))	During the post-closure period, the owner of a hazardous waste landfill must: • Maintain the function and integrity (integrity and effectives) of the final cover. • Maintain and monitor the leachate collection, removal, and treatment system to prevent excess accumulation of leachate in the system. • Protect and maintain surveyed benchmarks.		X	X	X
		MODIFICATIONS TO POST-CLOSURE CARE PLAN OR PERIOD				
16	Ohio Hazardous Waste Interim Standards Rules—Post-Closure Plan; Amendment of Plan OAC 3745-66-18(D)	The owner may amend the post-closure plan any time during the active life of the facility or during the post closure period.				X
17	Ohio Hazardous Waste Interim Standards Rules—Post-Closure Plan; Amendment of Plan OAC 3745-66-18(G)	The post-closure plan and length of the post-closure care period may be modified any time prior to the end of the post-closure care period. A modification of the post-closure plan may include, where appropriate, the temporary suspension rather than permanent deletion of one or more post-closure care requirements.				X

Table 2-1. Applicable or Relevant and Appropriate Requirements and To-Be-Considered Criteria (continued)

#	Title	Requirements	OU2 ROD	OU3 ROD	OU5 ROD	OSDF Permitting Pla
		At the end of specified period of suspension, the Ohio Director of Environmental Protection would then determine whether the requirements should be permanently discontinued or reinstated to prevent threats to human health and the environment.				
		PROPERTY USE RESTRICTIONS				
18	Ohio Hazardous Waste Interim Standards Rules—Post-Closure Care and Use of Property OAC 3745-66-17(C) (in lieu of 40 CFR §265.117(c))	Post-closure use of property on or in which hazardous wastes remain after partial or final closure must never be allowed to disturb the integrity of the final cover, liner(s), or any other component of the containment system, or the function of the facility's monitoring systems, unless the Ohio Director of Environmental Protection approves otherwise. Note: Identified in OU5 ROD as applicable only to existing HWMUs. Note: If clean closure is performed, then post-closure care is not required.			X	
19	Ohio Hazardous Waste Landfill Rules—Closure and Post-Closure OAC 3745-68-10(D)(5)	During the post-closure period, the owner of a hazardous waste landfill must restrict access to the landfill as appropriate for its post-closure use.		X	X	X
20	Ohio Municipal Solid Waste Rules—Final Closure of a Sanitary Landfill Facility OAC 3745-27-11-(H)(5)(a)	The owner shall file—with the board of health having jurisdiction with the county recorder of the county in which the facility is located, and with the Ohio Director of Environmental Protection—a plat of the units(s) of the sanitary landfill facility and information describing the acreage, exact location, depth, volume and nature of the solid waste deposited in the unit(s) of the sanitary landfill facility.		X		X
21	Ohio Hazardous Waste Interim Standards Rules—Survey Plat OAC 3745-66-16	The owner shall submit—to the local zoning authority, or the authority with jurisdiction over local land use, and to the Ohio Director of Environmental Protection—a survey plat, prepared and certified by a professional land surveyor, indicating the location and dimensions of landfill cells or other hazardous waste disposal units with respect to permanently surveyed benchmarks. The plat must contain a note, prominently displayed, which states the owner's obligation to restrict disturbance of the hazardous waste disposal unit in accordance with OAC 3745-66-17(C).		X		X
22	Ohio Hazardous Waste Interim Standards Rules—Post-Closure Notices OAC 3745-66-19(A)	The owner shall submit—to the local zoning authority, or the authority with jurisdiction over local land use, and to the Ohio Director of Environmental Protection—a record of the type, location, and quantity of hazardous wastes disposed of within each cell or disposal unit of the facility.				X

Table 2-1. Applicable or Relevant and Appropriate Requirements and To-Be-Considered Criteria (continued)

#	Title	Requirements	OU2 ROD	OU3 ROD	OU5 ROD	OSDF Permitting Plan
		DEED NOTATION				
23	Ohio Municipal Solid Waste Rules—Final Closure of a Sanitary Landfill Facility OAC 3745-27-11(H)(5)(b)	The owner shall record a notation on the deed to the sanitary landfill facility property, or on some other instrument which is normally examined during title search, that will notify in perpetuity any potential purchaser of the property that: • The land has been used as a sanitary landfill facility. • Includes information describing acreage, exact location, depth, volume, and nature of solid waste deposited in the sanitary landfill facility.	X	X		X
24	Ohio Hazardous Waste Interim Standards Rules—Post-Closure Notices OAC 3745-66-19(B)	The owner shall record, in accordance with state law, a notation or the deed of the facility property, or on some other instrument which is normally examined during title search, that will notify in perpetuity the potential purchasers of the property that: • The land has been used to manage hazardous wastes. • Its use is restricted under the Ohio Administrative Code closure and post-closure rules. • The survey plat and record of the type, location, and quantity of hazardous wastes disposed of within each cell or hazardous waste unit of the facility as required by OAC 3745-66-16 and 3745-66-19(A) have been filed with the local zoning authority or the authority with jurisdiction over local land use and with the Ohio Director of Environmental Protection.				X
25	Ohio Hazardous Waste Interim Standards Rules—Post-Closure Notices OAC 3745-66-19(C)	If the owner or any subsequent owner of the land upon which a hazardous waste disposal unit was located wishes to remove hazardous wastes and hazardous waste residues in satisfaction of the criteria in OAC 3745-66-17(C), the owner may request that the Ohio Director of Environmental Protection approve either or the following: • The removal of the notation on the deed to the facility property or other instrument normally examined during title search. • The addition of a notation to the deed or instrument indicating the removal of the hazardous waste.				X

Table 2-1. Applicable or Relevant and Appropriate Requirements and To-Be-Considered Criteria (continued)

#	Title	Requirements	OU2 ROD	OU3 ROD	OU5 ROD	OSDF Permitting Pla
		OTHER DOE CRITERIA				
26	Disposal Site Closure/Post-Closure DOE Order 5820.2A, Chapter III (3)(j)	• During post-closure, residual radioactivity levels for surface soil shall comply with existing DOE decommissioning guidelines. • Inactive disposal facilities, disposal sites, and disposal units shall be managed in conformance with RCRA, CERCLA, and the Superfund Amendments and Reauthorization Act of 1986, as amended. • Corrective measures shall be applied to new disposal sites or individual disposal units if conditions occur or are forecasted that could jeopardize attainment of the performance objectives [of the unit]. • Termination of monitoring and maintenance activity at closed facilities or sites shall be based on an analysis of site performance at the end of the institutional control period.	X	X	X	
27	Environmental Monitoring DOE Order 5820.2A, Chapter III(3)(k)—this order has been replace with DOE Order 435.1	I.1.E.(7) Environmental Monitoring. Radioactive waste management facilities, operations, and activities shall meet the environmental monitoring requirements of DOE 5400.1, General Environmental Protection Program; and DOE 5400.5, Radiation Protection of the Public and the Environment. IV.R.(3)(a) The site-specific performance assessment and composite analysis shall be used to determine the media, locations, radionuclides, and other substances to be monitored. IV.R.(3) Disposal Facilities. • (C) The environmental monitoring programs shall be capable of detecting changing trends in performance to allow application of any necessary corrective action prior to exceeding the performance objectives in this Chapter.	X	X	X	

2.5 Other Requirements

In addition to the requirements contained in the OSDF Design Criteria Package, the following requirements have been incorporated into this plan:

- Disturbed areas should be stabilized (i.e., vegetated) after the area has been reconstructed to final grade.

- General practices for inspection and maintenance of erosion and sediment control features should be as recommended by the Ohio Department of Natural Resources Division of Soil and Water Conservation document entitled *Rainwater and Land Development: Ohio's Standards for Storm Water Management, Land Development, and Urban Stream Protection* (ODNR 1996) or its most current revision.

Other criteria relevant to this plan consist of those industry standard practices that have proven effective at other waste disposal facilities. Inspection and monitoring requirements from the manufacturers and suppliers of material and equipment installed at the OSDF are also criteria relevant to this plan.

End of current text

3.0 Final Site Conditions

3.1 Site History

In July 1986, DOE and EPA signed a Federal Facilities Compliance Agreement (FFCA), addressing impacts to the environment associated with the federally operated site known as the Fernald Environmental Management Project. DOE agreed to conduct the FFCA investigation as a remedial investigation/feasibility study (RI/FS) in accordance with guidelines of CERCLA. In November 1989, the Fernald Site was included on the EPA National Priorities List (NPL). The FFCA was later amended by the June 1990 Consent Agreement between DOE and EPA, which was further modified by amendment in September 1991.

In accordance with the September 1991 Amended Consent Agreement, EPA approved and signed the OU2 ROD on June 8, 1995; the OU5 ROD on January 31, 1996; and similarly, the OU3 ROD for Final Remedial Action on September 24, 1996. The design of the OSDF, as currently developed, is presented in the *Final Design Criteria Package; On-site Disposal Facility* (GeoSyntec 1997). The Final Design Criteria Package includes the *Final Remedial Design Work Plan for Remedial Actions at OU2* (DOE 1995b), which presents the design approach for the OSDF. The Final Remedial Design Work Plan was submitted to EPA in August 1995 and subsequently approved in November 1995. The OEPA, which actively participated throughout the CERCLA response process, also concurred with the documentation and decisions to date.

The OSDF was constructed to permanently contain impacted materials derived from the remediation of the OUs at the Fernald Site. All material placed in the OSDF was required to meet OSDF WAC. The OU2 ROD established radiological WAC of 346 picocuries per gram (pCi/g) of uranium-238 or 1,030 milligrams per kilogram (mg/kg) total uranium for all soil and soil-like impacted material destined for the OSDF. Similarly, the OU5 ROD established additional radiological and chemical WAC for OU5 soils destined for the OSDF. The OU3 ROD established radiological WAC for debris materials destined for the OSDF of 105 grams technetium-99. These radiological/chemical WAC have been compiled and presented in Table 3–1. The impacted materials sent to the OSDF from OU3 may also have included small material contributions from OUs 1 and 4. Any material from these latter OUs destined for the OSDF met the OU3 WAC. In addition to the radiological/chemical WAC discussed above, the *Impacted Materials Placement Plan* (GeoSyntec 1996) presents physical WAC for the OSDF.

The volume of the impacted material that was destined for disposal in the OSDF was originally estimated at 2.9 million cubic yards (2.2 million cubic meters) bank/unbulked. Approximately 80 percent of this volume was expected to consist of impacted soil, with the remainder being building demolition rubble, fly ash, lime sludge, municipal solid waste, and small quantities of miscellaneous other materials. After soil and soil-like material, debris from demolition of buildings in the former production area is expected to constitute the largest volume of impacted material for OSDF disposal. The OU3 ROD indicates that impacted debris could be assigned to one of ten material categories. Only material from seven of these categories was to be disposed of in the OSDF. The seven material categories of impacted debris allowed for disposal in the OSDF are presented in Table 3–2, which also gives descriptions of the materials making up the categories.

Table 3–1. On-Site Disposal Facility Waste Acceptance Criteria

#	Constituent of Concern	Soil[a]		Debris[b]
		OU2	OU5[d]	OU3
	Radionuclides:			
1	Neptunium-237		3.12×10^{9} pCi/g	105 g
2	Strontium-90		5.67×10^{10} pCi/g	
3	Technetium-99		29.1 pCi/g	
4	Uranium-238	346 pCi/g		
	Total Uranium	1,030 mg/kg	1,030 mg/kg	
	Inorganics:			
5	Boron		1.04×10^{3} mg/kg	
6	Mercury[c]		5.66×10^{4} mg/kg	
	Organics:			
7	Bromodichloromethane		9.03×10^{-1} mg/kg	
8	Carbazole		7.27 × 104 mg/kg	
9	Alpha-chlordane		2.89 mg/kg	
10	Bis (2-chlorisopropyl) ether		2.44×10^{-2} mg/kg	
11	Chloroethane		3.92 × 105 mg/kg	
12	1,1-Dichloroethenec		11.4 mg/kg	
13	1,2-Dichloroethenec		11.4 mg/kg	
14	4-Nitroaniline		4.42×10^{-2} mg/kg	
15	Tetrachloroethenec		128 mg/kg	
16	Toxaphenec		1.06 × 105 mg/kg	
17	Trichloroethenec		128 mg/kg	
18	Vinyl chloridec		1.51 mg/kg	

[a]maximum concentration
[b]maximum total mass
[c]RCRA-based constituent of concern
[d]Constituents that have established maximums that serve as WACs; other compounds that will not exceed designated Great Miami Aquifer action levels within 1,000-year performance period, regardless of starting concentration in the OSDF, are not listed.
Sources:
OU2 ROD (DOE 1995a)
OU3 ROD (DOE 1996b)
OU5 ROD (DOE 1996a)

Table 3–2. OU3 Material Categories and Descriptions

Category A Accessible Metals	Category B Inaccessible Metals	Category D Painted Light Gauge Metals	Category E Concrete	Category G Non-regulated Asbestos-Containing Material	Category H Regulated Asbestos-Containing Material	Category I Miscellaneous Materials
Structural and miscellaneous steel	• Doors • Conduit/wire/cable tray • Electrical wiring and fixtures • Electrical transformers • Miscellaneous electrical items • HVAC equipment • Material handling equipment • Process equipment • Miscellaneous equipment • Piping	• Ductwork • Lead flashing • Louvers • Metal wall and roof panels	• Asphalt • Slabs • Columns • Beams • Foundations • Walls • Masonry • Clay piping	• Ceiling demolition • Feeder cable • Fire brick • Floor tile • Transite wall and roof panels	• Ductwork insulation • Piping insulation • Personal protective equipment • Copper scrap metal pile	• Polyvinyl chloride (PVC) conduit • Basin liners • Fabric • Drywall • Building insulation • Miscellaneous debris • Personal protective equipment • PVC piping • Roofing build-up • Process trailers • Non-process trailers • Windows • Wood

Source: Table 4–2, OU3 Material Categories/Description, OU3 ROD (DOE 1996b).
Note: Only those seven material categories allowed for on-site disposal per the OU3 ROD are presented.

3.2 Location and Description of the OSDF Area

A pre-design investigation was performed to define the most suitable location for the OSDF within an identified area at the Fernald Site, based on the OU2 and OU5 RI/FS. The results of that investigation are presented in the *Pre-design Investigation and Site Selection Report for the On-site Disposal Facility* (DOE 1995c). That report, its objectives, and its results are summarized below.

The identified best area is located on the east side of the Fernald Site property and measures approximately 2,000 feet (ft) east to west by 5,300 ft north to south. This location was considered the best location for an OSDF because it has the greatest thickness of gray clay, which provides a protective layer over the underlying Great Miami Aquifer. Fate and transport modeling and risk assessments in the OU2 and OU5 feasibility studies have shown that a disposal facility in this area, based on a feasible facility design and a 12-ft-thick gray clay layer, would be protective of human health and the environment. The identified best area is bounded on the north, east, and south using the OEPA siting requirements (buffer from property line and water supply wells). The western boundary incorporates areas with greater than 12 ft of gray clay, with the exception of the northern portion of the west boundary line, which was determined based on identification of sand lenses within the gray clay.

Based on planning meetings between DOE, EPA, and OEPA, the pre-design investigation had three objectives (identified in Table 3–3). Results of the pre-design investigation served as the basis for selecting the location within the identified best area for siting the OSDF. The selected location, measuring 800 ft east to west by 4,300 ft north to south, provided suitable space for the anticipated 2.5 million cubic yards of impacted materials and met applicable OEPA siting requirements. The gray clay thickness is greater than the minimum 12-ft thickness established in the OU2 ROD (DOE 1995a) for protection of the Great Miami Aquifer; the gray clay is actually greater than 15 ft thick within the selected location and approximately 75 percent of the selected location has a 20- to 50-ft thickness of gray clay. The investigation identified minimal amounts of interbedded granular material, none of which would offer a rapid migration pathway through the gray clay.

3.3 OSDF As-Built

The design approach for the OSDF is presented in the *Final Remedial Design Work Plan for Remedial Actions at Operable Unit 2* (DOE 1995b). The design approach of the OSDF, as currently developed, is presented in the *Final Design Criteria Package; On-site Disposal Facility* (GeoSyntec 1997). The design of the OSDF includes a liner system, impacted material placement, final cover system, leachate management system, surface water management system, and other ancillary features.

As-built conditions of the completed OSDF will be documented with a set of as-built record drawings (and possibly photographs). These drawings will be developed by DOE or its contractor, and will be used to prepare the topographic map discussed in the next paragraph. This information will illustrate baseline conditions for comparison to future conditions during the post-closure period. These drawings will be used to document changes in the physical site conditions of the OSDF over time and to develop a corrective action plan, if required. The drawings will be accessible at the site, either electronically or in hard copy.

Table 3–3. Pre-Design Investigation Objectives and Field Components

#	Objective	Field Components
1	Identify the most suitable hydrogeology within the identified best area	Verification of the gray clay thickness Identification of interbedded granular material
2	Verify protection of human health and the environment	Verification of existing vertical and horizontal uranium contamination Actual uranium solubility Uranium retardation Lateral and vertical gradients Background concentrations of uranium in water in the vadose zone
3	Develop field information for the design of the OSDF	Location and extent of interbedded granular material Obtain geotechnical information in the footprint of the OSDF

The final OSDF site map will be compiled from a final topographic map of the Fernald Site. The final topographical survey will be conducted in accordance with the standards of the *Manual of Photogrammetry* (ASPRS 1980). The following specifications will be used in developing the map, in accordance with the appropriate regulations (Ohio solid waste rules OAC 3745-27-06(B)(2) and 3745-27-11(H)(5)(a), and Ohio hazardous waste general new facility rule OAC 3745-54-18 and hazardous waste interim status facility rule OAC 3745-66-16):

- A scale of 1 inch = 200 ft (1 mm = 2.4 m).
- A contour interval of 5 ft (1.5 m).
- A coverage area of the OSDF site and a distance of 1,000 ft.
- North arrow displayed.

In addition to existing topography, the maps will define the following:

- Property lines of the land owned by DOE.
- Limits of impacted material placement.
- Outline of the toe and crest of the OSDF.
- The individual phases/cells of the OSDF.
- OSDF site property boundaries, fences, gates, and access roads.
- Location and extent of permanent storm water run-on and runoff control features.
- Vegetation, streams, lakes, springs, and other surface waters.
- Survey control stations/benchmarks.
- Permanent site surveillance features (e.g., monuments, markers, signs).

- Wetlands (if any) within the limits of impacted material placement and within 200 ft of the limits of impacted material placement.
- Limits of a regulatory floodplain (i.e., 100-year floodplain as depicted on a federal insurance administration flood map, as per OAC 3745-27-01 and 3745-54-18(B)).
- Site coordinate system.
- Existing residences, land uses, zoning classifications, property ownership, political subdivisions, and communities.
- Underground utilities (sewers, water lines, electric cables), field tiles, French drains, pipelines.
- Location (if any) within 200 ft of the limits of impacted material placement of any fault which has had displacement in Holocene time (OAC 3745-54-18(A)).
- All public and private water supply wells within 2000 ft of the limits of impacted material placement (using a scale insert if necessary), and the current status of each, including depth, use, and where applicable, abandonment date, based on publicly available information.

These as-built drawings will be submitted to EPA and OEPA. The map will be revised as part of the CERCLA 5-year review, if necessary. Note that DOE plans to update the information under the last bullet above regarding water supply wells only during the CERCLA 5-year reviews. When the OSDF map is updated, the revised map will include the year of revision, the revision number, and the type of the activity or event, which triggered the need for the revision.

All drawings, disposal facility site maps, and photographs will be archived. DOE is responsible for maintaining and archiving these maps, drawings, and photographs, as part of the OSDF permanent record.

3.4 OSDF Baseline Photographs

A photographic record of the final conditions after closure of the final cell of the OSDF will be included and maintained in the OSDF permanent site file. This record is anticipated to consist of a series of aerial and ground photographs that will provide a baseline visual record of final site construction and final site conditions to complement the as-built drawings. In particular, this set of aerial photographs will provide a permanent record of site conditions, enabling future inspectors to monitor changes in site conditions (e.g., erosion patterns, vegetation changes, land use) over time. The need for new aerial photographs will be evaluated at the CERCLA 5-year reviews. Table 3–4 summarizes the anticipated specifications for the aerial photographs.

Table 3–4. Aerial Photography Specifications

Area to be photographed	Final disposal site plus a minimum of 0.25 mi (0.4 km) beyond its boundaries unless site conditions require otherwise.
Products to be delivered	One set of vertical color, infrared stereo contact prints; glossy, double-weight, not trimmed; 9 inch × 9 inch (230 mm × 230 mm): Scale: 1 inch = 200 ft (1 mm = 2.4 m) (1:2,400) Index map showing flight lines and frame numbers: Scale: 1 inch = 1,000 ft (1:12,000) One set of natural color, low oblique photographs taken from a minimum of two different angles with 90-degree rotation. If 35mm or 70mm film used, glossy double-weight 8-inch × 10-inch enlargements; if 9-inch × 9-inch format used, glossy double-weight contact prints.
Flight date	To be determined; mid to late summer, at peak of photosynthetic response of vegetation, unless the flight is to be used exclusively for topographic mapping.
Camera	Vertical photos: Precision, 9-inch × 9-inch (230 mm × 230 mm) format. Oblique photos: A 35-millimeter (single lens reflex) or larger format camera is acceptable.
Film	Vertical photos: Eastman-Kodak Aerochrome Infrared 2443 or its equivalent. Oblique photos: Eastman-Kodak Aerocolor Negative Film 2445 or its equivalent.
Filter	Infrared (vertical) photos: Wratten No. 12 or No. 15. Color (oblique) photos: Skylight.
Flight line coverage	60 percent end overlap; 30 percent average side overlap.
Ground control	Control stations will be second order, Class 1, for horizontal control, and third order for vertical control (standard U.S. Geological Survey map accuracy specifications).

3.5 Site Inspection Photographs

Photographs will be taken during the quarterly site inspections to document conditions at the OSDF and its surrounding permanent features. These photographs will provide a continuous record for monitoring changing conditions over time. The photographs can be compared with the baseline photographs to monitor site integrity.

Each photograph will be recorded individually in a site-inspection photo log. An appropriate description of the feature photographed will be entered into the log. If possible, a photograph will include a reference point such as a survey monument, boundary monument, site marker, or monitoring well.

For specific areas where a photograph is used to monitor change over time, the distance from the feature and the azimuth should be recorded, and all subsequent photographs should be taken from the same orientation to provide an accurate picture of changing conditions. This information will be provided on the inspection checklist and in the photo log.

Copies of the site-inspection photographs and the photo log will be included in an annual site inspection report. All site-inspection photographs taken, as well as all corresponding photo log forms, will be maintained in the permanent OSDF file.

The following site features should be documented with photographs every scheduled inspection of the OSDF site:

- Permanent site surveillance features.
- Fences, gates, warning signs, access roads, perimeter roads, paths, toe, and drainages.
- The OSDF (top, sides, buffer area, surrounding area) panoramic sequences of photographs from selected vantage points may be used for this purpose.
- Any evidence of erosion (e.g., gullies, rivulets, rills) that the inspector considers significant and documents in the inspection notes.
- Any evidence of burrowing animals.
- Any off-OSDF features that may affect the OSDF in the future and that the inspector considers significant and documents in the inspection notes.
- General vegetation (OSDF topslope, sideslope, and buffer area), presence of woody vegetation, and/or invasive plant species.
- OSDF topslope and sideslope.
- Any evidence of ponded water.
- Erosion protection material (rip-rap).
- Evidence of leachate seeps.
- Survey control points for local coordinate system.
- Damaged monitoring wells.

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

4.0 Institutional Controls and Points of Contact

4.1 Introduction

As indicated in Sections 1.1 and 1.2 of the Institutional Controls Plan (IC Plan), this section, Section 4.0, discusses the institutional controls that will be in place for the OSDF and its buffer area during the post-closure care period (legacy management). The IC Plan is the enforceable governing document for institutional controls for the Fernald Preserve, and the PCCIP provides supporting details for the OSDF. Table 4–1 presents a compilation of the institutional controls for the OSDF and its buffer area, as identified in the OU2 and OU5 RODs. Environmental monitoring (item 5), inclusive of groundwater monitoring (item 4), is discussed in Section 5.0 of this PCCIP. This PCCIP, in general, addresses the maintenance program (item 6).

Table 4–1. Institutional Controls as Key Components in the RODs

#	Component	OU2 ROD	OU5 ROD
Institutional Controls			
1	Ownership	The selected remedy will include the following as institutional controls: "continued federal ownership of the [OSDF] site" [2a]	"Institutional controls, such as . . ." [5a] "property ownership will be maintained by the federal government of the area comprising the [on-site] disposal facility and associated buffer areas" [5b]
2	Access Controls/ Restrictions	"access restrictions (fencing)" [2a]	"access controls" [5a]
3	Deed Notations/ Use Restrictions	"restrictions on the use of property will be noted on the property deed before the property could be sold or transferred to another party" [2c]	"deed restrictions" [5a] ; "if portions of the Fernald property [outside the disposal facility area] are transferred or sold at any future time, restrictions will be provided in the deed, and proper notifications will be provided as required" [5b]
4	Groundwater Monitoring Program	"groundwater monitoring" [2a] . . . "following closure of the on-site disposal facility" [2b]	See entry 5 below, but not identified as an institutional control
Other Key Components of the Selected Remedy			
5	Environmental Monitoring program	See entry 4 above.	"long-term environmental monitoring program" [5a]
6	Maintenance Program	"maintenance of the on-site disposal facility" [2b]	"maintenance program to ensure the continued protectiveness of the remedy" [5a]

[2a] Declaration, Description of the Selected Remedy, p. D-2, OU2 ROD (DOE 1995a).
[2b] Decision Summary, Section 9.1 Key Components, p. 9-2, OU2 ROD (DOE 1995a).
[2c] Responsiveness Summary, Section 3.0 Summary of Issues and Responses, Issue 7 C Future Use/Ownership, p. RS-3-33, OU2 ROD (DOE 1995a).
[5a] Declaration Statement, Description of the Selected Remedy, p. D-ii, OU5 ROD (DOE 1996a).
[5b] Decision Summary, Section 9.1 Key Components, p. 9-18, OU5 ROD (DOE 1996a).

The remainder of Section 4.0 discusses the remaining items (1, 2, and 3).

4.2 Points of Contact

Points of contact by either the name or position title, address, and telephone number of the person or office to contact about the OSDF during the post-closure care period are provided in

Table 4-2, in accordance with appropriate regulations (Ohio solid waste rule OAC 3745-27-11(B)(3) in lieu of federal solid waste regulation 40 CFR §258.61(c)(2), and Ohio hazardous waste rules OAC 3745-66-18(C)(3) and 3745-68-10 in lieu of federal hazardous waste regulations 40 CFR §§265.118(c)(3) and 264.118(b)(3), respectively). Table 4-2 presents the on-site points of contact and an emergency contact number that is accessible 24 hours a day. These points of contact will serve to ensure that access to the facility will be possible for appropriate authorized personnel after closure and in the case of an emergency. An updated copy of this plan will be maintained at each of the locations identified in Table 4–2.

Table 4–2. Points of Contact

	Title of Contact	Telephone	Mailing Address
1	DOE-LM	513-648-3148	10995 Hamilton-Cleves Highway Harrison, Ohio 45030-9728
2	S.M. Stoller	513-648-5294	10995 Hamilton-Cleves Highway Harrison, Ohio 45030-9728
3	DOE Grand Junction 24-hour number	877-695-5322	N/A

Due to the duration of the post-closure period, DOE anticipates that the points of contact are likely to change over time. DOE will notify the regulatory agencies of any changes to the points of contact via modification to this PCCIP.

4.3 Ownership

As presented in item 1 of Table 4–1, property ownership of the area comprising the OSDF and its associated buffer areas will be maintained by the federal government (e.g., DOE or a successor federal agency).

4.4 Access Controls/Restrictions and Security Measures

As long as the federal government maintains property ownership, access to the OSDF will be restricted by means of fences, gates, and warning signs. Access to those areas within the fencing will be controlled by DOE authorization and will be limited to personnel for inspection, custodial maintenance, corrective actions, or other DOE authorized activity. The fences, gates, and warning signs are covered by the inspection and custodial maintenance components of the post-closure care program implemented under this PCCIP (refer to Sections 7.0 and 9.0) and the IC Plan.

To provide additional security, a warning sign with the following information will be placed on the access gates to the OSDF:

- The name of the site.
- The international symbol indicating the presence of radioactive material.
- A notice that trespassing is forbidden on this U.S. Government-owned site.

- A local DOE telephone number and a 24-hour DOE emergency telephone number; this same 24-hour telephone number will be recorded in agreements with local agencies to notify DOE in the event of an emergency or breach of site security or integrity.
- In addition to the entrance signs, all-weather resistant signs are mounted on the chain-link fence surrounding the OSDF at approximately equal spacing. The signs have the international symbol indicating the presence of radioactive material and state the following:

CAUTION,
Underground Radioactive Material,
Contact Site Manager Prior to Entry
513-910-6107

The effectiveness of site security measures (e.g., fence condition, locked gate) will be monitored through routine scheduled site inspections (refer to Section 6.0).

4.5 Deed Notations and Use Restrictions

If management of the OSDF is transferred from DOE to another federal entity, real estate restrictions will be included in the deed, and proper notifications will be provided as required by the appropriate rules and regulations. A preliminary draft of such notice in deed is provided below in Table 4–3, along with information extracted from the appropriate rules and regulations presented side by side to facilitate understanding of development of that notice. Note that specifics and the exact language appropriate to the specific parcels of property will need to be developed and inserted at the time of such recording of deed notice.

In such an event, signed certification that the notation in the deed has been recorded will be submitted to the EPA regional administrator and the Ohio director of environmental protection in accordance with appropriate regulations (Ohio solid waste rule OAC 3745-27-11(H)(5) in lieu of federal solid waste regulation 40 CFR §258.60(I), and Ohio hazardous waste rules OAC 3745-66-19(B) and 3745-68-10 in lieu of federal hazardous waste regulations 40 CFR §§265.119(b)(1) and 264.119(b)(1)), accompanied by a copy of the document in which the notation has been placed.

Table 4–3. Notice in Deed or Other Transfer Instrument

Ohio Solid Waste Rules	Ohio Hazardous Waste Rules	CERCLA	Fernald Preserve
OAC 3745-27-11(H)(5) The owner is required to submit – to the local zoning authority, or the authority with jurisdiction over local land use, and to the board of health having jurisdiction, and to the Ohio Director of Environmental Protection – a survey plat showing the units(s) of the sanitary landfill facility and information describing the acreage, exact location, depth, volume, and nature of the solid waste deposited in the units(s) of the sanitary landfill facility.	OAC 3745-66-16 and 19 and 3745-68-10(B) The owner is required to submit – to the local zoning authority, or the authority with jurisdiction over local land use, and to the Ohio Director of Environmental Protection – a survey plat, prepared and certified by a professional land surveyor, indicating the location and dimensions of landfill cells or other hazardous waste disposal units with respect to permanently surveyed.	CERCLA §120(h) Whenever any agency, department, or instrumentality of the United States enters into any contract for the sale or other transfer (e.g., lease) of real property owned by the United States and on which any hazardous substance was stored for one year or more, known to have been released, or disposed of, that agency, department or instrumentality shall include in such contract or instrument – to the extent such information is available on the basis of a complete search of agency files – (i) notice of the type and quantity of such hazardous substances, (ii) notice of the time at which such storage, release, or disposal took place, and (iii) a description of the remedial action taken, if any.	
The owner is required to record a notation on the deed to the sanitary landfill property, or on some other instrument, which is normally examined during title search, that will notify in perpetuity any potential purchaser that the land has been used as a sanitary landfill facility. The notation shall include information as described above regarding the requirement for filing the survey plat.	The owner is required to record a notation on the deed to the facility property, or on some other instrument which is normally examined during title search, that will notify in perpetuity the potential purchasers that: (a) the land has been used to manage hazardous wastes; (b) its use is restricted under OAC closure and post-closure rules; and (c) the survey plat and record of the type, location, and quantity of hazardous wastes disposed of within each cell or hazardous waste disposal unit of the facility has been filed as per above.		

Table 4–3. Notice in Deed or Other Transfer Instrument (continued)

Notice in Deed	Sample Notice in Deed	Notice in Transfer Instrument	Sample Notice in Transfer Instrument
	To Whom It May Concern: I, (owner or operator), the undersigned, or (street address), City of city), County of county), State of (state), hereby give the following notice, as required by Ohio Administrative Code hazardous waste rules 3745-66-19(A) and (B) and 3745-68-10(B) – in lieu of 40 CFR §§265.119(b)(1) and 264.119(b)(1), respectively.		To Whom It May Concern: I, (owner or operator), the undersigned, or (street address), City of city); County of county), State of (state), hereby give the following notice, as required by Ohio Administrative Code solid waste rule 3745-27-11(H)(5), and as required by Ohio Administrative Code hazardous waste rules 3745-66-19(B) and 3745-68-10(B) – in lieu of 40 CFR §§264.119(b)(1) and 265.119(b)(1), respectively – and as required by CERCLA §120(h).
	1. I am, and since month, day, year), have been in possession of the following described lands legal description).		1. I am, and since month, day, year), have been in possession of the following described lands legal description).
	2. Since (month, day, year), I have disposed of hazardous chemical wastes on/in the land described above under the terms of the Ohio Administrative Code rules, and regulations promulgated by the EPA.		2. Between (month, year) and (month, year), remedial actions have been conducted on the property which have disposed of materials consisting primarily of soils and building debris containing asbestos containing materials, chemical hazardous substances and radiological hazardous substances, under the terms of regulations promulgated by the EPA on/in the above described land.
	3. The future use of the land described above is restricted under the terms of Ohio Administrative Code hazardous waste rules 3745-66-17(C) and 3745-68-10 – in lieu of 40 CFR §§265.117 (c) and 264.117(c); the post-closure use of the identified property must never be allowed to disturb the integrity of either the containment system or the facility's monitoring system, unless the EPA Regional Administrator or the Ohio Director of Environmental Protection determines that the proposed use: • Will not increase the potential threat to human health or the environment, or • Is necessary to reduce the threat to human health or the environment.		3. The future use of the land described above used for disposal is restricted under the terms of Ohio Administrative Code hazardous waste rules 3745-66-17(C) and 3745-68-10 – in lieu of federal hazardous waste regulations 40 CFR §§265.117(c) and 264.117(c). The post-closure use of such property must never be allowed to disturb the integrity of either the on-site disposal facility's containment system or monitoring system, unless the EPA Regional Administrator and/or the Ohio Director of Environmental Protection determines that the proposed use: • Will not increase the potential threat to human health or the environment, or • Is necessary to reduce the threat to human health or the environment.

Table 4–3. Notice in Deed or Other Transfer Instrument (continued)

Notice in Deed	Sample Notice in Deed	Notice in Transfer Instrument	Sample Notice in Transfer Instrument
	4. Any and all future users of the land shall inform themselves of the requirements of the regulations and ascertain the amount and nature of wastes disposed of on/in the property described above.		4. Any and all future users of the land shall inform themselves of the regulations and ascertain the amount and nature of remediation wastes/impacted materials disposed of on/in the property described above.
File a survey plat with each of the following, showing the unit(s) of the sanitary landfill facility and information describing the acreage, exact location, depth, volume, and nature of the solid waste deposited in the unit(s) of the sanitary landfill facility: • Name and address of local zoning authority, or authority with jurisdiction over local land use	5. I have filed a survey plat with each of the following, showing the location and dimensions of the disposal facility and its individual units, and a record of the type, location and quantity of waste material disposed within each unit of the disposal facility: • Name and address of local zoning authority, or authority with jurisdiction over local land use • Regional Administrator of EPA Region 5		5. I have filed a survey plat with each of the following, showing the location and dimensions of the on-site disposal facility and its individual sells/phases, and a record of the type location and quantity of remediation waste/impacted material disposed within the on-site disposal facility: • Butler county Recorder's Office 130 High Street Hamilton, Ohio 45001 (513) 887-3409 • Hamilton County Recorder's Office ATTN: Registered Land Recordings 138 E. Court Street, Cincinnati, Ohio 45202 (513) 632-8336) • Butler County Health Department ATTN: Environmental 202 S. Monument Street Hamilton, Ohio 45001 (513) 887-5228) • Hamilton County Environmental Health Division 11499 Chester Road, Suit 1500 Sharonville, Ohio (513) 326-4500) • Ohio Department of Health Chief, Bureau of Radiological Protection 246 N. High St. Columbus, Ohio 43266-0149 (614) 644-2727 • EPA Region Administrator 77 W. Jackson Blvd. Chicago, IL 60604-3590

Table 4–3. Notice in Deed or O[illegible]ransfer Instrument (continued)

Notice in Deed	Sample Notice in Deed	Notice in Transfer Instrument	Sample Notice in Transfer Instrument
• Ohio Director of Environmental Protection	• Ohio Director of Environmental Protection		• Ohio Director of Environmental Protection 1800 Watermark Drive P.O. Box 1049 Columbus, Ohio 43266-0149
		• A covenant warranting that: • All remedial action necessary to protect the human health and the environment with respect to any such hazardous substances remaining on the property has been taken before the date of such transfer, and • Any additional remedial action found to be necessary after the date of such transfer shall be conducted by the United States.	• A covenant warranting that: • All remedial action necessary to protect the human health and the environment with respect to any such hazardous substances remaining on the property has been taken before the date of such transfer, and • Any additional remedial action found to be necessary after the date of such transfer shall be conducted by the United States.

End of current text

5.0 Environmental Monitoring

5.1 Introduction

The primary element of environmental monitoring associated with the OSDF post-closure care period is groundwater monitoring. This section describes the focus and scope of the plans for the groundwater monitoring that is continuing for the OSDF.

5.2 Groundwater Monitoring

Groundwater monitoring for the OSDF is currently presented in the OSDF Groundwater/Leak Detection and Leachate Monitoring Plan (DOE 2006a) (Attachment C to the LMICP). The focus of that plan is the leak detection monitoring program for the OSDF, addressing monitoring both within the OSDF (in the LCS and LDS) and the underlying groundwater (in the till layer immediately underneath the OSDF and the groundwater in the Great Miami Aquifer). Although the temporal coverage of that plan began in part prior to the placement of impacted material/remediation waste into the OSDF, its coverage continues during the legacy management of the site. The OSDF Groundwater/Leak Detection and Leachate Monitoring Plan will be revised over time to better define the monitoring strategy and its individual components; any such revisions will be completed in a consultative manner between DOE, EPA, and OEPA.

If a leak is detected from the OSDF, DOE will consult with EPA and OEPA in accordance with the requirements established in the OSDF Groundwater/Leak Detection and Leachate Monitoring Plan (GWLMP) for notifications and response actions.

5.3 Monitoring of Other Media

All environmental monitoring is covered by both the GWLMP and the IEMP. Monitoring under the IEMP indicates the additional media to be monitored (e.g., surface water, sediment) and includes sampling specifics (i.e., frequencies and constituents).

End of current text

6.0 Routine Scheduled Inspections

6.1 Introduction

This section establishes inspection techniques and frequency as required by the appropriate regulations (Ohio hazardous waste rules OAC 3745-66-18(A) and (C) in lieu of federal hazardous waste regulations 40 CFR §§ 264.118(b)(2) and 265.118(c)(2)). Components covered by these inspections are:

- Security system (e.g., fences, gates, locks, warning signs).
- Final cover system.
- Run-on and runoff control systems.
- Surveyed benchmarks—at least three third-order benchmarks on separate sides of the OSDF within easy access to the limits of waste/impacted materials placement (Ohio solid waste rule OAC 3745-27-08(C)(7)(a)-(c), and Ohio hazardous waste rule OAC 3745-68-10(D)(4) in lieu of federal hazardous waste regulation 40 CFR §265.310(b)(6)).

6.2 Routine Facility Inspections

Discussed in this section are those background details and preliminary considerations necessary to conduct routine scheduled site inspections, including the inspection team, frequency and timing of inspections, and inspection aids. Also discussed are the procedures for routine scheduled site inspections.

6.2.1 Preliminary Considerations

6.2.1.1 Frequency and Timing of Inspections

Routine scheduled inspections were conducted quarterly at the OSDF until the closure of the Fernald Closure Project. The objective of these inspections was to establish and record physical modifications to the OSDF through many seasonal cycles and to provide a basis for decisions regarding future inspections. Inspections will be conducted on a quarterly basis for 2 years following completion of cells 7 and 8. After the 2-year period, the frequency will be reevaluated. The frequency may also be re-evaluated through the CERCLA 5-year review process. Based on review of the inspection and maintenance reports and records for the OSDF, DOE may specify a new routine scheduled inspection frequency, which will be approved by EPA and concurred on by OEPA.

Timing of these routine scheduled inspections, as determined by DOE, will take into consideration such factors as:

- Inability to reach the site due to snow cover, runoff, or impassible roads.
- Inability to inspect due to snow cover.
- Climatic cycles most likely to adversely impact the site such as periods of heavy precipitation, runoff, or wind.
- Need to acquire data to confirm aerial photography data or reports from local officials or concerned citizens.

Should the inspectors find weather conditions at the site not conducive to making a complete and thorough inspection, they will use the opportunity to observe and record changes to cover, diversion channels, and other site features. The remainder of the inspection tasks will then be rescheduled to a more favorable day.

6.2.1.2 Inspection Team

The inspection team for routine scheduled inspections will consist of a chief inspector and one or more assistants. The minimum number on a team is two; more can be assigned depending on the conditions expected at the site at the time of inspection. If only two inspectors are assigned, one will be a geotechnical or civil engineer, and the second will be an ecologist. Prior to each inspection, DOE or its contractor will determine the size of the inspection team. EPA and OEPA will be notified of the scheduled dates and times of these routine inspections so they may send representatives to accompany the inspection team.

The chief inspector will have a degree in civil engineering or soil mechanics, and at least 5 years of experience (or an equivalent amount of experience and education) in projects involving the planning and implementation of earthen structure designs. Where possible, the chief inspector will have made at least one site inspection as an assistant inspector. Assistant inspectors will have degrees and experience complementing the chief inspector, as appropriate, for the expected site conditions. Assistants will have a minimum of 3 years experience (or an equivalent amount of experience/education) in their field. Prior to each inspection, DOE or its contractor will designate the chief inspector and assistants.

6.2.1.3 Familiarization with Site Characteristics

The site inspection team will become familiar with the OSDF site by reviewing this PCCIP, and the most recent previous inspection report.

6.2.1.4 Preparations for Conducting Site Inspections

After site familiarization, preparations must be made to conduct the field inspection. This requires the inspection team to:

- Obtain approval to enter adjacent property (if required).
- Assemble the equipment needed to conduct the inspection. Equipment may include such items as cameras and film, binoculars, tape measure, optical ranging devices, Brunton compass, photo scale stick, erasable board, additional signs, etc.

6.2.2 Site Inspection

The primary objective of the routine scheduled site inspection is to identify potential problems at an early stage prior to the need for significant maintenance or repairs. The inspection team will be guided by a knowledge and understanding of the processes that could adversely change the disposal facility. A fundamental part of the inspection will be the detection of change, and particularly the progressive change, over a number of years due to slow processes. The inspection checklist (refer to Appendix D of the LMICP) includes the following:

- Security of fences, gates, and locks, as well as the condition of applicable warning signs.
- General health and density of the vegetative cover.
- Presence of any deep rooted, woody species.
- Evidence of burrowing by animals on the cover.
- Presence, depth, and extent of erosion or surface cracking, indicating possible cap deterioration.
- Visibly noticeable subsidence, either localized or over a large area, especially that will allow for the ponding of water.
- Presence and extent of any leachate seeps.
- Integrity of run-on and runoff control features.
- Integrity of benchmarks.
- Integrity of monitoring wells.

6.2.3 Field Procedures

6.2.3.1 Adjacent Off-Site Features

A reconnaissance of the adjacent area within approximately 0.25 miles of the Fernald Preserve property line will be conducted as part of the OSDF inspection. Any evidence of a change in land use will be described. In general, any increase of human activity in the vicinity increases the probability of either inadvertent or purposeful intrusion into the site.

Evaluation will be made of whether the natural drainage courses in the immediate vicinity of the OSDF pose any threat to the continued integrity of the OSDF. An observation from a prominent topographic feature will be made first, looking for indications of high water levels, areas of active erosion and sedimentation, and potential changes in channel position.

Reaches of adjacent natural drainage courses will then be walked for approximately 1,000 ft, and notes will be made of unusual or changed sediment deposits, large debris accumulations, manmade or natural constrictions, and recent or potential channel changes. Any such features will be documented with photographs, which will include recognizable landmarks and known objects for scale.

Similarly, any gullies, or locations that appear to be favorable to the development of gullies, will be examined. The portion of the head of the gully will be the most important observation, but the shape of the cross section will give an indication of the degree of the activity, and any interruption in the longitudinal profile may suggest rejuvenation or the presence of a local base level.

6.2.3.2 Access Roads, Fences, Gates, and Signs

The OSDF area will be accessible via automobile. The condition of the on-property roads will be described, and if the need for maintenance is indicated, the location and type of work will be recommended. Roads and associated grading are frequently points of gully initiation, and near the OSDF particular care will be taken in looking for evidence of recent erosion associated with the roads.

A walking traverse of the fence will be made to inspect the condition of fencing, gates, locks, and signs. Evidence of deterioration, damage, or vandalism will be noted. Any breaks in the OSDF perimeter fence, or conditions which might lead to a break, will be described. Signs will be evaluated for legibility, proper location, and information. If human intrusion is indicated, an effort will be made to determine whether it was inadvertent or purposeful, and whether it poses any threat to the integrity of the OSDF. Missing, badly damaged, or defaced signs will be replaced in a timely manner.

6.2.3.3 Monuments

Each survey monument and cell boundary marker will be examined for evidence of disturbance. If any have been disturbed, a recommendation for their reestablishment and possible protective action will be made.

6.2.3.4 Crest

The crest of the OSDF is an obvious vantage point from which to examine the site and surrounding area. Observations, with the aid of binoculars, will be made in all directions from the crest of any features which are anomalous or unexpected, and which may require further inspection. These will be recorded on the checklist and on the overlay. Examples of such features that might be observed include changes in soil color, distressed vegetation patterns, trails, and patterns of erosion.

A walk around the edge and diagonal transects of the crest will be made. Additional transects, at approximately 50-yard intervals, will be walked along the sideslopes. A search will be made for evidence of differential settling, subsidence, and cracks, if any. The patterns of cracks and evidence of subsidence will be described in an overlay and photographed. The depth and width of the cracks will be measured; notes will be made of any points at which the cracks extend below the outer erosion barrier.

Erosion of the crest is not expected to be a problem because of the low slopes. However, differential settling or sliding along the slopes may cause flow concentrations that may disturb that protection, and thus irregularities will be examined for early evidence of erosion. Evidence of wind erosion, including the presence of ripple marks, partially exhumed vegetation, the presence of pedestal rocks, or obvious lag gravels, will be noted. The OSDF will be vegetated as part of the closure activities; therefore, careful examination will be made to determine areas of distressed or sparse vegetation, or the presence of deep-rooted, woody species.

6.2.3.5 Slopes

Changes to the OSDF are most likely to occur in the lower portions of the slopes. Therefore, an examination at the toe of the slope will be a key part of the inspection. A traverse at the toe of the slope will be made, and one additional traverse (or more, depending on findings) on the upper slopes will be made.

Settlement or sliding, although highly unlikely, will be apparent by the presence of bulges and depressions, cracks, and scarps. If any such features are observed, the extent of the area affected, whether the area is stable or likely to continue moving, and the nature of the movement that is occurring (settlement, planar, or rotational sliding) will be determined. Evidence of related erosion will be noted. Photographs showing detail and area perspective will be taken of any such features observed.

General health of grass cover and signs of stressed or dead grass will be noted. Grass density and coverage will be inspected. Any areas with sparse vegetation or no vegetation will be mapped and described. The presence of any woody vegetation or noxious/invasive plants will be noted.

During these inspections, the slopes will be examined for evidence of animal intrusion, burrowing, changes in vegetation, and human activity. Regularly used trails (human or animal) can concentrate runoff and encourage erosion; any such trails observed will be mapped and described. Any signs of small animal trails or burrows will be noted, and an effort will be made to tentatively identify the species. If animal burrows have been observed during previous inspections, the burrow sites will be examined for indications of current activity.

Erosion of vegetated slopes will first be apparent by the development of rills and rivulets, which extend only part way up the slope. If they are present, their spacing, length, depth, and width will be measured and noted. Particular attention will be placed on evidence of integration of the drainage and development of a master channel. Such a development can, in a short time, evolve into a gully.

Evidence of removal of the cover, extensive vandalism to signs and monuments, or the presence of well-established trails will be described in detail.

6.2.3.6 Periphery

The area adjacent to the OSDF will be examined during the traverse at the toe of the slope. Features to be looked for and described, if present, include erosion channels, accumulations of sediment, evidence of seepage, and signs of animal or human intrusion.

6.2.3.7 Diversion Channels

Each diversion channel will be walked its entire on-property length to determine whether the channels have been functioning, and can be expected to continue as designed. The channels and sideslopes will be examined for evidence of erosion or sedimentation, slides or incipient erosion channels, debris, or growing vegetation. The sideslopes of the diversion channels also will be examined for evidence of piping or burrowing by animals, which could lead to sloughing of material into the channel.

The portion of the channel that has riprap (or a concrete spillway), the soil or rock material adjacent to the structure, will be examined carefully for evidence of unstable conditions such as piping or destructive currents. The riprap (or concrete) will be examined for evidence of deterioration caused by weathering or erosion. At those portions of the channel slopes that are rock, plant colonization will be slow to develop but will gradually occur. The inspection procedure is expected to record this gradual colonization by noting the extent of vegetation, its location, and its cover density.

End of current text

7.0 Unscheduled Inspections

7.1 Introduction

An unscheduled inspection may be triggered by reports or information that the OSDF site integrity has been or may be compromised. The two types of unscheduled inspections anticipated (follow-up inspections and contingency inspections) are discussed in the following subsections.

7.2 Follow-up Inspections

Follow-up inspections investigate and quantify specific problems encountered during a routine scheduled inspection, special study, or other DOE or other regulatory agency activity. They determine whether processes currently active at or near the site threaten site security or stability, and they evaluate the need for custodial maintenance, repairs, or corrective action. They will also be conducted to evaluate the effectiveness of corrective measures and contingency repairs that have been implemented. Some of the situations that may require a follow-up inspection include:

- Unforeseen subsidence of the OSDF slopes or its foundation.
- Gullying which has cut through or is threatening to cut through the outer cover.
- Slides on the slopes of the OSDF.
- Seepage.
- Change in the position of an adjacent stream channel.
- Indications of rapid headward cutting of a nearby gully.
- Cracks which extend deeply (greater than 6 inches) into the slopes.
- Presence of animal burrows on the OSDF or in its diversion channels.
- Invasion of trees or shrubs onto the vegetative cover of the OSDF.
- Removal of some of the material from the OSDF cover.
- Corrective measures or contingency repair has been implemented.

Follow-up inspections should be made by technical specialists in a discipline appropriate to the problem that has been recognized. That is, if erosion is a problem, the inspectors will be individuals knowledgeable in evaluating erosion, presumably a soils scientist or geomorphologist; if settlement or sliding is the problem, a geotechnical engineer; if changes in an adjacent stream, a hydrologist; if plant invasion, a botanist; and the like.

The follow-up inspection begins with an on-site visit to determine the need for definitive tests or studies. Additional visits may be scheduled if more data are needed to draw conclusions and recommend corrective action. If repair or corrective action is warranted, DOE will notify EPA, OEPA, appropriate local officials, and other appropriate local stakeholders.

7.2.1 Objectives and Procedures

These investigations include all additional investigations or studies necessary to evaluate the continued effectiveness of the OSDF for containment of the impacted materials therein. The procedures used will be those required in the judgment of DOE and will depend upon the nature and severity of the problem. Representative and appropriate responses for several possible problems are listed in Table 7–1.

Table 7–1. Possible Problem Situations and Responses

Situation	Representative Response
Gullying on slopes	Measurement or mapping not done as part of routine scheduled inspection will be done. The primary objective is to determine the factors which led to the initiation of the gully. This might involve evaluation of the erosion barrier design parameters or site drainage, and the role of sheet erosion, rill formation, slides, or burrows. The product will be a recommendation for maintenance and preventative measures, if required.
Headward gully erosion	Procedures to determine the rate of headcutting will be established and implemented. A line of reference stakes (capped rebar) upstream from the gully head is a simple and effective method of measuring change in the position of the gully; comparison of periodic aerial photographs might also be useful. An understanding of why dissection is occurring and any limiting conditions will be sought. The product will be a recommendation for maintenance and preventative measures, if required.
Invasive vegetation	Species identification and abundance determination will be conducted if/when large trees or shrubs invade the vegetative cover of the OSDF. If deep-rooted species are present, analysis of plant material for radionuclides and heavy metals might be done. An eradication program might be recommended; if so, cover repair would also be undertaken.
Creep	The occurrence of creep can be determined by setting rows of stakes parallel to contours on the sideslopes, which will gradually tilt downslope if creep is occurring. The rate of creep can best be determined by marking a number of rock fragments on the slopes, and accurately determining their location in relation to additionally emplaced survey monuments over a number of years.
Landslides	Upon evidence of a slide or debris flow, an additional investigation will be made. The area and volume affected, the type of movement, and causal factors will be determined. Drilling, hand augering, or excavation might be necessary. The product will be a recommendation for what remedial and preventive maintenance are required.

7.2.2 Schedule and Reporting

Once a routine scheduled inspection has identified a concern, DOE will notify EPA and OEPA and begin a follow-up inspection by submitting a preliminary assessment of the concern and a plan for follow-up inspection. Upon review by EPA and OEPA, DOE will implement the inspection plan. Once the follow-up inspection is completed, DOE will recommend maintenance or other appropriate action to be performed, as needed.

7.3 Contingency Inspections

Contingency inspections are unscheduled situation-unique inspections ordered by DOE when it receives information indicating that site integrity has been or may be threatened. Events that could trigger contingency inspections include severe vandalism, intrusion by humans or livestock, severe rainstorms, or unusual events of nature such as tornadoes or earthquakes. Events that have caused severe damage to the OSDF or that pose an immediate threat to human health and the environment will be immediately reported to EPA and OEPA.

A preliminary inspection/assessment report of each contingency inspection triggered by such an unusual event will be submitted to EPA and OEPA within 60 days of the initial report that damage or disruption has occurred at the OSDF site. At a minimum, this report will include:

- Problem/event description.
- Preliminary assessment of the custodial maintenance or repair or corrective action required.
- Conclusions and recommendations.
- Assessment data, including field and inspection data and photographs.
- Names and qualifications of the field inspectors.

A copy of the report and all other data and documentation from such a contingency inspection will be maintained in the permanent site file and will be submitted to EPA and OEPA.

After EPA and OEPA have reviewed the preliminary inspection/assessment report, DOE will submit a corrective action plan (for those events requiring corrective action) for EPA review and approval in accordance with a schedule to be determined on a case-by-case basis via consultation between DOE, EPA, and OEPA. Based on the findings of these reports, DOE will implement the corrective action.

End of current text

8.0 Custodial Maintenance and Contingency Repair

8.1 Introduction

This section explains the procedures to be used by DOE to determine when maintenance or contingency repairs are needed at the OSDF. In general, the decision to conduct maintenance or contingency repair will be based on the results of follow-up site inspections or contingency site inspections (refer to Section 7.0 for both), which assess problems at the site.

This section will establish maintenance activities and their frequency, fulfilling the requirements to do so established in the appropriate regulations (Ohio hazardous waste rules OAC 3745-66-18(A) and (C) in lieu of federal hazardous waste regulations 40 CFR §§265.118(c)(2) and 264.118(b)(2)). The following subsections address custodial maintenance of the security system (e.g., fencing, gates, signage) and the impacted materials containment system as summarized below.

8.1.1 Security System

Custodial maintenance of the security system may require the repair and replacement of sections of fences, gates, locks, and signs due to normal wear, severe weather conditions, or vandalism.

8.1.2 Impacted Materials Containment System

Custodial maintenance of the Impacted Materials Containment System will require:

- Maintaining the integrity and effectiveness of the final cover, including making repairs to the cap/cover as necessary to correct the effects of settling, dead vegetation, subsidence, erosion, leachate outbreaks, or other events (Ohio solid waste rule OAC 3745-27-14(A), and Ohio hazardous waste landfill rule OAC 3745-68-10 in lieu of federal hazardous waste regulation 40 CFR §265.310).
- Mowing.
- Seeding and mulching repaired areas or areas that are lacking required vegetative cover.
- Maintaining surface water run-on and runoff drainage features to prevent erosion of, or other damage to, the final cover (Ohio solid waste rule OAC 3745-27-14(A), and Ohio hazardous waste landfill rule OAC 3745-68-10 in lieu of federal hazardous waste regulation 40 CFR 265.310).
- Controlling burrowing animals.

8.2 Conditions Requiring Maintenance or Repair Actions

Inspection reports and monitoring results will be reviewed, and site conditions will be compared from inspection to inspection so that trends of changing conditions can be determined. Identifiable trends will provide a means for predicting when maintenance or repairs will be needed. DOE, in conjunction with EPA and OEPA, will decide whether or not to initiate custodial maintenance or contingency repair. After the decision to initiate maintenance or a contingency repair, a statement of work will be prepared for the work to be performed. The maintenance or repair action required to correct a site problem will be dependent upon the nature of the problem. Although the details of maintenance or repair actions that may be needed throughout the post-closure care period cannot be reliably predicted in advance, examples of conditions that may require custodial maintenance or that may trigger contingency repairs are outlined in Table 8–1, along with the appropriate actions.

When compared with contingency repairs, custodial maintenance is expected to be generally less costly, smaller in scale, and more frequent in occurrence. In contrast, contingency repairs are very unlikely to be needed; however, repair costs may be more substantial due to the size of the workforce and the technical skills required for repairs.

8.3 Maintenance and Repair

The following subsections discuss custodial maintenance for the security system, the cap and final cover, and the run-on and runoff drainage features.

8.3.1 Security System

The security system established for the OSDF includes fencing, gates, locks, and warning signs. The routine custodial maintenance and repairing of the security systems include conducting visual inspections and repairing or replacing affected components. Possible problems include deterioration, erosion, or frost heave of fence post anchors resulting in fence damage. Normal wear, deterioration, and vandalism are also possible on fencing, gates, locks, and signs. Table 8–2 presents the inspection and maintenance activities for these features. These activities will be performed as needed as identified during the routine inspections (refer to Section 7.0).

8.3.2 Cap and Final Cover System

The routine custodial and preventative maintenance of the cap and final cover includes the visual inspection of benchmark integrity, the upkeep of the vegetative cover, general mowing, the clearing of debris, the removal of woody weeds and seedlings, and reseeding. These activities will be performed as needed as identified during the routine inspections (refer to Section 6.0). Table 8–3 presents the custodial maintenance schedule for these features. When excessive localized depression is indicated by persistent water ponding, repairs will be performed.

Note that the need for, and frequency of, grass cutting will depend on the final seed mix selected for the OSDF final cover systems in the near term. Mowing will normally occur in the spring at a time when the final cover system is reasonably dry. Mowing will not occur on a cap if it is determined that the mowing will have an adverse effect on the vegetation. Mowing equipment shall not cause the rutting or disturbance of topsoil. If the cell cap cannot be mowed in the spring, then the mowing will be postponed until the following fall. The cell caps will be mowed and baled on a 3-year rotation (cell caps 1, 2, and 3 the first year; cells 4, 5, and 6 the second; then cells 7 and 8 the third). Additional mowing may take place as a means of weed control or as a method to promote native grass establishment.

Table 8–1. Examples of Conditions That May Require Custodial Maintenance or Contingency Repair

Condition	Appropriate Actions
Custodial Maintenance	
1. Damage due to normal wear, severe weather conditions, or vandalism to survey control monuments.	• Reestablish survey control monuments.
2. Growth of woody species such as deep-rooted shrubs or trees on the cover.	• Remove deep-rooted shrubs or trees from the cover. • Backfill root hole with soil, compact to reestablish grade, and reestablish the regular vegetative cover via seeding.
3. Development of animal burrows on the cover or in the diversion channels.	• Control or eradication of burrowing animals. • Backfill burrow hole with soil, compact to reestablish grade, and reestablish the regular vegetative cover via seeding. • If the problem becomes extensive, the services of a professional exterminator will be retained.
Contingency Repair	
4. Development of rills or gullies deeper than 6 inches with near vertical walls and no vegetative cover.	• Fill in gullies or rills with soil, compact to reestablish grade, and reestablish the regular vegetative cover via seeding and mulching[1,2].
5. Surface rupture where the dimensions of the cracks are larger than 1 inch wide by 10 ft long by 1 ft deep, which would indicate severe shrinkage of cover materials or differential settlement.	• Reconstruction of slope segments where slumping, mass wasting, liquefaction, or other severe events have occurred. • Root cause analysis, evaluate corrective and preventive measures/actions, implement recommended actions[1,2].
6. Instability of the slopes to the point where mass wasting or liquefaction has occurred due to earthquakes, differential settlement, or other causes.	• Reconstruction of slope segments where slumping, mass wasting, liquefaction, or other severe events have occurred. • Root cause analysis, evaluate corrective and preventive measures/actions, implement recommended actions[1,2].
7. Encroachment of stream channels or gullies into the disposal facility or its buffer area.	• Reconstruction of cover or other features[1]. • Root cause analysis, evaluate corrective and preventive measures/actions, implement recommended actions[1,2].
8. Flood damage to the site in the form of new channels, or debris deposits.	• Reconstruction of cover or other features[1]. • Root cause analysis, evaluate corrective and preventive measures/actions, implement recommended actions[1,2].
9. Intrusion by man whereby cover materials have been removed.	• Reconstruction of cover or other features[1]. • Root cause analysis, evaluate corrective and preventive measures/actions, implement recommended actions[1,2].

[1]This might involve general regrading in the area to modify drainage and/or the use of temporary drainage structures and controls to reduce runoff velocities until vegetation has been reestablished.
[2]Severe or repetitive occurrences might best be addressed via a corrective action (refer to Section 10.0).

Table 8–2. Site Security System Inspection and Maintenance Activities

Component	Inspection Frequency	Condition	Remedy	Maintenance
Fence	Quarterly for 2 years following completion of cells 7 and 8	• Damaged fence fabric or posts • Under fence erosion	• Repair or replace as necessary • Repair erosion or extend fence as necessary	• Repair or replace as necessary • Provide erosion and sedimentation control
Gates	Quarterly for 2 years following completion of cells 7 and 8	• Tampering or damage to locks	• Repair or replace as necessary	• Install proper lock
Warning signs	Quarterly for 2 years following completion of cells 7 and 8	• Damaged or missing warning signs	• Repair or replace as necessary	• Install or re-attach warning signs to fence or gates

Notes:
1. Frequency of inspections will be reevaluated following the 2-year period of quarterly monitoring.
2. Site security system shall be inspected after the occurrence of major earthquakes (refer to Section 10.3).

Table 8–3. Drainage Channel System Inspection and Maintenance Activities

Component	Inspection Frequency	Condition	Remedy	Maintenance
Drainage channels	Quarterly for 2 years following completion of cells 7 and 8	• Free-flowing • Clogging by sediment or debris • Scouring, other evidence or erosion, or other damage	• None – desired condition • Remove accumulated debris or sediment • Repair damage	• None – desired condition • Remove accumulated debris or sediment • Maintain as-built or undertake corrective action
Grade control structures	Quarterly for 2 years following completion of cells 7 and 8	• Free-flowing • Clogging by sediment or debris • Scouring, undermining, other evidence of erosion, or other damage	• None – desired condition • Remove accumulated debris or sediment • Repair damage	• None – desired condition • Remove accumulated debris or sediment • Remove emergent vegetation • Maintain as-built or undertake corrective action
Culverts	Quarterly for 2 years following completion of cells 7 and 8	• Free-flowing • Clogging by sediment or debris • Other damage	• None – desired condition • Remove accumulated debris or sediment • Repair damage	• None – desired condition • Remove accumulated debris or sediment • Maintain as-built or undertake corrective action

Notes:
1. Frequency of inspections will be reevaluated following the 2 years of quarterly monitoring.
2. Drainage system shall be inspected after the occurrence of major earthquakes (refer to Section 11.3).

Woody reproduction that develops on the OSDF final cover systems shall be eliminated by hand, mechanically, chemically, or by fire. Many woody species maintain their root systems when cut and will rapidly resprout. The root system continues to grow through repeated cuttings and can become extensive. For this reason, chemical herbicides (spraying of individual trees and shrubs) or fire shall be preferred for woody species control, as eradication of the whole plant including the root system is a primary goal. A combination of mechanical and chemical treatment where cut stumps are treated with herbicide to prevent resprouting may also be considered. The most effective method for managing woody species vegetation will be evaluated for the OSDF by DOE based on available equipment, expertise, and cost.

Inspection/investigation, corrective maintenance, or contingency repair of the final cover may be required for one of the following reasons:

- Formation of localized depressions caused by subsidence of the emplaced impacted materials.
- Progressive deterioration of the cover caused by erosion.
- Destruction of a portion of the final cover by some gross physical event.

Settlement is not expected to be a significant problem as the OSDF contains little putrescible waste. In the case of localized depressions, it will likely be necessary to strip existing topsoil in the affected area and stockpile it in an adjacent area. General soil would then be used to fill the settled area to restore uniform grades in order to promote proper drainage. Topsoil would then be replaced. Where this phenomenon occurs in the upper cover, simple regrading and filling of the depression with compacted fill will likely be satisfactory. All affected areas will be reseeded and mulched immediately upon completion of repairs.

The following are typical steps to repair excessive settlement:

[1] When maintenance is required, the amount of soil needed should be estimated, and arrangements for stockpiling or delivery should be made in advance in order to minimize the amount of time the repair area is disturbed.

[2] Install temporary silt control and surface water controls.

[3] Remove and stockpile topsoil and vegetative soil layers. Segregate as necessary.

[4] Vegetative soil material can be added to the existing vegetative soil layer portion of the cover, or the existing vegetative soil material can be excavated, and appropriate fill placed to bring the area to acceptable grades.

[5] Document vegetative soil layer placement and compaction in accordance with the original construction quality assurance program (GeoSyntec 2001a).

[6] Replace vegetative and topsoil layers, and revegetate. Care should be taken during final grading to ensure the area is tracked perpendicular to the slope to minimize channeling by surface water.

Progressive deterioration of the cover caused by erosion will likely be addressed by reconstruction of the cover in that area and by improvement of the erosion problem. This may involve some general regrading in the area to modify drainage and/or the use of temporary drainage structures and controls to reduce runoff velocities until vegetation has been reestablished.

8.3.3 Run-on and Runoff Drainage Features

Diversion and drainage channels surrounding the OSDF function to collect runoff and divert run-on. The channels may require mowing and, from time to time, reshaping to control the runoff in a controlled manner. Vegetative growth in and around diversion channels will be maintained by periodic mowing and clearing. Mowing of the vegetation on the same schedule as the OSDF final cover system (refer to Section 8.3.2) will ensure proper maintenance of the channels. Any large plants or seedlings will be removed to prevent sediment buildup and damage caused by roots. Reseeding and mulching will be performed as needed in bare areas to prevent excessive erosion.

During the routine inspections (refer to Section 6.0), the drainage channels will be examined for erosion. Any problems identified by inspections will be repaired to conform as closely as possible to the original construction specifications and drawings. To the extent possible, appropriate measures will be taken to prevent problems from recurring.

Maintenance of the diversion channel system might be needed in areas of excessive sediment buildup, sloughing of banks, or plugging of culverts due to sediment and vegetation buildup. The grade control structures—rocks placed at an inlet, outlet, or along the length of a drainage channel—might also require maintenance for sediment and vegetation buildup. Appropriate actions will be taken to address these situations, including cleaning out and/or re-contouring channels, repair of banks, and unplugging of culverts. Table 8–3 presents the inspection and custodial maintenance schedule for these features.

9.0 Post-Closure Corrective Actions

9.1 Introduction

Previous sections of this plan address maintenance or repair activities for the OSDF, which are directed at routine or custodial problems. This section discusses at the conceptual level the steps necessary to evaluate and correct situations of more significant concern. Those steps include:

- Preliminary assessment of situation.
- Development of technical approach and work plan.
- Identification of alternatives.
- Evaluations of alternatives.
- Identification of the preferred alternative.
- Public involvement.
- Selection of corrective action/response action alternative.
- Implementation of the selected alternative.

9.2 Future Corrective Actions and Response Actions

The following points are important to keep in mind, based upon legislation and regulations in effect at the time of formulation of this plan:

- The Fernald Preserve has been listed on the NPL.
- Response actions under CERCLA have been and are being conducted at the Fernald Preserve to remediate the threats (or potential threats) to human health and the environment from past releases and potential releases at the site.
- Regardless of whether the Fernald Preserve is deleted from the NPL in the future, any future corrective actions/response actions would be conducted as a response action under CERCLA, either as a removal action or a remedial action as appropriate to the situation.

The inspection and maintenance activities identified elsewhere throughout this plan will be the mechanism to identify, and address as appropriate, situations needing maintenance or repair activities of a custodial or routine nature. DOE will consult with EPA and OEPA whenever it identifies a situation believed worthy of more significant attention.

When there is a situation that requires significant attention, the first focus will be identification of the perceived problem ("problem statement"). This should include, as possible based upon existing information, a preliminary assessment of the nature of the problem and its threats to human health and the environment. This step is intended to be a remedial or removal site evaluation, as those terms are currently used in the National Oil and Hazardous Substances Pollution Contingency Plan (40 CFR Part 300). The intended outcome of this first step is an assessment of the seriousness of the situation and a determination of the time-criticalness of response action. From this, the appropriate course of CERCLA response action (removal action vs. remedial action) will be decided.

Regardless of removal vs. remedial course of action, the next step would be development of a technical approach, including identification of objectives, activities to fulfill those objectives, and associated timeframes. The embodying document would vary depending on the course of CERCLA response action identified as appropriate:

1. If a time-critical removal action is necessary, then a removal action work plan will be required.
2. If a non-time-critical removal action is necessary, then an engineering evaluation/cost analysis will be required.
3. If a remedial action is necessary, then a work plan for a focused feasibility study will be required.

For numbers 2 and 3 above, the process will include the following:

- Identification of alternatives.
- Evaluations of alternatives.
- Identification of the preferred alternative.
- Public involvement.
- Selection of the corrective action/response action alternative.
- Implementation of the selected alternative.

10.0 Emergency Notification and Reporting

10.1 Introduction

The OSDF was designed to comply with EPA and OEPA standards with minimum maintenance and oversight during the post-closure care period. However, unforeseen events could create problems that could affect the disposal facility's ability to remain in compliance with these standards. Therefore, DOE has requested notification from local, state, and federal agencies of discoveries or reports of any purposeful intrusion or damage at the site, as well as the occurrence of earthquakes, tornadoes, or floods in the area of the disposal facility. Such notification would trigger a contingency inspection, as discussed in Section 7.3.

10.2 Agency Agreements

DOE-LM issued letters to the Hamilton County sheriff's department, the Butler County sheriff's department, and the Ross, Crosby, and Morgan Township police and fire officials, requesting that they notify DOE-LM in the event they observe any unauthorized human intrusion or unusual natural event.

DOE-LM issued a letter to the Ohio Earthquake Information center, located at Alum Creek State Park in Delaware County, Ohio, requesting that they notify DOE-LM in the event of an earthquake in the vicinity of the Fernald Preserve.

DOE-LM will monitor emergency weather notification system announcements and has requested notification from the National Weather Service (either Wilmington or Cincinnati) of severe weather alerts.

To notify DOE-LM of site concerns, the public may use the 24-hour security telephone numbers monitored at the DOE facility in Grand Junction, Colorado. The 24-hour security telephone numbers will be posed at site access points and other key locations on the site.

THE 24-HOUR EMERGENCY NUMBER
877-695-5322

10.3 Unusual Occurrences and Earthquakes

As the majority of the OSDF is within Hamilton County, DOE has requested that the Hamilton County sheriff's department notify DOE of any unusual occurrences in the area of the OSDF that may affect surface or subsurface stability, as well as any reports of vandalism or unauthorized entry. DOE has also requested the same from the Butler County sheriff's department.

Because the Fernald Preserve and the OSDF are not in an active seismic zone, and not situated on or constructed of lithified earth materials, the probability of occurrence of seismic events that could damage the OSDF, are slim. If they do occur, seismic events that could potentially damage the OSDF would manifest themselves in numerous ways in the area, the most apparent of which are:

- Rupture of potable water supply lines.
- Rupture of natural gas supply lines.
- Rupture of natural gas transmission lines and the like.

DOE-LM has issued a letter to the Ohio Earthquake Information Center, requesting notification in the event of an earthquake in the vicinity of the site.

DOE-LM issued letters to and requested acknowledgement from the Hamilton County sheriff's department, the Butler County sheriff's department, and both Ross and Crosby Township police and fire officials to notify DOE-LM in the event of unauthorized human intrusion or unusual natural events. All of the above-mentioned agencies have been asked to contact DOE-LM should an event occur that might affect the control of known contaminants or the condition of the OSDF. DOE-LM will also monitor emergency weather notification system announcements.

10.4 Meteorological Events

DOE has also requested that the National Weather Service (either the Wilmington, Ohio, or Cincinnati, Ohio, office) notify DOE whenever a flash-flood or tornado warning in Hamilton or Butler counties has been issued.

11.0 Community Relations

The public played a very important role in the remediation process at the Fernald Preserve, and the stakeholders remain very involved in legacy management. DOE holds regularly scheduled meetings with various groups and the general public to share information on the current site status and progress. The public and other key stakeholders will remain fully involved in the legacy management of the site, and the public meetings conducted by DOE will continue as long as the public continues to show an active interest. Additional information on the history of the public's involvement is included in Section 5.2 of the IC Plan (Volume II of the LMICP) and in the Community Involvement Plan (Attachment E to the LMICP).

Another process involving the public is the CERCLA 5-year review. The CERCLA 5-year reviews will focus on the protectiveness of the remedies associated with each of the five OUs. Following the review, a report will be submitted to EPA. The public will also be able to review these reports and provide feedback. In addition, the data and documentation used for the report will be accessible, either electronically or in hard copy.

Reporting to the public and stakeholders will occur on a regular basis. These requirements are further defined in Section 4.4 of the Legacy Management Plan (Volume I of the LMICP), in Section 5.1.3 of the IC Plan, and in the Community Involvement Plan.

End of current text

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Attachment C

Attachment C

Groundwater/Leak Detection and Leachate Monitoring Plan

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Acronyms and Abbreviations

ANOVA	analysis of variance
ARARs	applicable or relevant and appropriate requirements
ASER	Annual Site Environmental Report
ASL	analytical support level
CAWWT	converted advanced wastewater treatment facility
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	*Code of Federal Regulations*
cm/sec	centimeters per second
COC	constituent of concern
COD	chemical oxygen demand
CPT	cone penetrometer test
D&D	decontamination and demolition
DOE	U.S. Department of Energy
EPLTS	Enhanced Permanent Leachate Transmission System
EPA	U.S. Environmental Protection Agency
FRL	final remediation level
ft	feet
GEMS	Geospatial Environmental Mapping system
gpad	gallons per acre per day
gpm	gallons per minute
GWLMP	Groundwater/Leak Detection and Leachate Monitoring Plan
HDPE	high-density polyethylene
HTW	horizontal till well
IEMP	Integrated Environmental Monitoring Plan
K_d	distribution coefficient
L	liter
LCS	leachate collection system
LDS	leak detection system
LMICP	Comprehensive Legacy Management and Institutional Controls Plan
LM QAPP	Legacy Management CERCLA Sites Quality Assurance Project Plan
m	meters
NPDES	National Pollutant Discharge Elimination System
NTU	nephelometric turbidity units
OAC	Ohio Administrative Code
OEPA	Ohio Environmental Protection Agency
OSDF	on-site disposal facility
OU	Operable Unit
PCBs	polychorinated biphenyls
PCCIP	Post-Closure Care and Inspection Plan
PLS	permanent lift station
RA	remedial action
RCRA	Resource Conservation and Recovery Act
RI	remedial investigation
RI/FS	remedial investigation/feasibility study
SDWA	Safe Drinking Water Act

Acronyms and Abbreviations (continued)

SEEPro	Site Environmental Evaluation for Projects
SNL	Sandia National Laboratories
SWIFT	Sandia Waste Isolation Flow and Transport
TOC	total organic carbon
TOX	total organic halogens
UMTRCA	Uranium Mill Tailings Radiation Control Act
VAM3D	Variably Saturated Analysis Model in 3 Dimensions
WAC	Waste Acceptance Criteria
yd^3	cubic yards

1.0 Introduction

This document presents the groundwater/leak detection and leachate management monitoring program (GWMLP) for the on-site disposal facility (OSDF) at the U.S. Department of Energy's (DOE's) Fernald Preserve. This plan is a support plan for the OSDF, and it is required by the *Remedial Action* (RA) *Work Plan for the On-Site Disposal Facility* (DOE 1996a). Revision 0 of the GWMLP was issued in August 1997 (DOE 1997), Revision 1 was issued in April 2005 (DOE 2005a), and draft final Revision 2 was issued in January 2006 (DOE 2006a). As noted in the executive summary, the GWLMP has been integrated into this revision of the *Legacy Management and Institutional Controls Plan* (LMICP). The GWLMP is no longer a stand-alone document with its own review and revision cycle. It will be reviewed and revised each October.

As is discussed in detail in this document, the monitoring program comprises two primary elements: (1) a leak detection component, which provides information to verify the ongoing performance and integrity of the OSDF and its impact on groundwater; and (2) a leachate monitoring component, which satisfies regulatory requirements for leachate collection and management. The leak detection monitoring layers (made up of a leak detection layer inside the facility, and two groundwater zones occurring in the subsurface below the facility) will be used collectively to assess the existence of leakage from the facility and to satisfy OSDF groundwater monitoring requirements. The two groundwater zones in the monitoring plan are the Great Miami Aquifer (a water table found at depths ranging from 40 to 90 feet [ft] in the vicinity of the OSDF) and the perched groundwater residing in the glacial till overlying the Great Miami Aquifer. Note that an additional component of the OSDF is inspections and maintenance activities, which are discussed in Appendix D of this document—the Post-Closure Care and Inspection Plan (PCCIP) (DOE 2006c).

This OSDF monitoring plan has been developed to meet the regulatory requirements for groundwater detection monitoring in both the Great Miami Aquifer and the perched groundwater system. These detection monitoring requirements constitute the first tier of a three-tiered program consisting of (1) detection, (2) assessment, and (3) corrective action monitoring strategy required for engineered disposal facilities. Consistent with this three-tiered requirement, follow-up groundwater quality assessment and corrective action monitoring plans will be developed and implemented as necessary, if it is determined from detection monitoring that a leachate leak from the OSDF into the underlying natural hydrogeologic environment has occurred. Conversely, if the detection monitoring continues to successfully demonstrate that leachate leaks are not of concern (i.e., the facility is performing as designed), then the monitoring program will remain in the first-tier "detection" mode, and the need for the follow-up groundwater quality assessment and/or corrective action monitoring plans will not be triggered.

The DOE-Office of Legacy Management is responsible for OSDF monitoring, maintenance, and reporting. This plan will be revised, as necessary, to reflect approved updates to monitoring and reporting requirements, and will continue to be used through post-closure.

1.1 Overview of the OSDF

The OSDF is located along the northeast portion of the Fernald Preserve and, as required by the Operable Unit 2 (OU2), OU3, and OU5 records of decision (RODs), is situated over the "best available geology" at the Fernald Preserve to take maximum advantage of the protective hydrogeologic features of the glacial till above the Great Miami Aquifer. The OSDF footprint (including the capped area extending beyond the disposal area) occupies approximately 90 acres of the 1,050-acre Fernald Preserve. This area is dedicated to disposal and will remain under federal ownership and federal administrative control now that the Fernald Preserve's cleanup mission has been completed. The OSDF provides on-site disposal capacity for approximately 2.96 million cubic yards (yd^3) of contaminated soil and debris generated by Fernald Preserve's environmental restoration and building decontamination and demolition (D&D) activities.

The OSDF dimensions are as follows: capacity of 2.96 million yd^3 (2.2 million cubic meters), maximum height of approximately 65 ft (20 meters [m]), and an area coverage of approximately 90 acres (36.423 hectares) of the northeastern area of the Fernald Preserve. The facility was constructed in phases, with eight individual cells. Cells are approximately 700 ft by 400 ft, or 280,000 square ft (ft^2) (6.4 acres). Note that the dimensions of Cell 8 are larger than those of the other cells (approximately 9.4 acres). Each cell was constructed with a leachate collection system (LCS) that collected infiltrating rainwater and stormwater runoff during waste placement and prevented it from entering the underlying environment. Other engineered features include a multilayer composite liner system, a leak detection system (LDS) positioned beneath the primary liner, and a multilayer composite cover placed over each cell following the completion of waste placement activities.

The LCS and LDS layers are designed to convey any leachate/fluid that enters the system through pipes (i.e., the LCS pipes and LDS pipes) to the west side of each cell to the liner penetration box. The liner penetration box is the point where the LCS and LDS pipes penetrate the liner system and therefore represents the lowest elevation of each cell and the most likely point for a leak to occur. From the liner penetration box, the LCS and LDS pipes drain to the EPLTS valve houses where the leachate and LDS fluid are collected in tanks, flow rates/volumes are monitored, and samples are collected. Fluid that collects in the LCS and LDS collection tanks located in each cell's valve house is pumped to the gravity drain portion of the leachate transmission system line, which drains all valve houses to the permanent lift station (PLS). The leachate collected in the PLS is periodically pumped to the converted advanced wastewater treatment facility (CAWWT) backwash basin or directly to CAWWT feed tanks. The EPLTS consists of the valve houses and the equipment contained within them as well as the gravity drain portion of the leachate transmission line that runs from the valve house at Cell 1 to the PLS.. Figure 1–1 depicts a cross section of the liner system.

Additionally, it should be noted that there is institutional knowledge regarding the various complexities associated with the regulatory strategy for the OSDF leak detection and data evaluation processes. This information should be considered during future post-closure evaluations. To date, the process continues to evolve and there is much interaction between DOE, the U.S. Environmental Protection Agency (EPA), and the Ohio Environmental Protection Agency (OEPA) regarding the overall process.

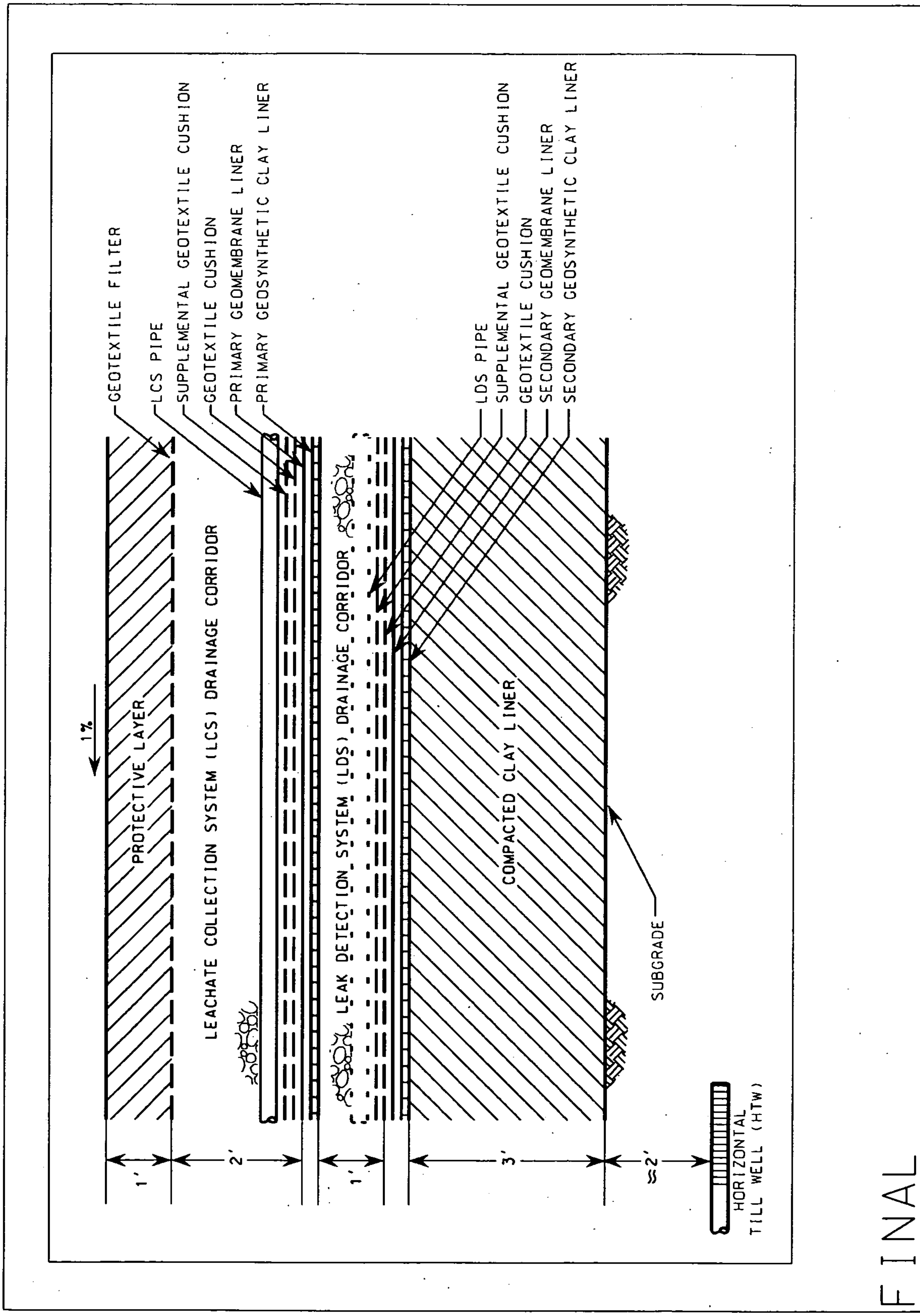

Figure 1–1. On-Site Disposal Facility Liner System with HTW at the Drainage Corridor

1.2 Program Overview

The OSDF monitoring plan was developed by reviewing the pertinent regulatory requirements for detection monitoring and translating those requirements into site-specific monitoring elements (e.g., designation of monitoring zones, monitoring station locations, sampling frequency, and establishment of analytical parameters).

The plan considers current hydrogeologic and contaminant conditions in the glacial till and Great Miami Aquifer beneath the facility. Preexisting contamination in the perched groundwater system and the Great Miami Aquifer, the variable nature of the geology and hydrogeology of the clay-rich glacial deposits, and the influence of aquifer restoration activities in the Great Miami Aquifer add complexity to the development of a groundwater monitoring program. Note that the Great Miami Aquifer was undergoing restoration during the same time period that the OSDF was actively accepting waste for disposal, after the facility was capped and during post-closure. The aquifer restoration is a pump-and-treat operation. The closest pumping wells are approximately 2,000 ft upgradient of the OSDF footprint.

Available site-specific information generated from more than 15 years of detailed site characterization efforts including geology and hydrogeology, results of detailed contaminant fate and transport modeling, OSDF construction activities, and monitoring results from the OSDF program and the *Integrated Environmental Monitoring Plan* (IEMP) (DOE 2006d) were used to develop the monitoring strategy and to determine monitoring locations. The strategy employs a four layer vertical slice/trend analysis approach to independently monitor the potential for leachate generation and leakage from each of the disposal cells comprising the facility. As part of this strategy, "baseline" conditions for each cell are being established to facilitate trend analysis from data generated for each of the monitoring stations over time. This baseline will help define existing conditions in both the perched groundwater and the Great Miami Aquifer in the immediate vicinity of the facility.

This plan focuses on the monitoring needs associated with detection monitoring during post-closure. Future amendments to the plan will be prepared to address program modifications, if changes to the monitoring program are necessary. An in-depth review of program needs is also envisioned at the completion of Great Miami Aquifer restoration activities. Prior to the completion of the aquifer restoration activities, the data comparisons will focus on shorter term "interim" leakage effects that might occur during the initial years after the cells are capped. The baseline will enhance the ability to conduct the interim comparisons until the facility enters its final long-term, post-closure mode and aquifer restoration activities are complete.

Throughout this process, the analytical results and trend analyses for all three leak detection monitoring layers (the LDS, perched groundwater, and the Great Miami Aquifer) and the LCS will be compared with one another to evaluate the performance of each cell and to determine whether a release from the facility has occurred. In concert with the groundwater monitoring component of the program, the leachate characterization and tracking component will provide for the monitoring of leachate concentrations and flows in the LCS and LDS to support leachate management and treatment decisions.

During the development of this plan, EPA and OEPA identified the need to monitor the potential for leachate leakage from the OSDF at its first point of entry into the natural hydrogeologic environment (rather than relying on Great Miami Aquifer groundwater monitoring alone). This led to the decision to install horizontal monitoring wells in the glacial till directly beneath the liner penetration boxes of the LCS and LDS layers in each cell. The subsurface area beneath the liner penetration boxes provides the best opportunity to monitor for an initial leak into the subsurface environment, should such a leak occur. As a result of the low transmissive properties of the glacial till and the discontinuous nature of the perched groundwater system in the till, it may not always be possible to collect groundwater samples routinely from the horizontal wells. In view of this limitation, DOE, EPA, and OEPA concurred that the placement of the horizontal wells beneath the liner penetration boxes represents the most feasible site-specific approach to monitor for first entry leakage from the facility to the environment, and this approach provides adequate and appropriate early warning detection capabilities for this site-specific setting.

The OSDF groundwater monitoring plan has been implemented as a project-specific plan (refer to Appendix B), with the results presented for EPA and OEPA review as part of the comprehensive IEMP reporting process (i.e., annual site environmental reports [ASERs]). The IEMP (DOE 2006d) provides a consolidated reporting mechanism for all of the environmental regulatory compliance monitoring activities including the data and findings from the OSDF groundwater monitoring plan. Incorporating the OSDF data into the IEMP maintains the commitment to an effective remediation-focused environmental surveillance monitoring program. Once the environmental remediation requirements have been completed and the site is successfully removed from the Superfund National Priorities List, the monitoring activity for the OSDF (which will be the last remaining facility in place at the site) will continue in accordance with applicable regulatory monitoring and reporting requirements.

1.3 Plan Organization

The remainder of this plan is organized as follows:

- A summary of the geology and hydrogeology in the immediate area of the OSDF is provided in Section 2.0.
- A regulatory analysis and strategy for OSDF monitoring is provided in Section 3.0.
- The OSDF leak detection monitoring program is provided in Section 4.0, including a description of program elements, monitoring frequencies, and data evaluation.
- The OSDF leachate management monitoring program, which will be used to support leachate management decisions, is provided in Section 5.0.
- Reporting requirements and notifications are provided in Section 6.0.
- References are provided in Section 7.0.

The appendixes that support this plan are:

- Appendix A—OSDF Applicable or Relevant and Appropriate Requirements (ARARs) and Other Regulatory Requirements.
- Appendix B—Project-Specific Plan for the On-Site Disposal Facility Monitoring Program.

- Appendix C—Fernald Site Data Quality Objectives, Monitoring Program for the On-Site Disposal Facility Program.
- Appendix D—Leachate Management Plan for the On-Site Disposal Facility.
- Appendix E—Selection Process for Site-Specific Leak Detection Indicator Parameters.

1.4 Related Plans

Several other RA plans have been prepared for the OSDF, or for the Fernald Preserve as a whole, containing information relevant to this plan. These other plans are listed below along with a brief statement of their relationship to this plan:

- *Pre-Design Investigation and Site Selection Report for the On-Site Disposal Facility*, and addendum (DOE 1995a and DOE 1996b): Describe field activities used to assess potential sites for the OSDF, and present the information collected during addendum activities to the Project Specific Plan (DOE 2001a).
- OSDF Systems Plan (DOE 2001b): Describes the inspection and maintenance of the LCS and LDS.
- *Enhanced Permanent Leachate Transmission System Operation* (DOE 2005b): Is the operational procedure for management, inspection, and conveyance of leachate and fluid from the LCS and LDS. Note that operational procedures are included in the *Legacy Management Fernald Operating Procedures* (DOE 2006b).
- OSDF Design Packages (GeoSyntec 1996a, GeoSyntec 1996b, GeoSyntec 1997, DOE 2004a) and construction drawing packages: Provide the overall approved design for each cell of the OSDF.
- *Post-Closure Care and Inspection Plan, On-Site Disposal Facility*, Revision 4, Final (DOE 2006c): Summarizes the inspection and maintenance activities (e.g., cap and runoff controls) to ensure continued proper performance of the OSDF and also summarizes at the conceptual level corrective actions/response actions.
- *Borrow Area Management and Restoration Plan, On-Site Disposal Facility* (GeoSyntec 2001a): Describes management of borrow soils used to construct the OSDF, and describes the planning for end state after soils have been excavated.
- *Surface Water Management and Erosion Control Plan, On-Site Disposal Facility* (GeoSyntec 2001b): Describes soil erosion control to minimize sediment loss.
- *Construction Quality Assurance Plan, On-Site Disposal Facility* (GeoSyntec 2002): Describes quality assurance methods and testing to certify the construction of the OSDF.
- *Impacted Materials Placement Plan, On-Site Disposal Facility* (GeoSyntec 2005): Describes the categories of material, prohibited items, and placement methods for impacted material placement in the cells.
- *Waste Acceptance Criteria Attainment Plan for the On-Site Disposal Facility* (DOE 1998): Defines the OSDF requirements for materials generated by the Fernald site's environmental restoration, and D&D efforts.
- *Project-Specific Plan for Installation of the OSDF Great Miami Aquifer Wells* (DOE 2001a): Describes the installation of Great Miami Aquifer wells.

- *Technical Memorandum for the OSDF Cells 1, 2, and 3 Baseline Groundwater Conditions* (DOE 2002): Describes baseline conditions for Cells 1, 2, and 3.
- IEMP (Attachment D) (DOE 2006d).
- Additionally, ASERs include OSDF reporting requirement updates.

End of current text

2.0 OSDF Area Geology and Hydrogeology

2.1 Introduction

The OU2, OU3, and OU5 RODs contain requirements that the OSDF be located in an area of the Fernald Preserve that takes maximum advantage of available geologic and hydrogeologic conditions to further reduce the potential for contaminant migration from the facility. To identify the preferred OSDF location, a detailed pre-design geotechnical and hydrogeologic investigation was conducted as a supplement to the sitewide characterization efforts contained in *Remedial Investigation* (RI) *for Operable Unit 5* (DOE 1995b). The detailed findings of the pre-design investigation are documented in the *Pre-Design Investigation and Site Selection Report for the On-Site Disposal Facility* (DOE 1995a). As documented in the site selection report, a final location along the eastern margin of the Fernald Preserve was selected to satisfy the RODs and other regulatory-based siting requirements.

The following sections summarize the principal geologic, hydrogeologic, and subsurface contaminant conditions in the OSDF area that have a direct bearing on the development of the leak detection and groundwater monitoring strategy for the facility. For more detailed information, refer to the *Pre-Design Investigation and Site Selection Report for the On-Site Disposal Facility* (DOE 1995a) and *Remedial Investigation* (RI) *for Operable Unit 5* (DOE 1995b).

2.2 OSDF Area Geology

The OSDF, inclusive of its final cap configuration, occupies an area of approximately 90 acres along the northeastern area of the Fernald Preserve. The facility is oriented in a north-to-south direction with dimensions of approximately 3,600 ft by 1,000 ft. The east edge of the facility (i.e., the toe of the cap system) is set back from the eastern property line by approximately 100 ft. The subsurface conditions in the immediate area of the selected OSDF location were characterized through the following field and laboratory activities:

Test Borings	Fifty-four borings were drilled in the immediate vicinity of the OSDF to obtain geotechnical soil samples and characterize underlying geology.
Monitoring Wells	Fifty-one groundwater monitoring wells were installed in the general vicinity of the OSDF from which water level data, preexisting groundwater contaminant concentration data, and lithology data have been obtained.
Geotechnical Tests	Key geotechnical tests (i.e., Atterberg limits, water content measurements, and permeability tests) were performed on subsurface geologic samples, including 116 sieve analyses to determine grain size.

Lysimeter Installation	Eight lysimeters were installed in the OSDF site area to determine the nature and concentration of uranium in the vadose zone of the glacial till and the unsaturated Great Miami Aquifer.
Slug Tests	Twenty-four slug tests were performed to assess the hydraulic characteristics of the perched groundwater system.
Water Level Monitoring	Water levels obtained from the perched groundwater and the Great Miami Aquifer wells were used to determine hydraulic gradients and flow directions.
Soil Analyses	Soil samples collected during the RI and the Pre-Design Investigation were characterized for mineralogy and analyzed for uranium and other constituents of concern (COCs) to determine preexisting contaminant levels in the subsurface beneath the OSDF.
Groundwater Flowmeter Study	Twenty-two flowmeter readings were obtained in the perched groundwater in the OSDF site area.
Distribution Coefficient (K_d) Study	A K_d study was performed to determine how uranium will partition itself between groundwater and soil in the OSDF site area.
Cone Penetrometer Tests (CPTs)	Eighty-eight CPTs were conducted in the OSDF site area to aid in making subsurface lithologic interpretations.

The information obtained through these activities, coupled with the sitewide interpretations gained through the OU5 RI, formed the basis for the interpretations of subsurface conditions in the vicinity of the OSDF site.

In general, the OSDF site is situated on glacial till underlain by sand and gravel deposits that comprise the Great Miami Aquifer, which is designated as a sole-source aquifer under the Safe Drinking Water Act (SDWA). The Great Miami Aquifer is a high-yield aquifer (i.e., wells completed in some areas of the aquifer yield greater than 500 gallons per minute [gpm]), and it supplies a significant amount of potable and industrial water to people located in Butler and Hamilton counties.

The glacial till ranges in thickness from approximately 20 to 60 ft in the immediate vicinity of the OSDF and is composed of about equal portions of carbonate (calcite and dolomite) and silicate (quartz, feldspar, and clay minerals) grains. Based on the results of 116 sieve and hydrometer analyses, the glacial till can be characterized as dense, heterogeneous, sandy, lean clay, with occasional discontinuous interbedded sand and gravel lenses. The glacial till can be further divided into an upper brown clay layer and a lower gray clay layer. This division is made on color and physical properties because the mineralogy is similar in both layers. The brown clay layer is more weathered (i.e., it exhibits iron oxidation and contains a greater abundance of desiccation fractures compared with the underlying gray clay layer) and has a higher incidence of interbedded sand and gravel lenses. In the eastern portions of the Fernald Preserve, the gray clay ranges in thickness from approximately 15 to 42 ft, and the brown clay ranges from approximately 8 to 15 ft. As indicated by the OU5 RI, the gray clay is the most uniform and least permeable and, therefore, the most protective geologic layer found above the Great Miami Aquifer across the site.

As a follow-up to the OU5 RI, one of the primary objectives of the *Pre-Design Investigation and Site Selection Report for the On-Site Disposal Facility* (DOE 1995a) was to identify the location where the thickest, laterally persistent gray clay layer is present that contains the least amount of interbedded coarse granular material, and which allows regulatory-based siting requirements (such as the property line and other geographic setbacks) to be met. The selected location for the OSDF has a minimum thickness of gray till of approximately 15 ft and an average thickness of approximately 30 ft. The percentage of interbedded sands and gravels in the gray till in this area is approximately 4 percent.

Beneath the glacial till layer, the sand and gravel deposits comprising the Great Miami Aquifer are approximately 175 ft thick. For RI characterization and monitoring purposes, the Great Miami Aquifer has been divided into three hydrologic zones: the uppermost zone, represented by the Fernald Preserve's Type 2 monitoring wells; the middle zone, represented by the Type 3 monitoring wells; and the lowermost zone, represented by the Type 4 monitoring wells. The sand and gravel deposits comprising the aquifer are extensive and, at the regional scale, occupy a land area of more than 970,000 acres.

Beneath the Great Miami Aquifer deposits, shale and limestone bedrock is encountered at a total depth of approximately 200 ft beneath the OSDF site. Regional studies by the Geological Survey of Ohio indicate the shale and limestone bedrock is approximately 330 ft thick in the Fernald Preserve area (Fenneman 1916).

2.3 Hydrogeologic Conditions

The Fernald Preserve has two distinctive bodies of groundwater that have been extensively characterized through the remedial investigation/feasibility study (RI/FS) process and the Pre-Design Investigation: the Great Miami Aquifer and the perched groundwater found within the overlying glacial till. The discontinuous sand and sand/gravel lenses found within the glacial till can provide water to a pumping well because the deposits are more permeable than the surrounding, clay-rich glacial till. The entire section of glacial till is believed to be saturated or nearly saturated with groundwater. An unsaturated sand and gravel zone approximately 20 ft to 30 ft thick separates the base of the glacial till from the regional water table in the Great Miami Aquifer. Depending on local weather patterns and rainfall, the water table in the Great Miami Aquifer exhibits annual fluctuations of approximately 6 ft within the unsaturated zone below the glacial till in the area of the OSDF.

The Great Miami Aquifer is a classic example of an unconfined buried valley aquifer. The depth to water in the aquifer in the vicinity of the OSDF ranges from 40 to 90 ft below the ground surface. Based on 5 years of water level measurements collected prior to the beginning of the pump-and-treat remedy (1988 through 1993), the groundwater flow direction in the aquifer in this area is from west to east (refer to OU5 RI report, Figure 3–50). Groundwater velocity in the area of the OSDF is approximately 451 ft per year, based on an average hydraulic gradient of approximately 0.0008 (refer to OU5 RI, page 3–61); an average hydraulic conductivity of approximately 463 ft per day (average of three pumping tests); and an effective porosity of 30 percent. Using the representative K_d for uranium of 1.78 liters per kilogram determined through the RI/FS process, the retardation factor for uranium movement in the Great Miami Aquifer is approximately 12. At a retardation factor of 12, the uranium moves approximately one-twelfth as fast as the water or approximately 37.6 ft per year. More recent studies conducted by Sandia National Laboratories (SNL) on uranium-contaminated sediment collected from the vadose zone indicate that the K_d ranges from 2.8 to 8.7 (SNL 2003, SNL 2004). The higher K_d values reported for the SNL study reflect natural variability in the aquifer and stronger bonding of the adsorbed uranium as it ages on the mineral surface, which results in a higher retardation factor and indicates slower migration times.

Perched groundwater is present above the unsaturated zone of the Great Miami Aquifer within the glacial till. Overall the till exhibits between 90 to 100 percent saturation (close to field capacity) and has the general properties of an aquitard. When the till reaches field capacity, it has the capability to release groundwater downward under a unit vertical hydraulic gradient into the underlying unsaturated zone of the Great Miami Aquifer. Eventually, this downward-moving groundwater will enter the saturated portion of the Great Miami Aquifer as recharge. Depths to perched groundwater in the till are generally 6 ft or less in the eastern portion of the Fernald Preserve in the area of the OSDF.

Although the till is generally saturated, there are no identified suitably thick or laterally continuous coarse-grained zones beneath the OSDF that can facilitate implementation of a comprehensive, interlinked (i.e., up- and downgradient monitoring points) perched groundwater monitoring system. The current amount of saturation in the till is expected to be reduced even further in the future, once the cap and underlying liners of the OSDF are in place; they will serve as local hydraulic barriers to further reduce the volume of infiltrating moisture within the OSDF footprint.

Slug test data from 24 perched groundwater wells (Type 1 monitoring wells) indicate that the average horizontal hydraulic conductivity for wells screened across the brown and gray clay layer interface is 6.30×10^{-6} centimeters per second (cm/sec). The gray clay layer beneath the brown clay is the least permeable layer above the Great Miami Aquifer. Laboratory hydraulic conductivities conducted on samples collected from this layer indicate measured values ranging from 9.53×10^{-9} cm/sec to 5.83×10^{-8} cm/sec. Other laboratory and field measurements indicate the till has an effective porosity of 4 to 10 percent, and a representative bulk density of 1.85 grams per cubic centimeter. The discontinuous nature of the perched water in the glacial till does not facilitate the measurement of a continuous water table gradient in the OSDF site area.

Model calibration studies conducted during the OU5 RI/FS indicate average vertical groundwater flow rates through the glacial till (including the gray clay layer) to be approximately 6 inches per year. The time it takes a contaminant to move through the glacial till and break through into the Great Miami Aquifer is controlled by the thickness of gray clay present in the till, the groundwater infiltration rate through the gray clay, and the retardation properties of the gray clay. In the OSDF area, modeled breakthrough travel times for uranium (the Fernald Preserve's predominant contaminant) range from approximately 210 years (to have a 20-micrograms-per-liter concentration in the aquifer) to 260 years (to have 1 percent of the source concentration). These breakthrough times were calculated using a retardation factor of 165 for the gray clay (refer to OU5 RI report, Appendix F [DOE 1995b]), not considering movement through the brown clay, and not including any retardation in the unsaturated Great Miami Aquifer sand and gravel. The modeled breakthrough travel time for 1 percent of a technetium source, the Fernald Preserve's most mobile contaminant, is approximately 3.6 years. This breakthrough time was calculated using a retardation factor of 2.29 for the gray clay (refer to OU5 RI report, Appendix F [DOE 1995b]), not considering movement through the brown clay, and not including any retardation in the unsaturated Great Miami Aquifer sand and gravel. This modeling strategy was used in the OU5 Feasibility Study (DOE 1995c) to calculate waste acceptance criteria (WAC) for the OSDF.

The extensive presence of low permeability lean sandy clay throughout the till matrix and the discontinuous nature of the coarser grained lenses are the dominant factors controlling the rate at which fluids can migrate through the more permeable portions of till, either vertically or laterally.

Unlike conditions in the Great Miami Aquifer, the up- and downgradient directions of perched groundwater flow are difficult to assign at the local scale. Groundwater flow meter readings from 22 wells taken during the Pre-Design Investigation indicate that the horizontal flow directions vary abruptly from well to well, with no discernable consistent patterns. Consequently, horizontal flow regimes are interpreted to be very localized in nature (perhaps on the order of tens to hundreds of feet in length) and not laterally persistent due to the discontinuous nature of the interbedded coarse-grained lenses. Taken collectively, the water levels obtained during the OU5 RI indicate that if an area gradient were present, it would range from between 0.008 to 0.015.

Model calibration studies conducted during the OU5 RI/FS indicate that vertical flow tends to dominate in the glacial till because of several factors: (1) the steep vertical hydraulic gradients across the till—which are at or near unity—compared to the small localized lateral hydraulic gradients, which collectively indicate a gradient that is much less than unity (0.008 to 0.015); (2) he laterally discontinuous nature of the coarse grained lenses in the till; and (3) the shorter overall flowpath distance in the vertical dimension for the Fernald Preserve (60 ft compared to hundreds or thousands of feet in the horizontal) before a potential discharge point for the glacial till groundwater is reached.

It can be generally interpreted from this information that if a leachate leak were able to exit through the OSDF liner system, it would be expected to migrate vertically towards the Great Miami Aquifer (although some localized "stair step" lateral motion may also be expected to take place in route). The exact pathway that a hypothetical leachate leak from the facility would take is difficult to determine, but it is clear that an effective monitoring program needs to consider both the most likely point of entry of the leak into the subsurface environment beneath the facility (i.e., above the horizontal till well [HTW]) and the ultimate arrival of the leak at the Great Miami Aquifer.

2.4 Existing Contamination

In the immediate vicinity of the OSDF, existing contaminant concentrations are present above background levels in surface and subsurface soil, the perched groundwater, and the Great Miami Aquifer. The nature and extent of contamination in these three media were documented in the OU5 RI report and preliminary remediation levels were developed for the Fernald Preserve's environmental media in the OU5 FS (DOE 1995c). Final remediation levels (FRLs) were documented in the OU5 ROD.

Based on the data presented in the OU5 RI report, only the surface soil (to a depth of approximately 6 inches) was considered contaminated above FRLs within the actual boundaries of the OSDF. The remaining media within the OSDF footprint were contaminated above background but generally below FRLs. An area of deep soil excavation to address deep soil and perched groundwater contamination was completed outside the OSDF footprint at the Fernald Preserve's sewage treatment plant, located immediately east of the OSDF. Additionally, in the spring of 2004, an area due west of Cell 8 was excavated to approximately 6 ft due to contamination just above the soil FRLs. This area was the closest excavation necessary to address soil FRL exceedances that were deeper than 6 inches.

Pre-OSDF aquifer contamination that was proximal to the OSDF footprint was present in the Plant 6 area. The Plant 6 area is located approximately 300 ft west of the OSDF. During the remedial investigation, a uranium plume was detected in this area. Direct-push sampling conducted in 2000 and 2001, in support of the Design for Remediation of the Great Miami Aquifer in the Waste Storage and Plant 6 Areas, indicated that the uranium plume in the Plant 6 area was no longer present. It is believed that the uranium plume dissipated to concentrations below the FRL as a result of the shutdown of plant operations in the late 1980s and the pumping of highly contaminated perched water as part of the Perched Water Removal Action #1 in the early 1990s. Because a total uranium plume with concentrations above the groundwater FRL was no longer present in the Plant 6 area at the time of the design, a restoration module for the Plant 6 area became unnecessary and was no longer planned.

In 2004, deep excavation work in the Plant 6 area was completed. As a follow-up to the excavation work, direct-push groundwater sampling was conducted in 2004 in the area to determine if any groundwater FRL exceedances for uranium or technetium-99 were present in the Great Miami Aquifer now that deep excavations were complete. The results of the direct-push groundwater sampling showed no uranium or technetium-99 FRL exceedances.

Since the decision not to install extraction wells in the Plant 6 Area was approved in 2001, uranium FRL exceedances have been measured at one well in the area, Monitoring Well 2389. The uranium FRL exceedances at Monitoring Well 2389 will continue to be monitored as part of the IEMP (DOE 2006d). It appears that a thin layer of contamination is present in the upper 1 ft or so of the aquifer at Monitoring Well 2389; this is not enough contamination to warrant the installation of a groundwater recovery well. It is expected that the concentration of uranium at Monitoring Well 2389 will dissipate on its own over time. The data will continue to be tracked as part of the IEMP sampling activities.

An abandoned steel casing was uncovered during excavation in late 2005 approximately 87 ft west-southwest of Monitoring Well 2389. The casing is believed to have been associated with the hydraulic cylinder of the Plant 5 freight elevator. The abandoned casing was deep enough to breach the aquifer and could have provided a potential contamination pathway to the aquifer. The presence of this abandoned casing could explain the thin layer of uranium contamination that has been detected in the upper 1 ft or so of the aquifer in the location of Monitoring Well 2389.

In accordance with the OU5 ROD, RAs for surface and subsurface soil, the perched groundwater in the glacial till, and the Great Miami Aquifer were implemented in areas where FRLs had been exceeded. However, at the completion of the sitewide RAs, low levels of some contaminants (i.e., above background levels but below FRLs) remained in the various environmental media at the Fernald Preserve, including the area adjacent to and beneath the OSDF. This residual low-level contamination remains after certification of cleanup at the Fernald Preserve has been achieved and it is recognized as a factor that creates a degree of uncertainty in the ability to distinguish small quantities of potential OSDF leakage from the preexisting levels of contamination in the media.

End of current text

3.0 Regulatory Analysis and Strategy

The OSDF groundwater/leak detection and leachate monitoring plan is designed to comply with all regulatory requirements associated with groundwater detection monitoring and leachate monitoring for disposal facilities. The source of these regulatory requirements is the ARARs listed in the RODs for OU2, OU3, and OU5. This section summarizes the regulatory requirements by describing each ARAR and presents the regulatory strategy for compliance with these ARARs.

As indicated in Section 1.1, there is institutional knowledge regarding the various complexities associated with the regulatory strategy for the OSDF leak detection and data evaluation processes. This information should be considered during future post-closure evaluations. To date, the process continues to evolve, and there is much interaction between DOE, EPA, and OEPA regarding the overall process.

3.1 Regulatory Analysis Process and Results

The analysis of the regulatory drivers for groundwater monitoring for the OSDF was conducted by examining the suite of ARARs in the Fernald Preserve's approved OU RODs to identify a subset of specific groundwater monitoring requirements for OSDF. Three RODs (for OU2, OU3, and OU5) include requirements related to on-site disposal. The RODs for these three OUs were reviewed and the ARARs relevant to the OSDF identified. The results of this review are provided in Appendix A and summarized below.

The following regulations were identified as being ARARs for the OSDF groundwater monitoring program:

- Ohio Solid Waste Disposal Facility Groundwater Monitoring Rules, Ohio Administrative Code (OAC) 3745-27-10, which specify groundwater monitoring program requirements for sanitary landfills (note that the OSDF is not a sanitary landfill). These regulations describe a three-tiered program for detection, assessment, and corrective measures monitoring.
- Resource Conservation and Recovery Act (RCRA)/Ohio Hazardous Waste Groundwater Monitoring Requirements for Regulated Units, title 40 *Code of Federal Regulations* (CFR) 264.90 through .99 (OAC 3745-54-90 through 99), which specify groundwater monitoring program requirements for surface impoundments, landfills, and land treatment units that manage hazardous wastes. Similar to the Ohio Solid Waste regulations, these regulations describe a three-tiered program of detection, compliance, and corrective action monitoring. Because the Ohio regulations mirror or are more stringent than the federal regulations, the Ohio regulations are the controlling requirements and are cited within this document.
- Uranium Mill Tailings Reclamation and Control Act (UMTRCA) Regulations, 40 CFR 192.32(A)(2), which specify standards for uranium byproduct materials in piles or impoundments. This regulation requires conformance with the RCRA groundwater monitoring performance standard in 40 CFR 264.92. Compliance with RCRA/Ohio Hazardous Waste regulations for groundwater monitoring will fulfill the substantive requirements for groundwater monitoring in the UMTRCA regulations.

- DOE Order M 435.1 1, *Environmental Monitoring*, which requires low level radioactive waste disposal facilities to perform environmental monitoring for all media, including groundwater. Compliance with RCRA/Ohio Hazardous Waste and Ohio Solid Waste regulations for groundwater monitoring will fulfill the requirement for groundwater monitoring in this Order, along with incorporating pertinent radiological parameters.

The following drivers necessitated an overall leak detection strategy:

- Ohio Municipal Solid Waste Rules, OAC 3745-27-06(C)(9a) and OAC 3745-27-10, which require that facilities prepare a groundwater monitoring plan that incorporates leachate monitoring and management to ensure compliance with OAC 3745 27 19(M)(4) and OAC 3745 27 19(M)(5).
- Ohio Municipal Solid Waste Rules – Operational Criteria for a Sanitary Landfill Facility, OAC 3745 27 19(M)(4) and (5), which require submittal of an annual operational report including:
  - A summary of the quantity of leachate collected for treatment and disposal on a monthly basis during the year, location of leachate treatment and/or disposal, and verification that the leachate management system is operating in accordance with the rule.
  - Results of analytical testing of an annual grab sample of leachate from the leachate management system.

3.2 OSDF Monitoring Regulatory Compliance Strategy

Of the ARARs presented above, the Ohio Solid Waste and the Ohio Hazardous Waste regulations are the most prescriptive and, therefore, warrant further discussion on how compliance with these two regulatory requirements will be met. The leak detection monitoring requirements of these two sets of regulations are similar, and they dictate the development of detection monitoring plans capable of determining the facility's impact on the quality of water in the uppermost aquifer and any significant zones of saturation above the uppermost aquifer underlying the landfill.

Typically a detection monitoring program consists of the installation of upgradient and downgradient monitoring wells, routine sampling of the wells, and analysis for a prescribed list of parameters, followed by a comparison of water quality upgradient of the landfill to water quality downgradient of the landfill. The detection of a statistically significant difference in downgradient water quality suggests that a release from the landfill may have occurred.

As discussed in Section 2.0, low permeability in the glacial till and preexisting contamination within the glacial till and the Great Miami Aquifer add complexity to the development of a groundwater detection monitoring program consistent with the standard approach of the Solid and Hazardous Waste regulations. Both sets of regulations accommodate such complexities by allowing alternate monitoring programs, which provide flexibility with respect to well placement, statistical evaluation of water quality, facility specific analyte lists, and sampling frequency. The OSDF groundwater/leak detection monitoring program has required the use of an alternate monitoring program, in accordance with the criteria in the Ohio Solid and Hazardous Waste regulations. Compliance with the criteria is discussed below in Section 3.2.1.

The regulatory requirements for the leachate monitoring program are provided by the Ohio Solid Waste regulations. The compliance strategy for the leachate monitoring program is discussed below in Section 3.2.2.

3.2.1 Leak Detection Monitoring Compliance Strategy

The groundwater/leak detection monitoring program for the OSDF includes routine sampling and analysis of water drawn from four zones within and beneath the disposal facility including the LCS, the LDS, perched water within the glacial till, and the Great Miami Aquifer. This four-layered "holistic" approach allows the earliest leak detection from the OSDF given the unique hydrogeologic and preexisting contaminant situation at the site. However, this tailored approach differs from a typical leak detection monitoring program in several ways, and requires a compliance strategy to ensure that the program meets or exceeds the substantive requirements within the Ohio Solid and Hazardous Waste regulations. Below is a detailed discussion of compliance with several elements of the program, including alternate well placement, statistical analysis, monitoring frequency, and parameter selection. The implementation of the OSDF groundwater/leak detection program is presented in Section 4.0 and Appendix B.

3.2.1.1 Alternate Well Placement

The Ohio Solid Waste regulations require that a groundwater monitoring system consist of a sufficient number of wells, installed at appropriate locations and depths, to yield groundwater samples from both the uppermost aquifer and any overlying significant zones of saturation (OAC 3745-27-10(B)(1)). Groundwater samples will be obtained through wells installed in the glacial till as well as the Great Miami Aquifer.

The regulations also state that the wells must represent the quality of groundwater passing directly downgradient of the limits of solid waste placement (OAC 3745-27-10(B)(1)(b)). In lieu of installing vertical glacial till monitoring wells along the perimeter of the OSDF, horizontal wells will be installed beneath the OSDF and screened beneath the liner penetration box of the LDS for each disposal cell where the greatest potential for leakage exists. Horizontal wells are preferred to vertical wells due to restrictions on well installation within 200 ft of waste placement so as to avoid interference with the disposal facility cap, and the absence of significant lateral flow within the overburden. The time required for contaminants to migrate laterally in the till toward wells located 200 ft from the limits of waste placement greatly exceeds the vertical travel time through the glacial till; therefore, the aquifer would be impacted by contaminants long before OSDF HTWs could detect the release. Although the existence of the OSDF may result in dewatering of the glacial till such that samples cannot be regularly obtained, horizontal wells installed beneath the liner of the OSDF represent the highest potential for detecting releases to the till. Such an alternate placement for the till wells is allowed in the Ohio Solid Waste regulations.

The performance criteria in OAC 3745-27-10(B)(4) require that the number, spacing, and depth of the wells must be based on site-specific hydrogeologic information and must be capable of detecting a release from the facility to the groundwater at the closest practical location to the limits of solid waste placement. The placement of till wells beneath the facility, as opposed to along its perimeter, meets or exceeds the requirement to be located adjacent to waste placement.

3.2.1.2 Alternate Statistical Analysis

A statistical analysis is required in both the Ohio Solid and Hazardous Waste regulations (OAC 3745 27 10(C)(6) and OAC 3745 54 97(H)). The statistical analysis methods listed in the regulations are: parametric analysis of variance (ANOVA), an ANOVA based on ranks, a tolerance or prediction interval procedure, a control chart approach, or another statistical test method. To date, the control chart approach (combined Shewart CUSUM control charts) has been used as it has been determined the most viable approach; however, problems with control charts are listed below. The method of evaluation for the OSDF groundwater/leak detection monitoring data is an intra-well trend analysis prior to the establishment of background (baseline) conditions in the perched water and Great Miami Aquifer beneath the OSDF. Statistically significant evidence of an upward trend would warrant further technical review, as necessary.

Although vertical monitoring wells are installed in the Great Miami Aquifer upgradient and downgradient of the OSDF, an intra-well comparison is more appropriate than an upgradient versus downgradient comparison until aquifer restoration is complete. Transient flow conditions within the aquifer, as well as the existence and anticipated fluctuation of contaminant concentrations at levels below the FRLs, discourage the use of a statistical comparison of upgradient and downgradient water quality as a reliable indicator of a release from the OSDF.

To date, establishing baseline conditions with statistical analyses has proven to be difficult due mainly to existing trend issues. Steady-state conditions, which are a requirement of control charting, have not been reached. In a letter dated April 19, 2007, DOE requested that control charts be excluded from the 2006 Site Environmental Report because it does not technically make sense to provide them until it has been determined that constituent-specific steady-state conditions have been established. A common ion study is underway that is scheduled to be completed in 2007. When the common ion study is complete, and the data have been compiled, DOE plans on meeting with the EPA/OEPA to go over the data and discuss the OSDF leak detection monitoring program and associated reporting. Once it has been demonstrated that steady-state conditions have been established, control charts could be provided in ASERs. OEPA concurred with this strategy in a letter dated May 21, 2007 (OEPA 2007).

Note: Trend analyses will continue to be performed/prepared annually, and it is anticipated that a statistical approach that includes a comparison to a statistically determined limit based on baseline data (such as control charts) will be the final procedure for evaluating OSDF monitoring data, in accordance with the regulatory citations discussed in Section 2.0. The purpose of the trend analyses currently being conducted is to assist in determining when reliable baseline statistics can be calculated.

3.2.1.3 Alternate Parameter Lists

The process used to select the indicator parameter list, described in detail in Appendix E, used the extensive RI database, and fate and transport modeling to evaluate potential indicator parameters. RIs have been completed for all Fernald Preserve source terms and contaminated environmental media. The RIs included extensive sampling and analysis to characterize wastes and quantify environmental contamination so that health protective remedies, such as the construction of the OSDF, could be selected.

Extensive databases were also used to develop WAC, which consist of concentration and mass-based limitations on the waste entering the OSDF. The WAC for the OSDF were developed with consideration of the types, quantities, and concentration of wastes that would be placed into the OSDF; the leachability, mobility, persistence, and stability of the waste constituents in the environment; and the toxicity of the waste constituents. Of 93 constituents that were evaluated for waste acceptance, 18 were identified as having a relatively higher potential to impact the aquifer within the 1,000-year specified performance period. Maximum allowable concentration limits were established for wastes containing these constituents.

The factors used to establish WAC are similar to the consideration criteria for developing an alternate parameter list specified in the Ohio Solid and Hazardous Waste regulations (OAC 3745-27-10(D)(2) and (3); OAC 3745-54-93(B); OAC 3745-54-98(A)); and OEPA policy and guidance (OEPA 1995, OEPA 1996, OEPA 1997). The methodology for developing an OSDF specific leak detection monitoring parameter list used the WAC methodology and the Ohio Solid and Hazardous Waste regulatory criteria to identify waste constituents that are expected to be derived from wastes placed in the OSDF. It should be noted that this exercise was not completely successful, as waste materials are nearly identical in composition to material outside of the OSDF.

Additionally, review of data collected during OSDF monitoring has indicated that the majority of the constituents, which are sampled initially for baseline, are not detected. It has been agreed upon by DOE, OEPA, and EPA that the list of constituents monitored can be refined to those that were detected more than 25 percent of the time. This is discussed further in Appendix E.

At this time, it is also understood that baseline conditions have not been established for any cell. In order to differentiate the types of monitoring, DOE will refer to baseline monitoring in the following two ways:

- Initial Baseline Monitoring – based on 12 rounds of samples for those initial site-specific leak detection monitoring parameters.
- Refined Baseline Monitoring – based on initial baseline parameters that are detected 25 percent or more of the time.

Specific monitoring parameter information is further discussed in Appendix E.

Note: Fernald Preserve has elected to perform up to 12 rounds of initial baseline sampling for both the perched system and the Great Miami Aquifer for all initial site-specific leak detection monitoring parameters.

Additionally, it should be noted that establishing baseline water chemistry in the perched groundwater and Great Miami Aquifer horizon under each cell is complicated by the construction process used to install the HTWs and the existence of past groundwater contamination in the till and Great Miami Aquifer zones. The installation of the HTWs involved excavation of a trench, placement of a porous filter media composed of sand, and then backfill with the porous media and till material. During this installation, the subsurface chemical properties of the till were altered by the contact of the excavated till material with the atmosphere (oxygen-rich environment). Contact of the subsurface till with the atmosphere may have impacted (1) the oxidation state of metals on the surface of grains and in the pore water and (2) microbial species that mediate oxidation/reduction reactions in the subsurface. Additionally, historical contamination in perched groundwater and Great Miami Aquifer horizons surrounded the cell may be migrating and diffusing into the horizontal and Great Miami monitoring wells.

In the March 2005 technical information exchange meeting, it was agreed between DOE, EPA, and OEPA that, in general, from a statistical standpoint, steady-state conditions in the groundwater (perched water and Great Miami Aquifer) have not been reached regarding OSDF monitoring. Therefore, baseline conditions could not be established at that time. In a letter dated April 19, 2007, DOE requested that control charts be excluded from the 2006 Site Environmental Report because it does not make sense to provide them until it has been determined that constituent-specific steady-state conditions have been established (DOE 2007). A common ion study is underway and is scheduled to be completed in 2007. When the common ion study is complete and the data have been compiled, DOE plans on meeting with EPA and OEPA to go over the study and discuss the OSDF leak detection monitoring program and associated reporting. Once it has been demonstrated that steady-state conditions have been established, control charts could be provided in ASERs. OEPA concurred with this strategy in a letter dated May 21, 2007.

With respect to trend analysis, it is not unexpected that concentrations in any one or a number of horizons might be trending upward. Upward trends are not necessarily indicative of a leak, but they can indicate changes in the environment surrounding the system. For example, the LCS concentrations could reflect more concentrated water as the leachate ages and the capped cells dry up. Also, there is the preexisting contamination in the Great Miami Aquifer, which could cause upward trends in concentrations as well. It is important to look at the overall LCS and LDS flow trends and concentration levels to evaluate the integrity of all components in the system.

The challenges noted above are being met with an extended monitoring period prior to establishing baseline, a significant increase in the number of parameters on the monitoring list, and a common ion study. The intent of the common ion study is to verify the presence of groundwater aging and to help assess when statistically-based leachate monitoring data analysis can be implemented. Observation and trend analysis during the extended monitoring period will determine if the monitored parameters reach a steady-state condition or continue to increase or decrease. Analysis of leachate and groundwater samples for common major and minor ions will allow a better quantitative assessment of the geochemistry in each horizon and identification of potential indicator ions for contaminant migration.

3.2.1.4 Alternate Sampling Frequency

The Ohio Solid Waste regulations require that, for detection monitoring, at least four independent samples from each well will be taken during the first 180 days after implementation of the groundwater detection monitoring program and at least 8 independent samples in the first year to determine the background (i.e., baseline) water quality (OAC 3745-27-10(D)(5)(a)(ii)(a)). The requirement to collect eight independent samples is only applicable to those wells installed after August 15, 2003, because that is the date that the code became effective. The Ohio Hazardous Waste regulations do not specify a frequency for determining a background dataset. The Ohio Hazardous Waste regulations do require a performance standard for establishing background; OAC 3745-54-97(G) states that the number and kinds of samples taken to establish background be appropriate for the statistical test employed.

Experience and technical knowledge gained from cell monitoring indicated that it was necessary to collect initial baseline samples quarterly. Sampling frequencies were based on the following: HTWs and Great Miami Aquifer wells were sampled bimonthly after waste placement until 12 samples were collected for statistical evaluation. These frequencies were selected to develop an appropriate statistical procedure, to address OSDF construction schedules, and to compensate for the varying temporal conditions and seasonal fluctuations. After sufficient samples were collected for statistical analysis, samples were collected quarterly from the HTWs and Great Miami Aquifer. The Ohio Solid Waste regulations allow for a semiannual sampling frequency for detection monitoring after the first year but also allow for the proposal of an alternate sampling program (OAC 3745-27-10(D)(5)(a)(ii)(b) and (b)(ii)(b), and 3745-27-10(D)(6)). After each cell is capped, the monitoring for each of the four components (i.e., the LCS, LDS, HTW, and Great Miami Aquifer wells) for the site-specific leak detection indicator parameters will be performed semiannually to continue to meet regulatory requirements. However, it is important to note that the frequency of monitoring may be increased again if it is found to be needed to help establish baseline conditions.

3.2.2 Leachate Monitoring Compliance Strategy

The Solid Waste regulations (OAC 3745-27-19(M)(5)) require collection and analysis of leachate annually for Appendix I and polychlorinated biphenyl (PCB) parameters listed in OAC 3745-27-10. Leachate samples from the LCS have been collected and analyzed for site-specific leak detection indicator parameters to support leachate treatment and discharge, as well as the annual analysis for Appendix I parameters and PCBs. The annual grab sample analysis for Appendix I parameters and PCBs ensures the accuracy of assumptions regarding the nature of wastes within the OSDF, which were used to develop the groundwater/leak detection parameter list.

Although constituents that are not part of the limited indicator parameter list for leak detection may be detected in the annual grab sample, it is not anticipated that the concentrations will be high enough to warrant revision of the leak detection parameter list. However, a review of the data will be conducted (and reported through the ASERs) to determine if any new indicator constituents should be added to the site-specific leak detection indicator parameter list. Constituent concentrations will be reviewed against information gathered during the OU5 RI/FS period and subsequent environmental monitoring data. OSDF annual LCS data will be compared to factors such as Great Miami Aquifer and perched water background values, range of site perched water concentrations, and current laboratory contract required detection limits. Ultimately, a constituent will be added if routine analysis of the constituent can significantly enhance early detection capability. The leak detection/leachate analysis will ensure that the character of the leachate will not adversely impact the treatment facility or the treatment facility effluent receiving stream (the Great Miami River).

Because waste is no longer being placed in the OSDF and an alternate sampling constituent list has been approved for the OSDF, it is envisioned that after completion of the common ion study that collection of an annual grab sample from the LCS of each cell to be tested for Appendix I and PCB parameters listed in OAC 3745-27-10 will no longer be required and this annual sampling/analysis task will stop. Annual sampling from the LCS of each cell will instead focus on site-specific parameters that have been approved for the facility. Annual sampling of the LCS of each cell for Appendix I and PCB listed parameters will not stop until concurrence has been obtained from the EPA/OEPA.

Although not specified in the OU RODs as an ARAR, the federal RCRA (Hazardous Waste) regulations include specific requirements in 40 CFR 264.303 for monitoring the volume of liquid collected from a disposal facility's LDS. Regulation 40 CFR 264.302 includes provisions for determining an "action leakage rate" that, if exceeded, would prompt specific response and notification actions. An action leakage rate of 200 gallons per acre per day (gpad) and an initial response leakage rate of 20 gpad were established during the design of the OSDF. The response and notification process for an exceedance of the both the initial response leakage rate and the "action leakage rate" (40 CFR 264.304) is provided in Section 6.0.

The leachate monitoring strategy, as part of the groundwater monitoring plan and required by OAC 3745-27-06(C)(7), must include provisions for obtaining the monthly volume of leachate collected for subsequent treatment, provide the method of leachate treatment and/or disposal, and include verification that the leachate management system is operating properly (OAC 3745-27-19(M)(4)). Monitoring to verify that the leachate management system is operating properly is identified in the OSDF *Enhanced Permanent Leachate Transmission System Operation* (DOE 2005b) procedure and in Appendix D of this document.

The monthly volume of leachate collected for treatment and subsequent disposal will be obtained based on the program in 40 CFR 264.303(c) to determine the flow rates of leachate collected in the LCS and water in the LDS. Monitoring the flow rates will provide data for determining the volume of leachate collected and will also provide data pertinent to the leak detection monitoring program. The flow rates are part of the leak detection monitoring program and are discussed further in Section 4.0. A separate leachate management monitoring strategy is provided as Section 5.0 to provide information on the method of leachate treatment and disposal, including analysis of parameters useful for leachate treatment. Section 5.0 also includes a discussion on obtaining an annual grab sample to be analyzed for Appendix I parameters and PCBs, in order to comply with the requirement in OAC 3745-27-19(M)(5).

4.0 Leak Detection Monitoring Program

This section presents the technical approach for leak detection monitoring at the OSDF, in light of the regulatory requirements for leak detection monitoring summarized in Section 3.0. This section includes a summary of the objectives of the program, a description of the major program elements, the selection process for analytical parameters (i.e., site-specific leak detection indicator parameters), the monitoring to be employed after cells have been capped, and the strategy for evaluating the data to determine whether a leak has occurred. The subsections are as follows:

- Section 4.1: Introduction.
- Section 4.2: Monitoring Objectives.
- Section 4.3: Leak Detection Monitoring Program Elements.
- Section 4.4: Leak Detection Sample Collection.
- Section 4.5: Leak Detection Data Evaluation Process.

Additionally, Appendixes B and C provide the Project-Specific Plan and Data Quality Objectives for the OSDF Monitoring Program for each cell, with details on specific monitoring lists and frequencies. Appendix E describes the selection process for site-specific leak detection indicator parameters. Section 5.0 describes the overall leak detection strategy including the collection and analysis of an annual leachate grab sample for Appendix I and PCB parameters per OAC 3745-27-10 and 19 to confirm the adequacy and appropriateness of the selected site-specific leak detection indicator parameters. A summary of the notifications and potential follow up response actions that accompany the monitoring program are provided in Section 6.0.

4.1 Introduction

As discussed in Section 1.0, the OSDF leak detection monitoring program constitutes the first tier of a three-tiered detection, assessment, and corrective action monitoring strategy that is required for engineered disposal facilities. Consistent with this three-tiered approach, follow up assessment and corrective action monitoring plans will be developed and implemented as necessary if it is determined that a leachate leak from the OSDF has occurred. Conversely, if the detection monitoring successfully demonstrates that leachate leaks have not occurred, then the monitoring program will remain in the first-tier "detection mode" indefinitely. The follow-up assessment and/or corrective action monitoring plans, if found to be necessary, would be prepared as new, independent plans that would supersede this first-tier detection program.

The leak detection monitoring program employs a multi-component, holistic approach for leak detection, relying on the collective responses obtained from four components: an LCS inside the OSDF; an LDS inside the OSDF and below the LCS; a perched groundwater monitoring component located beneath the compacted clay liner immediately below the LDS and LCS liner penetration boxes (refer to Figure 4–1); and a Great Miami Aquifer monitoring component, found at depths ranging from 40 to 90 ft beneath the OSDF. The data collected from the four components will be evaluated comparatively over time, so that short-term and long-term response relationships between the components can be effectively delineated.

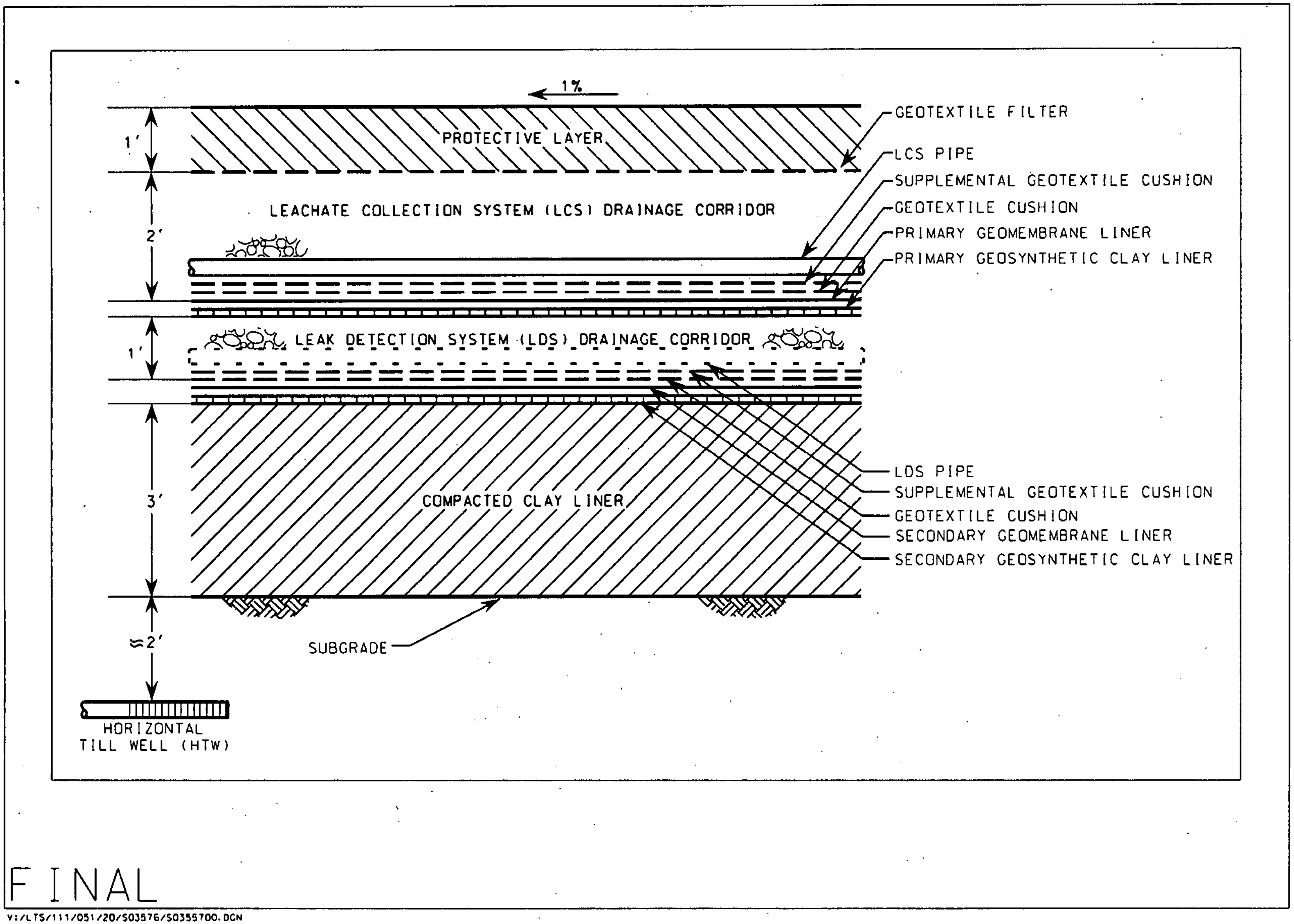

Figure 4–1. On-Site Disposal Facility Liner System with HTW at the Drainage Corridor

The Great Miami Aquifer is the prime resource of concern that could potentially be affected by the OSDF in the unlikely event that a leachate leak occurred. Therefore, it makes sense to monitor the aquifer at the immediate boundary of the OSDF. However, as discussed in Section 2.0, contaminant travel times to the aquifer through the glacial till beneath the OSDF are of such length that reliance on Great Miami Aquifer monitoring alone would be insufficient to provide effective early warning of a leak from the facility. The overriding intention of the holistic approach, therefore, is to ensure that there is no reliance on any one element alone to determine whether leakage has occurred. As is demonstrated in this section, the groundwater/leak detection monitoring program includes the establishment of baseline conditions in the disturbed and native environment underlying the OSDF (i.e., perched and Great Miami Aquifer groundwater) to be used as a point of comparison during the system wide evaluation of trends. Following the establishment of baseline conditions, the follow-up sampling conducted at each monitoring interval would provide a view of conditions that are present in each of the four components, which can be compared to past results to determine the collective significance of trends or intermittent fluctuations in the data.

To date, establishing baseline conditions based on statistical analyses has proven to be difficult due mainly to existing trend issues. Steady-state conditions, which are a requirement of control charting, have not been reached. In a letter dated April 19, 2007, DOE requested that control charts be excluded from the 2006 Site Environmental Report because it does not technically make sense to provide them until it has been determined that constituent-specific steady-state conditions have been established. A common ion study is underway that is scheduled to be completed in 2007. When the common ion study is complete, and the data have been compiled, DOE plans on meeting with EPA and OEPA to go over the data and discuss the OSDF leak detection monitoring program and associated reporting. Once it has been demonstrated that steady-state conditions have been established, control charts could be provided in ASERs. OEPA concurred with this strategy in a letter dated May 21, 2007.

Additionally, as indicated in Sections 1.1 and 3.0, there is institutional knowledge regarding the various complexities associated with the regulatory strategy for the OSDF leak detection and data evaluation processes. This information should be considered during future post-closure evaluations. To date, the process continues to evolve and there is much interaction between DOE, EPA, and OEPA regarding the overall process.

4.2 Monitoring Objectives

The fundamental objective of the leak detection monitoring program is to provide early detection of a leak from the facility, should one occur. Recognition of this fundamental objective allows the Fernald Preserve to move confidently into the next regulatory-based tiers of the program—assessment and corrective action monitoring—if required. This fundamental objective is the primary driver for all of the key site-specific elements (i.e., monitoring locations, frequencies, analytical parameters, and follow up response actions) of the program.

In addition to this fundamental objective, there are several other objectives that have been considered in the site-specific design of the leak detection program:

- The program should have the ability to distinguish an OSDF leak from the above background preexisting levels of contamination that are found in the subsurface.
- All monitoring wells must be installed at locations and with construction methods that do not interfere with or compromise the integrity of the cap and liner system of the OSDF.
- The program needs to satisfy the site-specific regulatory requirements for leak detection monitoring summarized in Section 3.0.

The leak detection monitoring approach described below meets the intent of providing early detection of a release from the OSDF within the hydrogeologic regime at the Fernald Preserve, and is tailored to accommodate the additional program design objectives summarized above.

4.3 Leak Detection Monitoring Program Elements

4.3.1 Overview

The success of the leak detection monitoring strategy for the OSDF is dependent upon how well the strategy integrates with facility integrity concerns (cap and liner system performance) and how well the groundwater component of the strategy addresses hydrogeologic conditions in the till and aquifer. The trends revealed by groundwater monitoring data need to be effectively integrated with leachate production information within the OSDF in order to provide a comprehensive evaluation of the OSDF performance and integrity.

The approved design for the OSDF is presented in detail in the initial OSDF Design Package and subsequent approved follow up design and construction drawing packages. The OSDF consists of eight individual cells that were constructed in phases. As shown in Figure 4–1, the liner for each cell is a composite liner system, assembled from the following layers (top to bottom): a soil cushion layer, geotextile fabric, LCS drainage layer, primary composite liner, high-density polyethylene (HDPE) (geotextile fabric, HDPE geomembrane, and geosynthetic clay liner), LDS drainage layer, and the underlying secondary composite liner (HDPE geomembrane, geosynthetic clay liner, and compacted clay). Both the LCS and LDS layers drain to the west within each cell. At the western edge of each cell liner, any liquid within the LCS and LDS is collected in pipes that pass through the liner penetration box and flows to the respective cell's valve house. As identified previously, the liner penetration box represents the area with the greatest leak potential for each cell and is considered the primary location where a leak would first enter the environment if a leak were to occur.

Each cell is also constructed with an engineered composite cover. The cover system consists of the following layers (top to bottom): a vegetative cover layer, a topsoil layer, a granular filter layer, a bio-intrusion barrier, a geotextile filter, a cover drainage layer, the primary composite cap (geotextile cushion, HDPE geomembrane, geosynthetic clay liner, and compacted clay), and an underlying contouring layer. The cover system was completed in 2006. Now that the cover system is in place and the cell contents are anticipated to reach equilibrium, leachate production is expected to diminish as a result of the moisture infiltration barrier properties of the cover system. During the time that the cell contents move towards equilibrium, leachate accumulation in the LCS drainage layer is expected to diminish over time.

The leak detection monitoring program involves (1) tracking the quantity of liquid produced within the LCS and LDS over time, and (2) the periodic water quality monitoring of the leachate, the perched groundwater, and the Great Miami Aquifer groundwater. Monitoring activities during post-closure operations consist of initial baseline, refined baseline, and post baseline monitoring, which use components of site-specific analytical parameters, to effectively implement a holistic comparative approach. The performance of each cell is monitored individually, on its own merit; each cell has its own engineered LCS and LDS drainage layers, perched groundwater monitoring component, and upgradient and downgradient Great Miami Aquifer monitoring wells.

4.3.2 Monitoring the Engineered Layers within the OSDF

Water quality samples are collected from individual LCS and LDS drainage layers within each cell during waste placement and after cell closure as described below and in Section 5.0. In addition to water quality monitoring, the quantity of leachate and fluid flowing through the LCS and LDS layers is recorded and reported. This information is used to support a collective qualitative trend analysis for each cell of the OSDF as discussed later in this plan.

4.3.2.1 Leachate Collection System

The LCS drainage layer functions primarily to collect infiltrating water and to keep it from entering the environment. As each cell is capped the volume of leachate decreases, which may, at some time in the future, limit the available sample volume and possibly affect the number of parameters that can be analyzed. The LCS drains to the west through an exit point in the liner to the leachate transmission system located on the west side of the OSDF. From there, the leachate collected is periodically pumped to the CAWWT backwash basin or directly to CAWWT feed tanks. Both flow (quantity/volume) and water quality information are collected from the LCS drainage layer according to Section 4.4, and Appendix B (of the OSDF Project Specific Plan).

4.3.2.2 Leak Detection System

By design, the primary composite liner located underneath the LCS drainage layer should not leak. By design, leachate that accumulates in the LCS drainage layer above the primary liner is drained by gravity out of the cells to further reduce the potential for leakage by minimizing the level of fluid buildup in the primary liner. Notwithstanding this design, a second fluid collection layer, the LDS drainage layer, is positioned beneath the primary composite liner to provide a means to track the integrity and performance of the primary liner. In the event that fluids collect within the LDS layer, by design the fluids gravity drain to the west, out of the cells, where they are routed for treatment.

Similar to the LCS, a greater volume of fluids may initially collect in the LDS as the moisture content of the materials comprising the liner move toward long-term equilibrium levels. This fluid volume is expected to gradually decrease over the long term. Below the LDS drainage layer is a secondary composite liner comprised of an HDPE geomembrane, geosynthetic clay liner, and compacted clay. This secondary liner serves as the lowermost hydraulic barrier in the liner system and inhibits fluids from entering the environment before they are collected and removed through the LDS drainage layer.

Like the LCS drainage layer, both flow (quantity/volume) and water quality information are collected from the LDS drainage layer according to Section 4.4, and Appendix B (of the OSDF Project-Specific Plan).

4.3.3 Monitoring the Perched Groundwater

The perched groundwater monitoring component of the program is designed to monitor for the presence of leachate leakage from the OSDF at its first point of entry into the Fernald Preserve's natural hydrogeologic environment. As discussed in Section 1.0, EPA, OEPA, and DOE concur that a horizontally oriented glacial till monitoring well (i.e., HTW), positioned directly beneath the location of the LCS and LDS liner penetration box in each cell, represents the most feasible site-specific approach to monitor for first entry leakage from the OSDF into the Fernald Preserve's environment.

The HTWs have been installed as part of the sub-grade construction activities for each of the cells comprising the OSDF. The individual wells were installed prior to waste placement, therefore eliminating final positioning uncertainties that would be associated with post-construction horizontal drilling techniques. The vertical portion of each of the monitoring wells is located along the western side of the OSDF, while the sample collection interval is positioned beneath the bottom of the secondary composite liner in alignment with the location of the LCS and LDS liner penetration box.

Lithologic and hydraulic characterization of the till in the vicinity of the OSDF indicates that the clay-rich deposits of carbonate and silicate grains may not readily yield fluid to a well. The amount of saturation in the till is further reduced by the barrier properties of the composite cover and liner system of the OSDF, which operate to significantly reduce local infiltration beneath the facility. These conditions may make it difficult or impossible to obtain sufficient sample volume from the till wells to perform detailed water quality analyses. In the event sufficient sample volume cannot be obtained to perform the full list of required analyses, a priority list will be implemented as necessary as identified in Appendix B.

Water quality information is collected from the HTWs according to Section 4.4 and Appendix B (of the OSDF Project Specific Plan).

4.3.4 Monitoring the Great Miami Aquifer

The subsections below describe the Great Miami Aquifer component of the program, including a discussion of the influence of planned aquifer restoration activities on the program, the siting of the monitoring wells, and the use of the groundwater models (i.e., Variably Saturated Analysis Model in 3 Dimensions [VAM3D] and Sandia Waste Isolation Flow and Transport [SWIFT]) to evaluate the adequacy of the planned well locations.

4.3.4.1 Siting of the Great Miami Aquifer Monitoring Wells

The Great Miami Aquifer monitoring wells are located immediately adjacent to the OSDF, just outside the footprint of the final composite cap configuration, so as not to interfere with the integrity of the facility. Each cell has its own set of monitoring wells to assist with the evaluation of conditions associated with that cell. As each new cell has been brought online, its associated monitoring wells have been installed before (or concurrently with) the construction of the cell liners so that the wells have been available for the initiation of baseline sampling prior to waste placement. Thus, the well installations have followed the north-to-south progression of OSDF cell construction. The OSDF is bordered by a network of 18 Great Miami Aquifer monitoring wells that provide upgradient and downgradient monitoring points for each cell (refer to Figure 4–2). All monitoring wells were constructed in accordance with the *Sitewide CERCLA Quality Assurance Project Plan* (DOE 2003) for Type 2 Great Miami Aquifer wells.

The overall objective of the Great Miami Aquifer component of the leak detection monitoring program is to provide long-term surveillance. Therefore, the current and future (post-remediation) aquifer flow conditions were used to select the 18 monitoring locations. As discussed in the next subsection, groundwater flow and particle tracking using both the VAM3D and the SWIFT groundwater modeling computer codes were used to help select the final monitoring locations identified in this plan.

4.3.4.2 VAM3D Flow Model and SWIFT Transport Model Evaluation of Well Locations

The VAM3D and SWIFT groundwater modeling codes were used to evaluate the adequacy of the density and locations of the monitoring wells planned for the Great Miami Aquifer. The modeling effort examined the fate of a hypothetical release from each cell to the aquifer at a point directly beneath the liner penetration box of the LCS and LDS. The modeling predicted the most likely flow path and plume configuration for particles released from the liner penetration box area over time. The modeling was conducted for post aquifer remediation conditions (when groundwater flow directions would be from west to east). The original modeling was performed using the SWIFT computer and has been updated subsequently using the VAM3D computer code. (Note: Modeling was performed on the assumption that there would be nine cells.)

Particle flow path modeling was conducted using the VAM3D flow model output from two model runs representing seasonal wet and dry conditions within the aquifer. Fifteen particles were seeded in a 125-ft radius around each of nine model nodes located nearest the nine cell liner penetration box locations. These particles were tracked for a 20-year period with no retardation. The velocity flow field data from the post aquifer remediation scenario shows the advective particle path results (refer to Figure 4–3). The particle tracks are generally from west to east beneath the OSDF. As indicated in the figure, the tracks deviate slightly in the north-south direction with seasonal water level fluctuations in the aquifer. Downgradient monitoring wells were located in the area traced out by the modeled flowpaths for each OSDF cell in order to be in the most likely position to detect a leak based on anticipated groundwater flow. These flow model results are similar to the flow modeling results previously obtained with the SWIFT groundwater model, which was used prior to converting to the VAM3D modeling code. Monitoring wells for Cells 1 through 3 were placed based on the results from the SWIFT groundwater flow model and monitoring wells from Cells 4 through 8 were placed based on the results from the VAM3D flow model (DOE 2000).

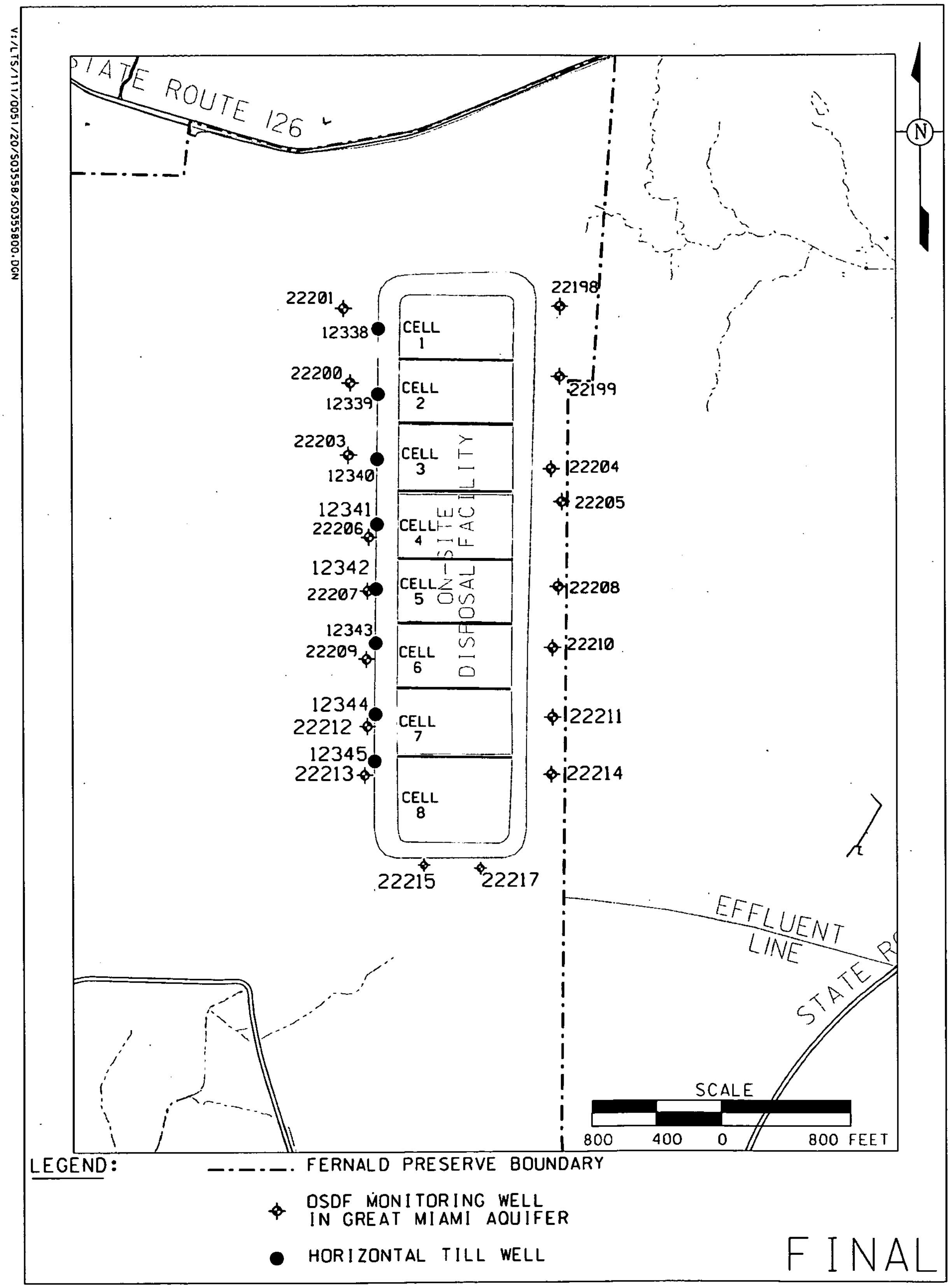

Figure 4–2. OSDF Well Locations

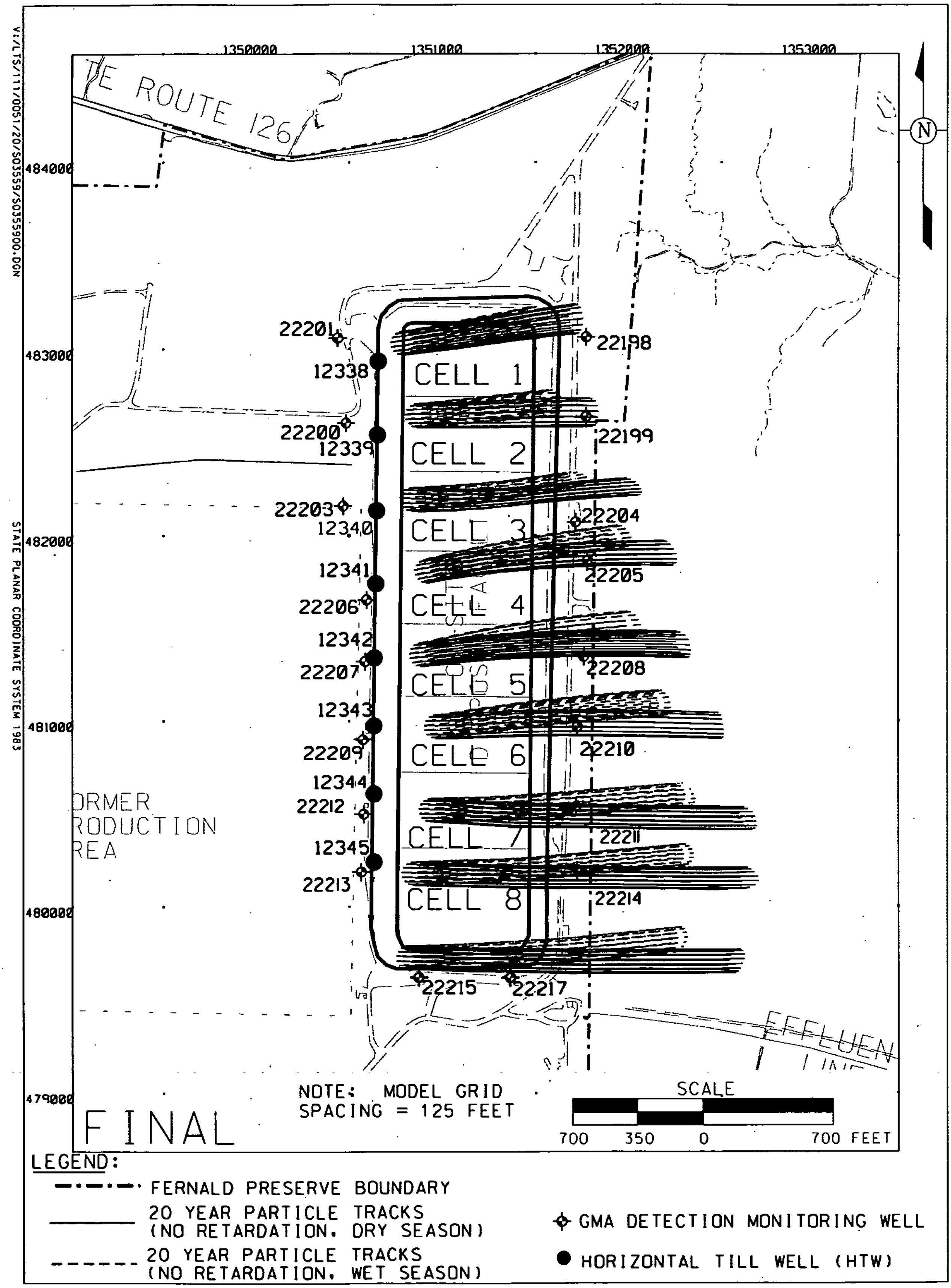

Figure 4–3. Post-Remediation Scenario

An earlier SWIFT model transport simulation was performed for Revision 0 of this plan to determine if the density of the downgradient Great Miami Aquifer monitoring well network is adequate to detect the smallest contaminant plume resulting from a leak in the OSDF that would be of concern. Those SWIFT model results are included here for completeness. The SWIFT model was used to simulate a leak from the cell liner penetration box beneath Cell 3 under natural flow gradients with no on-site pumping. Model simulations for both uranium and technetium 99 were performed. Constant loading from the cell was simulated throughout the model run such that a plume of minimum areal extent (i.e., a plume with maximum concentration equal to the FRL) was maintained in the aquifer. Hypothetical plumes of 20 parts per billion and 94 picocuries per liter were maintained for uranium and technetium 99, respectively. The plumes were loaded from two hypothetical locations. One location was approximated to be beneath the cell liner penetration box at the western edge of Cell 3 in order to represent the most likely leakage point from the cell. The other location was farther east, in order to provide a more conservative scenario where the plume would have less time to expand before the leading edge would reach the downgradient monitoring well network.

The modeling results for uranium at model year 55 (2051) and for technetium 99 at model year 30 (2026) are shown in Figures 4–4 and 4–5, respectively. (Note: Modeling was performed on the assumption that there would be nine cells.) The durations were determined from the modeling, and they represent the period of time under constant loading for the respective plumes to disperse to the width of the spacing distance between monitoring wells (approximately equal to the OSDF cell width). Modeling results indicate that the density of downgradient Great Miami Aquifer monitoring wells is sufficient to detect this minimal plume given the lateral expansion and the plume width under this minimal constant loading.

The width of each plume from horizontal dispersion is approximately the width of an OSDF cell, indicating that one downgradient Great Miami Aquifer monitoring well per cell is sufficient to ensure that a Great Miami Aquifer contaminant plume would be detected. Therefore, the configuration of Great Miami Aquifer wells (shown in Figure 4–2) is sufficient both in terms of well density and location for the OSDF leak detection monitoring program.

4.4 Leak Detection Sample Collection

The following subsections discuss the sample collection for the four components of the leak detection program: the LCS and the LDS drainage layers (flow and water quality), the HTWs in the glacial till (water quality), and the monitoring wells in the Great Miami Aquifer (water quality).

4.4.1 Water Quality Monitoring of the Perched Groundwater and Great Miami Aquifer

Sampling both the perched groundwater and the Great Miami Aquifer groundwater during the same timeframe is desired in order to enhance the comparability of the data; however, the overriding requirement is that enough fluid be present in the individual monitoring point to collect sufficient volume for the analyses.

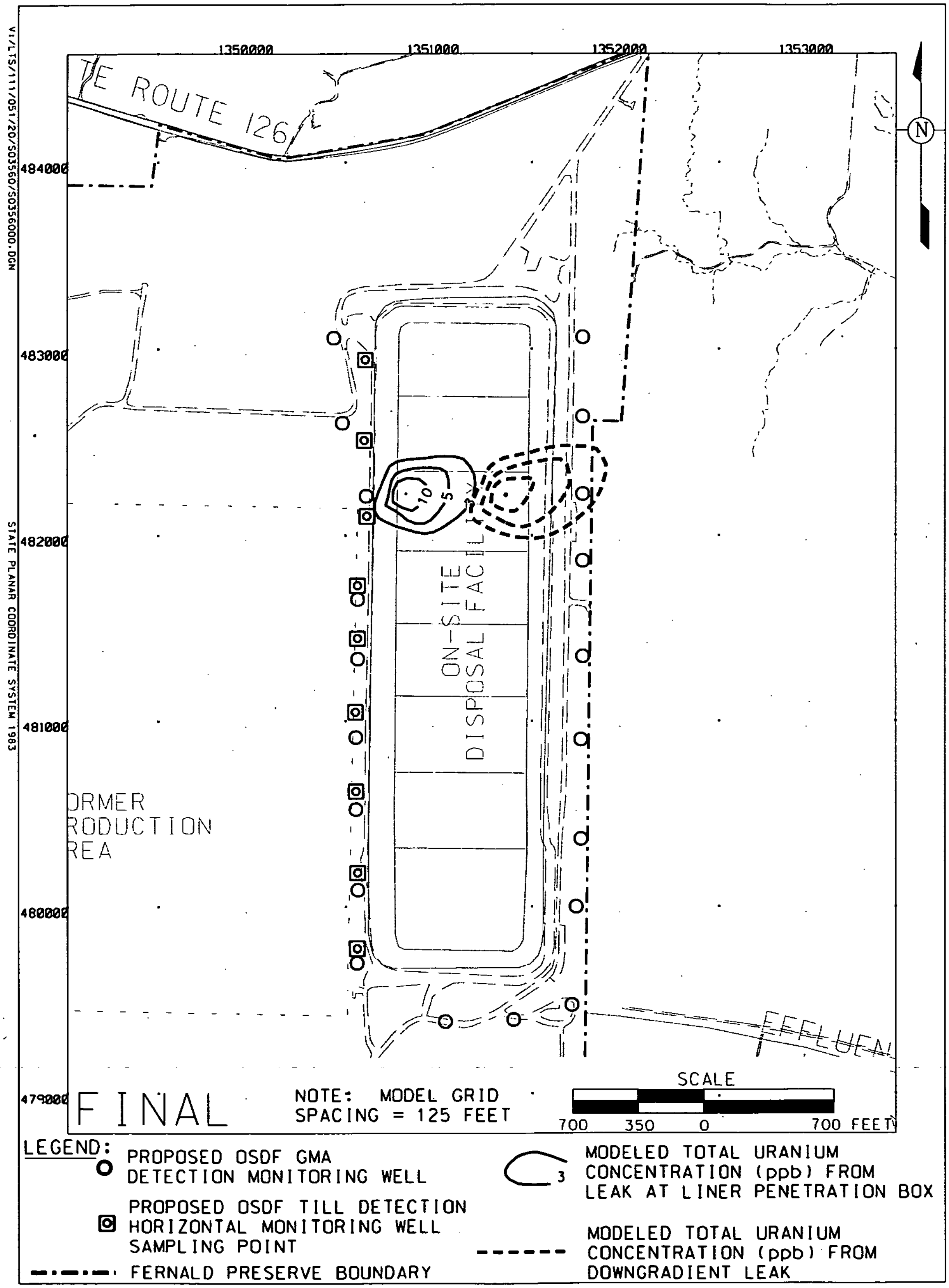

Figure 4–4. SWIFT Modeling with Uranium Loading—55 Years

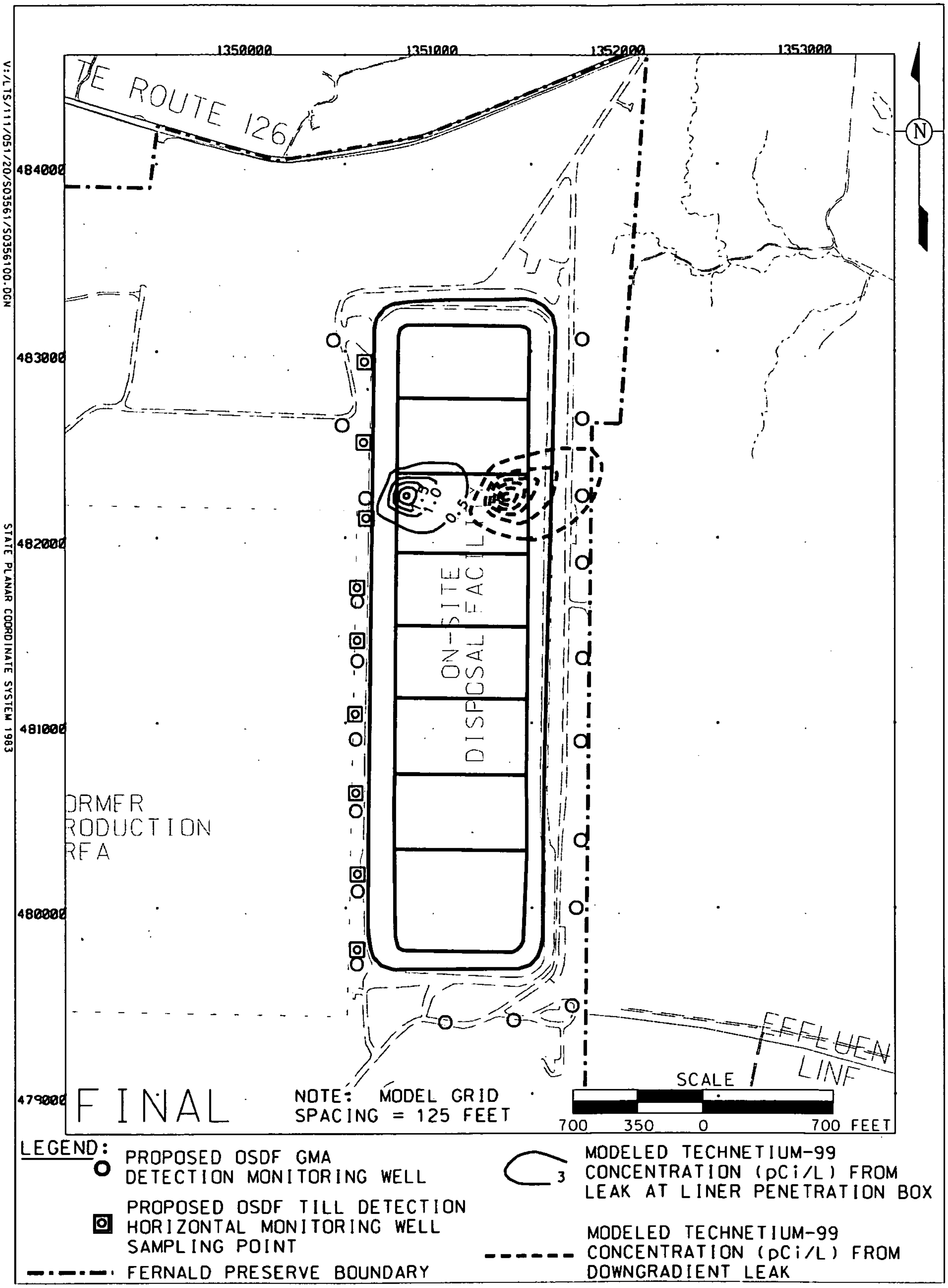

Figure 4–5. SWIFT Modeling with Technetium 99 Loading—30 Years

Prior to collecting the sample, the volume contained in the monitoring point is estimated in order to determine whether sufficient volume is present for the full suite of analytical parameters (refer to Appendix B for a discussion on setting priorities for low sample volume).

4.4.1.1 Establishment of Baseline Conditions in the Perched Groundwater and Great Miami Aquifer

In order to accurately determine whether there has been a leak from the OSDF, it is necessary to establish representative baseline conditions in the disturbed and natural environment underlying the facility, from which to draw future comparisons. As discussed in Section 2.0, both the perched groundwater system (disturbed) and the Great Miami Aquifer in the vicinity of the OSDF contain uranium and other Fernald Preserve related constituents at levels above background. Therefore, it is important to establish baseline conditions (i.e., constituent concentration levels and variability) for all of the OSDF analytical parameters so that accurate assessments of future data trends in the perched system and the Great Miami Aquifer can be made.

The Fernald Preserve's existing information concerning preexisting contaminant conditions in the subsurface is derived from the OU5 RI (DOE 1995b) and the OSDF Pre-Design Investigation (DOE 1995a). This existing information has been sufficient for the purpose of risk assessment, the development of conceptual and detailed designs for the Fernald Preserve's RAs, and the formulation of conservative assumptions for fate and transport modeling. The existing information is not of such detail, however, to permit the statistical evaluations, precise spatial and temporal comparisons, and comprehensive data trending that accompanies a leak detection program. More information regarding data variability and seasonal influences is needed in the immediate vicinity of the OSDF for both the perched system and the Great Miami Aquifer.

Based on the current understanding of preexisting levels of contaminants in the OSDF subsurface, DOE is electing to perform up to 12 rounds of initial baseline sampling for both the perched system and Great Miami Aquifer for all site-specific leak detection indicator parameters. Note that baseline monitoring has continued after initiation of waste placement, during active cell operations, and after a cell is capped. Appendix B of the Project Specific Plan (DOE 2001a) includes sampling frequencies for each specific cell.

Once the data from the initial sampling events have been received for both the perched groundwater and Great Miami Aquifer wells, DOE will evaluate whether sufficient information is available to establish baseline. At this juncture, an appropriate statistical method and associated statistical measure to establish baseline conditions will be selected. This identification is anticipated to be made on a cell specific basis for both the perched groundwater and Great Miami Aquifer components of the program. If the amount of data is insufficient for establishing baseline conditions, additional samples will be collected.

In the event that one or more monitoring points (e.g., the perched water wells) produce insufficient water volume for sampling the full suite of analytical parameters, the data accumulation period for establishing that monitoring point's baseline might be extended until sufficient data are obtained for that monitoring point and until such time that steady-state conditions have been established.

This approach and these frequencies (identified in Appendix B) exceed the minimum State of Ohio regulatory requirements and should provide sufficient information to conduct future comparative evaluations.

4.4.1.2 Long-Term Monitoring of the Perched Groundwater and Great Miami Aquifer

Modifications to the baseline sampling list will be based on the rationale identified in Appendix E. After enough samples have been collected to establish baseline conditions for the perched water and Great Miami Aquifer, sample frequency will be semiannual as identified in OAC 3745-27-10(D)(5)(a)(ii)(b) and (b)(ii)(b).

4.4.2 LCS/LDS Monitoring

4.4.2.1 Flow Monitoring in the LCS and LDS

Leachate collected by the LCS from each cell flows by gravity to the tanks located in the valve houses where its volume is measured. The leachate is then pumped into the EPLTS line where it flows by gravity to the PLS then is pumped to CAWWT for treatment. As the cells were capped leachate flow was reduced so that it could be accurately measured from the capped cells. Since Cells 7 and 8 were capped in 2006, beginning in 2007, leachate flow from all eight cells will be compiled and trended to provide an indication of changes in system performance. This data/trend analysis is provided in the ASERs.

The amount of liquid removed from the OSDF via the LDS system is recorded in accordance with the graded approach depicted below. This graded approach is patterned after federal hazardous waste landfill regulation 40 CFR 264.303(c)(2), and also satisfies Ohio solid waste rule OAC 3745 27 19(M)(4).

Tier	**LDS Volume Monitoring**
Prior to Placement of Final Cover on the Last OSDF Cell:	
0	Record amount of liquids removed from each LDS sump at least weekly.
Post-closure (after placement of final cover on the last OSDF cell)	
1	Record amount of liquids removed from each LDS sump at least **monthly**, except as provided by the following:
2	If the liquid level stays below the "pump operating level" for two consecutive months, record at least **quarterly**, except as provided by the following:
3	If the liquid level stays below the "pump operating level" for at least two consecutive quarters, record at least **semiannually**.

Note: If at any time during the post-closure care period the "pump operating level" is exceeded when on quarterly (Tier 2) or semiannually (Tier 3) recording schedule, the recording schedule will revert to monthly (Tier 1) until the requirement is met to move to the next highest tier.

"Pump operating level" is that liquid level based on pump activation level, sump dimensions, and the level that avoids backup into the LCS drainage layers in the OSDF cells, and minimizes head in the sump. The LDS flow rate shall be monitored to ensure the maximum design flow rate is not exceeded. The "action leakage rate" is the maximum design flow rate that the LDS can remove without the fluid head on the bottom liner exceeding 1 ft (40 CFR 264.302(a)). Flow rate monitoring for the LDS using the action leakage rate is outlined in the following table:

LDS Average Daily Flow Rate[a] Monitoring

Prior to Placement of Final Cover on Each Cell:

Calculate average daily flow rate for each sump once per **week**[b]

Post-closure:

Calculate average daily flow rate for each sump once per **month**[b]

[a]The average daily flow rate (in gpad) is calculated by converting the weekly or monthly flow rate using the data obtained for LDS volume monitoring.

[b]If the flow rate into the LDS exceeds the action leakage rate, then perform the response and notification action detailed in 40 CFR 264.304(b) and 40 CFR 264.304(c).

If the flow rate in the LDS exceeds the action leakage rate, notifications and response actions are initiated per 40 CFR 264.304(b) and 40 CFR 264.304(c). The required notifications and response actions are discussed in Section 6.0.

4.4.2.2 Water Quality Monitoring in the LCS and LDS

Through calendar year 2007, water quality monitoring for the LCS and LDS drainage layers within each cell (for leak detection monitoring purposes) has been conducted quarterly. It is proposed that beginning in 2008, sampling shift to a semiannual schedule. The samples are analyzed for parameters identified in Appendix E; more specifically, those identified in the Project Specific Plan provided in Appendix B.

Prior to collecting the sample, the volume contained in the LCS and LDS tanks or flowing through the individual LCS and LDS transfer lines is estimated in order to determine whether sufficient volume is present for the full suite of analytes (refer to the discussion in Appendix B for the setting of priorities). In case there is an absence of liquid in the LCS and/or LDS drainage layers such that water quality sampling cannot be conducted, it will be inferred that no leak from the cell has occurred.

While it is desirable that samples be collected from the LCS and LDS during the same time interval to enhance the comparability of the data, the overriding requirement is that enough leachate/fluid be present in the individual system to collect sufficient volume for the analyses.

4.5 Leak Detection Data Evaluation Process

The following components from each OSDF cell will be reviewed as part of the leak evaluation strategy:

- Trend analysis for the LCS, LDS, the glacial till, and the Great Miami Aquifer will help pinpoint potential leak related influences within each leak detection program element.
- The monitoring results from all elements will be correlated and evaluated holistically to determine whether a release has occurred and if a response action is necessary.
- LCS and LDS water volumes will be reviewed in tandem with water quality results to determine potential impacts to the environment from the OSDF.

As indicated previously, there is institutional knowledge regarding the various complexities associated with the regulatory strategy for the OSDF leak detection and data evaluation processes. This information will be considered during post-closure evaluations. To date, the process continues to evolve, and there is much interaction between DOE, EPA, and OEPA regarding the overall process.

4.5.1 Trend Analysis

Establishing an appropriate statistical trend analysis method is part of establishing background (baseline) conditions. Each cell is evaluated independently using intra-well trend analysis.

As identified in Section 3.2.1.2, to date, establishing baseline conditions based on statistical analyses has proven to be difficult due mainly to existing trend issues. Steady-state conditions, which are a requirement of control charting, have not been reached. In a letter dated April 19, 2007, DOE requested that control charts be excluded from the 2006 Site Environmental Report because it does not make sense to provide them until it has been determined that constituent-specific steady-state conditions have been established. A common ion study is underway that is scheduled to be completed in 2007. When the common ion study is complete, and the data have been compiled, DOE plans on meeting with EPA and OEPA to go over the data and discuss the OSDF leak detection monitoring program and associated reporting. Once it has been demonstrated that steady-state conditions have been established, control charts could be provided in ASERs. OEPA concurred with this strategy in a letter dated May 21, 2007.

Additionally, the intra-well trend analysis approach can be applied to data from all the elements—the LCS, LDS, and the groundwater monitoring components. This approach is most advantageous; however, there are issues associated with groundwater given the inherent difficulties in distinguishing potential releases from the OSDF from existing above background levels of monitoring constituents in the area of the OSDF. Regardless, point by point intra-well trending comparisons will be performed for the Great Miami Aquifer wells and HTWs.

4.5.2 Correlation of Monitoring Data

If fluid is collected from the LDS, it does not necessarily mean that the OSDF's leachate is leaking through the primary liner into the LDS. Liquid in the LDS could be from sources other than from within a particular cell. To determine whether liquid in the LDS is leachate and the primary liner of a cell is leaking, a correlation must exist between the LCS and LDS analyte concentrations. A correlation must also exist between the increases in volume of liquid in the LCS and the LDS ("flow monitoring data"). If volume increases and analyte concentrations between the two systems correlate, then a leak through the primary composite liner system will be suspected. The significance of the suspected leak with regard to the protection of the environment depends on the concentrations of the analytes found in the LDS and the volume of liquid present. Analyte concentrations and volume versus time plots of groundwater collected from the HTWs will be correlated with LCS and LDS data to detect a leak in the secondary composite liner system that contains the 3-ft compacted clay liner.

The primary purpose for the data collected in the Great Miami Aquifer is to establish a baseline from which to determine if leakage from the OSDF is detrimentally affecting the Great Miami Aquifer. It is recognized that an exhaustive characterization of the Great Miami Aquifer has already been conducted from which to determine Fernald Preserve impacts (from sources other than the OSDF), and to establish Fernald Preserve-specific COCs and associated FRLs. From this, a protective remedy for the Great Miami Aquifer has been developed, the success of which will be tracked through IEMP monitoring of site-specific indicator constituents. This has been documented in the OU5 RI (DOE 1995b) and FS Reports (DOE 1995c), the OU5 ROD (DOE 1995c), the IEMP (DOE 2006d), and associated IEMP reports. A secondary purpose for the Great Miami Aquifer data collected through the OSDF monitoring plan is to supplement the IEMP remedy performance monitoring data that will be collected for the aquifer. Groundwater data for those OSDF leak detection constituents that are also common to the IEMP groundwater remedy performance constituents are used in the IEMP data interpretations as the data become available. Groundwater data collected for those unique OSDF leak detection constituents that are not being monitored by the IEMP groundwater monitoring program are used only for the establishment of the OSDF baseline and subsequent leak detection monitoring.

End of current text

5.0 Leachate Management Monitoring Program

As discussed in Section 3.0, the Ohio Solid Waste Disposal regulations require an overall leak detection strategy to comply with the leachate management, monitoring, and reporting requirements in OAC 3745-27-19(M)(4) and OAC 3745-27-19(M)(5). To fulfill these requirements, the leachate management monitoring strategy provides:

1. A means to track the quantity of leachate collected for treatment and discharge, reported at least monthly.
2. A means to verify that the engineering components of the leachate management system will operate in accordance with OAC 3745-27-19, Operational Criteria for a Sanitary Landfill Facility.
3. A description of the site-specific leachate treatment and discharge elements to ensure that the leachate collected from the facility is properly managed.
4. Collection and analysis of an annual leachate grab sample for Appendix I and PCB parameters per OAC 3745-27-10 and 19 to confirm, on an ongoing basis, the adequacy and appropriateness of the selected site-specific leak detection indicator parameters.

Item 1 of the strategy above is fulfilled by the flow monitoring component of the leak detection monitoring strategy. Flow measurements are taken at the frequency identified in Section 4.4.2.2. Item 2 of the strategy above is fulfilled by the OSDF Enhanced Permanent Leachate Transmission System Operation procedure, and Appendix D of this plan. Items 3 and 4 are described in Sections 5.1 and 5.2, respectively. Item 4 is discussed in Appendix E.

5.1 Leachate Treatment and Discharge Management

Leachate is treated in the CAWWT and discharged at the National Pollutant Discharge Elimination System (NPDES)–permitted outfall to the Great Miami River. The following is a description of the management approach for leachate treatment, along with a description of the treatment system and the leachate monitoring needs to ensure proper operation of the treatment facility and compliance with the (NPDES) Permit.

Leachate is collected from both the LCS and LDS layers of each cell of the OSDF whenever such fluids are present. Fluid that collects in the LCS and LDS collection tanks located in each cell's valve house is pumped to the gravity drain portion of the leachate transmission system line, which drains all valve houses to the PLS. The leachate collected in the PLS is periodically pumped to the CAWWT backwash basin or directly to CAWWT feed tanks.

The CAWWT facility is a 1,800-gallon-per-minute (gpm) facility divided into a 1,200-gpm treatment train dedicated to groundwater, and a 600-gpm treatment train formerly used for the treatment of storm water and remediation wastewater including leachate. Since site stormwater no longer requires treatment, the CAWWT 600-gpm treatment train treats primarily groundwater but also treats leachate, and water from the backwash basin. All discharges from CAWWT are through the NPDES Outfall PF 4001. OAC 3745-27-19, "Operational Criteria for a Sanitary Landfill Facility," requires treatment of leachate. Leachate is a minimal flow and will likely have no bearing on operational decisions. It is required, however, that leachate be treated through the CAWWT prior to discharge to the Great Miami River until the CAWWT is no longer needed. Prior to the cessation of CAWWT operations, DOE will have proposed and negotiated the future management of leachate with EPA and OEPA. A passive treatment system for OSDF leachate was evaluated for potential use at the Fernald Preserve post-closure (DOE 2004b).

5.2 Confirmation of Leak Detection Indicator Parameters

The final leachate management monitoring requirement entails the annual confirmation of the site-specific leak detection indicator parameters. The purpose of this annual sampling is to confirm the appropriateness of the site-specific leak detection indicator parameters in the event that leachate composition changes over time, as described in OAC 3745-27-10(D)(2). An annual leachate grab sample is obtained and analyzed for parameters listed in Ohio Solid Waste regulation OAC 3745-27-10 and 19 (refer to Appendix I and PCBs). This sampling was necessary to fulfill the requirement in OAC 3745-27-19(M)(5) that calls for reporting the data from an annual grab sample of leachate.

Because waste is no longer being placed in the OSDF, and an alternate sampling constituent list has been approved for the OSDF, it is envisioned that after completion of the common ion study that collection of an annual grab sample from the LCS of each cell to be tested for Appendix I and PCB parameters listed in OAC 3745-27-10 will no longer be required, and this annual sampling/analysis task will stop. Annual sampling fro the LCS of each cell will instead focus on site-specific parameters that have been approved for the facility. Annual sampling of the LCS of each cell for Appendix I and PCB listed parameters will not stop until concurrence has been obtained from EPA and OEPA.

While it is anticipated that the results from analysis of the annual grab sample of leachate may indicate the presence of parameters not included in the leak detection indicator parameter list, it is not anticipated that these other parameters will exist in the leachate at concentrations high enough to warrant their addition to the leak detection indicator parameter list. However, a review of the data will be conducted (and reported through the ASERs) to determine if any new indicator constituents should be added to the site-specific leak detection indicator parameter list. Constituent concentrations will be reviewed against information gathered during the OU5 RI/FS period and subsequent environmental monitoring data. OSDF annual LCS data will be compared to factors such as Great Miami Aquifer and perched water background values, range of site perched water concentrations, and current laboratory contract required detection limits. Ultimately, a constituent will be added if routine analysis of the constituent can significantly enhance early detection capability. The leak detection/leachate analysis will ensure that the character of the leachate will not adversely impact the treatment facility or the treatment facility effluent receiving stream (the Great Miami River).

In order to gain pre-waste-placement information, a sample from both the LCS and LDS has been collected and analyzed for the annual leachate monitoring parameter list. This is not a regulatory requirement, but it was added to the monitoring requirements in order to obtain baseline information. This requirement was initiated in 2002.

6.0 Reporting

6.1 Routine Reporting

Information to establish baseline conditions is provided in ASERs as agreed upon in a March 8, 2005, meeting between DOE, EPA, and OEPA. DOE evaluates whether sufficient data are available to ascertain the type of distribution of the data, and from that, select an appropriate statistical method and associated statistical measure. To date, control chart methodology has been used. The determination for statistical analyses is made based on monitoring results from a cell-by-cell basis for each system (i.e., glacial till and Great Miami Aquifer). Once sufficient samples are collected for initial baseline monitoring, it will be recommended that the list of parameters be refined based upon the frequency of detections (i.e., constituents detected 25 percent or more of the time). Cell-specific evaluations will be summarized in ASERs. Initial baseline results for Cells 1 through 7 were presented prior to closure, and Cell 8's will be presented post-closure. The ASERs will also serve as the mechanism to propose modifications to the initial groundwater/leak detection and leachate monitoring plan in areas such as, but not limited to, the following:

- Modification of leak detection monitoring parameters list for routine monitoring.
- Modification of sampling frequency for LCS, LDS, glacial till, or Great Miami Aquifer monitoring points.
- Modification of leachate management monitoring parameters.
- Establishment of an appropriate statistical method and associated statistical measurements.
- Establishment of a pump operating level for the LCS.
- Temporary suspension or cessation of sampling and attendant statistical analysis for monitoring points (either singly or in combination).

To provide an integrated approach to reporting OSDF monitoring data, LCS and LDS flow data and concentrations, along with groundwater monitoring results, trending results, and interpretation of the data will also be provided in the ASERs. Presenting data in one report will facilitate a qualitative assessment of the impact of the OSDF on the aquifer, as well as the operational characteristics of OSDF caps and liners. Additionally, monitoring data will be made available electronically (i.e., Geospatial Environmental Mapping System [GEMS]).

6.2 Notifications and Response Actions

If the flow rate into any LDS tank exceeds 20 gpad, which is 10 percent of the OSDF design established action leakage rate of 200 gpad, monitoring frequency for the specific cell including both LCS and LDS will be increased to weekly as long as the high flow rate in the LDS remains. Leachate collected will be analyzed to determine concentrations of the indicator constituents. DOE will notify EPA and OEPA when this situation is identified during the routine monitoring. All the monitoring data collected during the subsequent increased monitoring frequency period will be forwarded to EPA and OEPA for review on a weekly basis.

If the flow rate into any LDS tank exceeds 10 percent of the action leakage rate continuously in every weekly monitoring event for more than 3 months, an engineering evaluation of the integrity of the specific cell will be initiated. The cell cap and toe will be inspected for any potential problems. The perched groundwater levels in the surrounding area will also be evaluated. Any significant findings that indicate potential sources of liquid will be reported. Appropriate maintenance actions will be identified and implemented to address any identified problems following consultation with EPA and OEPA.

If the flow rate into any LDS tank exceeds the action leakage rate, the actions presented in Table 6–1 will be implemented. In following the steps required in Table 6–1, both flow volumes and concentration levels of indicator constituents in the leachate collected in the LDS will be evaluated on a cell-by-cell basis together with all the other monitoring data collected from the LCS, till monitoring wells, and Great Miami Aquifer monitoring wells. The previous/historical monitoring data and weather information will be used to compare with the current conditions in order to narrow down the timeframe of potential changes in the system performance.

Preliminary field inspections of the cell caps, toes, run-on/runoff control channel, valve houses, and lift station will be conducted as soon as possible to meet the Step 7 schedule and to identify any visible signs of potential problems or sources of liquids. Pending field conditions, some mowing or snow removal may be required in order to conduct these inspections sufficiently. All necessary efforts will be made to allow sufficient visual inspections. EPA and OEPA will be notified prior to these inspections. Check lists similar to those prepared for the routine quarterly inspections will be submitted as a part of the written report specified in Step 7 to document these inspections.

The Engineer on Record for the OSDF (or other engineering consultants specialize in landfill design and acceptable to EPA and OEPA) will be requested to assist with the data evaluation, field inspections, and preparation of the report.

Preventative maintenance or any necessary repairs of selected OSDF caps or toes will be conducted based on results of routine visual inspections, engineering evaluation triggered by exceeding 10 percent of the action leakage rate continuously for three months, or the Table 6–1 process. If it is determined that both the cap and primary liner have failed following any of the inspections and/or engineering evaluations, then a more intensive OSDF response action will also be required. A response action might include initiating cap repair, investigating whether or not contamination has breached the compacted clay liner component of the secondary composite liner system that lies beneath the LDS, increasing monitoring, or a combination of these actions.

Potential leakage through the clay liner will be assessed by using the HTW installed beneath the liner penetration box area and secondary liner (along with the LCS and LDS flow volumes and water quality data). If it is determined that a leak has adversely impacted groundwater (till and/or Great Miami Aquifer), then a groundwater quality assessment monitoring program will be developed and initiated to determine the nature, rate, and extent of contaminant migration. Groundwater monitoring might also be increased to determine if leakage from the OSDF has entered the Great Miami Aquifer, although given the distances involved it would be unlikely that leakage from the OSDF would be able to migrate to the Great Miami Aquifer in the short timeframe between leak detection and response.

Table 6–1. Notification and Response Actions

Step	Timeframe	Action
1.	Within 7 days of the determination of an exceedance into any LDS at the action leakage rate of 200 gpad.	Notify both of the following in writing: • EPA Region 5 Regional Administrator 77 West Jackson Boulevard Chicago, Illinois 60604-3590 • Director, Ohio Environmental Protection Agency 122 South Front Street Columbus, Ohio 43215
2.	Within 14 days of the determination of an exceedance into any LDS at the action leakage rate of 200 gpad.	Submit to both of the individuals identified in Step 1 a written preliminary assessment as to the: • Amount of liquids. • Likely sources of liquids. • Possible location, size, and cause of any leaks. • Short-term actions taken and planned.
3.	As practicable to meet Step 7.	Determine to the extent practicable the location, size and cause of any leak.
4.	As practicable to meet Step 7.	Determine: • Whether receipt of impacted materials should be ceased or curtailed. • Whether any impacted materials within the OSDF or any individual cell/phase should be removed for inspection, repairs, or controls.
5.	As practicable to meet Step 7.	Determine any other short- or long-term actions to take to stop or mitigate the leaks.
6.	As practicable to meet Step 7.	In order to conduct Steps 3 through 5: • Assess the source of liquids, and amounts of liquids by source; and • In order to identify the source of liquids and the possible location of any leaks, and the hazard and mobility of the liquid, conduct a fingerprint, hazardous constituent, or other analyses of the liquids in the LDS; and • Assess the seriousness of any leaks in terms of potential for escaping into the environment. OR • Document why such assessments are not needed.
7.	Within 30 days of the notification given in Step 1.	Submit to both of the individuals identified in Step 1 a written report of the: • Results of the analyses and determinations made under Steps 3 through 6 (to the extent completed). • Results of action taken. • Actions ongoing (i.e., analyses and determinations under Steps 3 through 6 not yet completed) or planned (refer to Section 9.0 of the OSDF Post-Closure Care and Inspection Plan).
8.	Monthly thereafter, as long as the flow rate in the LDS exceeds the action leakage rate.	Submit to both of the individuals identified in Step 1 a written report summarizing the: • Results of actions taken. • Actions planned.

SOURCE: *Federal Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities*, Subpart NC-Landfills, Response Actions, 40 CFR 264.304(b) and 265.303(b).

End of current text

7.0 References

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Appendix A

On-Site Disposal Facility Applicable or Relevant and Appropriate Requirements and Other Regulatory Requirements

ARARs and to-be-considered criteria —for the OSDF groundwater detection monitoring, the OSDF leachate monitoring, and the OSDF response action—that should be addressed by this plan are provided in Table A–1, as obtained from the *Final Record of Decision for Remedial Actions at Operable Unit 2* (DOE 1995), the *Record of Decision for Final Remedial Action at Operable Unit 3* (DOE 1996c), the *Final Record of Decision for Remedial Actions at Operable Unit 5* (DOE 1996a), or the *Permitting Plan and Substantive Requirements for the On-Site Disposal Facility* (DOE 1996b). Additional regulatory requirements that are appropriate guidance for formulation of this plan have also been identified and included.

Table A–1. OSDF Groundwater/Leak Detection and Leachate Monitoring Plan Compliance Strategy ARARs and Other Regulatory Requirements

Citation	Requirement
PLANS	
Ohio Municipal Solid Waste Rules–Sanitary Landfill Facility Permit to Install Application OAC 3745-27-06(C)(9)(a)	• Prepare a "groundwater detection monitoring plan" as required by OAC 3745-27-10, and if applicable a "groundwater quality assessment plan" and/or "corrective measures plan" required by OAC 3745-27-10. • Prepare a "leachate monitoring plan" to ensure compliance with OAC 3745-27-19(M)(4) and (5).
GROUNDWATER/LEAK DETECTION MONITORING	
Ohio Municipal Solid Waste Rules–Groundwater Monitoring Program for a Sanitary Landfill Facility OAC 3745-27-10(A)	(1) The owner or operator of a sanitary landfill facility shall implement a "groundwater monitoring program" capable of determining the quality of groundwater occurring within the uppermost aquifer system and all significant zones of saturation above the uppermost aquifer system underlying the landfill facility, with the following elements: (a) A "groundwater detection monitoring program" which includes: (i) a "groundwater detection monitoring plan" in accordance with OAC 3745-27-10(B) through (D); (ii) a monitoring system in accordance with OAC 3745-27-10(B); (iii) sampling and analysis procedures, including an appropriate statistical method, in accordance with OAC 3745-27-10(C); and (iv) detection monitoring procedures, including monitoring frequency and a parameter list, in accordance with OAC 3745-27-10(D). (2) Schedule for implementation of detection monitoring. (4) For purposes of this rule, the groundwater monitoring program is implemented upon commencement of sampling of groundwater wells.
Ohio Municipal Solid Waste Rules–Groundwater Monitoring System OAC 3745-27-10(B)	(1) The "groundwater detection monitoring program" shall consist of sufficient number of wells, installed at appropriate locations and depths, to yield groundwater samples from both the uppermost aquifer system and any significant zones of saturation that exist above the uppermost aquifer system that: (a) represent the quality of the background groundwater that has not been affected by past or present operations; and (b) represent the quality of the groundwater passing directly downgradient of the limits of solid waste placement. (4) The number, spacing, and depth of groundwater monitoring wells shall be: (a) based on site-specific hydrogeologic information; and (b) capable of detecting a release from the facility to the groundwater at the closest practicable location to the limits of waste placement.
Ohio Municipal Solid Waste Rules–Groundwater Sampling, Analysis, and Statistical Methods OAC 3745-27-10(C)	(1) The "groundwater monitoring program" shall include consistent sampling and analysis procedures and statistical methods that are protective of human health and the environment and that are designed to ensure monitoring results that provide an accurate presentation of groundwater quality at the background and downgradient well. (a) Sampling and analysis procedures employed must be documented in a written plan. (b) The statistical method selected by the owner or operator must be in accordance with OAC 3745-27-10(C)(6)&(7). (6) After completing collection of the background data, the owner or operator shall specify one of the following statistical methods to be used in evaluating groundwater quality; the statistical method chosen must be conducted separately for each of the parameters required to be statistically evaluated: (a) a parametric ANOVA; or (b) an ANOVA based on ranks; or (c) a tolerance or prediction interval procedure; or (d) a control chart approach; or (e) another statistical method.

Citation	Requirement
	GROUNDWATER/LEAK DETECTION MONITORING (cont.)
	(7) Performance standards for statistical methods. (a) The statistical method used to evaluate groundwater monitoring data shall be appropriate for the distribution of chemical parameters or leachate and leachate-derived constituents. If shown to be inappropriate, then the data should be transformed or a distribution free theory test should be used. If the distributions for the constituents differ, more than one statistical method may be needed. (e) The statistical method shall account for data below the limit of detection with one or more statistical procedures that ensure protection of human health and the environment. Any practical quantitation limit (PQL) used in the statistical method shall be the lowest concentration level that can be reliably achieved within the specified limits of precision and accuracy during routine laboratory operating conditions that are available to the facility. (f) If necessary, the statistical method shall include procedures to control or correct for seasonal and spatial variability as well as temporal correlation in the data. (9) The number of samples collected to establish groundwater quality data shall be consistent with the appropriate statistical procedures.
Ohio Municipal Solid Waste Rules–Groundwater Detection Monitoring Program OAC 3745-27-10(D)	(2) Alternate monitoring parameter list. The owner or operator of a sanitary landfill facility may propose to delete any of the Appendix I parameters of this rule. The alternative monitoring parameter list may be approved if the removed parameters are not reasonably expected to be in or derived from the waste contained or deposited in the landfill facility. The following factors should be considered: (a) which of the parameters in Appendix I shall be deleted; (b) types, quantities, and concentrations of constituents in wastes managed at the landfill facility; (c) the concentrations of Appendix I constituents in the leachate from the relevant unit(s) of the landfill facility; (d) any other relevant information. (3) Alternate inorganic parameter list. The owner or operator of a sanitary landfill facility may propose that an alternative list of inorganic indicator parameters to be used in lieu of some or all of the inorganic parameters listed in Appendix I of this rule. The alternative inorganic indicator parameters may be approved if the alternative list will provide a reliable indication of inorganic releases from the facility to the groundwater. The following factors should be considered: (a) the types, quantities, and concentrations of constituents in wastes managed at the facility; (b) the mobility, stability, and persistence of waste constituents or their reaction products in the unsaturated zone beneath the facility; (c) the detectability of the indicator parameters, waste constituents, and their reaction products in the ground water; and (d) the concentrations or values and coefficients of variation of monitoring parameters or constituents in the background groundwater quality. (5) Monitoring parameters, frequency, location. The owner or operator shall monitor the groundwater monitoring well system (a) and (b) during the active life of the facility (including final closure and the post-closure care period, (ii) at least semiannually by collecting: (*a*) during the initial one hundred and eighty days after implementing the groundwater detection monitoring program (the first semiannual sampling event), a minimum of four independent samples from each monitoring well. Collect and analyze a minimum of eight independent samples during the first year of sampling. (*b*) After the first year during subsequent semiannual sampling events, at least one sample for each monitoring well. (iii) beginning with receiving the results from the first monitoring event under (D)(5)(a)(ii)(b) of this rule and semiannually thereafter, by statistically analyzing the results. (6) Alternative sampling and statistical analysis frequency. The owner or operator of a sanitary landfill facility may propose an alternative frequency for groundwater sampling and/or statistical analysis. The alternative frequency may be approved provided it is not less than annual. The following factors should be considered: (a) lithology of the aquifer system and all stratigraphic units above the uppermost aquifer system; (b) hydraulic conductivity of the uppermost aquifer system and all stratigraphic units above the uppermost aquifer system; (c) groundwater flow rates for the uppermost aquifer system and all zones of saturation above the uppermost aquifer system; (d) minimum distance between the upgradient edge of the limits of waste placement of the landfill facility and the downgradient monitoring well system; and (e) resource value of the uppermost aquifer system. NOTE: Table B-3 on page B.3-25 of the *Record of Decision for Operable Unit 5* states, "an alternate list of monitoring parameters will be required."

Table A–1. OSDF Groundwater/Leak Detection and Leachate Monitoring Plan Compliance Strategy ARARs and Other Regulatory Requirements (continued)

Citation	Requirement
GROUNDWATER/LEAK DETECTION MONITORING (Cont.)	
Ohio Hazardous Waste General Facility Standard–New Facilities Rules–Required Programs OAC 3745-54-91; 40 CFR 264.91	Owners or operators subject to the groundwater protection rules must conduct a monitoring and response program as follows: (1) whenever hazardous constituents from a regulated unit are detected at the compliance point, the owner or operator must institute a compliance monitoring program. "Detected" is defined as statistically significant evidence of contamination. (2) whenever the groundwater protection standard is exceeded, the owner or operator must institute a corrective action program. "Exceeded" is defined as statistically significant evidence of increased contamination. (3) whenever hazardous constituents from a regulated unit exceed concentration limits in groundwater between the compliance point and the downgradient facility property boundary, the owner or operator must institute a corrective action program. (4) in all other cases, the owner or operator must institute a detection monitoring program.
Ohio Hazardous Waste General Facility Standards–New Facilities Rules–Groundwater Protection Standard OAC 3745-54-92; 40 CFR 264.92	The owner or operator must comply with conditions specified in the facility permit that are designed to ensure that hazardous constituents detected in the groundwater from a regulated unit do not exceed the specified concentration limits (specified in the permit) in the uppermost aquifer underlying the waste management area beyond the point of compliance. The groundwater protection standard will be established when hazardous constituents have been detected in the groundwater.
Ohio Hazardous Waste General Facility Standards–New Facilities Rules–Hazardous Constituents OAC 3745-54-93; 40 CFR 264.93	(A) The permit will specify the hazardous constituents to which the groundwater protection standard applies. Hazardous constituents are those that have been detected in the groundwater in the uppermost aquifer underlying a regulated unit and that are reasonably expected to be in or derived from waste contained in a regulated unit, unless excluded under paragraph B of this rule. (B) A constituent will be excluded from the list of hazardous constituents specified in the facility permit if it is found that the constituent is not capable of posing a substantial present or potential hazard to human health or the environment. The following will be considered: (1) Potential adverse effects on groundwater quality, considering: (a) the physical and chemical characteristics of the waste in the regulated unit, included its potential for migration; (b) the hydrogeological characteristics of the facility and surrounding land; (c) the quantity of groundwater and the direction of groundwater flow; (d) the proximity and withdrawal rates of groundwater users; (e) the current and future use of groundwater in the area; (f) the existing quality of groundwater, including other sources of contamination and their cumulative impact on the groundwater quality; (g) the potential for health risks caused by human exposure to waste constituents; (h) the potential damage to wildlife, crops, vegetation, and physical structures caused by exposure to waste constituents; (i) the persistence and permanence of the potential adverse effects.

Table A–1. OSDF Groundwater/Leak Detection and Leachate Monitoring Plan Compliance Strategy ARARs and Other Regulatory Requirements (continued)

Citation	Requirement
Ohio Hazardous Waste General Facility Standards–New Facilities Rules–General Groundwater Monitoring Requirements OAC 3745-54-97; 40 CFR 264.97	(G) In detection monitoring or where appropriate in compliance monitoring, data on each constituent specified in the permit [or in the monitoring plan] is to be collected from background wells and wells at compliance point(s). The number and kinds of samples collected to establish background shall be appropriate for the form of statistical test employed. The sample size should be as large as necessary to ensure with reasonable confidence that a contaminant release to the groundwater from a facility will be detected. The owner or operator will determine an appropriate sampling procedure and interval for each constituent. (H) The owner or operator is to specify one of the following statistical methods to be used in evaluating groundwater monitoring data for each constituent to be specified. Use of any of the following statistical methods must be protective of human health and the environment: (1) a parametric ANOVA; (2) an ANOVA based on ranks; (3) a tolerance or prediction interval procedure; (4) a control chart approach; or (5) another statistical method.
GROUNDWATER/LEAK DETECTION MONITORING (Cont.)	
Ohio Hazardous Waste General Facility Standards–New Facilities Rules–Detection Monitoring Program OAC 3745-54-98; 40 CFR 264.98	(A) The owner or operator must monitor for indicator parameters (e.g., specific conductance, total organic carbon [TOC], or total organic halogen [TOX]), waste constituents, or reaction products that provide a reliable indication of the presence of hazardous constituents in groundwater. The director [of OEPA] will specify the parameters or constituents to be monitored in the facility permit, after considering the following factors: (1) types, quantities, and concentrations of constituents to be managed at the regulated unit; (2) mobility, stability, and persistence of the waste constituents or their reaction products in the unsaturated zone beneath the waste management area; (3) detectability of the indicator parameters, waste constituents, and their reaction products in the ground water; and (4) concentrations or values and coefficients of variation of proposed monitoring parameters or constituents in the ground water background. (D) The permit will specify the frequencies for collecting samples and conducting statistical tests to determine whether there is statistically significant evidence of contamination for any parameter or hazardous constituent specified in the permit. (F) The owner or operator must determine whether there is statistically significant evidence of contamination for any chemical parameter or hazardous constituent specified in the permit at the frequency specified in the permit.
Federal Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings: Subpart D–Standards for Management of Uranium Byproduct Material Pursuant to Section 84 of the Atomic Energy Act of 1954, as Amended 40 CFR 192.30 through .34	Uranium byproduct materials shall be managed to conform to the ground water protection standard in 40 CFR 264.92, which includes detection monitoring. Alternate concentration limits for uranium can be established, as described in 40 CFR 264.95 and 264.94(b).
Environmental Monitoring DOE M 435.1-1	I.1.E.(7) Environmental Monitoring. Radioactive waste management facilities, operations, and activities shall meet the environmental monitoring requirements of DOE 5400.1, General Environmental Protection Program; and DOE 5400.5, Radiation Protection of the Public and the Environment. IV.R.(3)(a) The site-specific performance assessment and composite analysis shall be used to determine the media, locations, radionuclides, and other substances to be monitored. IV.R.(3) Disposal Facilities. (C) The environmental monitoring programs shall be capable of detecting changing trends in performance to allow application of any necessary corrective action prior to exceeding the performance objectives in this Chapter.
LEACHATE MANAGEMENT AND MONITORING	
Ohio Municipal Solid Waste Rules–Operational Criteria for a Sanitary Landfill Facility OAC 3745-27-19(M)(4)&(5)	The owner annually shall report: • a summary of the quantity of leachate collected for treatment and disposal on a monthly basis during the year; location of leachate treatment and/or disposal; and verification that the leachate management system is operating in accordance with this rule; • results of analytical testing of an annual grab sample of leachate.
OTHER REQUIREMENTS	

Table A-1. OSDF Groundwater/Leak Detection and Leachate Monitoring Plan Compliance Strategy ARARs and Other Regulatory Requirements (continued)

Citation	Requirement
Federal Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities, Subpart N–Landfills, Monitoring and Inspection 40 CFR 264.302	Action Leakage Rate: (a) The action leakage rate is the maximum design flow rate that the LDS can remove without the fluid head on the bottom liner exceeding 1 ft. The action leakage rate must include an adequate safety margin to allow for uncertainties in the design (e.g., slope, hydraulic conductivity, thickness of drainage material), construction, operation, and location of the LDS, waste and leachate characteristics, likelihood and amounts of other sources of liquids in the LDS, and proposed response actions (e.g., the action leakage rate must consider decreases in the flow capacity of the system over time resulting from siltation and clogging, rib layover and creep of synthetic components of the system overburden pressures, etc.). (b) To determine if the action leakage rate has been exceeded, the owner or operator must convert the weekly or monthly flow rate from the monitoring data obtained under 40 CFR 264.303(c), to an average daily flow rate (gpad) for each sump (i.e., liner penetration box). Unless the [EPA] approves a different calculation, the average daily flow rate for each sump must be calculated weekly during the active life and closure period, and monthly during the post-closure care period when monthly monitoring is required under 40 CFR 264.303(c).
OTHER REQUIREMENTS (Cont.)	
Federal Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities, Subpart N–Landfills, Monitoring and Inspection 40 CFR 264.303(c)	An owner or operator required to have a LDS must record the amount of liquids removed from each LDS sump as follows: (1) During the active life and closure period, at least once each week. (2) After the final cover is installed, in accordance with the following graded approach: • at least monthly; or • if the liquid level in the sump stays below the pump operating level for two consecutive months, at least quarterly; or • if the liquid level in the sump stays below the pump operating level for two consecutive quarters, at least semiannually; but • if at any time during the post-closure care period the pump operating level is exceeded at units on quarterly or semiannual recording schedules, the owner or operator must return to monthly recording of amounts of liquids removed from each sump until the liquid level again stays below the pump operating level for two consecutive months. NOTE: There are no requirements in Ohio hazardous waste or Ohio solid waste rules regarding LDS flow monitoring.
Federal Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities, Subpart N–Landfills, Response Actions 40 CFR 264.304	(a) The owner or operator of landfill units subject to 264.301(c) or (d) must have an approved response action plan before receipt of waste. The response action plan must set forth the action to be taken if the "action leakage rate" has been exceeded [in any LDS sump]. (b) At a minimum, the response action plan [see entry 2 above] must describe the following actions to be taken: (1) Notify the Regional Administrator in writing of the exceedance within 7 days of the determination; (2) Submit a preliminary written assessment to the Regional Administrator within 14 days of the determination, as to the amount of liquids, likely sources of liquids, possible location, size, and cause of any leaks, and short-term actions taken and planned; (3) Determine to the extent practicable the location, size, and cause of any leak; (4) Determine whether waste receipt should cease or be curtailed, whether any waste should be removed from the unit for inspection, repairs, or controls, and whether or not the unit should be closed; (5) Determine any other short-term or longer-term actions to be taken to mitigate or stop any leaks; and (6) Within 30 days of the notification that the action leakage rate has been exceeded, submit to the Regional Administrator the results of the analysis specified in (3), (4), and (5) [above], the results of action taken, and actions planned. Monthly thereafter, as long as the flow rate in the LDS exceeds the action leakage rate, the owner or operator must submit to the Regional Administrator a report summarizing the results of any RAs taken and actions planned. (c) To make the leak and/or RA determinations in paragraphs (b)(3), (4) and (5) [above], the owner or operator must: • Asses the source of liquids, and amount of liquids by source; • Conduct a fingerprint, hazardous constituent, or other analyses of the liquids in the LDS to identify the source of liquids and possible location of any leaks, and the hazard and mobility of the liquid; and • Assess the seriousness of any leaks in terms of potential for escape to the environment; or • Document why such assessments are not needed.

References

DOE (U.S. Department of Energy), 1995. *Final Record of Decision for Remedial Actions at Operable Unit 2*, EPA/ROD/R05-95/289, Final, Fernald Environmental Management Project, Cincinnati, Ohio, June 8.

DOE (U.S. Department of Energy), 1996a. *Record of Decision for Remedial Actions at Operable Unit 5*, EPA/ROD/R05-96/312 (7478 U-007-501.4), Fernald Environmental Management Project, Cincinnati, Ohio, January 31.

DOE (U.S. Department of Energy), 1996b. *The Permitting Plan and Substantive Requirements for the On-Site Disposal Facility*, Fernald Environmental Management Project, Cincinnati, Ohio.

DOE (U.S. Department of Energy), 1996c. *Operable Unit 3 Record of Decision for Final Remedial Actions*, EPA/ROD/R05-96-311, Final, Fernald Environmental Management Project, Cincinnati, Ohio, September 24.

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Appendix B

Project-Specific Plan for the On-Site Disposal Facility Monitoring Program

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Acronyms and Abbreviations

APHA	American Public Health Association
ASER	Annual Site Environmental Report
CAWWT	Converted Advanced Wastewater Treatment facility
CLP	Contract Laboratory Program
DOE	U.S. Department of Energy
DQO	data quality objective
EPA	Environmental Protection Agency
GMA	Great Miami Aquifer
GWLMP	Groundwater/Leak Detection and Leachate Monitoring Plan
HTW	horizontal till well
IEMP	Integrated Environmental Monitoring Plan
L	liter
LCS	leachate collection system
LDS	leak detection system
LM QAPP	*Legacy Management CERCLA Sites Quality Assurance Project Plan*
LM SAP	*Sampling and Analysis Plan for United States Department of Energy Office of Legacy Management Sites*
mL	milliliter
OAC	Ohio Administrative Code
OSDF	On-Site Disposal Facility
SE	southeast
SEEPro	Site Environmental Evaluation for Projects database
SW	southwest
TDS	Total Dissolved Solids
TOC	Total Organic Carbon
TOX	Total Organic Halogens

End of current text

1.0 Introduction

1.1 Purpose

This plan was developed in support of the Groundwater/Leak Detection and Leachate Monitoring Plan (GWLMP) for the On-Site Disposal Facility (OSDF). Specifically, the purpose of this plan is to provide detailed information for samplers to collect data to support the analytical and reporting requirements described in the OSDF GWLMP. The GWLMP divides the OSDF monitoring program into two primary elements: (1) a leak detection component, which will provide information to verify the OSDF's ongoing performance, its integrity, and its impact on groundwater; and (2) a leachate monitoring component, which will satisfy requirements for leachate collection and management. This plan discusses requirements for sampling the groundwater monitoring system (i.e., horizontal till wells [HTWs] and Great Miami Aquifer [GMA] wells), leachate collection system (LCS), and leak detection system (LDS). All sampling and analysis activities will be consistent with the data quality objective (DQO) (DOE 2006b) provided in Appendix C of the GWLMP.

1.2 Scope

The leak detection monitoring strategy recognizes the various operating phases of the OSDF, including periods before, during, and after waste placement. Each cell has been constructed with an LCS to collect infiltrating rainwater and an LDS to provide early detection of leakage within the individual cells. Additionally, groundwater within the glacial till will be monitored using a series of HTWs constructed beneath each cell, and the GMA will be monitored by conventional monitoring wells located upgradient and downgradient of each OSDF cell. Monitoring locations for the eight cells are identified in Figure 1–1.

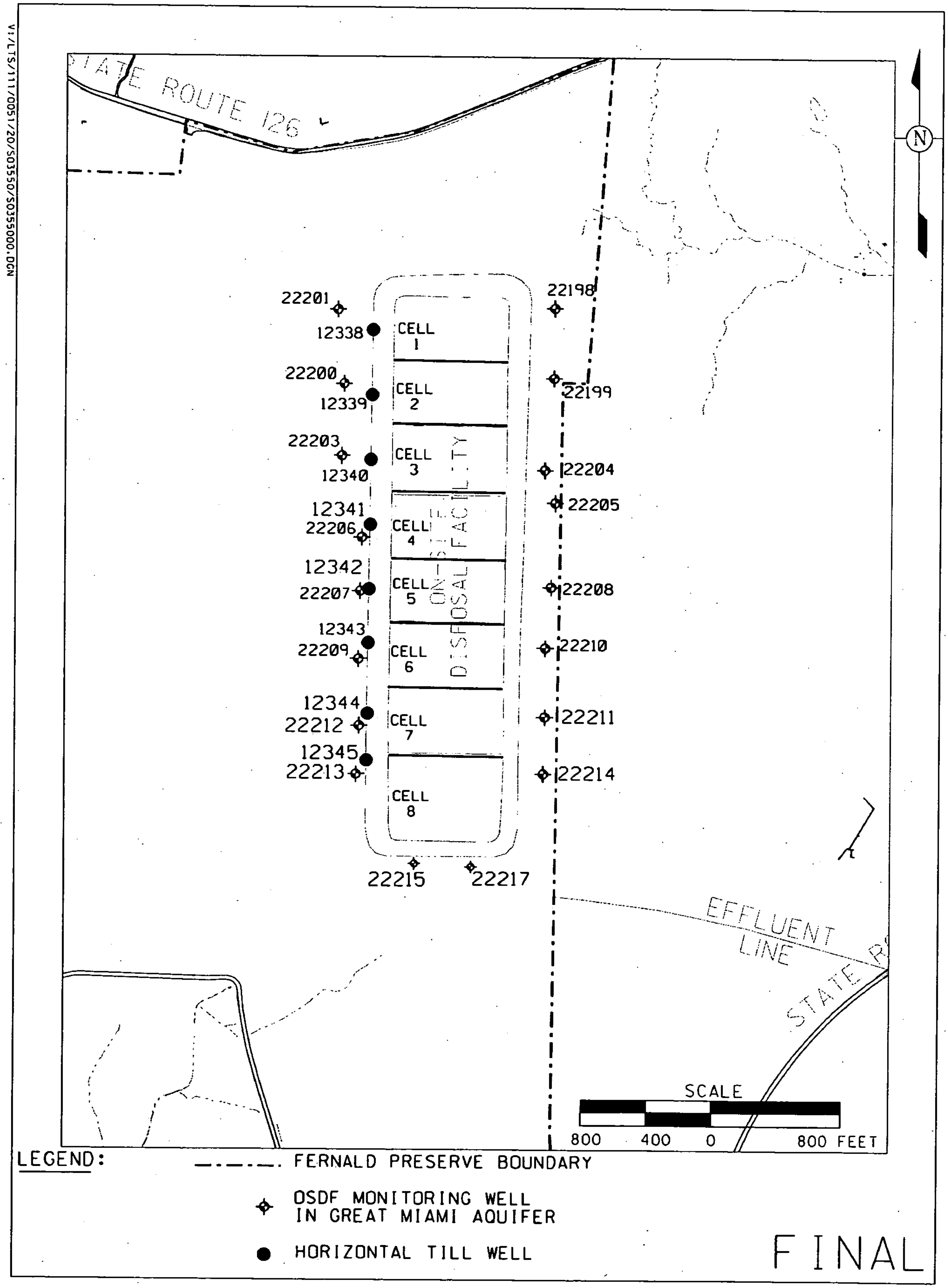

Figure 1–1. OSDF Well Locations

2.0 Sampling Program

As noted in Section 3.0 of the GWLMP, the Ohio Solid Waste regulations require that, for detection monitoring, at least four independent samples from each well will be taken during the first 180 days after implementation of the groundwater detection monitoring program and at least eight independent samples in the first year to determine the background (baseline) water quality (Ohio Administrative Code [OAC] 3745-27-10(D)(5)(a)(ii)(a)). The requirement to collect eight independent samples is only applicable to those wells installed after August 15, 2003, because that is the date that the code became effective. Current sampling frequencies are based on the following: HTWs and GMA wells are sampled bimonthly after waste placement until 12 samples are collected for statistical evaluation. These frequencies were selected to address OSDF construction schedules while the OSDF was under construction, to develop an appropriate statistical procedure, and to compensate for varying temporal conditions and seasonal fluctuations. After sufficient samples are collected for statistical analysis, samples are collected quarterly from the HTWs and the GMA. It is proposed that beginning in 2008, sampling from the HTWs and GMA be reduced to a semiannual schedule.

Specific monitoring requirements for each cell are provided in Sections 2.1, 2.2, and 2.3, with the specific analytical parameters listed in Tables 2–1, 2–2, and 2–3. Analytical detection limits, at a minimum, will meet the applicable final remediation levels identified in the *Integrated Environmental Monitoring Plan* (IEMP) (DOE 2006c and DOE 2006d). A summary of sampling requirements for each OSDF cell is presented in Table 2–4.

2.1 Sampling at Cells 1 through 7

Sampling will be as follows:

- Annual samples will be collected from the LCS for the parameters listed in Table 2–2.
- Annual samples will be collected from the LDS for the parameters listed in Table 2–1.
- Semiannual samples will be collected from the LCS, LDS, HTW, and GMA for the parameters listed in Table 2–3.

If an analyte is detected in the annual samples from either the LDS or LCS, then confirmatory sampling will be conducted for that constituent for three quarterly consecutive events from the horizon in which it was detected. Depending on the magnitude and persistence of the constituent detected, sampling of the next lower horizon may be considered. The requirements for this confirmatory sampling will be documented and approved through the established variance process.

Table 2–1. Initial Baseline Monitoring Requirements for the Cell 8 LDS, LCS, Glacial Till, and GMA

Parameter	Method	Priority[a]	ASL[b]	Holding Time	Preservation	Standard Volume	Minimum Volume	Container
Radionuclides:	LM QAPP[c]		D	6 months	HNO_3 to pH<2			
Technetium-99		2				1 L	500 mL	Plastic or Glass
Uranium, Total		1				100 mL	10 mL	
Inorganics:	CLP[d]/SW-846[e]	7	C					
Boron				6 months	HNO_3 to pH<2	1 L	600 mL	Plastic or Glass
Mercury				28 days				
Volatile Organics:	CLP[d]/SW-846[e]	3	C	14 days	Cool to 4°C With H_2SO_4, HCL, or solid $NaHSO_4$ to pH<2	5 X 40 mL	1 X 40 mL	Glass vial with Teflon-lined septum cap[f]
Bromodichloromethane								
1,1-Dichloroethene								
1,2-Dichloroethene (Total)								
Tetrachloroethene								
Trichloroethene								
Vinyl Chloride								
Semi-Volatile Organics:	CLP[d]/SW-846[e]	6	C	7 days to extraction/ 40 days from extraction to analysis	Cool to 4°C	1 L	1L	Amber glass bottle with Teflon-lined cap
Carbazole								
4-Nitroaniline								
Bis (2-Chloroisopropyl) ether								
Pesticides:	CLP[d]/SW-846[e]	8	C	7 days to extraction/ 40 days from extraction to analysis	Cool to 4°C	1 L	1 L	Amber glass bottle with Teflon-lined cap
alpha-Chlordane								

Table 2–1. Initial Baseline Monitoring Requirements for the Cell 8 LDS, LCS, Glacial Till, and Great Miami Aquifer (continued)

Parameter	Method	Priority[a]	ASL[b]	Holding Time	Preservation	Standard Volume	Minimum Volume	Container
General Chemistry:								
Total Organic Halogens (TOX)	9020B[e]	4	B	28 days	Cool to 4°C, H_2SO_4 to pH<2	500 mL	20 mL	Amber glass with Teflon-lined cap[g]
Total Organic Carbon (TOC)	9060[e]	5	B	28 days	Cool to 4°C, H_2SO_4 to pH<2	250 mL	125 mL	Amber glass with Teflon-lined cap
Sulfate	375.2[h], 300.0[h], 4500E[i]	9	B	28 days	Cool to 4°C	250 mL	100 mL	Plastic

Note: The LDS for Cells 1 through 7 will be monitored annually for these parameters per requirements in Section 2.1.

Note: Field parameters are performed at each sampling location prior to sample collection and include dissolved oxygen, pH, specific conductance, temperature, and turbidity at ASL A, Priority 1.

[a]If sufficient volume is not available for collection of a full suite at standard volume, then the minimum volume is to be collected for all analytical groups. If sufficient volume is still not available for collection of the full suite, then a partial sample is to be collected in accordance with the indicated priority rating.
[b]Analytical support level. The ASL may become more conservative, if necessary to meet detection limits or data quality objectives.
[c]Radiological analyses do not have standard methods; however, the performance-based analytical specifications for these parameters are provided in the LM QAPP.
[d]EPA Contract Laboratory Program (CLP) Statement of Work: Multi-Media, Multi-Concentration, most recent revision (EPA 2003, EPA 2004). Per the LM QAPP, where CLP is listed, SW-846 (EPA 1998) can now be used for ASL C or D.
[e]Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (EPA 1998)
[f]No head space
[g]Minimal head space – as close to zero as possible
[h]Methods for Chemical Analysis of Water and Wastes (EPA 1983)
[i]Standard Methods for Analysis of Water and Wastewater, 17th edition (APHA 1989)

Table 2–2. Annual Monitoring Requirements for the OSDF Leachate Collection System

Parameter	Method	Priority[a]	ASL[b]	Holding Time	Preservation	Standard Volume	Minimum Volume	Container
Radionuclides:	LM QAPP[c]		D	6 months	HNO_3 to pH<2			Plastic or Glass
Technetium-99		2				1 L	500 mL	
Uranium, Total		1				100 mL	10 mL	
Inorganics:	CLP[d]/SW-846[e]	7	C	6 months	HNO_3 to pH<2	1 L	300 mL	Plastic or Glass
Antimony								
Arsenic								
Barium								
Beryllium								
Boron								
Cadmium								
Calcium								
Chromium								
Cobalt								
Copper								
Iron								
Lead								
Magnesium								
Manganese								
Nickel								
Potassium								
Selenium								
Silver								
Sodium								
Thallium								
Vanadium								
Zinc								
Mercury				28 days				
General Chemistry:								
Ammonia	350.1[f], 350.3[f], 4500C[g], 4500F[g]	13	B	28 days	Cool to 4°C, H_2SO_4 to pH<2	500 mL	200 mL	Plastic
Total Organic Halogens (TOX)	9020B[e]	4	B	28 days	Cool to 4°C, H_2SO_4 to pH<2	500 mL	20 mL	Amber glass with Teflon-lined cap[h]
Total Organic Carbon (TOC)	9060[e]	5	B	28 days	Cool to 4°C, H_2SO_4 to pH<2	250 mL	125 mL	Amber glass with Teflon-lined cap
Chloride	325.2[f], 300(all)[f]	11	B	28 days	None	250 mL	100 mL	Plastic
Nitrate/Nitrite	353.1[f], 353.2[f], 4500D[g],4500E[h]	9	B	28 days	Cool to 4°C, H_2SO_4 to pH<2	100 mL	20 mL	Plastic or Glass
Sulfate	375.2[f], 300.0[f], 4500E[g]	12	B	28 days	Cool to 4°C	250 mL	100 mL	Plastic
Total Dissolved Solids (TDS)	160.1[f], 2540C[g]	10	B	7 days	None, Cool to 4°C	500 mL	250 mL	Plastic or Glass
Total Alkalinity	310.1[f], 2320B[g]	14	B	14 days	Cool to 4°C	500 mL	250 mL	Plastic

Table 2–2. Annual Monitoring Requirements for [illegible]SDF Leachate Collection System (continued)

Parameter	Method	Priority[a]	ASL[b]	Holding Time	Preservation	Standard Volume	Minimum Volume	Container
Volatiles:	CLP[d]/SW-846[c]	3	C	14 days	Cool to 4°C, H_2SO_4 to pH<2	5 X 40 mL	40 mL	Glass with Teflon-lined septum cap[h]
Acetone								
Acrylonitrile								
Benzene								
Bromochloromethane								
Bromodichloromethane								
Bromoform								
Bromomethane								
2-Butanone								
Carbon disulfide								
Carbon tetrachloride								
Chlorobenzene								
Chloroethane								
Chloroform								
Chloromethane								
Dibromochloromethane								
1,2-Dibromo-3-chloropropane								
Ethylene dibromide[i]								
1,2-Dichlorobenzene								
1,4-Dichlorobenzene								
trans-1,4-Dichloro-2-butene								
1,1-Dichloroethane								
1,2-Dichloroethane								
1,1-Dichloroethene								
1,2-Dichloroethene (Total)								
1,2-Dichloropropane								
cis-1,3-Dichloropropene								
trans-1,3-dichloropropene								
Ethylbenzene								
2-Hexanone								
Methylene Bromide								
Methylene Chloride								
Methyl iodide								
4-Methyl-2-pentanone								
Styrene								
1,1,1,2-Tetrachloroethane								
1,1,2,2-Tetrachloroethane								
Tetrachloroethene								
Toluene								
1,1,1-Trichloroethane								
1,1,2-Trichloroethane								
Trichloroethene								
Trichlorofluormethane								
1,2,3-Trichloropropane								
Vinyl Acetate								
Vinyl Chloride								
Xylenes (Total)								

Table 2–2. Annual Monitoring Requirements for the OSDF Leachate Collection System (continued)

Parameter	Method	Priority[a]	ASL[b]	Holding Time	Preservation	Standard Volume	Minimum Volume	Container
Semi-Volatile Organics: Carbazole 4-Nitroaniline bis(2 Chloroisopropyl)ether	CLP[d]/SW-846[e]	6	C	7 days to extraction/ 40 days from extraction to analysis	Cool to 4°C	1 L	1 L	Amber glass bottle with Teflon-lined cap
Pesticides: alpha Chlordane	CLP[d]/SW-846[e]	8	C	7 days to extraction/ 40 days from extraction to analysis	Cool to 4°C	1 L	1 L	Amber glass bottle with Teflon-lined cap
Polychlorinated Biphenyls: Aroclors 1016, 1221, 1232, 1242, 1248, 1254, and 1260	CLP[d]/SW-846[e]	15	C	7 days to extraction/ 40 days from extraction to analysis	Cool to 4°C	2 L	1 L	Amber glass bottle with Teflon-lined cap

Note: Field parameters are performed at each sampling location prior to sample collection and include dissolved oxygen, pH, specific conductance, temperature, and turbidity at ASL A, Priority 1.

[a]If sufficient volume is not available for collection of a full suite at standard volume, then the minimum volume is to be collected for all analytical groups. If sufficient volume is still not available for collection of the full suite, then a partial sample is to be collected in accordance with the indicated priority rating.
[b]Analytical support level. The ASL may become more conservative, if necessary to meet detection limits or data quality objectives.
[c]Radiological analyses do not have standard methods; however, the performance-based analytical specifications for these parameters are provided in the LM QAPP.
[d]EPA Contract Laboratory Program Statement of Work: Multi-Media, Multi-Concentration, most recent revision. Per the LM QAPP, where CLP is listed, SW-846 can now be used for ASL C or D.
[e]Test Methods for Evaluating Solid Waste, Physical/Chemical Methods
[f]Methods for Chemical Analysis of Water and Wastes
[g]Standard Methods for the Analysis of Water and Wastewater, 17th edition
[h]No head space
[i]Also referred to as 1,2-dibromoethane.

Table 2–3. Refined Baseline Monitoring Requirements for Cells 1 Through 7

Parameter	Method	Priority[a]	ASL[b]	Holding Time	Preservation	Standard Volume	Minimum Volume	Container
Radionuclides: Uranium, Total	LM QAPP[c]	1	D	6 months	HNO_3 to pH<2	100 mL	10 mL	Plastic or Glass
Inorganics: Boron	CLP[d]/SW-846[e]	4	C	6 months	HNO_3 to pH<2	1 L	600 mL	Plastic or Glass
General Chemistry:								
Total Organic Halogens (TOX)	9020B[e]	2	B	28 days	Cool to 4°C, H_2SO_4 to pH<2	500 mL	20 mL	Amber glass with Teflon-lined cap[f]
Total Organic Carbon (TOC)	9060[e]	3	B	28 days	Cool to 4°C, H_2SO_4 to pH<2	250 mL	125 mL	Amber glass with Teflon-lined cap
Sulfate	375.2[g], 300.0[g], and 4500E[h]	5	B	28 days	Cool to 4°C	250 mL	100 mL	Plastic

Note: Field parameters are performed at each sampling location prior to sample collection and include dissolved oxygen, pH, specific conductance, temperature, and turbidity at ASL A, Priority 1.

[a]If sufficient volume is not available for collection of a full suite at standard volume, then the minimum volume is to be collected for all analytical groups. If sufficient volume is still not available for collection of the full suite, then a partial sample is to be collected in accordance with the indicated priority rating.
[b]Analytical support level. The ASL may become more conservative, if necessary to meet detection limits or data quality objectives.
[c]Radiological analyses do not have standard methods; however, the performance-based analytical specifications for these parameters are provided in the LM QAPP.
[d]EPA Contract Laboratory Program Statement of Work: Multi-Media, Multi-Concentration, most recent revision. Per the LM QAPP, where CLP is listed, SW-846 can now be used for ASL C or D.
[e]Test Methods for Evaluating Solid Waste, Physical/Chemical Methods.
[f]Minimal head space (as close to zero as possible).
[g]Methods for Chemical Analysis of Water and Wastes.
[h]Standard Methods for the Analysis of Water and Wastewater, 17th edition.

Table 2–4. Summary of Sampling Requirements for the OSDF

Cell(s)	Monitoring Horizons[a]	Semiannually	Annually[b]
1 through 7	LCS	Table 2-3	Table 2-2
	LDS	Table 2-3	Table 2-1
	HTW	Table 2-3	NA
	GMA	Table 2–3	NA
8	LCS	Table 2–1	Table 2–2
	LDS	Table 2–1	NA
	HTW	Table 2–1	NA
	GMA (Up and Down)	Table 2–1	NA
	GMA (SE & SW)	Table 2–1	NA

Note: For Cell 8 a statistical analysis of the data for Refined Baseline Monitoring is scheduled to be conducted for the 2007 Annual Site environmental Report (ASER) due June 2008.

[a]LCS = leachate collection system
LDS = lead detection system
HTW = horizontal till will
GMA = Great Miami Aquifer
[b]NA = not applicable

Note: Confirmatory sampling for 1,1-dichloroethene is taking place in 2008 in the Cell 3 LCS. As indicated in the IEMP Mid-Year Data Summary Report for 2005 (DOE 2005a), 1,1-dichloroethene was detected in the annual Cell 3 LCS sample collected in May 2005, which triggered the confirmatory sampling. In 2006 sampling for 1,1-dichloroethene was also conducted in the Cell 3 LDS. As explained in the *2006 Annual Site Environmental Report* (ASER), confirmatory sampling at the Cell 3 LCS for 1,1-dichloroethene will continue in 2007 until the constituent is further evaluated using a site specific parameter selection approach that is presented in the 2006 ASER. Sampling for 1,1-dichloroethene in the Cell 3 LDS was discontinued in 2006. Continued sampling in the Cell 3 LCS is also documented in Appendix E, Table 4–1 of the GWLMP.

2.2 Sampling at Cell 8

Sampling will be as follows:

- Annual samples will be collected from the LCS for the parameters listed in Table 2–2.
- Semiannual samples will be collected from the LCS, LDS, HTW, and GMA (upgradient, downgradient, SE, and SW) for all parameters listed in Table 2–1.

Note: Based on the understanding of preexisting levels of contaminants in the OSDF subsurface, the Fernald Preserve elected to perform up to 12 rounds of initial baseline sampling for both the perched system and the GMA for all initial site-specific leak detection monitoring parameters. At the close of 2007, at least 12 rounds of initial baseline sampling had occurred. It is anticipated that a proposal will be made, via the 2007 ASER to be issued in June 2008, for a refined baseline sampling at Cell 8.

2.3 Common Ion Monitoring

Common ion monitoring was completed in the first half of 2007. For the study, common ions were monitored from each cell's LCS, LDS, and HTW for eight sampling rounds. Constituents that were monitored included calcium, iron, magnesium, manganese, phosphorus, potassium, silicon, sodium, alkalinity, chloride, fluoride, nitrate/nitrite, and oxidation reduction potential. Future action regarding the common ion study is pending review of the final report on the study.

2.4 Additional Sampling Requirements

All horizons for a particular cell will be sampled during the same timeframe to enhance the comparability of the data. In the event insufficient volume is available for collection of the entire analytical suite, the sample sets shall be collected in accordance with the priorities listed in Tables 2–1, 2–2, and 2–3. Samples will be collected from the HTWs, GMA wells, LCS, and LDS in accordance with the *Sampling and Analysis Plan for United States Department of Energy Office of Legacy Management Sites* (LM SAP) (DOE 2006f) and the *Legacy Management CERCLA Sites Quality Assurance Project Plan* (LM QAPP) (DOE 2006e), which references the *Sitewide CERCLA Quality Assurance Project Plan* as the primary document that describes procedures and protocols for monitoring the Fernald Preserve (DOE 2003).

2.5 LCS and LDS Sample Collection

Samples from the LCS and LDS shall be collected by entering the valve houses located on the western side of each cell. Samples will be collected directly from the sample ports on the bottom of the LCS and LDS as the lines enter the eastern side of the valve house. The LCS is located on the northern side of the valve house, and the LDS is located on the southern end of the valve house. No purging of the line is required prior to sample collection. If the discharge line is dry or does not yield enough water for the entire sample suite, the sample will be collected from the LCS and LDS tanks located within the valve house. The samples from the tanks will be collected using a dedicated Teflon bailer.

2.6 HTW Sample Collection

The glacial till is monitored under each cell using horizontal wells installed during construction of each cell. Prior to sample collection, the HTWs shall be purged of three well volumes or purged to dry, whichever occurs first. Sample collection from the horizontal well shall be accomplished using a Teflon bailer in accordance with the LM SAP.

2.7 Great Miami Aquifer Sample Collection

Each cell is monitored by two GMA wells, located east and west of each individual cell. Two additional GMA wells are located on the south side of Cell 8. These wells are sampled using dedicated sampling equipment in accordance with the LM SAP.

Filtering of groundwater samples at monitoring wells may take place on a case-by-case basis if deemed appropriate. If filtering is conducted, the reasons for filtering will be presented to EPA and OEPA as soon as possible through the weekly report and annually through the ASER.

3.0 Additional Sampling Program Requirements

3.1 Quality Assurance Requirements

Quality assurance requirements are consistent with those identified in the LM QAPP. Self-assessment and independent assessments of work processes and operations will be conducted to ensure quality of performance. Self-assessments will evaluate sampling procedures and/or paperwork associated with the sampling effort. Independent assessments will be performed by a quality assurance representative by conducting surveillances. Surveillances will be performed at least once per year at any time during the project and will consist of monitoring/observing ongoing project activity and work areas to verify conformance to specified requirements.

3.2 Changes to the Project-Specific Plan

Prior to the implementation of field changes, the project manager and field sampling lead shall be informed of the proposed changes. Once the field sampling lead has approved, and obtained approval from the project manager, data management lead, and quality assurance contact for, the field changes to the plan, the field changes may be implemented. Field changes to the plan shall be noted on a Variance/Field Change Notice. The Variance/Field Change Notice shall be approved by the project manager, field sampling lead, data management lead, and quality assurance contact prior to implementation of the changes.

3.3 Quality Control Samples

Quality control sample analyses are required as part of the GWLMP for the OSDF. A minimum of one set of field quality control samples is required for each sampling round. A "sampling round" refers to collection of samples from one or more locations for a specific project during a specified time period for a similar purpose. Duplicate and rinsate samples will be collected at a rate of one per sampling round or one per 20 samples, whichever is more frequent. Trip blanks will be collected one per day per team when samples are collected for volatile organic analysis. A rinsate sample will not be required for those locations with dedicated sample collection equipment. One matrix spike/matrix spike duplicate will be analyzed at a frequency of one per sampling event or one per 20 samples, whichever is more frequent. Quality control samples will be analyzed for the same analytes as the normal samples.

3.4 Equipment Decontamination

All non-dedicated sampling equipment shall be decontaminated per the LM SAP, prior to sample collection at each sample location. Sampling equipment shall also be decontaminated per the LM SAP upon completion of sampling activities, unless equipment has been dedicated to the sample location.

3.5 Disposition of Wastes

During sampling activities, waste will be generated in various forms; disposition of all waste will be in accordance with site requirements and procedures. The various forms of waste expected to be encountered during this program are contact waste, purge water, and decontamination wastewater.

Contact waste will be minimized by limiting contact with the sample media and by using disposable materials whenever possible. Contact waste shall be placed into plastic garbage bags and disposed of in a dumpster on site. If contact waste is determined to be radiologically contaminated, the assigned radiological control technician/engineer shall survey, contain, label, and disposition the waste according to radiological control requirements.

All decontamination wastewater and purge water will be containerized and disposed through the converted advanced wastewater treatment (CAWWT) facility for treatment. The point of entry into the CAWWT will either be via the CAWWT backwash basin or the OSDF permanent lift station.

3.6 Health and Safety

Health and Safety requirements are addressed in the *Fernald Project Health and Safety Plan* (DOE 2006g). Fernald Preserve–specific requirements are identified in this plan.

3.7 Data Management

Information collected as a part of this monitoring program will be managed according to the guidelines below to ensure availability of documentation for verification and reference and to ensure regulatory compliance.

Field documentation, as required by the LM SAP for this sampling program (e.g., Chain of Custody forms), will be carefully maintained in the field. To ensure appropriate documentation was completed during field activities and that documentation was completed correctly, required documentation shall be verified by Environmental Monitoring personnel. One hundred percent of the analytical data shall be validated in accordance to the ASL specified in Tables 2–1, 2–2, and 2–3. Information is stored in the Site Environmental Evaluation for Projects database, and the hard-copy original field documentation packages shall be stored in controlled file storage cabinets, and eventually a long-term archive environment. Per regulatory guidance, these records must be maintained for a minimum of 30 years.

4.0 References

Note: Tasks associated with this plan are performed under the most current revision of plans, procedures, and documents.

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Appendix C

Fernald Preserve Data Quality Objectives
Monitoring Program for the On-Site Disposal Facility

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Acronyms and Abbreviations

ASL	Analytical Support Level
BNA	base neutral acid
BTX	benzene, toluene, and xylene
CEC	cation exchange capacity
CFR	*Code of Federal Regulations*
DOE	U.S. Department of Energy
DQO	data quality objective
EPA	Environmental Protection Agency
FRLs	final remediation levels
FS	feasibility study
GMA	Great Miami Aquifer
GWLMP	Groundwater/Leak Detection and Leachate Monitoring Plan
HTW	horizontal till well
IEMP	Integrated Environmental Monitoring Plan
L	liter
LCS	leachate collection system
LDS	leak detection system
LM QAPP	*Legacy Management CERCLA Sites Quality Assurance Project Plan*
LM SAP	*Sampling and Analysis Plan for United States Department of Energy Office of Legacy Management Sites*
OAC	Ohio Administrative Code
ORP	oxidation reduction potential
OSDF	On-Site Disposal Facility
PCBs	polychlorinated biphenyls
PSP	*Project-Specific Plan for the On-Site Disposal Facility Monitoring Program*
QC	quality control
RA	remedial action
RI	remedial investigation
RD	remedial design
RvA	removal action
SDWA	Safe Drinking Water Act
SEEPro	Site Environmental Evaluation for Projects database
SWIFT	Sandia Waste Isolation Flow and Transport
TDS	Total Dissolved Solids
TCLP	toxicity characteristic leaching procedure
TSD	treatment, storage, and disposal
TOC	Total Organic Carbon
TOX	Total Organic Halogens
TPH	total petroleum hydrocarbons
VAM3D	Variably Saturated Analysis Model in 3 Dimensions
VOA	volatile organic analysis
WAC	Waste Acceptance Criteria

End of current text

1.0 Statement of Problem

Problem Statement: Analytical data, obtained from a multi-component monitoring system, is necessary to support the leak detection element of the on-site disposal facility (OSDF) monitoring strategy.

The construction of the OSDF for long-term storage and containment of low-level radioactive waste was completed in phases with eight individual cells. Each cell is monitored on an individual basis for leak detection and possible environmental impact.

A major concern regarding the storage of waste at the Fernald Preserve is the prevention of any additional environmental impact to the Great Miami Aquifer (GMA). To address this concern, site-specific monitoring requirements that integrate state and federal regulatory requirements were developed to provide a comprehensive program for monitoring the ongoing performance and integrity of the OSDF.

In consideration of unique hydrogeologic conditions and preexisting contamination on site, a baseline data set (Ohio Administrative Code (OAC) 3745-27-10(D)(5)(a)(ii)(a); OAC 3745-27-10(A)(2)(b) and OAC 3745-54-97(G)) will be established. In addition, an alternate sampling program (OAC 3745-2-10(D)(5)(a)(ii)(b) and (b)(ii)(b); 3745-27-10(D)(6)) will be initiated to address site-specific complexities and provide an effective monitoring program for the OSDF that meets and exceeds federal and state regulations for treatment, storage, and disposal (TSD) facilities.

The OSDF monitoring program strategy uses OSDF system design in combination with a monitoring well network to provide data for a collective assessment of OSDF performance. Each individual OSDF cell is constructed with a leachate collection system (LCS) and a leak detection system (LDS); these systems are separate and contain sample collection points within the valve house. The LCS is designed to collect infiltrating rainwater (and stormwater runoff during waste placement) and prevent it from entering the underlying environment; the leachate drainage layer drains to the west through an exit point in the liner to a leachate transmission system located on the west side of the OSDF and routed for treatment. The LDS is a drainage layer positioned beneath the primary composite liner; any collected fluids from that layer drain to the west where they are removed and routed for treatment as in the LCS. Flow monitoring measurements of the LCS and LDS will be conducted on a scheduled basis. Monitoring the flow and sampling of the LCS and LDS liquids will provide an assessment of migratory dynamics within each cell and determine primary liner performance.

The monitoring well network consists of two separate systems. A horizontal till well (HTW) is placed in the subsurface beneath the LCS and LDS liner penetration box within each cell. Each liner penetration box represents the lowest elevational area of each cell, by definition the most likely location for a potential leak to migrate. GMA monitoring wells are placed at the immediate boundaries of each cell, at upgradient and downgradient locations, to monitor the water quality of the aquifer and verify presence/absence of environmental impact. Sampling of the four components mentioned above (LCS, LDS, HTW, and GMA monitoring wells) will provide a four-layered holistic approach to provide early leak detection from the OSDF.

2.0 Identify the Decision

Analytical data provided by a monitoring program will provide the information necessary for management of the OSDF. Information derived from flow volume assessment and sample analyses will constitute the first tier of a three-tier strategy: detection, assessment, and corrective action; if it is determined from detection monitoring that a leachate leak from the OSDF has occurred, additional groundwater quality assessment studies will be initiated, and corrective action monitoring plans will be developed and implemented as necessary. If the detection monitoring continues to successfully demonstrate that the performance of the OSDF is as designed, then the monitoring program will remain in the first-tier detection mode, and a follow-up groundwater quality assessment or corrective action monitoring plans will not be necessary.

The OSDF monitoring strategy includes the establishment of baseline conditions in the hydrogeological environment beneath each individual cell prior to waste placement. Both perched groundwater and the GMA contain uranium and other Fernald Preserve–related constituents at levels above background in the vicinity of the OSDF; therefore, it is necessary to establish preexisting conditions (constituent concentration levels and variability) for applicable OSDF monitoring parameters.

3.0 Inputs that Affect the Decision

An extensive characterization of wastes, to quantify environmental contamination in the area of the Fernald Preserve, provided the information to develop the Waste Acceptance Criteria (WAC) for waste entering the OSDF. The leachability, mobility, persistence, toxicity, and stability of identified waste constituents were evaluated, and of 93 constituents, less than 20 constituents were identified as having the potential to impact the aquifer within a 1,000-year performance period. These site-specific leak detection indicator parameters chosen as monitoring parameters will be supplemented with additional water chemistry indicator parameters.

Additionally, waste TSD facilities must analyze collected leachate on an annual basis to fulfill a reporting requirement per Ohio Solid Waste regulation, OAC 3745-27-19(M)(5). OSDF monitoring has been complying by collecting a grab sample yearly and performing analysis for the parameters listed in Appendix I of OAC 3745-27-10 and polychlorinated biphenyls (PCBs). Because waste is no longer being placed in the OSDF, and an alternate sampling constituent list has been approved for the OSDF, it is envisioned that after completion of the Common Ion Study that collection of an annual grab sample for the LCS of each cell to be tested for Appendix I and PCB parameters listed in OAC 3745-27-10 will no longer be required, and this annual sampling/analysis task will stop. Annual sampling from the LCS of each cell will instead focus on site-specific parameters that have been approved for the facility. Annual sampling of the LCS of each cell for Appendix I and PCB listed parameters will not stop until concurrence has been obtained from the U.S. Environmental Protection Agency (EPA) and the Ohio Environmental Protection Agency (OEPA).

Although the site-specific leak detection indicator parameter list was initially created for the purpose of establishing baseline, it will probably provide sufficient and reliable data for the monitoring throughout the active operation of the OSDF; however, future considerations for potential modifications of the parameter list may occur during subsequent reevaluations of the monitoring program.

Monitoring of the liquid flow within the LCS and LDS drainage layers will be performed to provide a trend analysis that can be used as an indicator of containment system performance; changes in the trend of flow will initiate follow-up inspection and corrective action measures as necessary. A graded approach, patterned after federal hazardous waste landfill regulations title 40 *Code of Federal Regulations* (CFR) 264.303(c)(2) and Ohio solid waste rule OAC 3745-27-19(M)(4), will be used to provide a quantitative monitoring control for drainage within the OSDF.

4.0 Define the Boundaries of the Study

Subsurface conditions in the immediate area of the OSDF location are typical of glacial deposition; the subsurface formation comprises a glacial till underlain by sand and gravel deposits that are characterized as the GMA. The GMA is a high-yield aquifer and a designated sole-source aquifer under the Safe Drinking Water Act (SDWA). It supplies a significant amount of potable water for private and industrial use in Butler and Hamilton counties (Ohio); therefore, a leakage of contaminants from the OSDF could affect water quality for a large population.

Typically, a detection monitoring program consists of upgradient and downgradient monitoring well installations with routine sampling for a prescribed list of parameters. Consequently, detection of a statistically significant difference in downgradient water quality will indicate that release from a facility may have occurred. However, at the Fernald Preserve, low permeability and preexisting contamination within the overburden formation, and implementation of a site-wide groundwater remedial action (RA) for the subsurface aquifer formation, add complexity to the development of a groundwater detection monitoring program that is consistent with the standard approach in solid and hazardous waste regulations. To accommodate such complexities, federal and state regulations do allow alternative monitoring strategies, which provide flexibility with respect to well placement, statistical evaluation of data, parameter lists, and sampling frequency. The OSDF monitoring program does incorporate an appropriate alternative monitoring strategy to ensure integrity and provide effective early warning of a leak from the facility. The program includes alternate well placement, statistical analysis, parameter lists, and sampling frequencies.

An OSDF leak would migrate vertically towards the GMA beneath it; therefore, a horizontally positioned well placed within the glacial till shall have its screen interval beneath the LCS and LDS liner penetration box of each cell as a site-specific approach to monitor a first-entry leakage from the OSDF. The GMA wells are installed immediately adjacent to the OSDF, just outside the boundary of the final composite cap configuration. Each cell will be monitored with a set of GMA monitoring wells, placed upgradient and downgradient of each cell. The OSDF will be bordered by a network of GMA monitoring wells that provide upgradient and downgradient monitoring points for the entire facility.

The parameters are limited to those indicated as having a potential to migrate from the OSDF and impact the GMA. The concentration levels of concern are those required to determine fluctuations in GMA concentrations and provide a sensitivity great enough to indicate potential impacts.

Sampling frequencies for the OSDF monitoring program meet federal and state requirements. The additional data will be used to develop an appropriate statistical procedure and to compensate for the varying temporal conditions in the groundwater flow direction and chemistry due to seasonal fluctuations.

5.0 Decision Rule

The initial flow and water quality data obtained from the LCS, the LDS, and the groundwater monitoring components will be used to begin a statistical trend analysis of the volume of leachate produced by each cell and the corresponding concentrations of analytes in each individual monitoring component. Each cell will be evaluated independently; therefore, the preferred method of statistical evaluation for the OSDF will be an intra-well trend analysis following establishment of baseline conditions in the glacial till and GMA. The intra-well trend analysis approach will be applied to data from all of the components—the LCS, the LDS, and the groundwater monitoring wells. The data received from each component will be compared for evidence of consistent trend values that verify OSDF integrity status.

Note: Trend analyses will be performed/prepared annually, and it is anticipated that a statistical approach that includes a comparison to a statistically determined limit based on baseline data (such as control charts) will be the final procedure for evaluating OSDF monitoring data, in accordance with the regulatory citations discussed in Section 2.0 of the OSDF Groundwater/Leak Detection and Leachate Monitoring Plan (GWLMP). The purpose of the trend analyses currently being conducted is to assist in determining when reliable baseline statistics can be calculated. Additionally, data shall also be compared between all of the monitoring components within the multi-component monitoring system of each cell. This strategy is the four-layer vertical slice/trend analysis approach.

Data collected from the OSDF monitoring program will also be used to supplement the compilation of data for the *Integrated Environmental Monitoring Plan* (IEMP) reports. Groundwater data for those OSDF leak detection constituents that are also common to the IEMP groundwater remedy performance constituents will be used in the IEMP data interpretations as the data become available. Groundwater data collected for those unique OSDF leak detection constituents, which are not being monitored by the IEMP groundwater monitoring program will be used only for the establishment of the OSDF baseline and subsequent leak detection monitoring. To provide an integrated approach to reporting OSDF monitoring data, the annual site environmental report will serve as the mechanism by which LCS and LDS volumes and concentrations will be reported, along with groundwater monitoring results, trending results, and interpretation of the data. Presenting data in one report will facilitate a qualitative assessment of the impact of the OSDF on the aquifer, as well as the operational characteristics of OSDF caps and liners.

6.0 Limits on Uncertainty

In baseline establishment, the sensitivity and precision must be sufficient to define the GMA concentrations of the parameters of concern such that fluctuations will be observable and effects impacting the final remediation levels (FRLs) are observed. A false-positive error would indicate that either certain parameters are present when in fact they are not, or that baseline parameters are present at higher concentrations than are actually present in the GMA. This type of error would give a false indication that the cell is leaking. A false-negative error would indicate that certain parameters are not present when in fact they are. This may lead to a mistaken indication that the cell is not leaking. It is necessary to define the concentrations of the parameters of concern such that fluctuations in concentration and effects impacting the GMA will be observable.

Following baseline establishment, a false-positive result in OSDF monitoring may suggest that a leak from the OSDF has occurred, when in fact, it has not. Additional monitoring assessments would be initiated in response and added costs would be incurred unnecessarily. The greater concern would be a false-negative error, verifying that integrity of the OSDF was intact when in fact some component of the structure may have failed. No corrective action would be initiated and contaminants could migrate into the GMA undetected, possibly posing a threat to human health and the environment.

7.0 Optimize Design

An aquifer simulation model (i.e., SWIFT [Sandia Waste Isolation Flow and Transport] and, more recently, VAM3D [Variably Saturated Analysis Model in 3 Dimensions]) was used to select monitoring well locations, typically one upgradient and one downgradient of each cell. These wells are used in the detection monitoring program, as well as for baseline establishment.

Standard statistical modeling studies indicate that data from a minimum of four independent sampling events are necessary to establish baseline values; however, for an improved comparative statistical analysis, more sampling events were chosen to ensure sufficient available data for baseline establishment for each GMA monitoring well location.

To ensure consistency of method and an auditable sampling process, each sample will be collected per the following:

- *Sampling and Analysis Plan for United States Department of Energy Office of Legacy Management Sites* (LM SAP) (DOE 2006a).
- *Legacy Management CERCLA Sites Quality Assurance Project Plan* (LM QAPP) (DOE 2006b).
- *Project-Specific Plan for the On-Site Disposal Facility Monitoring Program* (PSP) (Appendix B of the OSDF GWLMP).

Laboratory quality control (QC) requirements will be as specified in the LM QAPP and PSP. One hundred percent of the data will undergo field and laboratory validation.

All chemical sample analyses will be performed at Analytical Support Level (ASL) C, except general water chemistry analyses, which will always be ASL B, and field water quality analyses, which will always be performed at ASL A. Radiological constituents will be analyzed at ASL D, unless ASL E is required to meet detection limits.

All samples require field QC and will include trip blanks as specified in the LM QAPP. Duplicates will be collected for each sampling round (a "sampling round" is defined as one round of sample collection from various locations occurring within a short period of time [i.e., several days]). Equipment rinsates will be performed when dedicated equipment is not available. One laboratory QC sample set shall be collected per each release of samples. Laboratory QC will include a method blank and a matrix spike for each analysis, as well as all other QC required per the method and LM QAPP.

If a well does not recharge sufficiently to collect specified volumes for all analytes or the LCS/LDS systems do not contain sufficient volume for a full suite of samples, parameters will be collected in the order of priority stated in the PSP. Sampling parameter requirements and frequencies are defined in the PSP and meet applicable federal and state requirements.

8.0 Data Quality Objectives

Baseline Establishment for GMA Groundwater Monitoring of the OSDF

1a. Task/Description. Baseline Establishment for GMA Groundwater Monitoring of the OSDF. This sampling program will determine a baseline characterization of the GMA in the immediate vicinity of the OSDF.

1b. Project Phase. Put an *X* in the appropriate box:

RI ☐ FS ☐ RD ☒ RA ☐ R_VA ☐ Other ☐ Specify:__________

1c. DQO No.: GW-024 DQO Reference No.: not applicable

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2. Media Characterization. Put an *X* in the appropriate box:

Air ☐ Biological ☐ Groundwater ☒ Sediment ☐ Soil ☐

Waste ☐ Wastewater ☐ Surface water ☐ Other ☐ Specify: Leachate

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3. Data Use with ASLs A–E. Put an *X* in the appropriate ASL boxes beside each applicable data use:

Site Characterization
A ☒ B ☒ C ☒ D ☒ E ☒

Risk Assessment
A ☐ B ☐ C ☐ D ☐ E ☐

Evaluation of Alternatives
A ☐ B ☐ C ☐ D ☐ E ☐

Engineering Design
A ☐ B ☐ C ☐ D ☐ E ☐

Monitoring during remediation activities
A ☒ B ☒ C ☒ D ☒ E ☒

Other (specify):__________
A ☐ B ☐ C ☐ D ☐ E ☐

4a. Drivers. OSDF GWLMP, the OAC for the containment of solid and hazardous waste, and the CFR TSD Facility Standards.

4b. Objective. To provide information by which verification of the ongoing performance and integrity of the OSDF and its impact on groundwater can be evaluated.

5. Site Information (description). The OSDF will consist of eight individual cells, and each cell will be monitored on an individual basis. The monitoring system developed to detect any potential leaks originating from the cells consists of four components: an LDS, an LCS, a till monitoring system, and a Great Miami Aquifer monitoring system. This DQO addresses baseline characterization, facility, and groundwater detection monitoring for the OSDF.

6a. Data Types with Appropriate ASL. Put an *X* to the right of the appropriate boxes for required analyses:

A.	pH	☒	B.	Uranium	☐	C.	BTX	☐
	Temperature	☒		Full Radiologic	☒*		TPH	☐
	Specific Conductance	☒		Metals	☒*		Oil/Grease	☐
	Dissolved Oxygen	☒		Cyanide	☐			
	Turbidity	☒		Silica	☐			
D.	Cations	☐	E.	VOA	☒*	F.	Other (specify): Total Alkalinity, Ammonia, Chloride, TDS, Sulfate, Nitrate/Nitrite, Fluoride, ORP	
	Anions	☐		BNA	☒*			
	TOC	☒		Pesticides	☒*			
	TCLP	☐		PCB	☒			
	CEC	☐		TOX	☒			
	COD	☐						

*See specific parameters listed in PSP.

7a. Sampling Methods. Put an *X* in the appropriate box:

Biased ☐ Composite ☐ Environmental ☐ Grab ☒ Grid ☐

Intrusive ☐ Non-Intrusive ☐ Phased ☐ Source ☐

Other (specify): ____________ DQO Number: DQO #GW-024

7b. Sample Work Plan Reference. List the samples required, and reference the work plan or sampling plan guiding the sampling activity, as appropriate. Baseline/background samples and routine monitoring samples: PSP for on-site disposal monitoring program.

7c. Sample Collection Reference. Provide a specific reference to the SCQ section and subsection guiding sampling collection procedures. A PSP will detail sampling methodology; unless otherwise indicated in the PSP, sampling will follow requirement guidelines outlined in the LM QAPP and LM SAP.

Sample Collection Reference: LM QAPP and LM SAP.

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8. Quality Control Samples. Put an *X* in the appropriate box:

Field Quality Control Samples

Trip Blanks	☒	Container Blanks	☐
Field Blanks	☒	Duplicate Samples	☒
Equipment Rinsate Samples	☒	Split Samples	☐
Preservative Blanks	☐	Performance Evaluation Samples	☐

Other (specify): none required

Laboratory Quality Control Samples

Method Blank	☒	Matrix Duplicate/Replicate	☒
Matrix Spike	☒	Surrogate Spikes	☒

Other (specify) none required

---

9. Other. Provide any other germane information that may impact the data quality or gathering of this particular objective, task, or data use.

9.0 References

DOE (U.S. Department of Energy), 2006a. *Sampling Analysis Plan for U.S. Department of Energy Office of Legacy Management Site*, DOE-LM/GJ1197-2006, Revision 0, S.M. Stoller Corporation, Grand Junction, Colorado, May.

DOE (U.S. Department of Energy), 2006b. *Legacy Management CERCLA Sites Quality Assurance Project Plan*, DOE-LM/GJ1189-2006, S.M. Stoller Corporation, Grand Junction, Colorado, June.

Appendix D

Leachate Management System for the On-Site Disposal Facility

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End of current text

Acronyms and Abbreviations

CAWWT	converted advanced wastewater treatment
CFR	*Code of Federal Regulations*
cm	centimeter
DOE	U.S. Department of Energy
EPLTS	enhanced permanent leachate transmission system
ft	foot/feet
HDPE	high-density polyethylene
LCS	leachate collection system
LDS	leak detection system
OAC	Ohio Administrative Code
OEPA	Ohio Environmental Protection Agency
OSDF	on-site disposal facility
PLS	permanent lift station
PS	pipe segment
RLCS	redundant leachate collection system

End of current text

1.0 Overview

The double liner system of each on-site disposal facility (OSDF) cell contains a leachate collection system (LCS) and a leak detection system (LDS). These systems are designed to convey any leachate/fluid that enters the system through pipes (i.e., the LCS pipes and LDS pipes) to valve houses located outside each cell. After closure of the OSDF, fluids that enter the LCS have infiltrated through the emplaced impacted material. Fluid that collects in the LCS and LDS collection tanks located in the valve house for each cell will be pumped to the enhanced permanent leachate transmission system (EPLTS). The EPLTS conveys leachate from each of the valve houses, via gravity flow, to a permanent lift station (PLS). The location of the LCS, LDS, and EPLTS pipes and gravity lines are shown in the as-built construction drawings.

The OSDF Systems Plan (DOE 2000), Collection and Management of Leachate for the OSDF procedure (DOE 2001a), and Enhanced Permanent Leachate Transmission System Operation procedure (DOE 2007) provide specifics on activities during post-closure. Note that operational procedures are included in the Legacy Management Fernald Operating Procedures (DOE 2006). Equipment will be maintained, operated, and serviced per manufacturer instructions and the Enhanced Permanent Leachate Transmission System Operation procedure.

2.0 Basic System Operation

What follows is a description of the basic operation of the OSDF leachate management system.

- The LCS and LDS pipes from the liner system to the valve houses for each cell consist of double-wall, high-density polyethylene (HDPE) pipes (i.e., inner carrier pipes and outer containment pipes). Each pipe drains by gravity from below the OSDF cell and terminates in a valve house for each cell.
- The LDS line in each valve house allows for direct discharge of flow from the LDS carrier pipe into a collection tank located inside the valve house. The lined valve house foundation wall serves as a secondary containment structure for the collection tank. The valve house has provisions to monitor liquid in the collection tank. The tank is equipped with a level-sensing element and a pump to discharge the contents of the tank. The level instrument is used to track the tank level so that pump-outs can be scheduled and the volume yield can be tracked. The discharge pipe from the tank pump is connected to the EPLTS gravity line. The LDS containment pipe has a monitoring port and a fixed end seal within the valve house to verify the absence of fluid in the annular space between the carrier pipe and containment pipe.
- Each LDS line has a cleanout within the valve house for maintaining the LDS carrier pipe.
- The LCS allows direct discharge of flow from the LCS carrier pipe into the EPLTS gravity line that passes through each valve house. The LCS line can also be directed to a tank in the valve house so that flow can be quantified once it has dropped to a point below the flow meter's ability to quantify flow. LCS flow has diminished to the point that flow from all 8 cells is currently directed through the collection tanks in each valve house. The leachate collected in the tanks is pumped to the EPLTS line as necessary to prevent overflow of the tanks. The LCS carrier pipe in each valve house also has a sampling port

for obtaining leachate samples. Each valve house has an inlet for a redundant LCS (RLCS) carrier pipe. The redundant carrier pipe has a valve (secured in a closed position) and a monitoring port (for periodically confirming the absence of leachate in the pipe). The redundant carrier pipe valve is configured so that it can be opened to allow flow to the EPLTS gravity line in the event of a failure due to clogging of the primary LCS carrier pipe. Both the primary and RLCS containment pipes have monitoring ports and fixed end seals within the LCS to verify the absence of leachate in the annular space between the carrier pipe and the containment pipe.

- Each valve house is equipped with liquid level alarms, consisting of a submersible liquid level sensor (located in a small sump in the corner of each valve house) and alarm light. Alarm signals are transmitted to the permanent lift station and a general alarm is subsequently sent to the CAWWT control room. The liquid level sensor is calibrated so that the alarm is activated when the fluid level in the valve house sump reaches approximately 11 inches.
- The EPLTS gravity line consists of a double-wall HDPE pipe with a 6-inch-diameter (15.2-centimeter [cm]) inner carrier pipe, and a 10-inch-diameter (25-cm) outer containment pipe.
- The EPLTS gravity line is equipped with a vent at its northern end. The purpose of the vent is to prevent pressure buildup in the systems. The EPLTS gravity line has cleanouts in each valve house that provide access to the EPLTS line in both directions for maintenance.
- The PLS has secondary containment designed so that it can be monitored for the presence of leakage.
- The PLS was designed to be capable of storing the anticipated quantity of leachate generated during a 1-week period using design assumptions simulating final closure of the OSDF.
- Prior to the discharge of fluid into the PLS, the fluid passes through a motor-operated inflow valve located in the control valve house just upstream of the PLS. This valve closes automatically in the event of a power failure, or if fluid levels in the lift station rise above the high-level alarm set point (or any level that would cause an electrical short or damage to equipment in the lift station). In the event of a power failure or high-level alarm, the motor-operated valve for the leachate transmission system will close automatically. The lift station also has a means for manually closing the motor-operated inflow valve. Therefore, this valve can be closed if needed until appropriate maintenance activities can be implemented.
- The PLS is equipped with a pumping system to transfer liquids in the lift station to the converted advanced wastewater treatment (CAWWT) facility for treatment.

2.1 LDS and LCS

The LDS and LCS of each OSDF cell shall be operated in conformance with the requirements of this section and the Enhanced Permanent Leachate Transmission System Operation procedure.

The valve on the RLCS carrier pipe shall be maintained closed at all times, unless overridden by conditions dictated by Section 1.3.

In order to allow discharge to the EPLTS gravity line, the valve on the LCS carrier pipe shall be maintained open at all times during the post-closure period of the OSDF, except for those periods when the valve needs to be closed for system maintenance and repair, or in the event of an operational emergency.

The LCS valve houses are designed as a closed system; leachate should not accumulate in these valve houses. If the alarms are activated, personnel shall respond to assess the problem and to take appropriate corrective actions. If the alarm occurs during day shift operations (6 a.m. to 4:30 p.m.) the response will be within 1 hour. If the alarm occurs during the night when operations personnel are not on site, the response will occur the next morning at the start of the day shift.

3.0 Inspection and Maintenance Activities

The Enhanced Permanent Leachate Transmission System Operation procedure provides the current details associated with inspection and maintenance activities for the leachate management system. The following subsection and Table 3–1 provide guidelines for the activities to continue during post-closure.

3.1 LCS and LDS

The LCS and LDS shall be inspected and maintained according to the schedule and activity requirements outlined in Table 3–1, or until leachate is no longer generated and an alternative activity schedule has been approved.

According to appropriate regulations—Ohio Administrative Code ([OAC] 3745-27-19[k][3])—the routine inspection of the pipe network shall be annual until final closure to ensure clogging has not occurred. Clogging could occur from deposition of sediments or from biological growth inside the pipe. Since the facility closed in 2006, the annual inspection requirement is no longer applicable; however, DOE will inspect the pipe network in 2010 and report the findings of this inspection in the site 5-year CERCLA review. This pipe network shall be inspected between the valve house and the first 100 feet (ft) of the subdrain pipe inside the cell (at minimum). The portion of the pipe beyond this point inside the cell is considered redundant because gradation for the LCS granular drainage material is designed to limit the level of leachate on the geomembrane liner to less than 1 ft (0.3 meters) without need for a subdrain pipe.

Access to the network pipes for inspection shall be through cleanouts located in each cell's valve house. Inspections shall be performed using a video camera, or any other appropriate inspection equipment. The inspection equipment shall have the ability to monitor its location (e.g., distance counter), be sized to fit within the LCS and LDS inner carrier pipes indicated on construction drawings, and be capable of being pushed the length to be inspected.

If an inspection indicates that a pipe in the pipe network is obstructed, the pipe shall be flushed by pumping water from a water truck through a hose inserted in the pipe cleanout. If flushing does not remove the obstruction, other methods shall be used to clean the pipe. These other methods may include blowing the obstruction out with air; vacuuming; jet rodding; or inserting a

Table 3–1. OSDF Leachate Management System Inspection and Maintenance Activities—Post-Closure

Component	Inspection Frequency	Conditions to Check	Remedy (and/or Actions)
Routine inspection and maintenance of LDS	Various	• Check general condition of valve house for each cell annually.	• Check level transmitter operations (e.g., operating temperature range, accuracy), electrical connections, and alarm light.
		• Inspect the primary containment vessel for leakage quarterly.	• Check for source of leak; if source identified, then take appropriate corrective measures (e.g., spot-seal vessel, replace vessel, etc.).
		• Check for fluid in LDS containment pipe monthly.	• Keep monitoring port drained; if above the action level in the Contingency Plan, perform video inspection of pipe and attempt to identify source of leakage; develop plan to mitigate effects.
Routine inspection and maintenance of LCS	Various	• Check general condition of valve house for each cell annually.	• Check level transmitter operations (e.g., operating temperature range, accuracy), electrical connections, strobe light, and radio transmission.
		• Check condition of shutoff valve quarterly.	• Check valve operability; correct any deficiencies.
		• Check for leachate in LCS containment pipe monthly.	• Keep monitoring port drained; if above the action level specified in the Contingency Plan, perform video inspection of pipe and attempt to identify source of leakage; develop plan to mitigate effects.
		• Check for leachate in RLCS carrier pipe annually.	• Drain pipe into EPLTS gravity line.
Routine inspection and maintenance of pipe networks	Once every 5 years if needed. Note: Monitoring is anticipated to remain in effect until it is demonstrated that leachate no longer poses a threat to human health or the environment. Temporary suspension of leachate requirements may also be considered.	Video inspect for: • Cracking/crushing of pipe • Clogging of pipe	• Flush clogged pipe with water or mechanically clean. • Insert small diameter pipe in crushed pipe, if possible. • Replace cracked/crushed pipe if cracked/crushed portion is outside of the cell. • Use RLCS.

Table 3–1. OSDF Leachate Management System Inspection and Maintenance Activities—Post-Closure (continued)

Component	Inspection Frequency	Conditions to Check	Remedy (and/or Actions)
OSDF Cell Valve Houses	Annually	• Confirm all required signage is visible. • Check general structural condition of valve house components. • Check for odors, bacterial growth (containment vessel).	• Repair and/or replace as necessary. • Check for structural integrity; if problems are found, take appropriate measures (e.g., spot seal vessel, replace vessel) and implement permanent solution. • Flush and/or spray sodium hypochlorite into containment vessel.
EPLTS Gravity Line	Various	• Check for fluid in EPLTS gravity line containment pipe monthly. • Inspect pipe for clogging or crushing once every 5 years if needed.	• Keep containment pipe drained; if above the action level specified in the Contingency Plan, perform video inspection of pipe and attempt to identify source of leakage; if leakage is minor, continue to operate; if leakage is significant, evaluate repair options. • Flush clogged pipe with water, or mechanically clean; repair as necessary.

snake, fish tape, or other suitable device. If air or water pressure is used, the working pressure inside the pipe shall not exceed the rated pressure for the pipe.

The specific pipe maintenance procedures (other than flushing) to be used to remove a pipe obstruction will be selected by the U.S. Department of Energy (DOE) on a case-by-case basis. In the event that LCS or LDS pipe obstruction cannot be dislodged, or in the very unlikely event that a pipe has undergone partial or total cracking, the following procedures will be considered:

- For the LCS, activate the RLCS pipe.
- For the LCS or LDS, insert a new small diameter pipe within the obstructed/collapsed pipe or replace the broken piece, as necessary.
- For the LCS or LDS pipe, if the obstruction or collapse is outside of the disposal facility containment systems, replace the pipe.
- All equipment inserted into the LCS or LDS line for inspection and/or maintenance shall be decontaminated prior to its removal from the OSDF.

In addition to the aforementioned requirements, all mechanical and electrical equipment shall be calibrated, operated, maintained, and serviced according to the manufacturer's instructions and site procedures.

3.2 EPLTS Inspection and Maintenance Activities

The EPLTS shall be inspected and maintained in accordance with the schedule and activity requirements outlined in Table 3–1, or until leachate is no longer generated and an alternative activity schedule has been approved.

The leachate transmission system, valves, connections, sampling ports, monitoring ports, pumps, and the like shall be routinely inspected and maintained to provide for proper OSDF operation. All mechanical and electrical equipment shall be calibrated, operated, maintained, and serviced according to the manufacturer's instructions and site procedures.

In addition, the inspection and maintenance activities for the EPLTS shall include the following:

- Confirm that appropriate warning signs are visible (e.g., for confined spaced).
- Check instruments and valves (e.g., note sticking or jammed devices, corrosion, leaks, and misalignments).
- Note any temperature extremes that may exist inside the valve houses.
- Verify instrument systems status (e.g., elevation and location of automatic level switch in the lift station).
- Monitor flow for pulsating, over pressure, or under pressure.
- Check for the presence of fluids in all secondary containment system.
- Confirm pump operation/priming.
- Check hoses for physical wear and poor connections prior to each use.

4.0 Leachate Management

Treatment of fluids collected from the LCS and LDS will be through the CAWWT as long as it is operating. Long-term treatment of the fluids collected from the LCS and LDS will be evaluated prior to discontinuation of operations of the CAWWT. In accordance with Ohio solid waste rule OAC 3745-27-19(K)(5), some of those alternatives are expected to consist of the following:

- On-site pretreatment of collected fluids with off-site disposal.
- Off-site treatment and disposal of collected fluids.
- Various options that may exist for the off-site portion of either of these alternatives.

It is anticipated that off-site treatment and/or disposal would likely require collection of leachate in the sump or another accumulation tank while awaiting periodic removal. Any modification involving such accumulation in a tank would need to estimate the quantity of leachate per time period, in order to specify the frequency of removal and how it will be treated or disposed of.

The processes presented above are anticipated to remain in effect until leachate is no longer detected (refer to federal hazardous waste regulation 40 *Code of Federal Regulations* [CFR] 264.310[b][2]), or until it is demonstrated that leachate no longer poses a threat to human health or the environment. If leachate volumes decrease below anticipated levels and the leachate toxicity decreases, the DOE may choose to petition the director of the Ohio Environmental Protection Agency (OEPA) to modify or temporarily suspend some of the leachate management requirements. OAC 3745-66-18(G) gives the director of OEPA authority to extend or reduce the post-closure care period based on cause. Eventually the leachate management system will be placed into its final, long-term configuration with the valve houses and contents being removed and replaced with straight lengths of pipes connecting the LDS and LCS to the EPLTS line. The decision regarding when the long-term configuration can be implemented will be made in conjunction with EPA and OEPA. This decision will be based on criteria developed in conjunction with EPA and OEPA. The criteria will include factors such as asymptotic leachate flows, a past history of no problems with plugging of the LCS or LDS lines, no recent activity to repair or revegetate the cap and the absence of similar conditions which argue for maintaining the ability to inspect and repair the LCS and LDS lines.

Information associated with leachate monitoring will be reported through the annual site environmental reports as identified in the upfront sections of Attachment C (the OSDF Groundwater/Leak Detection and Leachate Monitoring Plan).

5.0 Leachate Contingency Plan

By the summer of 2006, the flows from the OSDF LCS and LDS systems had decreased significantly due to the filling and capping of cells. The previous Leachate Management Contingency Plan was written in January 2001 for failure of the LDS, LCS, or EPLTS lines. The plan contained detailed operating modes for each line failure, including failure of the line downstream of the PLS that required using a tanker to transport water from the PLS to the treatment system. A review of the plan indicated that the most of the actions detailed in the plan are no longer applicable. For a failure of the EPLTS or the line downstream of the PLS, the preferred option is to close the valves from the LDS and LCS for each cell, allow the water to accumulate in the cells and repair the line as necessary.

To determine if this option was feasible, calculations were performed for each cell to determine how much water could be allowed to accumulate in each cell without exceeding 1 ft of head on the primary liner (DOE 1997). Information from Geosyntec indicated that the 1-ft level would be reached in each cell when 8,623 gallons had accumulated (GeoSyntec 2006). Daily flow from the cells was compared to that volume to determine the number of days required for each cell to accumulate 8,623 gallons. Table 5–1 shows the data used to determine the number of days. The table has been updated to reflect LCS flow data as of September 2007.

Table 5–1. Determination of the Number of Days Required to Reach the 1-ft Level (8,623 Gallons)

Tank	Dates	Water Vol. (gallons)	Change in Time (days)	Gallons per Day	Gallons per Acre per Day	# Days to Accumulate 8,623 Gallons
LCS 1	9/12–9/19	411	7.00	58.7	9.17	146
LCS 2	9/13–9/15	157.45	1.96	80.4	12.56	107
LCS 3	9/13–9/15	136.84	1.92	71.4	11.16	120
LCS 4	9/13–9/15	216.04	1.96	110.3	17.24	78
LCS 5	9/14–9/16	224.04	1.92	116.9	18.26	73
LCS 6	9/14–9/16	159.41	1.96	81.4	12.72	105
LCS 7	9/14–9/17	192.77	3.00	64.3	10.04	134
LCS 8	9/13–9/15	208.82	1.92	108.9	11.71	79

Since the minimum number of days required to reach the accumulation limit is 73 days and the number of days will increase as the flow from the individual cells decrease, it was determined that transporting leachate water by tanker to the treatment system in the event of a line failure will not be necessary. If any of the lines in the leachate system fail, the valves from the affected cell's LDS and LCS will be closed, and water will be allowed to accumulate in the cells while repairs are performed. The new Contingency Leachate Plan for the EPLTS or the line downstream of the PLS is to develop a repair plan and repair the line(s) before any of the affected cells accumulate 8,623 gallons. If repairs are anticipated to take longer than the time it would take to accumulate 1 ft of head on the primary liner, leachate would be transferred to the CAWWT via a rental tanker truck or other portable tank.

Monitoring of the LDS, LCS, RLCS, and LTS containment pipes will continue as specified in Table 3–1. The actions levels listed in Table 5–2 were derived from the January 2001 Leachate Management Contingency Plan for the OSDF and apply on a weekly basis. As the period between monitoring events is extended, the weekly action levels will be multiplied by the number of weeks between monitoring events to yield the applicable periodic action levels.

Table 5–2. Action Levels for Containment Pipe Monitoring

	LDS	LCS	RLCS	LTS in each Valve House (PS-1 through 7)	LTS at port V1007 (PS-9)	LTS at port V1006 (PS-10)	LTS at port V1008 (PS-8)
Weekly Maximum (milliliters)	2,270	2,650	2,650	5,300	18,900	370	No Maximum

If the water collected from any monitoring port exceeds the action level for the period, the port will be checked again in 1 week. If the amount of water collected again exceeds the action level, an investigation of the pipe segment (PS) in question will be performed and corrective actions taken as needed.

6.0 References

40 CFR 264.302. Environmental Protection Agency, "Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities—Action Leakage Rate," *Code of Federal Regulations*, 57 FR, January 29, 1992, as amended at 71 FR 40273, July 14, 2006.

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DOE (U.S. Department of Energy), 2001a. *Systems Plan, Collection and Management of Leachate for the On-Site Disposal Facility*, 20111-PL-0001, Revision 0, Fernald Closure Project, Cincinnati, Ohio, January.

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DOE (U.S. Department of Energy), 2006. *Legacy Management Fernald Operating Procedures*, Revision 0, S.M. Stoller Corporation, Grand Junction, Colorado.

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Appendix E

Selection Process for Site-Specific Leak Detection Indicator Parameters

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Acronyms and Abbreviations

ASER	Annual Site Environmental Report
COCs	constituents of concern
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
FRL	final remediation level
FS	feasibility study
GWLMP	Groundwater/Leak Detection and Leachate Monitoring Plan
LCS	leachate collection system
LDS	leak detection system
mg/kg	milligrams per kilogram
OAC	Ohio Administrative Code
OEPA	Ohio Environmental Protection Agency
OSDF	on-site disposal facility
OU	Operable Unit
PCB	polychlorinated biphenyl
pCi/g	picocuries per gram
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
RI/FS	remedial investigation/feasibility study
ROD	record of decision
TDS	total dissolved solids
TOC	Total Organic Carbon
TOX	Total Organic Halogens
WAC	waste acceptance criteria

End of current text

1.0 Introduction

A successful leak detection monitoring program must focus on the best indicators of potential releases, as opposed to analyzing for every possible constituent that may be present in a disposal facility (which would not be manageable and would add unnecessary complexity to the data analysis process). This section presents the criteria and process used to identify the site-specific indicator parameters for the on-site disposal facility (OSDF) groundwater leak detection monitoring program.

2.0 Guidelines for Site-Specific Monitoring Parameter Selection

At the Fernald Preserve, residual contamination in soil may move through the glacial till and impact the aquifer at concentrations below the groundwater final remediation levels (FRLs) but statistically elevated above current background conditions. It is important to recognize that all of the inorganic constituents and all but nine organic constituents included in the regulatory default monitoring parameters list (i.e., Appendix I of Ohio Administrative Code [OAC] 3745-27-10) have been detected in perched groundwater samples collected at various locations under the Fernald Preserve. Such preexisting contamination in the environment beneath the site, along with aquifer remediation activities, add complexity to the development of a successful leak detection parameter list capable of indicating the presence of a leak from the OSDF. Therefore, a tailored leak detection parameter list has been developed that provides adequate leak detection and is in compliance with the standard requirements of the Ohio Solid Waste Rules and the Ohio Hazardous Waste Rules. As discussed in Section 3.0 of the Groundwater/Leak Detection and Leachate Monitoring Plan (GWLMP), both sets of rules allow the use of an alternate monitoring parameter list based on site-specific conditions.

Ohio Solid Waste regulations OAC 3745-27-10(D)(2) and (3) allow six considerations in proposing an alternate monitoring parameter list in lieu of some or all of the parameters listed in Appendix I of OAC 3745-27-10. Also, the Ohio Hazardous Waste regulations for new facilities, OAC 3745-54-98(A), recognize four considerations in formulating the facility-specific monitoring parameter list. Table 2–1 summarizes the important considerations and approval criteria related to monitoring parameter selection under the Ohio Solid Waste and Ohio Hazardous Waste regulations.

It is important to point out that the chemical constituents listed in Appendix I of OAC 3745-27-10 are typical contaminants found in sanitary landfills. Appendix I does not include any radionuclides, which are the primary constituents of concern (COCs) at the Fernald Preserve. Therefore, any site-specific constituents that are not included in Appendix I of OAC 3745-27-10, but that are good indicators of potential leaks from the OSDF, also need to be evaluated in the parameter selection process. However, the general considerations summarized in Table 2–1 can apply to any constituent when selecting the leak detection indicator parameters.

Table 2-1. Regulatory Criteria for Alternate Parameter List

Ohio Solid Waste Regulation	Ohio Hazardous Waste Regulation
Requirements:	
• For all parameters, the removed parameters are not reasonably expected to be in or derived from the waste contained or deposited in the landfill facility; and	-
• [OAC 3745-27-10 (D)(2)]	
For inorganic parameters, the approved alternative monitoring parameter list will provide a reliable indication of inorganic releases from the landfill facility to the groundwater. [OAC 3745-27-10 (D)(3)]	Indicator parameters (e.g., specific conductance, total organic carbon, or total organic halogen), waste constituents, or reaction products that provide a reliable indication of the presence of hazardous constituents in groundwater. [OAC 3745-54-98 (A)]
Considerations:	
• Types, quantities, and concentrations of constituents to be managed at the facility;	Types, quantities, and concentrations of constituents to be managed at the regulated unit; [OAC 3745-54-98 (A)(1)]
• [OAC 3745-27-10 (D)(2)(b) and (D)(3)(a)]	
• Mobility, stability, and persistence of the waste constituents or their reaction products in the unsaturated zone beneath the facility;	Mobility, stability, and persistence of the waste constituents or their reaction products in the unsaturated zone beneath the waste management area; [OAC 3745-54-98 (A)(2)]
• [OAC 3745-27-10 (D)(3)(b)]	
• Concentrations in the leachate from the relevant unit(s) of the facility;	-
• [OAC 3745-27-10 (D)(2)(c)]	
• Detectability of the parameters, waste constituents, and their reaction products in the groundwater;	Detectability of the indicator parameters, waste constituents, and their reaction products in the groundwater; and [OAC 3745-54-98 (A)(3)]
• [OAC 3745-27-10 (D)(3)(c)]	
• Concentrations or values and coefficients of variation of monitoring parameters or constituents in the background [baseline] groundwater quality, and	Concentrations or values and coefficients of variation of monitoring parameters or constituents in the background [baseline] groundwater quality. [OAC 3745-54-98 (A)(4)]
• [OAC 3745-27-10 (D)(3)(d)]	
• Any other relevant information.	-
• [OAC 3745-27-10 (D)(2)(d)]	

Parameter selection focuses on establishing baseline conditions for the individual cells of the OSDF. Parameters selected for the baseline sampling and analysis approach of the OSDF groundwater monitoring program were selected using site-specific contamination data generated during the previous remedial investigation/feasibility study (RI/FS) processes in accordance with the regulatory considerations presented above.

The remainder of this section presents the site-specific monitoring parameters. These lists correspond to an alternate monitoring program parameters list as defined in the regulations. It is thought that these indicator parameters will provide sufficient and reliable indication of potential releases throughout the operation of the OSDF. However, future considerations for potential modifications of the parameter list are discussed in Section 4.0 of this appendix.

3.0 Initial Leak Detection Monitoring Parameter List

An alternate leak detection monitoring parameters list should include both primary (i.e., chemical-specific) parameters and supplemental indicator parameters. As suggested by the regulatory considerations summarized in Table 2–1, primary parameters should consist of selected site-specific chemical constituents that are expected to be of significant amounts in the monitored facility, and that are persistent, mobile, and differentiable from existing background conditions when released. The supplemental indicator parameters may include general groundwater quality parameters, which will have rapid and detectable changes in response to variations in chemical compositions in groundwater under the monitored facility, potentially as a result of a leak.

Fourteen primary parameters and four supplemental indicator parameters are proposed for the initial groundwater leak detection monitoring for the OSDF (i.e., initial baseline monitoring). Samples collected in the perched groundwater and Great Miami Aquifer monitoring wells for the initial baseline analyses, as well as samples collected in all four monitoring components during and after waste placement, will be analyzed for these 18 parameters. Following is the rationale for the selection of the primary and supplemental indicator parameters.

3.1 Primary Parameters

In general, organic constituents are more mobile but less persistent than most inorganic constituents and radionuclides. Because inorganic constituents and most radionuclides are present in natural soil, if the OSDF were constructed in a pristine site, organic constituents may be the preferred primary monitoring parameters for early leak detection purposes. However, because all three types of constituents have been detected in the media (i.e., perched groundwater and the Great Miami Aquifer), and in order to be differentiable from background conditions in case of a release, a good leak detection monitoring parameter must also be present in significant abundance or at relatively high source strengths in the OSDF.

Constituent-specific quantity, persistence, and mobility data were considered during the development of the waste acceptance criteria (WAC) for the OSDF. Therefore, information from the OSDF WAC development process was first reviewed to select the primary parameters for leak detection monitoring purposes. The WAC for the OSDF were developed for 42 constituents during the Operable Unit 5 (OU5) feasibility study (FS); 41 of the WAC are included in the final OU5 record of decision (ROD). (As discussed later, one compound—magnesium—was eliminated following completion of the FS.) As discussed in this section, 18 of the 41 WAC are numerical limits and 23 are non-numerical limits that were established to satisfy regulatory screening criteria for constituents regulated under the Resource Conservation and Recovery Act (RCRA).

The maximum acceptable leachate concentrations for constituents that will be present in the OSDF were determined by fate and transport modeling. The constituent-specific leaching potential, solubility, mobility, and benefits of the engineering controls in the OSDF were considered in the modeling process. These maximum acceptable leachate concentrations were converted into solid-phase WAC at the end of the process. These solid-phase WAC represent the maximum concentrations for soil and debris that can be disposed of in the OSDF.

To assist in selecting the primary parameters, the actual soil concentrations for each of the 18 COCs for which numerical WAC were developed were also reviewed in order to provide a clear perspective regarding which COCs may approach their corresponding WAC concentrations and, therefore, are more likely to be detectable when released from the OSDF.

During the OU5 FS, two categories of COCs were evaluated in the WAC development process. The first category includes all site-specific groundwater pathway COCs that were identified in the OU5 Remedial Investigation (RI). As a result of the process, 12 numerical WAC were developed for the groundwater pathway COCs. The second category includes those Fernald Preserve constituents that need to be managed and accounted for under RCRA regulations. Six additional numerical WAC were developed for the RCRA-regulated constituents, bringing the total numerical WAC for the OSDF to 18. The following subsections summarize the WAC development process for these two categories of constituents, as derived from the site-wide WAC development process described in the OU5 FS. Figure 3–1 summarizes the process in flow-chart fashion.

3.1.1 Groundwater Pathway COCs

Initially, only the WAC for groundwater pathway COCs were developed. WAC were determined necessary for 15 groundwater pathway COCs selected from Table F.2–2 of Appendix F of the OU5 FS. Among all the detected soil and groundwater constituents at the Fernald Preserve, these 15 COCs have potential to reach and impact the Great Miami Aquifer through the glacial till within 1,000 years under natural conditions (i.e., if they are not disposed of in the OSDF). Table F.2–2 of Appendix F of the OU5 FS also lists all the other constituents screened for potential cross-media impacts. Overall, 53 organics, 25 inorganics, and 15 radionuclides were evaluated in the groundwater COC selection process, including all the RCRA constituents that have been detected in soil and groundwater at the Fernald Preserve.

After considering the engineering controls provided by the OSDF in the modeling procedures, 12 of the original 15 groundwater pathway COCs were found to require numerical WAC. When determining what materials can be disposed of in the OSDF, compliance with the 12 numerical WAC will be required for the long-term protection of the Great Miami Aquifer. Table 3–1 lists the 15 COCs considered and the WAC that were developed. The technical approach of fate and transport modeling conducted to develop the COC-specific WAC has been summarized in Section F.5 in the OU5 FS.

Upon further review of the initial WAC development process contained in the OU5 FS, the U.S. Environmental Protection Agency (EPA), the Ohio Environmental Protection Agency (OEPA), and the U.S. Department of Energy (DOE) concurred that magnesium does not present a significant threat to human health. Therefore, magnesium was eliminated from further consideration, and a WAC for magnesium was not presented in Table 9–6 of the OU5 ROD.

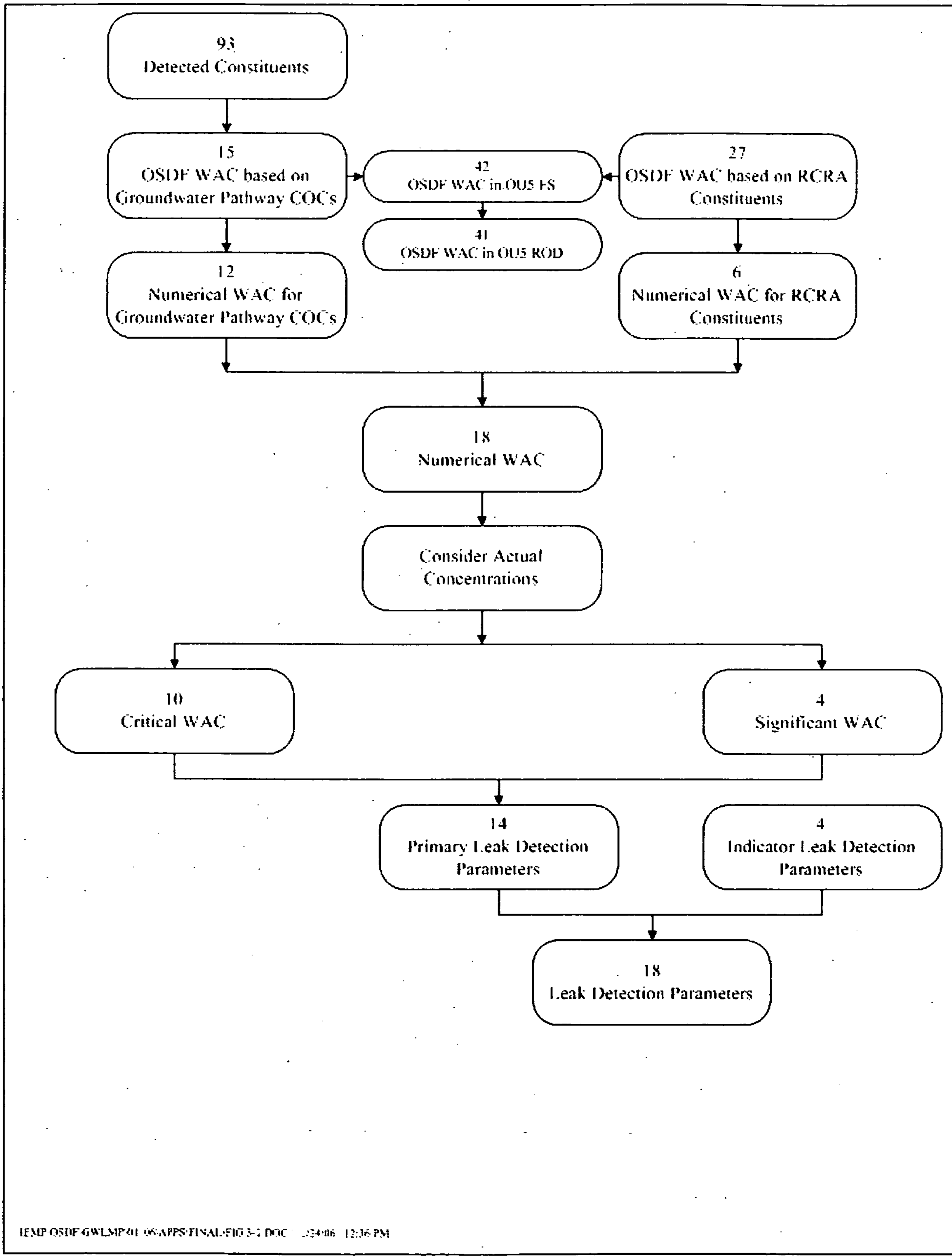

Figure 3–1. Groundwater/Leak Detection Parameter Selection Process

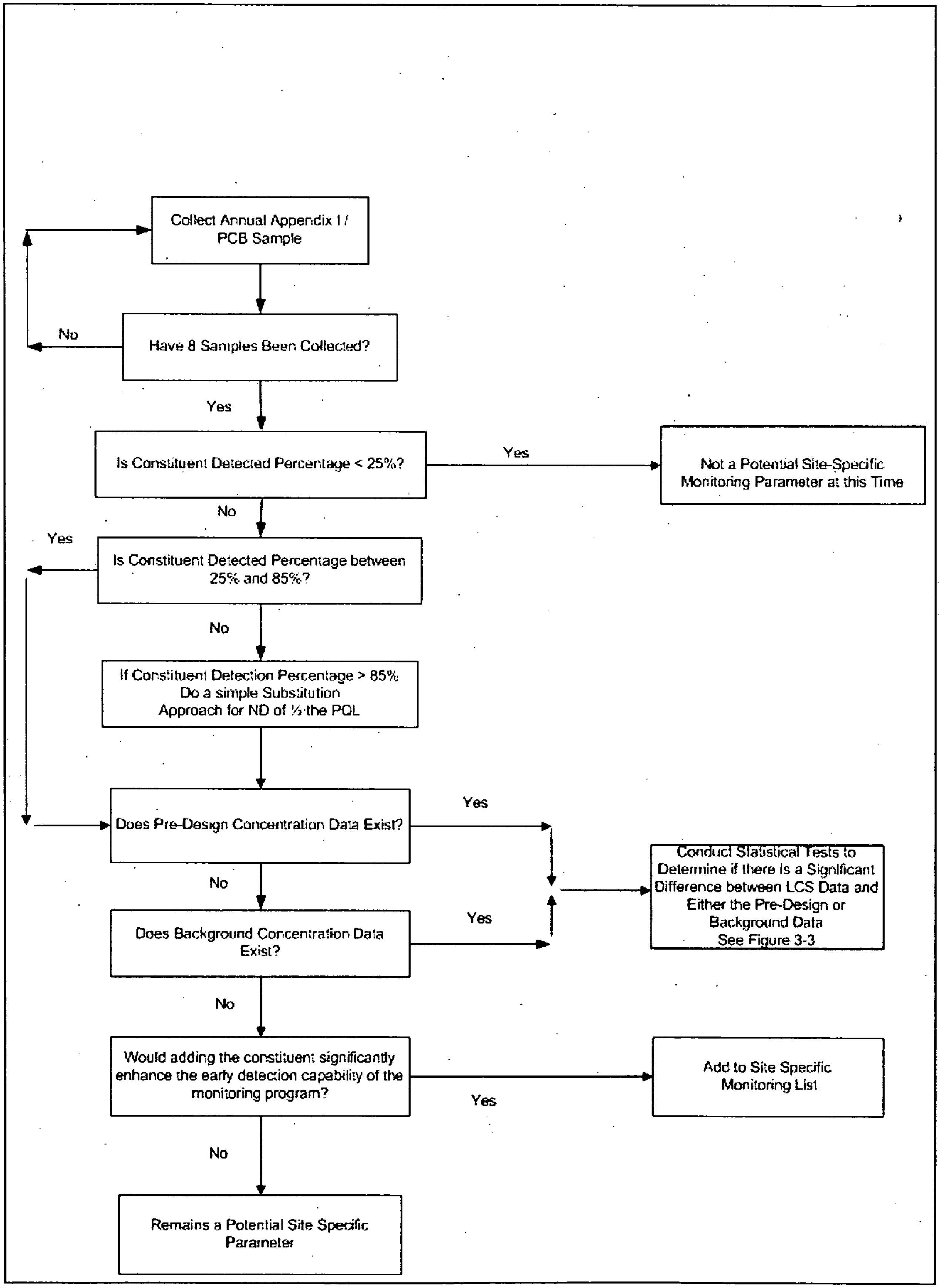

Figure 3–2. OSDF Site-Specific Leachate Monitoring Parameter Selection Approach

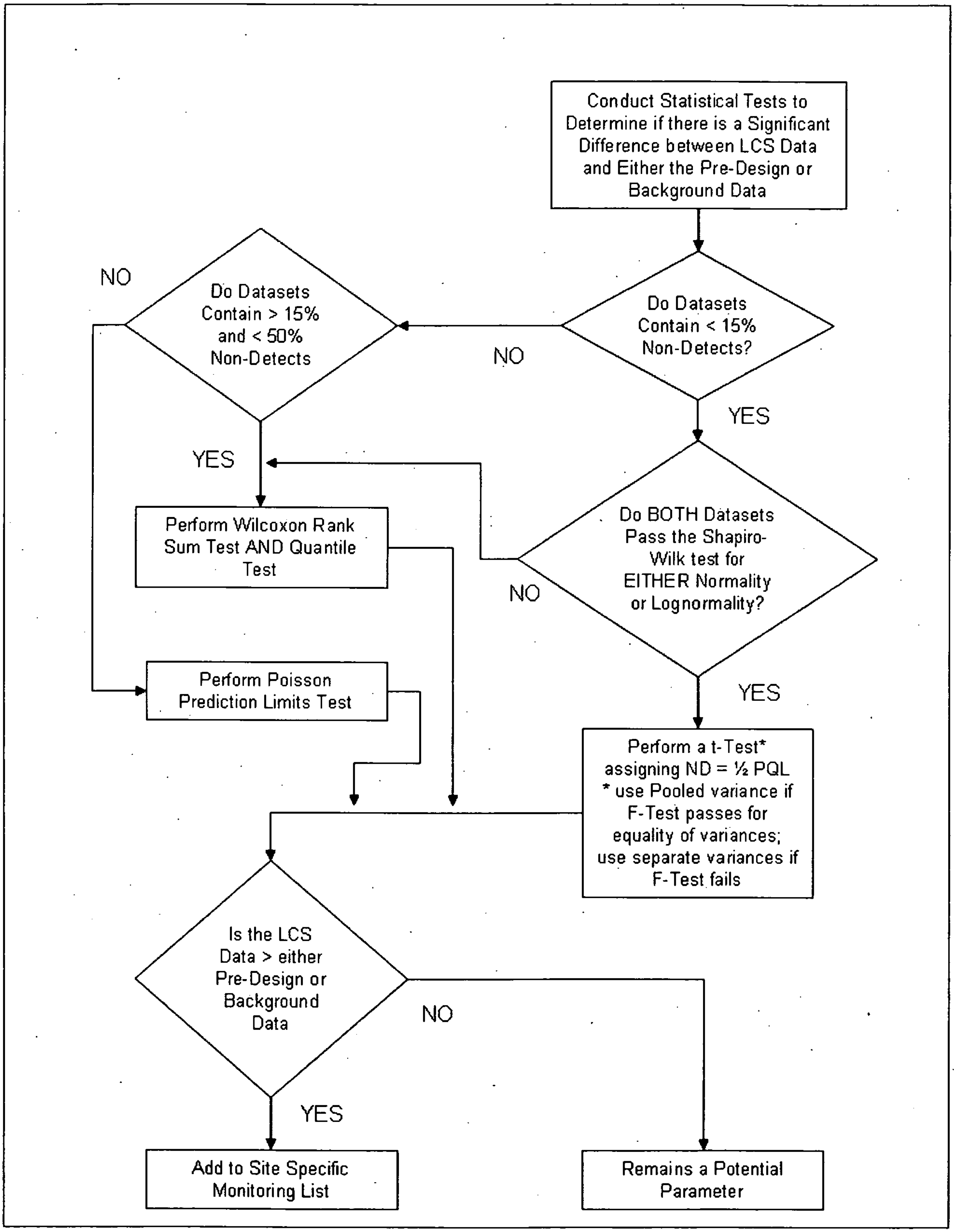

Figure 3–3. OSDF Site-Specific Leachate Monitoring Parameter Selection Statistical Testing Approach

The numerical WAC for the 12 groundwater pathway COCs were the main controlling factors for the disposal of contaminated soil in the OSDF. The 12 groundwater pathway COCs, which have numerical WAC, have significantly higher mobility and persistence and, therefore, should be considered prime candidates when selecting the indicator parameters for the detection monitoring program for the OSDF.

The numerical WAC for the 12 groundwater pathway COCs in Table 3–1 only define the maximum allowable soil concentrations that can be safely disposed of in the OSDF; they do not indicate what level of soil concentrations will actually be encountered during soil remediation. In order to frame the relative significance of these 12 WAC, the maximum soil concentrations for the 12 constituents that are expected in the OSDF following soil placement are provided in Table 3–2.

As shown in Table 3–2, the expected maximum soil concentrations in the OSDF reveal that only five of the 12 groundwater pathway COCs with numerical WAC (technetium-99, total uranium, vinyl chloride, bis (2-chloroisopropyl) ether, and 4-nitroaniline) are expected to approach their respective WAC concentrations. The other seven COCs will have maximum soil concentrations in the OSDF that are much less than the corresponding WAC. This information regarding overall abundance is also an important consideration for selecting indicator parameters for the leak detection monitoring program.

Table 3–1. WAC for Groundwater Pathway COCs

COC	WAC
Radionuclides (pCi/g):	
Neptunium-237	3.12×10^{9}
Strontium-90	5.67×10^{10}
Technetium-99	2.91×10^{1}
Total Uranium (mg/kg)	1.03×10^{3}
Organics (mg/kg):	
alpha-Chlordane	2.89×10^{0}
bis(2-Chloroisopropyl)ether	2.44×10^{-2}
Bromodichloromethane	9.03×10^{-1}
Carbazole	7.27×10^{4}
1,2-Dichloroethane	*
4-Nitroaniline	4.42×10^{-2}
Vinyl Chloride[1]	1.51×10^{0}
Inorganics (mg/kg):	
Boron	1.04×10^{3}
Chromium VI[1]	*
Magnesium	*
Mercury[1]	5.66×10^{4}

*Denotes constituents that will not exceed designated Great Miami Aquifer action level within 1,000-year performance period, regardless of starting concentration in the disposal facility.
[1]RCRA constituent.

Table 3–2. Expected Maximum COC Concentrations in the OSDF

COC	Maximum Concentration[1]	WAC	MAX/WAC
Radionuclides (pCi/g):			
Neptunium-237	2.63×10^{0}	3.12×10^{9}	8.43×10^{-10}
Strontium-90	6.49×10^{0}	5.67×10^{10}	1.14×10^{-10}
Technetium-99	2.91×10^{1}	2.91×10^{1}	1.00×10^{0}
Total Uranium (mg/kg)	1.03×10^{3}	1.03×10^{3}	1.00×10^{0}
Organics (mg/kg):			
alpha-Chlordane	5.10×10^{-3}	2.89×10^{0}	1.76×10^{-3}
bis(2-Chloroisopropyl)ether	2.44×10^{-2}	2.44×10^{-2}	1.00×10^{0}
Bromodichloromethane	7.00×10^{-3}	9.03×10^{-1}	7.75×10^{-3}
Carbazole	2.50×10^{-1}	7.27×10^{4}	3.44×10^{-6}
4-Nitroaniline	4.42×10^{-2}	4.42×10^{-2}	1.00×10^{0}
Vinyl Chloride[2]	1.51×10^{0}	1.51×10^{0}	1.00×10^{0}
Inorganics (mg/kg):			
Boron	1.43×10^{1}	1.04×10^{3}	1.38×10^{-2}
Mercury	1.30×10^{0}	5.66×10^{4}	2.30×10^{-4}

[1]Lower value between the WAC and the maximum soil concentration presented in Table F.3.4–3 of OU 5 RI.
[2]Also consider tetrachloroethene and trichloroethene in soil.

3.1.2 RCRA Constituents

After the WAC for the groundwater pathway COCs were developed, WAC for 27 additional RCRA-regulated constituents (termed the RCRA COCs) were evaluated. The development of WAC for these specific constituents was considered necessary from a regulatory standpoint to address a requirement that the RCRA COCs not be eliminated in any COC screening step during the RI/FS process. The intention was to demonstrate compliance with RCRA regulations by providing a mechanism for keeping track of the fate of materials contaminated with RCRA constituents during the remediation.

Most of the RCRA COCs are not groundwater pathway COCs; thus, the calculated WAC for the majority of these constituents are relatively high (i.e., essentially pure product concentration). Only six of the additional constituents were determined to need a numerical WAC. The details of the RCRA constituent WAC development process are provided in Attachment F.5.I of the OU5 FS. Table 3–3 summarizes the results.

The six additional numerical WAC in Table 3–3 are actually not expected to affect any disposal decisions for contaminated waste, soil, and debris from OU2, OU3, and OU5. As shown in Table 3–3, the WAC for chloroethane and toxaphene are close to pure product concentration (i.e., 1.00 × 106 milligrams per kilogram [mg/kg]). The WAC for tetrachloroethene, trichloroethene, 1,1-dichloroethene, and 1,2-dichloroethene are higher than the highest detected soil concentrations, which were used in the previous screening process summarized in Table F.2–2 of the OU5 FS. The maximum detected soil concentrations presented in Table F.3.4–3 of the OU5 RI for tetrachloroethene, trichloroethene, 1,1-dichloroethene, and 1,2-dichloroethene are 1.6 × 100, 8.90 × 101, 3.90 × 10^{-2}, and 3.4 × 10^{-1} mg/kg, respectively.

In general, the 15 groundwater pathway COCs listed in Table 3–1 already include all the constituents detected in soil and groundwater at the Fernald Preserve which may have potential to impact the Great Miami Aquifer and, therefore, are more likely to be detectable in the monitoring system in case of a leak from the OSDF.

3.1.3 Selected Primary Parameters

Based on information presented in Tables 3–1 through 3–3, 14 constituents are considered to be the initial primary parameters list for OSDF leak detection monitoring purposes. Table 3–4 summarizes these constituents and the rationale for their selection. Table 3–4 also indicates whether each of the 14 constituents is listed in OAC 3745-27-10 Appendix I as a regulatory default parameter.

Four of the 18 constituents that have numerical WAC listed in Tables 3–1 or 3–3 (chloroethane, toxaphene, neptunium-237, and strontium-90) were not selected because of their expected actual maximum concentrations in the OSDF and their comparatively high WAC values that indicate less likely potential impacts and detectability in case of a leak from the OSDF. However, four RCRA constituents that are not groundwater pathway COCs (tetrachloroethene, trichloroethene, 1,1-dichloroethene, and 1,2-dichloroethene) were selected because their expected maximum soil concentrations are reasonably close to the WAC.

The 14 constituents identified in Table 3–4 that were selected as the primary leak detection monitoring parameters have a potential to enter the environment in measurable quantities and are likely to be more differentiable from background conditions. These 14 constituents will provide a reliable indication of potential releases from the OSDF to the groundwater. A possible exception may be boron because it is present in the crushed carbonate stone used for the leachate collection system (LCS), leak detection system (LDS), and cap drainage layers.

Table 3–3. WAC for Additional RCRA Constituents

RCRA Constituents	Detected and Previously Screened	WAC	OAC 3745-27-10 Appendix I
Organics (mg/kg):			
Acetone	Yes	*	Yes
Benzene	Yes	*	Yes
Carbon tetrachloride	Yes	*	Yes
Chloroethane	No	3.92×10^5	Yes
Chloroform	Yes	*	Yes
Chloromethane	No	*	Yes
1,1-Dichloroethane	Yes	*	Yes
1,1-Dichloroethene	Yes	1.14×10^1	Yes
1,2-Dichloroethene	No	1.14×10^1	Yes
Endrin	No	*	No
Ethylbenzene	Yes	*	Yes
Heptachlor	No	*	No
Heptachlor epoxide	No	*	No
Hexachlorobutadiene	No	*	No
Methoxychlor	No	*	No
Methylene chloride	Yes	*	Yes
Methyl ethyl ketone	Yes	*	Yes
Methyl isobutyl ketone	No	*	Yes
Tetrachloroethene	Yes	1.28×10^2	Yes
1,1,1-Trichloroethane	Yes	*	Yes
Trichloroethene	Yes	1.28×10^2	Yes
Toluene	Yes	*	Yes
Toxaphene	No	1.06×10^5	No
Xylenes	Yes	*	Yes
Inorganics (mg/kg):			
Barium	Yes	*	Yes
Lead	Yes	*	Yes
Silver	Yes	*	Yes

*Denotes constituents that will not exceed designated Great Miami Aquifer action level within 1,000-year performance period, regardless of starting concentration in the disposal facility.

Table 3–4. Proposed Primary Parameters List

Constituents of Concern	Rationale	Appendix I
Radionuclides (pCi/g):		
Technetium-99	likely detectable when released	No
Total uranium (mg/kg)	likely detectable when released	No
Organics (mg/kg):		
alpha-Chlordane	likely detectable when released	No
bis(2-Chloroisopropyl)ether	likely detectable when released	No
Bromodichloromethane	likely detectable when released	Yes
Carbazole	likely detectable when released	No
1,1-Dichloroethene	significant RCRA constituent	Yes
1,2-Dichloroethene	significant RCRA constituent	Yes
4-Nitroaniline	likely detectable when released	No
Tetrachloroethene	significant RCRA constituent	Yes
Trichloroethene	significant RCRA constituent	Yes
Vinyl Chloride	likely detectable when released and significant RCRA constituent	Yes
Inorganics (mg/kg):		
Boron	likely detectable when released	No
Mercury	likely detectable when released and significant RCRA constituent	No

3.2 Supplemental Indicator Parameters

In addition to the primary parameters discussed in the preceding subsection, four general groundwater contamination indicator parameters were also proposed to supplement the selected chemical constituents in the initial leak detection monitoring parameters list. These supplemental indicator parameters comprise the following:

- pH
- Specific Conductance
- Total Organic Halogens (TOX)
- Total Organic Carbon (TOC)

These general groundwater contamination indicator parameters are typically used to aid in the detection of releases from disposal facilities. However, given that the largest volume of material placed in the cell is contaminated glacial till (made up of approximately 50 percent carbonate grains by volume), the pH of leachate will not be appreciably different from the pH of perched water or groundwater in the Great Miami Aquifer. Therefore, the remaining three supplemental indicator parameters provide an added means to detect contaminant migration and will be useful as indicators for general groundwater quality degradation.

Although the initial indicator parameters should provide indications of potential releases throughout the operational life of the OSDF, efficiency of the parameters list may still be improved based on the collected data obtained over the course of the program. Any proposed modifications based on the accumulated database will involve EPA and OEPA review and approval before adoption, as discussed below.

4.0 Parameter List Modifications

The sections above identify the process for selecting parameters for initial baseline sampling and analysis (i.e., site-specific leak detection indicator parameters, which are the proposed primary parameters in Table 3–4, and the supplemental indicator parameters listed in Section 3.2 of this appendix). It is anticipated that during the data collection process for OSDF, recommended refinements to the monitoring lists will be made periodically. The following subsections describe some of the considerations of future additions and deletions to the parameter lists and Table 4–1 identifies modifications that have been made through 2006. As explained below no additional modifications will be made until results of the Common Ion Study have been shared with the EPA/OEPA. Also, a new evaluation process that was presented in the 2006 SER (and is presented below) will be utilized for any future evaluation of existing data. All modifications have been and will be identified to EPA and OEPA and approved prior to implementation. Variances and revisions will be made as necessary. Currently, recommendations for parameter list modifications have been made through the Cells 1, 2, and 3 Technical Memorandum, the annual review process (which is documented in the annual site environmental reports), and through DOE, OEPA, and EPA agreements.

4.1 Eliminating Monitoring Parameters

An indicator parameter will be considered for elimination from the long-term leak detection monitoring parameters list if it is not detected in the LCS leachate samples collected during active waste placement. Any constituents not detected in the LCS leachate samples after waste placement are likely to be absent, insoluble, or of insignificant abundance in the OSDF.

An indicator parameter will be eliminated from the long-term leak detection monitoring program if not detected more than 25 percent of the time during the initial baseline period. This approach will be implemented on a cell-by-cell basis. Another reason parameters will be eliminated for monitoring is through agreements between DOE, OEPA, and EPA.

4.2 Adding Monitoring Parameters

Until the Common Ion Study is completed and cell monitoring becomes refined, analytical results of the annual grab sample of leachate collected in the LCS for the Appendix I and polychlorinated biphenyl (PCB) parameters specified in OAC 3745-27-10 and 19, detected constituents will be evaluated to determine whether the original indicator parameters list is sufficient for leak detection purposes. As mentioned before, most of the Appendix I constituents have already been detected in perched groundwater under the Fernald Preserve and were considered when selecting the initial leak detection indicator parameters. It is expected that these constituents will also be detected in future OSDF leachate samples. However, they will not

Table 4–1. OSDF GWLMP Parameters List Modifications through 2006

	CELL 1	CELL 2	CELL 3	CELL 4	CELL 5	CELL 6	CELL 7	CELL 8
LCS (Initial Baseline)	(02/1998)	(11/1998)	(10/1999)	(11/2002)	(11/2002)	(10/2003)	(09/2004)	(10/2004)
Parameter	**Sulfate**	**Sulfate**	**Sulfate**	**Sulfate**	**Sulfate**	**Sulfate**	**Sulfate**	**Sulfate**
Reason[a]	1[b]	1[b]	1[b]	1[b]	1[b]	1[b]	1[b]	1[b]
Sampling Period	02/2003–indefinitely	02/2003–indefinitely	02/2003–indefinitely	09/2003–indefinitely	02/2003–indefinitely	10/2003–indefinitely	09/2004–indefinitely	10/2004–indefinitely
Parameter	**PCBs**	**PCBs**	**Technetium-99**	**PCBs**	**PCBs**	**PCBs**	**PCBs**	**PCBs**
Reason[a]	3[c]	3[c]	2	3[c]	3[c]	3[c]	3[c]	3[c]
Sampling Period	05/2004–indefinitely	05/2004–indefinitely	02/2004–08/2004	05/2004–indefinitely	05/2004–indefinitely	05/2004–indefinitely	09/2004–indefinitely	10/2004–indefinitely
Parameter	**COD**	**COD**	**PCBs**	**COD**	**COD**	**COD**	**COD**	**COD**
Reason[a]	6[c]	6[c]	3[c]	6[c]	6[c]	6[c]	6[c]	6[c]
Sampling Period	05/2004–indefinitely	05/2004–indefinitely	05/2004–indefinitely	05/2004–indefinitely	05/2004–indefinitely	05/2004–indefinitely	09/2004–indefinitely	10/2004–indefinitely
Parameter	**Common Ions**	**Common Ions**	**COD**	**TDS & NO_3/NO_2**	**TDS & NO_3/NO_2**	**TDS & NO_3/NO_2**	**TDS & NO_3/NO_2**	**TDS & NO_3/NO_2**
Reason[a]	3	3	6[c]	7[d]	7[d]	7[d]	7[d]	7[d]
Sampling Period	Initiated 05/2005 (8 rounds)	Initiated 05/2005 (8 rounds)	05/2004–indefinitely	02/2005-indefinitely	02/2005-indefinitely	02/2005-indefinitely	02/2005-indefinitely	02/2005-indefinitely
Parameter	**Toxaphene**	**Toxaphene**	**Common Ions**	**Common Ions**	**Common Ions**	**Common Ions**	**Common Ions**	**Common Ions**
Reason[a]	3[c]	5[c]	3	3	3	3	3	3
Sampling Period	08/2005	08/2005	Initiated 05/2005 (8 rounds)	Initiated 05/2005 (8 rounds)	Initiated 05/2005 (8 rounds)	Initiated 05/2005 (8 rounds)	Initiated 05/2005 (8 rounds)	Initiated 05/2005 (8 rounds)
Parameter			**Toxaphene**	**Toxaphene**	**Toxaphene**	**Toxaphene**	**Toxaphene**	**Toxaphene**
Reason[a]	--	--	5[c]	5[c]	5[c]	5[c]	5[c]	5[c]
Sampling Period			08/2005	08/2005	08/2005	08/2005	08/2005	08/2005
Parameter			**1,1-Dichloroethene**					
Reason[a]	--	--	2	--	--	--	--	--
Sampling Period			11/2005–indefinitely					
LDS (Initial Baseline)	(02/1998)	(02/1998)	(08/2002)	(11/2002)	(11/2002)	(10/2003)	(09/2004)	(10/2004)
Parameter	**Sulfate**	**Sulfate**	**Sulfate**	**Sulfate**	**Sulfate**	**Sulfate**	**Sulfate**	**Sulfate**
Reason[a]	1[b]	1[b]	1[b]	1[b]	1[b]	1[b]	1[b]	1[b]
Sampling Period	02/2003–indefinitely	02/2003–indefinitely	05/2003–indefinitely	05/2003–indefinitely	05/2003–indefinitely	10/2003–indefinitely	09/2004–indefinitely	10/2004–indefinitely
Parameter	**Common Ions**	**Common Ions**	**Common Ions**	**Common Ions**	**Common Ions**	**Common Ions**	**PCBs**	**PCBs**
Reason[a]	3	3	3	3	3	3	3[c]	3[c]
Sampling Period	Initiated 05/2005 (8 rounds)	Initiated 11/2005 (8 rounds)	Initiated 05/2005 (8 rounds)	Initiated 05/2005 (8 rounds)	Initiated 05/2005 (8 rounds)	Initiated 05/2005 (8 rounds)	09/2004-indefinitely	10/2004-indefinitely
Parameter			**1,1-Dichloroethene**				**Common Ions**	**Common Ions**
Reason[a]	--	--	2	--	--	--	3	3
Sampling Period			08/2006-02/2007				Initiated 05/2005 (8 rounds)	Initiated 08/2005 (8 rounds)

Table 4–1. OSDF GWLMP Parameters [illegible]odifications through 2006 (continued)

	CELL 1	CELL 2	CELL 3	CELL [illegible]	CELL 5	CELL 6	CELL 7	CE[illegible]
HTW (Initial Baseline)	(10/1997)	(06/1998)	(07/1998)	(02/2002)	(02/2002)	(03/2003)	(02/2004)	(05/2004)
Parameter	**Sulfate**	**Sulfate**	**Sulfate**	**Sulfate**	**Sulfate**	**Sulfate**	**Sulfate**	**Sulfate**
Reason[a]	1[b]	1[b]	1[b]	1[b]	1[b]	1[b]	1[b]	1[b]
Sampling Period	02/2003–indefinitely	02/2003–indefinitely	02/2003–indefinitely	01/2003–indefinitely	01/2003–indefinitely	03/2003–indefinitely	02/2004–indefinitely	05/2004–indefinitely
Parameter	**Common Ions**	**Common Ions**	**Common Ions**	**Common Ions**	**Common Ions**	**Common Ions**	**Common Ions**	**Common Ions**
Reason[a]	3	3	3	3	3	3	3	3
Sampling Period	Initiated 05/2005 (8 rounds)	Initiated 05/2005 (8 rounds)	Initiated 05/2005 (8 rounds)	Initiated 05/2005 (8 rounds)	Initiated 05/2005 (8 rounds)	Initiated 08/2005 (8 rounds)	Initiated 08/2005 (8 rounds)	Initiated 08/2005 (8 rounds)
GMA (Initial Baseline)	**U-GMA & D-GMA** (03/1997)	**U-GMA &D-MA** (06/1997)	**U-GMA & D-GMA** (08/1998)	**U-GMA & D-GMA** (11/2001)	**U-GMA & D-GMA** (11/2001)	**U-GMA & D-GMA** (12/2002)	**U-GMA & D-GMA** (01/2004)	**U-GMA, D-GMA, SW-GMA, & SE-GMA[f]** (03/2004)
Parameter	**Sulfate**	**Sulfate**	**Sulfate**	**Sulfate**	**Sulfate**	**Sulfate**	**Sulfate**	**Sulfate**
Reason[a]	1[b]	1[b]	1[b]	1[b]	1[b]	1[b]	1[b]	1[b]
Sampling Period	02/2003-indefinitely	02/2003-indefinitely	02/2003-indefinitely	01/2003-indefinitely	01/2003-indefinitely	01/2003-indefinitely	01/2004-indefinitely	03/2004-indefinitely
Refined Baseline								
Reason	4	4	4	4	4	4	4	--
Initiated	08/2002	08/2002	08/2002	08/2005	08/2005	08/2005	Post-closure	

[a]The reasons for sampling program modifications are identified in Section 4.2 of this appendix and are as follows:

1. Addition was based on annual LCS concentration, because it could significantly enhance the early detection capability of the monitoring program.
2. Addition was based on constituent being detected in either the annual LCS or LDS during refined baseline sampling. Confirmatory sampling for the constituent will consist of three quarterly consecutive sample events from the horizon in which it was detected.
3. Addition was based on EPA/OEPA agreement beyond what is included in 1 or 2 above.
4. Deletion was based on constituent not being detected more than 25 percent of the time during initial baseline sampling.
5. Deletion was based on constituent not being detected in LCS during active waste placement.
6. Deletion was based on EPA/OEPA agreement beyond what is included in 4 or 5 above.
7. Frequency modification based on EPA/OEPA approval.

[b]In 2002, there were relatively high concentrations of sulfate in the Cells 4 and 5 LCS indicating a sulfate source in the gravel. Due to sulfate's high mobility and the presence of an ongoing source in the LCS/LDS layers, sulfate was added to the monitoring requirements at all locations.

[c]OAC 3745-27-19(M)(5) indicates PCB analysis and no required COD analysis.

[d]TDS and NO_3/NO_2 were originally sampled quarterly, based on potential treatment system impacts. Frequency was reduced to annual, based on 7+ years of data collected (DOE 2004). Implemented after approval on 01/2005. For Cells 1 through 3, frequency modification occurred when refined baseline was initiated.

[e]Constituent was added as a result of Comment #138 from EPA/OEPA (DOE 2005).

[f]For the SW-GMA and SE-GMA, the initial baseline sampling date was 08/2005.

necessarily be adequate indicators of a release. Therefore, constituents detected in the annual OSDF LCS samples will not be automatically added to the leak detection indicator parameters list, unless they meet the criteria discussed below.

Because waste is no longer being placed in the OSDF, and an alternate sampling constituent list has been approved for the OSDF, it is envisioned that after completion of the Common Ion Study that collection of an annual grab sample from the LCS of each cell to be tested for Appendix I and PCB parameters listed in OAC 3745-27-10 will no longer be required, and this annual sampling/analysis task will stop. Annual sampling from the LCS of each cell will instead focus on refined site-specific list of parameters that has been approved for the facility. Annual sampling of the LCS of each cell for Appendix I and PCB listed parameters will not stop until concurrence has been obtained from EPA/OEPA.

Until monitoring is refined, an indicator parameter will be added when it can be demonstrated that routine analysis of the constituent in the leak detection monitoring system can significantly enhance the early detection capability of the monitoring program. Evaluations of the annual leachate grab sampling data will be conducted to determine the need for adjustments to the current parameter list; the results of the evaluations will be reported in accordance with the OAC 3745-27-19(M) reporting requirement. The evaluation process is presented in Figure 3–2 and Figure 3–3.

Although constituents that are not part of the limited indicator parameter list for leak detection may be detected in the annual grab sample, it is not anticipated that the concentrations will be high enough to warrant revision of the leak detection parameter list. However, a review of the data will be conducted (and reported through the annual site environmental reports) to determine if any new indicator constituents should be added to the site-specific leak detection indicator parameter list. Constituent concentrations will be reviewed against information gathered during the OU5 RI/FS period and subsequent environmental monitoring data. OSDF annual LCS data will be compared to factors such as Great Miami Aquifer and perched water background values, range of site perched water concentrations, and current laboratory contract-required detection limits. Ultimately, a constituent will be added if routine analysis of the constituent can significantly enhance early detection capability. The leak detection/leachate analysis will ensure that the character of the leachate will not adversely impact the treatment facility or the treatment facility effluent receiving stream (the Great Miami River). Evaluations will be documented through tables provided in the annual site environmental reports. Sample results will be compared to groundwater FRLs, groundwater (perched water and Great Miami Aquifer) background concentrations, and site perched water concentrations.

Additionally, as recommended in the Cells 1, 2, and 3 Technical Memorandum, even when cell monitoring becomes refined (i.e., based on those constituents detected more than 25 percent of the time during initial baseline sampling), annual samples collected from LCS and LDS will be analyzed for all site-specific leak detection indicator constituents. If a constituent is detected in either the LCS or LDS, then confirmatory sampling for that constituent will consist of three quarterly consecutive sample events from the horizon in which it was detected. Depending on the magnitude and/or persistence of the constituent detected in the LCS or LDS, sampling for the detected constituent in the next lower horizon may occur. If the constituent is detected in the next lower horizon, then confirmatory sampling will again be conducted for three quarterly consecutive events. This strategy, performed as necessary, is based on detected constituents to ensure that a thorough evaluation of all detected constituents is completed.

Another reason parameters will be added for monitoring is through agreements between DOE, OEPA, and EPA.

5.0 References

DOE (U.S. Department of Energy), 2005. *Response to EPA and OEPA Technical Review Comments on the Revised Comprehensive Legacy Management and Institutional Controls Plan, Volumes I and II, Draft Final, April*, Fernald Closure Project, Cincinnati, Ohio, August.

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End of current text

Attachment D

Attachment D

Integrated Environmental Monitoring Plan

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Appendixes

Appendix A The Revised Groundwater Monitoring Approach
Appendix B Surface Water Final Remediation Levels Exceedances
Appendix C Dose Assessment
Appendix D Natural Resource Monitoring Plan

End of current text

Acronyms and Abbreviations

ALARA	as low as reasonably achievable
ANSI	American National Standards Institute
ARARs	applicable or relevant and appropriate requirements
ASL	analytical support level
BAT	best available technology
BTV	benchmark toxicity value
CAWWT	converted advanced wastewater treatment facility
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CIP	Community Involvement Plan
CFR	*Code of Federal Regulations*
CMT	continuous multi-channel tubing
COC	contaminant of concern
CRARE	Comprehensive Remedial Action Risk Evaluation
D&D	decontamination and demolition
DCF	dose conversion factor
DFM	data fusion modeling
DOE	U.S. Department of Energy
DOECAP	U.S. Department of Energy Consolidated Audit Program
EM	Office of Environmental Management
EMP	Fernald Site Environmental Monitoring Program
EPA	United States Environmental Protection Agency
ESD	Explanation of Significant Differences
FCAB	Fernald Citizens Advisory Board
FEMP	Fernald Environmental Management Project
FFA	Federal Facility Agreement
FFCA	Federal Facility Compliance Agreement
FRESH	Fernald Residents for Environmental Safety and Health
FRL	final remediation level
GEMS	Geospatial Environmental Mapping System
GPMPP	Groundwater Protection Management Program Plan
GWLMP	Groundwater/Leak Detection and Leachate Monitoring Plan
IC Plan	Institutional Controls Plan
IEMP	Integrated Environmental Monitoring Plan
LCS	leachate collection system
LDS	leak detection system
LM	Office of Legacy Management
LM SAP	Legacy Management Sampling and Analysis Plan
LM QAPP	Legacy Management CERCLA Sites Quality Assurance Project Plan
LMICP	Comprehensive Legacy Management and Institutional Controls Plan
MCL	maximum contaminant level
MS/MSD	matrix spike/matrix spike duplicate
NEPA	National Environmental Policy Act
NESHAP	National Emissions Standards Hazardous Air Pollution
NPDES	National Pollutant Discharge Elimination System
NRMP	National Resource Monitoring Plan
NRRP	National Resource Restoration Plan
NRRDP	National Resource Restoration Designs Plan

Acronyms and Abbreviations (continued)

NTU	nephelometric turbidity units
OAC	Ohio Administrative Code
OEPA	Ohio Environmental Protection Agency
OMMP	Operations and Maintenance Master Plan for the Aquifer Restoration and Wastewater Project
OSDF	on-site disposal facility
OU	operable unit
PCCIP	Post-Closure Care and Inspection Plan
PDF	portable document file
ppb	parts per billion
PRG	preliminary remediation goal
PRRS	Paddys Run Road Site
RCRA	Resource Conservation and Recovery Act
RI/FS	remedial investigation/feasibility study
ROD	record of decision
SEP	Site-Wide Excavation Plan
SSOD	Storm Sewer Outfall Ditch
SWIFT	Sandia Waste Isolation Flow and Transport
TLD	thermoluminescent dosimeter
U.S.C.	United States Code
VAM3D	Variability Saturated Analysis Model in 3 Dimensions
WAC	waste acceptance criteria

1.0 Introduction

As noted in the executive summary, the Integrated Environmental Monitoring Plan (IEMP) has been integrated into this revision of the Legacy Management and Institutional Controls Plan (LMICP). The IEMP is no longer a stand-alone document with its own review and revision cycle. It will be reviewed and revised each October as part of the annual LMICP review.

1.1 Background

The U.S. Department of Energy's (DOE's) Fernald Preserve has completed its remedial investigation/feasibility study (RI/FS) obligations, and the final RODs for all five Fernald Preserve operable units (OUs) are now in place. Since 1997, the site's focus has been on the safe and efficient execution of site remediation, including facility decontamination and dismantling, the design and construction of waste processing and disposal facilities, waste excavation and shipping, and the continuation of groundwater remediation. In recognition of the increased focus on remedy implementation, DOE developed an integrated environmental monitoring strategy tailored to the near-term cleanup actions. The integrated strategy will continue in post-closure to ensure that environmental monitoring and reporting for all site media including remedy performance monitoring is a coordinated effort.

The basis for the current understanding of environmental conditions at the Fernald Preserve is the extensive site environmental data that have been collected. The data were collected over a 10-year period through the remedial investigation process required under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended, combined with 9 years of subsequent routine environmental monitoring data collected through the IEMP. Analysis of the remedial investigation data resulted in the selection of a final remedy for the Fernald Preserve's environmental media, with the issuance of the *Final Record of Decision* (ROD) *for Remedial Actions at Operable Unit 5* (DOE 1996a) in January of 1996. OU5 includes all environmental media, contaminant transport pathways, and environmental receptors (soil, groundwater, surface water, sediment, air, and biota) at and around the Fernald Preserve that have been affected by past uranium production operations. The remedy for OU5 defines final site-wide cleanup levels and establishes the general areal extent of on- and off-property actions necessary to mitigate the environmental effects of site-production activities.

The IEMP is a formal remedial design deliverable required to fulfill Task 9 of the *Remedial Design Work Plan for Remedial Actions at Operable Unit 5* (DOE 1996b) and is an enforceable portion of the LMICP. This revision to the IEMP provides an update to the original IEMP (approved in August of 1997) as required by the Remedial Design Work Plan and DOE Order 450.1 (DOE 2003a).

1.2 Program Objectives and Scope

As post-closure and continued cleanup activities are conducted, the need for accurate, accessible, and manageable environmental monitoring information continues to be essential. The IEMP has been formulated to meet this need and will serve several comprehensive functions for the site by:

- Maintaining the commitment to a remediation-focused environmental surveillance monitoring program that is consistent with DOE Orders 450.1 and 5400.5 (DOE 1993) and that continues to address stakeholder concerns. Both orders are listed as "to be considered" criteria in the OU5 ROD and are, therefore, key drivers for the scope of the monitoring program.
- Fulfilling additional site-wide monitoring and reporting requirements activated by the CERCLA ARARs for the OU5 ROD, including determining when environmental restoration activities are complete and cleanup standards have been achieved.
- Providing the mechanism for assessing the performance of the Great Miami Aquifer groundwater remedy, including determining when restoration activities are complete.
- Providing a reporting mechanism for many environmental regulatory compliance monitoring activities (i.e., OSDF groundwater monitoring, Federal Facility Compliance Agreement [FFCA] and elements of the National Pollutant Discharge Elimination System [NPDES] discharge reporting, and the air pathway specific dose estimates required under National Emissions Standards for Hazardous Air Pollutants [NESHAP] Subpart H) with the environmental reporting for DOE Orders 450.1/231.1 (DOE 2005a).
- Providing a reporting interface for project-specific monitoring (i.e., OSDF), which is conducted under a separate attachment to the LMICP (Attachment C, "On-Site Disposal Facility [OSDF] Groundwater/Leak Detection and Leachate Monitoring Plan [GWLMP]").

Under the IEMP, data showing the environmental conditions at the Fernald Preserve are collected, maintained, and evaluated. Performance monitoring results associated with the Fernald Preserve are also evaluated and compared against established thresholds. DOE fulfills its obligation to document environmental monitoring information under the umbrella of the IEMP reports.

The boundary conditions defined in the IEMP are as follows:

- The administrative boundary lies between remedial actions for groundwater south of the Fernald Preserve and those potential remedial actions associated with the Paddys Run Road Site (PRRS) plume. This boundary is shown in the Feasibility Study Report for Operable Unit 5 (DOE 1995a) and the Proposed Plan for Operable Unit 5 (DOE 1995b).
- The programmatic boundary refers to the differentiation between the scope and responsibility associated with the design, implementation, and documentation. OSDF monitoring activities are designated as project-specific monitoring. The designation is based on an evaluation of the pertinent regulatory drivers and DOE policies that have monitoring implications.

The IEMP monitoring programs measure the collective environmental impacts resulting from continued Fernald Preserve cleanup and monitoring activities.

1.3 Plan Organization

The IEMP is composed of seven sections and four appendixes. The remaining sections and their contents are as follows:

- Section 2.0—Post-Closure Strategy and Organization: Provides an overview of the post-closure monitoring strategy and a description of the post-closure organization.
- Section 3.0—Groundwater Monitoring Program: Provides a description of the monitoring activities necessary to track the progress of the restoration of the Great Miami Aquifer and discusses the groundwater monitoring activities necessary to maintain compliance with Resource Conservation and Recovery Act (RCRA) requirements as specified in the Ohio Environmental Protection Agency (OEPA) Director's Findings and Orders dated September 2000; and a description of the integration with the groundwater monitoring program for the OSDF.
- Section 4.0—Surface Water and Treated Effluent Monitoring Program: Provides a description of the routine site-wide surface water monitoring to be performed during post closure to maintain compliance with surface water and treated effluent discharge requirements.
- Section 5.0—Sediment Monitoring Program: Provides a description of the sediment monitoring activities to independently verify the overall effectiveness of the sediment controls.
- Section 6.0—Air Monitoring Program: Provides a description of the site-wide air monitoring to be conducted during post-closure.
- Section 7.0—Program Reporting: Provides a detailed accounting of the reporting elements included within the IEMP reporting framework

Appendix A—The Groundwater Monitoring Approach: Provides detailed justification for the groundwater sampling program.

Appendix B—Surface Water Final Remediation Level (FRL) Exceedances: Provides documentation, by constituent, of the particular sample location where FRLs have been exceeded.

Appendix C—Dose Assessment: Summarizes the IEMP's responsibility for preparing the Fernald Preserve's annual radiological dose assessment related to remediation activities to comply with NESHAP Subpart H requirements and the intention of DOE Order 5400.5.

Appendix D – Natural Resource Monitoring Plan (NRMP): Provides the regulatory requirements and strategy for the monitoring of ecological impacts to wetlands, threatened and endangered species, and terrestrial and aquatic habitats.

The IEMP is organized according to the principal environmental media and contaminant migration pathways routinely examined under the program. For each of the media constituting the program, evaluations of the regulatory drivers and pertinent DOE policies that govern environmental monitoring were conducted. The details and results of this evaluation are presented in Sections 3.0 through 6.0.

1.4 Role of the IEMP in Remedial Action Decision Making

The data generated through the IEMP support a number of management decisions regarding the progressive implementation strategy, sequence, and overall management control of remedial actions. This subsection highlights the following: (1) the key management decisions that will be supported by the IEMP, (2) the organizational responsibilities for making the decisions, (3) the framework and criteria needed to facilitate the decisions, and (4) the communication process for internally conveying the results of the decisions to the respective project organizations and externally to the Fernald Preserve's stakeholders. Each of the environmental media sections of this plan (Sections 3.0 through 6.0) provides detailed discussions of the specific IEMP data-use and decision-making criteria relevant to that particular medium.

The IEMP is the mechanism to assess the continued protectiveness of the remedial actions. The IEMP will specify the type and frequency of environmental monitoring activities to be conducted during remedy implementation, and ultimately, following the cessation of remedial operations as appropriate. The IEMP will delineate the Fernald Preserve's responsibilities for site-wide monitoring of surface water and sediment over the life of the remedy and ensure that FRLs are achieved at project completion. The IEMP will also serve as the primary vehicle for determining (to U.S. Environmental Protection Agency's (EPA's) and OEPA's satisfaction) that remedial action objectives for the Great Miami Aquifer are being attained. In addition to these FRL attainment responsibilities, the IEMP will also define site-wide remedial monitoring requirements for air.

1.4.1 Management Decisions

The IEMP supports the following key management decisions:

- From an environmental media perspective, do the completed remedial actions remain protective of human health and the environment?
- From a site-wide perspective, is the Fernald Preserve maintaining compliance with its various regulatory requirements for environmental monitoring?
- Are there any trends in the site-wide environmental monitoring data that indicate the potential for an unacceptable future condition?
- In the event of a regulatory non compliance situation or potentially unacceptable cumulative trend, what activities or projects are the principal contributors to the situation? What specific response actions must be taken to address the situation?
- What communication with regulatory agencies or other concerned stakeholders is necessary as a result of the situation and/or decisions made?
- As discussed in the next subsection, Legacy Management (LM) decision makers will be conducting ongoing evaluations of the data generated at the site to ensure satisfactory conditions are maintained.

1.4.2 Who is Responsible for Making the Decisions?

The environmental data are used by LM personnel to monitor the acceptability of the site activities underway. The bulk of the day-to-day planning and routine operating decisions will be internal to the Fernald Preserve, with process adjustments implemented on a situation-specific, as-needed basis.

In the majority of cases, the data evaluation will conclude that all regulatory requirements are being met and that no unacceptable cumulative trends in the monitoring data are present. The evaluation and conclusions will be documented for regulatory agency concurrence through the normal reporting mechanisms described in this plan.

LM will notify EPA and OEPA immediately (prior to taking an action internally) if an evaluation indicates that attainment of a regulatory schedule milestone is in jeopardy because of the mitigative actions necessary to address an adverse cumulative situation

LM personnel will (1) identify the root cause of the unacceptable situation, (2) determine the options for addressing the problem, and (3) communicate with EPA and OEPA to arrive at a mutually acceptable decision concerning the follow-up actions to be taken. Immediate notification to EPA and OEPA will be made via telephone, followed by written communication. For all remaining situations (i.e., those involving the Fernald Preserve's responses to undesirable data trends for any of the environmental media), LM personnel will identify and implement appropriate actions internally, and will document the decisions and resultant response actions via telephone or in the annual site environmental reports.

Subject matter experts are responsible for the ongoing review of media-specific monitoring data and the identification of any related environmental-compliance issues. If the potential for an unacceptable future situation is identified, then options for addressing the problem will be identified. The options will be assessed with respect to their implications, and the results of the evaluations will be communicated as necessary to the Fernald Preserve's stakeholders, EPA, and OEPA.

1.4.3 What Are the General Criteria for the Decisions?

The IEMP establishes, on a medium-specific basis, the types of data and thresholds or regulatory limits required to support the management decisions described above. Each set of medium-specific criteria is handled uniquely because of the varying medium-specific locations where the regulatory criteria are applied.

The medium-specific sections of this plan identify monitoring requirements and ARARs for each environmental medium with the applicable compliance locations. Additionally, the medium-specific sections define the criteria to be used to identify trends in the data that could indicate an imminent unacceptable situation. Each of the medium-specific sections specifies the frequency of the data evaluations to satisfy the Fernald Preserve's overall planning and decision making requirements. DOE will evaluate the data accordingly and will report the results according to the approach summarized below.

1.4.4 How Will IEMP Decisions Be Communicated?

Each medium section of this IEMP (Sections 3.0 through 6.0) presents medium-specific reporting components, and Section 7.0 summarizes the overall reporting strategy for the IEMP. LM information is available on the DOE Office of LM website (http://www.lm.doe.gov/). The Fernald data will be made available to the regulatory agencies on an ongoing basis in the form of electronic data files through this site at the following link: http://www.lm.doe.gov/land/sites/oh/fernald/fernald.htm. Fernald-specific information will continue to be available in query form through the Geospatial Environmental Mapping System (GEMS) and through downloadable files (both types of data are accessible through the above-referenced link). GEMS is a Web-based application that provides access to data queries upon completion of data review. The annual site environmental reports will also be issued as part of the IEMP program. The report will provide a reporting mechanism for IEMP data to meet regulatory-compliance requirements pertinent to site-wide interpretation.

The routine process adjustment decisions (e.g., converted advanced wastewater treatment [CAWWT] facility) will not necessarily be reported as part of the IEMP reports. These types of routine decisions will be maintained as part of the daily operations logs and are considered to be normal in the course of day-to-day practice in order to achieve operating objectives. The major project control decisions will be summarized in the annual site environmental reports. The decision reporting format will include (1) a description of the pending adverse conditions, (2) the actions taken to respond to the situation, and (3) the mitigation results obtained. All such internal decisions will be made consistent with the Fernald Preserve's enforceable work plans and ARAR compliance requirements. Once a mutually agreeable decision is reached, the actions will be implemented. The decision process, actions taken, and results obtained will be summarized in the annual site environmental reports.

The annual site environmental reports will be furnished to EPA and OEPA in accordance with the provisions summarized in Section 7.0. The annual site environmental reports will also be available for review by the Fernald Preserve's stakeholders at the Visitors Center and the Public Environmental Information Center and to select stakeholders via mail.

2.0 Fernald Preserve Post-Closure Strategy and Organization

This section presents a description of the Fernald Preserve's post-closure strategy and organizational structure associated with post-closure activities, which includes the continuing OU5 (i.e., environmental media) remediation and monitoring efforts.

2.1 Post-Closure Strategy

The Fernald Preserve's post-closure strategy reflects the completion of the majority of CERCLA activities at the site. There have been extensive site characterization activities to determine the nature and extent of contamination, baseline risk assessments, and detailed evaluation and screening of remedial alternatives leading to a final remedy selection as documented in the ROD for each OU. The majority of all OU remediation activities were completed in 2006. In 2008, the remaining OU with continuing remediation efforts is OU5. Table 2–1 provides a summary of the OU5 remedy overview.

During post-closure, active remediation of the Great Miami Aquifer will continue. Additionally, surface water surveillance monitoring (including NPDES monitoring), sediment surveillance monitoring, and natural resources restoration activities will also continue. The sources associated with air monitoring requirements were removed in 2006; however, limited monitoring will continue to ensure that all air monitoring requirements have been met and levels are acceptable from a closure standpoint. It is anticipated that air monitoring will cease in the future, but agency approval will be secured before ceasing this activity.

2.2 Post-Closure Organization

The post-closure organizational structure is much simplified over previous Fernald organizations. Adequate staff will remain at the site to continue to meet regulatory and OU5 commitments.

2.3 Post-Closure Status

In 2006, the contaminant sources that were at the Fernald Preserve were removed. Soil and on-property sediments were certified, with the exception of those areas indicated in Figure 2–1. Great Miami Aquifer restoration activities continue post-closure as does surveillance monitoring for surface water, sediment, and air. Natural resource restoration activities also continue post-closure. Monitoring associated with the IEMP is mainly associated with these activities. Figure 2–2 shows the site configuration during post-closure.

Table 2–1. OU5 Remedy Overview

OU	Description	Remedy Overview
OU5	Environmental Media • Groundwater • Surface water and sediments (on-property sediment cleanup completed) • Soil not included in the definitions of OU1 through OU4 (cleanup completed with the exception of those areas identified in Figure 2–2) • Flora and fauna	ROD Approved: January 1996 An Explanation of Significant Differences document was approved in November 2001, formally adopting EPA's Safe Drinking Water Act Maximum Contaminant Level for uranium of 30 µg/L as both the FRL for groundwater remediation and the monthly average uranium effluent discharge limit to the Great Miami River. Continued extraction of contaminated groundwater from the Great Miami Aquifer to meet FRLs at all affected areas of the aquifer. Treatment of contaminated groundwater, storm water, and wastewater to attain concentration and mass-based discharge limits and FRLs in the Great Miami River. Continued site restoration, institutional controls, and post-remediation maintenance. Completion of excavation of contaminated soil and sediment to meet FRLs.* Excavation of contaminated soil containing perched water that presents an unacceptable threat, through contaminant migration, to the underlying aquifer. Completion of on-site disposal of contaminated soil and sediment that meet the OSDF waste acceptance criteria. Soil and sediment that exceed the waste acceptance criteria for the OSDF will be treated, when possible, to meet the OSDF waste acceptance criteria or will be disposed of at an off-site facility.

* Due to elevated uranium concentration in retained surface water in the area between former waste pit 3 and Paddys Run, additional soils in the area will be removed as a maintenance activity.

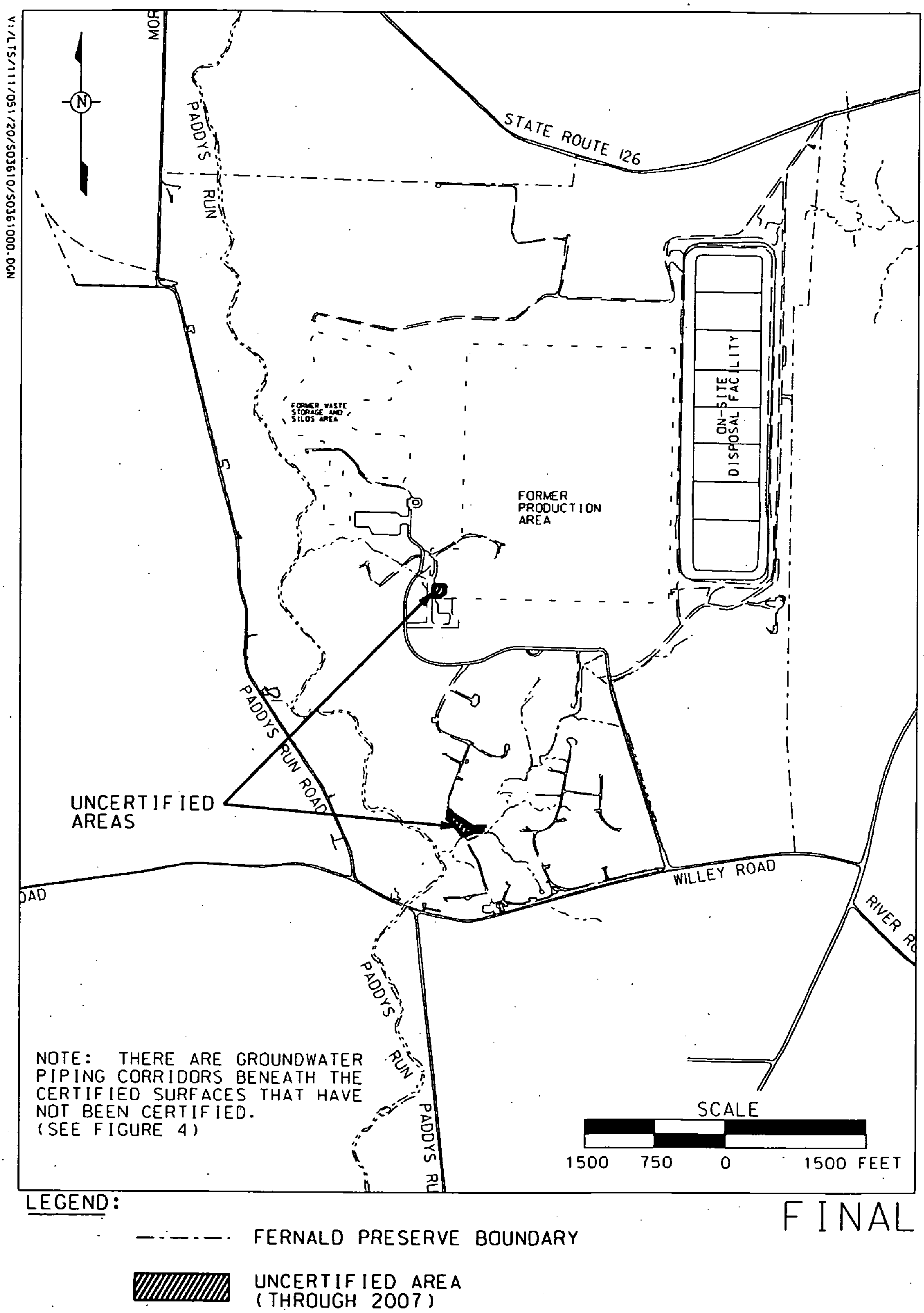

Figure 2–1. Uncertified Areas

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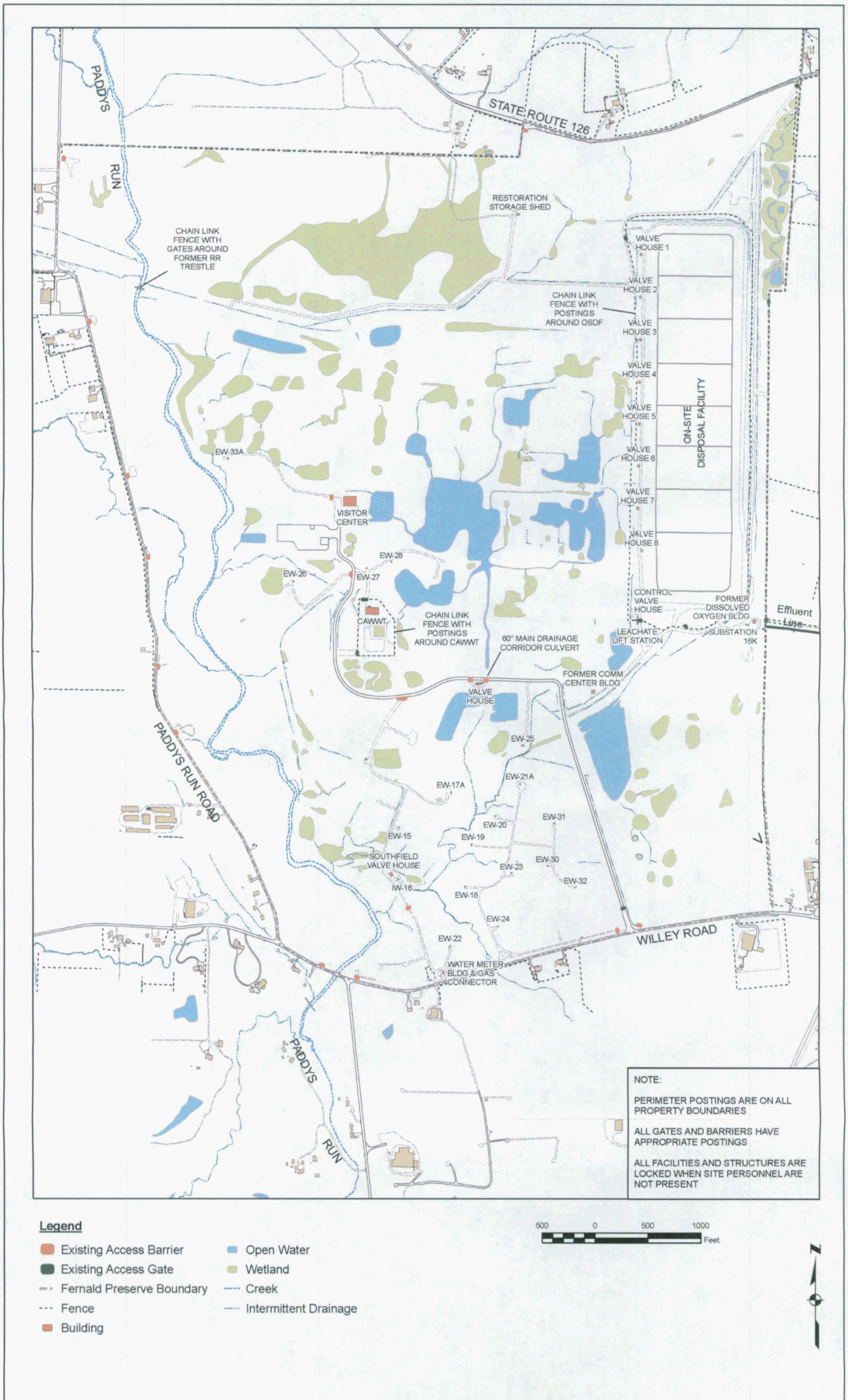

Figure 2–2. Fernald Preserve Site Configuration

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3.0 Groundwater Monitoring Program

Section 3.0 presents the monitoring strategy for tracking the progress of the restoration of the Great Miami Aquifer and satisfying the site-specific commitments related to groundwater monitoring. A medium-specific plan for conducting all groundwater monitoring activities is provided. Program expectations are outlined in Section 3.4, and the program design is presented in Section 3.5.

3.1 Integration Objectives for Groundwater

The Fernald Groundwater Certification Plan (DOE 2006b) defines a programmatic strategy for certifying the completion of the aquifer remedy. Remediation of the Great Miami Aquifer is being conducted using pump-and-treat technology, and it is progressing toward certification through a staged process. The six stages are:

Stage I: Pump-and-Treat Operations
Stage II: Post–Pump-and-Treat Operations/Hydraulic Equilibrium State
Stage III: Certification/Attainment Monitoring
Stage IV: Declaration and Transition Monitoring
Stage V: Demobilization
Stage VI: Long-Term Monitoring

The groundwater sampling specified in the IEMP tracks the performance of the Great Miami Aquifer groundwater restoration remedy. The IEMP is the controlling document for groundwater remedy performance monitoring and is currently focused on groundwater monitoring needed to support Stage I (Pump-and-Treat Operations). Groundwater monitoring requirements for Stages II through VI of the groundwater certification process will be defined in future revisions of the IEMP. The following is a brief description of the stages listed above:

Stage I – Pump-and-Treat Operations

The aquifer remedy is currently in Stage I. The principal contaminant of concern is uranium. Groundwater is being pumped from contaminated portions of the aquifer and treated for uranium.

A phased approach to remediation of the aquifer has been organized around three groundwater restoration modules:

1. The South Plume Module
2. The South Field Module
3. The Waste Storage Area Module

An overview of each aquifer restoration module is provided in Section 3.4, and Figure 3–1 identifies the location of these aquifer restoration modules. As discussed in Section 3.4, the aquifer remedy once included a re-injection module.

Pump-and-treat operations will continue for each groundwater module until FRL concentrations in the aquifer have been achieved or until the mass removal efficiency of the extraction system

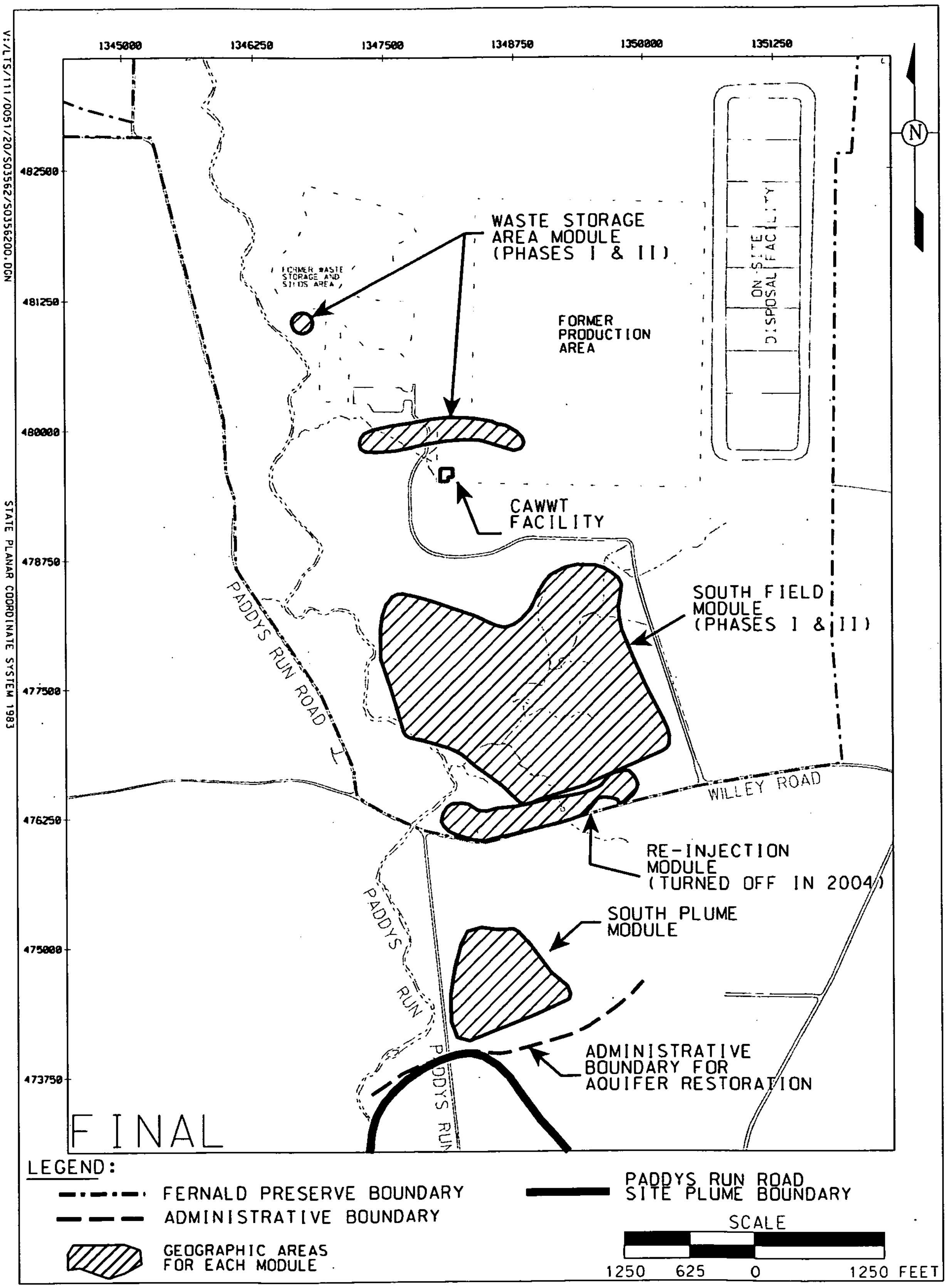

Figure 3–1. Location of Aquifer Restoration Modules

has decreased such that it is apparent groundwater FRL concentration limits in the aquifer cannot be achieved. The controlling document for the operation of the pump-and-treat system is Attachment A the Operations and Maintenance Master Plan for Aquifer Restoration and Wastewater Treatment (OMMP). Ultimately, the IEMP will be used to document the approach to determine when the various modules complete pump-and-treat operations. Monitoring requirements needed to support later stages of the certification strategy will be incorporated into future revisions of the IEMP when deemed appropriate.

The design of the groundwater monitoring program was developed in recognition of:

- Operation of the South Field (Phases I and II) Module
- Operation of the South Plume Module
- Operation of the Waste Storage Area (Phases I and II) Module

Along with this performance-based responsibility, the IEMP serves to integrate several former compliance-based groundwater monitoring or protection programs:

- OEPA Director's Findings and Orders for property boundary groundwater monitoring to satisfy RCRA facility groundwater monitoring requirements (OEPA 2000)
- Private well sampling
- Groundwater Protection Management Program Plan

As discussed in Section 3.7, these activities were brought together under a single reporting structure to facilitate regulatory agency review of the progress of the OU5 groundwater remedy.

Stage II—Post Pump-and-Treat Operations/Hydraulic Equilibrium State

Stage II monitoring will begin on a module-specific basis when pump-and-treat operations have stopped. The objective will be to document that the aquifer has readjusted to steady-state non-pumping conditions prior to proceeding to Stage III (Attainment Monitoring). During Stage II, groundwater levels will be routinely measured to document that steady-state water level conditions have been achieved. Groundwater FRL constituent concentrations will also be routinely measured. If uranium concentrations rebound to levels above the groundwater FRL during the steady-state assessment, then pumping operations would resume. If uranium concentrations remain below the groundwater FRL during the steady-state assessment and do not appear to be trending up toward the groundwater FRL, then the certification process will proceed to Stage III (Certification/Attainment Monitoring). It is anticipated that Stage II monitoring will take approximately 3 months.

Stage III—Certification/Attainment Monitoring

Certification/attainment monitoring will also be module specific. Data collected during Stage III will be used to document that remediation goals have been met and that the goals will continue to be maintained in the future. Statistical tests will be used to predict the long-term ability to stay below FRL constituent concentrations.

Stage IV—Declaration and Transition Monitoring

Because certification is being approached on a module-specific basis, efforts need to be taken to ensure that upgradient plumes do not migrate into and re-contaminate downgradient areas where remediation goals have been achieved. A few monitoring wells will be positioned at the upgradient edge of the clean areas and will be monitored to document that the upgradient plume is not impacting the clean area. It is anticipated that Stage IV monitoring could be conducted for as long as 10 years, essentially the time when the groundwater model predicts that cleanup goals will be achieved in the South Plume Module versus the Waste Storage Area Module.

Stage V—Demobilization

Stage V identifies that all structures, trailers, liners, pipes (except the outfall line), and utilities dedicated for aquifer restoration and wastewater treatment will need to be properly decontaminated and dismantled in order to be protective of the environment. With the exception of the water treatment facility, the decontamination and dismantling (D&D) of infrastructure will not take place until the entire aquifer has been certified clean. This will provide the means to reinitiate pumping in any area of the aquifer that may require additional pumping prior to achieving final certification.

Stage VI – Long-Term Monitoring

Long-term monitoring will be conducted in former source areas after the last groundwater module is certified clean. If the water table rises to an elevation that exceeds what was previously recorded for a former source area, then groundwater monitoring beneath the former source area will be initiated to determine if any new sources have dissolved into the groundwater.

3.2 Summary of Regulatory Drivers, DOE Policies, and Other Fernald Preserve–Specific Agreements

This section presents a summary evaluation of the regulatory-based requirements and policies governing the monitoring of the Great Miami Aquifer. The intent of the section is to identify the pertinent regulatory drivers, including applicable or relevant and appropriate requirements (ARARs) and to-be-considered requirements, for the scope and design of the Great Miami Aquifer groundwater monitoring system. These requirements are used to confirm that the program design satisfies the regulatory obligations for monitoring that have been activated by the OU5 ROD and to achieve the intentions of other pertinent criteria, such as DOE Orders and the Fernald Preserve's existing agreements that have a bearing on the scope of groundwater monitoring.

3.2.1 Approach

The analysis of the regulatory drivers and policies for groundwater monitoring was conducted by examining the suite of ARARs and to-be-considered requirements in the five approved CERCLA OU RODs to identify the subset with specific groundwater monitoring requirements. The Fernald Preserve's existing compliance agreements issued outside the CERCLA process were also reviewed.

3.2.2 Results

The following regulatory drivers, compliance agreements, and DOE policies were found to govern the monitoring scope and reporting requirements for remedy performance monitoring and general surveillance of the protectiveness of the Great Miami Aquifer groundwater remedy:

- The CERCLA ROD for remedial actions at OU5 requires the extraction and treatment of Great Miami Aquifer groundwater above FRLs until the full, beneficial use potential of the aquifer is achieved, including use as a drinking water source. The FRLs are established by considering chemical specific ARARs, hazard indices, and background and detection limits for each contaminant. Many Great Miami Aquifer FRLs are based on established or proposed Safe Drinking Water Act maximum contaminant levels (MCLs), which are ARARs for groundwater remediation. For Fernald Preserve related contaminants that do not have an established MCL under the Safe Drinking Water Act, a concentration equivalent to an incremental lifetime cancer risk of 10 5 for carcinogens or a hazard quotient of 1 for non carcinogens was used as the FRL, unless background concentrations or detection limits are such that health-based limits could not be attained. (In these cases the background or detection limit became the FRL.) The FRLs will be tracked throughout all affected areas of the aquifer and will be the basis for determining when the Great Miami Aquifer restoration objectives have been met. By definition, the OU5 ROD incorporates the requirements of the Fernald Preserve's existing CERCLA South Plume Removal Action (which was the regulatory driver for the former Design Monitoring and Evaluation Program Plan and the Groundwater Monitoring and Reporting Program).
- Per the CERCLA Remedial Design Work Plan for remedial actions at OU5, monitoring will be conducted following the completion of cleanup as required to assess the continued protectiveness of the remedial actions. The IEMP will specify the type and frequency of environmental monitoring activities to be conducted during remedy implementation and ultimately, following the cessation of remedial operations as appropriate. The IEMP will delineate the Fernald Preserve's responsibilities for site-wide monitoring over the life of the remedy, and ensure that FRLs are achieved at project completion. The IEMP will also serve as the primary vehicle for determining to EPA and OEPA's satisfaction that remedial action objectives for the Great Miami Aquifer have been attained.
- The September 10, 1993, OEPA Director's Findings and Orders required groundwater monitoring at the Fernald Preserve's property boundary to satisfy RCRA facility groundwater monitoring requirements (OEPA 1993), and have been superseded by Director's Final Findings and Orders, issued September 7, 2000. The September 7, 2000, Director's Final Findings and Orders specify that the site's groundwater monitoring activities will be implemented in accordance with the IEMP. The revised language allows modification of the groundwater monitoring program as necessary via the IEMP revision process without issuance of a new order.
- DOE Order 450.1, *Environmental Protection Program*, establishes the requirement for a Groundwater Protection Management Program Plan (GPMPP) for DOE facilities. The required informational elements of a GPMPP are fulfilled by the remedial investigation (DOE 1995c) and feasibility study reports for OU5. The groundwater monitoring program requirement is being fulfilled by the IEMP. This also satisfies DOE Manual 435.1 (DOE 2001a), which refers to DOE Order 5400.5.
- DOE Order 5400.5, *Radiation Protection of the Public and Environment*, establishes radiological dose limits and guidelines for the protection of the public and environment.

Demonstration of compliance with these limits and guidelines for radiological dose is based on calculations that make use of information obtained from the Fernald Preserve's monitoring and surveillance program. This program is based on guidance in the *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance* (DOE 1991). The Fernald Preserve's private well sampling program for the Great Miami Aquifer (that was previously in the Fernald Preserve Environmental Monitoring Plan [DOE 1995d]) is conducted to satisfy the intention of this DOE Order with respect to groundwater. While most private well water users in the affected area are now provided with a public water supply, a limited private well sampling activity will be maintained to supplement the groundwater monitoring network provided by monitoring wells. A dose assessment is no longer required due to the availability of a public water supply.

- The 1986 Federal Facilities Compliance Agreement requires that the Fernald Preserve maintain a sampling program for daily flow and uranium concentration of discharges to the Great Miami River and report the results quarterly to the EPA, OEPA, and Ohio Department of Health. The sampling program conducted to address this requirement has been modified over the years and is currently governed by an agreement reached with EPA and OEPA in early 1996 with modifications documented in IEMP revisions. For groundwater, this agreement is specifically related to the South Plume well field to quantify the amount of uranium removed and total volume of groundwater extracted.

The groundwater monitoring plan provided in this IEMP has been developed with full consideration of the regulatory drivers described above. Each of these drivers, and the associated monitoring conducted to comply with these drivers, is listed in Table 3–1. This table also lists each regulatory requirement for the OSDF groundwater monitoring program and the associated project-specific plan. Sections 3.7 and 7.0 outline the current and long-range plan for complying with the reporting requirements contained in the IEMP drivers.

Project-specific groundwater monitoring is required only for one project—the OSDF. The IEMP will not be used as the mechanism for conducting OSDF performance monitoring within the glacial overburden and the Great Miami Aquifer. A leak detection monitoring program plan, which includes both leachate and groundwater monitoring as part of a leak detection program, was submitted separately from the IEMP and initially approved by EPA and OEPA in 1997. The OSDF monitoring requirements include the regulatory drivers, the ARARs, and to-be-considered criteria that have a bearing on the design and execution of a groundwater monitoring program for the OSDF and are as follows:

- Ohio Solid Waste Disposal Facility Groundwater Monitoring Rules, Ohio Administrative Code (OAC) 3745 27 10 specify groundwater monitoring program requirements for sanitary landfills. These regulations describe a three tiered program for detection, assessment, and corrective measures.
- RCRA/Ohio Hazardous Waste Groundwater Monitoring Requirements for Regulated Units, 40 Code of Federal Regulations (CFR) 264.90 through .99 (OAC 3745 54 90 through 99) and 40 CFR 265.90 through .94 (OAC 3745 65 90 through 94), which specify groundwater monitoring program requirements for surface impoundments, landfills, and land treatment units that manage hazardous wastes. Because the Ohio regulations are at least as stringent, and in some cases more stringent, they are the controlling regulations.

- Uranium Mill Tailings Reclamation and Control Act Regulations, 40 CFR 192.32(A)(2), which specify standards for uranium byproduct materials in piles or impoundments. These regulations require conformance with the RCRA groundwater monitoring performance standard in 40 CFR 264.92. Compliance with RCRA/Ohio Hazardous Waste rules for groundwater monitoring will fulfill the substantive requirements for groundwater monitoring in the Uranium Mill Tailings Reclamation and Control Act regulations.
- Ohio Solid Waste Disposal Facility Rules, OAC 3745 27 19(M)(4) and (5), which require submittal of an annual operational report, including a summary of the quantity of leachate collected for treatment and disposal, location of leachate treatment, verification that the leachate management system is operating properly, and the results of analytical testing of an annual grab sample of leachate for groundwater monitoring constituents listed in Appendix I of OAC 3745 27 10.

Table 3–1. Fernald Preserve Groundwater Monitoring Program Regulatory Drivers and Responsibilities

	DRIVER	ACTION	
	CERCLA ROD for OU5	The IEMP describes routine monitoring to ensure remedy performance and to evaluate impacts of remediation activities to the Great Miami Aquifer. The IEMP will be modified toward completion of the remedial action to include a sampling plan to certify achievement of the FRLs.	
	OEPA Director's Final Findings and Orders; RCRA/Hazardous Waste Facility Groundwater Monitoring	The IEMP describes routine monitoring at wells located at the property boundary to ensure remedy performance and to evaluate impacts of remediation activities to the Great Miami Aquifer.	
	DOE Order 450.1, *Groundwater Protection Management Plan.* Also satisfies DOE M 435.1 which refers to DOE Order 5400.5	The IEMP describes routine monitoring to ensure remedy performance of the Great Miami Aquifer.	
	Federal Facilities Compliance Agreement, Radiological Monitoring	The IEMP describes the routine sampling and reporting of the South Plume well field in terms of the total volume extracted and the amount of uranium removed.	
IEMP	OAC 3745-27-10, Ohio Solid Waste Disposal Facility Groundwater Monitoring	A leak detection monitoring program in the glacial overburden and the Great Miami Aquifer is being conducted for the OSDF.	Groundwater, leak detection, and leachate monitoring plan for the OSDF
	40 CFR 264.90-.99 (OAC 3745-54-90 through 99); 40 CFR 265.90-.94 (OAC 3745-65-90 through 94), RCRA/Ohio Hazardous Waste Disposal Facility Groundwater Monitoring	A leak detection monitoring program in the glacial overburden and the Great Miami Aquifer is being conducted for the OSDF.	Groundwater, leak detection, and leachate monitoring plan for the OSDF
	Uranium Mill Tailings Reclamation and Control Act Regulations Groundwater Monitoring for Disposal Facilities	A leak detection monitoring program in the Great Miami Aquifer is being conducted for the OSDF.	Groundwater, leak detection, and leachate monitoring plan for the OSDF
	OAC 3745-27-19(M)(4) and (5), Ohio Solid Waste Disposal Facility Leachate Detection and Collection Systems	Monitoring of OSDF leachate detection and collection systems is included in the OSDF leak detection monitoring program.	Groundwater, leak detection, and leachate monitoring plan for the OSDF

Note: Refer to Appendix A of Attachment C — *On-site Disposal Facility Groundwater/Leak Detection and Leachate Monitoring Plan* for ARARs and other regulatory requirements.

3.3 Groundwater Monitoring Program Boundaries

Administrative Boundary between the IEMP and Paddys Run Road Site Contaminant Plumes
As described in the remedial investigation report for OU5 (refer to Section 4.8.2), the PRRS consists of two facilities: PCS Purified Phosphates (formerly Albright and Wilson Americas Inc.) and Ruetgers-Nease Chemical Company Inc. PCS Purified Phosphates occupies the northern portion of the site and manufactures phosphate compounds. Rutgers-Nease manufactures aromatic sulfonated compounds and occupies the southern portion of the site.

The PRRS Remedial Investigation Report released in September 1992 documented releases to the Great Miami Aquifer of inorganics, volatile organic compounds, and semi-volatile organic compounds. The Proposed Plan for OU5 acknowledged that DOE's role and involvement, if any, in OEPA's ongoing assessment and cleanup of the PRRS plume would be separately defined as part of the PRRS response obligations and in accordance with the PRRS project schedule. Groundwater monitoring will continue south of the Administrative Boundary until certification of the off-property South Plume is complete. This monitoring will assess the nature of the 30-μg/L total uranium plume south of the Administrative Boundary and the impact that pumping of the South Plume extraction wells has on the PRRS plume.

Boundary for Performance Monitoring at the OSDF
As previously mentioned, the OSDF monitoring is conducted under a separate plan. OSDF monitoring results will be reported on the DOE-LM site and in the annual site environmental reports. Evaluation of baseline conditions and long-term monitoring will also be provided in the annual site environmental reports.

3.4 Program Expectations and Design Considerations

3.4.1 Program Expectations

The IEMP groundwater monitoring program is designed to provide a comprehensive monitoring network that will track remedial well-field operations and assess aquifer conditions. The expectations of the monitoring program are to:

- Provide groundwater data to assess the capture and restoration of the 30-μg/L total uranium plume.
- Provide groundwater data to assess the capture and restoration of non-uranium FRL constituents.
- Provide groundwater data to assess groundwater quality at the downgradient Fernald Preserve property boundary and off site at the leading edge of the 30-μg/L total uranium plume.
- Provide groundwater data that are sufficient to assess how reasonable are model predictions over the long term.
- Provide groundwater data to assess the impact that the aquifer restoration is having on the PRRS plume.
- Continue to fulfill DOE Order 450.1 requirements to maintain an environmental monitoring plan for groundwater.
- Continue to address concerns of the community regarding the progress of the aquifer restoration.

3.4.2 Design Considerations

3.4.2.1 Background

The Great Miami Aquifer is contaminated with uranium and other constituents from the Fernald Preserve. An evaluation of the nature and extent of contamination in the Great Miami Aquifer can be found in the Remedial Investigation Report for Operable Unit 5. Uranium is the principal constituent of concern (COC).

Figures 3–2a and 3–2b show the maximum total uranium plume map (30 µg/L uranium or higher) as of the second half of 2006. These maps represent a compilation of several different monitoring depths within the aquifer, and they illustrate the maximum lateral extent of the plume at all depths. The majority of the top of the plume is situated at the water table. In some regions of the aquifer, however, the top of the plume is situated below the water table. More detailed presentations of the geometry of the uranium plume can be found in Appendix G of the *Baseline Remedial Strategy Report, Remedial Design for Aquifer Restoration (Task 1)* (DOE 1997a); the *Conceptual Design for Remediation of the Great Miami Aquifer in the Waste Storage and Plant 6 Areas* (DOE 2000a); the *Design for Remediation of the Great Miami Aquifer South Field (Phase II) Module* (DOE 2002), and the *Waste Storage Area (Phase II) Design Report* (DOE 2005b).

The primary sources of contamination at the Fernald Preserve that contributed to the present geometry of the uranium plume include (1) the former waste pits that were present in the waste storage area, (2) the former inactive flyash pile that was present in the South Field area, (3) former production activities, and (4) the previously uncontrolled surface water runoff from the former production area that had direct access to the aquifer through a former drainage originating near the Plant 1 pad and flowing west through the former waste storage area and the Pilot Plant drainage ditch.

A groundwater remediation strategy that relies on pump-and-treat technology is being used to conduct a concentration-based cleanup of the Great Miami Aquifer. The restoration strategy focuses primarily on the removal of uranium, but it has also been designed to limit the farther expansion of the plume, remove targeted contaminants to concentrations below designated FRLs, and prevent undesirable drawdown impacts beyond the Fernald Preserve.

The aquifer's "remediation footprint" is a term used to define those areas of the aquifer that will be targeted for remediation. The OU5 ROD establishes that "areas of the Great Miami Aquifer exceeding FRLs will be restored through extraction methods." Over the course of the aquifer remedy, the areas of the aquifer being targeted for restoration have changed due to:

- The collection of additional characterization data to support modular designs.
- Changing the uranium FRL concentration for groundwater from 20 µg/L to 30 µg/L.

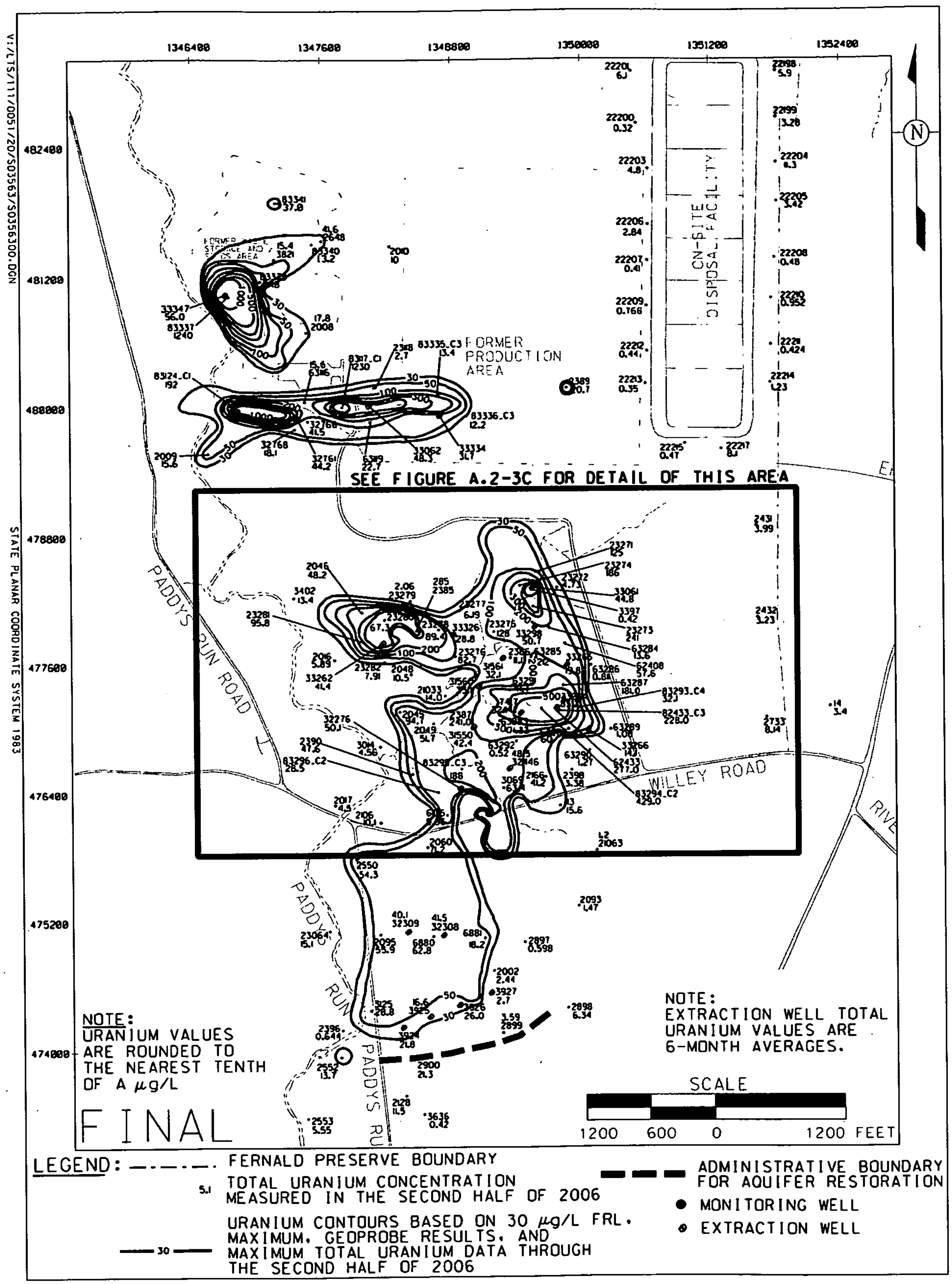

Figure 3–2a. Monitoring Well Data and Maximum Total Uranium Plume in South Field through the Second Half of 2006

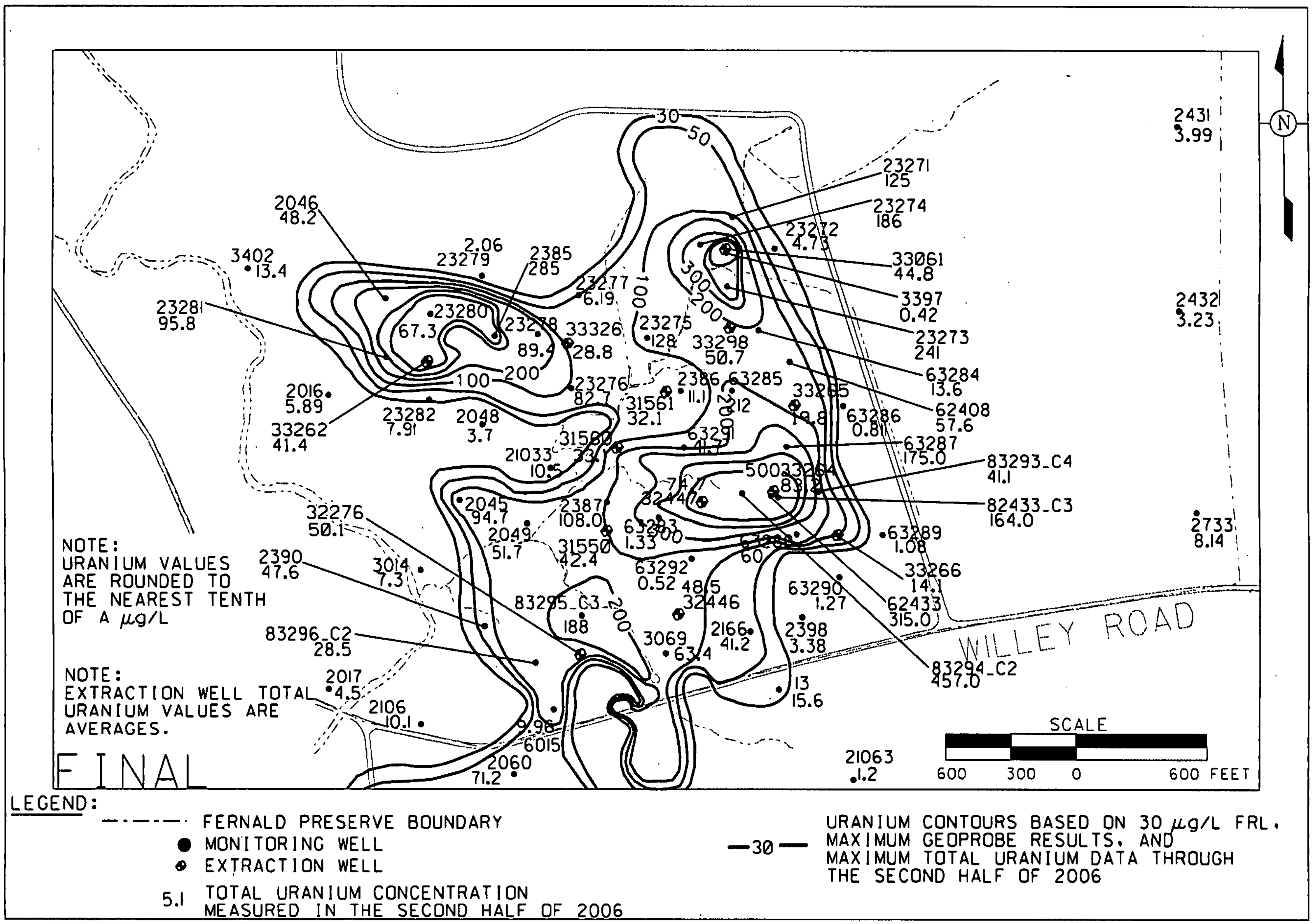

Figure 3–2b. Monitoring Well Data and Maximum Total Uranium Plume through the Second Half of 2006

Following is a brief discussion of the changes, along with information on the remediation footprint:

- Continued groundwater monitoring and direct-push sampling conducted to support the design of individual aquifer modules provided data that indicated the area of the aquifer exceeding the groundwater FRL for uranium was larger than the area defined in the OU5 ROD.
- Changing the FRL concentration for uranium in groundwater from 20 μg/L to 30 μg/L decreased the area of the aquifer that was defined as exceeding the groundwater FRL for uranium in the OU5 ROD. In 1996, when the OU5 ROD was signed, the MCL for uranium in drinking water had not been promulgated but was proposed as 20 μg/L. The FRL for uranium for the groundwater remedy was defined as 20 μg/L to match the proposed MCL. In 2001, EPA finalized the MCL for uranium at 30 μg/L for drinking water. Through a ROD Explanation of Significant Differences (ESD), the MCL became the FRL for total uranium in groundwater at the Fernald Preserve.

To incorporate the changes presented above, the remediation footprint of the aquifer is conservatively defined as the areas contained within a composite of all previous 20-μg/L maximum uranium plume interpretations through 2000, and 30-μg/L maximum uranium plume interpretations subsequent to 2000, located north of the Administrative Boundary for aquifer restoration. The remediation footprint of the aquifer (updated through 2006) is shown in Figure 3–3. The interpretation will be updated each year as new data are collected.

Pumping groundwater from the aquifer prior to the start of the actual groundwater remediation began in August 1993 with the startup of five extraction wells in the South Plume. The wells were installed and operated as part of a removal action to prevent the farther southern migration of the uranium plume while the remedial investigation of the plume was being completed and a remediation system was being designed.

The design of the aquifer remediation system has evolved via the issuance of several different design documents. The first aquifer remediation design was presented in the OU5 feasibility study. The design consisted of 28 extraction wells pumping for 27 years. It is this design that is contained in the OU5 ROD. A commitment was made in the OU5 ROD to pursue technological advances that might decrease the remediation time. A technology that was pursued was treated groundwater re-injection. Groundwater modeling was conducted to determine if adding re-injection wells to the remediation would facilitate a quicker cleanup. The groundwater modeling showed that a faster cleanup could be realized by using re-injection if several other actions were also realized. These other actions included:

- Other OUs completing their accelerated cleanup objectives so that surface access is available for aquifer remediation wells.
- The accelerated removal of sources to allow extraction wells to be located closer to the center of uranium plumes.
- Modeled geochemical and hydraulic parameters being consistent with aquifer conditions.

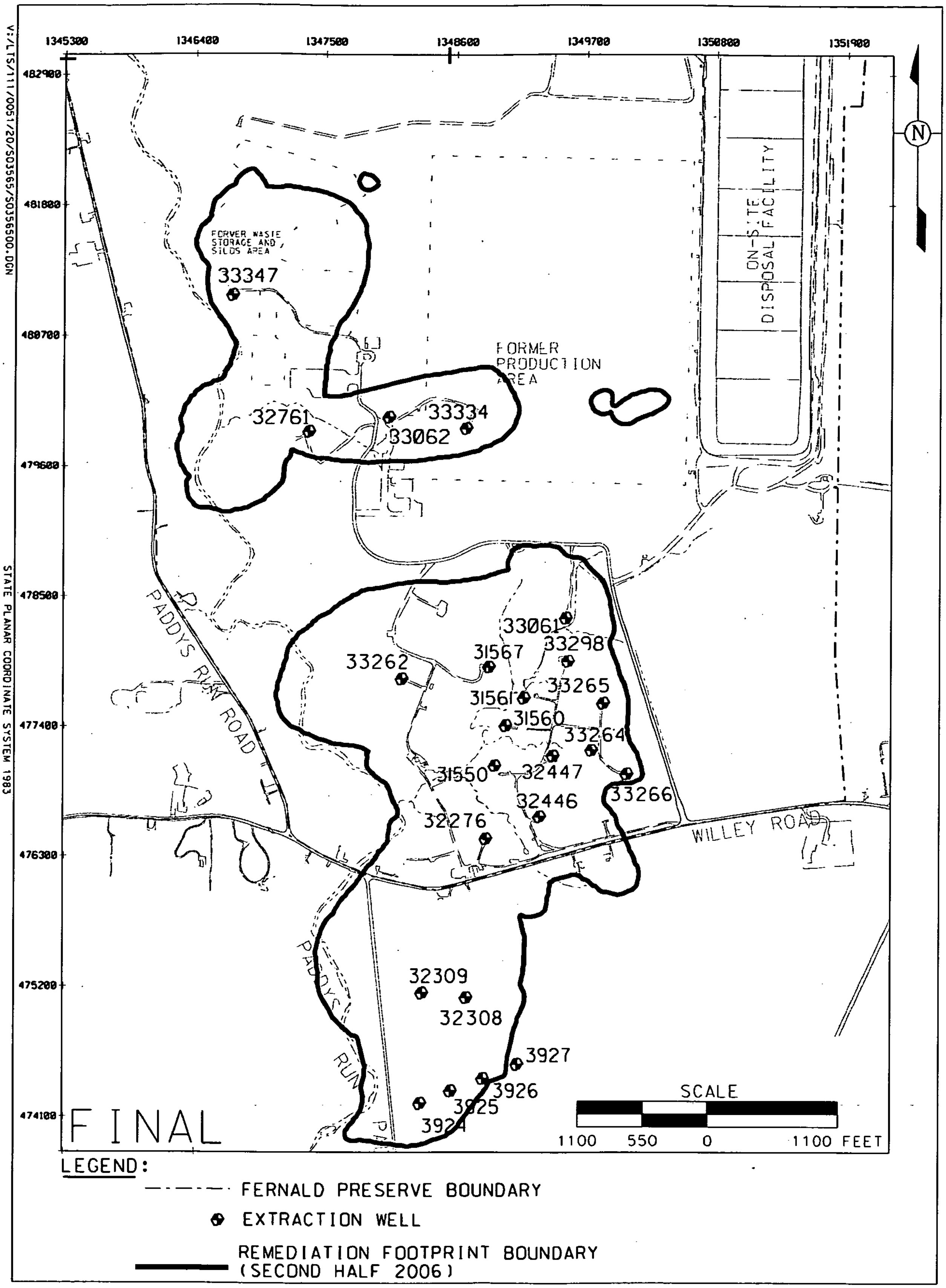

Figure 3–3. Extraction Well Locations

An aquifer remediation design, which included re-injection, was presented in the *Baseline Remedial Strategy Report, Remedial Design for Aquifer Restoration*. This design called for 37 pumping wells and 10 re-injection wells. The predicted cleanup time was modeled at 10 years. The pumping and re-injection wells were subdivided into five area-specific restoration modules:

- The South Plume Module
- The South Field Module
- The Waste Storage Area Module
- The Plant 6 Module
- The Re-Injection Demonstration Module

Although groundwater modeling showed that re-injection expedited the cleanup, the technology was unproven at the Fernald Preserve. Of concern was the cost of keeping the wells operational (industry experience showed that these wells tend to plug). A demonstration was needed to prove that the re-injection wells could be operated efficiently at the Fernald Preserve. The decision was made to tie the demonstration into the remedy design presented in the *Baseline Remedial Strategy Report*. If successful, the impact to the remedy would be immediate.

In the summer of 1998, the first wells for the aquifer remediation became operational and marked implementation of the aquifer remedy design presented in the *Baseline Remedial Strategy Report*. Implementation of the *Baseline Remedial Strategy Report* design included a groundwater re-injection demonstration that was conducted from September 2, 1998, to September 2, 1999. At the request of the Fernald Preserve, the evaluation of re-injection technology at the Fernald Preserve was sponsored by DOE's Office of Science and Technology Subsurface Contaminants Focus Area. The re-injection demonstration was successful, and re-injection was incorporated into the aquifer remedy.

Changes to the aquifer remedy design for the Waste Storage Area and Plant 6 modules were implemented in 2002 based on findings and groundwater modeling results presented in the *Conceptual Design for Remediation of the Great Miami Aquifer in the Waste Storage and Plant 6 Areas*. Characterization efforts conducted in support of the design showed that the uranium plume in the Plant 6 area had dissipated, eliminating the need for extraction wells there. Therefore, an aquifer restoration module was not installed in the Plant 6 area; however, groundwater monitoring in the Plant 6 area will continue (at Monitoring Well 2389) until the Waste Storage Area Module, which is upgradient of the Plant 6 area, has been certified clean.

Characterization efforts conducted in support of the waste storage area design also showed that the uranium plume in the waste storage area was smaller than what was characterized during the RI/FS, and that the waste storage area uranium plume in the vicinity of the confluence of Paddys Run and the Pilot Plant drainage ditch needed to be redefined and extended to the east. In light of these findings, a new restoration module for the waste storage area was modeled and designed. The number of wells needed in the design to remediate the waste storage area went from 10 (*Baseline Remedial Strategy Report* design) down to five (modified module design). The details concerning this design are presented in the *Design for Remediation of the Great Miami*

Aquifer in the Waste Storage and Plant 6 Areas (DOE 2001b). Three of the extraction wells began pumping in 2002.

Changes to the aquifer remedy design for the South Field Module were implemented in 2003 based on findings presented in the *Design for Remediation of the Great Miami Aquifer, South Field (Phase II) Module*. Characterization efforts conducted to support the design showed that uranium concentrations beneath western portions of the Southern Waste Units were much lower than in previous years. The lower concentrations were attributed to source removal, the natural flow of clean groundwater from the west into the area, the continued flushing of clean recharge water through Paddys Run to the underlying aquifer, the increased flushing of clean recharge water through deep surface excavations in the inactive flyash pile, and the remedial pumping of the extraction wells to the east of this area. The modified design for Phase II of the South Field Module went from nine new extraction wells and five new re-injection wells (*Baseline Remedial Strategy Report* design) down to four new extraction wells, one new re-injection well, the conversion of an existing extraction well into an injection well, and an injection basin (modified module design).

In 2004, aquifer remedy design changes were implemented to address changing water treatment needs resulting from site closure and to stop well-based re-injection. Several water treatment flows were eliminated or reduced (e.g., remediation wastewater, sanitary wastewater, storm water runoff) from the scope of the treatment operation. Elimination or reduction of these flow streams provided an opportunity to reduce the size of the water treatment facility remaining to service the aquifer restoration after site closure. Reducing the size of the treatment facility prior to site closure in 2006 reduced the amount of impacted materials that will be sent for off-site disposal after closure.

Groundwater modeling presented in the *Comprehensive Groundwater Strategy Report* (DOE 2003b) predicted that continued use of large-scale re-injection using existing re-injection wells would shorten the aquifer remedy by 3 years (comparison of Alternatives 1 and 6). These results indicated limited benefit to maintaining the infrastructure for large-scale, well-based re-injection (when viewed in relation to water treatment facility scale-down activities) and supported the decision to stop re-injection. Therefore, the decision was also made in 2004 not to restart well-based re-injection once the CAWWT was operational.

The last aquifer module design for the groundwater remedy was completed in 2005. The *Waste Storage Area Phase II Design Report* was issued in June of 2005 (DOE 2005b). Aquifer characterization data collected in support of the Phase II design revealed that uranium concentrations in the aquifer near the former silos area were higher than what was previously mapped, but that the footprint of the uranium plume was smaller than what was previously mapped. Non-uranium FRL exceedances included technetium-99, nitrate/nitrite, nickel, carbon disulfide, trichloroethene, molybdenum, and manganese. With the exception of manganese, these non-uranium FRL exceedances were within or very near the footprint of the uranium plume. The footprint of the manganese plume was larger than the footprint of the uranium plume, and biofouling was suspected at some of the monitoring wells where the highest manganese concentrations were detected.

Follow-up work was conducted to determine if manganese might be bioaccumulating around the well screens of some of the monitoring wells in the Waste Storage Area, and to also remodel the cleanup of the manganese plume using a manganese K_d value that was representative of the

Great Miami Aquifer at the Fernald Preserve. Results of the follow-up work were presented in the *Addendum to the Waste Storage Area (Phase II) Design Report* (DOE 2005c), which was issued in a comment response package on December 6, 2005. The follow-up work concluded that manganese was bioaccumulating around some of the monitoring wells. Modeled predicted cleanup of the manganese plume (using a K_d of 1.3 L/kg) indicated that the manganese plume would be cleaned up considerably faster than the uranium plume using the Phase II design (one additional extraction well).

A test was conducted in 2005 to gauge seasonal flow of water in the Storm Sewer Outfall ditch (SSOD) and to determine if recharge to the Great Miami Aquifer through the SSOD at a rate of 500 gallons per minute (gpm) was feasible (DOE 2005d). As reported in the *Groundwater Remedy Evaluation and Field Verification Plan* (DOE 2004), infiltration through the SSOD at a rate of 500 gpm was predicted to decrease the cleanup time by 1 year. The study concluded, though, that the operation would not be cost effective. Subsequent discussions with EPA and OEPA in 2006 led to an agreement to proceed with a scaled-down version of the operation. Clean groundwater is being pumped into the SSOD to supplement natural storm water runoff in an attempt to accelerate remediation of the South Plume. Three existing wells on the east side of the site are being utilized to deliver as much clean groundwater as is needed to maintain a flow of approximately 500 gpm into the SSOD. This supplemental pumping will continue until the existing wells, pumps, or motors are no longer serviceable. At that time, the operation will be suspended, pending a determination that the remedy is benefiting from the operation.

3.4.2.2 The Modular Approach to Aquifer Restoration

Restoration of the Great Miami Aquifer is being accomplished by using three area-specific groundwater restoration modules (South Plume Module, South Field Module, and Waste Storage Area Module) and a centralized water treatment facility (Figure 3–1). Figure 3–3 shows the location of the extraction wells that comprise these modules.

<u>South Plume Module</u>
Six extraction wells (3924, 3925, 3926, 3927, 32308, and 32309) are operating in the South Plume Module. Extraction Wells 3924, 3925, 3926, and 3927, which were originally called the South Plume Module, have been in operation since 1993 as part of a removal action. Located at the southern edge of the total uranium plume, the initial South Plume Module, as reported in the Work Plan for the South Contaminated Plume Removal Action (DOE 1992), was installed to create a hydraulic barrier and to prevent further southern migration of the uranium plume. In 1998, two additional extraction wells (32308 and 32309) became operational just north of the four original South Plume Module wells. These two wells were installed under a project known as the South Plume Optimization Module. The term "South Plume Module" is used to refer to both the original extraction wells installed under the South Plume Module and those installed under the South Plume Optimization Module.

<u>South Field Module</u>
Thirteen extraction wells (31550, 31560, 31561, 32276, 32446, 32447, 33061, 33262, 33264, 33265, 33266, 33298, and 33326) are operating in the South Field Module. Restoration of the aquifer in the South Field area began in 1998 when 10 extraction wells (31550, 31560, 31561, 31562, 31563, 31564, 31565, 31566, 31567, and 32276) began pumping around the excavation area near the SSOD ditch (South Field Extraction [Phase I] Module). Six of the original ten extraction wells (31562, 31563, 31564, 31565, 31566, and 31567) are no longer operating:

- Extraction Well 31562 was shut down in 2003 and replaced by a new well (33298).
- Extraction Well 31563 was shut down in 2002 and converted to a re-injection well as part of the South Field (Phase II) project.
- Extraction Wells 31564 and 31565 were shut down in 2001 so that additional soil remediation could be conducted in the area. The decision was made not to re-start pumping at these wells because they are no longer situated in locations that will provide a pumping benefit to the aquifer remedy.
- Extraction Well 31566 was shut down in 1998 to minimize the potential for pulling contamination into a region of the aquifer with finer grain sediment.
- Extraction Well 31567 was shut down in 2005 due to excessive plugging of the well screen; it was replaced by a new well (33326).

The South Field Module was expanded in 1999 and 2002. In 1999, Extraction Wells 32446 and 32447 were added and began operating in 2000. Extraction Well 33061 was added and became operational in 2002. In 2003, the module was modified again, this time as part of Phase II. Four new extraction wells (33262, 33264, 33265, and 33266), one replacement well (33298), two re-injection wells (33263 and 31563), and one injection basin became operational. Because of the decision in 2004 to stop well-based re-injection, the two re-injection wells (33263 and 31563) are no longer operating. Also, the injection basin has become a passive feature in that water is not being actively pumped to the basin. Figure 3–3 shows the location of the extraction wells that are operational.

Waste Storage Area Module

Four extraction wells (32761, 33062, 33334, and 33347) are operating in the Waste Storage Area Module. Two of the extraction wells (32761 and 33062) were installed as part of the Waste Storage Area (Phase I) Module. A third extraction well (33063) installed as part of the Waste Storage Area (Phase I) Module was plugged and abandoned in 2004 to facilitate surface excavation activities. A replacement well (33334) has been installed. Extraction Well 33347 is part of the Waste Storage Area (Phase II) design. It became operational in 2006.

The groundwater monitoring program is designed to track remedy performance of the modules presented above. For monitoring purposes, the aquifer is divided into five zones referred to as "aquifer zones" (refer to Figure 3–4). These aquifer zones are used to evaluate the predicted performance (both individually and collectively) at the aquifer restoration modules. Aquifer Zones 1, 2, and 4 contain aquifer remediation modules. Aquifer Zone 0 (the fifth zone) is the area outside the other four aquifer zones.

The locations of the extraction wells comprising the restoration modules are as follows:

- The South Plume Module is located in Aquifer Zone 4.
- The South Field Module (Phases I and II) is located in Aquifer Zone 2.
- The Waste Storage Area Module (Phases I and II) is located in Aquifer Zone 1.

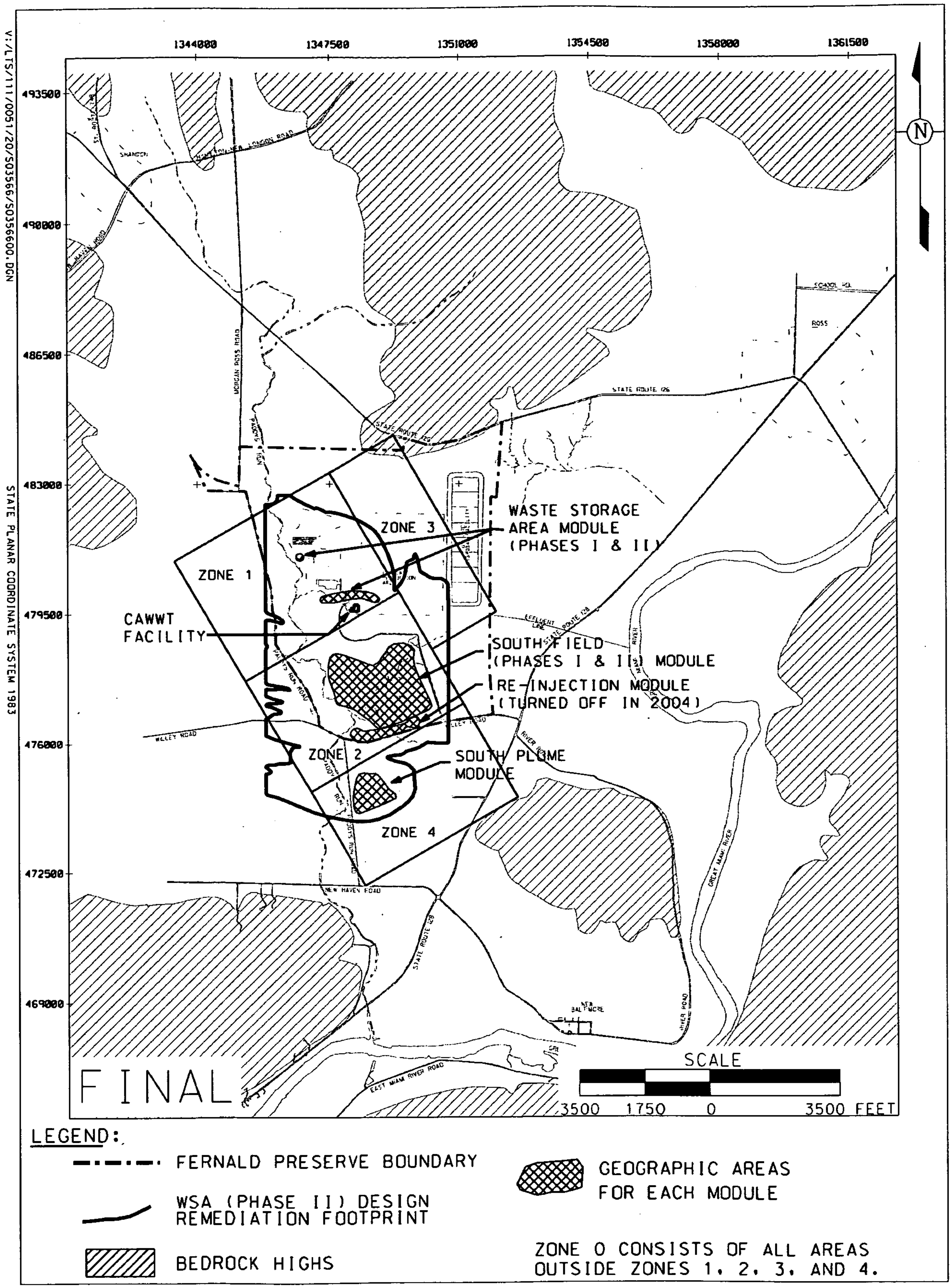

Figure 3–4. Groundwater Aquifer Zones and Aquifer Restoration Footprint

Ten-year, reverse particle path modeling predicts a hydraulic capture zone that is larger than the actual dimension of the 30-µg/L total uranium plume. In previous plans, the extent of this capture zone was called the 10-year, uranium-based restoration footprint. The 10-year time reference originated from the 1997 modeling done for the *Baseline Remedial Strategy Report* that predicted a 10-year cleanup time. As discussed earlier, the current Waste Storage Area (Phase II) design is modified from the *Baseline Remedial Strategy Report* design; therefore, the 10-year aquifer restoration footprint originating from the *Baseline Remedial Strategy Report* is no longer applicable to the remedy. The 10-year time of travel remediation footprint presented in this plan (see Figure 3–4) is based on the Waste Storage Area (Phase II) design (2007 through 2023). This design remediation footprint was constructed using reverse, non-retarded, particle-path interpretations from the VAM3D Groundwater Model. The limits of most of the particle tracks are truncated because the particles reached the edge of the Zoom groundwater model domain.

3.4.2.3 Well Selection Criteria

Geologic and hydrogeologic properties, predicted and actual groundwater flow, and contaminant distribution within the Great Miami Aquifer (before and during remediation) serve as input to the design and modification of the IEMP groundwater monitoring network. Field measurements and computer simulations were conducted to support initial design efforts.

All available information is reviewed to select appropriate monitoring well locations. The monitoring well locations for the IEMP are selected according to the following criteria:

- Monitor within the projected capture zone of the groundwater restoration operation unless an operational concern (e.g., the close proximity of the South Plume extraction wells to the PRRS plume) requires a monitoring location to be outside of the capture zone. Note: Pumping rates may change to optimize the operation through time; therefore, the capture zone may also change.
- Use existing monitoring wells in the remediation footprint of the aquifer and avoid installing new monitoring wells unless determined necessary based on operational knowledge, which will be used to help select new locations.
- Provide adequate areal coverage across each remediation module area.
- Include monitoring wells that are needed to meet site-specific monitoring commitments.
- Select monitoring well locations that will provide data needed to determine how reasonable model predictions are over the long term.
- Select monitoring well locations in consideration of landowner concerns. In the off-property portion of the South Plume, landowner access concerns have, and will continue to have, a bearing on the location and number of monitoring wells in that area. Generally, location of monitoring wells is limited to peripheral areas along the edges of the farm fields. This monitoring well limitation is being addressed through supplemental use of direct push sampling that can be conducted during the times of the year when the fields are not being used for crops.

Approximately 140 wells at the Fernald Preserve are being sampled as identified in the subsections that follow.

3.4.2.4 Constituent Selection Criteria

The groundwater sampling constituent selection criteria are based on evaluation of the groundwater data that have been collected since the inception of the IEMP. Rationale and information concerning constituent selection is presented in Appendix A. Following is an overview.

Restoration of the aquifer will be verified against FRLs. FRLs for the aquifer have been established in the OU5 ROD for 50 COCs. Groundwater monitoring focuses on these 50 FRL constituents to assess the progress of the aquifer remedy.

As presented in Appendix A, a short list of constituents has been established for monitoring purposes and is based on where and whether constituents have had FRL exceedances in the aquifer since the inception of the IEMP. Constituents on the short list are monitored semiannually. Monitoring of those constituents not on the short list will be addressed during Stage III (Certification/Attainment Monitoring), as necessary.

Table 3–2 summarizes groundwater sampling results since the inception of the IEMP program and contains the following information:

- Column 1 lists the 50 constituents for which FRLs were established in the OU5 ROD.
- Column 2 lists the respective FRL concentration for each of the constituents.
- Column 3 identifies the basis for each FRL constituent (i.e., risk, ARAR, background, or detection limit) as defined in the OU5 Feasibility Study Report.
- Column 4 documents the number of samples that have been analyzed for each constituent since the start of IEMP sampling.
- Column 5 notes the number of samples that have had a concentration greater than the FRL for each constituent.
- Column 6 notes the percent of the samples for each constituent that have had a concentration greater than the FRL.
- Column 7 identifies the zones where FRL exceedances have been observed and the number of wells in each zone that had exceedances.
- Column 8 shows the above FRL concentration range for each constituent that had FRL exceedances.

As shown in Table 3–2, 35 of the 50 groundwater FRL constituents have not had an FRL exceedance. Excluding uranium, the groundwater FRL constituents that did have recorded exceedances were from a limited number of wells. The spatial distribution of these wells indicates that many of the non-uranium FRL exceedances are not associated with a plume.

Table 3–2. Groundwater FRL Exceedances Based on Samples and Locations Since IEMP Inception (from August 1997 through 2006)

(1) Constituent	(2) Groundwater FRL[a]	(3) Basis for FRL[b]	(4) No. of Samples[c]	(5) No. of Samples >FRL[c,d]	(6) Percent of Samples >FRL	(7) Zones with FRL Exceedances (No. of Wells with exceedances in each Aquifer Zone)[c,d,e]	(8) Range above FRL[c,d,e]
Uranium, Total	30 µg/L	A	4538	1155	25.45%	1(19) 2(38) 3(3) 4(16)	30.13 J/1240 NV
Zinc	0.021 mg/L	B	1267	81	6.39%	0(10) 1(5) 2(14) 3(5) 4(2)	0.0212 NV/13.6 -
Manganese	0.90 mg/L	B	1479	96	6.49%	0(5) 1(6) 2(10) 3(5) 4(4)	0.916 -/105 J
Nickel	0.10 mg/L	A	1301	20	1.54%	0(1) 1(1) 2(7) 3(1)	0.101 -/1.54 -
Technetium-99	94 pCi/L	R*	1532	35	2.28%	1(3)	101.08 -/1352.266 J
Nitrate[f]	11 mg/L	B	1923	38	1.98%	1(5) 2(1)[g]	11.4 -/331 NV
Lead	0.015 mg/L	A	1276	13	1.09%	0(2) 1(2) 2(4) 3(2)	0.0157 -/0.201 -
Arsenic	0.050 mg/L	A	1494	14	0.94%	0(1) 1(1) 2(1) 4(4)	0.051 -/0.125 -
Molybdenum	0.10 mg/L	A	835	13	1.56%	1(1)	0.207 -/0.69 -
Boron	0.33 mg/L	R	2065	15	0.73%	2(2)	0.331 -/1.16 -
Antimony	0.0060 mg/L	A	1277	9	0.70%	0(4) 1(1) 2(2)4(1)	0.00601 -/0.0196 J
Trichloroethene	0.0050 mg/L	A	1392	13	0.93%	1(2)	0.0207 -/0.120 -
Carbon disulfide	0.0055 mg/L	A	1023	6	0.59%	0(1)[h] 1(3) 2(1)[h]	0.006 -/0.014 -
Fluoride	4 mg/L	A	1497	4	0.27%	0(2) 1(1) 3(1)	5.3 -/12.3 -
Vanadium	0.038 mg/L	R	951	1	0.11%	0(1)	0.0664 J[i]
1,1-Dichloroethane	0.28 mg/L	A	86	0	0%	NA	NA
1,1-Dichloroethene	0.0070 mg/L	A	565	0	0%	NA	NA
1,2-Dichloroethane	0.0050 mg/L	A	704	0	0%	NA	NA
2,3,7,8-Tetrachlorodibenzo-p-dioxin	0.000010 mg/L	D	19	0	0%	NA	NA
4-Methylphenol	0.029 mg/L	R	86	0	0%	NA	NA
4-Nitrophenol	0.32 mg/L	R	86	0	0%	NA	NA
alpha-Chlordane	0.0020 mg/L	A	772	0	0%	NA	NA
Aroclor-1254	0.00020 mg/L	D	86	0	0%	NA	NA
Barium	2.0 mg/L	A	194	0	0%	NA	NA
Benzene	0.0050 mg/L	A	947	0	0%	NA	NA
Beryllium	0.0040 mg/L	A	877	0	0%	NA	NA
bis(2-Chloroisopropyl) ether	0.0050 mg/L	D	459	0	0%	NA	NA
bis(2-Ethylhexyl)phthalate	0.0060 mg/L	A	86	0[j]	0%	NA[j]	NA
Bromodichloromethane	0.10 mg/L	A	771	0	0%	NA	NA
Bromomethane	0.0021 mg/L	R	86	0	0%	NA	NA
Cadmium	0.014 mg/L	B	994	0	0%	NA	NA

Table 3–2. Groundwater FRL Exceedances Based on Samples and Locations Since IEMP Inception (from August 1997 through 2006) (continued)

(1) Constituents	(2) Groundwater FRL[a]	(3) Basis for FRL[b]	(4) No. of Samples[c]	(5) No. of Samples >FRL[c,d]	(6) Percent of Samples >FRL	(7) Zones with FRL Exceedances (No. of Wells with exceedances in each Aquifer Zone)[c,d,e]	(8) Range above FRL[c,d,e]
Carbazole	0.011 mg/L	R	459	0	0%	NA	NA
Chloroethane	0.0010 mg/L	D	86	0	0%	NA	NA
Chloroform	0.10 mg/L	A	86	0	0%	NA	NA
Chromium VI	0.022 mg/L	R	16	0	0%	NA	NA
Cobalt	0.17 mg/L	R	878	0	0%	NA	NA
Copper	1.3 mg/L	A	86	0	0%	NA	NA
Mercury	0.0020 mg/L	A	2112	0[k]	0%	NA	NA
Methylene chloride	0.0050 mg/L	A	84	0	0%	NA	NA
Neptunium-237	1.0 pCi/L	R*	1606	0	0%	NA	NA
Octachlorodibenzo-p-dioxin	1.0E-7 mg/L	D	19	0	0%	NA	NA
Radium-226	20 pCi/L	A	194	0	0%	NA	NA
Radium-228	20 pCi/L	A	86	0	0%	NA	NA
Selenium	0.050 mg/L	A	991	0	0%	NA	NA
Silver	0.050 mg/L	A	856	0	0%	NA	NA
Strontium-90	8.0 pCi/L	A	1394	0	0%	NA	NA
Thorium-228	4.0 pCi/L	R*	992	0	0%	NA	NA
Thorium-230	15 pCi/L	R*	86	0	0%	NA	NA
Thorium-232	1.2 pCi/L	R*	902	0	0%	NA	NA
Vinyl chloride	0.0020 mg/L	A	771	0	0%	NA	NA

[a]From OU5 ROD, Table 9–4.
[b]From OU5 Feasibility Study, Table 2–16:
A = ARAR-based
B = Based on 95th percentile background concentrations
D = Based on lowest achievable detection limit
R = Risk-based Preliminary Remediation Goal (PRG)
R* = Risk-based Preliminary Remediation Level includes the radionuclide risk-based PRG plus its 95th percentile background concentration.
[c]Based on filtered and unfiltered samples from the August 1997 through 2006 IEMP groundwater data.
[d]Sample results having a -, J, or NV qualifier were used:
- = result is confident as reported
J = result is quantitatively estimated
NV = result is not validated
[e]NA = not applicable
[f]Nitrate/nitrite results are evaluated with respect to the nitrate FRL.
[g]Since the IEMP inception, there has been only one nitrate/nitrite exceedance at Well 2017 (in 1998) (refer to Figure A–12).
[h]Since the IEMP inception, there has been one isolated exceedance for carbon disulfide at two locations (refer to Figure A–5).
[i]Since the IEMP inception, there has been only one vanadium exceedance at Well 2426 (in 1998) (refer to Figure A–16).
[j]Of the 86 samples analyzed for bis(2-Ethylhexyl)phthalate, a common laboratory containment, five had results above the FRL. The FRL results above are all considered suspect due to laboratory analysis issues, laboratory blank and field blank contamination, or field duplicate results being non-detected. The five exceedances are as follows: 0.014J mg/L, Well 2398 and 0.010J mg/L, Well 3390 in Aquifer Zone 2; 0.016J mg/L, Well 2109 in Aquifer Zone 3; and 0.008J mg/L, Well 2125 and 0.13J mg/L, Well 3095 in Aquifer Zone 4.
[k]The mercury exceedance is suspect, due to negative matrix spike/matrix spike duplicate (MS/MSD) recoveries. In fact, the MS/MSD (i.e., spiked samples) results were both extremely below the original sample result.

Groundwater monitoring focuses on the short list of 15 groundwater FRL constituents. The following monitoring will be conducted:

1. Uranium, which is the primary COC and has the greatest number of wells with exceedances, will be monitored semiannually.

2. Constituents that have FRL exceedances in multiple zones (i.e., antimony, arsenic, fluoride, lead, manganese, nickel, and zinc) will be monitored semiannually as follows:

   - At a minimum, all constituents will be monitored at downgradient wells including existing property boundary/OSDF wells along the eastern perimeter of the site and those wells along the eastern/southern boundary of the South Plume. Area C on Figure A–19 shows the configuration of this monitoring network, which lies in Zones 0, 2, 3, and 4, and for the most part outside of the restoration footprint. Monitoring at these locations will document that above-FRL contaminants are not migrating beyond the expected capture zone.

     Note: Carbon disulfide and nitrate/nitrite are considered to have legitimate exceedances in only one zone (Zone 1) and are discussed below (refer to item #3).

   - In addition to being monitored in Zones 0, 2, 3, and 4, constituents that have exceedances in multiple zones were evaluated with respect to Zone 1 to determine if monitoring is conducted to address consistent/recent exceedances in this area. Monitoring will be addressed in this zone, in addition to the monitoring at the Property/Plume Boundary, to ensure that the constituents exhibiting consistent/recent exceedances are being monitored near potential sources. From review of Table A–2 (in Appendix A), manganese in Zone 1 appears to have consistent/recent exceedances. Therefore, it will be monitored in this zone at wells that have exceedances. In addition to manganese, nickel had an exceedance in 2002. Nickel will also be monitored in Zone 1. Refer to Area A on Figure A–19 for the locations to be monitored in Zone 1.

3. Constituents that have FRL exceedances in only one zone will be monitored semiannually solely in that zone. The monitoring will consist of the following: carbon disulfide, molybdenum, nitrate/nitrite, technetium-99, and trichloroethene in Zone 1 (waste storage area), and boron in Zone 2 (South Field). Specific monitoring locations will be based on the wells that have exceedances.

   Note: Carbon disulfide has exceedances primarily in Zone 1. The two wells that have exceedances outside Zone 1 were Property Boundary Wells 2432 and 3069. These wells were sampled quarterly and exceedances were slightly above the FRL (6 µg/L with respect to the 5.5 µg/L FRL). For Well 2432, there have been no additional exceedances since the occurrence during first quarter 1999. With regard to the one exceedance for Well 3069 that occurred during fourth quarter 2001, a duplicate result during the sampling event was below the FRL (Figure A–5). No additional exceedances for carbon disulfide have occurred at Well 3069 since 2001.

   Nitrate/nitrite has exceedances primarily in Zone 1. One well (2017), which is located in Zone 2, had a one-time exceedance in 1998.

4. Vanadium has a one-time exceedance in 1998 during quarterly sampling at one well (2426). This constituent will be monitored less than semiannually due to the lack of exceedances. Monitoring for this constituent is addressed in Section A.3.2. Vanadium will be addressed during Stage III (Certification/Attainment Monitoring).

Based on the above four criteria, 13 non-uranium groundwater FRL constituents are on the short list and are monitored semiannually (Table 3–3).

3.5 Design of the IEMP Groundwater Monitoring Program

Monitoring focuses on IEMP data and specifically calls for semiannual monitoring of groundwater FRL constituents with exceedances. A list of IEMP groundwater monitoring wells is provided in Table 3–4. Table 3–5 provides a list of the monitoring requirements. Justification for the monitoring approach is provided in Appendix A.

The monitoring strategy and technical approach will be revised as necessary in subsequent revisions to the IEMP to encompass operational changes over the life of the remedy. A startup monitoring, project-specific plan or variance to an existing plan will be developed to supplement the IEMP each time a new extraction well begins to operate for the first time.

3.6 Medium-Specific Plan for Groundwater Monitoring

This section serves as the medium-specific plan for implementation of the sampling, analysis, and data-management activities associated with the site-wide groundwater remedy performance monitoring program. The program expectations and design presented in Section 3.4 were used as the framework for developing the monitoring approach presented in this section. The activities described in this medium-specific plan have been designed to provide groundwater data of sufficient quality to meet the program expectations as defined in Section 3.4.1. All sampling procedures and analytical protocols described or referenced herein are consistent with the requirements of the *Legacy Management CERCLA Sites Quality Assurance Project Plan* (LM QAPP) (DOE 2006c), which references the *Site-Wide CERCLA Quality Assurance Project Plan* (SCQ) (DOE 2003c) as the primary document that describes procedures and protocols for monitoring the Fernald Preserve.

Subsequent sections of this medium-specific plan define the following:

- Project organization and associated responsibilities
- Sampling program
- Change control
- Health and safety
- Data management
- Project quality assurance

Table 3–3. IEMP Constituents with FRL Exceedances, Location of Exceedances, and Revised Monitoring Program

Parameter	Aquifer Zones with Exceedances	Monitoring Program
Antimony	Multiple Zones	Property/Plume Boundary
Arsenic	Multiple Zones	Property/Plume Boundary
Boron	Aquifer Zone 2 (South Field)	South Field
Carbon Disulfide	Aquifer Zone 1 (Waste Storage Area)	Waste Storage Area
Fluoride	Multiple Zones	Property/Plume Boundary
Lead	Multiple Zones	Property/Plume Boundary
Manganese	Multiple Zones[a]	Property/Plume Boundary, Waste Storage Area
Molybdenum	Aquifer Zone 1 (Waste Storage Area)	Waste Storage Area
Nickel	Multiple Zones	Property/Plume Boundary, Waste Storage Area
Nitrate/Nitrite	Aquifer Zone 1 (Waste Storage Area)	Waste Storage Area
Technetium-99	Aquifer Zone 1 (Waste Storage Area)	Waste Storage Area
Trichloroethene	Aquifer Zone 1 (Waste Storage Area)	Waste Storage Area
Zinc	Multiple Zones	Property/Plume Boundary

[a]There are consistent/recent exceedances of manganese in Zone 1; therefore, this constituent will be monitored in the waste storage area and along the Property/Plume Boundary.

Table 3–4. List of IEMP Groundwater Monitoring Wells[a]

		Property/Plume Boundary Monitoring				
Number[a]	Total Uranium Monitoring	Monitor FRL Exceedances	Monitor OSDF Constituents[b]	Monitor PRRS Constituents[c]	Waste Storage Area Monitoring - FRL Exceedances	South Field Monitoring - FRL Exceedances
1	13					
2	14					
3	2002					
4	2008					
5	2009					
6	2010				2010	
7	2014					
8	2016					
9	2017					
10	2045					2045
11	2046					
12	2048					
13	2049					2049
14	2060 (12)					
15	2093	2093				
16	2095					
17	2106					
18	2125					
19	2128	2128		2128		
20	2166					
21	2385					

Table 3–4. List of IEMP Groundwater Monitoring Wells (continued)

		Property/Plume Boundary Monitoring				
Number[a]	Total Uranium Monitoring	Monitor FRL Exceedances	Monitor OSDF Constituents[b]	Monitor PRRS Constituents[c]	Waste Storage Area Monitoring - FRL Exceedances	South Field Monitoring - FRL Exceedances
22	2386					
23	2387					
24	2389					
25	2390					
26	2396					
27	2397					
28	2398	2398				
29	2402					
30	2431	2431				
31	2432	2432				
32	2550					
33	2552					
34	2553					
35	2625	2625		2625		
36	2636	2636		2636		
37	2649				2649	
38	2733	2733				
39	2821				2821	
401	2880					
41	2897					
42	2898	2898		2898		
43	2899	2899		2899		
44	2900	2900		2900		
45	3014					
46	3015					
47	3045					
48	3046					
49	3049					
50	3069					
51	3070	3070				
52	3093	3093				
53	3095					
54	3106					
55	3125					
56	3128	3128		3128		
57	3385					
58	3387					
59	3390					
60	3396					
61	3397					
62	3398	3398				
63	3402					
64	3424	3424				
65	3426	3426				
66	3429	3429				
67	3431	3431				
689	3432	3432				

Table 3–4. List of IEMP Groundwater Monitoring Wells (continued)

Number[a]	Total Uranium Monitoring	Property/Plume Boundary Monitoring: Monitor FRL Exceedances	Property/Plume Boundary Monitoring: Monitor OSDF Constituents[b]	Property/Plume Boundary Monitoring: Monitor PRRS Constituents[c]	Waste Storage Area Monitoring - FRL Exceedances	South Field Monitoring - FRL Exceedances
69	3550					
70	3552					
71	3636	3636		3636		
72	3733	3733				
73	3821				3821	
74	3880					
75	3897					
76	3898	3898		3898		
77	3899	3899		3899		
789	3900	3900		3900		
79	4125					
80	4398	4398				
81	6015					
82	6880					
83	6881					
84	21033					
85	21063	21063				
86	21192					
87	22198	22198	22198.			
88	22199	22199	22199			
89	22204	22204	22204			
90	22205	22205	22205			
91	22208	22208	22208			
92	22210	22210	22210			
93	22211	22211	22211			
94	22214	22214	22214			
95	23064					
96	23118					
97	23271					
98	23272					
99	23273					
100	23274					
101	23275					
102	23276					
103	23277					
104	23278					
105	23279					
106	23280					
107	23281					
108	23282					
109	31217	31217				
110	32766					
111	32768					
112	62408					
113	62433					
114	63116					
115	63119					

Table 3–4. List of IEMP Groundwater Monitoring Wells (continued)

Number[a]	Total Uranium Monitoring	Property/Plume Boundary Monitoring: Monitor FRL Exceedances	Property/Plume Boundary Monitoring: Monitor OSDF Constituents[b]	Property/Plume Boundary Monitoring: Monitor PRRS Constituents[c]	Waste Storage Area Monitoring - FRL Exceedances	South Field Monitoring - FRL Exceedances
116	63283					
117	63284					
118	63285					
1190	63286					
120	63287					
121	63288					
122	63289					
123	63290					
124	63291					
125	63292					
126	82433					
127	83117					
128	83124					
129	83293					
130	83294					
131	83295					
132	83296					
133	83335					
134	83336					
135	83337				83337[d]	
136	83338				83338[d]	
137	83339				83339[d]	
138	83340				83340[d]	
139	83341				83341[d]	
140	83346				83346[d]	

[a]The number in Column 1 is used to identify the number of wells in the program. The individual monitoring well identification numbers are provided in Columns 2-7 as appropriate.
[b]List of total uranium monitoring wells and Property/Plume Boundary monitoring wells that overlap with OSDF monitoring wells.
[c]List of total uranium monitoring wells and Property/Plume Boundary monitoring wells that overlap with PRRS monitoring wells.
[d]Volatile organics are not sampled in Type 8 wells.

Table 3–5. Monitoring Requirements

Monitoring Requirements[a]

1. TOTAL URANIUM

2. WASTE STORAGE AREA

General Chemistry	Inorganic	Radionuclide	Organic
Nitrate/Nitrite	Manganese Molybdenum Nickel	Technetium-99 Total Uranium[b]	Carbon Disulfide Trichloroethene

3. SOUTH FIELD

General Chemistry	Inorganic	Radionuclide	Organic
NA[c]	Boron	Total Uranium[b]	NA[c]

4. PROPERTY/PLUME BOUNDARY FOR FRL EXCEEDANCES

General Chemistry	Inorganic	Radionuclide	Organic
Fluoride	Antimony Arsenic Lead Manganese Nickel Zinc	Total Uranium[b]	NA[c]

5. PROPERTY/PLUME BOUNDARY FOR PRRS

General Chemistry	Inorganic	Radionuclide	Organic
Phosphorous	Arsenic[d] Potassium Sodium	NA[c]	Benzene Ethyl benzene Isopropyl benzene Toluene Total xylene

[a]Monitoring will be conducted semiannually.
[b]Total uranium is monitored as part of the site-wide uranium monitoring.
[c]NA = not applicable
[d]Arsenic is also monitored with respect to FRL exceedances as part of the Property/Plume Boundary.

3.6.1 Project Organization

A multi-discipline project organization has been established to effectively implement and manage the project planning, sample collection and analysis, and data-management activities directed in this medium-specific plan. The key positions and associated responsibilities required for successful implementation are as follows:

The project team leader will have full responsibility and authority for the implementation of this medium-specific plan in compliance with all regulatory specifications and site-wide programmatic requirements. Integration and coordination of all medium-specific plan activities defined herein with other project groups are also key responsibilities. All changes to these activities must be approved by the team leader or designee.

Health and safety are the responsibility of all individuals working on this project scope. Qualified health and safety personnel shall participate on the project team to assist in preparing and obtaining all applicable permits. In addition, safety specialists shall periodically review and update the specific health and safety documents and operating procedures, conduct pertinent safety briefings, and assist in evaluating and resolving all safety concerns. All activities will be conducted according to the *Fernald Preserve Safety Plan* (DOE 2006h).

Quality assurance personnel will participate on the project team, as necessary, to review project procedures and activities, ensuring consistency with the requirements of the LM QAPP or other referenced standards, and assist in evaluating and resolving all quality-related concerns.

3.6.2 Sampling Program

The information derived from the groundwater monitoring program should produce a clear understanding of groundwater quality in the Great Miami Aquifer. The groundwater sampling process will be controlled so that collected samples are representative of groundwater quality. All procedures for monitoring well development, sample collection, and shipment will be performed in accordance with directives established in the *Sampling and Analysis Plan for United States Department of Energy Office of Legacy Management Sites* (LM SAP) (DOE 2006d) and the LM QAPP.

3.6.2.1 Total Uranium Monitoring

Approximately 140 monitoring wells will be sampled semiannually for total uranium. Approximately 50 of these wells will be sampled for additional constituents as described in Sections 3.6.2.2 through 3.6.2.4. A list of the wells to be sampled for only total uranium is provided in Table 3–6 and shown in Figure 3–5. The wells extend across all aquifer zones and provide monitoring coverage in all restoration module areas. Figure 3–5 shows the locations of the monitoring wells.

This semiannual total uranium sampling activity will address the following remediation sampling needs:

- The need to interpret changes to the total uranium plume over time due to remediation activities.
- The need to interpret the extent of capture in relation to the total uranium plume.
- The need to interpret the effectiveness of the aquifer remedy in maintaining a hydraulic barrier that limits the further southern migration of the total uranium plume and to document the area of uranium contamination (above 30 μg/L) south of the Administrative Boundary.
- Continued tracking of uranium concentrations at three off-property private monitoring wells.

Up to 27 locations will also be sampled each year for total uranium using a direct-push sampling tool. Direct-push sampling will provide vertical profile concentration data. The vertical profile data will be used to supplement the fixed monitoring well data in order to produce more robust plume interpretations. Exact locations for the direct-push sampling will be selected each year based on monitoring well data, modeling needs, and data-interpretation needs.

Table 3–6. List of Groundwater Wells to Be Sampled for Total Uranium Only

13	3046	23278
14	3049	23279
2002	3069	23280
2008	3095	23281
2009	3106	23282
2014	3125	32766
2016	3385	32768
2017	3387	62408
2046	3390	62433
2048	3396	63116
2060 (12)	3397	63119
2095	3402	63283
2106	3550	63284
2125	3552	63285
2166	3880	63286
2385	3897	63287
2386	4125	63288
2387	6880	63289
2389	6015	63290
2390	6881	63291
2396	21033	63292
2397	21192	82433
2402	23064	83117
2550	23118	83124
2552	23271	83293
2553	23272	83294
2880	23273	83295
2897	23274	83296
3014	23275	83335
3015	23276	83336
3045	23277	

Note: Six of the seven available channels in a Type 8 well (also known as a continuous multi-channel tubing (CMT) well) are available for water quality sampling. The seventh channel is used only for water level measurements. The channel completed in the plume interval with the highest measured uranium concentration will be sampled every 6 months. The other five channels will be sampled once a year to document any changes in the plume concentration profile.

Three private wells (12, 13, and 14) will also be sampled for total uranium. Figure 3–5 shows the location of these three wells (Private Well 12 is also identified as Monitoring Well 2060). Continuing to add to the historical database at these three private-well locations is beneficial for facilitating discussions with area stakeholders on the progress of the aquifer restoration. The three locations are situated immediately downgradient of the Fernald Preserve property boundary.

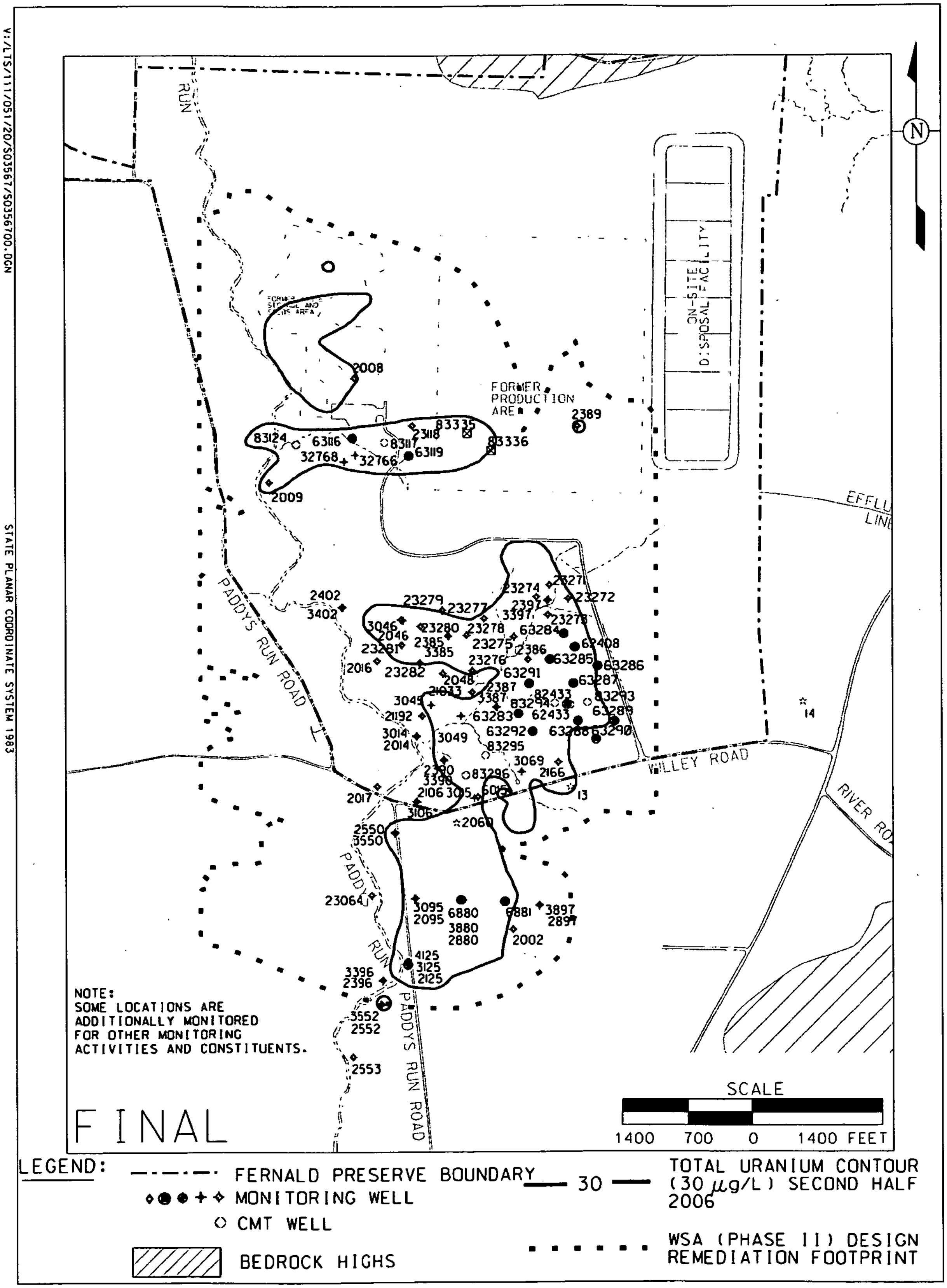

Figure 3–5. Locations for Semiannual Total Uranium Monitoring Only

3.6.2.2 South Field Monitoring

The South Field is located in Aquifer Zone 2 (refer to Figure 3–4). Thirteen extraction wells (South Field [Phases I and II] Module) are operating in the South Field.

In addition to the monitoring wells being sampled in the South Field for total uranium only (refer to Section 3.6.2.1), two monitoring wells (2045 and 2049) will be sampled semiannually for boron and total uranium. The rationale for the selection of these wells and this constituent is presented in Section 3.4 and Appendix A. Figure 3–6 shows the locations of these two wells. Following is the monitoring table:

South Field Monitoring Table
Semiannual Sampling Frequency

General Chemistry	Inorganic	Radionuclide	Organic
NA	Boron	Total Uranium	NA

Direct-push sampling has been conducted annually at five locations (12367, 12368, 12369, 12370, 12371, 12372, and 12373) along and south of Willey Road. These locations have been sampled annually since the re-injection demonstration. Figure 3–7 shows these locations. This annual direct-push sampling will continue at five of the locations in order to track remediation progress. Direct–push sampling at Locations 12367 and 12371 will not continue. These locations are outside of the uranium plume. At each direct-push location, a groundwater sample will be collected at 10-foot intervals beneath the water table and analyzed for only uranium until it can be verified that the entire thickness of the 30-µg/L total uranium plume has been sampled.

3.6.2.3 Waste Storage Area Monitoring

The waste storage area is located in Aquifer Zone 1 (refer to Figure 3–4). Four extraction wells (32761, 33062, 33347, and 33334) are operating in the waste storage area. Figure 3–3 shows the locations of these four wells.

In addition to the monitoring wells being sampled in the waste storage area for total uranium only (refer to Section 3.6.2.1), the 10 wells listed below will be sampled semiannually (refer to Figure 3–6 for the locations of these 10 wells).

Monitoring Wells to Be Monitored Semiannually
in the Waste Storage Area

2010	2649	2821	3821	
83337	83338	83339	83340	83341
83346				

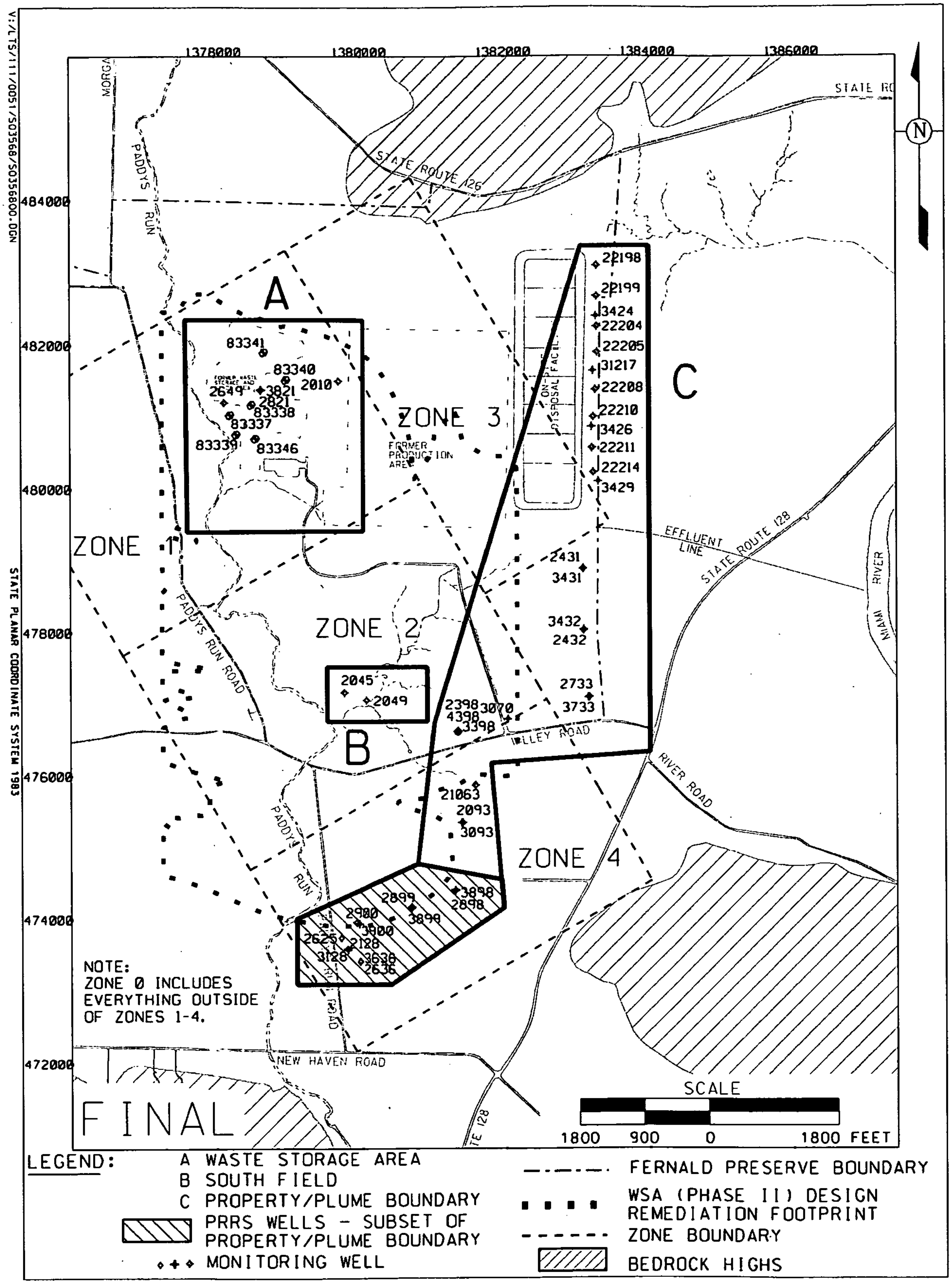

Figure 3–6. Locations for Semiannual Monitoring for Property/Plume Boundary, South Field, and Waste Storage Area

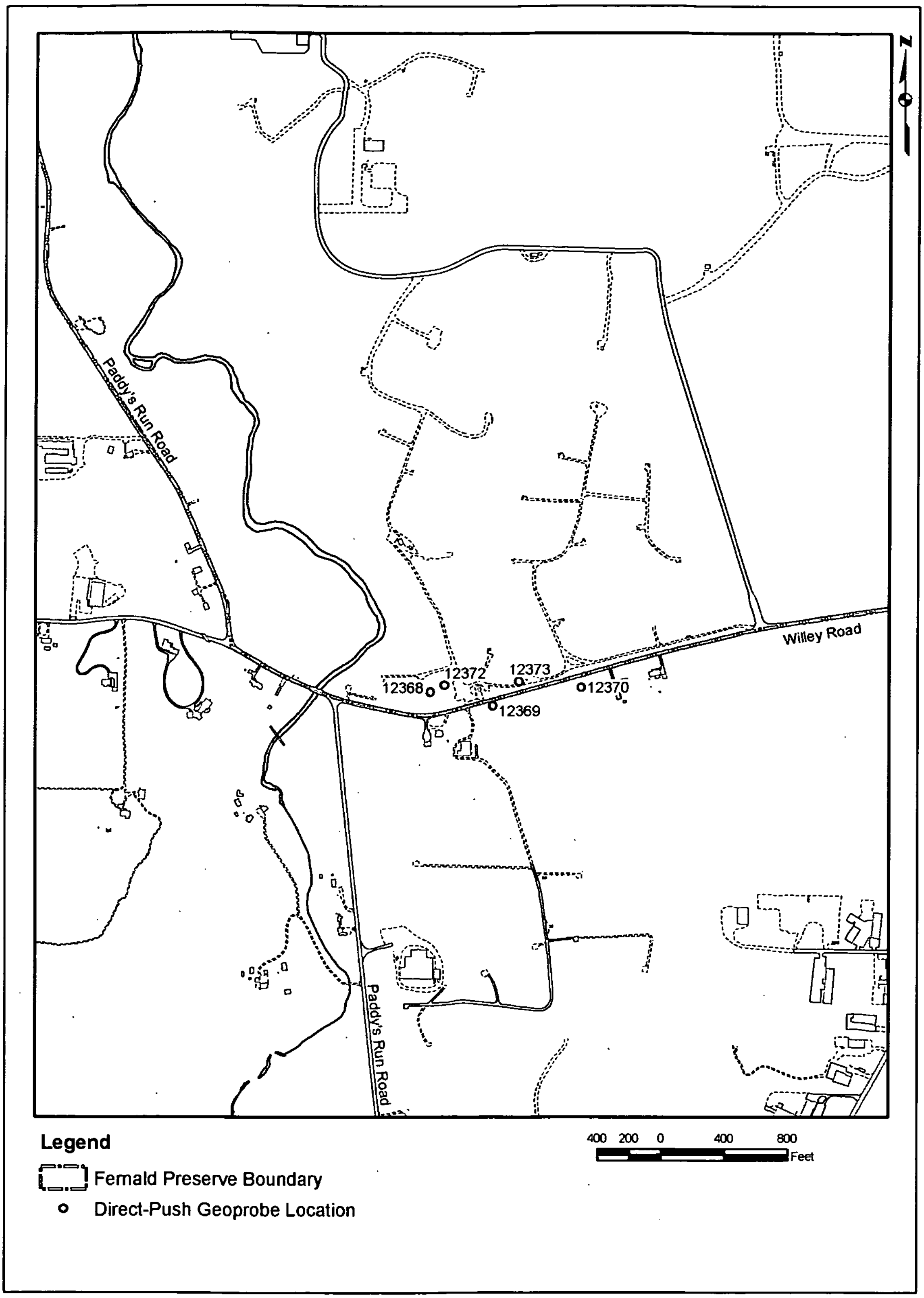

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Figure 3–7. Direct-Push Sampling Locations

The four Type 2 and Type 3 wells will be sampled semiannually for the constituents listed in the table below. The rationale for the selection of these wells and these constituents is presented in Section 3.4 and Appendix A. The six Type 8 wells will also be sampled for the constituents listed in the table below, with the exception of the organics. Type 8 wells will not be used to sample for organics. The six Type 8 wells listed above for the waste storage area are three channel CMT wells. All three channels will be sampled semiannually.

Locations may also be sampled in the waste storage area, utilizing a direct-push sampling tool. Direct-push sampling will provide vertical profile concentration data. The vertical profile data will be used to supplement the fixed monitoring well data in order to produce more robust plume interpretations. Direct-push locations in the waste storage area will be sampled for the waste storage area monitoring semiannual constituents listed below, excluding the organic constituents.

A direct-push sample will be collected prior to any filtering and will be analyzed for nitrate/nitrite. The remainder of the samples (manganese, molybdenum, nickel, total uranium, and technetium-99) will, at a minimum, be filtered through a 5-micron filter. Samples filtered through a 5-micron filter will be identified as "unfiltered" on the Chain-of-Custody.

If the turbidity of the 5-micron filter direct-push sample is below 5-NTUs, the remaining five constituents will be sampled. If the turbidity of the 5-micron filtered direct-push sample is above 5-NTUs, the sample will be further filtered through a 0.45-micron filter. Both the 5-micron and the 0.45-micron filtered sample will be analyzed for total uranium and the four remaining constituents will be analyzed from the 0.45-micron filtered sample only. All samples filtered with a 0.45-micron filter will be identified as "filtered" on the Chain-of-Custody.

Waste Storage Area Monitoring Table
Semiannual Sampling Frequency

General Chemistry	Inorganic	Radionuclide	Organic
Nitrate/Nitrite	Manganese	Technetium-99	Carbon Disulfide
	Molybdenum	Total Uranium	Trichloroethene
	Nickel		

3.6.2.4 Property/Plume Boundary Monitoring

The focus of the Property/Plume Boundary Groundwater Monitoring activity is to detect and assess potential changes in groundwater conditions along the eastern property boundary and downgradient of the leading edge of the 30-µg/L total uranium plume south of the Fernald Preserve property.

Monitoring will be conducted along the property boundary and downgradient uranium plume boundary for FRL exceedances; the influence (or lack of influence) that pumping is having on the PRRS plume will be documented. Monitoring will also reduce redundancy with OSDF monitoring.

Property/Plume Boundary Monitoring for FRL Exceedances

Twenty-five monitoring wells along the eastern property boundary and the leading edge of the off-site total uranium plume will be sampled semiannually (refer to the table that follows). Figure 3–6 is a map showing the locations of the wells.

Property/Plume Boundary Monitoring Wells
To Be Monitored for FRL Exceedances Only

2093	3424	22198
2398	3426	22199
2431	3429	22204
2432	3431	22205
2733	3432	22208
3070	3733	22211
3093	4398	22214
3398	21063	22210
		31217

The 25 monitoring wells will be sampled semiannually for the constituents listed below. All of these constituents have had FRL exceedances. The rationale for the selection of these constituents and the monitoring schedule are presented in Section 3.4 and Appendix A.

Property Plume Boundary Monitoring Table
for FRL Exceedances Semiannual Sampling Frequency

General Chemistry	Inorganic	Radionuclide	Organic
Fluoride	Antimony Arsenic Lead Manganese Nickel Zinc	Total Uranium	NA

Eight of the 25 monitoring wells (22204, 22205, 22208, 22198, 22211, 22214, 22210, and 22199) are also sampled for OSDF constituents.

Property/Plume Boundary Monitoring for Paddys Run Road Site Constituents

Groundwater is being pumped from the aquifer immediately north of the PRRS (Extraction Wells 3924, 3925, 3926, and 3927); it remains important to document the influence (of lack of influence) that the pumping has on the PRRS plume. Groundwater samples will be collected semiannually from 11 monitoring wells (refer to Figure 3–6).

The 11 wells are:

2128	2899	3898
2625	2900	3899
2636	3128	3900
2898	3636	

These 11 wells will be analyzed for PRRS constituents as well as for IEMP FRL exceedance constituents. The PRRS constituents listed below are the constituents to be monitored:

Property Plume Boundary Monitoring Table for FRL Exceedances and Paddys Run Road Site Constituents Semiannual Sampling Frequency

General Chemistry	Inorganic	Radionuclide	Organic
Fluoride	Antimony	Total Uranium	Benzene
Phosphorous	Arsenic		Ethyl benzene
	Lead		Isopropyl benzene
	Manganese		Toluene
	Nickel		Total Xylene
	Potassium		
	Sodium		
	Zinc		

If pumping rates of wells in the South Plume Module are increased above rates established in 1998 (maximum pumping rates listed in Table 5–1 of the OMMP under the objective of minimizing the impact to the PRRS plume), then arsenic sampling will be conducted weekly in Monitoring Wells 2128, 2625, 2636, and 2900, and in Extraction Wells 3924 and 3925. The arsenic sampling will be used to determine if the increased pumping rates have adversely impacted the PRRS plume. The weekly sampling will be done for a minimum of 3 weeks after a pumping rate increase; if no changes in arsenic concentration trends are observed, the increased arsenic sampling will be discontinued. Figure 3–6 identifies the locations of these monitoring wells.

3.6.2.5 Monitoring Non-Uranium Groundwater FRL Constituents without IEMP FRL Exceedances

Monitoring for non-uranium groundwater FRL constituents that have not had an FRL exceedance since the inception of the IEMP will be addressed during Stage III (Certification/Attainment Monitoring), as necessary.

3.6.2.6 Routine Water Level Monitoring

The water table in the Great Miami Aquifer and its response to seasonal fluctuations has been well characterized in the Remedial Investigation Report for OU5. Water level data have been routinely collected at the Fernald Preserve since 1988. Water level data are used to evaluate seasonal variations and interpret groundwater flow directions. This is accomplished by preparing hydrographs and maps of the water table in the Great Miami Aquifer. During the remediation phase of the CERCLA process, water levels will be monitored across the site to assess the effects of extraction operations on the water table and flow conditions within the Great Miami Aquifer.

The Great Miami Aquifer is an unconfined aquifer and responds rapidly to recharge events. Data collected at the Fernald Preserve and reported in the OU5 Remedial Investigation Report document that no strong vertical gradients exist in the area of the Fernald Preserve. Water level monitoring will rely mostly on data from Type 2 wells, which will be supplemented as necessary with data from Type 3, Type 6, and Type 8 wells. Type 8 wells will have water level measurements taken in the top and bottom channels. If the top channel is dry, a measurement will be collected from the next deeper channel that is not dry.

Approximately 180 monitoring wells were selected for water level monitoring; they are shown in Figure 3–8 and listed below. Groundwater elevation monitoring locations were selected to provide areal coverage across the Fernald Preserve with an increasing density of wells in areas surrounding active aquifer restoration wells. Groundwater elevations will be measured quarterly in these wells to provide data for construction of water table elevation maps. These maps will be used to interpret the location of flow divides, capture zones, and stagnation zones created by the operation of remediation wells. Additional monitoring wells and more frequent measurement intervals may be used near aquifer remediation modules as they become operational and as sensitive capture zones or stagnation zones are identified, or if unpredicted fluctuations in contaminant concentrations are observed.

3.6.2.7 Sampling Procedures

Sample analysis will be performed either on-site or at off-site contract laboratories, depending on specific analyses required, laboratory capacity, turnaround time, and performance of the laboratory. The laboratories used for analytical testing have been audited to ensure that Department of Energy Consolidated Audit Program (DOECAP) or equivalent process requirements have been met as specified in the *Legacy Management CERCLA Sites Quality Assurance Project Plan* (LM QAPP). These criteria include meeting the requirements for performance evaluation samples, pre-acceptance audits, performance audits, and an internal quality assurance program.

All monitoring wells will be purged and sampled using the guidelines specified in the LM SAP and the LM QAPP, which have been incorporated into the standard operating procedures used for conducting groundwater sampling. Table 3–7 summarizes the field sampling information by analytical constituent groups and includes the analytical support level (ASL), holding time, preservative, container requirement, and analytical method. The volume of purge water to be removed from monitoring and extraction wells is specified in LM SAP.

In 2001, routine filtering of groundwater samples collected at groundwater monitoring wells was initiated. The objective was to collect a representative sample of what was dissolved and mobile in the sample as opposed to what was bound to the sediments then released by the preservative added to the sample during the collection process. A review of 221 analytical results for uranium shows mixed reviews in achieving this objective. Unexpectedly, approximately 27 percent of the filtered uranium results were higher than the unfiltered uranium results. T-test statistics indicate that there is no evidence to suggest that the two sample sets (unfiltered vs. filtered) come from populations having different means. In conclusion, filtering provided inconsistent results and does not appear to have achieved its objective; therefore, routine filtration of groundwater samples collected at monitoring wells will no longer occur.

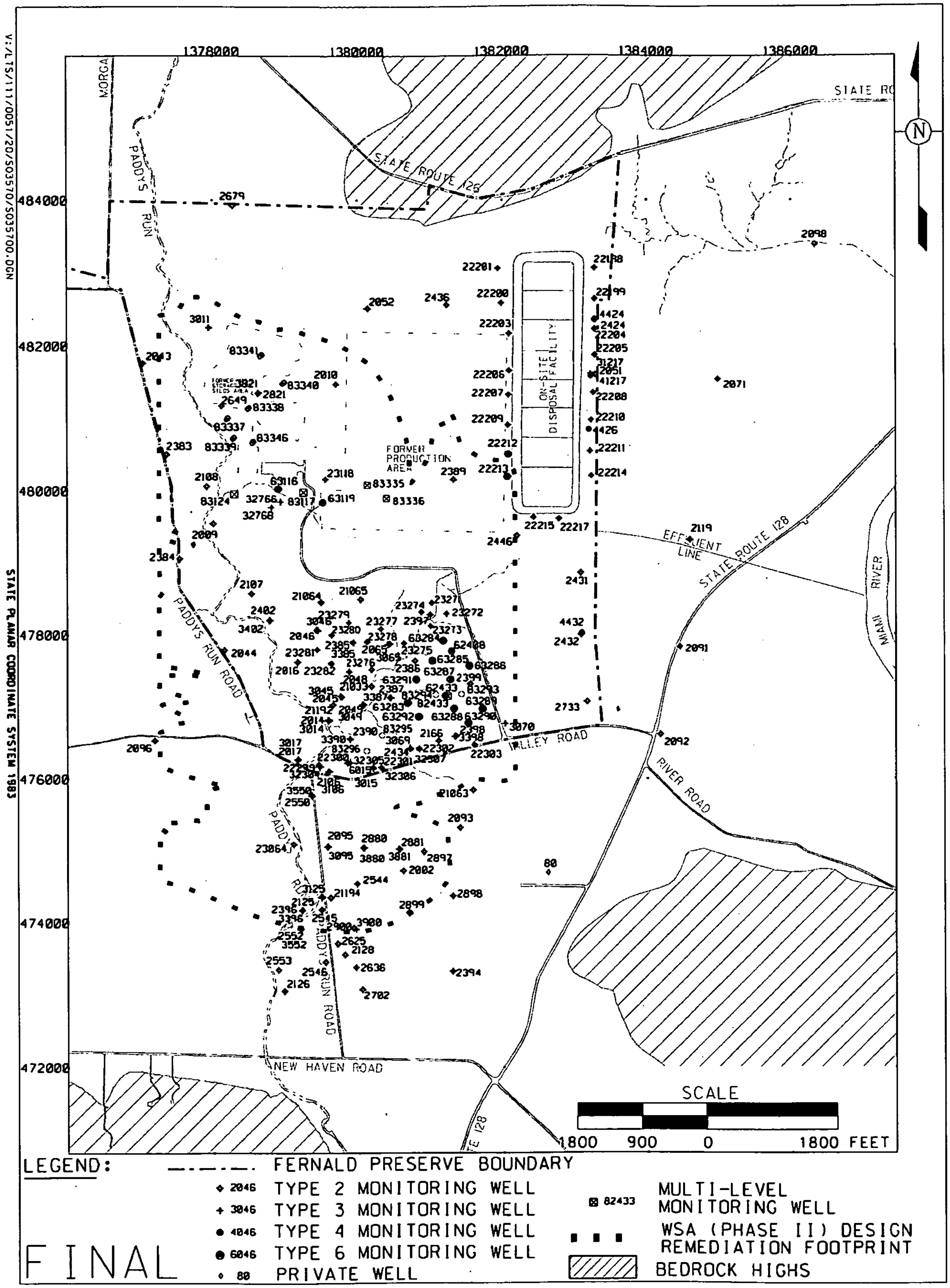


Figure 3–8. Groundwater Elevation Monitoring Wells

Table 3–7. Analytical Requirements for the Groundwater Monitoring Program

Constituent	Method	Sample Type	ASL[a]	Holding Time[b]	Preservative[b]	Container[b,c]
General Chemistry:						
Fluoride	300.0[d], 340.2[d], or 4500C[e]	Grab	B	28 days	None	Plastic
Nitrate/Nitrite	353.1[d], 353.2[d], 4500D[e], or 4500E[e]	Grab	B	28 days	Cool to 4EC, H_2S0_4 to pH <2	Plastic or glass
Phosphorus	365.(all)[d] or 4500E[e]	Grab	B	28 days	Cool to 4EC, H_2S0_4 to pH <2	Plastic or glass
Inorganics:						
Metals	6020[f], 7000A[f], or 6010B[f]	Grab	B	6 months	HNO_3 to pH <2	Plastic or glass
Radionuclides: (All Radiological)	DOE-EML HASL 300[g]	Grab	B	6 months or 5 × half-life, whichever is less	HNO_3 to pH <2	Plastic or glass
Volatile Organics:	8260B[f]	Grab	B	7 days	Cool to 4EC	Glass vial with Teflon-lined septum cap
		Grab	B	14 days	Cool to 4EC H_2SO_4, HCl, or solid $NaHSO_4$ to pH <2	Glass vial with Teflon-lined septum cap
Field Parameters[h]:	LM SAP & LM QAPP[i]	Grab	A	NA[j]	NA[j]	NA[j]

Note: The analytical site-specific contract identifies the specific method.

[a]The ASL may become more conservative if it is necessary to meet detection limits or data quality objectives.
[b]Appropriate preservative, holding time, and container will be used for the corresponding method.
[c]Container size is left to the discretion of the individual laboratory.
[d]Methods for Chemical Analysis of Water and Wastes (EPA 1983).
[e]Standard Methods for the Examination of Water and Wastewater (APHA 1989).
[f]Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (EPA 1998).
[g]Procedures Manual of the Environmental Measurements Laboratory (DOE 1997b).
[h]Field parameters include dissolved oxygen, pH, specific conductance, temperature, and turbidity.
[i]The LM SAP and LM QAPP provide field analytical methods.
[j]NA = not applicable.

List of Groundwater Elevation Monitoring Wells

80	2389	3017	22203	32306
2002	2390	3045	22204	32307
2009	2394	3046	22205	32766
2010	2396	3049	22206	32768
2014	2397	3065	22207	41217
2016	2398	3069	22208	62408
2017	2399	3070	22209	62433
2043	2402	3095	22210	63116
2044	2424	3106	22211	63119
2045	2431	3125	22212	63283
2046	2432	3385	22213	63284
2048	2434	3387	22214	63285
2049	2436	3390	22215	63286
2051	2446	3396	22217	63287
2052	2544	3398	22299	63288
2065	2545	3402	22300	63289
2071	2546	3550	22301	63290
2091	2550	3552	22302	63291
2092	2552	3821	22303	63292
2093	2553	3880	23064	82433
2095	2625	3881	23118	83117
2096	2636	3900	23271	83124
2098	2649	4424	23272	83293
2106	2679	4426	23273	83294
2107	2702	4432	23274	83295
2108	2733	6015	23275	83296
2119	2821	21033	23276	83335
2125	2880	21063	23277	83336
2126	2881	21064	23278	83337
2128	2897	21065	23279	83338
2166	2898	21192	23280	83339
2383	2899	21194	23281	83340
2384	2900	22198	23282	83341
2385	3011	22199	31217	83346
2386	3014	22200	32304	
2387	3015	22201	32305	

Not filtering groundwater samples collected at monitoring wells is a more conservative (and an EPA–recommended) approach to determining the true mobility of metals and uranium in groundwater. Filtering of groundwater samples at monitoring wells may take place on a case-by-case basis if deemed appropriate.

If filtering is conducted, the reasons for filtering will be presented to the EPA and OEPA as soon as possible through the routine weekly report and annually through the site environmental report.

Due to the temporary nature of direct-push sampling locations and the smaller amount of development that takes place compared to a monitoring well, direct-push samples are often turbid. Therefore, direct-push groundwater samples are routinely filtered through a 5-micron filter. Measured uranium concentrations in direct-push samples collected in 2001 were consistently similar regardless of whether or not the sample was filtered using a 5-micron filter or a 0.45-micron filter. Therefore, direct-push samples for uranium analysis are routinely filtered through a 5-micron filter only. Exceptions to this filtering procedure include the collection of Waste Storage Area parameters as discussed in Section 3.6.2.3.

3.6.2.8 Quality Control Sampling Requirements

Field quality control samples will be collected to assess the accuracy and precision of field and laboratory methods as outlined in LM SAP and LM QAPP. These samples will be collected and analyzed in order to evaluate the possibility that some controllable practice, such as decontamination, sampling technique, or analytical method, may be responsible for introducing bias in the analytical results. The following types of quality control samples will be collected: sampling equipment rinsates, trip blanks, and duplicate samples. Each quality control sample is preserved using the same method for groundwater samples.

The quality control sample frequencies will be tracked to ensure that proper frequency requirements are met as follows:

- Trip blanks will be prepared for each sampling team on each day of sampling when organic compounds are included in the respective analytical program.
- They will be prepared before entering the field, and will be taken into the field and handled along with the collected samples. Trip blanks will not be opened in the field.
- Equipment rinsates will be collected for every 20 groundwater samples that are collected using reusable sampling equipment. If a specific sampling activity consists of less than 20 groundwater samples, then a rinsate sample will still be required. Rinsates are not required when dedicated well equipment or disposable sampling equipment is used.
- Field duplicates will be collected for every 20 groundwater samples (or a fraction thereof) if the specific sampling program consists of fewer than 20 samples.

The groundwater samples associated with each quality control sample also will be tracked to ensure traceability in the event that contaminants are detected in the quality control samples.

3.6.2.9 Decontamination

In general, decontamination of equipment is minimized due to limited use of reusable equipment during sample collection. However, if decontamination is required, then equipment will be cleaned between sample locations. The decontamination is identified in the LM QAPP and more specifically outlined in the LM SAP.

3.6.2.10 Waste Disposition

Wastes that will be generated during sampling activities are purge water, decontamination solutions, and contact wastes. The following subsections provide the proposed disposition methodology for each type of waste generated.

Purge Water and Decontamination Solutions: All decontamination wastewater and purge water will be containerized and disposed through the CAWWT for treatment. The point of entry into the CAWWT will either be via the CAWWT back wash basin or the OSDF permanent lift station.

Contact Wastes: Contact wastes, such as personal protective equipment, paper towels, and other solid wastes, will be placed in plastic bags and put in dumpsters.

3.6.2.11 Monitoring Well Maintenance

Monitoring wells at the Fernald Preserve will be maintained in order to keep them in a condition that is protective of the subsurface environment and to ensure that representative groundwater samples can be obtained. Two types of activities are recognized: well maintenance inspections and well evaluations.

Well Maintenance Inspections

Routine inspections of Great Miami Aquifer groundwater monitoring wells will be conducted during sampling or collection of water levels (at a minimum of once a year if the well is not being routinely sampled) to determine if the well is protective of the environment based on the inspection criteria below. Wells may be inspected more frequently if they are located in an area of active surface restoration. All assessment and maintenance activities will be recorded on applicable field data forms. The inspections include, but are not limited to, the following:

- Ensuring that the well identification number is painted or welded on the top of the lid.
- Inspecting the ground surrounding the well for depressions and channels that allow surface water to collect and flow toward the wellhead; and for debris and foreign material that could leach contaminants into the subsurface or otherwise interfere with well sampling.
- Ensuring visibility and accessibility to the well.
- Inspecting locking lids and padlocks to check for rust and ease of operation.
- Inspecting the exposed (protective) well casing to ensure that it is free of cracks and signs of corrosion; it is reasonably plumb with the ground surface; it is painted bright orange; the drain hole is clear; it is free of debris; and the well casing has no sharp edges.
- Removing and inspecting the well cap to ensure that it is free of debris, fits securely, and the vent hole is clear; and if equipped with a ground-flush cap, ensuring that it is water-tight to prevent surface water from entering the well.
- Inspecting concrete surface seals for settling and cracking.
- If exterior guards are used to protect the well, then periodically inspecting the guards for visibility and damage and repaint, if necessary.

Well Evaluation

A monitoring well evaluation will be initiated if there is an indication that the monitoring well may no longer by yielding a representative groundwater sample. A monitoring well may no longer be yielding a representative groundwater sample for several reasons. The well's integrity may be compromised, as determined through the well maintenance inspections discussed above. The downhole integrity of the monitoring well may be compromised as evidenced through an increase in the turbidity of the collected sample or the amount of sediment measured in the bottom of the monitoring well. The bioaccumulation of metals around the monitoring well may be occurring as evidenced by the cloudiness or coloration of the collected water sample or the odor of the collected sample. If a problem is suspected then the following work may be performed to evaluate the cause:

- Review existing well installation documentation.
- Review well history and historical water quality data to identify whether it produces consistently clear or turbid samples.
- Review groundwater sampling field records.
- Conduct a downhole camera survey to inspect the integrity of the screen and casing.

At least once a year, an assessment will be made of wells that are sampled as to whether or not the well is yielding a representative sample. This assessment includes, but is not limited to, the following:

- Determining how much sediment has entered the well screen and accumulated in the well; and review historical depth records. This will be done by measuring the depths of those wells that do not have dedicated packers.
- Determining if any foreign material is present in the well (e.g., bentonite grout).
- Determining if the groundwater color has changed over time (e.g., due to iron bacteria).
- Evaluating turbidity within the sample.
- Noting if an odor that could be associated with biofouling (i.e., rotten-egg or fish odor) is present.

Well Maintenance Corrective Actions

Corrective actions to address problems identified in the well maintenance inspections will be conducted as soon as feasible. Corrective maintenance to address excessive turbidity will include the removal of sediment from the well through the redevelopment of the well.

It is possible that minerals can precipitate on well screens or that metals can bioaccumulate around well screens. If it is determined that minerals have precipitated in the well or on the well screen, or that metals have bioaccumulated around the well screen and the representativeness of the groundwater sample is being impacted, then the limited use of chemicals (e.g., chlorine, hydrochloric acid) to remove the mineral build-up or alleviate the biofouling may be considered. It should be noted that CMT wells could probably not be rehabilitated due to the small diameters of the sampling channels. It is understood that chemicals have a very limited application in the rehabilitation of monitoring wells because the chemicals can cause changes such that the well will no longer yield a representative sample (EPA 1991). Changes resulting from the use of chemicals could last for a short time or could be permanent. Therefore, if chemical rehabilitation is attempted, it will only be attempted as a last resort. Water quality parameters (such as Eh [redox potential], pH, temperature, and conductivity) will be measured prior to the application of the chemicals and following the use of the chemicals. These measurements will serve as values for comparison of water quality before and after well maintenance.

If a groundwater monitoring well has been damaged in such a way that it is no longer protective of the subsurface environment and it cannot be repaired, then the well will be plugged and abandoned. If it is determined that the well is not yielding a representative groundwater sample and rehabilitation efforts are not effective in correcting the condition, then the well will be considered for plugging and abandonment. If the well is still protective of the subsurface environment, then it might be used for the collection of water level data even though it does not yield representative groundwater samples. Wells designated for plugging and abandonment may be sampled one last time for a subset of water quality parameters listed in Table 3–5.

The exact parameter list selected for the sampling will be based on the location of the well. CMT wells being plugged and abandoned may have each available channel sampled for total uranium (or any groundwater FRL constituent) prior to being plugged and abandoned, as deemed appropriate. A replacement monitoring well will only be installed if the monitoring well that was plugged and abandoned was being actively monitored for either water quality or water levels. Any preliminary decision not to replace a monitoring well will be discussed with the EPA and OEPA prior to finalizing the decision.

3.6.3 Change Control

Changes to the medium-specific plan will be at the discretion of the project team leader. Prior to implementation of field changes, the project team leader or designee shall be informed of the proposed changes and circumstances substantiating the changes. Any changes to the medium-specific plan must have written approval by the project team leader or designee, quality assurance representative, and the field manager prior to implementation. If a Variance/Field Change Notice is required, it will be completed in accordance with LM QAPP. The Variance/Field Change Notice form shall be issued as controlled distribution to team members and will be included in the field data package to become part of the project record. During revisions to the IEMP, Variance/Field Change Notices will be incorporated to update the medium-specific plan.

3.6.4 Health and Safety Considerations

The Fernald Preserve's health and safety personnel are responsible for the development and implementation of health and safety requirements for this medium-specific plan. Hazards (such as physical, radiological, chemical, and biological) typically encountered by personnel when performing the specified fieldwork will be addressed during team briefings. Health and Safety requirements are addressed in the Fernald Preserve Project Safety Plan.

All involved personnel will receive adequate training to the health and safety requirements prior to implementation of the fieldwork required by this medium-specific plan. Safety meetings will be conducted prior to beginning fieldwork to address specific health and safety issues.

3.6.5 Data Management

Field documentation and analytical results will meet the IEMP data reporting and quality objectives, comply with the LM QAPP, *LM Standard Practice for Validation of Laboratory Data* (DOE 2006i), and the LM SAP. Data documentation and validation requirements for data collected for the IEMP fall into two categories depending upon whether the data are field- or laboratory-generated. Field data validation will consist of verifying medium-specific plan compliance and appropriate documentation of field activities. Laboratory data validation will consist of verifying that data generated are in compliance with ASLs specified in the medium-specific plan. Specific requirements for field data documentation and validation, and laboratory data documentation and validation will be in accordance with the LM QAPP, the *Standard Practice for Validation of Laboratory Data*, and the LM SAP.

There are five analytical levels (ASL A through ASL E) defined for use at the Fernald Preserve. For groundwater, field data documentation will be at ASL A, and laboratory data documentation, in general, will be at ASL B. A more conservative ASL may be required for laboratory data in order to meet required detection limits or in order to ensure data quality objectives. ASL B is appropriate for laboratory-generated data because the data are being used for surveillance during site restoration. ASL B provides qualitative, semi-qualitative, and quantitative data with some quality assurance/quality control checks.

At a minimum, 10 percent of the IEMP field and analytical data will undergo validation to ensure that analytical data are in compliance with the ASL method criteria being requested and in order to meet data quality objectives. The percentage of data validated could increase in order to meet data quality objectives.

Data will be entered into a controlled database using a double-key or other verification method to ensure accuracy. The hard-copy data will be managed in the project file according to LM record keeping requirements and DOE Orders.

3.6.6 Quality Assurance

Assessments of work processes shall be conducted to verify quality of performance and may include audits, surveillances, inspections, tests, data verification, field validation, and peer reviews. Assessments shall include performance-based evaluation of compliance to technical and procedural requirements and corrective action effectiveness necessary to prevent defects in data quality. Assessments may be conducted at any point in the life of the project. Assessment documentation shall verify that work was conducted in accordance with IEMP, LM SAP, and LM QAPP requirements.

Recommended semiannual quality assurance assessments or surveillances shall be performed on tasks specified in the medium-specific plan. These assessments may be in the form of independent assessments or self-assessments, with at least one independent assessment conducted annually. Independent assessments are the responsibility of quality assurance personnel. The project team leader and quality assurance personnel will coordinate assessment activities and comply with the LM QAPP. The project or quality assurance personnel shall have "stop work" authority if significant adverse effects to quality conditions are identified or work conditions are unsafe.

3.7 IEMP Groundwater Monitoring Data Evaluation and Reporting

This section provides the methods to be used in analyzing the data generated by the IEMP groundwater sampling program. It summarizes the data evaluation process and actions associated with various monitoring results. The planned reporting structure for IEMP-generated groundwater data, including specific information to be reported in the annual site environmental report, is also provided.

3.7.1 Data Evaluation

Data resulting from the IEMP groundwater program will be evaluated to meet the program expectations identified in Section 3.4.1. Data evaluation will look at both the operational efficiency and the operational effectiveness of the groundwater remediation system (EPA 1992). Operational efficiency refers to implementing the most efficient remedy possible. The objectives are to minimize downtimes, conduct stable operations, meet planned performance goals, and operate a cost-effective system. Operational efficiency will be assessed by tracking the following:

- Pumping rates for individual wells and modules.
- Gallons of water pumped.
- Extraction well total hours of operation during the year.
- The volume of treated water.
- Planned versus actual gallons of water pumped.

Operational effectiveness refers to the evaluation of the degree of contamination cleanup achieved. Operational effectiveness will be assessed by tracking the following:

- Planned versus actual pounds of uranium removed from the Great Miami Aquifer.
- Pounds of uranium removed per million gallons of water pumped (uranium removal index).
- Running cumulative pounds of uranium removed from the Great Miami Aquifer versus predicted running cumulative pounds of uranium removed from the Great Miami Aquifer.
- Total uranium concentration data collected from extraction wells.
- Total uranium concentration data collected from monitoring wells.
- Water level data collected from monitoring wells.
- Interpretations of capture zones.
- Regression curves of uranium concentration data at extraction wells.
- Regression curves of uranium concentration data at groundwater monitoring wells every 5 years. Regression curves of uranium concentration data at groundwater monitoring wells will be prepared every 5 years because only two data points a year will be added to the database used to generate the curves.

Most of the data will be tabulated, presented in graphs, or presented in maps and evaluated in the following manner:

- Concentration versus time plots for specific constituents.
- Tables identifying wells with constituents above FRL concentrations.
- Mann-Kendall trend analyses for specific constituents.
- Concentration contour maps.

Large quantities of data will be collected and evaluated each year. In order to evaluate the results of the sampling, the data collected for the IEMP will be presented and evaluated using the formats above. The findings of data evaluations will be shared with project personnel. EPA and OEPA have identified that this is a successful method of evaluating and presenting the data. Groundwater monitoring program data will be evaluated to:

- Assess progress in capturing and restoring the area containing the >30-µg/L total uranium plume.
- Assess progress in capturing and restoring the areas affected by non-uranium FRL exceedances.
- Assess water quality at the downgradient Fernald Preserve property boundary.
- Assess model predictions.
- Assess the impact that the aquifer restoration is having on the PRRS plume.
- Meet other monitoring commitments.
- Address community concerns.

The aquifer restoration system is designed to reduce the concentration of uranium and non-uranium FRL constituents in the aquifer to concentrations that are at or below their FRL. Because uranium is the principal COC, the aquifer restoration system has been designed to capture the 30-µg/L total uranium plume, with the understanding that the system may need to be modified in the future to capture and remediate non-uranium FRL constituents.

Extraction wells have been positioned within each restoration module to capture the uranium plume. Operational decisions and pumping changes will focus on the capture of the uranium plume. Operational changes to meet non-uranium FRL concentrations are considered to be a secondary objective. However, evaluation of the need for an operational change to address non-uranium FRL constituents will be ongoing throughout aquifer remediation and is expected to gain in importance as the achievement of the uranium objective approaches.

Following is a discussion of how each of the groundwater program expectations are intended to be met through evaluation of IEMP groundwater data.

<u>Capturing and Restoring the Area Containing the >30-µg/L Total Uranium Plume</u>
Capture and restoration of the area containing the >30-µg/L total uranium plume will be evaluated using groundwater elevation data and the most current maximum total uranium plume interpretation. Groundwater elevation maps with capture zone and flow divide interpretations will be prepared to evaluate the extent of capture.

Remediation of the 30-µg/L total uranium plume will be assessed by monitoring total uranium concentrations over time. The 30-µg/L maximum total uranium plume will be mapped and compared to previous maps to determine how the plume has changed in response to remediation. Direct-push sampling data will be used throughout the remedy to supplement fixed monitoring well location data by providing vertical profile concentration data.

If a new total uranium FRL exceedance is detected in the aquifer, then an attempt will be made to determine the cause of the exceedance. Considerations will include:

- Movement of known total uranium contamination in response to pumping, or natural migration.
- Previously undetected uranium contamination that has now moved into a monitoring zone as a result of pumping, or natural migration.

When a new extraction well begins operating, water levels will be collected more frequently until conditions have stabilized. Once conditions have stabilized, monitoring will fall back to the regular IEMP monitoring schedule. Individual startup plans will provide specifics on the frequency of water level and water quality data collection during the startup time period.

Capturing and Restoring the Areas Affected by Non-uranium FRL Exceedances

The OU5 ROD identifies 49 FRL constituents, other than total uranium, that also need to be tracked as part of the aquifer restoration. These 49 constituents are collectively referred to as the non-uranium FRL constituents. During the aquifer restoration, groundwater monitoring will take place for the non-uranium FRL constituents. Constituents that have been detected in the aquifer above their respective FRL will be monitored semiannually.

Non-uranium FRL concentration trends in the Great Miami Aquifer will be assessed through trend analysis when sufficient data have been obtained. The Mann-Kendall statistical test for trend will be used to facilitate the trending interpretation. Concentrations versus time plots may be used to illustrate how the concentrations are trending.

If a new non-uranium FRL exceedance is detected in the aquifer, then an attempt will be made to determine the cause of the exceedance. Considerations will include:

- Movement of known contamination in response to pumping or natural migration.
- Previously undetected contamination that has now moved into a monitoring zone as a result of pumping or natural migration.

Any FRL exceedance detected at a property boundary/plume boundary well location will be evaluated using the same data evaluation protocol that was approved for the *Restoration Area Verification Sampling Program, Project-Specific Plan* (DOE 1997c) in order to determine if additional action is required. The constituent concentration data over time will be graphed. If two or more sampling events following an FRL exceedance indicate that the concentrations are below the FRL, then the location will not be considered for remediation or further monitoring above and beyond what is already prescribed by the IEMP. If sampling following the initial FRL exceedance indicates that the exceedance was not just a one-time occurrence, and the exceedance is judged to be the result of Fernald Preserve activities (either historical or current), then action will be taken to address the exceedance.

Meeting Other Monitoring Commitments
Other groundwater monitoring commitments that need to be addressed are private well sampling, property boundary monitoring, and fulfillment of DOE Order 450.1 requirements to maintain an environmental monitoring program for groundwater.

Total uranium data collected at private wells will be graphed to illustrate changes and will be used in the preparation of total uranium contour maps. Data collected from the Fernald Preserve property/plume boundary monitoring system will be compared to FRLs. This will facilitate the detection and monitoring of FRL exceedances and will determine if interim actions are warranted, in addition to implementing the site-wide aquifer restoration. Lastly, this groundwater monitoring program presented in the IEMP, along with the groundwater data reporting in IEMP annual integrated site environmental reports, fulfills DOE Order 231.1 requirements.

Groundwater Modeling
Groundwater uranium concentration data and water level data obtained through the life of the remedy will be compared against model-predicted concentrations and water levels to evaluate how reasonable the predictions are over the long term. Individual well residuals (model-predicted concentration versus actual measured concentrations) will be determined without running the model. A mean residual calculation for each monitoring event will also be determined. Monitoring wells in the remediation footprint of the aquifer will be included in the residual exercise. Results of the first assessment were provided in the 2005 site environmental report. A brief summary of background information on the groundwater model follows.

Since modeling was conducted for the RI/FS and *Baseline Remedial Strategy* reports, the model has undergone several changes in order to improve its capability for making water level and uranium concentration predictions. DOE has changed from the Sandia Waste Isolation Flow and Transport (SWIFT) groundwater modeling code to the Variably Saturated Analysis Model in 3 Dimensions (VAM3D) modeling code for all site groundwater modeling operations. This transition has been documented in detail in *Development and Verification of VAM3DF, a Numerical Flow and Transport Modeling Code* (HydroGeologic 1998).

The groundwater modeling grid used in the SWIFT model was retained for the VAM3D model. However, vertical discretization of the model was increased in the VAM3D model to 12 vertical layers instead of the six layers used in the SWIFT model.

The groundwater model was recalibrated for flow to address observed changes in water level conditions and to address seasonal changes in water levels prior to it being used to support the design of the Waste Storage Area Module in 2001, the South Field (Phase II) Module in 2002, and the Waste Storage Area (Phase II) Module in 2005. The 12-layer VAM3D model was recalibrated to current groundwater elevations in May 2000 with calibration activities detailed in the *Great Miami Aquifer VAM3D Flow Model Recalibration Report* (DOE 2000b). With increased vertical resolution in the VAM3D ZOOM model (14 layers compared to 12 layers in the original VAM3D model), predicted wellhead concentrations for total uranium more closely match observed wellhead concentrations. Wellhead concentration decline curves were first published in the 2004 Site Environmental Report (DOE 2005f) comparing modeled versus observed wellhead concentrations for total uranium. These comparisons continue to be provided in annual site environmental reports.

In the past, initial conditions in the fate and transport portion of the groundwater model have been routinely updated. Until recently, the update of initial conditions was considered necessary to incorporate additional characterization data collected during the design of the planned groundwater restoration modules (South Plume Module, South Field [Phases I and II] Module, and Waste Storage Area [Phases I and II] Module). Without the update of initial conditions, the module designs would not have reflected the most up-to-date plume conditions. Because the last planned aquifer restoration module design was recently completed (Waste Storage Area [Phase II] Design), the process of routinely updating initial conditions in the fate and transport portion of the groundwater model has stopped.

Because of significant seasonal changes in Great Miami Aquifer groundwater elevations, three sets of steady-state flow model boundary conditions were developed for the VAM3D model as a result of the recalibration effort. These three steady-state flow model boundary conditions correspond to nominal groundwater elevations, and minimum and maximum groundwater elevations observed during the wet and dry seasons of the year, respectively. The wet and dry boundary condition data sets will be used in future groundwater modeling activities to predict aquifer remedy performance under those conditions.

To facilitate computational efficiency, a local VAM3D ZOOM model was designed covering a smaller area than the 12-layer VAM3D model. The VAM3D ZOOM model contains 14 layers and covers an area just large enough to encompass the total uranium plume and the extraction wells in the aquifer remedy. The VAM3D ZOOM model design is documented in *Integration of Data Fusion Modeling (DFM) with VAM3DF Contaminant Transport Code* (HydroGeologic 2000).

Because the ZOOM model boundaries are near some of the aquifer remedy extraction wells, ZOOM model steady-state flow boundaries must be derived from the larger 12-layer VAM3D model to avoid model boundary effects impacting flow model predictions of remedy performance. For all current and future operational flow modeling activities, aquifer remedy pumping scenarios are first run to steady-state in the large 12-layer VAM3D model then ZOOM model boundary values are derived from the output of the 12-layer flow model run. This technique is described in more detail in Design for Remediation of the Great Miami Aquifer, South Field (Phase II) Module.

It is understood that the groundwater model may need to be recalibrated for flow if measured water levels and model predictions are not adequate for managing the remedy. If future flow model calibration efforts are performed, the large 12-layer VAM3D model will be recalibrated to observed groundwater elevation data; then VAM3D ZOOM model boundary conditions will be derived from the larger 12-layer VAM3D model. Calibration standards will be the same as those used to calibrate the SWIFT model.

The basic strategy for assessing flow predictions will be as follows:

- Model-predicted water level values will be compared to actual field measured values. The decision to recalibrate the groundwater model will be based on how close the model predictions are to field measured values.
- The difference between the maximum and minimum measured groundwater elevation over time will be used to define a water level elevation range for a particular well. The water level range is the result of seasonal variations and long-term water level trends within the aquifer. A range of water levels over time has been established for each water level monitoring well identified in the IEMP.
- If the difference between measured elevations and modeled predictions is greater than 5 feet for more than one-third of the monitoring wells within the capture zone of the

FIGURE 3-9 GROUNDWATER CERTIFICATION PROCESS AND STAGES

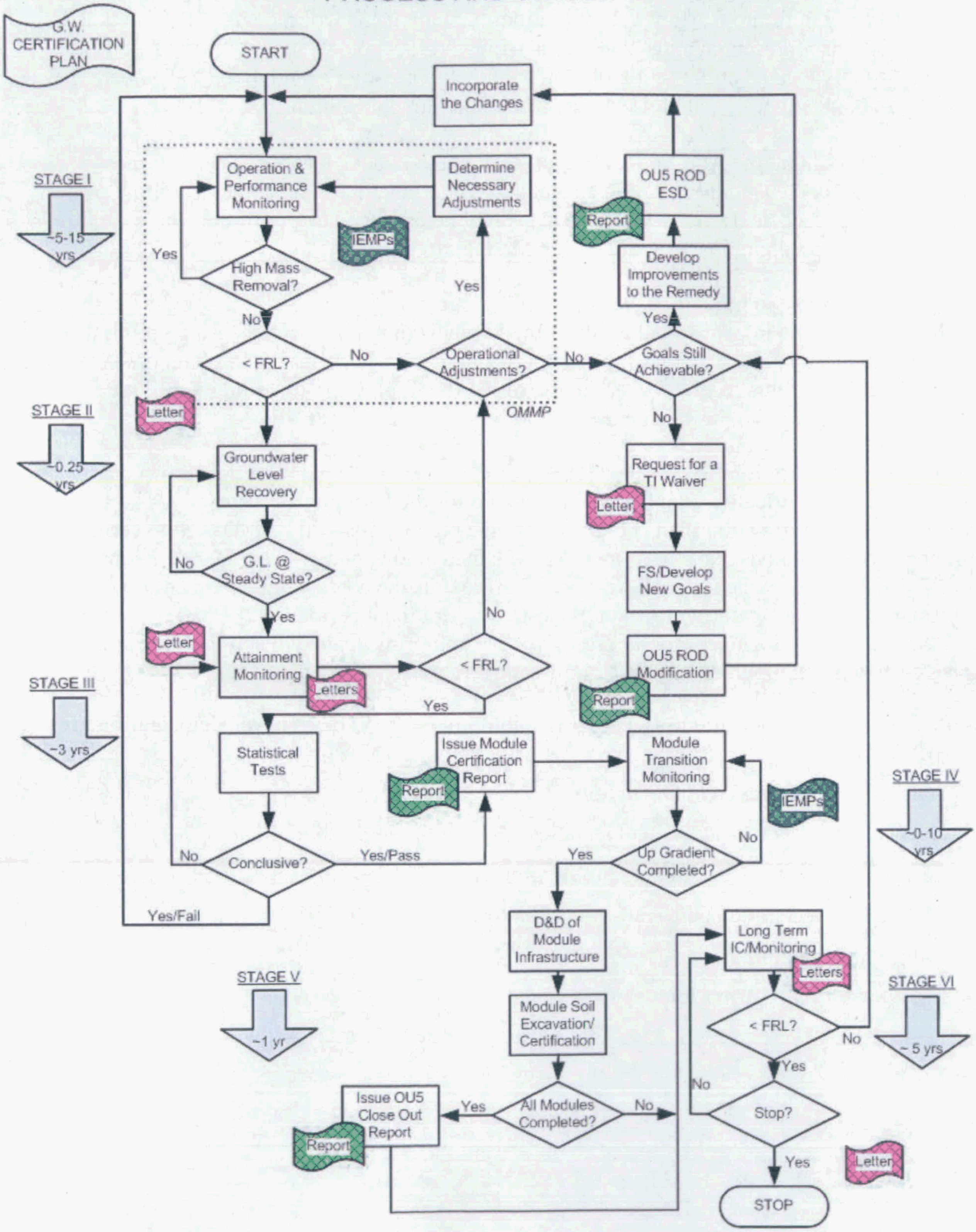


Figure 3–9. Groundwater Certification Process and Stages

Remedy performance monitoring is currently supporting pump-and-treat operations. As illustrated in Figure 3–9, remedy performance monitoring is conducted to assess the efficiency of mass removal and to gauge performance in meeting FRL objectives. If it is determined that high mass removal is not being maintained, or FRL goals are not being achieved, then the need for operational adjustment will be evaluated and implemented if deemed appropriate. A change to the operation of the aquifer restoration system would be implemented through the OMMP. A groundwater monitoring change, if found to be necessary, would be implemented through the IEMP. If additional characterization data are needed beyond the current scope of the IEMP, then a separate sampling plan will be prepared. Additional sampling activities may use other sampling techniques, such as a direct-push sampling tool, which has been successfully used at the Fernald Preserve to obtain groundwater samples without the use of a permanent monitoring well.

The IEMP will be used to document the approach for determining when various modules can be removed from service and groundwater monitoring can focus on subsequent stages of the groundwater certification process.

3.7.2 Reporting

The IEMP groundwater program data will be reported on the DOE-LM website and in the annual site environmental report. Groundwater data that support the On-Site Disposal Facility Groundwater/Leak Detection and Leachate Monitoring Plan will be provided in the same manner. Additional information on IEMP data reporting is provided in Section 7.0.

Data pertaining to the groundwater program will be provided on the DOE-LM website. The data will be in the format of searchable data sets and/or downloadable data files. This site will be updated every 2 to 4 weeks, as data become available.

The annual site environmental report will be issued each June for the previous calendar year. This comprehensive report discusses a year of IEMP data previously reported on the DOE-LM website. The report includes the following:

<u>Operational Assessment</u>

- The set point pumping rates for each extraction well during the year.
- The uranium removal rate of individual wells.
- Extraction well total hours of operation during the year.
- The volume of treated groundwater.
- Extraction well operating time expressed as a percentage of total available operating time.
- The volume of water pumped from each extraction well during the year.
- Planned versus actual gallons of water pumped.
- The net water balance.
- Total pounds of uranium removed during the year.
- Total pounds of uranium removed from the aquifer since the start of remediation.
- Planned versus actual pounds of uranium removed from the Great Miami Aquifer.
- Running cumulative pounds of uranium removed from the Great Miami aquifer versus predicted running cumulative pounds of uranium removed from the Great Miami Aquifer.

- Total uranium concentration data collected from extraction wells.
- Total uranium concentration data collected from monitoring wells.
- Water level data collected from monitoring wells.
- The maximum, minimum, and average uranium concentration sent to treatment during the last year.
- The monthly average uranium concentration in water discharged to the Great Miami River during the year.
- Pumping rate figures for each extraction well.
- Regression curves of uranium concentration data at extraction wells.
- Regression curves of uranium concentration data at groundwater monitoring wells (every 5 years).

Aquifer Conditions

- The area of capture during the year.
- A description of the geometry of the total uranium plume during the year.
- The effect that restoration had (i.e., pumping) on the PRRS plume during the year.
- The status of non-uranium FRL exceedances, including any newly detected FRL exceedances.
- Identification of any new areas of FRL exceedances.
- A comparison of groundwater restoration performance with respect to model predictions established in the *Baseline Remedial Strategy Report.*
- Any changes that may have been made to the operation or design.

Data that Support the OSDF Groundwater/Leak Detection and Leachate Monitoring Plan

- Status information pertaining to the OSDF wells along with baseline data summaries.
- Leachate volumes and concentrations from the leachate collection system and from the leak detection system for the OSDF.
- Results of quarterly groundwater sampling initiated after waste is placed in a cell of the OSDF.

In addition, the annual site environmental report will include trend analysis of the data collected from the OSDF.

Because the IEMP is a living document, annual reviews and 5-year revisions have been instituted. The annual review cycle provides the mechanism for identifying and initiating any groundwater program modifications (e.g., changes in constituents, locations, or frequencies) that are necessary to align the IEMP with the current activities. Any program modifications that may be warranted prior to the annual review would be communicated to EPA and OEPA.

4.0 Surface Water and Treated Effluent Monitoring Program

Section 4.0 provides a description of the routine site-wide surface water and treated effluent monitoring to be performed at the Fernald Preserve. This includes compliance-based monitoring and reporting obligations for surface water and treated effluent, and a medium-specific plan for conducting all surface water and treated effluent monitoring activities.

4.1 Integration Objectives for Surface Water and Treated Effluent

Because surface water represents both a contaminant transport pathway and a route of exposure for human and ecological receptors, routine monitoring of surface water is necessary to confirm that the Fernald Preserve's point and non-point discharges to receiving waters fall below established thresholds. The monitoring activities for surface water will thus function as both a surveillance and compliance tool at the Fernald Preserve. These measures will help document the protection of both groundwater (via the surface water cross-medium pathway) and intended surface water uses in the vicinity of the Fernald Preserve.

The IEMP is the designated mechanism for conducting the site-wide surface water surveillance and compliance monitoring downstream from site controls. In this role, the IEMP serves to integrate several compliance based monitoring and reporting programs currently in existence for the Fernald Preserve:

- The discharge monitoring and reporting program related to the site's NPDES Permit.
- The radiological monitoring of and reporting for the treated effluent mandated by the OU5 ROD.
- The IEMP Characterization Program which combines portions of the former Environmental Monitoring Program (EMP) that has been ongoing at the Fernald Preserve since the 1950s and was updated in the IEMP, Revision 0 (DOE 1997d), to accommodate surface water monitoring needs during remediation and during post-closure. As indicated in the OMMP, this monitoring is performed as a supplement in order to monitor surface water and treated effluent for potential site impacts to various receptors during aquifer remediation.

As discussed in Section 4.5, these programs have been brought together under a single reporting structure to facilitate review of the performance of the Fernald Preserve's surface water protection actions and measures.

4.2 Analysis of Regulatory Drivers, DOE Policies, and Other Fernald Preserve Site-Specific Agreements

This section presents a summary evaluation of the regulatory drivers governing the monitoring of the Fernald Preserve's point source discharges to Paddys Run and the Great Miami River. The intent of this section is to identify the pertinent regulatory requirements, including ARARs and to-be-considered requirements, for the scope and design of the surface water monitoring program. These requirements will be used to confirm that the program satisfies the regulatory obligations for monitoring that have been activated by the RODs and will achieve the intentions of other pertinent criteria, such as DOE Orders and the Fernald Preserve's existing agreements and permits, as appropriate, that have a bearing on the scope of surface water and treated effluent monitoring.

4.2.1 Approach

The analysis of the regulatory drivers and policies for surface water and treated effluent was conducted by examining the suite of ARARs and to-be-considered requirements in the OU5 ROD to identify the subset with specific environmental monitoring requirements. The Fernald Preserve's existing compliance agreements issued outside the CERCLA process were also reviewed.

4.2.2 Results

The following summary of regulatory drivers, compliance agreements, and DOE Orders was found to govern the monitoring scope and reporting requirements for surface water and treated effluent:

- CERCLA ROD for remedial actions at OU5, which requires remediation of the site such that the surface water pathway is protective of the underlying Great Miami Aquifer and various surface water environmental receptors. The surface water FRLs provided in the OU5 ROD considered and incorporated all chemical specific ARARs and to-be-considered requirements for the protection of human health via the surface water pathway. In addition, treatment performance based limits were established restricting total uranium mass discharged to the Great Miami River to 600 lbs/year and a uranium concentration limit of 30 μg/L as a monthly average. (The concentration limit of 30 μg/L established in the OU5 Explanation of Significant Differences Document.)
- Per the CERCLA Remedial Design Work Plan for remedial actions at OU5, monitoring will be conducted following the completion of cleanup as required to assess the continued protectiveness of the remedial actions. The IEMP will specify the type and frequency of environmental monitoring activities to be conducted during remedy implementation, and ultimately, following the cessation of remedial operations as appropriate. The IEMP will delineate the Fernald Preserve's responsibilities for monitoring of surface water and sediment over the life of the remedy, and ensure that FRLs are achieved at project completion.
- The current NPDES Permit for the Fernald Preserve, which triggers a variety of site-specific surface water and treated effluent sampling, analysis, and reporting requirements (as specified in OAC 3745 33) for non radiological contaminants .
- The 1986 FFCA, which requires that the Fernald Preserve maintain a continuous sample collection program for radiological constituents at the Fernald Preserve's treated effluent discharge points and report the results quarterly to the EPA, OEPA, and the Ohio Department of Health. The sampling program to address this requirement has been modified over the years and is currently governed by an agreement reached with EPA and OEPA in early 1996 as described in the letter "Phase VII Removal Actions and Reporting Requirements Under the Fernald Environmental Management Project Legal Agreements" from DOE to EPA (DOE 1996c). This agreement became effective May 1, 1996 and has since been modified, documented and approved through biennial revisions of the IEMP.

- DOE Order 450.1, *Environmental Protection Program Requirements*, which requires DOE facilities that use, generate, release, or manage significant pollutants or hazardous materials to develop and implement an environmental monitoring plan. Each DOE site's environmental monitoring plan must contain the design criteria and rationale for the routine treated effluent monitoring and environmental surveillance activities of the facility.
- DOE Order 5400.5, *Radiation Protection of the Public and the Environment*, which obligates the Fernald Preserve to perform surveillance monitoring of surface water to ensure that radiological dose limits to the public in the DOE Order are not exceeded. Under these requirements, the exposure to members of the public associated with activities at DOE facilities from all pathways must not exceed, in 1 year, an effective dose equivalent greater than 100 millirem (mrem). Studies in support of the OU5 feasibility study demonstrated for all media that combined exposure to radiological COCs at their respective FRLs fall well below the DOE dose requirement. Therefore, monitoring designed to track and document the CERCLA FRL based remediation of the site meets the intent of DOE Order 5400.5.

The surface water and treated effluent monitoring program described in this IEMP has been developed with full consideration of these regulatory drivers. Table 4–1 lists each of these IEMP drivers and the associated monitoring conducted to comply with them. Sections 4.5 and 7.0 provide the Fernald Preserve's current and long-range plan for complying with the reporting requirements invoked by these drivers.

Table 4–1. Fernald Preserve Surface Water and Treated Effluent Monitoring Program Regulatory Drivers and Responsibilities

	DRIVER	ACTION
IEMP	DOE Order 450.1, environmental monitoring plan for all media	The IEMP describes treated effluent and surveillance monitoring as required by DOE Order 450.1.
	DOE Order 5400.5, *Radiation Protection of Public and Environment*	The IEMP includes a description for routine sampling of Paddys Run and on-site drainage ditches for radionuclides.
	OU5 ROD	The IEMP will be modified toward completion of the remedial action to include sampling to certify FRL achievement. IEMP includes monitoring for performance based uranium discharge limits.
	NPDES Permit	The IEMP describes routine sampling of permit-designated effluent discharges and storm water drainage points for NPDES Permit constituents.
	Federal Facilities Compliance Agreement Radiological Monitoring	The IEMP describes the routine sampling at the Parshall Flume (PF 4001) for radiological constituents.

Note that soil and sediment at the Fernald Preserve has been certified, with the exception of those areas identified in Figure 2–2. It is, therefore, not expected that FRL exceedances will occur in association with uncontrolled runoff.

4.3 Program Expectations and Design Considerations

4.3.1 Program Expectations

The IEMP surface water and treated effluent monitoring program is being designed to collect data sufficient to meet the following expectations:

- Provide an ongoing assessment of the potential for cross-medium impacts from surface water to the underlying Great Miami Aquifer at locations near the point where the protective glacial overburden has been breached by site drainages.
- Document whether the sporadic exceedances of FRLs in various site drainages (noted in IEMP reports) continue to occur at key on property locations, at the property boundary on Paddys Run, and in the Great Miami River outside the mixing zone, and determine if monitoring can be reduced based on surface water data results.
- Provide an assessment of impacts to surface water due to uncontrolled runoff (As noted previously, soil and sediment at the Fernald Preserve has been certified with exception of those areas identified in Figure 2–2).
- Provide additional data at background locations on Paddys Run and the Great Miami River to refine the ability to distinguish site impacts from background.
- Continue to fulfill monitoring and reporting requirements associated with the site NPDES Permit.
- Continue to fulfill monitoring and reporting requirements associated with the FFCA and OU5 ROD.
- Continue to fulfill DOE Order 450.1 requirements to maintain an environmental monitoring plan for surface water.
- Continue to address the concerns of the community regarding the magnitude of the Fernald Preserve's discharges to surface water (i.e., to Paddys Run and the Great Miami River).

The following section provides the design considerations required to fulfill each of these expectations.

4.3.2 Design Considerations

4.3.2.1 Constituents of Concern

A comprehensive listing of COCs has been developed and provides the suite of parameters that have been evaluated for monitoring. Table 4–2 presents this information. The following is a description of each of the columns in Table 4–2.

- Column 1, Constituent: This column represents the suite of constituents considered for monitoring in the surface water pathway as a result of the RI/FS process at the Fernald Preserve. It represents the constituents for which a FRL was established in the OU5 ROD.
- Column 2, Final Remediation Levels: This column represents the human/health protective remediation levels for surface water that were established in the OU5 ROD.

Table 4–2. Surface Water Selection Criteria Summary

			95th Percentile Background Level in Surface Water[c,d]			
			Paddys Run		Great Miami River	
Constituent[a]	FRL[b]	FRL Basis[b]	Original	Revised	Original	Revised
General Chemistry (mg/L)						
Fluoride	2.0	A	0.22	0.091	0.9	0.504
Nitrate/Nitrite	2400	R	1.7	4.90	6.6	7.87
Inorganics (mg/L)						
Antimony	0.19	A	ND	0.0012	ND	0.00175
Arsenic	0.049	R	ND	0.00616	0.0036	0.0139
Barium	100	R	0.053	0.0545	0.1	0.100
Beryllium	0.0012	A	ND	0.0003	ND	0.0009
Cadmium	0.0098	B	ND	0.00075	0.01	0.00375
Chromium (VI)[e]	0.010	D	ND	0.00943	ND	0.00991
Copper	0.012	A	ND	0.00652	0.012	0.0141
Cyanide	0.012	A	ND	0.00367	0.005	0.00412
Lead	0.010	B	ND	0.00568	0.010	0.00958
Manganese	1.5	R	0.035	0.229	0.08	0.113
Mercury	0.00020	D	ND	0.000126	ND	0.000175
Molybdenum	1.5	R	ND	0.00328	0.02	0.00902
Nickel	0.17	A	ND	0.00792	0.023	0.0116
Selenium	0.0050	A	ND	0.00254	ND	0.00293
Silver	0.0050	D	ND	0.000706	ND	0.000348
Vanadium	3.1	R	ND	0.0188	ND	0.00671
Zinc	0.11	A	ND	0.0361	0.045	0.0463

Table 4–2. Surface Water Selection Criteria Summary (continued)

Constituent[a]	FRL[b]	FRL Basis[b]	95th Percentile Background Level in Surface Water[c,d]			
			Paddys Run		Great Miami River	
			Original	Revised	Original	Revised
Radionuclides (pCi/L)						
Cesium-137	10	R	3.1	4.74	ND	3.16
Neptunium-237	210	R	-	0.054	ND	0.083
Lead-210	11	R	-	2.97	-	2.45
Plutonium-238	210	R	ND	ND	ND	0.038
Plutonium-239/240	200	R	0.09	0.093	ND	0.01
Radium-226	38	R	0.35	0.844	0.41	0.728
Radium-228	47	R	2.1	1.98	2.2	3.85
Strontium-90	41	R	0.96	1.09	ND	1.14
Technetium-99	150	R	ND	4.65	ND	7.65
Thorium-228	830	R	ND	0.238	0.62	0.234
Thorium-230	3500	R	ND	0.543	0.36	0.789
Thorium-232	270	R	ND	0.213	ND	0.231
Uranium, Total (µg/L)	530	R	1.0	1.29	1.0	2.13
Pesticide/PCBs (µg/L)						
Alpha-Chlordane	0.31	R	-	ND	-	0.003
Aroclor-1254	0.20	D	-	ND	-	ND
Aroclor-1260	0.20	D	-	ND	-	ND
Dieldrin	0.020	D	-	ND	-	0.0095
Semi-Volatiles (µg/L)						
Benzo(a)anthracene	1.0	D	-	ND	-	ND
Benzo(a)pyrene	1.0	D	-	ND	-	ND
bis(2-Chloroisopropyl)ether	280	R	-	ND	-	ND
bis(2-Ethylhexyl)phthalate	8.4	A	-	2	-	2.5
Dibenzo(a,h)anthracene	1.0	D	-	ND	-	1.9
3,3'-Dichlorobenzidine	7.7	R	-	ND	-	ND

Table 4–2. Surface Water Selection Criteria Summary (continued)

Constituent[a]	FRL[b]	FRL Basis[b]	95th Percentile Background Level in Surface Water[c,d]			
			Paddys Run		Great Miami River	
			Original	Revised	Original	Revised
Semi-Volatiles (μg/L) (Cont.)						
Di-n-butylphthalate	6000	R	-	5.09	-	5.5
Di-n-octylphthalate	5.0	D	-	1.75	-	ND
p-Methylphenol	2200	R	-	ND	-	0.6
4-Nitrophenol	7,400,000	R	-	ND	-	ND
Volatiles (μg/L)	280	R				
Benzene	280	R	-	ND	-	0.35
Bromodichloromethane	240	R	-	ND	-	ND
Bromomethane	1300	R	-	ND	-	ND
Chloroform	79	A	-	0.782	-	0.3
1,1-Dichloroethene	15	R	-	ND	-	ND
Methylene chloride	430	A	-	1	-	ND
Tetrachloroethene	45	R	-	0.367	-	ND
1,1,1-Tricholoroethane	1.0	D	-	ND	-	ND
1,1,2-Tricholoroethane	230	R	-	ND	-	ND
Other Constituents						
Ammonia			-	0.14	-	0.176
Carbon disulfide			-	ND	-	0.35
Cobalt			-	-	-	0.0124
Trichloroethene			-	0.2	-	ND

[a]Shaded text indicates constituents selected in the past for IEMP surface water analysis at locations other than background and NPDES Permit sample locations.
[b]Derived from OU5 ROD, Table 9–5.
A = ARAR values
B = background concentrations
D = analytical detection limit
R = human health risk
[c]ND = non-detected result
- = not applicable/not available
[d]For small data sets (less than or equal to seven samples), the maximum detected concentration is used as the 95th percentile.
[e]FRL based on chromium (VI); however, the analytical results are for total chromium.

- Column 3, FRL Basis: This column is the basis for establishment of the FRL as defined in the OU5 Feasibility Study.
- Column 4, Background Values in Surface Water: This column represents updated background values for Paddys Run and the Great Miami River based on data collected for the IEMP through 2006. The IEMP provides this information for purposes of comparison.

4.3.2.2 Surface Water Cross-Medium Impact

To assess the cross-medium impact that contaminated surface water has on the underlying Great Miami Aquifer, the following design considerations are necessary:

- Samples should be collected at those points near where the glacial overburden has been breached by site drainages. As described in the OU5 remedial investigation, the majority of the Fernald Preserve is underlain by clay rich glacial overburden. Where present, this glacial overburden provides a measure of protection to the underlying sand and gravel aquifer. However, the glacial overburden has been eroded by site drainages primarily in the lower reaches of Paddys Run and in the Storm Sewer Outfall Ditch (Figure 4–1). Pre design groundwater characterization activities in the former waste storage and former Plant 6 areas confirmed that an area in the Pilot Plant drainage ditch adjacent to Paddys Run should be considered as a primary source of infiltration. At these locations, a direct pathway exists for surface water and associated contaminants to reach the underlying sand and gravel Great Miami Aquifer.
- During remediation and restoration efforts, new wetlands and ponds were created within the site perimeter. Some of these water bodies have little or no underlying glacial overburden. Therefore, five additional surface water locations were selected to assess the possible impacts of surface water infiltrating into the aquifer. Sampling at these locations will occur semiannually for uranium for 2 years to evaluate potential impacts. Data will be evaluated to determine the need for further sampling following the initial 2-year period.
- Constituents analyzed should represent those area-specific COCs identified in the OU5 Feasibility Study and subsequent fate and transport modeling as having the potential for cross-medium impact to groundwater via the surface water pathway.

4.3.2.3 Sporadic Exceedances of FRLs

Sample locations should be located (1) on property locations downstream of historical FRL exceedances, (2) at the point where Paddys Run flows off the Fernald Preserve property, and (3) at the Parshall Flume (PF 4001), where treated effluent is discharged from the Fernald Preserve to the Great Miami River. (Refer to Figure 4–2 for IEMP surface water and treated effluent sample locations.) To determine the concentration of the treated effluent constituents outside the mixing zone in the Great Miami River, a conservative calculation using the 10-year, low-flow conditions is necessary requiring that flow conditions at the Hamilton Dam gauge be periodically reviewed.

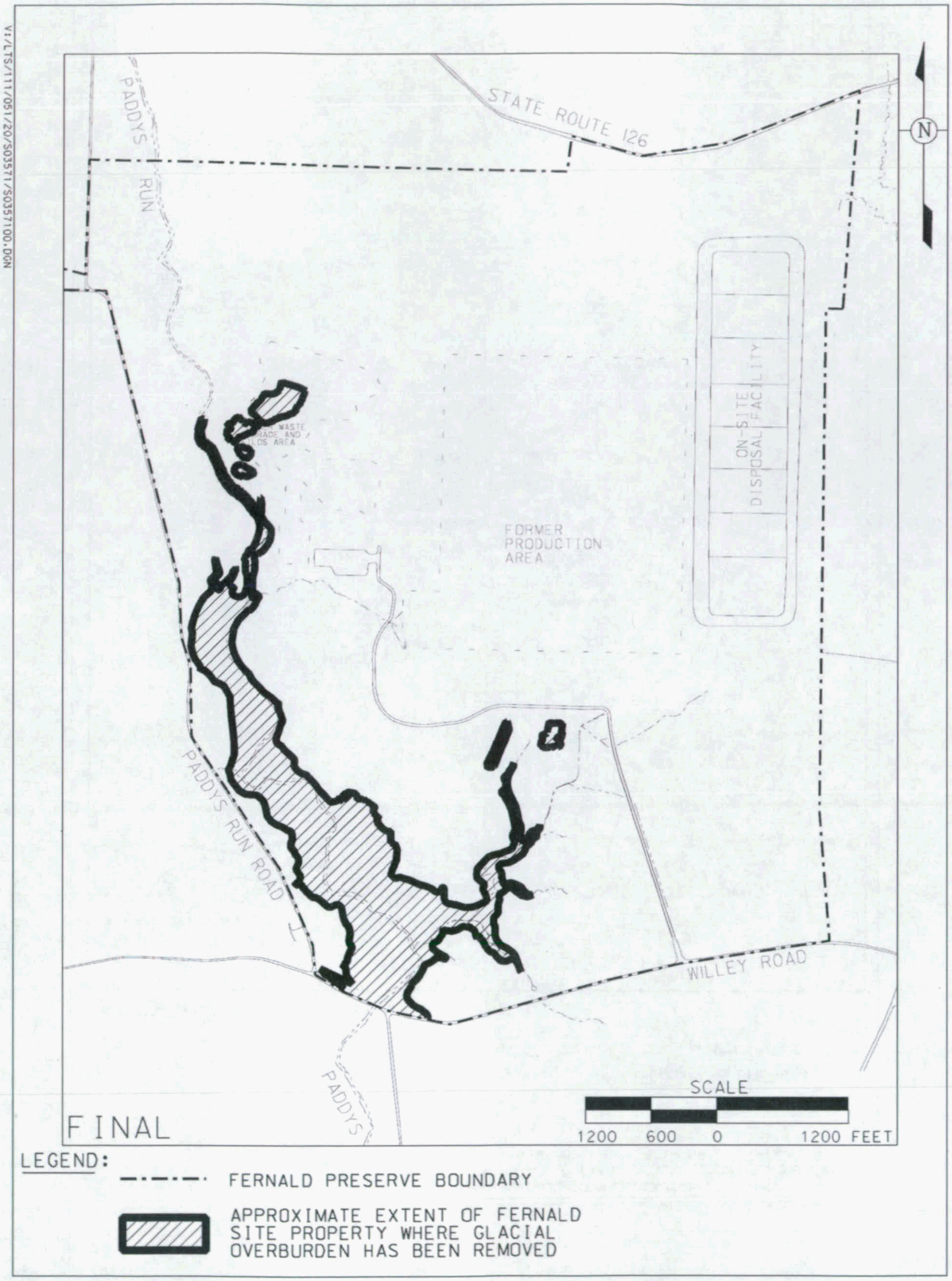


Figure 4–1. Area where Glacial Overburden Has Been Removed

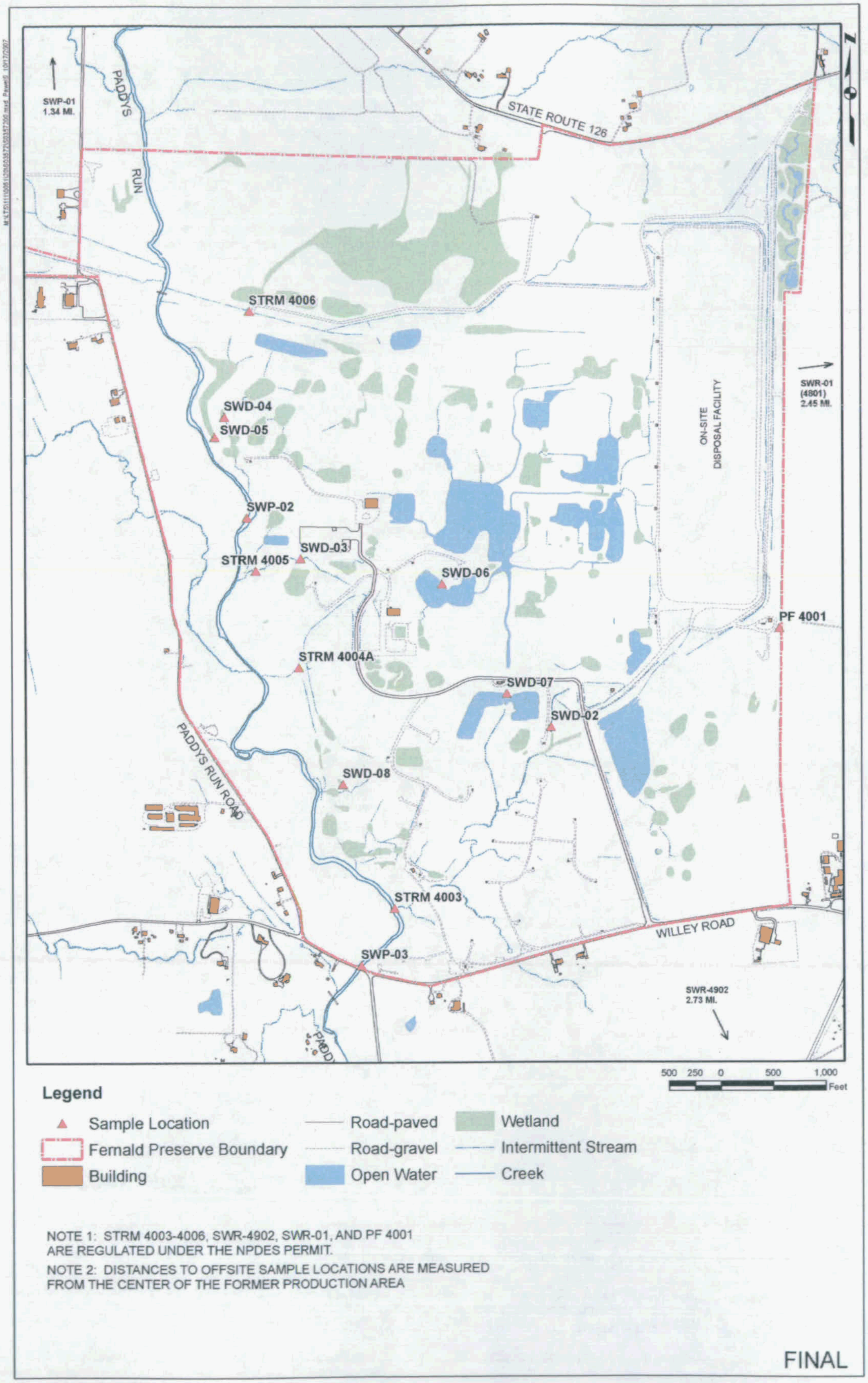


Figure 4–2. IEMP Surface Water and Treated Effluent Sample Locations

To assist in the development of the scope and focus of the IEMP surface water and treated effluent program, a review of the IEMP surface water data is conducted periodically. The last such review was based on data collected under the IEMP program from August 1997 through December 2006. The recommended parameters and locations for monitoring are indicated in Table 4–3 (i.e., IEMP Characterization). To provide surveillance monitoring for FRL exceedances, samples will be collected semiannually and analyzed for those constituents identified in Table 4–3.

Constituents are monitored at SWP 03 because it is the last location that surface water is monitored on Paddys Run prior to leaving the site and all non-radiological area specific constituents and uranium are monitored at this location in order to be conservative. Monitoring for radiological constituents at this location has been eliminated (with the exception of uranium) with the completion of remedial activities that eliminated the source of these contaminants. Data collected to date for these constituents further supports this decision. Appendix B provides maps detailing surface water locations with FRL exceedances including historical exceedances and those exceedances at background locations.

4.3.2.4 Impacts to Surface Water Due to Uncontrolled Storm Water Runoff

During remediation of the site, storm water runoff was collected and treated as necessary to ensure protection of human health and the environment. With remediation completed, there are no areas where storm water runoff is controlled, with the exception of the footprint of the CAWWT tankage located on a controlled pad. Therefore, all runoff is uncontrolled. However, IEMP surface water monitoring will continue at points of storm water runoff entry into receiving waters or within main site drainage ditches (in addition to ambient monitoring for background quantification purposes).

Figure 4–3 shows the dramatic effect past storm water runoff controls have had on lowering the concentrations of uranium, the principal site contaminant, in surface water leaving the site via Paddys Run. Other important distinctions regarding uranium in uncontrolled runoff from the site to Paddys Run, based on the data in Figure 4–3, include:

- Average concentrations have been far below the human/health protective surface water FRL concentration of 530 μg/L in each year since 1981. (This includes 9 years while the site was in production.)
- Annual average concentrations have been consistently below the human/health protective groundwater FRL of 30 μg/L since the previous Storm Water Retention Basin began collecting contaminated runoff in 1986.

Additional controls for storm water runoff may be required per the *Storm Water Pollution Prevention Plan* for construction activities.

Effective sampling points for this surveillance monitoring need to be:

- At points where storm water runoff from the Fernald property enters Paddys Run.
- At the Fernald Preserve boundary in Paddys Run.

Table 4–3. Summary of Surface Water and Treated Effluent Sampling Requirements by Location

Location	Constituent[a]	IEMP Characterization Requirements (reason for selection)[b,c]	NPDES Requirements[c]	OU5 ROD[c] Requirements
SWP-01 and SWR-01 (SWR-4801) (Paddys Run and Great Miami River Background)	**General Chemistry:**			
	Ammonia	-	Quarterly[d]	-
	Total hardness	-	Quarterly[d]	-
	Inorganics:			
	Beryllium	Semiannually (B)	-	-
	Cadmium	Semiannually (B)	Quarterly[d]	-
	Chromium, Total	Semiannually (B)	Quarterly[d]	-
	Cobalt	-	Quarterly[d]	-
	Copper	Semiannually (B)	Quarterly[d]	-
	Cyanide	Semiannually (B)	-	-
	Lead	-	Quarterly[d]	-
	Manganese	Semiannually (B)	Quarterly[d]	-
	Mercury	Semiannually (B)	Quarterly[d]	-
	Nickel	-	Quarterly[d]	-
	Silver	Semiannually (B)	Quarterly[d]	-
	Zinc	Semiannually (B)	Quarterly[d]	-
	Radionuclides:		-	-
	Uranium, Total	Semiannually(B)	-	-
SWP-02 (Paddys Run)	**Radionuclides:**			
	Uranium, Total	Semiannually (PC)	-	-
SWP-03 (Paddys Run at Downstream Property Boundary)	**Inorganics:**			
	Beryllium	Semiannually (S)	-	-
	Cadmium	Semiannually (S)	-	-
	Chromium, Total	Semiannually(S)	-	-
	Copper	Semiannually (S)	-	-
	Cyanide	Semiannually (M)	-	-
	Manganese	Semiannually(S)	-	-
	Mercury	Semiannually (M)	-	-
	Silver	Semiannually(M)	-	-
	Zinc	Semiannually (M)	-	-
	Radionuclides:			
	Uranium, Total	Semiannually (PC)	-	-

Table 4–3. Summary of Surface Water and Treated Effluent Sampling Requirements by Location (continued)

Location	Constituent[a]	IEMP Characterization Requirements (reason for selection)[b,c]	NPDES Requirements[c]	OU5 ROD[c] Requirements
SWD-02 (Storm Sewer Outfall Ditch)	**Radionuclides:**			
	Uranium, Total	Semiannually (PC)	-	-
SWD-03 (Waste Storage Area)	**Radionuclides:**			
	Uranium, Total	Semiannually(PC)	-	-
PF 4001 (Parshall Flume - Treated Effluent)	**General Chemistry:**			
	Ammonia	-	3/Week[e]	-
	Carbonaceous biochemical oxygen demand	-	2/Week	-
	Fluoride	-	Monthly	-
	Nitrate/Nitrite	-	Monthly	-
	Oil and grease	-	2/Week	-
	Total dissolved solids	-	Monthly	-
	Total residual chlorine	-	2/Week[f]	-
	Total suspended solids	-	Daily	-
	Inorganics:			
	Antimony	-	Monthly	-
	Arsenic	-	Monthly	-
	Barium	-	3/Week	-
	Beryllium	-	Monthly	-
	Boron	-	Monthly	-
	Cadmium	-	3/Week	-
	Chromium, Total	-	3/Week	-
	Cobalt	-	2/Week	-
	Copper	-	3/Week	-
	Cyanide	-	Monthly	-
	Lead	-	3/Week	-
	Manganese	-	2/Week	-
	Mercury	-	Monthly	-
	Molybdenum	-	3/Week	-
	Nickel	-	3/Week	-
	Selenium	-	3/Week	-
	Silver	-	3/Week	-
	Zinc	-	3/Week	-
PF 4001 (Parshall Flume - Treated Effluent) (Cont.)	**Radionuclides:**			
	Uranium, Total	Semiannually(PC)	-	Daily
	Semi-Volatiles:			
	Bis (2-ethylhexyl) phthalate	-	Quarterly	-
	Volatiles:			
	Chloroform	-	Quarterly	-
	1,1-Dichloroethane	-	Quarterly	-
	Trichloroethene	-	Quarterly	-
	Other:			
	Flow Rate	-	Daily	-

Table 4–3. Summary of Surface Water and Treated Effluent Sampling Requirements by Location (continued)

Location	Constituent[a]	IEMP Characterization Requirements (reason for selection)[b,c]	NPDES Requirements[c]	OU5 ROD[c] Requirements
STRM 4003, STRM 4004[g]	**General Chemistry:**			
	Total suspended solids	-	Semiannually	-
STRM 4005, STRM 4006 (Drainages to Paddys Run)	**Inorganics:**			
	Copper (4003, 4004, 4006)	-	Semiannually	-
	Lead (4004, 4005, 4006)	-	Semiannually	-
	Mercury	-	Semiannually	-
	Silver (4004, 4006)	-	Semiannually	-
	Radionuclides:			
	Uranium, Total	Semiannually(PC)	-	-
	Other:			
	Fecal coliform	-	Semiannually	-
	Flow Rate	-	Semiannually	-
SWD-04, SWD-05, SWD-06, SWD-07, SWD-08[h]	**Radionuclides:**			
	Uranium, Total	Semiannually	-	-
SWR-4902 (Downstream of Fernald Preserve Effluent)	**General Chemistry:**			
	Ammonia	-	Quarterly	-
	Total Hardness	-	Quarterly	-
	Inorganics			
	Cadmium	-	Quarterly	-
	Chromium	-	Quarterly	-
	Cobalt	-	Quarterly	-
	Copper	-	Quarterly	-
	Lead	-	Quarterly	-
	Manganese	-	Quarterly	-
	Mercury	-	Quarterly	-
	Nickel	-	Quarterly	-
	Silver	-	Quarterly	-
	Zinc	-	Quarterly	-

[a]Field parameter readings, taken at each location, include temperature, specific conductance, pH, and dissolved oxygen.
[b]B = background evaluation; M = based on modeling; PC = primary COC; S = sporadic exceedances of FRLs; WP = Waste Pits Excavation Monitoring
[c]"-" indicates the constituent is not included in the sample program.
[d]Refers only to location SWR-01 (NPDES location SWR-4801); constituents sampled quarterly.
[e]Sampled twice a week in winter (November 1 through April 30) and three times a week in summer (May 1 through October 31).
[f]Constituent not sampled from November through April.
[g]New location STRM 4004A has been identified as an alternative sample location for STRM 4004. STRM 4004A will be sampled for the constituents if no flow is observed at STRM 4004 or is otherwise not accessible.
[h]Sampling will be conducted for 2 years to determine if sampling should continue. Locations are based on sampling from Residual Risk Assessment Analysis and lack of glacial overburden.

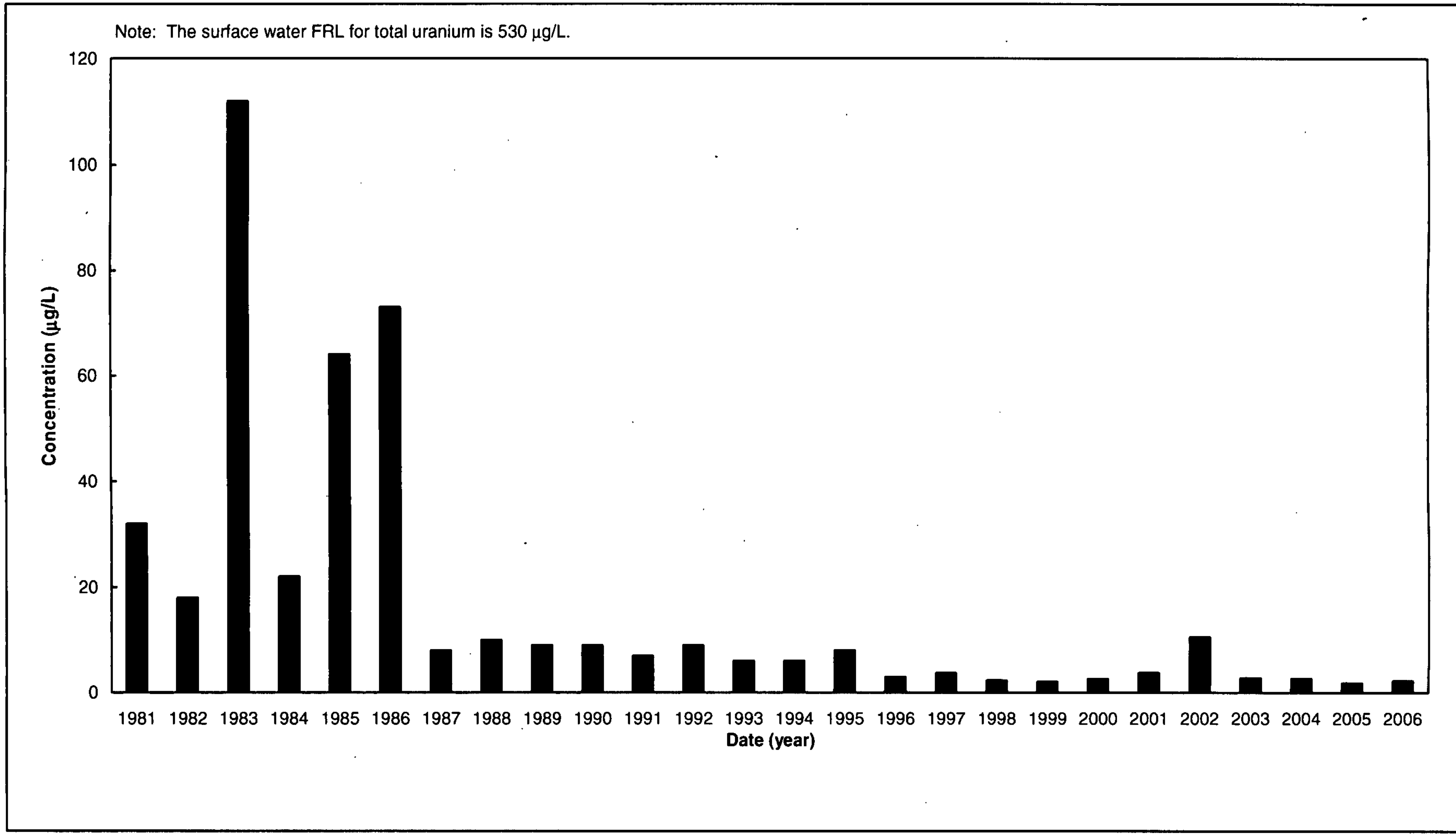


Figure 4–3. Comparison of Average Total Uranium Concentrations at Paddys Run at Willey Road Sample Location SWP-03

4.3.2.5 Ongoing Background Evaluation

Because the RI/FS background data set for Paddys Run and the Great Miami River surface water was limited by the number of samples and temporal variability represented by the samples, monitoring for surface water background has been performed from the initiation of the IEMP through 2004 for all 55 surface water FRL constituents. Although there are only 17 area-specific surface water constituents (i.e., constituents identified as being FRL concerns and monitored under the IEMP characterization program), the extensive list of 55 constituents was monitored at background in order to establish a robust data set. The more extensive list was monitored at background so that if soil sampling indicated the need to expand the list of 17 area-specific surface water constituents, there would be corresponding background data.

Since soil sampling did not indicate a need to add constituents to the list of 17 area-specific surface water constituents and due to the abundance of background data, the list of surface water constituents monitored at the background locations was reduced to coincide with the 17 area-specific constituents monitored for surface water FRLs beginning in 2005. Refer to Table 4–3 for background monitoring requirements; refer to Figure 4–4 for background surface water sample locations.

Additionally, it is anticipated that as part of surface water certification, background values along with FRL values will be compared to the concentrations at locations monitored for area-specific constituents. The recalculated background values based on IEMP data collected from August 1997 through 2006 is provided in Table 4–2.

4.3.2.6 Fulfill National Pollutant Discharge Elimination System Requirements

As noted in Section 4.2, wastewater and storm water discharges from the Fernald Preserve are regulated under the state-administered NPDES program. The current permit (OEPA Permit 1IO00004*GD) was issued on June 1, 2003, became effective on July 1, 2003, and expires on June 30, 2008. Figure 4–5 identifies the current NPDES Permit sample locations.

4.3.2.7 Fulfill Federal Facilities Compliance Agreement and OU5 ROD Requirements

As noted in Section 4.2.2, the current FFCA sampling and reporting requirements became effective on May 1, 1996. During post-closure, these requirements include sampling at the Parshall Flume (PF 4001) and the South Plume extraction wells. In addition to these sampling requirements, an estimate of the amount of uranium reaching Paddys Run via uncontrolled storm water runoff is calculated. The IEMP incorporates sampling of the Parshall Flume and total uranium calculations for uncontrolled storm water runoff and the Parshall Flume. Section 3.0 discusses sampling of the South Plume extraction wells. As discussed in Section 7.0, monitoring data required by the FFCA have been incorporated into the comprehensive IEMP reporting structure.

Based on the completion of remediation of each of the four source OUs, there is no longer a need to monitor any radiological constituent other than uranium—the primary site contaminant—at any of the proposed monitoring locations.

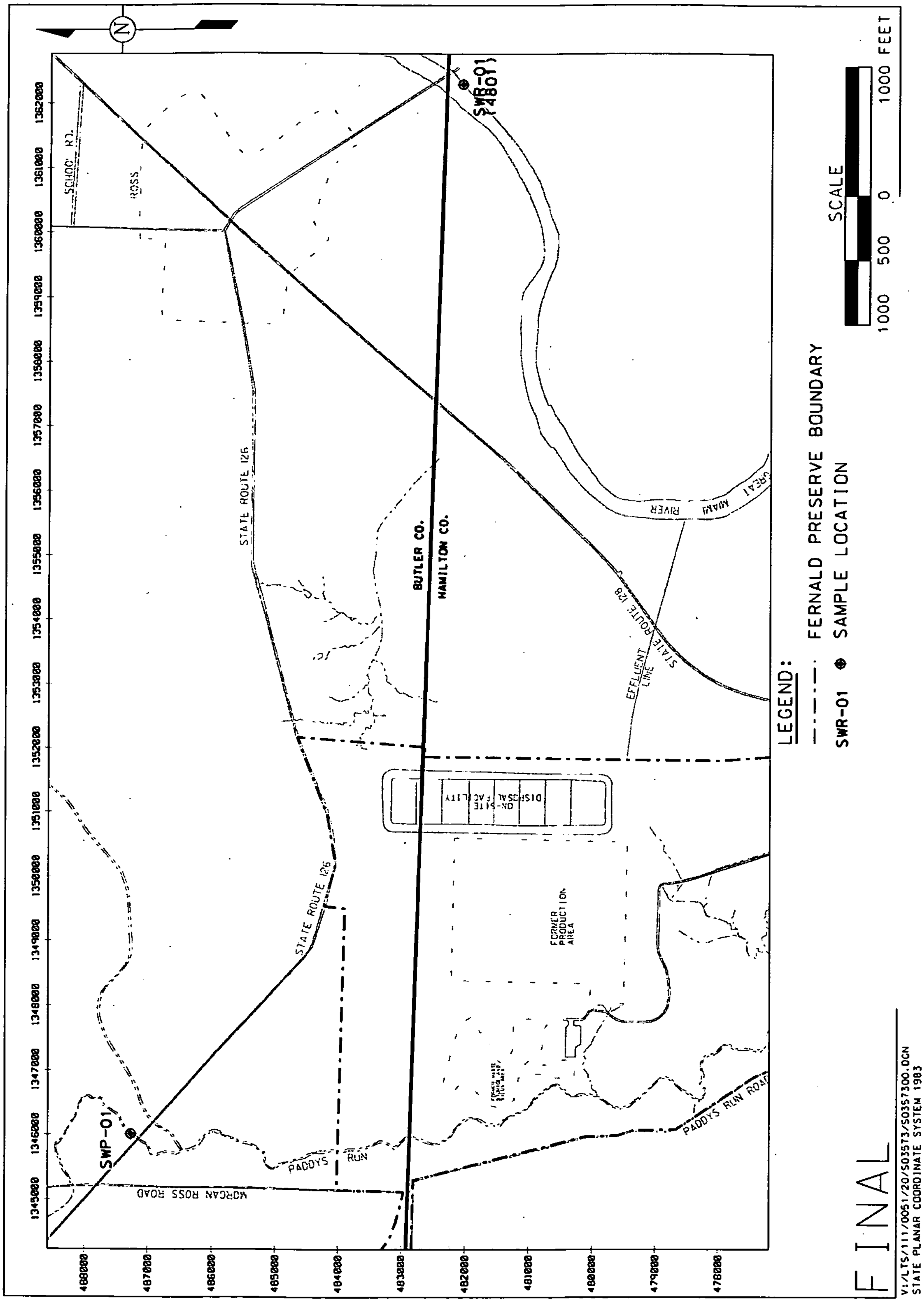


Figure 4–4. IEMP Background Surface Water Sample Locations

4.3.2.8 Fulfill DOE Order 450.1 requirements

The design considerations provided above, which were based on information and conclusions derived from the existing DOE-compliant environmental monitoring program as well as the comprehensive findings of the RI/FS process, are sufficient to meet or exceed the requirements of DOE Order 450.1 as summarized in Section 4.2.2.

4.3.2.9 Address Concerns of the Community

The monitoring derived from Section 4.3.2.4 will be sufficient to address the concerns of the community. These concerns focus on limiting the amount of Fernald Preserve-related contamination entering Paddys Run and the Great Miami River. This monitoring will provide a comprehensive monitoring program on Paddys Run at the facility boundary and in the treated effluent destined for the Great Miami River.

4.3.3 Program Design

This section provides the IEMP surface water and treated effluent sampling program developed from the design considerations provided in Section 4.3.2. Table 4–3 summarizes the program design by providing the sample locations, the frequency, and the constituents to be sampled for at each location. This table also provides the basis for the locations and constituents with respect to program expectations identified in Section 4.3.1. To simplify the presentation of the surface water and treated effluent program, the basis for IEMP characterization can be found in column 3 described as "(reason for selection)" in Table 4–3. This terminology is consistent with the approach used for reporting through the IEMP.

The non-radiological discharge monitoring and reporting related to the NPDES Permit has been incorporated into the IEMP. The radiological discharge monitoring related to the FFCA and OU5 ROD has been incorporated into the IEMP. Near the completion of site remediation, sampling will occur to certify that the surface water pathway at the Fernald Preserve is meeting the obligations set forth in the OU5 ROD.

4.4 Medium-Specific Plan for Surface Water and Treated Effluent Sampling

This section serves as the medium-specific plan for implementation of the sampling, analytical, and data management activities associated with the IEMP surface water and treated effluent sampling program. The activities described in this medium-specific plan were designed to provide surface water and treated effluent data of sufficient quality to meet the program expectations as stated in Section 4.3.1. The program expectations, along with the design considerations presented in Section 4.3.2, were used as the framework for developing the monitoring approach presented in this plan. All sampling procedures and analytical protocols described or referenced herein are consistent with the requirements of the LM QAPP.

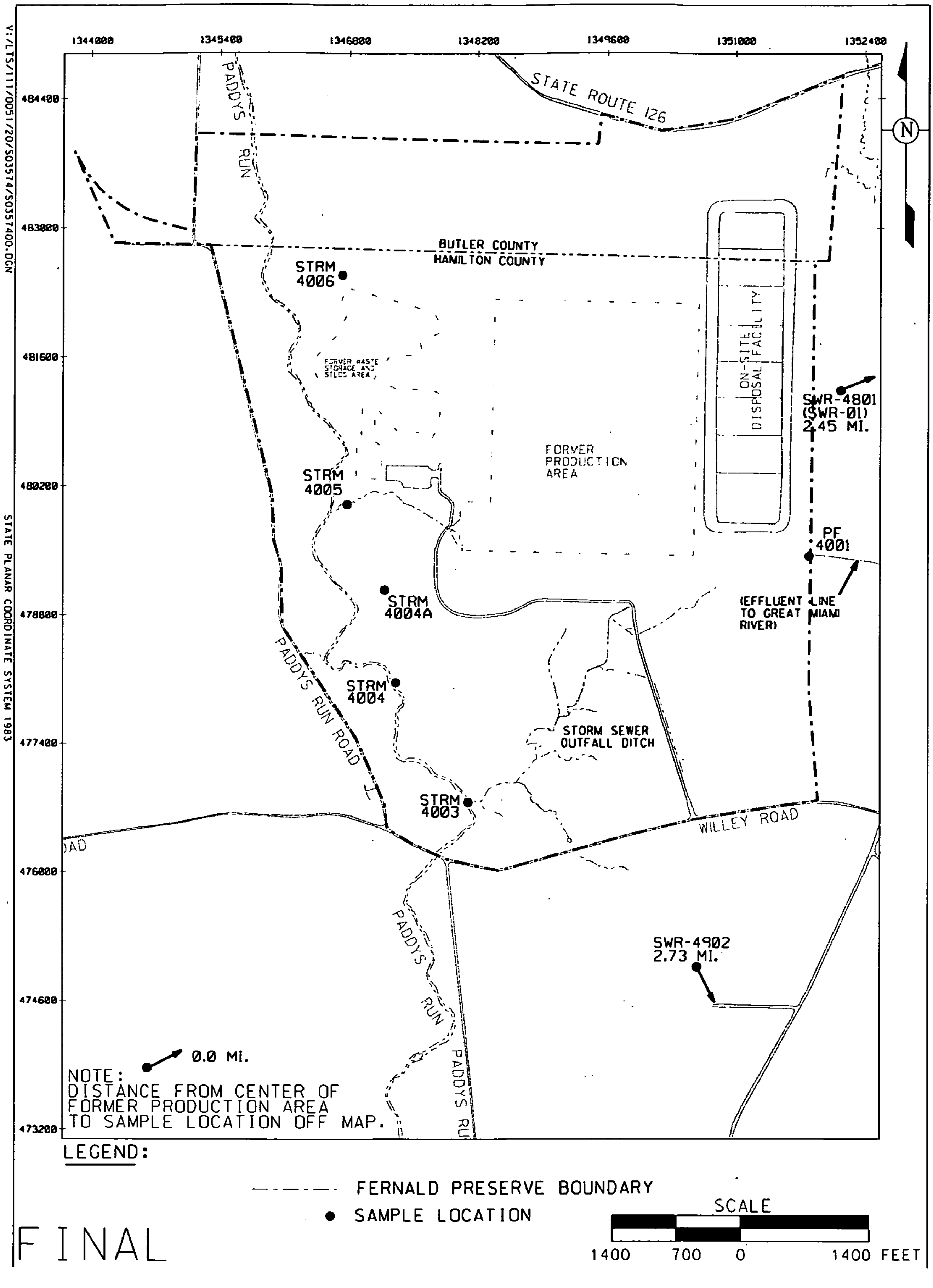


Figure 4–5. NPDES Permit Sample Locations

Subsequent sections of this medium-specific plan define the following:

- Project organization and associated responsibilities
- Sampling program
- Change control
- Health and safety
- Data management
- Project quality assurance

4.4.1 Project Organization

A multidiscipline project organization has been established and assigned responsibility to effectively implement and manage the project planning, sample collection and analysis, and data management activities directed in this medium-specific plan. Following are the key positions and associated responsibilities required for successful implementation.

The project team leader will have full responsibility and authority for the implementation of this medium-specific plan in compliance with all regulatory specifications and site-wide programmatic requirements. Integration and coordination of all medium-specific plan activities defined herein with other project groups is also a key responsibility. All changes to project activities must be approved by the project team leader or designee.

Health and safety are the responsibility of all individuals working on this project scope. Qualified health and safety personnel shall participate on the project team to assist in preparing and obtaining all applicable permits. In addition, safety specialists shall periodically review and update the project-specific health and safety documents and operating procedures, conduct pertinent safety briefings, and assist in evaluation and resolution of all safety concerns.

Quality assurance personnel will participate on the project team, as necessary, to review project procedures and activities ensuring consistency with the requirements of the LM QAPP or other referenced standard and assist in evaluating and resolving all quality-related concerns.

4.4.2 Sampling Program

To fulfill the requirements of the integrated surface water and treated effluent program, surface water and treated effluent samples shall be collected from locations shown in Figures 4–2, 4–4, and 4–5. Table 4–3 summarizes the surface water and treated effluent sampling frequency and location-specific analytical suites. Tables 4–4 and 4–5 provide the sample collection and analytical method information for these locations and constituents.

Sample analysis will be performed either on site or at off-site contract laboratories, depending on specific analyses required, laboratory capacity, turnaround time, and performance of the laboratory. The laboratories used for analytical testing have been audited to ensure that DOECAP or equivalent process requirements have been met as specified in LM QAPP. These criteria include meeting the requirements for performance evaluation samples, pre-acceptance audits, performance audits, and an internal quality assurance program.

Table 4–4. Surface Water Analytical Requirements for Constituents at Sample Locations SWD-02, SWD-03, SWD-04, SWD-05, SWD-06, SWD-07, SWD-08, SWP-01[a], SWP-02, SWP-03, AND SWR-01[a]

Constituent	Analytical Method	ASL[b]	Holding Time	Preservative	Container
Inorganics:					
Beryllium Cadmium Chromium, Total Copper Manganese Silver Zinc	7000A[c], 3500[d], 6020[c], or 6010B[c]	B	6 months	HNO_3 to pH <2	Plastic or glass
Mercury	7470A[c]	B	28 days	HNO_3 to pH <2	Plastic or glass
Cyanide, Total	9010B[c], 9012[c], 335.2[e], or 335.3[e]	B	14 days	Cool 4°C, NaOH to pH >12	Plastic or glass
Radionuclides:					
Uranium, Total	DOE-EML HASL 300[f]	B	6 months	HNO_3 to pH <2	Plastic or glass
Field Parameters[g]:	LM SAP & LM QAPP[h]	A	NA[i]	NA[i]	NA[i]

Note: The analytical site-specific contract identifies the specific method.
Note: Only sample locations SWP-01 and SWR-01 are analyzed for all constituents listed in this table. The remaining sample locations are analyzed for a subset of these constituents (summarized in Table 4–3).
[b]The ASL may become more conservative if it is necessary to meet detection limits or data quality objectives.
[c]Test Methods for Evaluating Solid Waste, Physical/Chemical Methods
[d]Standard Methods for the Examination of Water and Wastewater
[e]Methods for Chemical Analysis of Water and Wastes
[f]Procedures Manual of the Environmental Measurements Laboratory.
[g]Field parameters include temperature, specific conductance, pH, and dissolved oxygen.
[h]The LM SAP & LM QAPP provide field methods.
[i]NA = not applicable

4.4.2.1 Sampling Procedures

Specific sampling procedures associated with surface water and treated effluent will be performed in accordance with directives established in the LM SAP and the LM QAPP.

Surface Water Sampling

Surface water samples will be collected from locations in Paddys Run, drainage ditches to Paddys Run, and the Great Miami River. A qualitative assessment of flow conditions (i.e., base flow, storm flow, or between storm and base flow) will be documented at the time of sample collection at each of these locations. Sampling personnel will ensure that access to the sample locations will not result in the inadvertent introduction of foreign materials into the water sample. Additional precautions will be taken to avoid the introduction of floating organic material such as leaves or twigs during sample collection. Samples will be collected without disturbing bottom sediment. Sample technicians shall approach sample locations from downstream of the location; if sample locations are accessed by way of a bridge, samples shall be collected on the upstream side of the bridge.

Table 4–5. Surface Water and Effluent Analytical Requirements for Constituents at Sample Locations PF 4001, STRM 4003, STRM 4004, STRM 4005, STRM 4006, SWR-4801, and SWR-4902

Constituent[a]	Analytical Method[b]	Sample Type[c]	ASL[b,d]	Holding Time[b]	Preservative[b]	Container[b]
General Chemistry:						
Ammonia	350.1[e], 350.3[e], 4500C[f], or 4500F[f]	Composite or Grab[g]	B	28 days	Cool 4°C, H_2SO_4 to pH <2	Plastic or glass
Carbonaceous biochemical oxygen demand	5210B[f]	Composite	B	48 hours	Cool 4EC	Plastic or glass
Chlorine, residual	4500[f]	Grab	B	Analyze immediately	None	Plastic or glass
Fluoride	300.0[e], 340.2[e], 4500C[f]	Composite	B	28 days	None	Plastic or glass
Nitrate/Nitrite	353.1[e], 353.2[e], 353.3[e], 4500D[f], or 4500E[f]	Composite	B	28 days	Cool 4°C, H_2SO_4 to pH <2	Plastic or glass
Oil and grease	1664A[i] or 5520B[f]	Grab	B	28 days	Cool 4°C, H_2SO_4 to pH <2	Glass
Total dissolved solids	160.1[e] or 2540C[f]	Grab	B	7 days	Cool 4°C	Plastic or glass
Total hardness	2340C[f]	Grab	B	28 days	Cool 4°C, H_2SO_4 to pH <2	Plastic
Total suspended solids	160.2[e] or 2540D[f]	Composite	B	7 days	Cool 4°C	Plastic or glass
Inorganics:						
Antimony	6020[h], 7000A[h], 3500[f], 6010B[h], 200.8[j], 220.2[e], or 272.2[e]	Composite or Grab[g]	B	6 months	HNO_3 to pH <2	Plastic or glass
Arsenic						
Barium						
Beryllium						
Boron						
Cadmium						
Chromium, Total						
Cobalt						
Copper						
Lead						
Manganese						
Molybdenum						
Nickel						
Selenium						
Silver						
Zinc						
Mercury	7470A[h] or 1631[e,k]	Grab	B	28 days	HNO_3 to pH <2	Plastic or glass
Cyanide, Free	335.1[e] or 4500-CNG[f]	Grab	B	14 days	Cool 4°C, NaOH to pH >12	Plastic or glass

Table 4–5. Surface Water and Effluent Analytical Requirements for Constituents at Sample Locations PF 4001, STRM 4003, STRM 4004, STRM 4005, STRM 4006, SWR-4801, AND SWR-4902 (continued)

Constituent[a]	Analytical Method[b]	Sample Type[c]	ASL[b,d]	Holding Time[b]	Preservative[b]	Container[b]
Radionuclides:						
Uranium, Total	DOE-EML HASL 300[l]	Composite[m]	B	6 months	HNO_3 to pH <2	Plastic or glass
Semi-Volatiles:						
Bis(2-ethylhexyl)phthalate	625[n]	Grab	B	7 days to extraction 40 days from extraction to analysis	Cool 4°C	Glass (amber with Teflon-lined cap)
Volatiles:						
Trichloroethene	624[n]	Grab	B	14 days	H_2SO_4 pH <2 Cool 4EC	Glass (with Teflon-lined septum cap)
Chloroform						
1,1-Dichloroethane						
Other:						
Fecal coliform	9222D[f]	Grab	B	6 hours	Cool 4°C	Plastic or glass (sterile)
Flow rate	NA	24 hour total	NA	NA	NA	NA
Field Parameters[o]	LM SAP & LM QAPP[p]	Grab	A	NA	NA	NA

Note: The analytical site-specific contract identifies the specific method.

[a]This represents a comprehensive list of constituents taken from the indicated list of surface water and treated effluent monitoring locations. Each location will be analyzed for a subset of these constituents (summarized in Table 4–3).
[b]NA = not applicable
[c]For composite samples at PF 4001, a flow-weighted composite sample collected over a 24-hour period; for STRM 4003, STRM 4004, STRM 4005, and STRM 4006, composite samples shall be comprised of four samples collected at intervals of at least 30 minutes but not more than 2 hours.
[d]The ASL may become more conservative if necessary to meet detection limits or data quality objectives.
[e]Methods for Chemical Analysis of Water and Wastes
[f]Standard Methods for the Examination of Water and Wastewater
[g]Grab samples are collected at locations SWR-4801 and SWR-4902 for this constituent.
[h]Test Methods for Evaluating Solid Waste, Physical/Chemical Methods
[i]Method 1664, Revision A: N-Hexane Extractable Material (HEM; Oil and Grease) and Silica Gel Treated N-Hexane Extractable Material (SGT-HEM; Non-Polar material) by Extraction and Gravimetry.
[j]Methods for the Determination of Metals in Environmental Samples
[k]Method 1631 for mercury analysis will only be used at NPDES Permit locations where mercury sampling is required.
[l]Procedures Manual of the Environmental Measurements Laboratory.
[m]Total uranium is a grab sample at STRM 4003, STRM 4004, STRM 4005, and STRM 4006 and a composite sample at all other locations.
[n]40 CFR 136, Appendix A
[o]Field parameters include dissolved oxygen, pH, specific conductance, and temperature.
[p]The LM SAP & LM QAPP provide field analytical methods.

Samples will be collected using the methods outlined in the LM SAP including the collection method, container, preservative, and documentation. Tables 4–4 and 4–5 identify the sample preservative, volume, and container requirements for each constituent.

Treated Effluent Sampling

Treated effluent will be collected by means of flow-proportional samplers at the Parshall Flume. Sampling will be conducted according to the LM SAP and the LM Fernald operational procedures (DOE 2006e).

After every 24 hours of operation, the collected liquid is removed from the automatic sampler to provide a daily flow-weighted sample of the treated effluent. A portion of each daily sample is analyzed to determine the estimate of total uranium discharged to the Great Miami River for the day. The Parshall Flume will be analyzed for the constituents listed in Table 4–3 for the respective locations. Table 4–5 lists the sample preservative, volumes, container requirements, and analytical methods for each constituent.

4.4.2.2 Quality Control Sampling Requirements

Quality control samples will be taken according to the frequency recommended in the LM SAP and LM QAPP. These samples will be collected and analyzed in order to evaluate the possibility that some controllable practice, such as sampling technique, may be responsible for introducing bias in the project's analytical results. Quality control samples will be collected as follows:

- A duplicate sample shall be collected each quarter at a randomly selected sample location.
- Trip blanks will be prepared and placed in coolers containing samples for volatile organic compound analysis and shall accompany the samples from collection to receipt at the laboratory.

For low-level mercury all-field sampling equipment will be sent to the off-site laboratory for decontamination and certification of cleanliness via rinsate analysis (equipment blank analysis) before reuse. In addition, trip blanks and field blanks will be supplied by the off-site laboratory and shall accompany the samples from collection to receipt at the laboratory.

4.4.2.3 Decontamination

In general, decontamination of equipment is minimized because reusable equipment is not used during sample collection. However, if decontamination is required, then equipment will be cleaned between sample locations. The decontamination is identified in the LM QAPP and more specifically outlined in the LM SAP. Sampling bailers used in sampling for mercury at NPDES Permit locations will be decontaminated at a contract laboratory.

4.4.2.4 Waste Dispositioning

Contact waste that is generated by the field technicians during field sampling activities are collected, maintained, and dispositioned, as necessary.

4.4.3 Change Control

Changes to the medium-specific plan will be at the discretion of the project team leader. Prior to implementation of field changes, the project team leader or designee shall be informed of the proposed changes and circumstances substantiating the changes. Any changes to the medium-specific plan must have written approval by the project team leader or designee, quality assurance representative, and the field manager prior to implementation. If a Variance/Field Change Notice is required, it will be completed in accordance with the LM QAPP. The Variance/Field Change Notice form shall be issued as controlled distribution to team members and will be included in the field data package to become part of the project record. During revisions to the IEMP, Variance/Field Change Notices will be incorporated to update the medium-specific plan.

4.4.4 Health and Safety Considerations

The Fernald Preserve's health and safety personnel are responsible for the development and implementation of health and safety requirements for this medium-specific plan. Hazards (physical, radiological, chemical, and biological) typically encountered by personnel when performing the specified fieldwork will be addressed during team briefings. Health and safety requirements are addressed in the Fernald Preserve Project Safety Plan.

All involved personnel will receive adequate training to the health and safety requirements prior to implementation of the fieldwork required by this medium-specific plan. Safety meetings will be conducted prior to beginning fieldwork to address specific health and safety issues.

4.4.5 Data Management

Field documentation and analytical results will meet the IEMP data reporting and quality objectives; they will also comply with the LM QAPP, the *LM Standard Practice for Validation of Laboratory Data*, and the LM SAP.

Data documentation and validation requirements for data collected for the IEMP fall into two categories depending upon whether the data are field- or laboratory-generated. Field data validation will consist of verifying medium-specific plan compliance and appropriate documentation of field activities. Laboratory data validation will consist of verifying that data generated are in compliance with medium-specific, plan-specified ASLs. Specific requirements for field data documentation and validation and laboratory data documentation and validation are in accordance with the LM QAPP, the *Standard Practice for Validation of Laboratory Data*, and the LM SAP.

There are five analytical levels (ASL A through ASL E) defined for use at the Fernald Preserve. For surface water, field data documentation will be at ASL A and laboratory data documentation will be at ASL B. A more conservative ASL may be required for laboratory data in order to meet required detection limits or in order to ensure data quality objectives. ASL B provides qualitative, semi-qualitative, and quantitative data with some quality-assurance/quality-control checks.

At a minimum, 10 percent of the IEMP data will undergo validation to ensure that analytical data are in compliance with the ASL method criteria being requested and in order to meet data quality objectives. The percentage of data validated could increase in order to meet data quality objectives.

Data will be entered into a controlled database using a double key or verification method to ensure accuracy. The hard-copy data will be managed in the project file in accordance with LM record keeping requirements and DOE Orders.

4.4.6 Quality Assurance

Assessments of work processes shall be conducted to verify quality of performance and may include audits, surveillances, inspections, tests, data verification, field validation, and peer reviews. Assessments shall include performance-based evaluation of compliance to technical and procedural requirements and corrective action effectiveness necessary to prevent defects in data quality. Assessments may be conducted at any point in the life of the project. Assessment documentation shall verify that work was conducted in accordance with IEMP, LM SAP, and LM QAPP requirements.

Recommended semiannual quality assurance assessments or surveillances shall be performed on tasks specified in the medium-specific plan. These assessments may be in the form of independent assessments or self-assessments, with at least one independent assessment conducted annually. Independent assessments are the responsibility of quality assurance personnel. The project team leader and quality assurance personnel will coordinate assessment activities and comply with the LM QAPP. The project or quality assurance personnel shall have "stop work" authority if significant adverse effects to quality conditions are identified or work conditions are unsafe.

4.5 IEMP Surface Water and Treated Effluent Monitoring Data Evaluation and Reporting

This section provides the methods for analyzing the data generated by the IEMP surface water and treated effluent sampling program. This section summarizes the data evaluation process and actions associated with various monitoring results. The planned reporting structure for IEMP-generated surface water and treated effluent data, including specific information to be reported in the annual site environmental report, is also provided.

4.5.1 Data Evaluation

Data resulting from the IEMP surface water and treated effluent program will be evaluated to meet the program expectations identified in Section 4.3.1. Based on these expectations, the following questions will be answered through the surface water and treated effluent data evaluation process, as indicated:

- Are surface water contaminant concentrations such that cross-medium impacts to the underlying aquifer could be expected?

Data from sample locations near areas where the glacial overburden is breached by site drainages will be compared to surface water and groundwater FRLs to assess potential impacts to the Great Miami Aquifer. Basic statistics, such as the minimum, maximum, and mean, will be generated yearly. The data generated from individual sampling events will be trended by sample location over time via graphical and, if necessary, statistical methods when sufficient data become available. Should trends above the historical ranges or above FRLs be observed, actions shown in Figure 4–6 will be implemented.

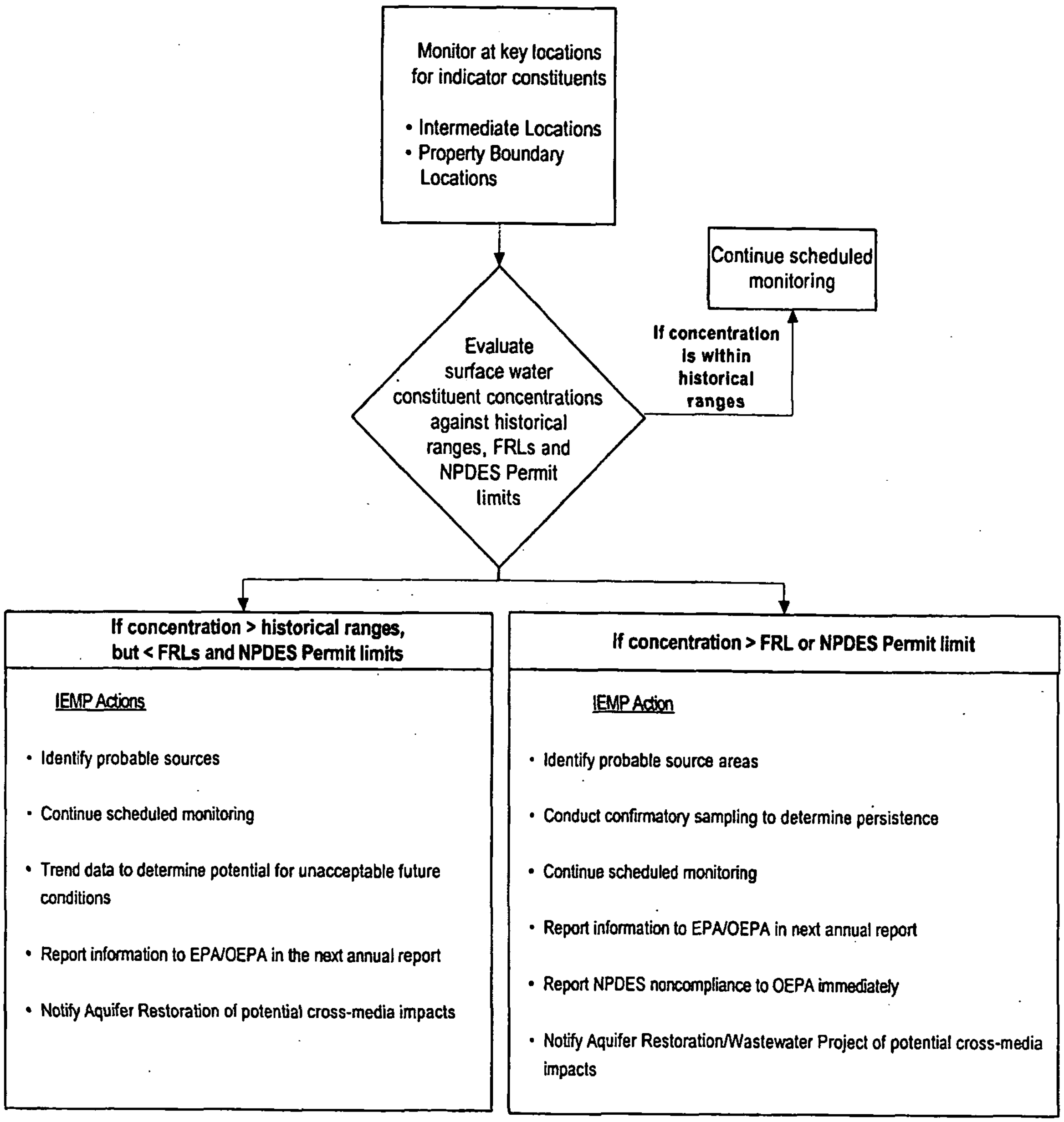


Figure 4–6. IEMP Surface Water Data Evaluation and Associated Actions

The personnel responsible for the restoration of the Great Miami Aquifer will be informed so that any potential adverse cross-medium impacts can be factored into the site groundwater remedy. Decision-making process described in Figure 4–6 can be implemented as necessary.

- Do the sporadic exceedances of FRLs continue to occur, decrease, or increase?

  Data evaluation will consist of direct comparison of data to FRLs. It is anticipated that it will be possible to reduce the list of constituents monitored with respect to FRLs (i.e., IEMP Characterization Monitoring).

- Has storm water runoff caused an undue adverse impact to the surface water or treated effluent?

  Trend analyses of data will be used to identify trends that may require further investigation of activities occurring within the drainage basin (or basins).

- Are the requirements of the NPDES Permit being fulfilled?

  Data collected to fulfill the site NPDES Permit requirements will be evaluated for compliance with the NPDES Permit provisions. This evaluation will serve to identify if immediate reporting of noncompliances to OEPA is necessary, and to determine the appropriate corrective action to address the noncompliance.

- Are the FFCA and OU5 ROD reporting requirements being fulfilled?

  Radiological discharges to the Great Miami River and Paddys Run are regulated by the FFCA and OU5 ROD. Reporting for these requirements have been incorporated into the IEMP reporting structure and include a cumulative summary of pounds of total uranium discharged and the monthly average total uranium concentration discharged to the Great Miami River.

- Are the program and reporting requirements of DOE Order 450.1 being met?

  DOE Order 450.1 requires that DOE implement and report on an environmental protection program for the Fernald Preserve. The surface water and treated effluent monitoring program is one component of the site-wide IEMP monitoring program. This IEMP and the annual site environmental report fulfill the requirements of this DOE Order.

- Are community concerns being met through the surface water and treated effluent IEMP program?

  The IEMP fulfills the needs of the Fernald community by preparing surface water and treated effluent environmental results in the annual site environmental report. DOE makes these reports available to the public at the Public Environmental Information Center. The specific community concern of the magnitude of Fernald Preserve discharges to Paddys Run and the Great Miami River is addressed in the annual site environmental report in the surface water and treated effluent section.

4.5.2 Reporting

The IEMP surface water and treated effluent program meets the reporting requirements for the NPDES Permit and the FFCA and OU5 ROD. The IEMP surface water, treated effluent, and quarterly FFCA data will be reported in the annual site environmental report and on the DOE-LM website at http://www.lm.doe.gov/land/sites/oh/fernald/fernald.htm. Additional information on IEMP data reporting is provided in Section 7.0.

The annual site environmental report will be issued each June. This comprehensive report will discuss a year of IEMP data previously reported on the DOE-LM website. The annual site environmental report will include the following:

- An annual summary of data from the IEMP surface water and treated effluent monitoring program.
- Constituent concentrations for each sample location.
- Statistical analysis summary for constituents, as warranted by data evaluation.
- Status of FFCA and OU5 ROD Great Miami River effluent limits, to be presented graphically showing status of compliance with the 30-μg/L and 600-pound total uranium limits.
- Status of regulatory compliance of the NPDES Permit.
- Actions taken to mitigate unacceptable surface water conditions revealed by the IEMP surface water sampling program.
- Observed trends and results of the data comparison to FRLs.

Because the IEMP is a living document, a structured schedule of annual reviews and 5-year revisions has been instituted. The annual review cycle provides the mechanism for identifying and initiating any surface water and treated effluent program modifications (i.e., changes in constituents, locations, or frequencies) that are necessary. Any program modifications that may be warranted prior to the annual review would be communicated to EPA and OEPA.

End of current text

5.0 Sediment Monitoring Program

Section 5.0 discusses the monitoring strategy for assessing the impact on sediments. This plan discusses the IEMP sampling design. In addition a medium-specific plan for sediment monitoring activities, a discussion of sediment data evaluation and the reporting structure are also provided.

5.1 Integration Objectives for the Sediment Monitoring Program

The design considerations for the IEMP sediment monitoring program (discussed in Section 5.3), especially the location of sample points, incorporate information from previous site sediment programs including the IEMP data and information regarding site controls that are in place.

Historically, the site-wide sediment pathway has been evaluated under the site's initial environmental monitoring program that began in 1974, and the RI/FS characterization of sediment that focused on a broader range of constituents (both radiological and non-radiological) in site drainages. The information produced by these programs through 1993 was reported and evaluated in the Remedial Investigation Report for OU5 and carried forward into the feasibility study report for OU5 for the development of sediment cleanup levels. The ROD for remedial actions at OU5 established health-protective FRLs for sediment. Off-property sediment from the Great Miami River is the focus of post-closure monitoring, since on-property sediments were certified as "clean" in 2006.

5.2 Analysis of Regulatory Drivers, DOE Policies, and Other Fernald Preserve Site-Specific Agreements

This section presents an evaluation of the regulatory drivers governing sediment monitoring during post-closure. The intent of this section is to identify any pertinent regulatory requirements, including ARARs and to-be-considered requirements, for the sediment monitoring program. These requirements will be used to confirm that the design specifications satisfy the regulatory obligations stated below and will achieve the intentions of other pertinent criteria, such as DOE Orders and the Fernald Preserve's existing agreements. The results of the evaluation also are used to define, as appropriate for these media, the programmatic boundaries between the IEMP and project-specific emissions control monitoring conducted by individual project organizations.

5.2.1 Approach

The analysis of the regulatory drivers and policies was conducted by examining the approved CERCLA RODs to identify any sediment-specific monitoring requirements.

5.2.2 Results

The evaluation of regulatory drivers for sediment monitoring resulted in two regulatory requirements governing the technical scope and reporting for the IEMP sediment monitoring program as well as project-specific monitoring of sediment:

- The CERCLA ROD for remedial actions at OU5 requires remediation of the site such that the sediment pathway is protective of the underlying Great Miami Aquifer and environmental receptors. The FRLs for sediment are specified in the OU5 ROD; however, a specified volume or area of sediment to be remediated was not identified due to the sporadic and isolated detections of contaminants above sediment FRLs. Attainment of sediment FRLs for on-property sediments was achieved as part of the Stream Corridors Project. An attainment of sediment FRLs for the Great Miami River sediments will be achieved by monitoring at the end of remediation activities, as committed to in the feasibility study report for OU5.
- Per the CERCLA Remedial Design Work Plan for remedial actions at OU5, monitoring will be conducted following the completion of cleanup as required to assess the continued protectiveness of the remedial actions. The IEMP will specify the type and frequency of environmental monitoring activities to be conducted following the cessation of remedial operations as appropriate. The IEMP will delineate the Fernald Preserve's responsibilities for site-wide monitoring of surface water and sediment over the life of the remedy, and ensure that FRLs are achieved at project completion.
- The CERCLA Feasibility Study Report for OU5 stated that if the concentrations of constituents remain above sediment BTVs after completion of the remedial action, then further investigation and remediation might be warranted. The sediment benchmark toxicity values (BTVs) listed in the Feasibility Study Report for OU5 were identified as contaminant concentrations that are protective of ecological receptors.

DOE Order 450.1, *Environmental Protection Program*, and DOE Order 5400.5, *Radiation Protection of the Public*, were also evaluated for any to-be-considered criteria that may drive environmental monitoring of sediment. This evaluation concluded that although sediment sampling has been conducted under previous sampling based on DOE Orders, continued sediment monitoring is not mandated by DOE Orders in light of the current site conditions, completed actions regarding IEMP surface water sampling, and the completed sediment verification sampling both on and off property.

Table 5–1 lists the regulatory drivers for sediment monitoring. Sections 5.5 and 7.0 provide the plan for the evaluation and reporting of sediment monitoring data.

Table 5–1. Fernald Preserve Sediment Monitoring Program Regulatory Drivers and Responsibilities

	DRIVER	ACTION
IEMP	OU5 Feasibility Study/OU5 ROD	The IEMP will be modified toward completion of the remedial actions to include sampling to verify FRL achievement.

5.3 Program Expectations and Design Considerations

5.3.1 Program Expectations

The expectations for the sediment sampling program are to:

- Continue monitoring two sample locations in the Great Miami River to confirm that the river is not being impacted by the Fernald Preserve, including treated discharges from the outfall line.

The IEMP sediment program is limited to the Great Miami River sample locations. Continued compliance with the Fernald Preserve's NPDES discharge limits precludes any discharge or accumulation of contaminated sediment in the river. It is anticipated that both the verification sampling and historical information from the Great Miami River will confirm that remediation of sediment in the Great Miami River is unnecessary along with fulfilling the OU5 Feasibility Study conclusion/recommendation.

5.3.2 Design Considerations

Based on the sediment data over the past 14 years, sediments from the Fernald Preserve do not currently pose a risk to the public. Since 1991, the only sediment FRL exceedance occurred in a 1996 sediment sample from the storm sewer outfall ditch for thorium-232 (sample result of 1.8 picocuries per gram [pCi/g] versus the FRL of 1.6 pCi/g).

Consistent with recent years, samples will be collected annually from the two locations on the Great Miami River: one downstream from the outfall line and one background location (Figure 5–1).

5.4 Medium-Specific Plan for Sediment Monitoring

This section serves as the medium-specific plan for implementation of the sampling, analytical, and data management activities associated with the IEMP sediment monitoring program. This plan pertains to those samples to be collected from the Great Miami River.

The activities described in this medium-specific plan were designed to provide sediment data of sufficient quality to meet the program expectations and design as stated in Sections 5.3.1 and 5.3.2. All sampling procedures and analytical protocols described or referenced herein are consistent with the requirements of the LM QAPP.

Subsequent sections of this medium-specific plan define the following:

- Project organization and associated responsibilities
- Sampling program
- Change control
- Health and safety
- Data management
- Project quality assurance

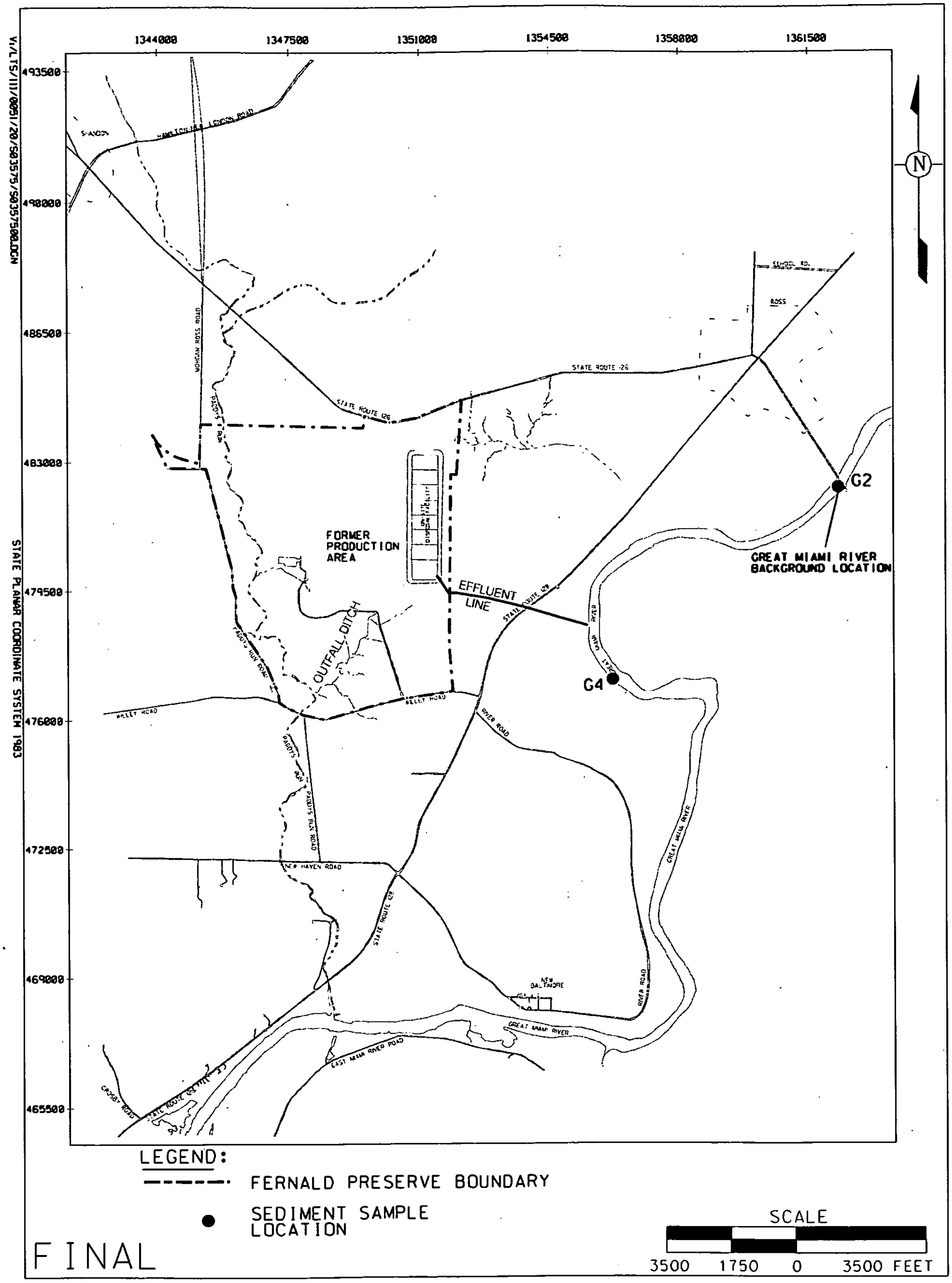


Figure 5–1. Sediment Sample Locations

5.4.1 Project Organization

The project team leader will have full responsibility and authority for the implementation of this medium-specific plan, in compliance with all regulatory specifications and site-wide programmatic requirements. All changes to project activities must be approved by the project team leader or designee.

Health and safety are the responsibility of all individuals working on this project scope. Qualified health and safety personnel shall participate on the project team to assist in preparing and obtaining all applicable permits. In addition, safety specialists shall periodically review and update the project-specific health and safety documents and operating procedures, conduct pertinent safety briefings, and assist in evaluation and resolution of all safety concerns.

Quality assurance personnel will participate on the project team, as necessary, to review project procedures and activities ensuring consistency with the requirements of the LM QAPP or other referenced standards, and to assist in evaluating and resolving all quality-related concerns.

5.4.2 Sampling Program

Sediment samples will be collected from two locations on the Great Miami River, typically in the summer or fall. Sampling is usually performed in this time period in order to take advantage of the abundance of fresh sediment deposited during flood conditions that commonly occur after the winter and spring seasons, and to enable sampling during low-flow or dry conditions. Sampling at other times of the year is also acceptable although sample collection may be more difficult due to water flow.

Figure 5–1 depicts the two IEMP sediment sample locations. Table 5–2 summarizes the field sample collection information for each of the locations. Sample analysis will be performed either at the on-site laboratory or a contract laboratory dependent on specific analyses required, laboratory capacity, turnaround time, and performance of the laboratory. The laboratories used for analytical testing have been audited to ensure that DOECAP or equivalent process requirements have been met as specified in the LM QAPP. These criteria include meeting the requirements for performance evaluation samples, pre-acceptance audits, performance audits, and an internal quality assurance program.

5.4.2.1 Sampling Procedures

Specific sampling procedures associated with surface water and treated effluent will be performed in accordance with directives established in the LM SAP and the LM QAPP.

Following are project-specific sampling considerations:

- Only recently deposited surface sediment shall be collected, typically from deposition locations such as areas with a slow flow rate (e.g., obstructions in the stream bed that allow sediment to be deposited).
- Samples shall be collected from the top two inches and consist of fine-grained material.
- Any non-sediment materials shall be discarded from the sample, any free water drained from the non-sediment material, and the non-sediment material placed in the sample container.

Table 5–2. Sediment Sampling Program Design and Analytical Requirements

Location *Expectation*	Number of Locations	Sample Frequency	Constituent[a]	ASL[b]	Container	Holding Time	Preservative
Great Miami River (G4) *Measure the impact of site effluent*	1	Annually	Uranium, Total	B	500 mL glass or plastic jar	6 months	None
Great Miami River background (G2) *Establish range of background concentration in Great Miami River*	1	Annually	Uranium, Total	B	500 mL glass or plastic jar	6 months	None

[a]Analytical Methods are from Procedure Manual of the Environmental Measurements Laboratory.
[b]A more conservative ASL may be required for laboratory data in order to meet required detection limits or in order to ensure data quality objectives.

The exact locations of the sediment sample points are approximate and may change based on where stream flow has deposited sufficient material for sampling. Sediment samples are collected and analyzed according to Table 5–2.

5.4.2.2 Quality Control Sampling Requirements

Quality control samples will be taken according to the frequency recommended in the LM SAP and LM QAPP. These samples will be collected and analyzed to evaluate the possibility that some controllable practice, such as decontamination, sampling, or analytical technique, may be responsible for introducing bias in the analytical results. One field duplicate will be collected from the G4 location in the Great Miami River.

5.4.2.3 Decontamination

Decontamination of sampling equipment will be performed between sample locations to prevent the introduction of contaminants or cross contamination into the sampling process. The decontamination is identified in the LM QAPP and more specifically outlined in the LM SAP.

5.4.2.4 Waste Disposition

Contact wastes that are generated by the field technicians during field sampling activities are collected and placed in a clean trash receptacle.

5.4.3 Change Control

Changes to the medium-specific plan will be at the discretion of the project team leader. Prior to implementation of field changes, the project team leader or designee shall be informed of the proposed changes and circumstances substantiating the changes. Any changes to the medium-specific plan must have written approval by the project team leader or designee, Quality Assurance representative, and the Field Manager prior to implementation. If a Variance/Field Change Notice is required, it will be completed in accordance with the LM QAPP. The Variance/Field Change Notice form shall be issued as controlled distribution to team members and will be included in the field data package to become part of the project record. During revisions to the IEMP, Variance/Field Change Notices will be incorporated to update the medium-specific plan.

5.4.4 Health and Safety Considerations

All involved personnel will receive adequate training to the health and safety requirements prior to implementation of the fieldwork required by this medium-specific plan. Safety meetings will be conducted prior to beginning fieldwork to address specific health and safety issues. Health and Safety requirements are also addressed in the Fernald Project Health and Safety Plan.

5.4.5 Data Management

Field documentation and analytical results will meet the IEMP data reporting and quality objectives, comply with the LM QAPP, the LM Standard Practice for Validation of Laboratory Data, and the LM SAP.

Data documentation and validation requirements for data collected for the IEMP fall into two categories depending upon whether the data are field- or laboratory-generated. Field data validation will consist of verifying compliance and appropriate documentation of field activities. Laboratory data validation will consist of verifying that data generated are in compliance with specified ASL B. Specific requirements for field data documentation and validation and laboratory data documentation and validation are in accordance with the LM QAPP, the Standard Practice for Validation of Laboratory Data, and the LM SAP. ASL B provides qualitative, semi-qualitative, and quantitative data with some quality assurance/quality control checks. The IEMP sediment data will undergo validation to ensure that analytical data are in compliance with the ASL B method criteria being requested and in order to meet data quality objectives.

Data will be entered into a controlled database using a double key or other verification method to ensure accuracy. The hard-copy data will be managed in the project file in accordance with LM record keeping requirements and DOE Orders.

5.4.6 Quality Assurance

Assessments of work processes may be conducted to verify quality of performance, and may include audits, surveillances, inspections, tests, data verification, field validation, and peer reviews. Assessments shall include performance-based evaluation of compliance-to-technical and procedural requirements, and corrective action effectiveness necessary to prevent defects in data quality. Assessment documentation shall verify that work was conducted in accordance with IEMP, LM SAP, and LM QAPP requirements.

5.5 IEMP Sediment Monitoring Data Evaluation and Reporting

This section provides the methods to be used in analyzing the data generated by the IEMP sediment sampling program. It summarizes the data evaluation process and actions associated with various monitoring results. The planned reporting structure for IEMP-generated sediment data to be reported in the annual site environmental reports is provided.

5.5.1 Data Evaluation

Data resulting from the IEMP sediment program will be evaluated to meet the program expectations identified in Section 5.3.1. Based on these expectations, the following questions will be answered through the sediment data evaluation process, as indicated:

- Have changes in the residual contaminant concentrations occurred in sediments found in the Great Miami River as a result of runoff and treated effluent from the site?

  Data evaluation will consist of comparison to historical data, background levels, and FRLs. This evaluation will identify long-term trends of targeted radiological constituents in sediment to determine if the potential exists for an FRL exceedance in the future. As indicated in Figure 5–2, results of the data interpretation will be communicated to project personnel to implement appropriate actions, as necessary.

- Should the sediment program be refined in scope?

  Data evaluation to determine if the IEMP sediment program should be revised will be based on the comparison to historic ranges and the sediment FRLs. Data evaluation to address any remaining expectations identified in Section 5.3.1 is encompassed in the data evaluation techniques described above.

- Are community concerns being met through the IEMP sediment program?

  The IEMP fulfills the need of the Fernald community by preparing sediment environmental results in annual site environmental reports. DOE makes these reports available to the public at the Public Environmental Information Center.

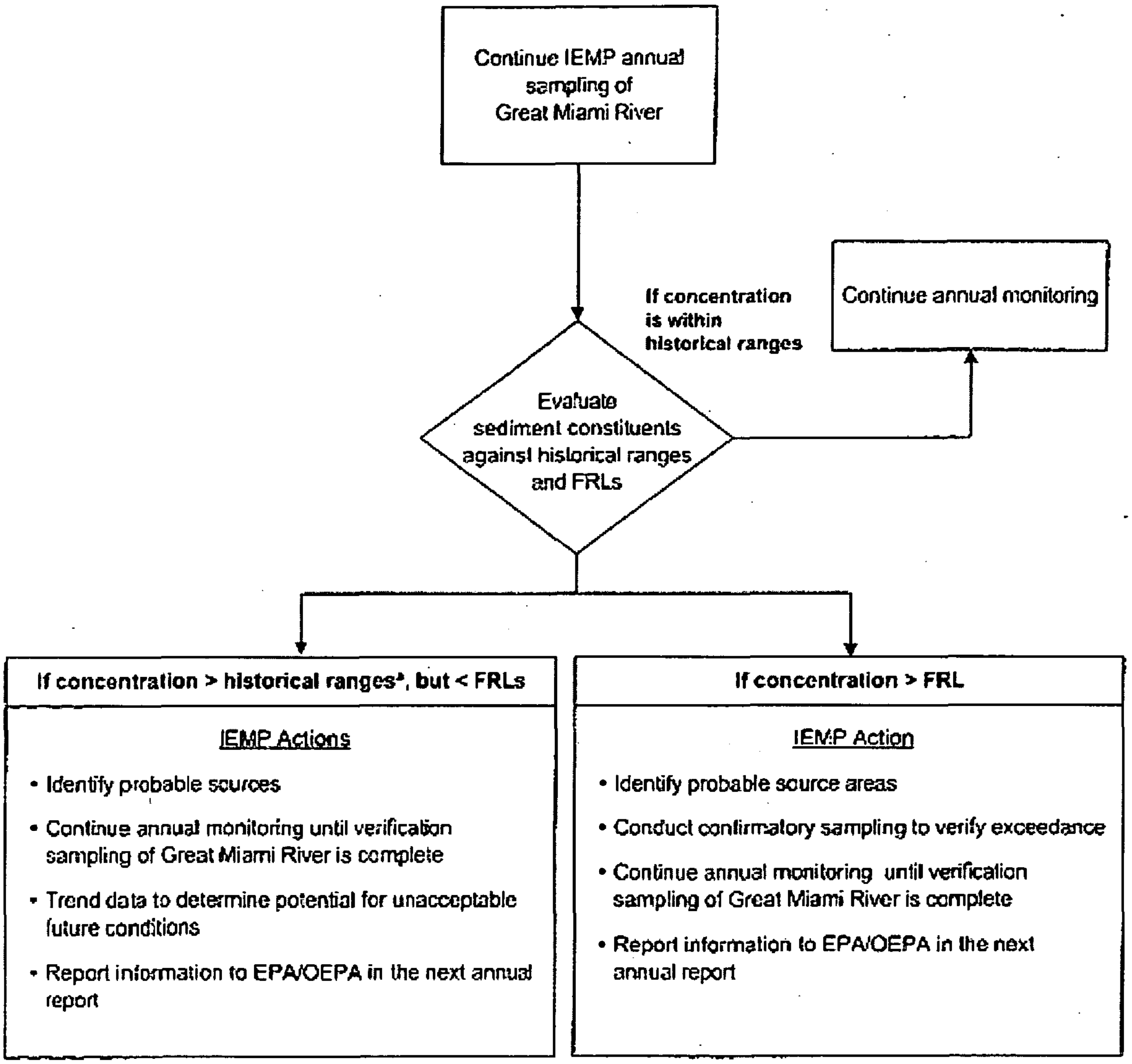
- Are the program and reporting requirements of DOE Order 450.1 being met?

  DOE Order 450.1 requires that DOE implement and report results from the environmental protection program for the Fernald site. The sediment monitoring program is one component of the site-wide IEMP monitoring program. This IEMP and annual site environmental reports fulfill the requirements of this DOE Order.

5.5.2 Reporting

The IEMP sediment program data will be reported on the DOE-LM website and in the annual site environmental report. Data on the DOE-LM website will be in the format of searchable data sets and/or downloadable data files. The DOE-LM website will be updated when sediment data become available. Additional information on IEMP data reporting is provided in Section 7.0.

The annual site environmental report will supplement the DOE-LM website by providing a summary and assessment of the data results, and identifying notable results and/or events related to those data.



[a]Historical range established by sediment data collected from 1990 through 2005

Figure 5–2. IEMP Sediment Data Evaluation and Associated Actions

The IEMP annual site environmental report will be issued each June and will include the following:

- An annual summary of data from the IEMP sediment monitoring program (Great Miami River sample locations); graphical presentation of data trends over time for the Great Miami River locations
- Statistical summary (i.e., minimum, maximum, and mean) by constituent for Great Miami River locations

If necessary, sediment results will be presented prior to the submittal of annual site environmental report to the EPA and OEPA if significant changes in sediment contaminant concentrations are evident.

Because the IEMP is a living document, a schedule of annual reviews and 5-year revisions has been instituted. The annual review cycle provides the mechanism for identifying and initiating any sediment program modifications (i.e., changes in constituents, locations, or frequencies) that are necessary. Any program modifications that may be warranted prior to the annual review will be communicated to EPA and OEPA.

6.0 Air Monitoring Program

Section 6.0 discusses the monitoring strategy for assessing the air pathway. The strategy identifies the activities conducted to satisfy requirements for particulate, radon, and direct radiation monitoring. A medium-specific plan for conducting site-wide and off-property air monitoring activities is provided, along with a plan for reporting air-related activities.

6.1 Integration Objectives for the Air Monitoring Program

The IEMP air-monitoring-program objectives for 2008 are consistent with program objectives in previous IEMP revisions. The objectives involve physically monitoring the air pathway to demonstrate compliance with 40 CFR 61 Subpart H and the requirements of DOE Orders. These assessments will be integrated with the assessments of the other media sampled under the IEMP and provided to regulatory agencies in reports according to the reporting schedule established in Section 6.5 and summarized for all media in Section 7.0.

The IEMP site boundary air monitoring program will continue through the year. Then the removal of air monitors (particulate, radon, and direct radiation) will be discussed through the conference calls and/or correspondence with the EPA and OEPA on a case-by-case basis.

A reporting plan is provided in Section 6.5 to combine the results of the air assessment program and the NESHAP dose assessments into a single reporting mechanism to facilitate regulatory agency review of the site-wide remediation activities and associated emission controls. Appendix C outlines the Fernald Preserve's plan for demonstrating NESHAP Subpart H compliance and producing a required dose assessment.

6.2 Analysis of Regulatory Drivers, DOE Policies, and Other Fernald Preserve Site-Specific Agreements

This section identifies the pertinent regulatory requirements, including ARARs and to-be-considered requirements, for the scope and design of the air monitoring program. These requirements will be used to confirm that the program satisfies the regulatory obligations for monitoring that have been activated by the RODs and will achieve the intentions of other pertinent criteria (such as DOE Orders and the Fernald Preserve existing agreements) that have a bearing on the scope of air monitoring.

6.2.1 Approach

The analysis of the additional regulatory drivers and policies for air assessments was conducted by identifying the suite of ARARs and to-be-considered requirements in the approved CERCLA RODs and legal agreements that contain specific air monitoring requirements. This subset was further divided to identify those monitoring requirements with site-wide implications (and, therefore, fall under the scope of the IEMP).

6.2.2 Results

The following regulatory drivers govern the technical scope and reporting requirements for the IEMP's site-wide air monitoring program:

- DOE Order 450.1, *Environmental Protection Program*, which requires DOE facilities that use, generate, release, or manage significant pollutants or hazardous materials to develop and implement an environmental monitoring plan. Each DOE site's environmental monitoring plan must contain the design criteria and rationale for the routine effluent monitoring and environmental surveillance activities of the facility. The IEMP strategy is responsive to the changing site mission and complies with DOE Orders.
- DOE Order 5400.5, *Radiation Protection of the Public and Environment*, which establishes radiological dose limits and guidelines for the protection of the public and environment. Under this requirement, the exposure to members of the public associated with activities from DOE facilities from all pathways must not exceed, in 1 year, an effective dose equivalent of 100 mrem. For radiological dose due to airborne emissions only, the DOE Order requires compliance with the 40 CFR 61 Subpart H limit of an effective dose equivalent of 10 mrem/year to a member of the public. Demonstration of compliance with this standard is to be based on an air monitoring approach. The DOE Order also provides guidelines for radionuclide concentrations in air (known as Derived Concentration Guides) and radon concentration limits for interim storage of sources during remediation.
- Proposed 10 CFR 834, *DOE Facilities Radiation Protection of the Public and Environment*, which is similar in intent to DOE Order 5400.5. However, differences include the deletion of the 100-pCi/L limit and 30-pCi/L annual limit, lowering the fenceline limit to 0.5 pCi/L above background, changes to facility and facility boundary definitions, and clarification of the definition of "point of compliance."
- NESHAP 40 CFR 61 Subpart H, which provides national emissions standards for radionuclides other than radon. Per this requirement, emissions of radionuclides (excluding radon) to the ambient air from DOE facilities shall not exceed those amounts that would cause any member of the public to receive in any year an effective dose equivalent in excess of 10 mrem/year. Demonstration of compliance with this standard is to be based on an air monitoring approach.
- Federal Facility Agreement (FFA), *Control and Abatement of Radon-222 Emissions*, signed November 19, 1991, which ensures that DOE takes all necessary actions to control and abate radon-222 emissions at the Fernald Preserve.
- DOE Order 435.1, *Environmental Monitoring*, which requires low-level radioactive waste disposal facilities to perform environmental monitoring. This requirement applies to the OSDF because it is the only disposal facility at the Fernald Preserve. Instead of a separate monitoring plan for the OSDF, the air monitoring program for the OSDF will be integrated and incorporated into the IEMP's air monitoring program.
- Per the CERCLA Remedial Design Work Plan for remedial actions at OU5, monitoring will be conducted as required following the completion of cleanup to assess the continued protectiveness of the remedial actions. The IEMP will specify the type and frequency of environmental monitoring activities to be conducted, following the cessation of remedial operations as appropriate.

Upon evaluating the IEMP ARARs in consideration of protection of human health and the environment, the 10-mrem/year dose limit was determined to be the most stringent emission limit. Therefore, the 10-mrem/year NESHAP standard provides a reasonable benchmark for ensuring compliance with all other air standards (excluding radon) and ensuring an adequate level of protectiveness.

Other regulatory drivers have air monitoring implications of an emissions control nature that fall outside the scope of the IEMP. These requirements pertain to the monitoring of fugitive area emission controls and the monitoring of point source emissions, and if necessary, they will be considered during post-closure. The drivers for fugitive dust include:

- Ohio General Provisions on Air Pollution Control, Air Pollution Nuisances Prohibited, OAC 3745-15-07 and Ohio Revised Code (ORC) 3704.01-05, which prohibits the emission or escape into the open air of smoke, ashes, dust, dirt, grime, acids, fumes, gases, vapors, and odors in such amounts that may cause a public nuisance.
- Ohio Emissions of Particulate Matter, Restriction of Emission of Fugitive Dust, OAC 3745-17-08, which provides for the restriction of emission of fugitive dust by the use of control measures. Such control measures include, for example, water or dust suppression chemicals for control of fugitive dust from demolition of buildings or on dirt or gravel roads, the use of hoods or fans to enclose and control fugitive dust, and the use of canvas or other coverings for stockpiles.

The regulatory drivers for point and other sources include:

- NESHAP 40 CFR 61 Subpart H, which provides national emissions standards for radionuclides other than radon. This regulation also requires emission measurements at point sources with a potential to discharge radionuclides into the air in quantities that could cause an effective dose equivalent in excess of 1 percent of the standard (10 mrem/year).

Table 6–1 lists all of the requirements above and includes each of the air assessment regulatory requirements to be conducted under the IEMP and the associated assessment designed to comply with each requirement. Sections 6.5 and 7.0 outline the plan for complying with the reporting requirements invoked by the IEMP regulatory drivers.

Table 6–1. Fernald Preserve Air Monitoring Program Regulatory Drivers and Responsibilities

	DRIVER	ACTION
IEMP	DOE Order 450.1, Environmental Protection Program Environmental Monitoring Plan for all media	The IEMP describes effluent and surveillance monitoring as required by DOE Order 450.1.
IEMP	DOE Order 5400.5, Proposed 10 CFR 834 Radiation Protection of the Public and Environment	The IEMP describes on-site and off-site monitoring for radon and other radionuclides, and monitoring to determine annual dose from the air pathway.
IEMP	NESHAP 40 CFR 61, H Emission Standards for Radionuclides (excluding radon)	The IEMP includes an assessment of the annual dose to the public from the air pathway.
IEMP	Federal Facility Agreement Control and Abatement of Radon-222 Emissions	The IEMP includes radon monitoring.
IEMP	DOE Order 435.1, Radioactive Waste Management	The IEMP boundary monitoring includes air monitoring at locations adjacent to the OSDF.

6.3 Program Expectations and Design Considerations

6.3.1 Program Expectations

The IEMP air assessment program has been designed to collect data sufficient to meet the following expectations for 2008:

- Provide a program that will provide a continual assessment to determine if the air monitoring results are as low as reasonably achievable (ALARA).
- Provide assessment data sufficient to demonstrate compliance with 40 CFR 61 Subpart H requirements ensuring that no member of the public receives an annual effective dose equivalent in excess of 10 mrem.
- Provide data sufficient to determine compliance with the radon concentration limits of DOE Order 5400.5 and 10 CFR 834.
- Provide measurements of direct radiation sufficient to support the annual dose assessment calculations required by DOE Order 5400.5 accounting for exposure pathways.
- Provide a program that promotes the continued confidence of the public and is responsive to concerns raised by stakeholders regarding forthcoming remediation activities.

6.3.2 Design Considerations

The air assessment program comprises three distinct components:

- Radiological air particulate monitoring.
- Radon monitoring.
- Direct radiation monitoring.

Each component of the site-wide air assessment program is designed to address a unique aspect of air pathway monitoring and, as such, reflects distinct sampling methodologies and analytical procedures. The following sections and Appendix C provide a detailed discussion on the design of the IEMP air assessment program.

6.3.2.1 Radiological Air Particulate Monitoring Design Summary

The radiological air particulate monitoring program for 2008 is designed to fulfill the following primary program expectations:

- Provide a continual assessment and early-warning feedback to determine if air monitoring results meet the health protective NESHAP standard of 10 mrem.
- Provide sufficient monitoring data to demonstrate compliance with 40 CFR 61 Subpart H requirements ensuring that no member of the public receives an annual effective dose equivalent greater than 10 mrem.

To meet these expectations during 2008, the program design is based on taking direct measurements of radionuclide concentrations in the environment at the site boundary and a background location (Figure 6–1). Five high-volume air monitoring stations have been chosen, based on the location of the potential off-site receptors and in consideration of the 16 primary

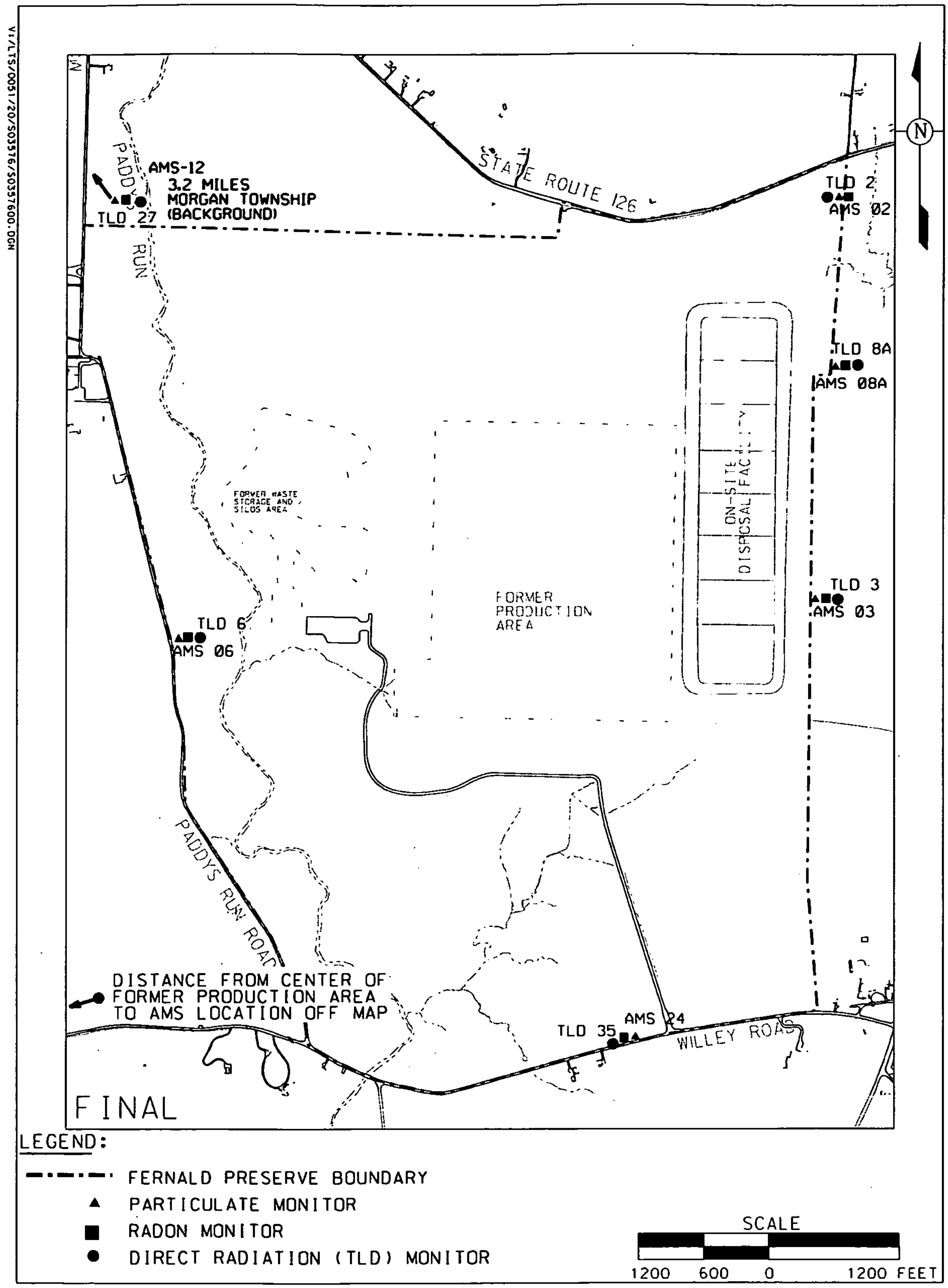


Figure 6–1. Post-Closure Air Monitoring Locations for 2008

wind rose sectors (Figure 6–2). In addition, there is one background monitor (AMS-12). The criteria found in the*Probe and Monitoring Path Siting Criteria for Ambient Air Quality Monitoring*(40 CFR 58, Appendix E) and provided by EPA were considered when selecting these locations.

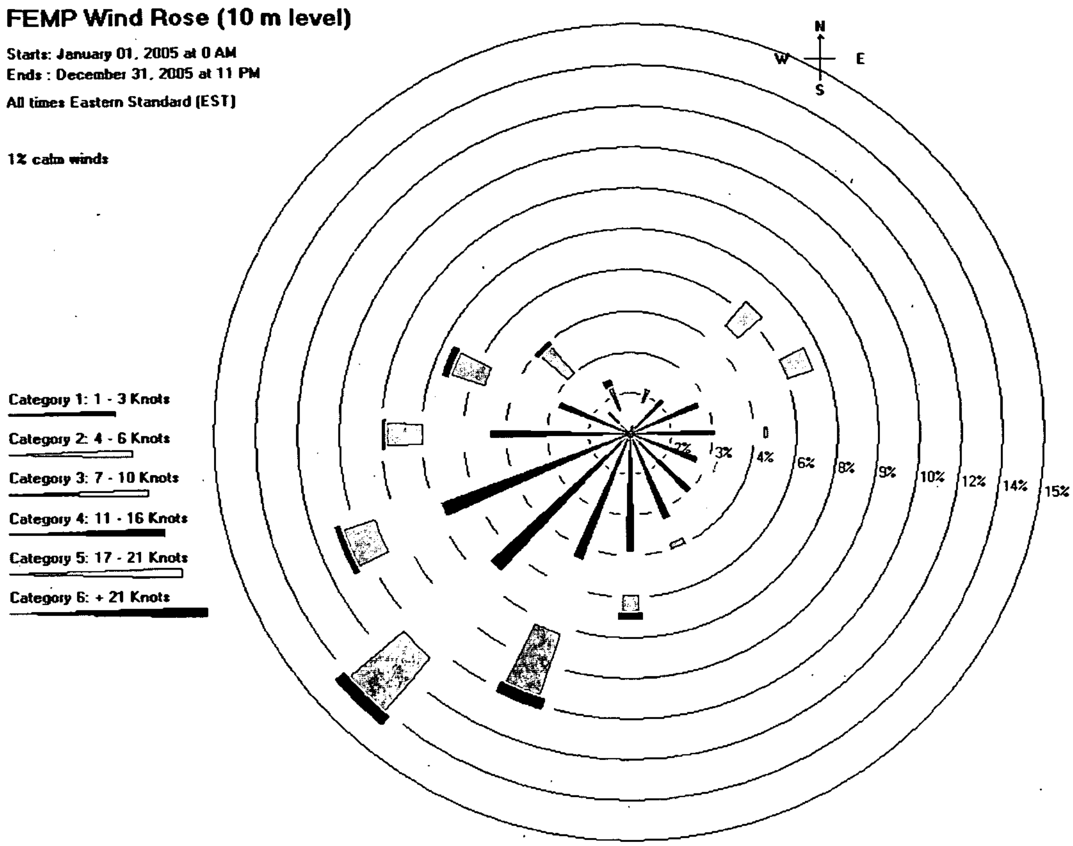


Figure 6–2. Average Fernald Site Wind Rose Data, 2000–2005

The sampling and analysis plan for the air particulate monitoring program is designed to meet the following two fundamental criteria:

- Provide routine analysis that supports a timely evaluation.
- Account for contributors to dose as defined in 40 CFR 61.93(b)(5)(ii).

Based on these criteria, the sampling and analysis frequency for the radiological air particulate monitoring program for 2008 consists of the following:

- Monthly Uranium and Total Particulate Samples:

  Filters will be exchanged monthly at all air monitoring stations and will be analyzed for total uranium and total particulate. Monitoring frequency is monthly based on the lack of major sources. Section 6.5 presents the data evaluation process.

- Quarterly Composite Samples:

  A portion of each monthly sample will be used to form a quarterly composite sample for each air monitoring station. The quarterly composite samples will be analyzed at an off-site laboratory for the expected major contributors to dose, including uranium-238, uranium-235/236, uranium-234, thorium-232, thorium-230, thorium-228, and radium-226. The results of the quarterly composite data will be used to track compliance against the NESHAP Subpart H standard. The data will also be incorporated into the ongoing evaluation of emission controls.

The key isotopes selected for quarterly analysis represent the major contributors to dose, based on the following considerations:

- Radionuclides that were stored in large quantities at the Fernald Preserve and were handled or processed during the remediation effort.
- Radionuclides that were the major contributors to dose, based on environmental and stack-filter measurements.

Additional technical information supporting the sampling and analysis plan presented here is provided in Appendix C. Table 6–2 presents a summary of the analytical and sampling information provided below.

6.3.2.2 Radon Monitoring Design Summary

The monitoring design is influenced by the radon concentration limits established in DOE Order 5400.5 and Proposed 10 CFR 835, and satisfies FFA–mandated monitoring requirements. Continuous environmental radon monitors collect data representing the short-term fluctuations in radon concentrations. These monitors are placed at five locations at the Fernald Preserve boundary and at one off-site background location. The monitoring locations reflect DOE guidance for siting environmental samplers. Figure 6–1 depicts the locations of continuous alpha scintillation monitors.

Data from the monitors are used to assess compliance with the following limits outlined in DOE Order 5400.5 and Proposed 10 CFR 834:

- 100 pCi/L at any given location and any given time.
- Annual average concentration of 30 pCi/L (above background) over the facility.
- Annual average concentration of 0.5 pCi/L (above background) at and beyond the Fernald Preserve boundary (Proposed 10 CFR 834).

Site boundary monitors are collocated with the high-volume air particulate samplers and fulfill the Proposed 10 CFR 834 monitoring and reporting requirements.

The instrument background is the combination of the laboratory-determined count rate for a specific electronic instrument (also known as electronic noise), and any counts from trace radioactive decay products and impurities found in the scintillation material of the continuous radon monitor as measured in a radon-free environment. Instrument background is subtracted from the measurement data prior to comparing data from site boundary and on-site monitors to data from the background monitor. Instrument background corrected data will be presented in IEMP summary reports.

Table 6–2. Sampling and Analytical Summary for Radiological Air Particulate Samples

Constituent	Sample Matrix	Sample Frequency	ASL[a]	Detection Level	Container
Total Uranium	Air	Monthly	B	2-μg/filter	20 cm x 25 cm polypropylene 0.3-μm filter
Total Particulate	Air	Monthly	A	NA[b]	20 cm x 25 cm polypropylene 0.3 μm filter
Uranium-234	Air	Quarterly composite	E	$9x10^{-5}$ pCi/m3	NA[b]
Uranium-235/236				$9x10^{-5}$ pCi/m3	
Uranium-238				$9x10^{-5}$ pCi/m3	
Thorium-228				$7x10^{-6}$ pCi/m3	
Thorium-230				$7x10^{-6}$ pCi/m3	
Thorium-232				$7x10^{-6}$ pCi/m3	
Radium-226				$2x10^{-4}$ pCi/m3	

[a]The ASL may become more conservative if it is necessary to meet detection limits or data quality objectives.
[b]NA = not applicable

Table 6–3 summarizes the sampling and analysis plan for the radon monitoring program.

Table 6–3. Sampling Analytical Summary for Continuous Radon Detectors

Constituent	Sample Matrix	Sample Frequency	ASL	Holding Time	Preservative	Detection Level	Detection Method
Radon-222	Air	Continuous/24 hours	A	NA[a]	NA[a]	0.05 to 0.15 pCi/L	Alpha Scintillation

[a]NA = not applicable

6.3.2.3 Direct Radiation Monitoring Design Summary

The direct radiation monitoring component of the IEMP program is designed to collect measurements of environmental radiation levels. This is accomplished using five environmental thermoluminescent dosimeters (TLDs) collocated with the air particulate monitors at the site boundary and one background location off site. Figure 6–1 identifies the TLD monitoring locations.

The TLDs provide a mechanism to measure and track ambient radiation levels that used to be at the Fernald Preserve boundary from gamma-emitting radioactive materials (primarily radium-226, thorium-232, and their decay products).

Three individual TLDs are placed at each location in order to assess the precision of the data. The TLDs are placed 1 meter above the ground and exchanged quarterly in accordance with industry standards and DOE guidance. The TLDs are processed at the DOE Laboratory Accreditation Program–approved laboratory.

Data from the TLDs are used to assess the direct radiation component of the air pathway dose calculation (refer to Appendix C). Table 6–4 summarizes the sampling and analysis plan for the direct radiation monitoring program.

Table 6–4. Analytical Summary for Direct Radiation (TLD)

Analyte	Sample Matrix	Sample Frequency	ASL[a]	Holding Time	Preservative	Detection Level	Container
Gamma Radiation	TLD	Quarterly	B	NA[b]	NA[b]	5 mrem	NA[b]

[a]The ASL may become more conservative if it is necessary to meet detection limits or data quality objectives.
[b]NA = not applicable

6.3.2.4 Meteorological Monitoring Program Design Summary

Although not a distinct component of the existing site-wide air monitoring program, the meteorological monitoring program is designed to provide data on the atmospheric conditions that influence the dispersion and transport of contaminants in the air pathway. This data is available to assist in the evaluation and interpretation of air monitoring data.

Meteorological data are used in the evaluation and interpretation of radon and environmental data collected from air. Meteorological data is obtained from a local weather station through the National Weather Service, as necessary.

6.4 Medium-Specific Plan for Site-Wide Environmental Air Monitoring

This section serves as the medium-specific plan for implementation of the sampling, analytical, and data-management activities associated with the site-wide environmental air monitoring program. The program expectations and design presented in Section 6.3 were used as the framework for developing the monitoring approach presented in this section. The activities described herein were designed to provide environmental data of sufficient quality to meet the intended data use as described in the program design in Section 6.3.2. All sampling procedures and analytical protocols described or referenced in this medium-specific plan are consistent with the requirements of the LM QAPP and LM SAP.

The subsections of this medium-specific plan define the following:

- Program organization and associated responsibilities
- Sampling programs (radiological air particulate, radon, and direct radiation)
- Change control
- Health and safety
- Data management
- Project quality assurance

6.4.1 Project Organization

A multidiscipline project organization has been established and assigned responsibility to effectively implement and manage the project planning, sample collection and analysis, and data management activities directed in this medium-specific plan. The key positions and associated responsibilities required for successful implementation are described as follows.

The project team leader will have full responsibility and authority for the implementation of this medium-specific plan in compliance with all regulatory specifications and site-wide programmatic requirements. Integration and coordination of all medium-specific plan activities defined herein with other project groups are also key responsibilities. All changes to project activities must be approved by the project team leader or designee.

Health and safety are the responsibility of all individuals working on this project scope. Qualified health and safety personnel shall participate on the project team to provide radiation protection and industrial hygiene support and to assist in preparing and obtaining all applicable permits. In addition, safety personnel shall periodically review and update the project-specific health and safety documents and operating procedures, conduct pertinent safety briefings, and assist in the evaluation and resolution of all safety concerns.

Quality assurance personnel will participate on the project team as necessary to review project procedures and activities ensuring consistency with the requirements of the LM QAPP or other referenced standards and assist in evaluating and resolving all quality-related concerns.

6.4.2 Sampling Program

Sample analysis will be performed at off-site contract laboratories, depending on specific analyses required, laboratory capacity, turnaround time, and performance of the laboratory. The laboratories used for analytical testing meet DOECAP requirements as specified in LM QAPP. These criteria include meeting the requirements for performance evaluation samples, pre-acceptance audits, performance audits, and an internal quality assurance program.

6.4.2.1 Sampling Procedures

Specific sampling procedures associated with air monitoring will be performed in accordance with directives established in the LM SAP and the LM QAPP and the requirements of the *Environmental Regulatory Guide for Radiological Effluent Monitoring*.

Air Particulate

Table 6–5 provides the technical specifications for radiological air particulate monitoring using high-volume air monitoring equipment and filter media.

Table 6–5. Technical Specifications for Radiological Air Particulate Monitoring

Monitor Type	Flow Rate	Filter Type	Gauge/Meters	Indicator
High-volume continuous	45 cfm	Multi-ply polypropylene	Hours Flow-rate set point	Low-flow warning light

Sample collection is accomplished by using high-volume air monitoring stations that continuously collect samples of airborne particulates. Any changes in flow rate are accounted for by the automatic flow controller in the monitor and are documented on a flow chart recorder that continuously records flow data. Air monitoring equipment must meet the following criteria per DOE guidance and industry practice:

- Environmental air samplers shall be mounted in locked, all-weather stations with the sampler discharge positioned to prevent the recirculation of air.
- The air sampling system shall have a flow-rate meter, and the total air flow or total running time should be indicated.
- The air sampling rate should not vary by more than 10 percent of the monitor set point of 45 cfm for the collection of a given sample.
- Linear flow rate across air particulate filters should be maintained between 20 and 50 meters per minute (m/min).
- Air sampling systems shall be flow-calibrated, tested, and routinely inspected according to written procedures. Flow calibration shall be at least as often as recommended by the manufacturer.

The monitors are inspected and calibrated at least once a year according to manufacturer recommendations. All units placed in the field are tracked via a field-tracking log that tells when calibrations were last completed and the date of the next scheduled calibration. Boundary monitors are checked daily to ensure continuous operation.

Radon

Continuous environmental radon monitors are calibrated as a unit at least once per year (as specified per sampling procedures) with National Institute of Standards and Technology traceable sources. Monitors are tracked upon deployment in the field via an equipment-tracking log and field logbooks. The instrument background reading is also recorded for use in data evaluation and reporting. In addition, an equipment-maintenance/calibration logbook is used to track and schedule units requiring maintenance and calibrations.

Table 6–3 provides a sample and analytical summary of the radon monitoring program. The continuous environmental radon monitors used at the Fernald Preserve are passive devices, meaning radon diffuses into the continuous passive radon detector without the aid of a pump. Alpha particles generated by radioactive decay of the radon and its daughters interact with the inside surface of the detector, producing photons of light. The light photons interact with a photo-multiplier tube that generates electrical pulses. The number of pulses in a given time period is proportional to a radon concentration. The monitors are set to collect measurements of 1-hour duration.

Direct Radiation (TLDs)

Table 6–4 provides a sample and analytical summary for the direct radiation monitoring program. Sample collection is accomplished using Panasonic UD-814 dosimeters or equivalent dosimeters. Environmental TLDs must meet the following criteria as per DOE guidance:

- Environmental TLDs shall be mounted at one meter above ground.

- The frequency of exchange should be based on predicted exposure rates from site operations.
- The exposure rate should be long enough (typically one calendar quarter) to produce a readily detectable dose.
- Annealing, calibration, readout, storage, and exposure periods used should be consistent with the American National Standard Institute (ANSI) standard recommendations.

All TLDs placed in the field are tracked via a field-tracking log that tells when and where dosimeters were deployed as well as scheduled collection dates.

6.4.2.2 Quality Control Sampling Requirements

Quality control samples will be taken according to the frequency recommended in the LM QAPP and LM SAP. These samples will be collected and analyzed in order to evaluate the possibility that some controllable practice, such as a sampling or analytical practice, may be responsible for introducing bias in the project's analytical results. The following quality assurance samples will be collected under this sampling program:

Air Particulate Samples

- One blank sample will be submitted for analysis with each set of quarterly composite samples.
- The laboratory is also required to perform analyses on method blanks, matrix spikes, and laboratory control samples as required by the LMQAPP for the corresponding ASL and analytical method. For the quarterly composite samples analyzed under ASL E, a method blank, duplicate, matrix spike, and laboratory control sample will be analyzed for each batch of samples.

Radon Monitoring

Quality control practices for the continuous environmental radon monitors will be maintained per established maintenance and calibration schedules outlined in the applicable operating procedures. Quality control data will be recorded on process control charts and only instruments demonstrating acceptable performance will be used in the field to collect data. At a minimum, the continuous environmental radon monitors will be source checked monthly. Acceptable performance is defined as generating source check results that fall within three standard deviations of the mean expected efficiency in accordance with typical industry standard practices. If the source check results for an instrument fall outside of the three-standard-deviation control limit, then that instrument will not be used again until it is examined, repaired, and calibrated, if necessary.

Direct Radiation (TLDs)

Quality control samples will be collected and analyzed in order to evaluate the possibility that some controllable practice, such as sampling or analytical practice, may be responsible for introducing bias in the project's analytical results. Quarterly data from the three TLDs at each location must agree within 15 percent or will be considered suspect and invalid data.

6.4.2.3 Decontamination

Decontamination of sampling equipment will be performed between sample locations to prevent the introduction of contaminants or cross contamination into the sampling process. The decontamination is identified in the LM QAPP and more specifically outlined in the LM SAP.

6.4.2.4 Waste Disposition

Contact wastes that are generated by the field technicians during field sampling activities are collected, maintained, and dispositioned as necessary, depending upon the location of waste generation.

6.4.3 Change Control

Changes to the medium-specific plan will be at the discretion of the project team leader. Prior to implementation of field changes, the project team leader or designee shall be informed of the proposed changes and circumstances substantiating the changes. Any changes to the medium-specific plan must have written approval by the project team leader or designee, quality assurance representative, and the field manager prior to implementation. If a Variance/Field Change Notice is required, then it will be completed according to the LM QAPP. The Variance/Field Change Notice form shall be issued as controlled distribution to team members and will be included in the field data package to become part of the project record.

6.4.4 Health and Safety Considerations

The Fernald Preserve's health and safety personnel are responsible for the development and implementation of health and safety requirements for this medium-specific plan. Hazards (physical, radiological, chemical, and biological) typically encountered by personnel when performing the specified fieldwork will be addressed during team briefings. Health and safety requirements are also addressed in the Fernald Preserve Project Safety Plan. Fernald Preserve specific requirements are identified in this plan.

All involved personnel will receive adequate training to the health and safety requirements prior to implementation of the fieldwork required by this medium-specific plan. Safety meetings will be conducted prior to beginning fieldwork to address specific health and safety issues. All Fernald employees and subcontractor personnel who will be performing fieldwork required by this medium-specific plan are required to have completed applicable training.

For areas that are subject to more restrictive radiological controls where the potential for exposure is greater, radiation work permits are necessary and will be obtained prior to the fieldwork being performed in those areas. A radiological control technician will be assigned to each field crew performing any activities in an area requiring a radiation work permit.

6.4.5 Data Management

Field documentation and analytical results will meet the IEMP data reporting and quality objectives, comply with the LM QAPP, the *LM Standard Practice for Validation of Laboratory Data*, and the LM SAP.

Data documentation and validation requirements for data collected in 2008 for the IEMP fall into two categories, depending upon whether the data are field- or laboratory-generated. Field data validation will consist of verifying medium-specific plan compliance and appropriate documentation of field activities. Laboratory data validation will consist of verifying that data generated are in compliance with medium-specific plan ASLs. Specific requirements for field data documentation and validation and laboratory data documentation and validation are in accordance with the LM QAPP, the *Standard Practice for Validation of Laboratory Data*, and the LM SAP.

There are five analytical levels (ASL A through ASL E) defined for use at the Fernald Preserve. For 2006, field data documentation will be at ASL A and laboratory data documentation will be at ASL B. For some air programs, a more conservative ASL is required for laboratory data to meet regulatory commitments in order to meet required detection limits, or to ensure data quality objectives are met. The specific air monitoring ASL requirements are detailed in the sampling programs subsections above and in Appendix C.

At a minimum, 10 percent of the IEMP data will undergo validation to ensure that analytical data are in compliance with the ASL method criteria being requested and in order to meet data quality objectives. The percentage of data validated could increase in order to meet data quality objectives.

Data will be entered into a controlled database using a double key or verification method to ensure accuracy. The hard-copy data will be managed in the project file in accordance with LM record keeping requirements and DOE Orders.

6.4.6 Quality Assurance

Assessments of work processes shall be conducted to verify quality of performance, and may include audits, surveillances, inspections, tests, data verification, field validation, and peer reviews. Assessments shall include performance-based evaluation of compliance to technical and procedural requirements and corrective action effectiveness necessary to prevent defects in data quality. Assessments may be conducted at any point in the life of the project. Assessment documentation shall verify that work was conducted in accordance with IEMP, LM SAP, and LM QAPP requirements.

Recommended semiannual quality assurance assessments or surveillances shall be performed on tasks specified in the medium-specific plan. These assessments may be in the form of independent assessments or self-assessments, with at least one independent assessment conducted annually. Independent assessments are the responsibility of quality assurance personnel. The project team leader and quality assurance personnel will coordinate assessment activities and comply with the LM QAPP. The project or quality assurance personnel shall have "stop work" authority if significant adverse effects to quality conditions are identified or work conditions are unsafe.

6.5 IEMP Air Monitoring Data Evaluation and Reporting

This section provides the methods to be used in analyzing the data generated by the IEMP air assessment program in 2008. It summarizes the data evaluation process and actions associated with various monitoring results. The planned reporting structure for IEMP-generated air monitoring data in the annual site environmental report is also provided.

6.5.1 Data Evaluation

Data resulting from the IEMP air monitoring program will be evaluated to meet the program expectations identified in Section 6.3.1. Based on these expectations, the following questions will be answered for all air monitoring programs:

- Are the program and reporting requirements of DOE Order 450.1 being met?

  DOE Order 450.1 requires that DOE implement and report on an environmental protection program for the Fernald Preserve. The air assessment program is one component of the site-wide IEMP monitoring program. This IEMP and the annual site environmental report fulfill the requirements of this DOE Order.

- Are the program emissions ALARA?

  The programs (air particulate monitoring, radon monitoring, and direct radiation monitoring) are designed to provide continual assessments of air monitoring results with respect to ALARA.

- Are community concerns being met through the air monitoring IEMP program?

  The IEMP fulfills the needs of the Fernald community by presenting air monitoring results in the annual site environmental report.

Specific air program (i.e., radiological air particulate, radon, and direct radiation) evaluation process questions are identified in the following subsection. Figure 6–3 shows the overall air decision making processes with respect to the IEMP.

<u>Radiological Air Particulate Data Evaluation</u>
Based on the expectations in Section 6.3.1, the following questions will be answered for the radiological air particulate program:

- Are the collective air monitoring results in line with ALARA?
- Do the air- inhalation dose calculations indicate potential air emissions are below the NESHAP public dose limit?

  Basic statistics (such as minimum, maximum, and mean) will be routinely generated per sample location as the data are received from the laboratory. The data generated from individual sampling events will be trended by sample location over time via statistical methods when sufficient data have been generated. Do the results of quarterly composite radionuclide concentrations indicate that the dose limit of NESHAP Subpart H may be exceeded?

- Are modifications or adjustments in program focus necessary?

  The quarterly composite results will be compared to the NESHAP Appendix E, Table 2 values. If the comparison indicates a contaminant other than uranium, radium, or thorium is contributing the largest percentage of dose, then modifications to the IEMP air monitoring and analytical schedule may be proposed in order to better monitor the major contributors to inhalation dose.

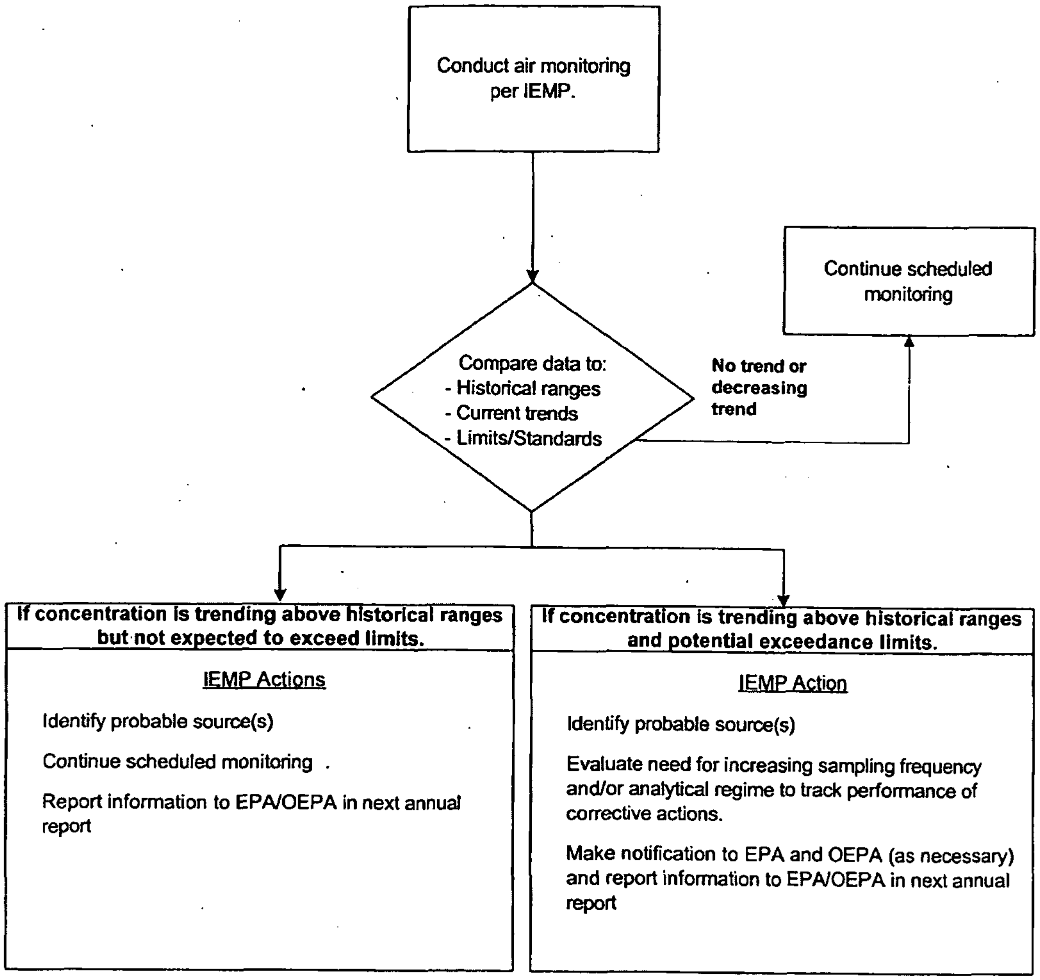


Figure 6–3. IEMP Air Data Evaluation and Associated Actions

Radon Data Evaluation

Data resulting from the radon monitoring program will be evaluated with respect to the program expectations identified in Section 6.3.1 and radon monitoring design summary in Section 6.3.2.2. Based on these expectations, the following questions will be answered through the radon data evaluation processes indicated by the text following each of the questions:

- Are radon concentrations below the limits set in DOE Order 5400.5 and 10 CFR 834?

  Data from the alpha scintillation continuous radon monitoring locations will be compared to the annual limits (0.5 pCi/L above background at the site fenceline and 30 pCi/L site-wide), and short-term (100 pCi/L) limits of DOE Order 5400.5. The data generated from individual sampling events will be trended by sample location over time via statistical methods (when sufficient data have been generated).

  If historical data are available from or near a particular IEMP sample location, then the IEMP-generated trends will be evaluated with respect to the historical trends in order to assess whether current conditions are similar to the past, increasing, or decreasing.

Direct Radiation Monitoring Data Evaluation

Data resulting from the direct radiation monitoring program will be evaluated with respect to the program expectations identified in Section 6.3.1 and direct radiation monitoring design summary in Section 6.3.2.3. Based on these expectations, the following questions will be answered through the direct radiation data evaluation processes indicated by the text following the question:

- Do direct radiation levels indicate a significant increase that could contribute to an exceedance of the 100-mrem/year, all-pathway dose limit from DOE Order 5400.5?

  The data generated from individual TLD locations will be trended over time. Historical TLD monitoring data will be used to assess whether current trends are similar to the past, increasing, or decreasing.

6.5.2 Reporting

The IEMP air monitoring program will meet the reporting requirements for the NESHAP Subpart H, 10 CFR 834, and the FFA compliance, as follows:

- The NESHAP Subpart H report has been incorporated into the annual site environmental report.
- The quarterly FFA reporting is being fulfilled via the DOE-LM website.
- Monthly trending of the annual limit of 0.5 pCi/L above background.

IEMP air program data will be reported on the DOE-LM website in the form of electronic files and in the annual site environmental report. Additional information on IEMP data reporting is provided in Section 7.0.

Data on the DOE-LM website is in the form of searchable data sets and/or downloadable data files. This site will be updated every four weeks, as data become available.

The annual site environmental report will be issued each June for the previous year. This comprehensive report will discuss a year of IEMP data previously reported on the DOE-LM website. The air monitoring portion of the annual site environmental report will consist of the following:

- An annual summary of data from the IEMP air monitoring program.
- Constituent concentrations for each sample location.
- Statistical analysis summary for each constituent, as warranted by data evaluation.
- Status of regulatory compliance with NESHAP Subpart H.
- Summary of FFA radon information.
- Information that indicates the exceedance of an ARAR at an on-site location.
- Information that is relevant to explaining significant changes in the data from the IEMP air monitoring network.

Air data will continue to be provided to EPA and OEPA electronically via the DOE-LM website as the data become available.

End of current text

7.0 Program Reporting

7.1 Introduction

This section summarizes how the reporting discussions in Sections 3.0 through 6.0 are integrated and provides an overview of the entire environmental data reporting strategy.

7.2 Program Design

As discussed throughout this document, the IEMP combines environmental monitoring requirements that have been activated by the ARARs and to-be-considered requirements (contained in the Fernald Preserve's CERCLA remedy decision documents), as well as other ongoing monitoring programs required by other regulatory requirements. In combining these elements, the IEMP establishes a site-wide environmental monitoring program that continues to meet the effluent and surveillance monitoring requirements of DOE Orders 450.1 and 5400.5. IEMP medium-specific monitoring programs were developed through a systematic evaluation of existing monitoring scopes, technical considerations, pertinent regulatory drivers, and critical Fernald site stakeholder concerns.

The IEMP is designed to provide accurate, accessible, and manageable environmental monitoring information to support the following:

- Continued compliance with the monitoring and reporting requirements contained in DOE Orders 450.1, 231.1, and 5400.5.
- Fulfilling additional site-wide monitoring and reporting requirements activated by the CERCLA ARARs for each ROD, including determining when environmental restoration activities are complete and cleanup standards have been achieved.
- Monitoring the performance of the Great Miami Aquifer groundwater remedy, including determination of when restoration activities are complete.
- Providing a consolidated reporting mechanism for environmental data.

7.2.1 IEMP Monitoring Summary

The IEMP monitoring scope for groundwater, surface water, sediment, and air has been described in detail in Sections 3.0 through 6.0. The summary that follows is intended to provide the basis for each medium's monitoring program. Evaluation of each program will form the basis for any IEMP program modifications in the future.

Groundwater: The groundwater monitoring program for the Great Miami Aquifer provides for monitoring water quality and water levels in monitoring wells distributed over the aquifer restoration area, along the Fernald site's downgradient property boundary, and at a few private well locations. These wells provide a monitoring network to track the progress of the aquifer restoration and to monitor groundwater quality in the area of the OSDF. The analytical requirements for this monitoring program are based on the FRLs documented in the ROD for Remedial Actions at OU5.

Surface Water: The surface water and treated effluent monitoring program is designed to assess the impacts on surface water. The non-radiological discharge monitoring and reporting related to the NPDES Permit have been incorporated into the IEMP.

Sediment: The IEMP sediment sampling program determines whether substantial changes to current residual contaminant conditions occur in the sediment along the Great Miami River. Sediment sampling will continue at the Great Miami River sample points for uranium to verify that no adverse impacts have occurred to sediment.

Air: The air monitoring program consists of three distinct sampling elements: airborne particulate monitoring stations, radon monitoring locations, and direct radiation monitoring locations. Each element has five monitoring locations at the Fernald Preserve boundary, and one off-site background location.

7.2.2 Program Review and Revision

As noted in the executive summary, the IEMP has been integrated into this revision of the LMICP. The IEMP is no longer a stand-alone document with its own review and revision cycle. It will be reviewed and revised each October. Revisions will identify any program modifications that are necessary as a result of progressive findings of the IEMP, and any changes to existing regulatory agreements or requirements applicable to site-wide monitoring.

In addition to the IEMP-sponsored review and revision obligations, an independent review and assessment mechanism exists through the Cost Recovery Grant reached between OEPA and DOE. The Cost Recovery Grant provides a way for OEPA to conduct an independent review of DOE environmental monitoring programs. OEPA's role, as defined in the Cost Recovery Grant, is to independently verify the adequacy and effectiveness of DOE's environmental monitoring programs through program review and independent data collection. Results of the OEPA review are summarized in an annual report that will be considered during the IEMP's annual review process. Modifications to the scope or focus of the IEMP, as a result of OEPA's activities, will be incorporated as necessary via the annual LMICP review process.

7.3 Reporting

As stated in Section 1.0, a primary objective of the IEMP is to successfully integrate the numerous routine environmental reporting requirements under a single comprehensive framework. The IEMP centralizes, streamlines, and focuses site-wide environmental monitoring and associated reporting under a single controlling document.

7.3.1 Regulatory Drivers for Reporting Monitoring Data

An analysis of regulatory drivers and policies was conducted by examining ARARs within each OU's ROD, Fernald site compliance agreements, and DOE Orders applicable to monitoring each medium. These regulatory drivers are identified in Sections 3.0 through 6.0 of the IEMP and were evaluated for reporting requirements. The following reporting drivers are in the IEMP reporting strategy:

- DOE Orders 450.1/231.1, *Environmental Protection Program Requirements/Environment, Safety and Health Reporting Manual*, which requires DOE facilities to submit annual site environmental reports that summarize the environmental monitoring data results.

- The September 7, 2000, *OEPA Director's Findings and Orders* (OEPA 2000), which requires continuation of the groundwater monitoring program as specified in this IEMP to meet RCRA/Ohio hazardous waste regulations for groundwater monitoring.
- The current NPDES Permit for the Fernald site, which requires monthly reports to demonstrate compliance with provisions in the NPDES Permit.
- The 1986 FFCA, which requires, per an agreement made with the EPA and OEPA in January 1996, submittal of quarterly data reports. Note that this requirement is being fulfilled through the posting of data to the DOE-LM website as the data becomes available.
- NESHAP 40 CFR 61, Subpart H, which requires submittal of an annual NESHAP report to demonstrate compliance with emission standards for radionuclides other than radon.
- FFA, *Control and Abatement of Radon-222 Emissions*, signed November 19, 1991, which requires, per an agreement made with EPA and OEPA in January 1996, submittal of the continuous air monitoring data in selected on-site areas in a quarterly progress report. Note that this requirement is being fulfilled through the posting of data to the DOE-LM website as the data becomes available.

7.3.2 IEMP Reporting

The IEMP reporting frequency will be annual with a continued emphasis on timely data reporting in the form of electronic files (i.e., the DOE-LM website). The annual site environmental report will continue to be submitted by June 1 to provide a comprehensive evaluation of IEMP data for both the regulatory agencies and the public, and electronic data will be made available to the regulatory agencies as soon as data have been reviewed.

<u>DOE-LM Website</u>
The DOE-LM website (http://www.lm.doe.gov/land/sites/oh/fernald/fernald.htm) allows the regulatory agencies access to Fernald data in a timely manner. The data are available after analysis, analytical validation, entry into SEEPro, and review by environmental media personnel. These data are provided in downloadable files; in some cases, user-defined queries for specific data sets are available. The use of the DOE-LM website for reporting IEMP data provides the agencies with access to IEMP data sooner than through the annual reports. In addition to the environmental media addressed in the IEMP, water quality and water accumulation rate data from the OSDF are included on the DOE-LM website.

<u>Annual Site Environmental Reports</u>
The annual site environmental report will continue to be submitted to EPA and OEPA on June 1 of each year. It will continue to document the technical monitoring approach, to summarize the data for each environmental medium, and to summarize CERCLA, RCRA, and waste management activities. The report will also include water quality and water accumulation rate data from the OSDF monitoring program. The summary report serves the needs of both the regulatory agencies and the public. The accompanying detailed appendices compile the information reported on the DOE-LM website and are intended for a more technical audience including the regulatory agencies.

Table 7–1 identifies the media that are being reported under the IEMP and the associated reporting schedule. Any program modifications that may be warranted prior to the annual review will be communicated to EPA and OEPA.

Table 7–1. IEMP Reporting Schedule for 2008

	2008											
	First Quarter			Second Quarter			Third Quarter			Fourth Quarter		
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
GROUNDWATER/OSDF[a]	*	*	*	*	*	* •	*	*	*	*	*	*
SURFACE WATER[b]	*	*	*	*	*	* •	*	*	*	*	*	*
NPDES PERMIT COMPLIANCE	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦
SEDIMENT[c]						•					*	
AIR[d]				*		•	*			*		

*= DOE-LM website Data Reporting
•=Annual Reporting
♦=Monthly Reporting

[a]Encompasses aquifer restoration operational assessment, aquifer conditions, and OSDF groundwater monitoring.
[b]Encompasses NPDES and IEMP characterization monitoring.
[c]Sediment data will be collected annually at the Great Miami River.
[d]Encompasses all air monitoring programs including FFA and NESHAP Subpart H.

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Appendix A

The Revised Groundwater Monitoring Approach

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End of current text

1.0 Introduction

This appendix provides detailed justification for the groundwater sampling program presented in Section 3.0. The groundwater sampling program was initiated in August of 1977 and remained relatively unchanged until January 1, 2003. Based on the results and findings derived from the groundwater data that was collected under the Integrated Environmental Monitoring Plan (IEMP) from 1997 through 2001, a revised groundwater monitoring program was initiated in January 2003. This program was initiated due to the general absence of final remediation level (FRL) exceedances during the first five years of sampling under the IEMP program.

The revised sampling program uses a representative monitoring strategy to successfully track remedy progress and ultimately determine the completion of groundwater restoration, while satisfying regulatory commitments and administrative requirements.

Conservative constituent selection criteria were developed to define the sampling program. These criteria included categorizing the 50 FRL constituents according to their fate and transport mobility characteristics and identifying the location-specific distribution of each constituent's FRL exceedances in the aquifer. The initial basis for each constituent's distribution was determined with sampling results obtained from 1988 through 1995 under the IEMP, Revision 0 (DOE 1997). This sampling was conducted in support of the Operable Unit 5 Remedial Investigation/Feasibility Study reports (DOE 1995a and b) and subsequent pre-IEMP programs. The constituent FRL exceedance distributions were updated with IEMP data through 1999 in the IEMP, Revision 2 (DOE 2001a) and have been updated with each subsequent IEMP revision. The distribution of the constituent-specific FRL exceedances was evaluated zone-by-zone to identify the geographic distribution of the exceedances. The five established zones include areas both inside and outside the WSA (Phase II) remediation footprint and are comprised of the following general areas:

- Zone 0 – The area outside of Zones 1 through 4
- Zone 1 – Waste storage area
- Zone 2 – South Field
- Zone 3 – Northeastern portion of the site
- Zone 4 – Southern portion of the South Plume

Figure A–1 shows the areas covered by each zone along with the Waste Storage Area (Phase II) remediation footprint. The following sections provide a summary of the IEMP groundwater data results and findings, the groundwater monitoring approach, and general.

2.0 IEMP Groundwater Results and Findings

The summary results and findings of the IEMP groundwater data from1997 through 2006 are provided in two tables: Table A–1 presents overall information for the 50 constituents with FRLs; Table A–2 provides specific information for the constituents that have FRL exceedances. Figures A–2 through A–17 provide constituent-specific locations of wells that have exceedances with respect to the site and the aquifer zones.

IEMP Groundwater Data for the 50 FRL Constituents

Table A–1 summarizes groundwater sampling results since the inception of IEMP program and contains the following information:

- Column 1 lists the 50 constituents for which FRLs were established in the Operable Unit 5 Record of Decision.
- Column 2 lists the respective FRL concentration for each of the constituents.
- Column 3 identifies the basis for each FRL constituent (i.e., risk, applicable or relevant and appropriate requirement [ARAR], background, or detection limit) as defined in the Operable Unit 5 Feasibility Study Report.
- Column 4 documents the number of samples that have been analyzed for each constituent since the start of IEMP sampling.
- Column 5 notes the number of samples that have had a concentration greater than the FRL for each constituent.
- Column 6 notes the percent of the samples for each constituent that have had a concentration greater than the FRL.
- Column 7 identifies the zones where FRL exceedances have been observed and the number of wells in each zone that had exceedances.
- Column 8 shows the concentration range for each constituent that had FRL exceedances.

As shown in the table, 35 of the constituents have not had any FRL exceedances while 15 of the 50 FRL constituents have had at least one FRL exceedance. Of the 15 constituents having FRL exceedances, the following observations are noted:

- As expected, uranium is by far the predominant constituent of concern with over 25 percent of the sample results exceeding the FRL.
- Two additional constituents have greater than 5 percent of their sample results above the FRL (zinc and manganese).
- Five constituents (nickel, lead, molybdenum, technetium-99, and nitrate) have between 1 and 3 percent of their sample results above their respective FRL.
- Six constituents (boron, carbon disulfide, trichloroethene, antimony, arsenic and fluoride) have more than one FRL exceedance, but have less than 1 percent of their sample results exceeding their respective FRL.
- One constituent, vanadium, has a one-time exceedance in 1998 in one well.

IEMP Groundwater Data for the FRL Exceedances

Figures A–2 through A–17 show the geographic distribution for the 15 constituents with FRL exceedances. These maps show that:

- Uranium is the constituent with the greatest number exceedances in the greatest number of wells. These exceedances have occurred in Zones 1 through 4.
- Both zinc and manganese have exceedances in Zones 0 through 4 in 40 and 32 wells, respectively. The remaining 12 constituents have exceedances in fewer than 12 wells, with vanadium having an exceedance in only one well.

- Five constituents have exceedances in only one zone. They are boron – Zone 2 (South Field); molybdenum – Zone 1 (waste storage area); mercury – Zone 3 (former Plant 6 area); vanadium –Zone 0, and technetium-99 – Zone 1 (waste storage area).
- Five constituents (boron, molybdenum, nitrate/nitrite, uranium, and trichloroethene) have exceedances solely inside the Waste Storage Area (Phase II) remediation footprint; nine constituents have exceedances both inside and outside the footprint; and vanadium has an exceedance in one well outside the footprint.

With the exception of uranium, these constituents had exceedances in a limited number of wells, and the spatial distribution of these exceedances indicates many of these constituents are not associated with a plume.

Table A–2 identifies the frequency of FRL exceedances for each well and constituent that had an exceedance since the inception of the IEMP. This table contains the following information:

- Column 1 lists the 15 non-uranium constituents which have had FRL exceedances since the inception of the IEMP.
- Column 2 lists the wells that have FRL exceedances for each of the constituents.
- Column 3 identifies the corresponding zone for each well with an exceedance.
- Column 4 identifies the frequency with which each constituent is monitored at the well of interest.
- Columns 5 through 9 show for each year and quarter (August 1997 through December 2005) the distribution of each constituent/well FRL exceedance. An "X" indicates when an exceedance occurred.

From review of Table A–2, the following observations can be made for the non-uranium constituents with more than one FRL exceedance:

- Since 2001 there were fewer FRL exceedances than for the previous years.
- The reduction in the number of exceedances starting in 2001 is particularly striking for metals.
- Most constituents do not have concentrations that are consistently above their respective FRLs. The constituents with consistent exceedances include: boron (Zone 2), manganese (Zones 0, 1, and 3), molybdenum (Zone 1), nickel (Zone 3), nitrate/nitrite (Zone 1), technetium-99 (Zone 1), trichloroethene (Zone 1), and zinc (Zones 0 and 2).

  Note: Consistent exceedances are considered to be any constituent/well combination that has at least four consecutive exceedances. Sampling frequencies, which are identified in Table A–2, have been factored into this evaluation.

<u>Conclusions</u>

The information presented in the referenced tables and figures identifies the general absence of FRL exceedances for many of the FRL constituents since the inception of IEMP sampling. This absence of FRL exceedances resulted in the 2003 revision to the IEMP groundwater sampling program, allowing for focus on the constituents that continue to exceed their respective FRLs. In revising the sampling program, the modeling approach was taken to ensure the continued achievement of the groundwater sampling program objectives. Constituents with FRL exceedances will continue to be monitored in order to track the progress of the remedy and to determine whether it is necessary to change the design of the aquifer remedy. Additionally, continued monitoring of constituents that have not had FRL exceedances will ensure that remediation of the source operable units is not adversely impacting aquifer conditions. Monitoring requirements will also continue to satisfy regulatory commitments and administrative requirements.

3.0 Monitoring Approach

This section provides the details associated with the monitoring approach:

- Section 3.1 – Monitoring FRL constituents with exceedances.
- Section 3.2 – Monitoring FRL constituents without exceedances.
- Section 3.3 – Monitoring to satisfy regulatory commitments and administrative requirements.

Each section provides the constituents to be monitored along with sampling frequencies and locations.

3.1 Monitoring FRL Constituents with Exceedances

The current monitoring approach was implemented in January 2003. Prior to January 2003, constituents with exceedances had been monitored as frequently as quarterly or at least annually. Slow groundwater flow rates and the resultant slow plume migration rates justify going to a semiannual sampling schedule. Specifically, on average the uranium contamination only travels 33–83 feet per year. Therefore, monitoring semiannually should be sufficient to track the groundwater remedy.

To successfully address the monitoring of constituents with FRL exceedances, two criteria were considered: geographic location (i.e., zones) of exceedances; and consistency and recentness of exceedances.

For the 15 constituents shown to have exceedances, the following monitoring is recommended:

1. Uranium, which is the primary constituent of concern and has the greatest number of wells with exceedances, will be monitored sitewide. Monitoring locations are presented in Figure A–18. Review of Figure A–18 indicates that the spatial distribution and density of monitoring wells will be sufficient to ensure that remedy performance is successfully monitored.

2. Constituents that have FRL exceedances in multiple zones (i.e., antimony, arsenic, fluoride, lead, manganese, nickel, and zinc) will be monitored as follows:

    - At a minimum, all constituents will be monitored at locations that include existing property boundary/on-site disposal facility wells along the eastern perimeter of the site and those wells along the eastern/southern boundary of the South Plume. Area C in Figure A–19 shows the configuration of this monitoring network, which lies in Zones 0, 2, 3, and 4, and outside of the 10-year, time-of-travel remediation footprint. Monitoring at these locations will ensure that the progress of the remedy is being tracked and will help determine whether to change the design of the aquifer remedy.

Note: Carbon disulfide and nitrate/nitrite are considered to have legitimate exceedances in Zone 1 only. They are discussed below (item #3).

- In addition to being monitored in Zones 0, 2, 3, and 4, constituents that have exceedances in multiple zones were evaluated with respect to Zone 1 to determine if monitoring should be conducted to address consistent/recent exceedances in this area. Monitoring will be addressed in this zone, in addition to the monitoring at the property/plume boundary, to ensure that the constituents exhibiting consistent/recent exceedances are being monitored near potential sources. From review of Table A–2, it appears that only manganese in Zone 1 has recent and consistent exceedances. Therefore, it will be monitored in this zone at wells that have exceedances. Refer to Area A in Figure A–19 for the locations to be monitored in Zone 1. In addition to manganese, nickel had an exceedance in 2002. Nickel will also be monitored in Zone 1.

3. Constituents that have FRL exceedances in only one zone will be monitored only in that zone. In Zone 1, carbon disulfide, molybdenum, nitrate/nitrite, technetium-99, and trichloroethene will be monitored; boron will be monitored in Zone 2 (South Field). Specific monitoring locations will be based on the wells that have exceedances. Refer to Areas A and B in Figure A–19 for the monitoring locations for these constituents in Zones 1 and 2.

   Note: Carbon disulfide has exceedances primarily in Zone 1. The two wells with exceedances outside Zone 1 were property boundary Wells 2432 and 3069. These wells were sampled quarterly and exceedances were minimally above the FRL (6 µg/L with respect to the 5.5 µg/L FRL). For Well 2432, there have been no additional exceedances since the occurrence during first quarter 1999. With regard to the one exceedance that occurred during fourth quarter 2001 for Well 3069, a duplicate result during the sampling event was below the FRL (refer to Figure A–5). No additional exceedances for carbon disulfide have occurred at Well 3069 since 2001.

4. Nitrate/nitrite has exceedances primarily in Zone 1. One well, 2017, which is located in Zone 2, had a one-time exceedance in 1998.

5. Vanadium had a one-time exceedance in 1998 during IEMP quarterly sampling at one well, 2426 (refer to Table A–2). This constituent will be monitored less frequently than semiannually due to the lack of exceedances. Monitoring for this constituent is addressed in Section A.3.2.

Summary
Table A–3 consolidates the information above pertaining to non-uranium constituents that have FRL exceedances and identifies whether these constituents have single or multiple zone exceedances. The table also identifies the constituents that have consistent/recent exceedances and the monitoring program under which these constituents will be monitored.

The monitoring program ensures that all FRL exceedances are monitored at sufficient frequencies (semiannually) and locations, that the remedy progress is being tracked, that monitoring near potential sources is occurring, and that data are being collected to determine whether the remedy needs to be modified. Specifically, uranium will be monitored sitewide to track the overall remedy and determine when restoration is complete. Monitoring for non-uranium constituents both inside and outside the Waste Storage Area (Phase II) remediation footprint is addressed by sampling constituents with the following criteria:

- Those with exceedances occurring in only one zone. This sampling addresses the objectives of monitoring near potential sources and tracking of remedy progress.
- Those with exceedances occurring in multiple zones at the property/plume boundary, which encompasses Zones 0, 2, 3, and 4. This sampling tracks remedy progress and indicates whether a change to the remedy is necessary. Additionally, sampling for constituents with multiple-zone exceedances that prove to be consistent/recent in Zone 1 will be performed near potential sources to track the remedy progress.

3.2 Monitoring FRL Constituents without Exceedances

As presented in the Fernald Groundwater Certification Plan, (DOE 2006) non-uranium FRL constituents with no exceedances since the inception of the IEMP will no longer be monitored every five years. They will be monitored for again during the first quarter of the third year of Stage III "Certification/Attainment Monitoring" as part of a streamlined confirmation strategy. All FRL constituents were monitored in 2001 at approximately 90 locations, with the exception of the two dioxins and chromium VI, which were sampled at 19 and five locations respectively. The lack of exceedances identified in this extensive 2001 sampling effort, along with the Fernald-area groundwater flow rates, justify the streamlined confirmation strategy presented in the Fernald Groundwater Certification Plan.

The following are some specific monitoring requirements for dioxins (i.e., octachlorodibenzo-p-dioxin and 2,3,7,8-tetrachlorodibenzo-p-dioxin) and chromium VI:

- Streamlined confirmation for dioxin will only take place in the waste storage area. In 2001, 19 locations (2008, 2009, 2010, 2016, 2032, 2027, 2045, 2046, 2048, 2385, 2648, 2649, 2821, 3009, 3032, 3045, 3046, 3385, and 3821) were monitored (refer to DOE letter #DOE-0642-01, "Request to Reduce the Number of IEMP Groundwater Monitoring Wells to be Sampled for Dioxin," dated June 13, 2001 [DOE 2001b]). Of the 19 locations that were sampled for dioxins in 2001, none had detected dioxin results.
- Even though re-injection was discontinued in late 2004, streamlined confirmation for chromium VI will still take place in Monitoring Wells 22301, 22302, and 22303. These wells are located within 25 feet of the once active re-injection wells.

3.3 Monitoring to Satisfy Regulatory Commitments and Administrative Requirements

The monitoring protocol outlined in Sections 3.1 and 3.2 will satisfy regulatory requirements currently identified in Section 3, Table 3–1. The following will be continued:

- Routine monitoring to ensure remedy performance and to evaluate impacts of remediation activities to the Great Miami Aquifer.
- Monitoring private wells to evaluates the contribution of the groundwater pathway to the annual dose to the public.
- Routine sampling of the South Plume wellfield in terms of the total volume extracted and the amount of uranium removed.

With respect to administrative requirements, monitoring for Paddys Run Road Site constituents will continue. With respect to constituents and locations, no change will be made to the current Paddys Run Road Site sampling program (refer to the shaded part of Area C in Figure A–19 for monitoring locations). Monitoring will be conducted semiannually concurrently with the property/plume boundary sampling activity. Sampling for Paddys Run Road Site plume constituents (i.e., phosphorous, arsenic, potassium, sodium, benzene, ethyl benzene, isopropyl benzene, toluene, and total xylene) will continue in order to document the influence, or lack thereof, that remedial groundwater pumping is having on the Paddys Run Road Site plume.

4.0 Conclusions

The sampling approach is considered conservative because constituents that had FRL exceedances during sampling under the IEMP will be monitored semiannually in areas of concern. Additionally, those constituents that have not exceeded their FRL will be included in a streamlined confirmation as part of the Fernald Groundwater Certification Process. The sampling activities will still ensure that the groundwater sampling program objectives of satisfying regulatory commitments, developing and using representative monitoring constituent lists to successfully track remedy progress, and ultimately determining when groundwater restoration activities are complete will continue to be met.

5.0 References

DOE (U.S. Department of Energy), 1995a. *Feasibility Study Report for Operable Unit 5*, Final, Fernald Environmental Management Project, Cincinnati, Ohio, June.

DOE (U.S. Department of Energy), 1995b. *Remedial Investigation Report for Operable Unit 5*, Final, Fernald Environmental Management Project, Cincinnati, Ohio.

DOE (U.S. Department of Energy), 1997. *Integrated Environmental Monitoring Plan*, 2505-WP-0022, Revision 0, Final, Fernald Environmental Management Project, Cincinnati, Ohio.

DOE (U.S. Department of Energy), 2001a. *Integrated Environmental Monitoring Plan*, 2505-WP-0022, Revision 2, Final, Fluor Fernald, Cincinnati, Ohio, January.

DOE (U.S. Department of Energy), 2001b. "Request to Reduce the Number of IEMP Groundwater Monitoring Wells to be Sampled for Dioxin," letter #DOE-0642-01, Fluor Fernald, Cincinnati, Ohio, June 13.

DOE (U.S. Department of Energy), 2003. *Integrated Environmental Monitoring Plan*, 2505-WP-0022, Revision 3, Final, Fluor Fernald, Cincinnati, Ohio, January.

DOE (U.S. Department of Energy), 2005. *Integrated Environmental Monitoring Plan*, 2505-WP-0022, Revision 4, Final, Fluor Fernald, Cincinnati, Ohio, January.

DOE (U.S. Department of Energy), 2006. *Fernald Groundwater Certification Plan*, 51900-PL-0002, Revision 1, Final, Fluor Fernald, Cincinnati, Ohio, April

Table A–1. Groundwater FRL Exceedances Based on Samples and Locations Since IEMP Inception (from August 1997 through 2006)

(1) Constituent	(2) Groundwater FRL[a]	(3) Basis for FRL[b]	(4) No. of Samples[c]	(5) No. of Samples >FRL[c,d]	(6) Percent of Samples >FRL	(7) Zones with FRL Exceedances (No. of Wells with Exceedances in each Aquifer Zone)[c,d,e]	(8) Range above FRL[c,d,e]
Uranium, Total	30 µg/L	A	4538	1155	25.45%	1(19) 2(38) 3(3) 4(16)	30.13 J/1240 NV
Zinc	0.021 mg/L	B	1267	81	6.39%	0(10) 1(5) 2(14) 3(5) 4(2)	0.0212 NV/13.6 -
Manganese	0.90 mg/L	B	1479	96	6.49%	0(5) 1(6) 2(10) 3(5) 4(4)	0.916 -/105 J
Nickel	0.10 mg/L	A	1301	20	1.54%	0(1) 1(1) 2(7) 3(1)	0.101 -/1.54 -
Technetium-99	94 pCi/L	R*	1532	35	2.28%	1(3)	101.08 -/1352.266 J
Nitrate[f]	11 mg/L	B	1923	38	1.98%	1(5) 2(1)[g]	11.4 -/331 NV
Lead	0.015 mg/L	A	1276	13	1.09%	0(2) 1(2) 2(4) 3(2)	0.0157 -/0.201 -
Arsenic	0.050 mg/L	A	1494	14	0.94%	0(1) 1(1) 2(1) 4(4)	0.051 -/0.125 -
Molybdenum	0.10 mg/L	A	835	13	1.56%	1(1)	0.207 -/0.69 -
Boron	0.33 mg/L	R	2065	15	0.73%	2(2)	0.331 -/1.16 -
Antimony	0.0060 mg/L	A	1277	9	0.70%	0(4) 1(1) 2(2)4(1)	0.00601 -/0.0196 J
Trichloroethene	0.0050 mg/L	A	1392	13	0.93%	1(2)	0.0207 -/0.120 -
Carbon disulfide	0.0055 mg/L	A	1023	6	0.59%	0(1)[h] 1(3) 2(1)[h]	0.006 -/0.014 -
Fluoride	4 mg/L	A	1497	4	0.27%	0(2) 1(1) 3(1)	5.3 -/12.3 -
Vanadium	0.038 mg/L	R	951	1	0.11%	0(1)	0.0664 J[i]
1,1-Dichloroethane	0.28 mg/L	A	86	0	0%	NA	NA
1,1-Dichloroethene	0.0070 mg/L	A	565	0	0%	NA	NA
1,2-Dichloroethane	0.0050 mg/L	A	704	0	0%	NA	NA
2,3,7,8-Tetrachlorodibenzo-p-dioxin	0.000010 mg/L	D	19	0	0%	NA	NA
4-Methylphenol	0.029 mg/L	R	86	0	0%	NA	NA
4-Nitrophenol	0.32 mg/L	R	86	0	0%	NA	NA
alpha-Chlordane	0.0020 mg/L	A	772	0	0%	NA	NA
Aroclor-1254	0.00020 mg/L	D	86	0	0%	NA	NA
Barium	2.0 mg/L	A	194	0	0%	NA	NA
Benzene	0.0050 mg/L	A	947	0	0%	NA	NA
Beryllium	0.0040 mg/L	A	877	0	0%	NA	NA
bis(2-Chloroisopropyl) ether	0.0050 mg/L	D	459	0	0%	NA	NA
bis(2-Ethylhexyl)phthalate	0.0060 mg/L	A	86	0[j]	0%	NA[j]	NA
Bromodichloromethane	0.10 mg/L	A	771	0	0%	NA	NA
Bromomethane	0.0021 mg/L	R	86	0	0%	NA	NA
Cadmium	0.014 mg/L	B	994	0	0%	NA	NA

Table A–1 Groundwater FRL Exceedances Based on Samples and Locations Since IEMP Inception (from August 1997 through 2006) (continued)

(1) Constituents	(2) Groundwater FRL[a]	(3) Basis for FRL[b]	(4) No. of Samples[c]	(5) No. of Samples >FRL[c,d]	(6) Percent of Samples >FRL	(7) Zones with FRL Exceedances (No. of Wells with Exceedances in each Aquifer Zone)[c,d,e]	(8) Range above FRL[c,d,e]
Carbazole	0.011 mg/L	R	459	0	0%	NA	NA
Chloroethane	0.0010 mg/L	D	86	0	0%	NA	NA
Chloroform	0.10 mg/L	A	86	0	0%	NA	NA
Chromium VI	0.022 mg/L	R	16	0	0%	NA	NA
Cobalt	0.17 mg/L	R	878	0	0%	NA	NA
Copper	1.3 mg/L	A	86	0	0%	NA	NA
Mercury	0.0020 mg/L	A	2112	0[k]	0%	NA	NA
Methylene chloride	0.0050 mg/L	A	84	0	0%	NA	NA
Neptunium-237	1.0 pCi/L	R*	1606	0	0%	NA	NA
Octachlorodibenzo-p-dioxin	1.0E-7 mg/L	D	19	0	0%	NA	NA
Radium-226	20 pCi/L	A	194	0	0%	NA	NA
Radium-228	20 pCi/L	A	86	0	0%	NA	NA
Selenium	0.050 mg/L	A	991	0	0%	NA	NA
Silver	0.050 mg/L	A	856	0	0%	NA	NA
Strontium-90	8.0 pCi/L	A	1394	0	0%	NA	NA
Thorium-228	4.0 pCi/L	R*	992	0	0%	NA	NA
Thorium-230	15 pCi/L	R*	86	0	0%	NA	NA
Thorium-232	1.2 pCi/L	R*	902	0	0%	NA	NA
Vinyl chloride	0.0020 mg/L	A	771	0	0%	NA	NA

[a]From Operable Unit 5 Record of Decision, Table 9–4.
[b]From Operable Unit 5 Feasibility Study, Table 2–16:
A = ARAR-based.
B = Based on 95th percentile background concentrations.
D = Based on lowest achievable detection limit.
R = Risk-based Preliminary Remediation Goal (PRG).
R* = Risk-based Preliminary Remediation Level includes the radionuclide risk-based PRG plus its 95th percentile background concentration.
[c]Based on filtered and unfiltered samples from the August 1997 through 2006 IEMP groundwater data.
[d]Sample results having a -, J, or NV qualifier were used.
- = result is confident as reported.
J = result is quantitatively estimated.
NV = result is not validated.
[e]NA = not applicable.
[f]Nitrate/nitrite results are evaluated with respect to the nitrate FRL.
[g]Since the IEMP inception, there has been only one nitrate/nitrite exceedance at Well 2017 (in 1998) (refer to Figure A–12).
[h]Since the IEMP inception, there has been one isolated exceedance for carbon disulfide at two locations (refer to Figure A–5).
[i]Since the IEMP inception, there has been only one vanadium exceedance at Well 2426 (in 1998) (refer to Figure A–16).
[j]Of the 86 samples analyzed for bis(2-Ethylhexyl)phthalate, a common laboratory containment, five had results above the FRL. The FRL results above are all considered suspect due to laboratory analysis issues, laboratory blank and field blank contamination, or field duplicate results being non-detected. The five exceedances are as follows: 0.014J mg/L, Well 2398 and 0.010J mg/L, Well 3390 in Aquifer Zone 2; 0.016J mg/L, Well 2109 in Aquifer Zone 3; and 0.008J mg/L, Well 2125 and 0.13J mg/L, Well 3095 in Aquifer Zone 4.
[k]The mercury exceedance is suspect, due to negative MS/MSD recoveries. In fact, the MS/MSD (i.e., spiked samples) results were both extremely below the original sample result.

Table A-2. Groundwater FRL Exceedances [illegible]m 1997 through 2006 Quarterly/Semiannually

		Aquifer		1997		1998				1999				2000				2001				2002				2003		2004		2005		2006	
Constituent	Well[a]	Zone	Project[b]	3[c]	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	1	2	1	2	1	2
Antimony																																	
	2093	4	P/PB																														
	2128	4	PRRS																														
	21063	4	P/PB																														
	22198	0	OSDF																														
	22199	0	OSDF																														
	22204	0	OSDF																														
	22205	0	OSDF																														
	22208	0	OSDF																								x						
	22210	0	OSDF																														
	22211	0	OSDF																														
	22214	0	OSDF																														
	2398	2	P/PB																														
	2431	0	P/PB																								x						
	2432	0	P/PB																														
	2625	4	PRRS																														
	2636	4	PRRS																									x		x			
	2733	0	P/PB																														
	2898	4	PRRS																														
	2899	4	PRRS																														
	2900	4	PRRS																														
	3070	2	P/PB																														
	3093	4	P/PB																														
	31217	0	P/PB																														
	3128	4	PRRS																														
	3398	2	P/PB																														
	3424	0	P/PB																														
	3426	0	P/PB																														
	3429	0	P/PB																														
	3431	0	P/PB																														
	3432	0	P/PB																														
	3636	4	PRRS																														
	3733	0	P/PB																														
	3898	4	PRRS																														
	3899	4	PRRS																														
	3900	4	PRRS																														
	4398	2	P/PB																														

Table A–2. Groundwater FRL Exceedances from 1997 through 2006 Quarterly/Semiannually (continued)

Constituent	Well[a]	Aquifer Zone	Project[b]	1997		1998				1999				2000				2001				2002				2003		2004		2005		2006	
				3[c]	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	1	2	1	2	1	2
Arsenic																																	
	2093	4	PRRS																														
	2128	4	PRRS																														
	21063	4	P/PB																														
	22198	0	OSDF																														
	22199	0	OSDF																														
	22204	0	OSDF																														
	22205	0	OSDF																														
	22208	0	OSDF																														
	22210	0	OSDF																														
	22211	0	OSDF																														
	22214	0	OSDF																														
	2398	2	P/PB																														
	2431	0	P/PB																														
	2432	0	P/PB																														
	2625	4	PRRS												x																		
	2636	4	PRRS		x	x				x	x											x						x					
	2733	0	P/PB																														
	2898	4	PRRS											x																			
	2899	4	PRRS																														
	2900	4	PRRS											x																			
	3070	2	P/PB																														
	3093	4	P/PB																														
	31217	0	P/PB																														
	3128	4	PRRS																														
	3398	2	P/PB																														
	3424	0	P/PB																														
	3426	0	P/PB																														
	3429	0	P/PB																														
	3431	0	P/PB																														
	3432	0	P/PB																														
	3636	4	PRRS																														
	3733	0	P/PB																														
	3898	4	PRRS																														
	3899	4	PRRS																														
	3900	4	PRRS																														
	4398	2	P/PB																														

Table A–2. Groundwater FRL Exceedances from 19[illegible]ough 2006 Quarterly/Semiannually (continued)

Constituent	Well[a]	Aquifer Zone	Project[b]	1997		1998				1999				2000				2001				2002				2003		2004		2005		2006	
				3[c]	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	1	2	1	2	1	2
Benzene																																	
	2128	4	PRRS																														
	2625	4	PRRS																														
	2636	4	PRRS																														
	2898	4	PRRS																														
	2899	4	PRRS																														
	2900	4	PRRS																														
	3128	4	PRRS																														
	3636	4	PRRS																														
	3898	4	PRRS																														
	3899	4	PRRS																														
	3900	4	PRRS																														
Boron																																	
	2045	2	SF								x		x		x																		
	2049	2	SF	x	x			x	x	x	x	x	x	x	x		x								x								
	22198	0	OSDF																														
	22199	0	OSDF																														
	22204	0	OSDF																														
	22205	0	OSDF																														
	22208	0	OSDF																														
	22210	0	OSDF																														
	22211	0	OSDF																														
	22214	0	OSDF																														
Bromodichloromethane																																	
	22198	0	OSDF																														
	22199	0	OSDF																														
	22204	0	OSDF																														
	22205	0	OSDF																														
	22208	0	OSDF																														
	22210	0	OSDF																														
	22211	0	OSDF																														
	22214	0	OSDF																														
Carbazole																																	
	22198	0	OSDF																														
	22199	0	OSDF																														
	22204	0	OSDF																														
	22205	0	OSDF																														
	22208	0	OSDF																														
	22210	0	OSDF																														
	22211	0	OSDF																														
	22214	0	OSDF																														

Table A–2. Groundwater FRL Exceedances from 1997 through 2006 Quarterly/Semiannually (continued)

		Aquifer		1997		1998				1999				2000				2001				2002				2003		2004		2005		2006	
Constituent	Well[a]	Zone	Project[b]	3[c]	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	1	2	1	2	1	2
Carbon disulfide																																	
	2010	1	WSA																														
	2648	1	WSA																														
	2649	1	WSA						x																								
	2821	1	WSA																														
	3821	1	WSA										x																x				
Alpha-Chlordane																																	
	22198	0	OSDF																														
	22199	0	OSDF																														
	22204	0	OSDF																														
	22205	0	OSDF																														
	22208	0	OSDF																														
	22210	0	OSDF																														
	22211	0	OSDF																														
	22214	0	OSDF																														
Bis(2-Chloroisopropyl)ether																																	
	22198	0	OSDF																														
	22199	0	OSDF																														
	22204	0	OSDF																														
	22205	0	OSDF																														
	22208	0	OSDF																														
	22210	0	OSDF																														
	22211	0	OSDF																														
	22214	0	OSDF																														
1,1-Dichloroethene																																	
	22198	0	OSDF																														
	22199	0	OSDF																														
	22204	0	OSDF																														
	22205	0	OSDF																														
	22208	0	OSDF										x																				
	22210	0	OSDF																														
	22211	0	OSDF																														
	22214	0	OSDF																														
Fluoride																																	
	2093	4	P/PB																														
	2128	4	PRRS																														
	21063	4	P/PB																														
	22198	0	OSDF																														
	22199	0	OSDF																														
	22204	0	OSDF																														
	22205	0	OSDF																														

Table A-2. Groundwater FRL Exceedances from 19[illegible]ugh 2006 Quarterly/Semiannually (continued)

Constituent	Well[a]	Aquifer Zone	Project[b]	1997		1998				1999				2000				2001				2002				2003		2004		2005		2006	
				3[c]	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	1	2	1	2	1	2
Fluoride (Contd)	22208	0	OSDF																														
	22210	0	OSDF																														
	22211	0	OSDF																														
	22214	0	OSDF																														
	2398	2	P/PB																														
	2431	0	P/PB						x																								
	2432	0	P/PB																														
	2625	4	PRRS																														
	2636	4	PRRS																														
	2733	0	P/PB																														
	2898	4	PRRS																														
	2899	4	PRRS																														
	2900	4	PRRS																														
	3070	2	P/PB																														
	3093	4	P/PB																														
	31217	0	P/PB																														
	3128	4	PRRS																														
	3398	2	P/PB																														
	3424	0	P/PB																														
	3426	0	P/PB																														
	3429	0	P/PB																														
	3431	0	P/PB																														
	3432	0	P/PB																														
	3636	4	PRRS																														
	3733	0	P/PB																														
	3898	4	P/PB																														
	3899	4	P/PB																														
	3900	4	P/PB																														
	4398	2	P/PB																														
Lead																																	
	2093	4	P/PB																														
	2128	4	PRRS																														
	21063	4	P/PB																														
	22198	0	OSDF																														
	22199	0	OSDF																														
	22204	0	OSDF																														
	22205	0	OSDF																														
	22208	0	OSDF																														
	22210	0	OSDF																														
	22211	0	OSDF																														
	22214	0	OSDF																														

Table A-2. Groundwater FRL Exceedances from 1997 through 2006 Quarterly/Semiannually (continued)

Constituent	Well[a]	Aquifer Zone	Project[b]	1997		1998				1999				2000				2001				2002				2003		2004		2005		2006	
				3[c]	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	1	2	1	2	1	2
Lead (Cont.)																																	
	2398	2	PRRS																														
	2431	0	PRRS											x																			
	2432	0	PRRS																														
	2625	4	PRRS																														
	2636	4	PRRS																														
	2733	0	PRRS																														
	2898	4	PRRS																														
	2899	4	PRRS																														
	2900	4	PRRS																														
	3070	2	P/PB																														
	3093	4	P/PB																														
	31217	0	P/PB																														
	3128	4	PRRS																														
	3398	2	P/PB																														
	3424	0	P/PB																														
	3426	0	P/PB																														
	3429	0	P/PB																														
	3431	0	P/PB																														
	3432	0	P/PB																														
	3636	4	PRRS																														
	3733	0	P/PB	x													x																
	3898	4	PRRS																														
	3899	4	PRRS																														
	3900	4	PRRS																														
	4398	2	P/PB																														
Manganese																																	
	2010	1	WSA													x				x						x	x	x	x		x	x	x
	2093	4	P/PB																														
	2128	4	PRRS																														
	21063	4	P/PB																														
	22198	0	OSDF																					x									
	22199	0	OSDF																														
	22204	0	OSDF																							x			x	x	x	x	x
	22205	0	OSDF																												x		
	22208	0	OSDF																														
	22210	0	OSDF																														
	22211	0	OSDF																														
	22214	0	OSDF																														
	2398	2	P/PB																														
	2431	0	P/PB			x	x																										
	2432	0	P/PB														x			x	x		x			x							
	2625	4	PRRS																														
	2636	4	PRRS																														

Table A-2. Groundwater FRL Exceedances from [illegible] through 2006 Quarterly/Semiannually (continued)

Constituent	Well[a]	Aquifer Zone	Project[b]	1997		1998				1999				2000				2001				2002				2003		2004		2005		2006	
				3[c]	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	1	2	1	2	1	2
Manganese (Cont.)	**2648**	1	WSA		x				x				x		x				x				x						x	x		x	
	2649	1	WSA																														
	2733	0	P/PB																														
	2821	1	WSA																														
	2898	4	PRRS																				x					x					
	2899	4	PRRS													x																	
	2900	4	PRRS													x																	
	3070	2	P/PB																														
	3093	4	P/PB																														
	31217[d]	0	P/PB																														
	3128	4	PRRS																														
	3398	2	P/PB																														
	3424	0	P/PB																														
	3426	0	P/PB																														
	3429	0	P/PB																														
	3431	0	P/PB																														
	3432	0	P/PB																														
	3636	4	PRRS																														
	3733	0	P/PB																														
	3821	1	WSA										x		x				x				x			x	x	x			x	x	
	3898	4	PRRS																														
	3899	4	PRRS																														
	3900	4	PRRS																														
	4398	2	P/PB																														
	83337_C1	1	WSA																														
	83337_C2	1	WSA																														
	83337_C3	1	WSA																														
	83338_C1	1	WSA																														
	83338_C2	1	WSA																														
	83338_C3	1	WSA																														
Mercury																																	
	22198	0	OSDF																														
	22199	0	OSDF																														
	22204	0	OSDF																														
	22205	0	OSDF																														
	22208	0	OSDF																														
	22210	0	OSDF																														
	22211	0	OSDF																														
	22214	0	OSDF																														

Table A–2. Groundwater FRL Exceedances from 1997 through 2006 Quarterly/Semiannually (continued)

		Aquifer		1997		1998				1999				2000				2001				2002				2003		2004		2005		2006	
Constituent	Well[a]	Zone	Project[b]	3[c]	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	1	2	1	2	1	2
Molybdenum																																	
	2010	1	WSA																														
	2648	1	WSA																														
	2649	1	WSA	x					x				x		x				x				x			x	x	x	x	x	x	x	
	2821	1	WSA																														
	3821	1	WSA																														
	83337_C1	1	WSA																														
	83337_C2	1	WSA																														
	83337_C3	1	WSA																														
	83338_C1	1	WSA																														
	83338_C2	1	WSA																														
	83338_C3	1	WSA																														
Nickel																																	
	2093	4	P/PB																														
	2128	4	PRRS																														
	21063	4	P/PB																														
	22198	0	OSDF										x																				
	22199	0	OSDF																														
	22204	0	OSDF																														
	22205	0	OSDF																														
	22208	0	OSDF																														
	22210	0	OSDF																														
	22211	0	OSDF																														
	22214	0	OSDF																														
	2398	2	P/PB	x		x	x	x	x			x	x																				
	2431	0	P/PB																														
	2432	0	P/PB																														
	2625	4	PRRS																														
	2636	4	PRRS																														
	2733	0	P/PB																														
	2898	4	PRRS																														
	2899	4	PRRS																														
	2900	4	PRRS																														
	3070	2	P/PB																														
	3093[d]	4	P/PB																														
	31217	0	P/PB																														
	3128	4	PRRS																														
	3398	2	P/PB																														
	3424	0	P/PB																														
	3426	0	P/PB																														
	3429	0	P/PB																														

Table A-2. Groundwater FRL Exceedances from [illegible] through 2006 Quarterly/Semiannually (continued)

Constituent	Well[a]	Aquifer Zone	Project[b]	1997		1998				1999				2000				2001				2002				2003		2004		2005		2006	
				3[c]	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	1	2	1	2	1	2
Nickel (Cont.)	**3431**	0	P/PB																														
	3432	0	P/PB																														
	3636	4	PRRS																														
	3733	0	P/PB																														
	3898	4	PRRS																														
	3899	4	PRRS																														
	3900	4	PRRS																														
	4398	2	P/PB							x				x																			
	83337_C1	1	WSA																														
	83337_C2	1	WSA																														
	83337_C3	1	WSA																														
	83338_C1	1	WSA																														
	83338_C2	1	WSA																														
	83338_C3	1	WSA																														
Nitrate/Nitrite																																	
	2010	1	WSA																														
	2648	1	WSA				x						x		x			x									x	x	x			x	
	2649	1	WSA		x		x		x		x		x		x		x	x	x	x	x	x	x		x	x	x	x	x		x	x	
	2821	1	WSA										x													x				x		x	x
	3821	1	WSA														x				x										x		
	83337_C1	1	WSA																														
	83337_C2	1	WSA																														
	83337_C3	1	WSA																														
	83338_C1	1	WSA																														
	83338_C2	1	WSA																														
	83338_C3	1	WSA																														
Technetium-99																																	
	2010	1	WSA																														
	22198	0	OSDF																														
	22199	0	OSDF																														
	22204	0	OSDF																														
	22205	0	OSDF																														
	22208	0	OSDF																														
	22210	0	OSDF																														
	22211	0	OSDF																														
	22214	0	OSDF																														
	2648	1	WSA										x					x	x							x							
	2649	1	WSA		x		x		x		x		x		x		x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	
	2821	1	WSA										x												x	x	x	x	x	x	x	x	x
	3821	1	WSA																														
	83337_C1	1	WSA																														

Table A–2. Groundwater FRL Exceedances from 1997 through 2006 Quarterly/Semiannually (continued)

Constituent	Well[a]	Aquifer Zone	Project[b]	1997		1998				1999				2000				2001				2002				2003		2004		2005		2006	
				3[c]	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	1	2	1	2	1	2
Technetium-99 (cont.)	83337_C2	1	WSA																														
	83337_C3	1	WSA																														
	83338_C1	1	WSA																														
	83338_C2	1	WSA																														
	83338_C3	1	WSA																														
Trichloroethene																																	
	2010	1	WSA																														
	22198	0	OSDF																														
	22199	0	OSDF																														
	22204	0	OSDF																														
	22205	0	OSDF																														
	22208	0	OSDF																														
	22210	0	OSDF																														
	22211	0	OSDF																														
	22214	0	OSDF																														
	2648	1	WSA																														
	2649	1	WSA						x				x		x				x				x			x	x	x	x	x	x	x	
	2821	1	WSA																														
	3821	1	WSA																														
Vinyl Chloride																																	
	22198	0	OSDF																														
	22199	0	OSDF																														
	22204	0	OSDF																														
	22205	0	OSDF																														
	22208	0	OSDF																														
	22210	0	OSDF																														
	22211	0	OSDF																														
	22214	0	OSDF																														
Zinc																																	
	2093	4	P/PB																														
	2128	4	PRRS																														
	21063	4	P/PB																														
	22198	0	OSDF																														
	22199	0	OSDF																							x							
	22204	0	OSDF																							x							
	22205	0	OSDF																														
	22208	0	OSDF																														
	22210	0	OSDF																											x		x	
	22211	0	OSDF																														
	22214	0	OSDF																														
	2398	2	P/PB				x																										

Table A-2. Groundwater FRL Exceedances from 1997 through 2006 Quarterly/Semiannually (continued)

Constituent	Well[a]	Aquifer Zone	Project[b]	1997		1998				1999				2000				2001				2002				2003		2004		2005		2006	
				3[c]	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	1	2	1	2	1	2
Zinc (Cont.)	**2431**	0	P/PB					x	x					x																			
	2432	0	P/PB							x				x			x																
	2625	4	PRRS																														
	2636	4	PRRS																														
	2733	0	P/PB								x																						
	2898	4	PRRS																														
	2899	4	PRRS																														
	2900	4	PRRS													x												x					
	3070	2	P/PB																														
	3093	4	P/PB																														
	31217	0	P/PB																														
	3128	4	PRRS																											x			
	3398	2	P/PB																														
	3424	0	P/PB																														
	3426	0	P/PB								x		x																				
	3429	0	P/PB							x	x																						
	3431	0	P/PB																			x											
	3432	0	P/PB																														
	3636	4	PRRS																														
	3733	0	P/PB																							x							
	3898	4	PRRS																														
	3899	4	PRRS																x														
	3900	4	PRRS																														

Note: Shading indicates well is outside the Waste Storage Area (Phase-II) design remediation footprint.
[a]As defined in the IEMP, Rev. 3, all monitoring is now semiannual. Well numbers that are **bold** have historical FRL exceedances.
[b]WSA = Waste Storage Area
SF = South Field
P/PB = Property/Plume Boundary for FRL Exceedances
PRRS = Property/Plume Boundary for Paddys Run Road Site
OSDF = Property/Plume Boundary for on-site disposal facility
[c]Sampling for the IEMP was initiated in August 1997.

Table A-3. IEMP Non-Uranium Constituents with FRL Exceedances, Location of Exceedances, and Revised Monitoring Program

Parameter	Aquifer Zones with Exceedances	Monitoring Program
Antimony	Multiple Zones	Property/Plume Boundary
Arsenic	Multiple Zones	Property/Plume Boundary
Boron	Aquifer Zone 2 (South Field)	South Field
Carbon Disulfide	Aquifer Zone 1 (Waste Storage Area)	Waste Storage Area
Fluoride	Multiple Zones	Property/Plume Boundary
Lead	Multiple Zones	Property/Plume Boundary
Manganese	Multiple Zones[a]	Property/Plume Boundary, Waste Storage Area
Molybdenum	Aquifer Zone 1 (Waste Storage Area)	Waste Storage Area
Nickel	Multiple Zones	Property/Plume Boundary Waste Storage Area
Nitrate/Nitrite	Aquifer Zone 1 (Waste Storage Area)	Waste Storage Area
Technetium-99	Aquifer Zone 1 (Waste Storage Area)	Waste Storage Area
Trichloroethene	Aquifer Zone 1 (Waste Storage Area)	Waste Storage Area
Zinc	Multiple Zones	Property/Plume Boundary

[a]There are consistent/recent exceedances of manganese in Zone 1; therefore, this constituent will be monitored in the waste storage area.

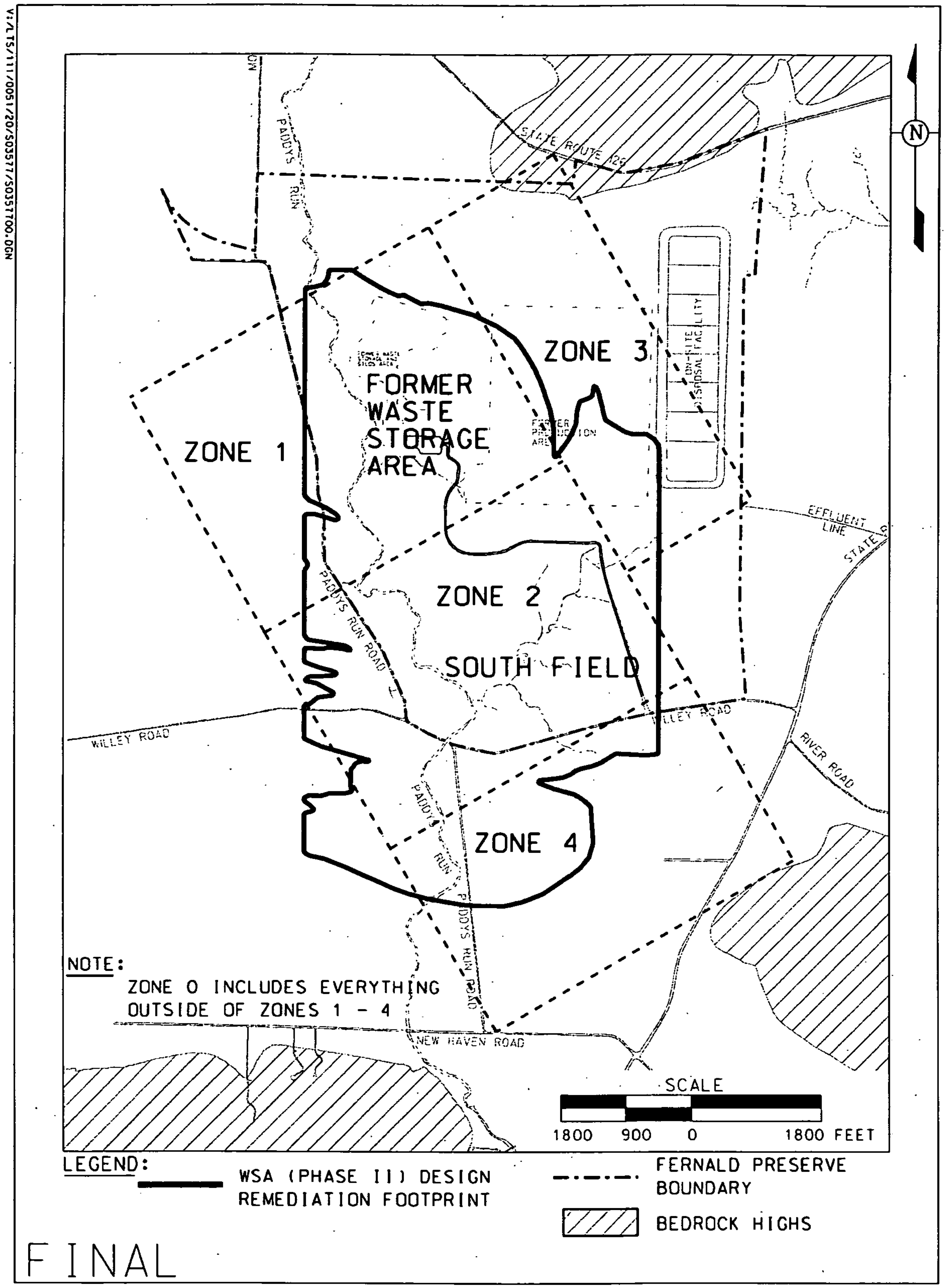

Figure A–1. Groundwater Aquifer Zones and Aquifer Restoration Footprint

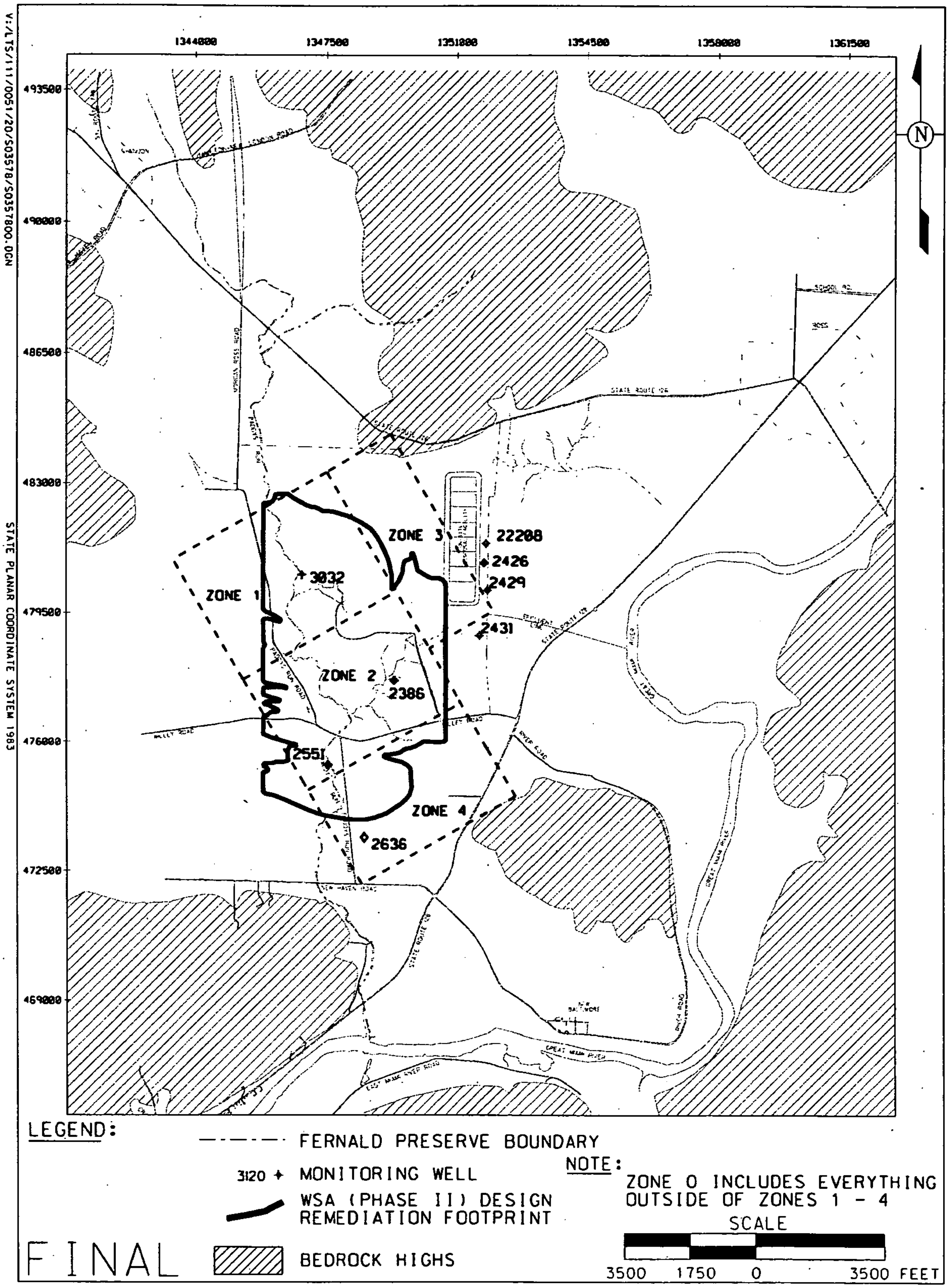

Figure A–2. Monitoring Well Locations with Concentrations Above the FRL for Antimony

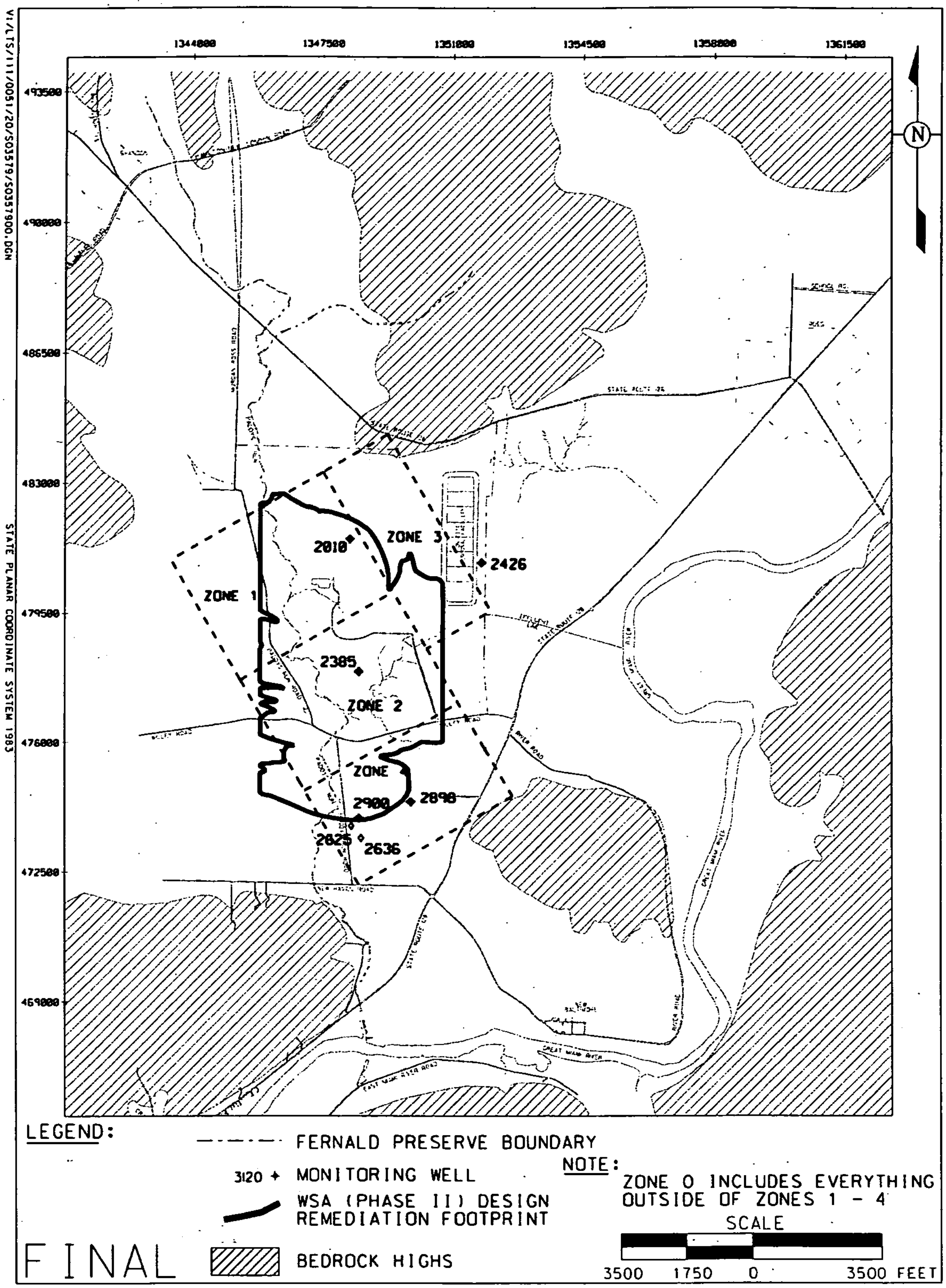

Figure A–3. Monitoring Well Locations with Concentrations Above the FRL for Arsenic

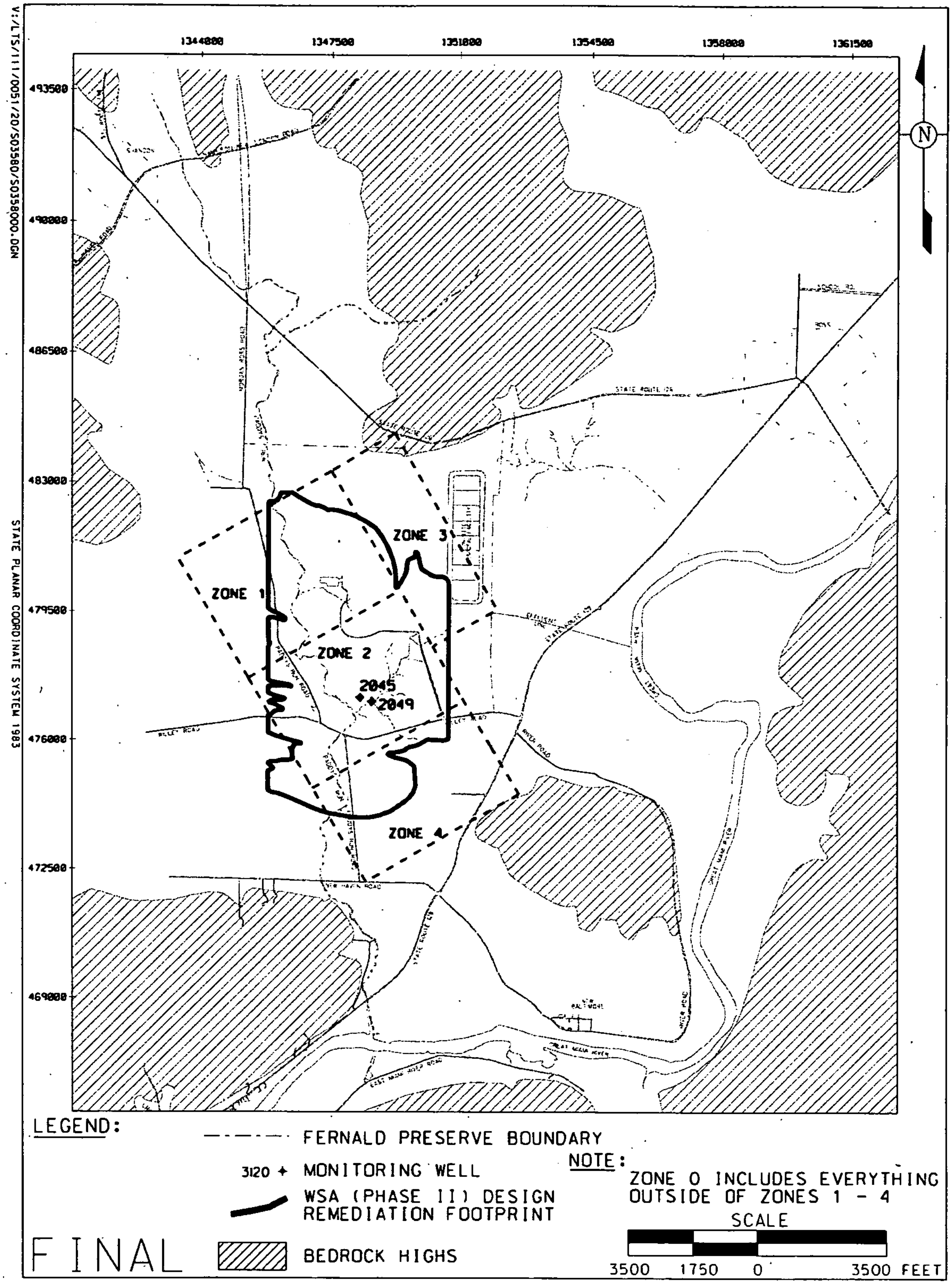

Figure A–4. Monitoring Well Locations with Concentrations Above the FRL for Boron

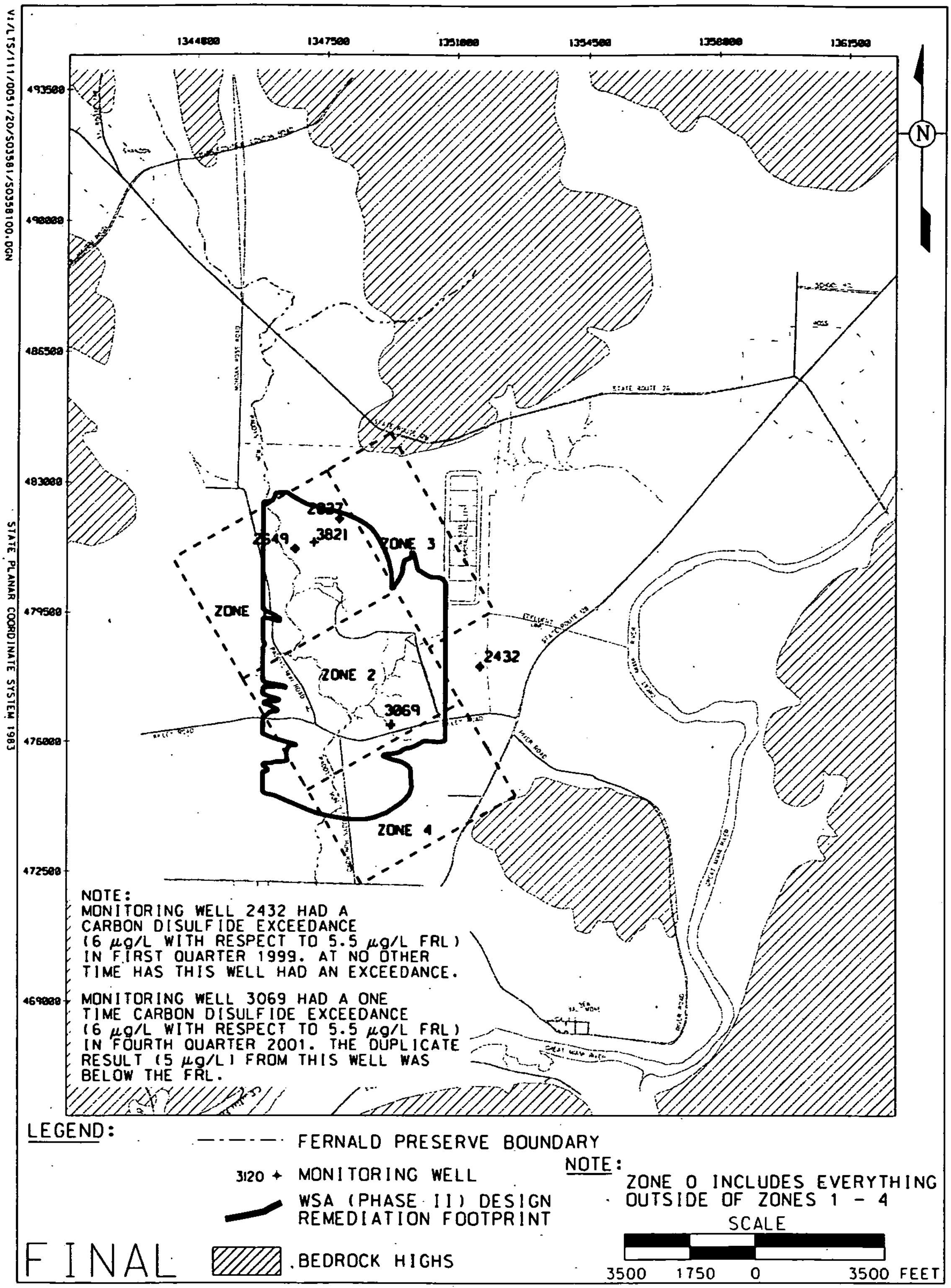

Figure A–5. Monitoring Well Locations with Concentrations Above the FRL for Carbon Disulfide

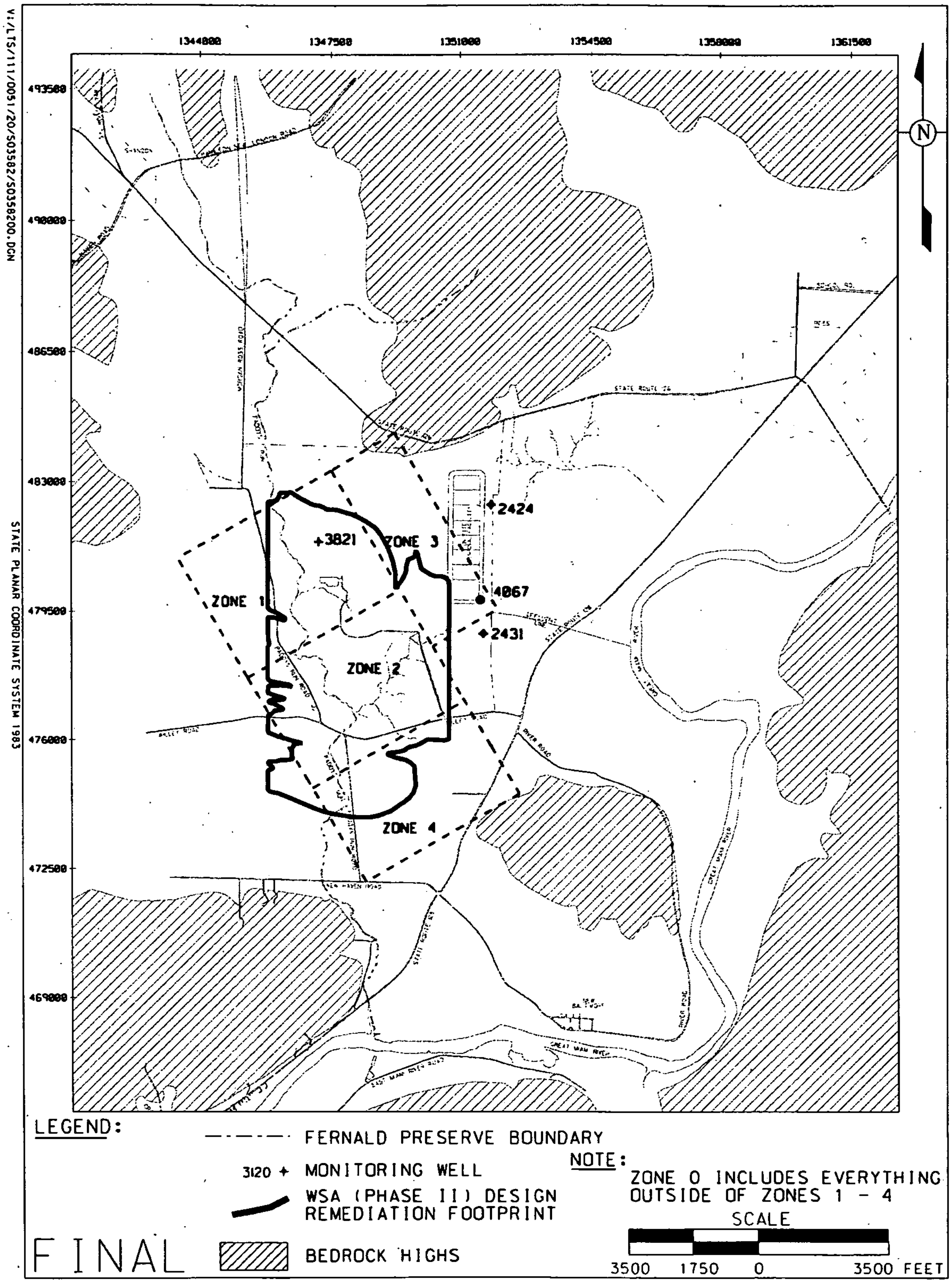

Figure A–6. Monitoring Well Locations with Concentrations Above the FRL for Flouride

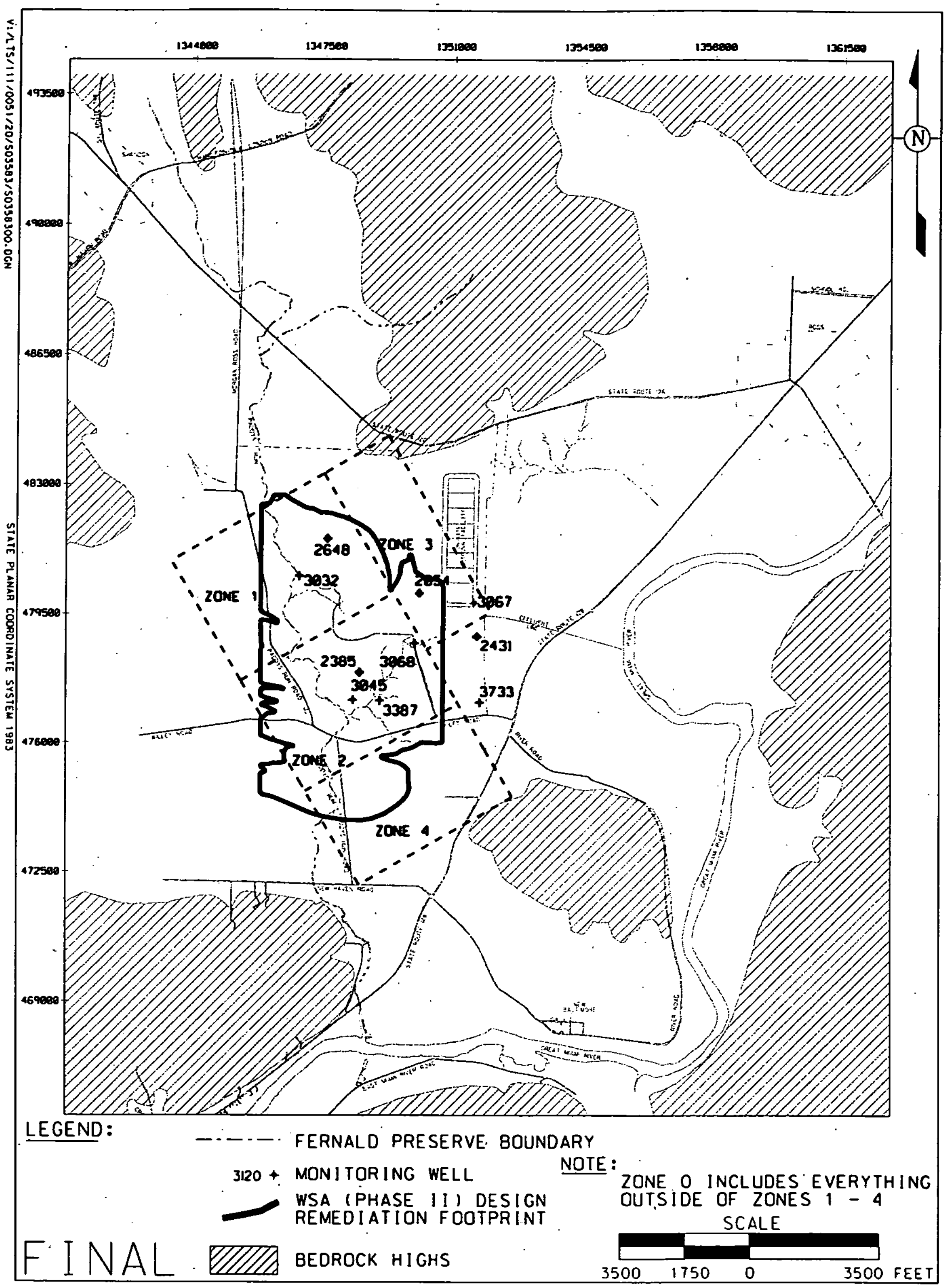

Figure A–7. Monitoring Well Locations with Concentrations Above the FRL for Lead

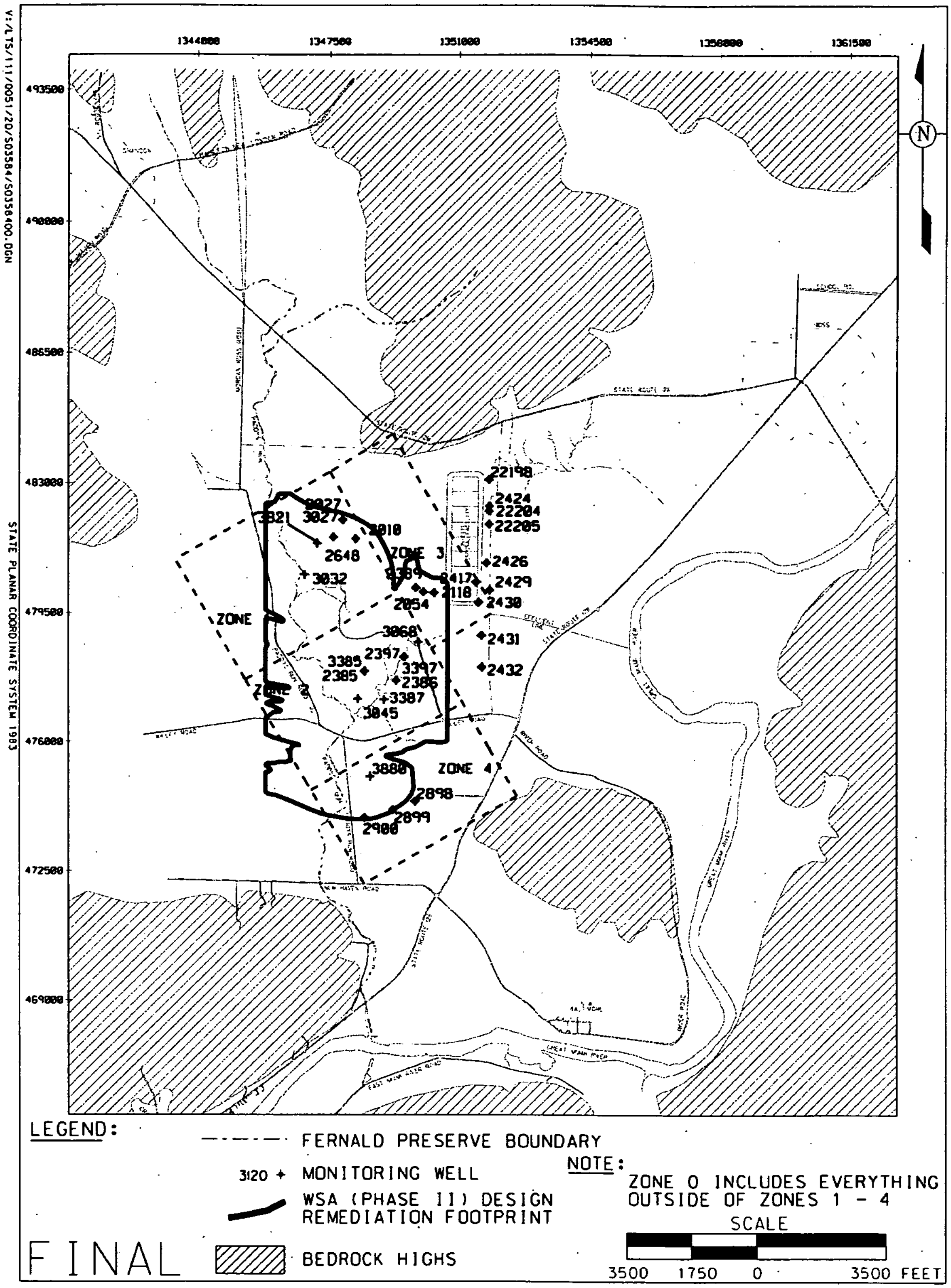

Figure A–8. Monitoring Well Locations with Concentrations Above the FRL for Manganese

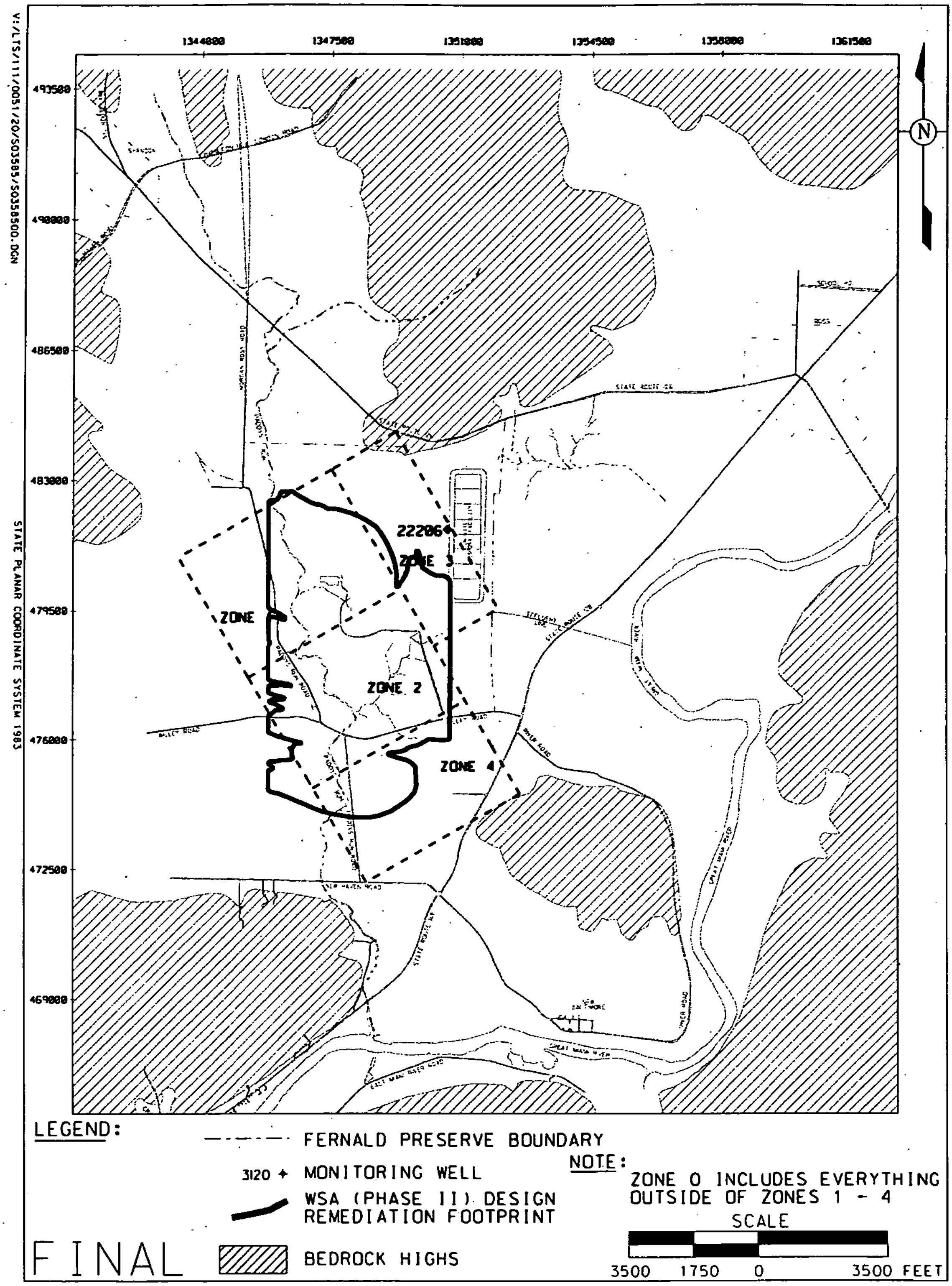

Figure A–9. Monitoring Well Locations with Concentrations Above the FRL for Mercury

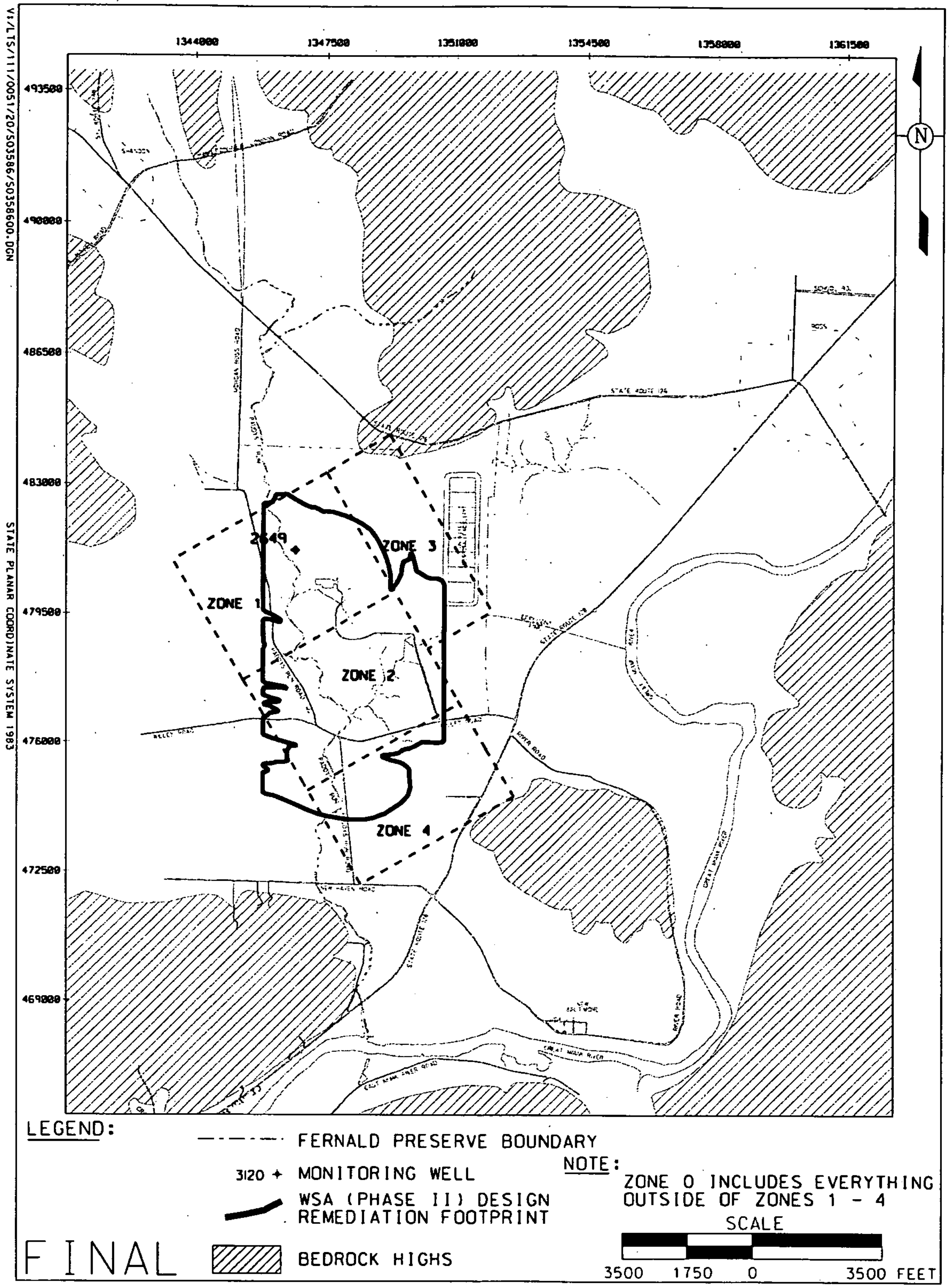

Figure A–10. Monitoring Well Locations with Concentrations Above the FRL for Molybdenum

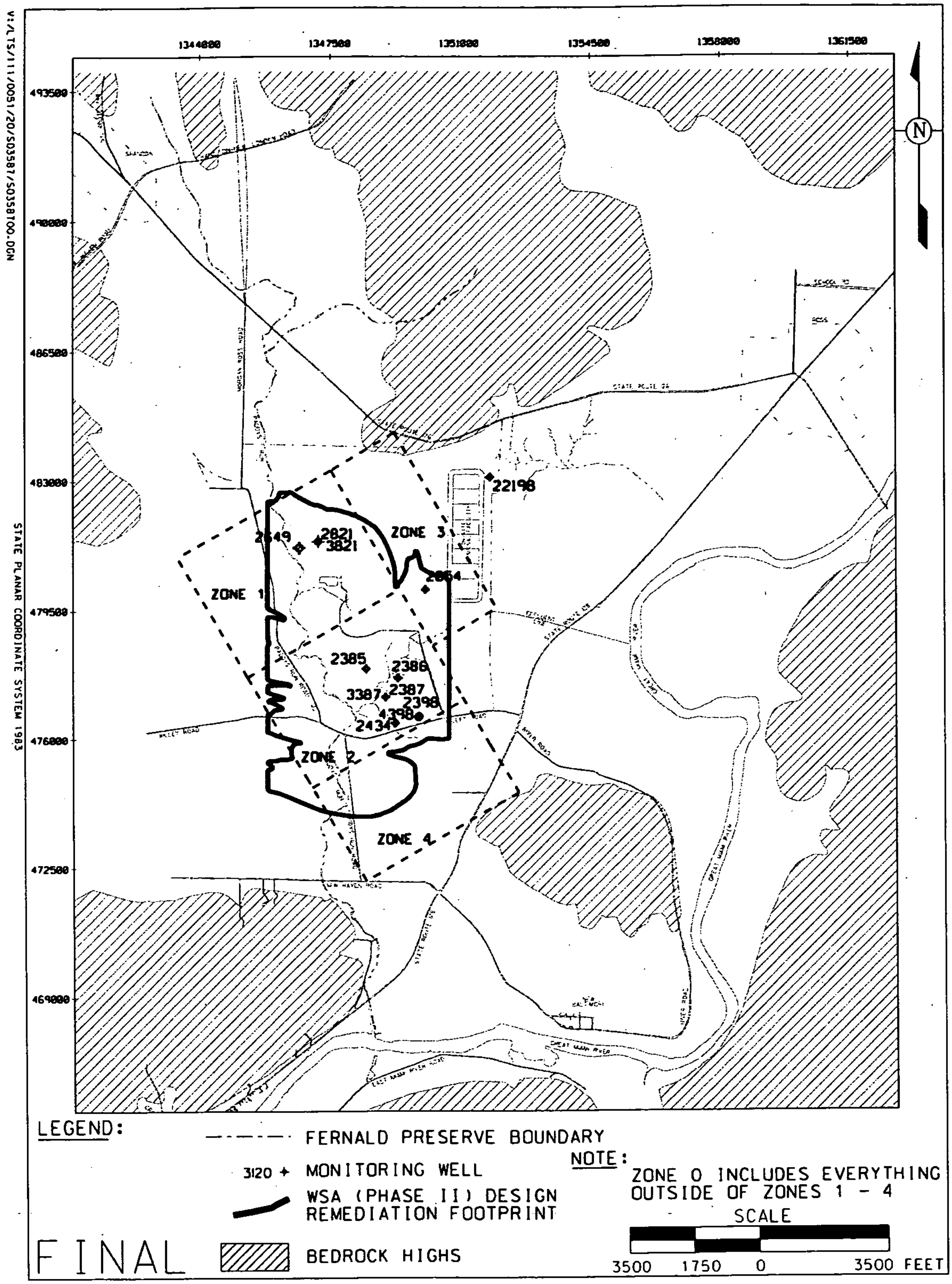

Figure A–11. Monitoring Well Locations with Concentrations Above the FRL for Nickel

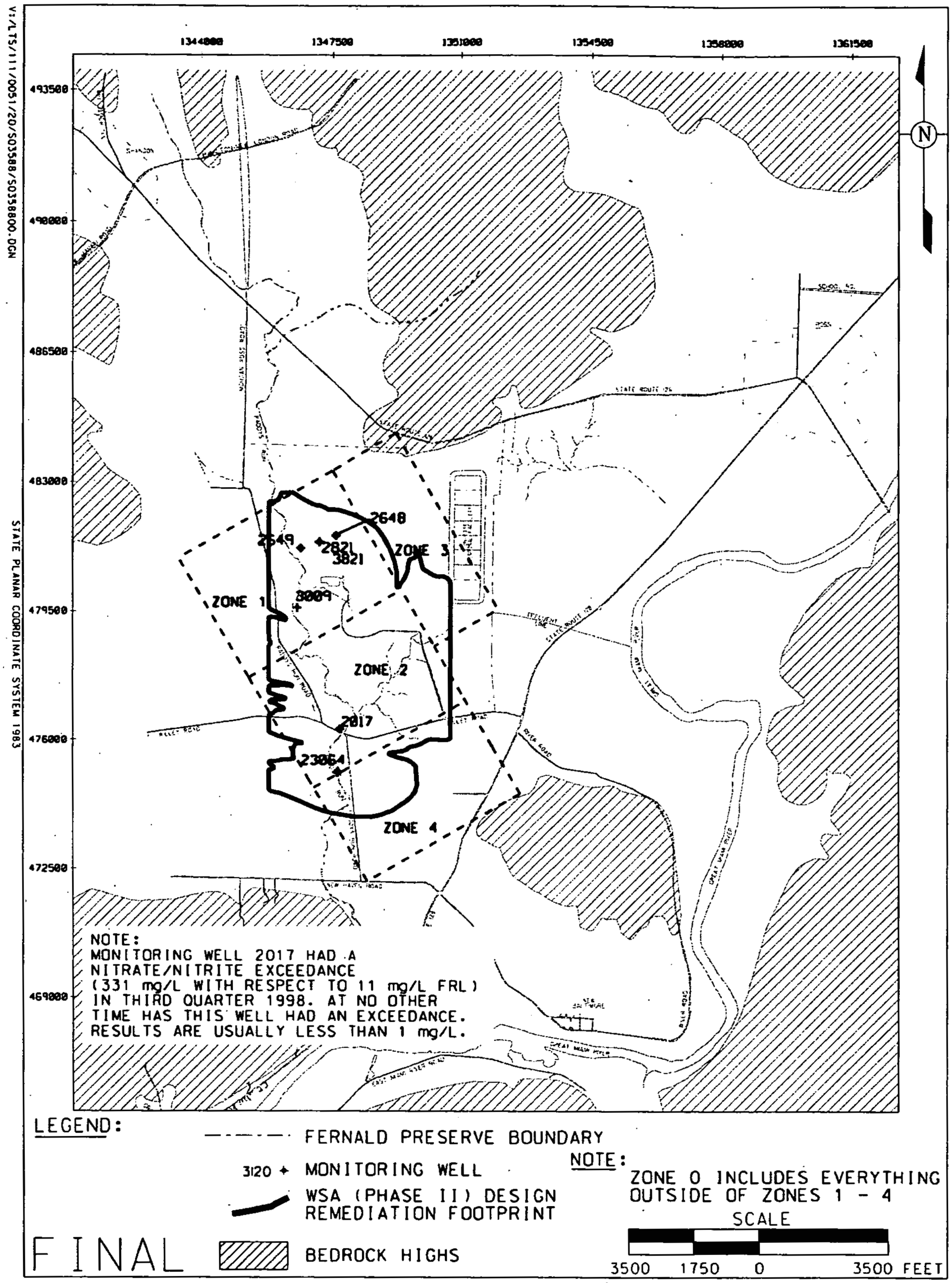

Figure A–12. Monitoring Well Locations with Concentrations Above the FRL for Nitrate/Nitrite

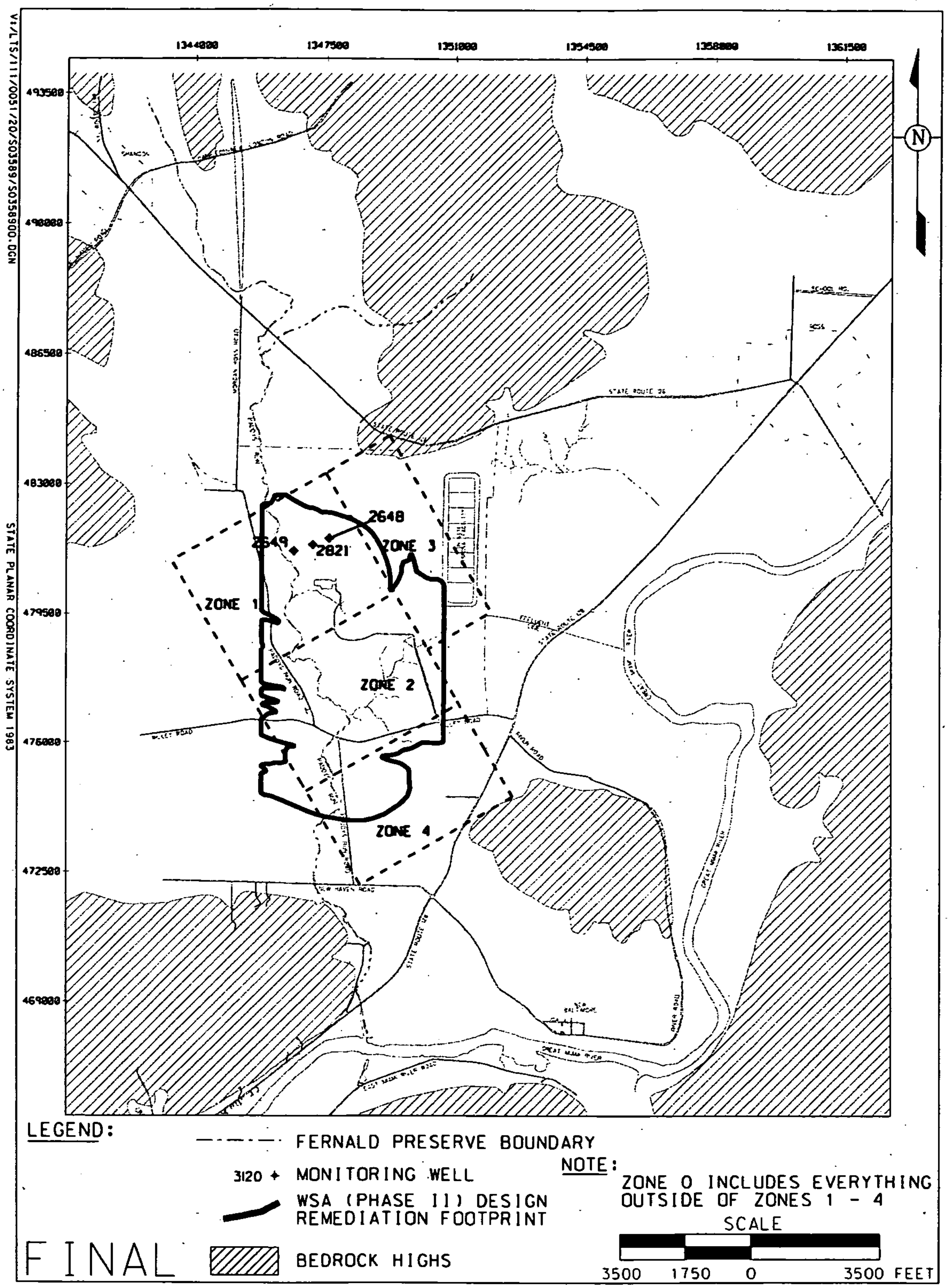

Figure A–13. Monitoring Well Locations with Concentrations Above the FRL for Technetium-99

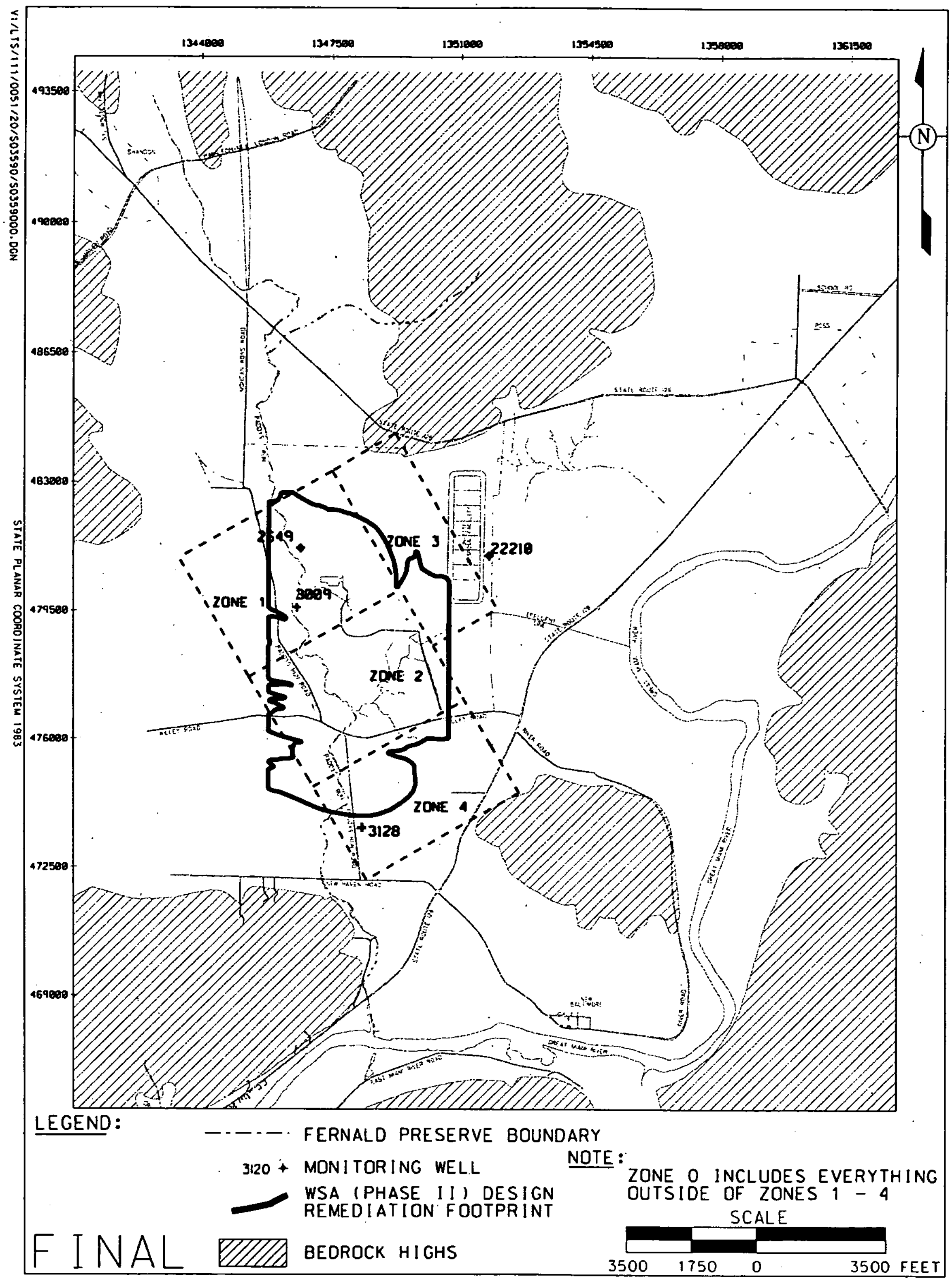

Figure A–14. Monitoring Well Locations with Concentrations Above the FRL for Trichloroethene

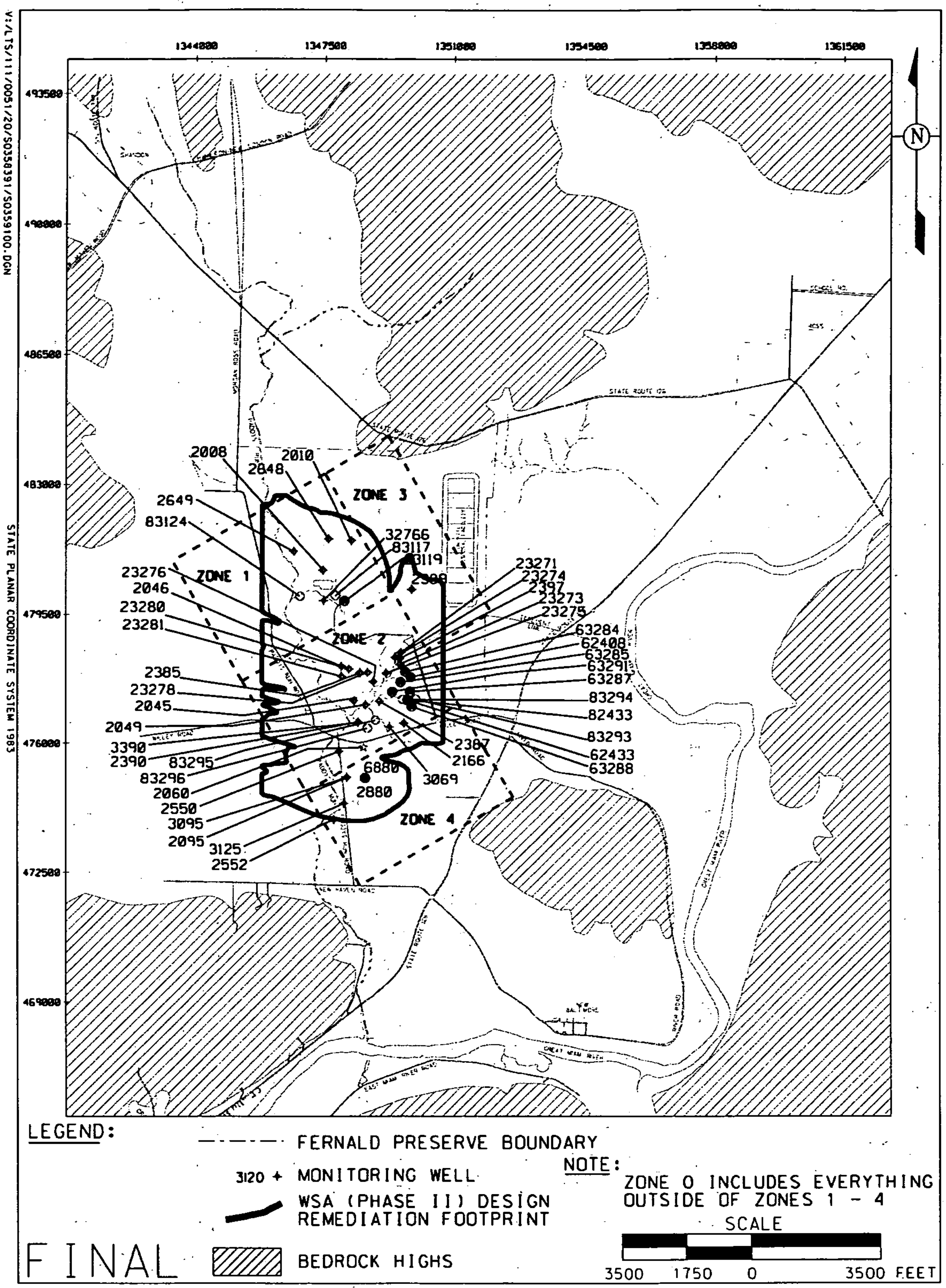

Figure A–15. Monitoring Well Locations with Concentrations Above the FRL for Uranium

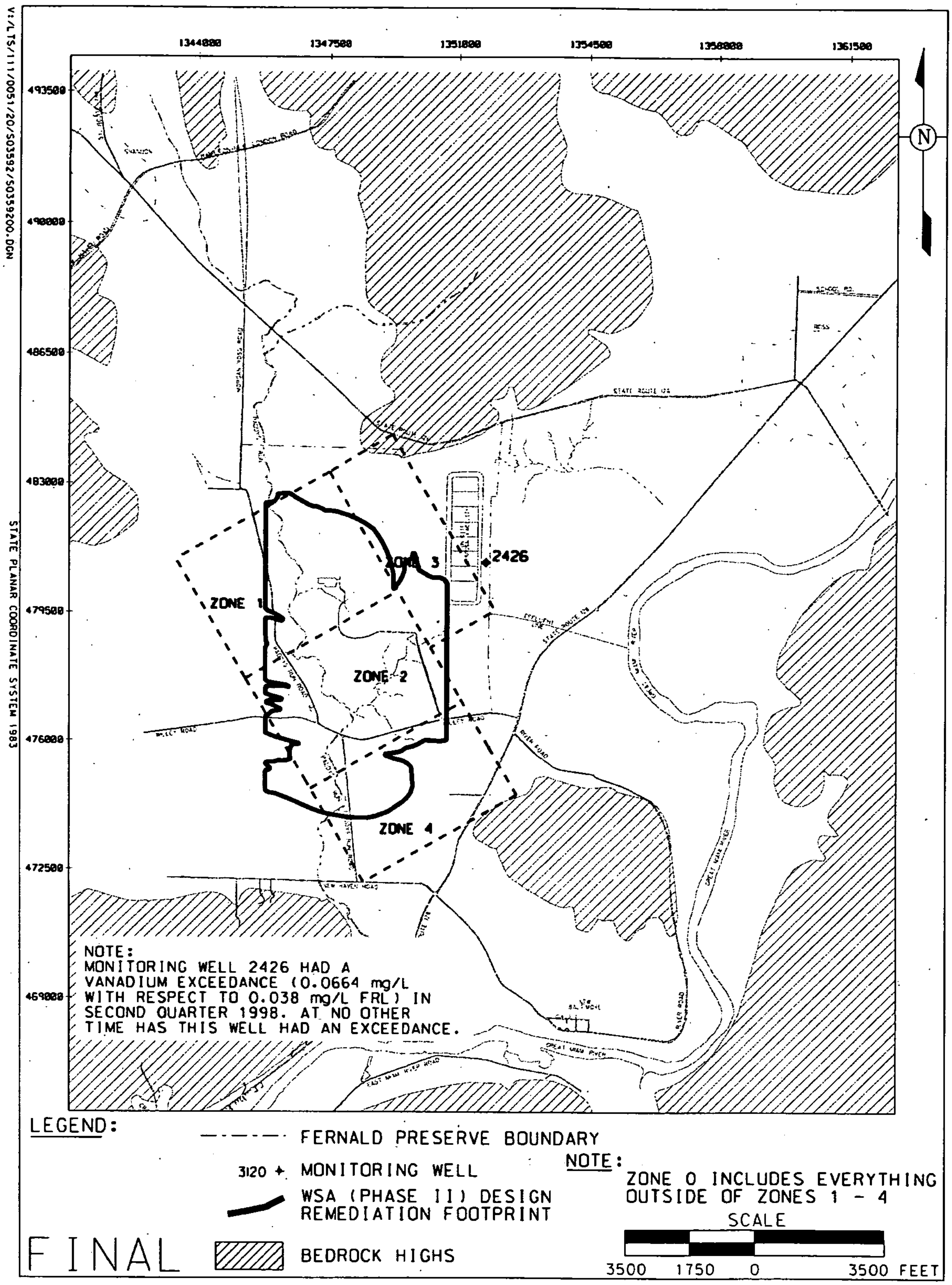

Figure A–16. Monitoring Well Locations with Concentrations Above the FRL for Vanadium

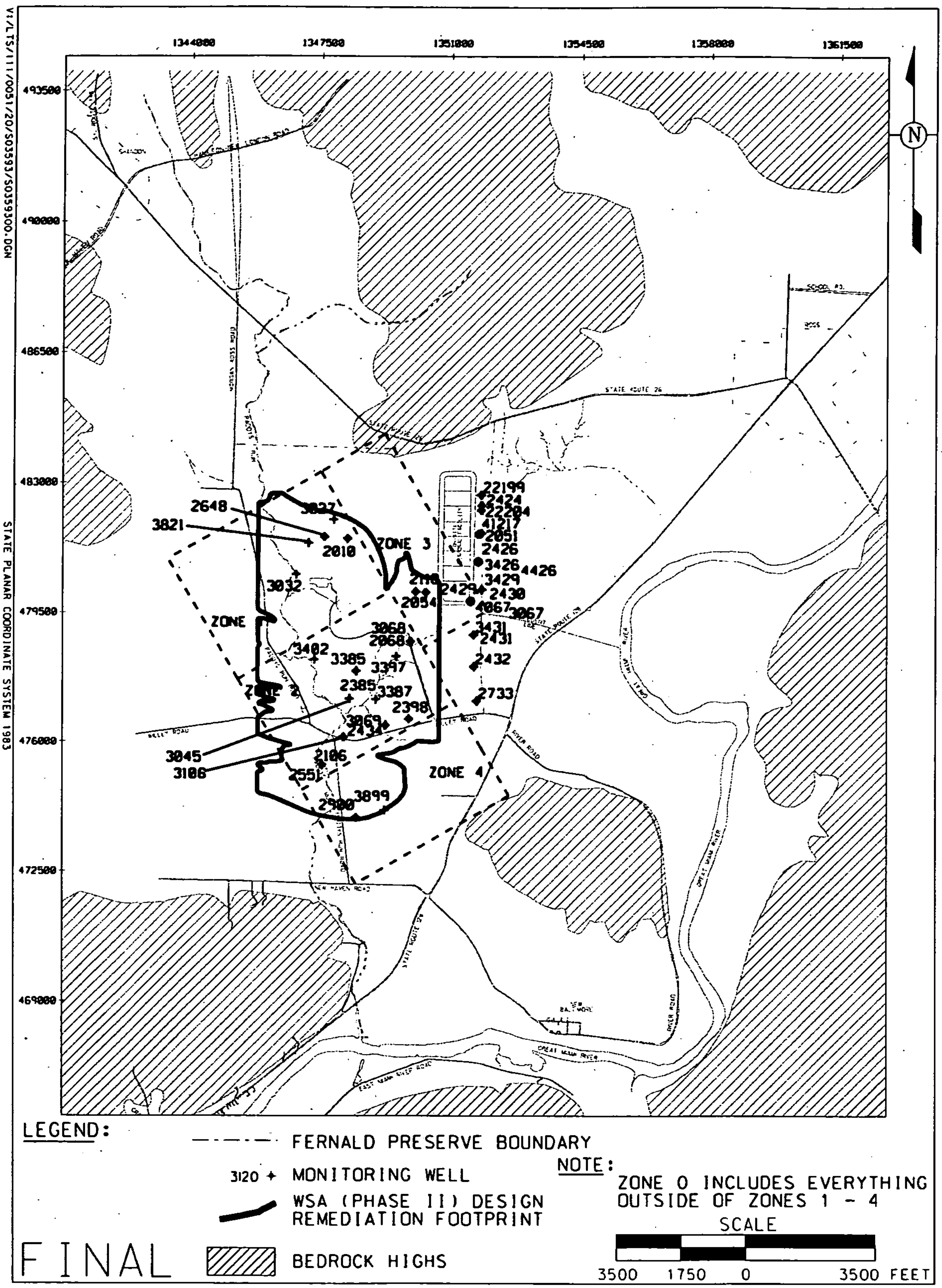

Figure A–17. Monitoring Well Locations with Concentrations Above the FRL for Zinc

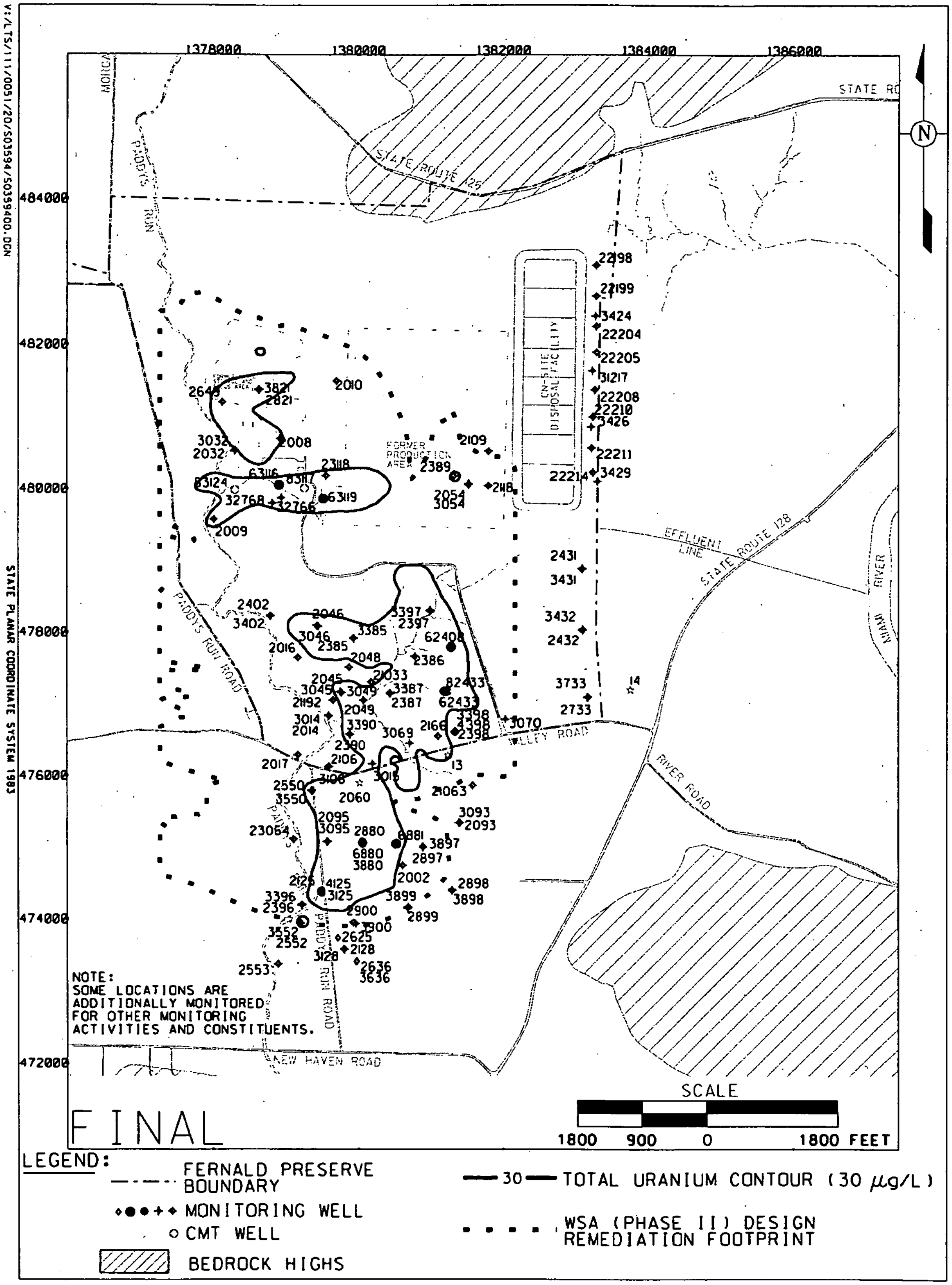

Figure A–18. Locations for Semiannual Total Uranium Monitoring

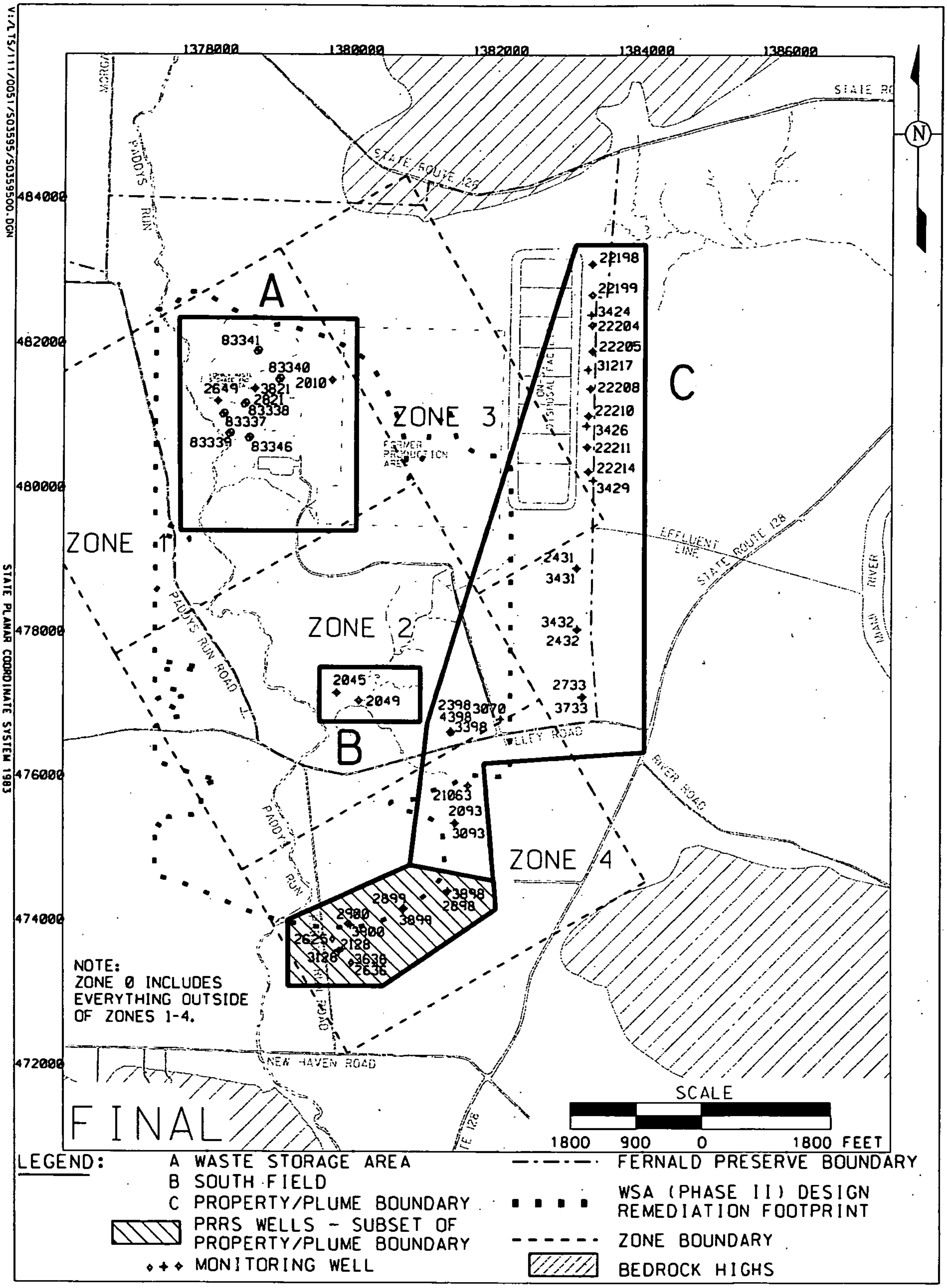

Figure A–19. Locations of Semiannual Monitoring for Property/Plume Boundary, South Field, and Waste Storage Area

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Appendix B

Surface Water Final Remediation Level Exceedances

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Table B–1. Evaluation of Constituents Selected for IEMP Characterization Surface Water Monitoring Due to FRL Exceedances 2

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1.0 Introduction

This appendix provides further information regarding the final remediation level (FRL) exceedances. As discussed in Section 4.4.2.3, a limited number of constituents have been detected above their respective FRLs at several surface water sample locations. To better quantify the actual number and location of exceedances, data collected under the IEMP (from August 1997 through December 2006) were compiled and compared to FRLs to determine the number and locations of the exceedances. Table B–1 itemizes the Fernald Site FRL exceedances based on IEMP characterization monitoring.

This appendix also provides figures that document the particular sample location where FRLs have been exceeded. Figures B–1 through B–10 show, by constituent, those locations with FRL exceedances. The figures also show FRL exceedances at background locations to document non-site exceedances; they also show exceedances from constituents previously monitored (i.e., constituents removed from monitoring as documented in IEMP, Revision 3, Appendix B; and IEMP, Revision 4, Appendix B) to provide a historical perspective.

Table B–1. Evaluation of Constituents Selected for IEMP Characterization Surface Water Monitoring Due to FRL Exceedances

Location	Currently Monitored COCs	Basis for Selection of Constituent Code[a, b]	No. of Analyses[c]	No. of FRL Exceedances[c]	Date of Last FRL Exceedance (No. of samples since exceedance)[c]
SWP-02 (Paddys Run)[d]	**Radionuclides:**				
	Technetium-99[e]	M	43	0	-
	Total Uranium[e,f]	PC	43	0	-
SWP-03[g] **(Paddys Run at Downstream Property Boundary)**	**Inorganics:**				
	Chromium, Total	S	43	5	11/12/2003 (13)
	Copper	S	43	2	9/27/2002 (18)
	Cyanide	M	33	0	-
	Mercury	M	41	1	04/13/1998 (35)
	Silver	M	42	0	-
	Zinc	M	36	0	-
	Radionuclides:				
	Radium-226	M	41	0	-
	Strontium-90	M	36	0	-
	Technetium-99	M	43	0	-
	Thorium-228[h]	WP	24	0	-
	Thorium-230[h]	WP	24	0	-
	Thorium-232[h]	WP	24	0	-
	Total Uranium[f]	PC, M	55	0	-
SWD-02 (Storm Sewer Outfall Ditch)	**Radionuclides:**				
	Strontium-90[e]	M	38	0	-
	Technetium-99[e,f]	M	39	0	-
	Total Uranium[f]	PC, M	71	0	-
SWD-03 (Waste Storage Area)	**Inorganics:**				
	Copper[e]	S	47	4	7/29/2006 (1)
	Cyanide[e]	M	36	0	-
	Mercury[e]	M	33	0	-
	Silver[e]	M	36	1	4/4/2000 (22)
	Zinc[e]	M	36	3	10/5/2002 (12)
	Radionuclides:				
	Technetium-99[e]	M	36	0	-
	Total Uranium[f]	PC	70	0	-
PF 4001 (Parshall Flume - Treated Effluent)	**Inorganics:**				
	Cadmium[i]	S	1024	2	12/19/2003 (421)
	Cyanide[i]	M	552	0	-
	Mercury[i]	M	117	0	-
	Silver[i]	M	1026	0	-
	Radionuclides:				
	Radium-226	M	44	0	-
	Strontium-90	M	38	0	-
	Technetium-99	M	118	0	-
	Total Uranium[f]	PC, M	3378	0	-

Table B–1. Evaluation for Constituents Selected for IEMP Characterization Surface Water Monitoring Due to FRL Exceedances (continued)

Location	Currently Monitored COCs	Basis for Selection of Constituent Code[a, b]	No. of Analyses[c]	No. of FRL Exceedances[c]	Date of Last FRL Exceedance (No. of samples since exceedance)[c]
STRM 4003 (Drainage to Paddys Run)	**Radionuclides:** Total Uranium[f]	PC, M, S	36	0	-
STRM 4004 (Drainage to Paddys Run)	**Radionuclides:** Total Uranium[f]	PC, M, S	29	0	-
STRM 4005 (Drainage to Paddys Run)	**Radionuclides:** Total Uranium[f]	PC, M, S	63	0	-
STRM 4006 (Drainage to Paddys Run)	**Radionuclides:** Total Uranium[f]	PC, M, S	36	0	-

Shading indicates location-specific constituents of concern. With the end of remediation and the fact that no FRL exceedances have occurred, this monitoring is no longer required.

[a]M = based on modeling; PC = primary constituent of concern; S = sporadic exceedances; WP = waste pits excavation monitoring

[b]Those constituents monitored based on Modeling (M) will continue to be monitored even if there has been no FRL/BTV exceedance.

[c]Based on analytical data from August 1997 through December 2006.

[d]With the removal of silos and excavation of the waste pits, this location is no longer needed.

[e]These location-specific constituents of concern were monitored during excavation. With the end of excavation and the fact that there has only been one nominal FRL exceedance, this monitoring was deemed to be no longer required starting with IEMP, Revision 5.

[f]Total uranium will continue to be monitored semiannually whether there is a basis or not (i.e., M, S, I) and the monitoring criteria will be identified as a Primary COC (PC). In addition, technetium-99 will continue to be monitored semiannually at Location SWD-02.

[g]Beryllium, cadmium, manganese, and radium-228 are being added to the program, but not to this table. This location is the last one surface water is monitored on Paddys Run prior to leaving the site; therefore, these constituents are being monitored at this location in order to be conservative.

[h]These constituents of concern were added during excavation of the waste pits. Even though waste pit excavation has ended, these constituents of concern were retained at this downstream property boundary location in order to be conservative.

[i]The COCs are monitored more frequently for NPDES and have been removed from IEMP Characterization.

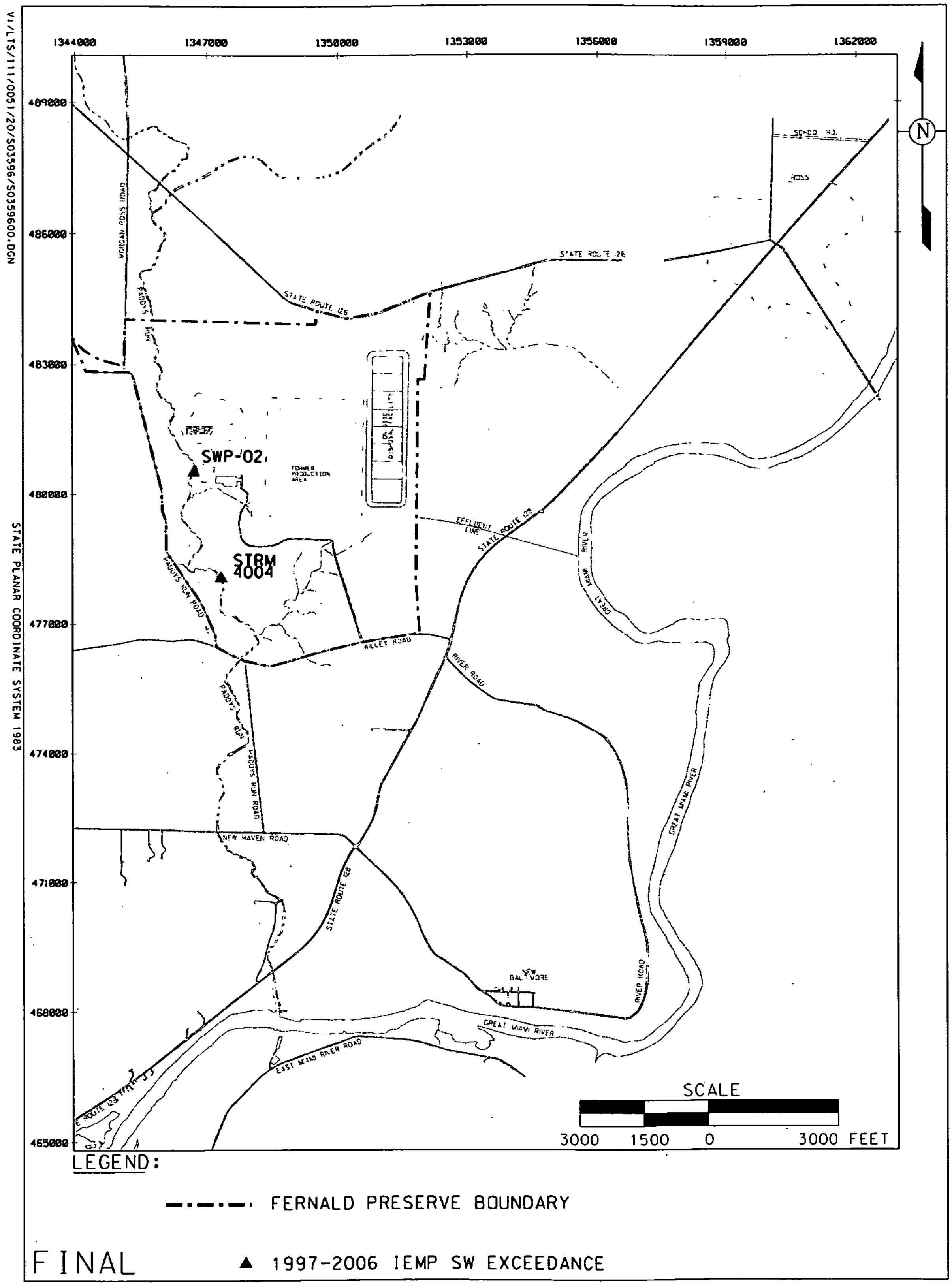

Figure B–1. Surface Water Locations with FRL Exceedances for Beryllium

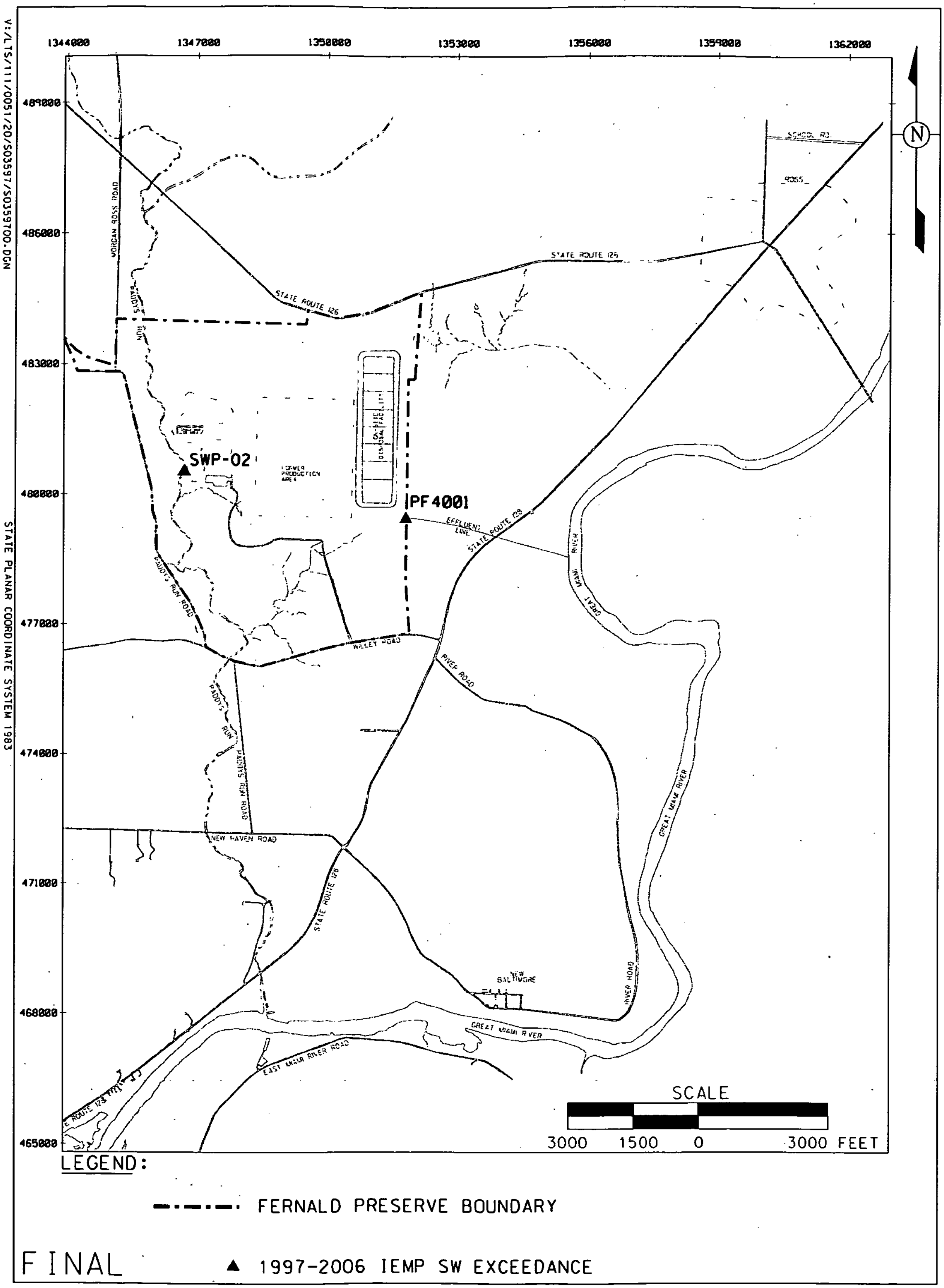

Figure B–2. Surface Water Locations with FRL Exceedances for Cadmium

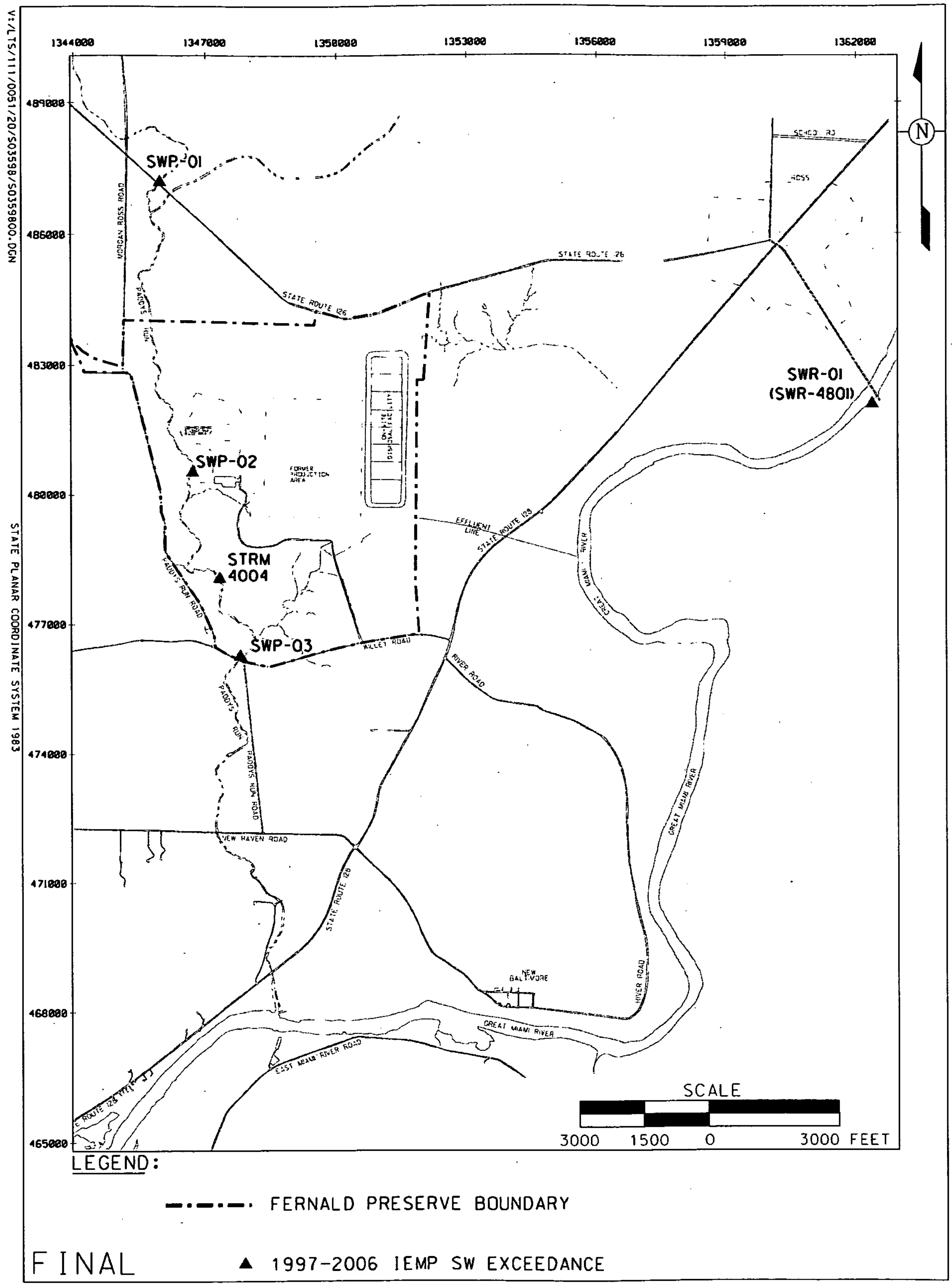

Figure B–3. Surface Water Locations with FRL Exceedances for Total Chromium

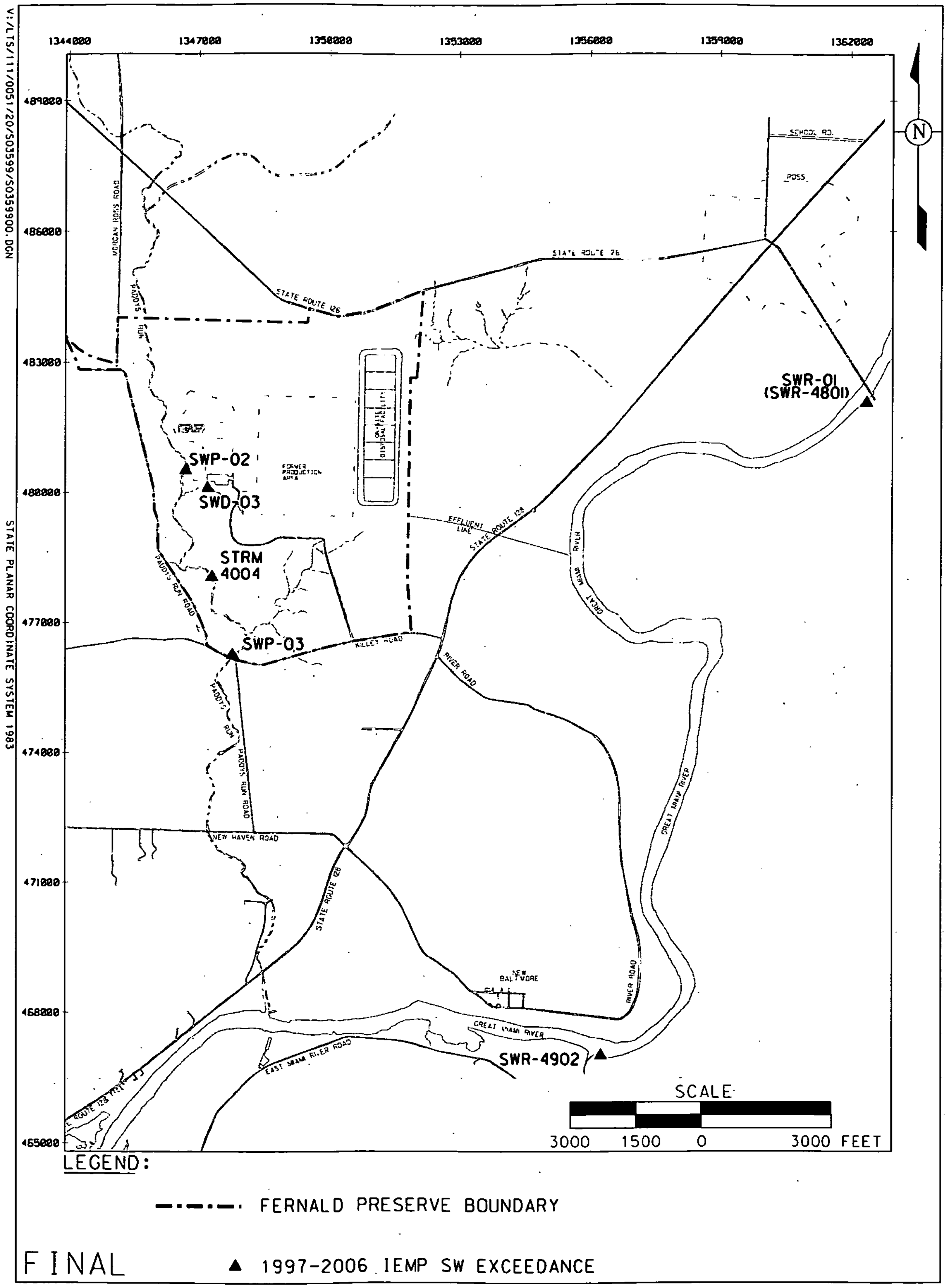

Figure B–4. Surface Water Locations with FRL Exceedances for Copper

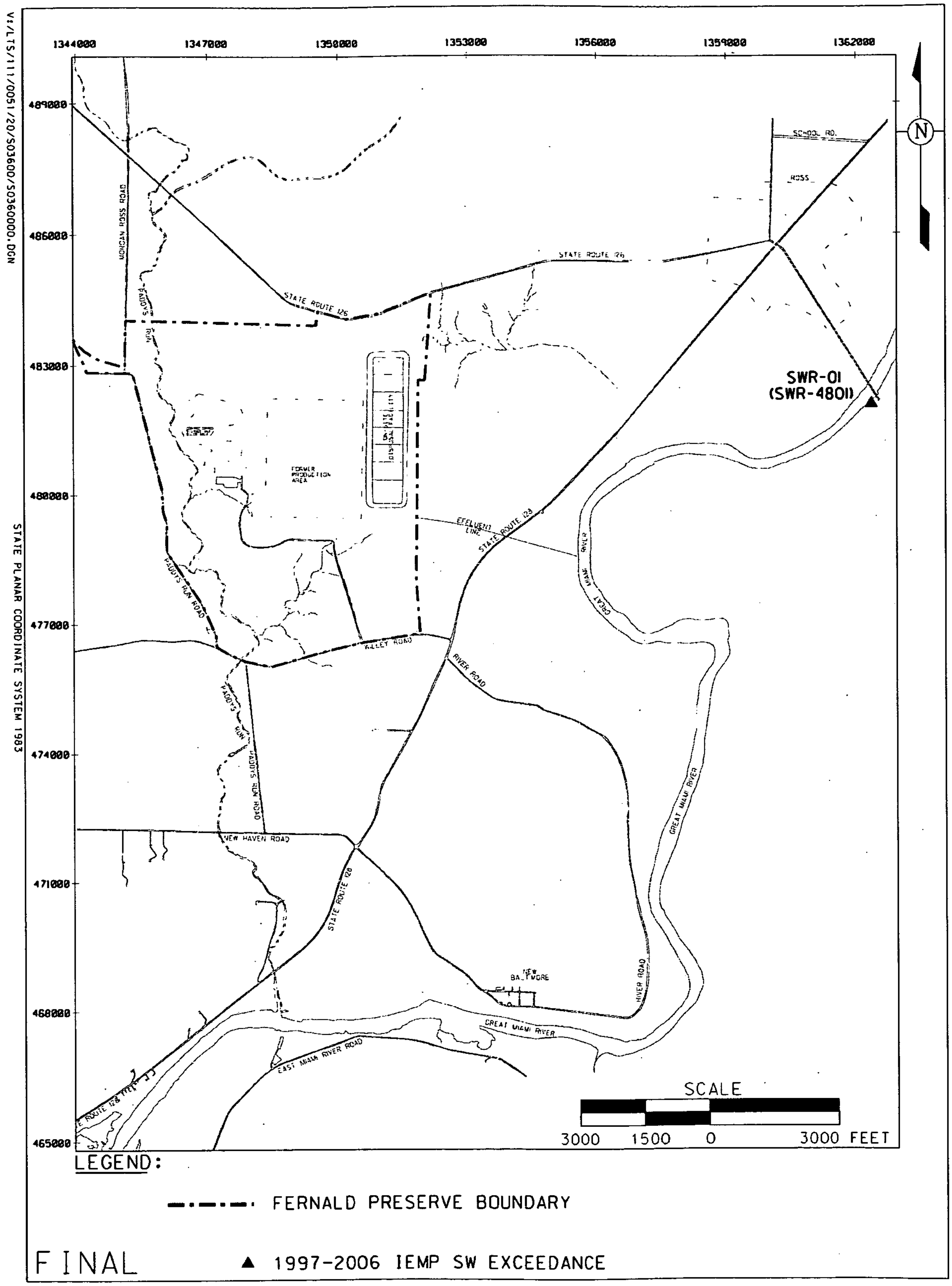

Figure B–5. Surface Water Locations with FRL Exceedances for Dibenzo(a,h) anthracene

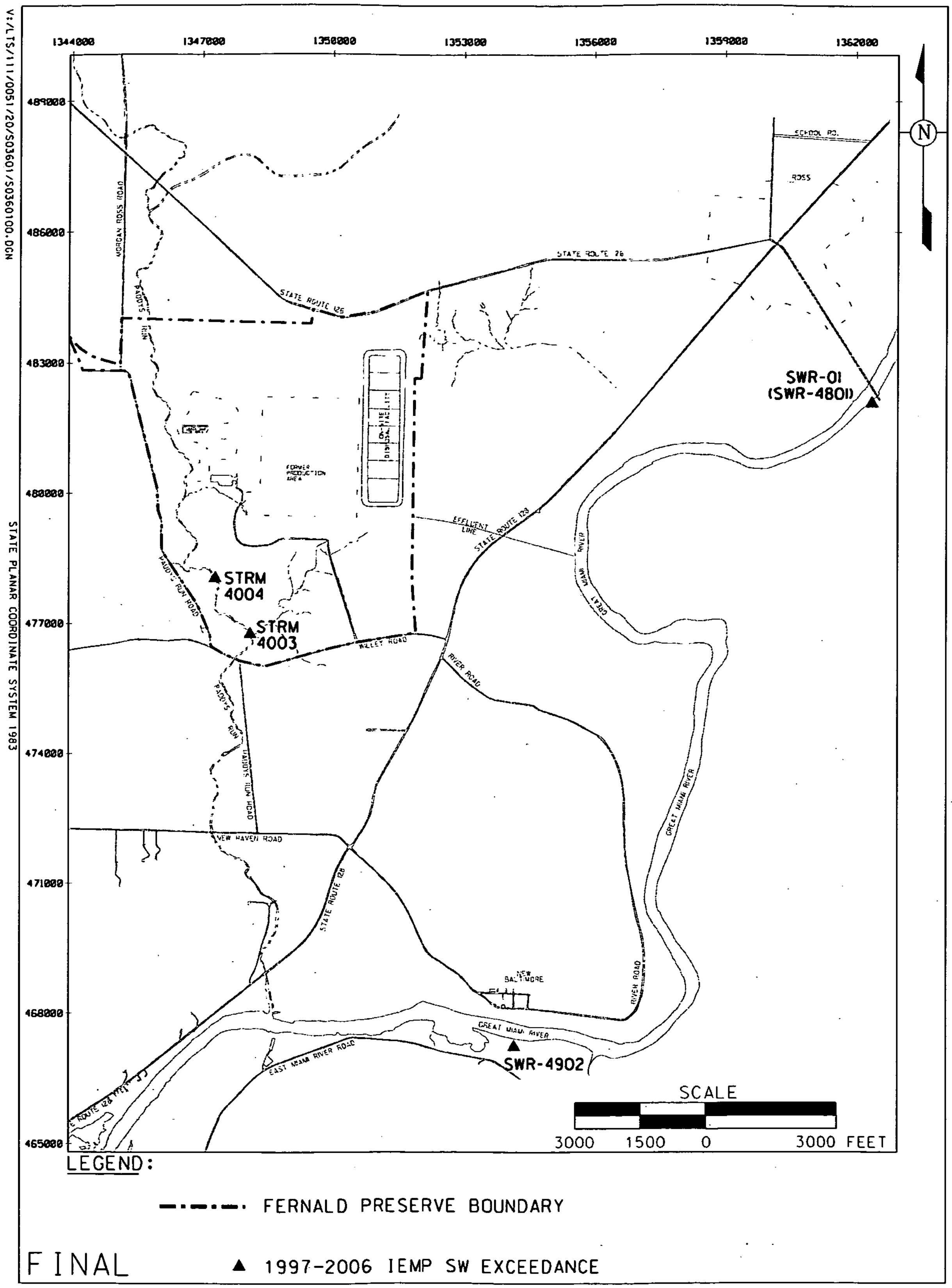

Figure B-6. Surface Water Locations with FRL Exceedances for Lead

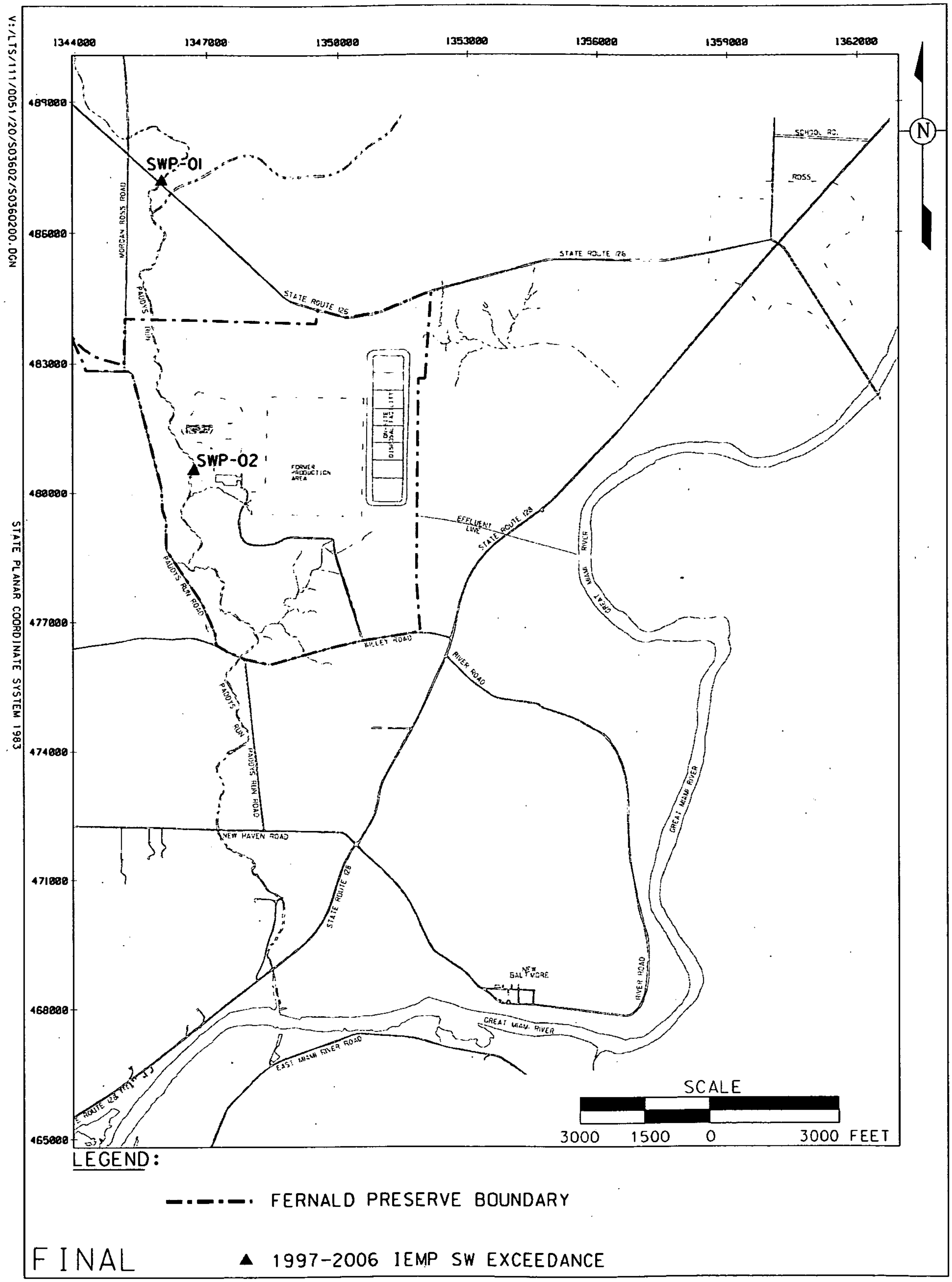

Figure B–7. Surface Water Locations with FRL Exceedances for Manganese

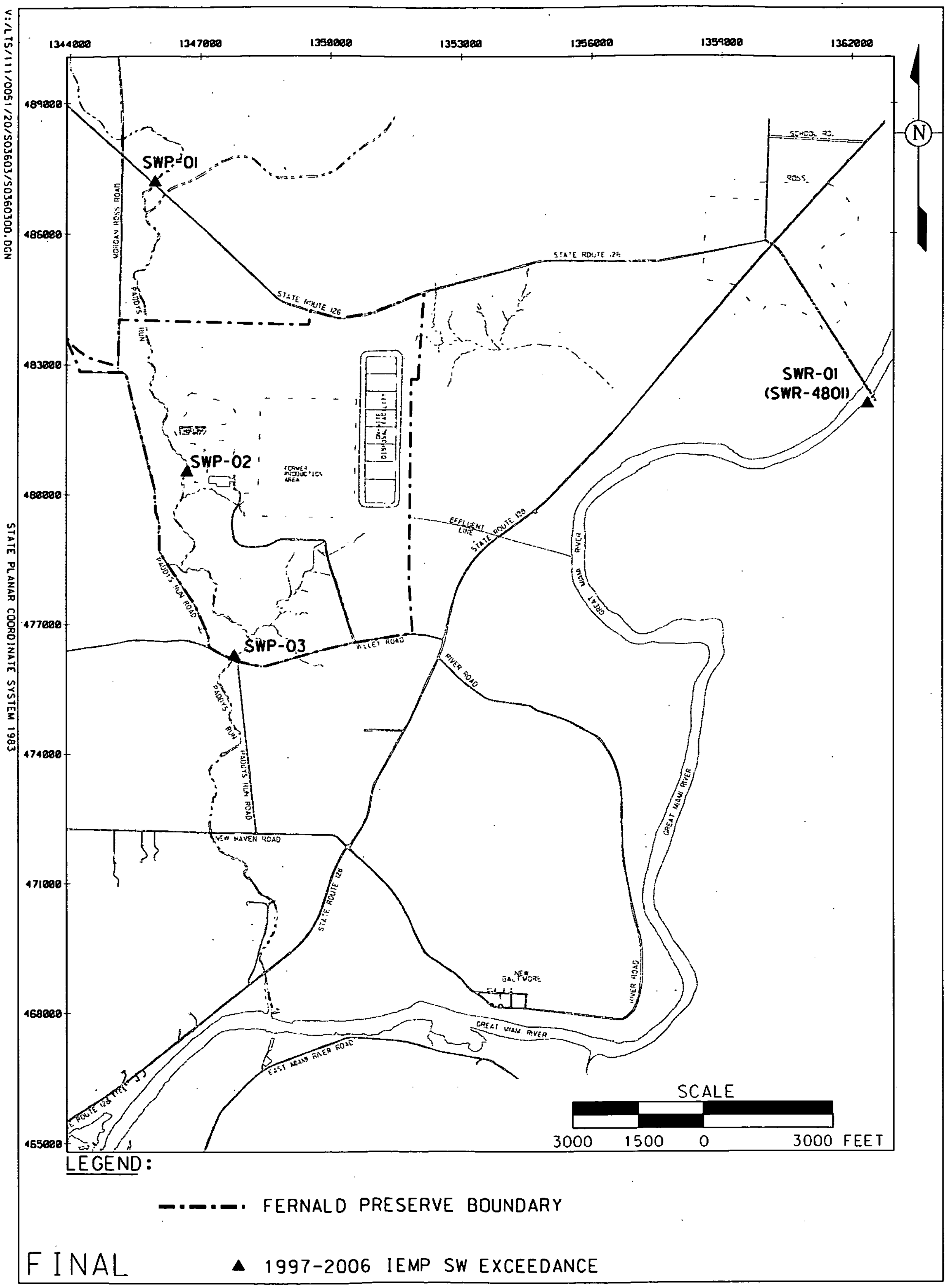

Figure B–8. Surface Water Locations with FRL Exceedances for Mercury

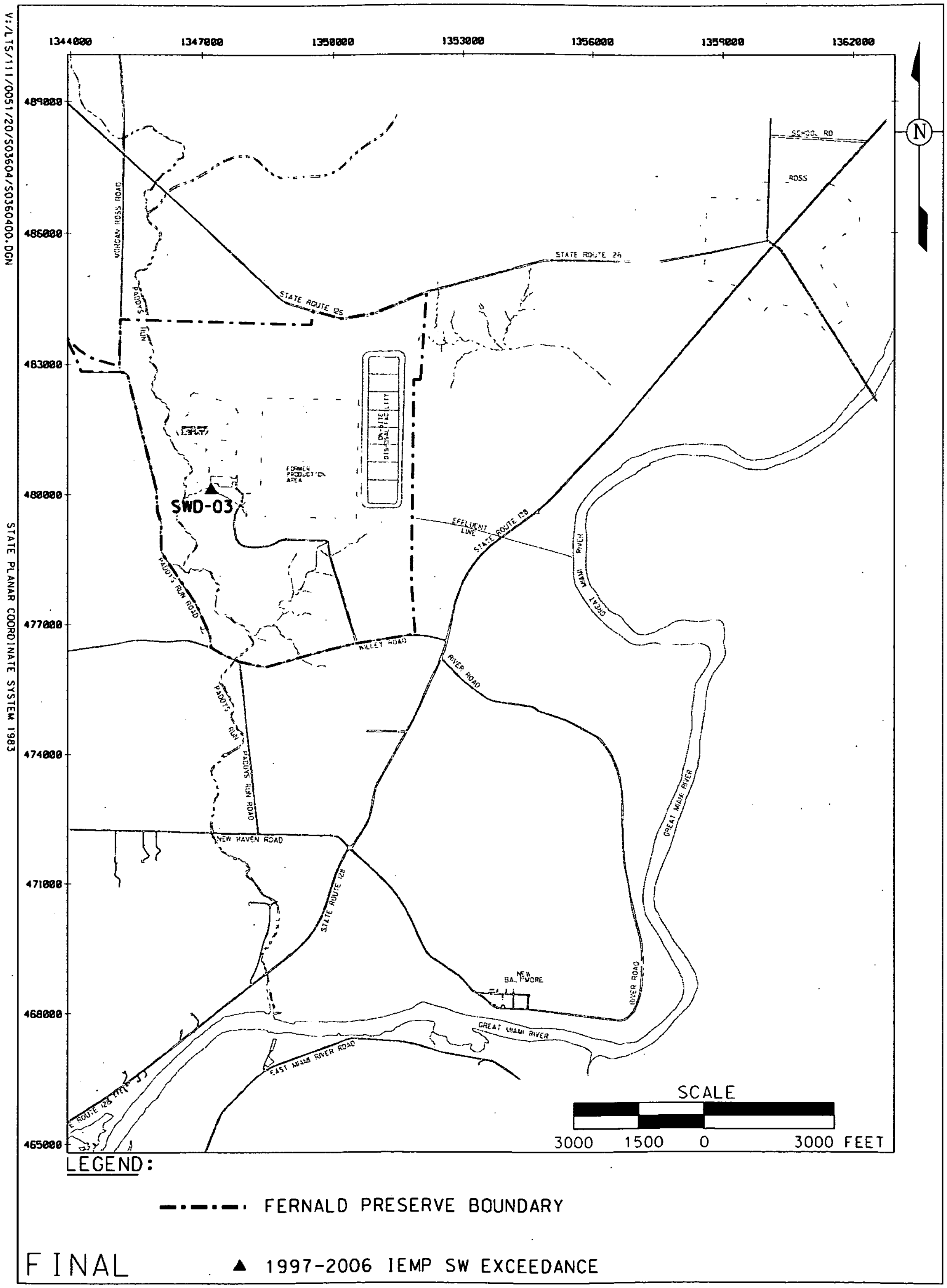

Figure B–9. Surface Water Locations with FRL Exceedances for Silver

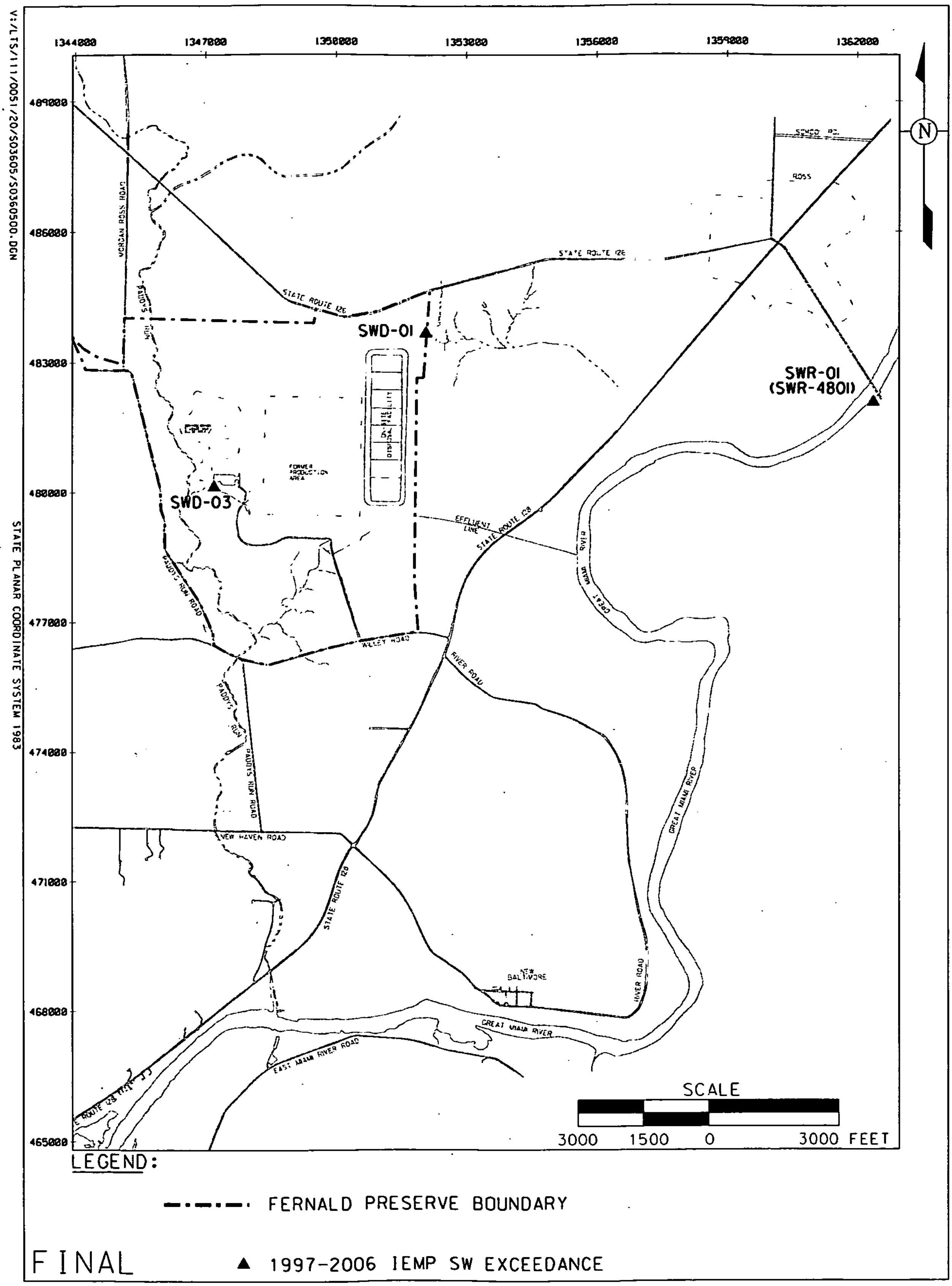

Figure B–10. Surface Water Locations with FRL Exceedances for Zinc

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Appendix C

Dose Assessment

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1.0 Introduction

This appendix describes the technical approach for conducting the annual radiological dose assessment. This approach will meet the intentions of U.S. Department of Energy (DOE) Order 5400.5 (DOE 1993) and the air pathway compliance determination (detailed in 40 *Code of Federal Regulations* [CFR] 61 National Emissions Standards for Hazardous Air Pollutants [NESHAP] Subpart H). The Integrated Environmental Monitoring Plan (IEMP) will be the mechanism for conducting and reporting the annual sitewide radiological dose assessments.

2.0 Background, Regulatory Drivers, and Requirements

Doses assessments have been prepared annually to confirm that radiological doses to the public from routine operations and emissions comply with the dose limits set by the U.S. Environmental Protection Agency (EPA) and DOE regulations and orders. Before 1998, yearly dose assessments of radiological air inhalation were based on computer modeling results generated with measured and estimated releases of airborne radioactive materials from significant sources. Since 1998, radiological dose assessments have been based on environmental monitoring results. This has resulted in more accurate estimates of doses attributable to fugitive emissions. Environmental monitoring results will continue to be collected from a limited number of monitors (five boundary monitors and one background monitor) until 2007. After 2007, upon approval from the EPA, dose assessments will be concluded.

This section describes radiological dose limits and guidelines as defined by various regulatory requirements including the applicable or relevant and appropriate requirements (ARARs), as they relate to dose assessments at the Fernald Preserve.

2.1 ARARs and Other Regulatory Drivers

This subsection summarizes the ARARs and other regulatory drivers for the dose assessment and associated dose limits. A site wide radiological dose assessment is needed to demonstrate compliance with the following limits and guidelines from DOE Order 5400.5 (DOE 1993), which incorporates dose assessment standards in 40 CFR 61 NESHAP, Subpart H:

The exposure of members of the public to radiation sources as a consequence of all routine activities at a DOE site shall not cause, in a year, an effective dose equivalent greater than 100 millirem (mrem). This annual effective dose equivalent is defined as the sum of direct external exposure for the year, plus the committed effective dose equivalent for intakes experienced during the year.

The guideline includes doses from remediation activities and naturally occurring radionuclides released by DOE processes, but not radon and its decay products. All pathways that could significantly contribute to the exposure are to be included in the calculations. Significant exposures are considered to be 1 percent (1 mrem) of the 100-mrem dose limit or greater.

Public exposure to radioactive materials released to the atmosphere as a consequence of all activities at a DOE site shall not cause, in a year, an effective dose equivalent greater than 10 mrem. Because this guideline implements the dose limits of 40 CFR 61 Subpart H, doses caused by radon-222 and its decay products are not included. The same annual effective dose equivalent definition applies as above.

The liquid effluents from DOE activities shall not cause private or public drinking water systems to exceed the drinking water radiological limits. These limits are defined 40 CFR 141, which says that effluents must not cause the drinking water radiological limits to exceed any of the following independent limits: man-made beta/gamma-emitting radionuclides at an annual average concentration that would cause an annual dose equivalent of 4 mrem to the total body or any internal organ; combined radium-226 and radium-228 at any time totaling 5 picocuries per liter (pCi/L); or gross alpha activity (including radium but excluding radon and uranium) of 15 pCi/L at any time.

The absorbed dose to native aquatic organisms shall not exceed one rad per day from exposure to the radioactive material in liquid wastes discharged to natural waterways. For the purposes of satisfying this requirement, the term "native aquatic organisms" (which is not otherwise defined by DOE) is interpreted to mean insects, macro-invertebrates, finned fish, and mammals.

3.0 General Technical Approach

This section presents a discussion of the general technical approach to be followed for performing the dose tracking and actual annual dose assessment. The discussion includes an explanation of exposure pathways and media important to the dose assessment, surveillance and characterization of these pathways, and the dose calculation procedure.

3.1 Medium-Specific Pathways

According to the past seven annual dose assessments and remedial investigation/feasibility studies at the Fernald Preserve, human receptors are potentially exposed through two medium-specific pathways: the air pathway, which includes inhalation and ingestion; and the direct radiation pathway. The air pathway may involve inhalation of contaminated fugitive dust. The direct radiation pathway includes exposure to contaminated soil and sediment and direct radiation from stored materials (e.g., K-65 silos). Note that the remediation activities associated with these pathways were completed in 2006.

3.1.1 Potential Receptors

Hypothetical receptors are usually selected to replicate the worst possible dose at locations with measured or calculated maximum air concentrations, even when there is no actual receptor at those locations. Thus, the NESHAP compliance demonstration is based on site boundary measurements although there are no actual receptors on the fence line. The IEMP focuses on measuring and ensuring levels at the site boundary are not exceeded, thereby ensuring the exposure levels to off-property residents are also below limits. As with previous dose assessments, exposure scenarios and parameters (e.g. duration of exposure and potential food sources) will generally be conservative.

3.1.2 Routine Surveillance of Pathways

Environmental media that have the potential to lead to a significant annual dose (greater than 1 percent of the DOE all-pathway combined dose limit of 100 mrem) at the Fernald Preserve boundary and representative receptor locations will be routinely sampled and analyzed for constituents contributing to the dose. Sections 3.0 through 6.0 of the main document describe medium-specific monitoring programs under the IEMP. Both the air and direct-exposure routes are monitored under the IEMP.

3.2 Dose Assessment Approach

3.2.1 Air Monitoring for NESHAP Subpart H Compliance

This section describes the technical approach for demonstrating compliance with NESHAP Subpart H using environmental measurements of radionuclide air concentrations at the Fernald Preserve boundary. It also addresses each of the criteria for environmental measurement compliance programs as described in 40 CFR 61.93 (b)(5) and the basic requirements issued by EPA for NESHAP Subpart H environmental measurements at the Fernald Preserve.

Criterion I: The air at the point of measurement shall be continuously sampled for collection of radionuclides.

The air monitoring stations sample air at approximately 1.3 cubic meters per minute (m^3/minute) using a 0.3 micron filter. The air monitoring stations contain a flow rate chart recorder and an hour meter to provide a record of the monitors operation over the sampling period. The air monitoring stations are routinely checked to ensure normal operation. Monitoring locations have been selected based on wind rose sectors and potential receptor locations.

Criterion II: Radionuclides released from the facility, which are the major contributors to the effective dose equivalent, must be collected and measured as part of the environmental measurement program.

The IEMP air-monitoring program consists of the following sampling and analytical regime:

Table C–1 identifies the analysis regime for samples collected from each air monitoring station.

Table C–1. Analysis Regime

Constituent	Frequency	Method	RL[a] (pCi/m^3)
Total Particulate	Monthly	Gravimetric	-
Total Uranium	Monthly	KPA	3E-05

[a]RL = Reporting Limit

Quarterly composite samples will be prepared from the monthly samples for each monitor. The composite samples will be analyzed at analytical support level E by an off-site laboratory for the following constituents of concern. Table C–2 provides the basis for the frequency of analysis and selection of constituents.

Table C-2. Quarterly Analysis Regime

Constituent	Method[a]	RL[b] (pCi/m^3)
Uranium-238	Alpha Spec.	9E-05
Uranium-234	Alpha Spec.	9E-05
Uranium-235/236	Alpha Spec.	9E-05
Thorium-228	Alpha Spec.	7E-06
Thorium-230	Alpha Spec.	7E-06
Thorium-232	Alpha Spec.	7E-06
Radium-226	Gamma Spec./Alpha Spec. Analysis	2E-04

[a]Or other EPA-approved methods
[b] RL=Reporting Limit, which provide adequate sensitivity to detect below 10 percent of the corresponding NESHAP standard for each radionuclide of interest

3.3 Frequency of Analysis

Quarterly analysis of composite samples is performed in order to meet the following needs of the IEMP air monitoring program:

- Confirmation that sufficient air sample volumes were collected to detect the low concentrations of contaminants in the air.
- Periodic confirmation that contaminant concentrations are below the levels that would cause a dose of 10 mrem/year.

Large volumes of air must be sampled from both the background and blank concentrations in order to readily detect and distinguish the presence of a contaminant at low concentrations. Because filter loading limits the volume of air that can be sampled with a single filter, quarterly composite sampling is used to create a sample that represents a large volume of air.

Quarterly measurements provide a means to check the concentrations of contaminants several times during the year. Activities or work practices will be adjusted if quarterly measurements indicate that the 10-mrem/year limit might be exceeded.

3.3.1 Basis for Quarterly Composite Analytical Suite

The isotopes selected for quarterly analysis represent the previous major contributors to dose based on the following considerations:

- Radionuclides that were stored in large quantities at the Fernald Site and were handled or processed during the remediation effort (uranium, thorium-232, thorium-230, and radium-226).
- Radionuclides that were the major contributors to dose based on recent environmental filter measurements (uranium, radium, and thorium-230).
- Radionuclides, which, due to their concentration in waste and contaminated soil, were major contributors to dose if the waste or soil is released in the form of fugitive dust (uranium, thorium-228, and thorium-230).

Note: DOE has monitored the changing mix of contributors by comparing the quarterly composite results to the NESHAP Appendix E, Table 2 values.

3.3.2 Consideration of Decay-Chain Daughter Products

Uranium-238, thorium-232, and uranium-235 are initial radionuclides in the uranium, thorium, and actinide decay chains, respectively. Table C–3 shows the decay chains and the half-lives of the daughter products.

Note: Doses caused by radon-222 and its decay products formed after the radon is released from the facility are not included in the NESHAP dose limit of 10 mrem/year and will not be measured as part of the NESHAP Subpart H compliance demonstration. A description of the Fernald Preserve radon monitoring program is included in Section 6.0.

Table C–3. Uranium, Thorium, and Actinide Decay Chains

Isotope	Half-Life	Isotope	Half-Life	Isotope	Half-Life
Uranium-238	4.5×10^9 years	Thorium-232	1.4×10^{10} years	Uranium-235	7.1×10^8 years
Thorium-234	24 days	Radium-228	5.7 years	Thorium-231	25.64 hours
Protactinium-234 (2 isomeric states)	1.2 minutes & 6.7 hours	Actinium-228	6.13 hours	Protactinium-231	3.25×10^4 years
Uranium-234	2.5×10^5 years	Thorium-228	1.9 years	Actinium-227	21.6 years
Thorium-230	8.0×10^4 years	Radium-224	3.64 days	Thorium-227	18.2 days
Radium-226	1622 years	Radon-220	55 seconds	Francium-223	22 minutes
Radon-222	3.8 days	Polonium-216	0.16 second	Radium-223	11.4 days
Polonium-218	3.05 minutes	Lead-212	10.6 hours	Radon-219	4.0 seconds
Lead-214	26.8 minutes	Bismuth-212	60.5 minutes	Polonium-215	1.77×10^{-3} seconds
Bismuth-214	19.7 minutes	Polonium-212	3.04×10^{-7} seconds	Lead-211	36.1 minutes
Polonium-214	1.6×10^{-4} sec.	Lead-208	Stable	Bismuth-211	2.16 minutes
Thallium-210	1.3 minutes			Thallium-207	4.79 minutes
Lead-210	22 years			Lead-207	Stable
Bismuth-210	5 days				
Polonium-210	138 days				
Lead-206	Stable				

The majority of uranium and thorium received and processed during the production era of the Fernald Site had been separated from their decay chain daughters prior to shipment to the Fernald Site.

Radioactive decay laws govern the ingrowth of the daughters from the purified parent. Daughter product ingrowth is based on the length of time the parent-bearing material has been stored on site. As a general rule, the daughter of a long-lived parent (e.g., uranium-238, thorium-232, or uranium-235) grows into equilibrium with the parent in about 10 daughter half-lives. For example, using data from the table above, thorium-234 would reach equilibrium with uranium-238 in about 240 days (10 × 24 days).

Considering the half-lives in the table above and the 40-year production history of the Fernald Site, a number of the daughters (those with half-life greater than a few hours) can be considered present in equilibrium concentrations with their parents. These radionuclides (thorium-234, protactinium-234, radium-228, actinium-228, thorium-228, radium-224, and thorium-231) will be considered to be in equilibrium with their parent concentrations measured in the quarterly composite. The equilibrium-based concentration for these radionuclides will be compared to the corresponding 40 CFR 61 Subpart H, Appendix E, Table 2 value as described in Criterion IV. Other radionuclides (protactinium-231, actinium-227, and their decay products) have not had sufficient time to reach equilibrium with their parent. In fact, due to the 32,500-year half-life of protactinium-231, none of the decay chain daughters have had time for significant ingrowth. Therefore, concentrations of decay chain daughters in the uranium-235 chain below thorium-231 will be considered zero in the quarterly composite samples.

Criterion III: Radionuclide concentrations that would cause an effective dose equivalent of 10 percent of the standard shall be readily detectable and distinguishable from background.

As indicated in Table C-2, the reporting limits for the major contributors to dose are less than 10 percent of NESHAP Appendix E, Table 2 values and will be readily detectable if present. The analysis of samples from the background monitors will provide the data to distinguish fenceline and potential receptor monitoring results from background.

Criterion IV: Net measured radionuclide concentrations shall be compared to the concentration levels in Table 2 of Appendix E to determine compliance with the standard. In the case of multiple radionuclides being released from the facility, compliance shall be demonstrated if the value for all radionuclides is less than the concentration level in Table 2, and the sum of the fractions that result when each measured concentration value is divided by the value in Table 2 for each radionuclide is less than one.

Annual average radionuclide concentrations at each monitoring location will be determined for each radionuclide by dividing the sum of the radionuclide mass values, obtained via quarterly laboratory analysis, by the total volume of air drawn through the filter. As described above, decay chain daughter products will be assumed to be in equilibrium with the measured parent concentration. Concentrations will be corrected for background to obtain the net measured concentration. The resulting net annual average concentrations will be divided by the corresponding 40 CFR 61 Subpart H, Appendix E, Table 2 values. The resulting fractions will be summed per monitoring location to demonstrate compliance. Compliance with the Subpart H standard will be documented in a summary that will be submitted as part of the annual site environmental reports.

3.3.3 Managing Analytical Results

The analysis of environmental air samples may result in contaminant concentrations being reported at levels that are at or below the minimum detectable concentration (MDC). Contaminant concentrations, which are at or below MDC, are statistically indistinguishable from concentrations found in a blank sample. Air sample results that are reported at or below the MDC will, therefore, be considered non-detects (zero) for the purpose of demonstrating compliance with the NESHAP dose limit.

Detectable contaminant concentrations will be corrected to net detectable concentrations using the background concentration measured during the same sampling period. Background air monitoring results that are at or below MDCs will not be used.

Criterion V: A quality assurance program shall be conducted that meets the performance requirements described in Appendix B, Method 114.

All environmental sample collection and analysis conducted in support of the remediation effort at the Fernald Preserve are subject to the quality assurance requirements of the Legacy Management CERCLA Sites Quality Assurance Project Plan (LM QAPP) (DOE 2006a).

Criterion VI: Use of environmental measurements to demonstrate compliance with the standard is subject to prior approval by EPA. Applications for approval shall include a detailed description of the sampling and analytical methodology and show how the above criteria will be met.

The IEMP and its appendices provide a description of the sampling and analytical methodology and explain how the criteria will be met. DOE submitted an application to use environmental measurements to demonstrate compliance with the NESHAP Subpart H standard to EPA in May 1997. EPA approved the application in August 1997.

3.4 All-Pathway Dose Calculations

This section describes the technical approach for demonstrating compliance with the 100-mrem/year, all-pathway dose limit in DOE Order 5400.5 (DOE 1993). Estimates of annual dose are based on the measured, background-corrected concentration of a contaminant in each environmental medium.

The general form of the dose assessment equation is:

$$D = C_{i,m} * I_m * DCF_i$$

where:

D = Dose (mrem/year)

$C_{i,m}$ = Background-corrected concentration of radionuclide "i" in medium "m" (pCi/kg or pCi/L)

I_m = Intake (ingestion) rate for medium (kg/year)

DCF_i = Dose conversion factor for radionuclide "i" (mrem/year*pCi)

The detailed calculation of doses from the various environmental media is governed by OLM SAP (DOE 2006b). Doses from all the media monitored under the IEMP also will be calculated according to relevant sections in this procedure. In general, air inhalation dose and direct radiation dose will be separately calculated and then combined into the DOE all-pathway annual dose.

4.0 Reporting

Based on the objective of the dose assessment described in Section 1, there will be two interfacing and reporting mechanisms in which the dose assessment results will be presented. Each of these two reporting processes is described in the following subsections.

4.1 Regulatory Interfaces

The IEMP air monitoring data will be posted to the Geospaticial Environmental Mapping System (GEMS). When the monitoring data indicate a need for adjusting or implementing project-specific source control measures, the regulatory agencies will be notified by the specific remediation projects. The modifications and the effectiveness of the improved source control measures will also be documented.

4.2 Annual Reporting

The NESHAP Subpart H Annual Report will be issued as part of the annual site environmental report, according to reporting schedule in Section 7.0 of the IEMP. Annual summaries of the monitoring results, calculated doses from airborne emissions and calculated direct radiation dose will be included in the report. Comparisons of the pathway-specific doses and the combined annual radiological doses to the regulatory dose limits will also be presented.

5.0 Summary

Table C–4 further summarizes the responsibilities of the IEMP to fully implement the sitewide air-pathway dose tracking and annual dose assessment processes.

Table C–4. Sitewide Dose Tracking and Annual Assessment Tasks

Tasks	IEMP
• Annual Sitewide Planning	Evaluate planned activities and conditions at beginning of the year
• Routine Site boundary Monitoring	Conduct routine air monitoring at background and site boundary locations
• Preventive Tracking/Feedback	Directly compare routine monitoring results to annual dose benchmarks; report and evaluate any exceedances
• NESHAP Compliance Demonstration	Based on actual monitoring data, calculate annual doses at monitoring locations.
• Reporting	Prepare summaries and the annual NESHAP report

6.0 References

DOE (U.S. Department of Energy), 1993. *Radiation Protection of the Public and the Environment,* DOE Order 5400.5, Change 2, U.S. Department of Energy, Washington, DC, January 7.

DOE (U.S. Department of Energy), 2006a. *Legacy Management CERCLA Sites Quality Assurance Project Plan*, DOE-LM/GJ1189-2006, S.M. Stoller Corporation, Grand Junction, Colorado, June.

DOE (U.S. Department of Energy), 2006b. *Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites*, DOE-LM/GJ1197-2006, Revision 0, S.M. Stoller Corporation, Grand Junction, Colorado, May.

Appendix D

Natural Resource Monitoring Plan

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1.0 Introduction and Objectives

The purpose of the Natural Resource Monitoring Plan (NRMP) is to outline a comprehensive plan for monitoring natural resources at the Fernald Preserve. Monitoring requirements related to natural resources include the following: (1) monitoring the status of several priority natural resource areas to maintain compliance with applicable regulations; (2) monitoring of completed restoration projects as specified in Natural Resource Restoration Design Plans (NRRDP); and (3) monitoring impacts to natural resources from site activities. The results of this monitoring will be used to inform the U.S. Environmental Protection Agency (EPA), Ohio Environmental Protection Agency (OEPA), and the Fernald Natural Resource Trustees of the status of natural resources at the Fernald Preserve. Monitoring results will be reported in the annual site environmental reports.

2.0 Analysis of Regulatory Drivers

As shown in Table D–1, regulatory drivers for the management of natural resources and associated impact monitoring include six areas: endangered species protection; wetlands/floodplain regulations; cultural resource management; the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) natural resource trusteeship process; the National Environmental Policy Act (NEPA); and the NRRDPs.

2.1 Threatened and Endangered Species

The federal laws and regulations listed below mandate that any action authorized, funded, or carried out by the U.S. Department of Energy (DOE) cannot jeopardize the continued existence of any threatened or endangered (i.e., listed) species or result in the destruction or adverse modification of the constituent elements essential to the conservation of a listed species within a defined critical habitat. Additional requirements may apply if it is determined that a proposed activity could adversely affect these species or their habitat. These laws and regulations include the Endangered Species Act (16 United States Code [U.S.C.] §1531, et seq.) and its associated regulations (50 *Code of Federal Regulations* [CFR] 17 and 50 CFR 402).

State law also protects endangered species by prohibiting the taking or destruction of any state-listed endangered species. These laws are found in Ohio Revised Code §1518 and §1531, as well as in Ohio Administrative Code §1501.

2.2 Wetlands/Floodplains

Executive Order 11990 (Protection of Wetlands) and Executive Order 11988 (Protection of Floodplains), which are implemented by DOE Regulation 10 CFR 1022, "Compliance with Floodplain/Wetlands Environmental Review Requirements," specify the requirement for a Floodplain/Wetland Assessment in cases where DOE is responsible for providing federally undertaken, financed, or assisted construction and improvements that may impact floodplains or wetlands. This regulation further requires that DOE exercise leadership to minimize the destruction, loss, or degradation of wetlands; and preserve and enhance the natural and beneficial values of wetlands.

Table D-1. Fernald Site Natural Resource Monitoring

DRIVER	ACTION
Endangered Species Act Ohio Endangered Species Regulations	The IEMP describes management of existing habitat and follow-up surveys.
Clean Water Act — Section 404	The IEMP describes the monitoring of mitigated wetlands.
National Historic Preservation Act Native American Graves Protection and Repatriation Act Archaeological Resources Protection Act	The IEMP describes the monitoring of cultural resources.
CERCLA Executive Order 12580 National Contingency Plan	The IEMP describes the CERCLA Natural Resources Trusteeship process.
NEPA	The IEMP discusses the substantive requirements of NEPA for protecting sensitive environmental resources.
Project-specific NRRDPs	The IEMP discusses restored area monitoring.

Pursuant to Section 404 of the Clean Water Act and 33 CFR § 323.3, any activity that results in the discharge of dredged or fill material out of or into a wetland or water of the United States requires permit authorization by the Army Corps of Engineers. These permits can be in the form of either nationwide permits (33 CFR Part 330) or individual permits (33 CFR Part 323) depending on the nature of the activity.

Section 401 of the Clean Water Act and 33 CFR §325.2(b)(1)(ii) also require that a Section 401 State Water Quality Certification be obtained to authorize discharges of dredged and fill material under a Section 401 permit. In Ohio, the Section 401 State Water Quality Certification program is administered by OEPA pursuant to Chapter 3745-32 of the Ohio Administrative Code.

2.3 Cultural Resource Management

Management of cultural resources, particularly archeological sites, is mandated by the National Historic Preservation Act (16 United States Code [U.S.C.] §470), the Native American Graves Protection and Repatriation Act (25 U.S.C. 3001, et seq.), and the Archeological Resources Protection Act (16 U.S.C. §470aa-470ll). The associated regulations for the above laws are found in 36 CFR 800, 43 CFR 10, and 43 CFR 7, respectively. These laws and regulations ensure that archeological resources on federal land are appropriately managed. Section 106 of the National Historic Preservation Act ensures that DOE takes into consideration the effect of its undertakings on properties eligible for listing on the National Register of Historic Places. The Native American Graves Protection and Repatriation Act and 43 CFR 10 require that the rightful control of Native American cultural items discovered on federal land be relinquished to the appropriate, culturally affiliated tribe. Federal land is defined as "land that is owned or controlled by a federal agency." Cultural items are defined as "human remains, associated funerary objects, unassociated funerary objects, sacred objects, and objects of cultural patrimony." The Archeological Resources Protection Act and 43 CFR 7 ensure that competent individuals carry out archeological excavations in a scientific manner.

DOE signed a Programmatic Agreement with the Advisory Council on Historic Preservation and the Ohio Historic Preservation Office that streamlines the National Historic Preservation Act, Section 106 consultation process. Monitoring provisions will be included as part of this agreement to ensure that appropriate management is implemented for any eligible properties at the Fernald Preserve.

2.4 The CERCLA Natural Resource Trusteeship Process

CERCLA, Executive Order 12580, and the National Contingency Plan collectively require certain federal and state officials to act on behalf of the public as trustees for natural resources. Natural Resource Trustees for the Fernald Preserve are the Secretary of DOE; the Secretary of the U.S. Department of the Interior; and officials of the OEPA, appointed by the governor of Ohio.

The role of the Natural Resource Trustees is to act as guardians for public natural resources at or near the Fernald Preserve. The trustees are responsible for determining if natural resources have been injured as a result of a release of a hazardous substance or oil spill from the site, and if so, how to restore, replace, or acquire the equivalent natural resources to compensate for the injury. As the responsible party, DOE is potentially liable for costs related to natural resource injury.

The Fernald Natural Resource Trustees began meeting in June 1994to evaluate and determine the feasibility of integrating the trustees' concerns with site remediation activities. The trustees identified their desire to resolve DOE's liability by integrating restoration activities with the Fernald Site's remediation.

The Fernald Natural Resource Trustees chose to focus on a restoration-based approach to resolve DOE's liability for natural resource impacts. To accomplish this, the trustees signed a Memorandum of Understanding that established implementation of a Natural Resource Restoration Plan (NRRP) as the primary means of settlement for an existing natural resource damage claim by OEPA against DOE. The NRRP set forth a conceptual design for a series of ecological restoration projects that encompasses approximately 904 acres of the Fernald Site. Detailed designs were generated through NRRDPs written for each restoration project. Results of NRMP monitoring were taken into consideration during the design of these area-specific restoration projects. NRRDPs have project-specific monitoring requirements to determine the success of the restoration project. As stated in Section D.1, this monitoring will be summarized in the site environmental reports. Detailed results of restoration monitoring will be provided annually in the appendix to the site environmental report.

2.5 National Environmental Policy Act

In addition to the regulatory drivers summarized above, aspects of natural resource management and monitoring are mandated through the incorporation of substantive NEPA requirements into remedial action planning. In June 1994, DOE issued a revised secretarial policy on NEPA compliance. This policy called for the integration of NEPA requirements into the CERCLA decision-making process. Therefore, requirements for the protection of sensitive environmental resources including threatened and endangered species and cultural resources are to be considered throughout legacy management activities.

2.6 Natural Resource Restoration Design Plans

NRRDPs were written for each ecological restoration project completed on site. The design documents were submitted to EPA and the Fernald Natural Resource Trustees prior to the commencement of restoration activities in a given area. In addition to describing the restoration activities, they also outline the monitoring requirements for each project area once restoration activities were completed. Following is a list of the NRRDPs that are associated with the areas that require monitoring following closure of the site (i.e., physical completion was declared on October 29, 2006).

- Wetland Mitigation Project (Phase II) NRRDP (Area 6, Phase I).
- Borrow Area NRRDP Wetland Mitigation (Phase III).
- Area 8, Phase III NRRDP (Paddys Run West).
- Paddys Run East NRRDP.
- Silos NRRDP.
- Former Production Area NRRDP.
- Waste Pits Area and Paddys Run NRRDP.

3.0 Program Expectations and Design Considerations

The expectations of the monitoring and reporting as outlined in the NRMP are as follows:

- Provide a mechanism to monitor the status of the Fernald Site's natural resources to remain in compliance with applicable laws and regulations.
- Monitor restored areas to ensure requirements of the NRRDPs are being met and restored areas continue to develop and function as designed.

The results of the monitoring outlined in this NRMP will be compiled and reported to EPA and OEPA. Results will be reviewed to ensure that ecologically restored areas are performing as designed. In the event that results indicate that a restored area is not functioning as intended, decisions will need to be made by the DOE Office of Legacy Management (DOE-LM) in consultation with EPA, OEPA, and Natural Resource Trustees regarding appropriate corrective actions.

4.0 Natural Resource Monitoring Plan

Monitoring was implemented during remediation activities to identify impacts to natural resources at the Fernald Site with particular emphasis placed on meeting regulatory requirements for NEPA, threatened and endangered species, wetlands/floodplains, and cultural resources. To accommodate natural resource monitoring, priority natural resource areas have been established across the Fernald Preserve (Figure D–1). Fernald Site personnel conducted all natural resource monitoring during remediation, with oversight from the DOE Office of Environmental Management (DOE-EM). Monitoring has and will continue during legacy management (post-closure), but will be carried out under DOE-LM.

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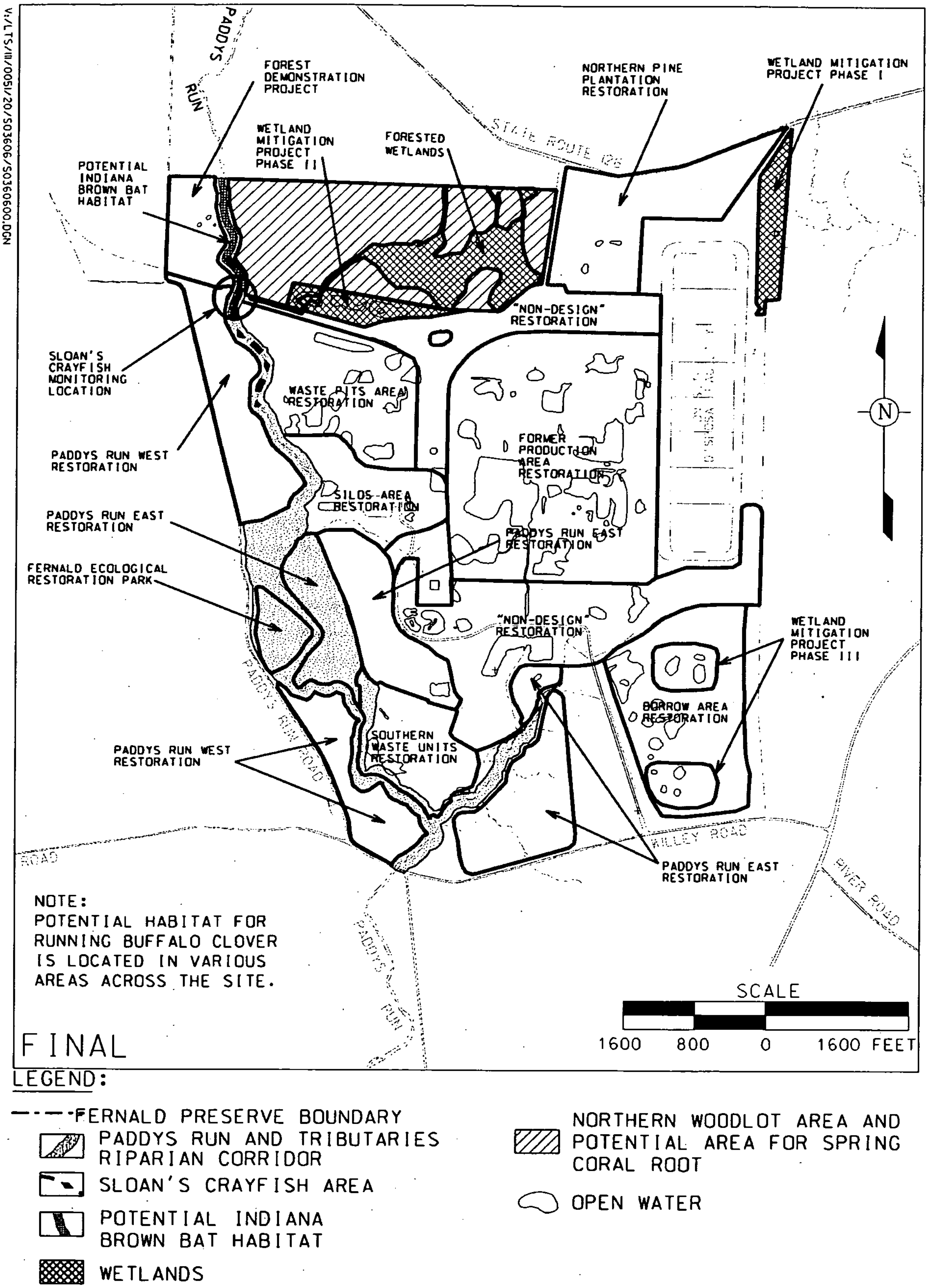

Figure D–1. Priority Natural Resource Areas

Outside expertise may be used in limited circumstances depending on the type of monitoring to be conducted. A description of the monitoring strategies to be implemented at the Fernald Preserve is provided below.

4.1 Threatened and Endangered Species

The state-listed threatened Sloan's crayfish (*Orconectes sloanii*) and the federally endangered Indiana brown bat (*Myotis sodalis*) are the only threatened or endangered species to have a known population at the Fernald Preserve. However, there is the potential for other state-listed and federally listed threatened and endangered species to have habitat ranges that encompass and/or occupy the Fernald Preserve. Monitoring will continue to track the status of the Indiana brown bat populations and their habitat. If activities take place at the Fernald Preserve that could potentially impact the Sloan's crayfish habitat, active monitoring of those areas will resume. Monitoring for several other listed species that may be present at the Fernald Preserve will take place if potential habitat would be impacted by site activities.

4.1.1 Sloan's Crayfish

The state-listed threatened Sloan's crayfish is a small crayfish found in the streams of southwest Ohio and southeast Indiana. It prefers streams with constant (though not necessarily fast) current flowing over rocky bottoms. A large, well-established population of Sloan's crayfish is found at the Fernald Site in the northern reaches of Paddys Run. In dry periods, the crayfish retreat to the deeper pools that remain, primarily upstream of the former rail trestle, located approximately at the boundary between Hamilton and Butler counties. A significant population of Sloan's crayfish also resides in an off-property section of Paddys Run at New Haven Road.

This species resides with one other competing species of crayfish (*Orconectes rusticus*) that is generally considered more aggressive. In addition, the Sloan's crayfish is sensitive to siltation in streams.

Impacts on Sloan's crayfish are similar to those on other aquatic organisms in Paddys Run. Impacts of concern would include excavation and alteration of the streambed along with increased siltation and runoff into Paddys Run. With the majority of onsite soil disturbance now complete, habitat impacts are not expected. If the potential for impacts does return, a Sloan's crayfish management plan will be put in place. This plan would detail monitoring and contingency plans to mitigate impacts.

4.1.2 Indiana Brown Bat

Good to excellent summer habitat for the federally listed endangered Indiana brown bat (*Myotis sodalis*) has been identified north of the former rail trestle along Paddys Run. The habitat provides an extensive mature canopy from older trees and the presence of water throughout the year. In 1999, one adult female was captured along Paddys Run and released. Potential impacts to Indiana brown bat habitat would include tree removal and/or stream alteration in the northern on-property sections of Paddys Run. Because the bats use loose-bark trees for their maternal colonies, removal of trees would impact this species by eliminating its summer habitat.

The habitat of the Indiana brown bat was monitored during remediation activities to identify any unanticipated impacts during remediation. A follow-up survey was conducted in the summer of 2002 as a result of remediation activities north of the train trestle along Paddys Run. No Indiana brown bats were found during this survey.

DOE and the agencies agreed to keep the former rail trestle in place after a thorough review of the impacts that would result from its removal. The trestle was modified to promote use by bats. Additional monitoring will be conducted in 2008 to determine the extent of bat use.

Monitoring methods for the Indiana brown bat would consist of visual observations of that activity and mist netting in areas suitable as bat flyways and where canopy occurs. Mistnetting would occur between May 15 and August 15, because some bats begin to disperse for winter shelter in late August. Data recorded at each sampling site would include type of habitat, water depth and permanence, type of bottom, tree species and size, and presence of hollow trees or trees with loose bark in the vicinity.

In addition to mistnets, bat detectors (which indicate bat activity) would be used during all sampling to detect echolocation calls near the net. The number of calls on the detector would be recorded to indicate the effectiveness of the nets in relation to bat activity. Bat detectors can also be used to sample areas of marginal habitat to determine if netting should be attempted.

One such sampling event took place in the summer of 2007. While several species of bats were collected, no Indiana brown bats were captured. Visual monitoring for bat activity will be conducted through 2008.

4.1.3 Running Buffalo Clover

Surveys conducted in 1994 of the federally listed endangered running buffalo clover (*Trifolium stoloniferum*) found no individuals of this species at the Fernald Site. However, because running buffalo clover is found nearby in the Miami Whitewater Forest, the potential exists for this species to establish at the Fernald Site. The running buffalo clover prefers habitat with well-drained soil, filtered sunlight, limited competition from other plants, and periodic disturbance. This plant is a perennial that forms long stolons, rooting at the nodes. The plant is also characterized by erect flowering stems, typically 3 to 6 inches tall, with two leaves near the summit topped by a round flower head. In the event surveys are necessary, they would be conducted between May and June, which is the optimal time frame for blooms. An appropriate number of transects would be walked in suspect areas to identify the running buffalo clover. If populations are discovered, then best management practices will be used to minimize impending impacts, if any.

4.1.4 Spring Coral Root

The state-listed threatened spring coral root (*Corallorhiza wisteriana*) is a white and red orchid that blooms in April and May, and grows in partially shaded areas of mesic deciduous woods, such as forested wetlands and wooded ravines. Although surveys conducted in 1994 and 1995 indicated no individuals were present, suitable habitat exists in portions of the northern woodlot.

A floristic analysis for the northern woodlot and associated northern, forested wetland was conducted in 1998. This analysis showed that no spring coral root was present in the northern woodlot.

4.2 Wetlands/Floodplains

Approximately 11.87 acres of on-property wetlands adjacent to the former production area were impacted as a result of contaminated soil excavation. The 26-acre northern forested wetland area and associated drainage characteristics were avoided and protected during remediation activities. A mitigation ratio of 1.5:1 (i.e., 1.5 acres of wetlands replaced for every one acre of wetland disturbed) was negotiated between DOE and the appropriate agencies (i.e., EPA, OEPA, U.S. Fish and Wildlife Service, and Ohio Department of Natural Resources). As a result of this agreement, 17.8 acres of new wetlands had to be established to compensate for the impacts during remediation.

Wetland mitigation was initiated at the Fernald Site in 1999. Approximately 6 acres of wetlands were constructed within a 12-acre ecological restoration project along the North Access Road. Monitoring requirements for this wetland area have been completed. Two other wetland mitigation projects have been completed: Area 6, Phase I; and the Borrow Area. Monitoring for these two project areas will continue during legacy management under DOE-LM. More detailed monitoring requirements are discussed in the NRRDP for each project.

4.3 Cultural Resource Management

All field personnel must comply with the procedure, Unexpected Discovery of Cultural Resources, if cultural resources are uncovered during ground disturbing activities. In the event that ground-disturbing activities must occur during legacy management, limited monitoring will occur in all areas that have been surveyed to identify any unexpected discoveries of human remains (Figure D–2). More intensive field monitoring will take place only in areas known to have a high potential for archaeological sites as determined by previous investigations. In most instances, discovery of human remains in previously surveyed areas will require data recovery work. Disturbance of previously unsurveyed areas will require at least a Phase I investigation. An annual summary of all cultural resource field activities is provided separately from the IEMP under the Programmatic Agreement for Archeological Activities at the Fernald Site. Monitoring of cultural resource areas will continue during legacy management to ensure that the areas are not being disturbed, as is described in the Institutional Controls Plan.

4.4 Restored Area Monitoring

Restored area monitoring is required following the completion of natural resource restoration work. Monitoring of restored areas involved two phases, implementation phase and functional phase monitoring. However, only implementation phase monitoring is currently ongoing at the site.

Implementation phase monitoring is conducted to ensure that restoration projects are completed pursuant to their NRRDP and to determine vegetation survival and herbaceous cover. There must be 80 percent survival of all planted vegetation in any given restored area, determined by mortality counts. There must be 90 percent cover for any seeded area, with 50 percent being native species.

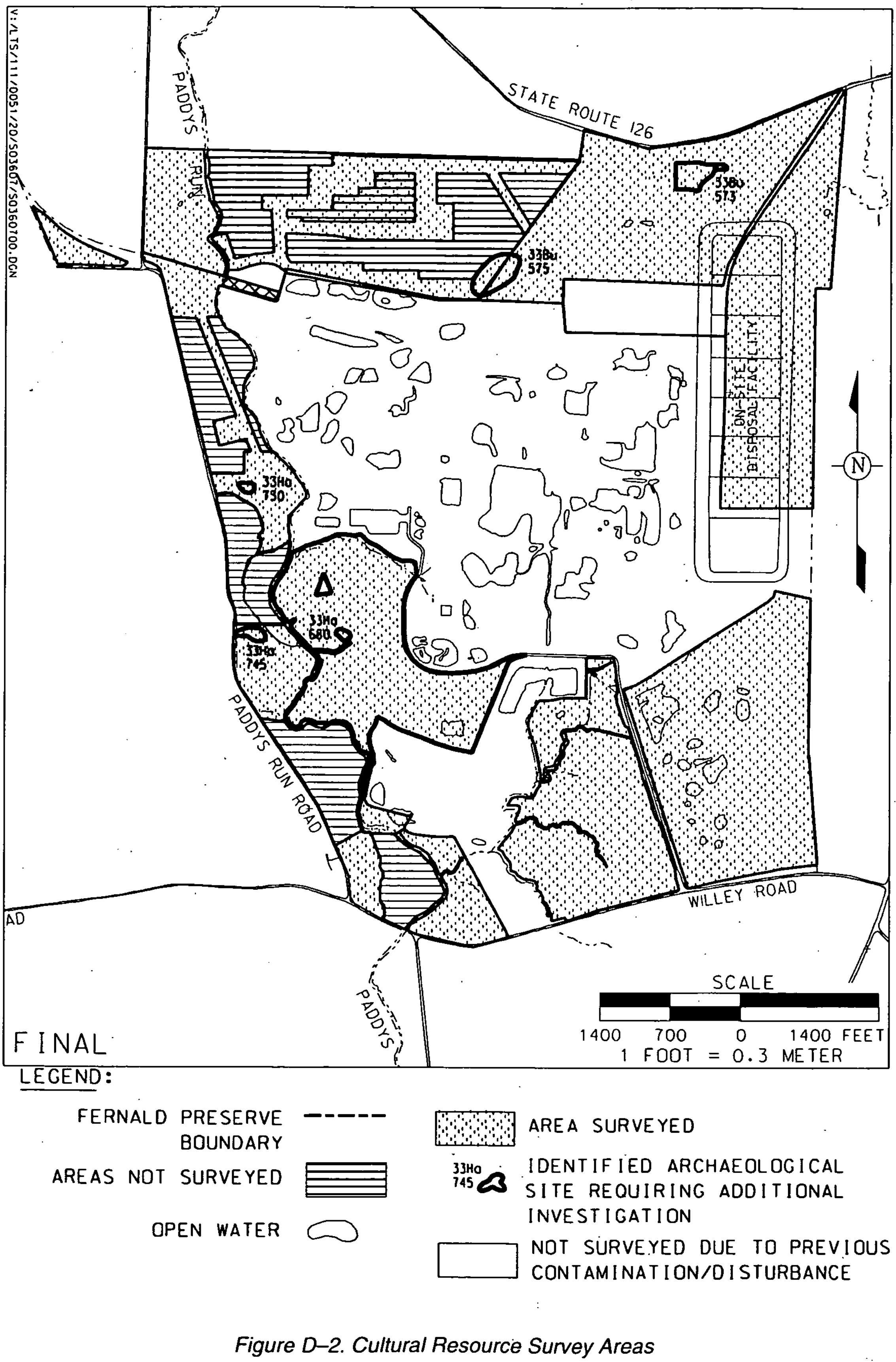

Figure D–2. Cultural Resource Survey Areas

Functional phase monitoring was conducted to evaluate the progress of a restored community against pre-restoration baseline conditions and an ideal reference site. Woody and herbaceous vegetation were evaluated for species richness, density, and frequency. Size of woody vegetation was also recorded. Currently, no further functional monitoring is scheduled for any restored area. The last round of functional monitoring was conducted in the fall of 2005.

4.4.1 Implementation Phase Monitoring

To determine vegetation survival, mortality counts are conducted at the end of the first growing season. Each container grown tree and shrub will be inspected and assigned one of four categories: alive, resprout, vitality, or dead. Trees and shrubs will be considered "alive" when their main stem and/or greater than 50 percent of the lateral stems are viable. "Resprout" trees and shrubs will have a dead main stem, with one or more new shoots growing from the stem or the root mass. Plants will be categorized as "vitality" when less than 50 percent of its lateral branches are alive. "Dead" trees will have no signs of life at all.

For seeded areas within a restoration project, the Natural Resource Trustees agreed to a 90 percent cover survival rate for cover crops (necessary for slope stabilization and erosion control) and 50 percent survival rate for native species at the end of the implementation monitoring period as a goal.

All seeded areas are evaluated within each restoration project. Depending on the size of the restoration project, seeded areas may be grouped into habitat-specific sub-areas. For each distinct area, at least three one-meter square quadrats are randomly distributed and surveyed. Field personnel will estimate the total cover and list all species present within each quadrat. The data collected will be used to determine total cover, percent native species composition, and relative frequency of native species, as described below.

For total cover, the quadrat-specific cover estimates will be averaged. Percent native species composition will be calculated by dividing the total number of species surveyed into the total number of native species present. The relative frequency of native species will be determined as follows. First, DOE will record the number of times each species appears in a quadrat. To obtain the frequency, the number of times a species appears in a quadrat will be divided by the total number of quadrats surveyed. Next, the frequencies of all native species will be summed and divided by the total of all frequencies within a given area.

By collecting the information described above, DOE will evaluate implementation phase success of seeded areas based on two criteria. First, 90 percent cover must be met by the end of the first growing season. Second, the goal of 50 percent native species composition or relative frequency must be obtained by the end of the implementation monitoring period. These criteria address both erosion control and native community establishment, which are the two primary goals of seeding in restored areas.

Implementation phase monitoring for all restoration projects was completed in 2007. However, additional monitoring may be required in future years in order to ensure adequate herbaceous cover and vegetation survival. DOE will evaluate data collected in 2007 and determine whether corrective actions and/or additional monitoring are necessary.

4.4.2 Implementation Monitoring for Mitigation Wetlands

Area 6, Phase I, and the Borrow Area are the only wetland mitigation projects that will require implementation monitoring in 2008. The requirements for the wetland areas are typically for 3 years following completion, instead of just one as with the other restoration areas. The monitoring requirements are also more extensive. Monitoring includes water level measurements, water quality sampling, soil sampling, and wetland plant (herbaceous cover) surveys. Implementation monitoring for mitigation wetlands will be carried out under DOE-LM, and the requirements are spelled out in the NRRDP for the project. Monitoring of Area 6, Phase I was originally to be completed in 2007. However, given the extremely dry summer, DOE determined that it was necessary to suspend the final year or monitoring until 2008.

4.4.3 Functional Monitoring

Currently, negotiations are still ongoing for the Natural Resource Damage Settlement. The negotiations include functional monitoring requirements. At this time, no further functional monitoring is scheduled for any restoration area. However, the outcome of the settlement may require that functional monitoring be resumed. In that case, details of the functional monitoring methodology and the areas that require functional monitoring would be included in the next revision of the Comprehensive Legacy Management and Institutional Controls Plan and this IEMP. If functional monitoring of restored areas is resumed at the Fernald Preserve, the monitoring activities would be carried out under DOE-LM.

4.5 Natural Resource Data Evaluation and Reporting

The results of natural resource monitoring will be integrated with the annual reporting, a commitment in the IEMP. Annual site environmental reports will provide appropriate updates on unexpected impacts to natural resources and the results of specific natural resource monitoring that have been implemented (e.g., monitoring of crayfish, cultural resources, etc.). A summary of the findings will be provided in the site environmental report. A detailed discussion and evaluation of the available data will be presented in the appendix to the site environmental report. Significant findings as a result of natural resource monitoring will be communicated to EPA and OEPA as needed.

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Attachment E

Attachment E

Community Involvement Plan

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Acronyms and Abbreviations

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DOE	U.S. Department of Energy
EM	Office of Environmental Management
FCAB	Fernald Citizens Advisory Board
FCHEC	Fernald Community Health Effects Committee
FFCA	Federal Facilities Compliance Agreement
FRESH	Fernald Residents for Environmental Safety and Health
LM	Office of Legacy Management
LMICP	Legacy Management and Institutional Controls Plan
LSO	Local Stakeholder Organization
LTS&M	long-term surveillance and maintenance
NPL	National Priorities List
OLM	Office of Legacy Management
OSDF	On-Site Disposal Facility
OU	Operable Unit
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act of 1986
EPA	U.S. Environmental Protection Agency

End of current text

1.0 Introduction

The Fernald Preserve (Fernald), located northwest of Cincinnati, Ohio, is currently managed by the U.S. Department of Energy (DOE) Office of Legacy Management (LM). DOE-LM was established in December 2003 to allow for optimum management of DOE's legacy responsibilities. The mission of DOE-LM is to effectively and efficiently manage the environmental and human legacy issues related to the U.S. Government's Cold War nuclear weapons program for current and future generations.

Since the early 1990's, DOE has made it a priority to gather community opinion as part of its decision-making process. Involvement by stakeholders who possess local knowledge and diverse areas of expertise has been instrumental to the success of the cleanup project. Stakeholders have been involved in site cleanup activities, have assisted in addressing technical and management challenges, and have guided the decision-making process. The Fernald cleanup, including plans for long-term management of the site, has benefited from early dialogue among state and federal regulators, stakeholder organizations, elected officials, and members of the general public. Long-term site management goals include informing future generations and new residents about the site, ensuring the effectiveness of institutional controls, and maintaining community support for the site remedy. DOE will establish a Visitors Center on site and will cooperate to the extent possible in helping the community make this a viable entity. The anticipated completion date for the Visitors Center is summer 2008.

This Community Involvement Plan is a follow-on document to existing public affairs plans for the site and public involvement efforts described in the Federal Facilities Compliance Agreement (FFCA). All community relations activities, including this Community Involvement Plan, continue to follow U.S. Environmental Protection Agency (EPA) and DOE guidance on public participation and comply with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) public participation requirements, as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986. This Community Involvement Plan documents how DOE will ensure the public appropriate opportunities for involvement in post-closure site monitoring and maintenance.

This Community Involvement Plan outlines the methods of communication and addresses plans for public involvement after site closure. The plan will be updated as appropriate to address post-closure public involvement activities. Updates will be made as needed, but no more frequent than annually. Significant changes in public participation activities, changes in land reuse plans, and remedy failures are examples of scenarios under which updates would be considered. DOE will collaborate with stakeholder organizations in effect at that time to update the plan. Notification of any changes to the Legacy Management and Institutional Controls Plan (LMICP) or the Community Involvement Plan will be through regularly scheduled quarterly meetings and the website.

End of current text

2.0 Site Description and Background

In 1951, construction of the uranium processing plant began on a 1,050-acre parcel of land near Cincinnati, Ohio. During the Cold War, the Fernald plant, originally named the Feed Materials Production Center, produced 500 million pounds of high-purity uranium metal products for the nation's weapons production program. The products were shipped to other sites within the nuclear weapons complex. Some sites used the products as fuel for nuclear reactors to produce plutonium.

In the late 1980s, when Fernald shut down because of declines in demand for Fernald's product and increasing environmental concerns, 31 million net pounds of nuclear product, 2.5 billion pounds of waste, and 2.5 million cubic yards of contaminated soil and debris remained on site. The uranium metal production mission shifted to focus on environmental restoration and waste management issues.

To manage the cleanup more effectively, the entire site was organized into five distinct study areas called operable units. Each operable unit had similar physical characteristics, waste inventories, regulatory requirements, and/or anticipated remedial action technologies. The operable units were as follows:

- Operable Unit 1 (OU1) included six waste pits, a Burn Pit, and Clearwell.
- OU2 included a solid waste landfill, lime sludge ponds, inactive flyash pile, active flyash pile and the South field area.
- OU3 included all processing facilities located in a 136-acre area.
- OU4 included K-65 Silos 1 and 2, which contained radium-bearing radioactive wastes dating back to the 1940s; Silo 3, which contained dried uranium-bearing wastes; and Silo 4, which was always empty.
- OU5 encompassed the environmental media on the Fernald property and surrounding areas that were impacted by the facility. Environmental media included the groundwater, surface water, soils, sediments, vegetation, and wildlife throughout the Fernald facility and surrounding areas. OU5 also included the South Plume, an area of off-property groundwater contamination.

Cleanup of OU1 through OU4 was a requirement for site closure. Aquifer restoration in OU5 will continue under LM.

In 1996, Fernald completed a 10-year environmental investigation to determine contamination levels and develop cleanup plans. The significant investigation resulted in records of decision (RODs), or final cleanup plans, for the five operable units. After completing the engineering designs, the site's cleanup program was organized into seven major projects to integrate fieldwork and improve safety and efficiency. Those project areas included:

- Aquifer Restoration.
- Building Demolition.
- Soil and Disposal Facility.
- Silos 1 and 2.

- Silo 3.
- Waste Pits.
- Waste Management/Nuclear Material Disposition.

The final mission of the FCP is to clean up the site in compliance with Fernald's approved RODs. In 1999, DOE issued the Final Land Use Environmental Assessment that addressed recommendations and feedback received from the public. To ensure appropriate future use, the site will remain under federal ownership in perpetuity. In support of public use of the site, DOE has restored natural resources on 904 acres to compensate for natural resources that were destroyed or damaged by site operations and cleanup.

3.0 Regulatory Framework

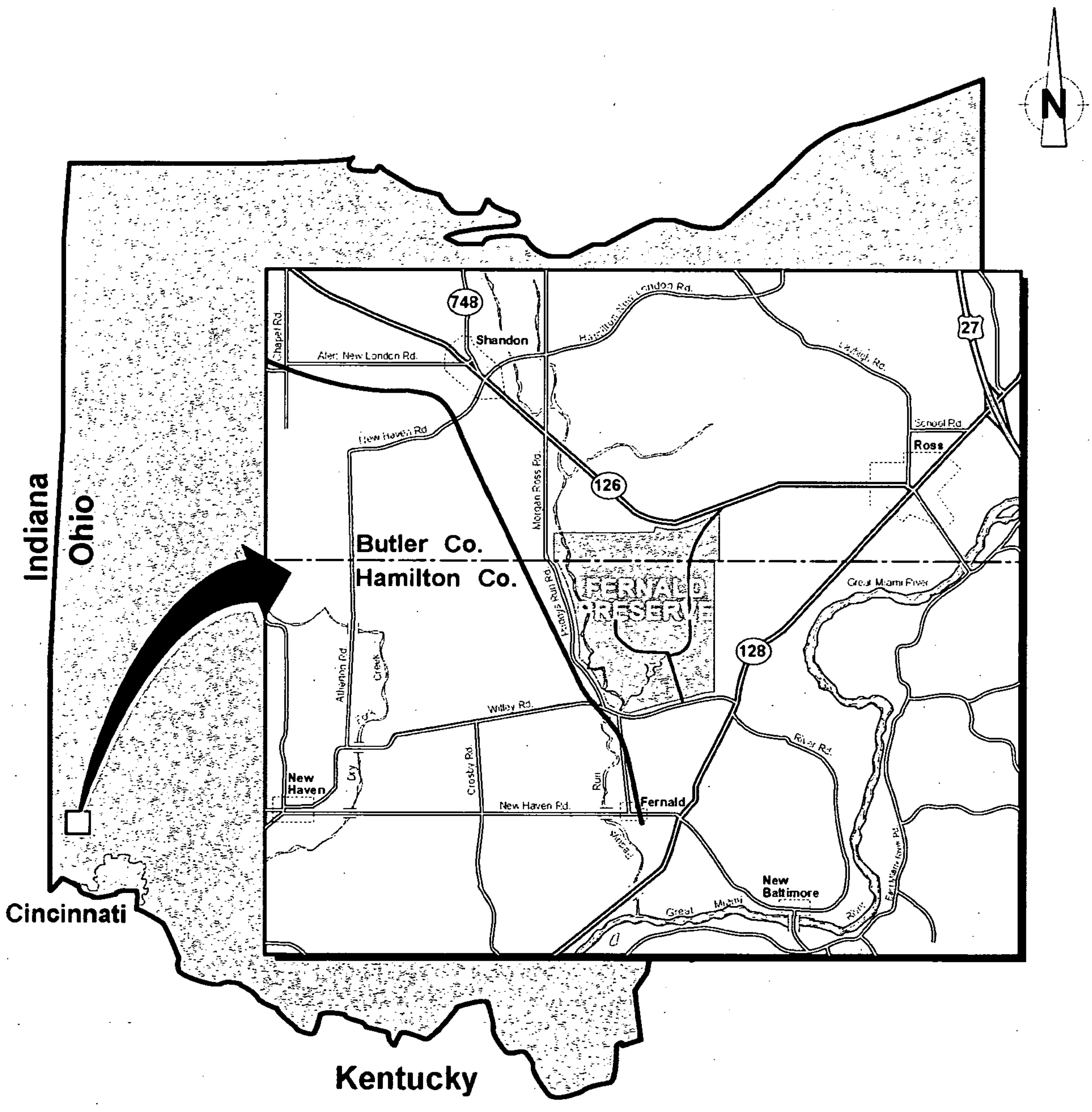
In response to growing concern about health and environmental risks posed by hazardous waste sites, Congress established the Superfund Program in 1980 and SARA in 1986. EPA administers the Superfund Program in cooperation with individual states and tribal governments. The National Priorities List (NPL) is a list of top-priority hazardous waste sites that are eligible for extensive, long-term cleanup under the Federal Superfund Program. EPA placed Fernald on the NPL in November 1989 as the Feed Materials Production Center. All sites under the Superfund Program are regulated by CERCLA, as amended by SARA, and Subpart E of the National Oil and Hazardous Substances Pollution Contingency Plan, found in 40 U.S. *Code of Federal Regulations* Part 300.400. All cleanup activities must satisfy the requirements of CERCLA.

In July 1986, DOE and EPA signed a Federal Facilities Compliance Agreement (FFCA) that established a procedural framework and schedule for developing appropriate response actions and facilitates cooperation and exchange of information. The FFCA initiated the Remedial Investigation/Feasibility Study (RI/FS), a comprehensive environmental investigation conducted in and around Fernald to identify the nature and extent of contamination and to determine the best cleanup solutions.

End of current text

4.0 Community Profile

The Fernald Preserve is located in southwest Ohio, approximately 18 miles northwest of Cincinnati, and straddles the boundary between Butler and Hamilton counties (Figure 4–1). The site is located near the unincorporated communities of Ross (northeast), Shandon (northwest), Fernald (south), New Baltimore (southeast), and New Haven (southwest). The site encompasses portions of Crosby, Ross, and Morgan townships.



The Fernald site covers about 1,050 acres (425 hectares).

Figure 4–1. Fernald Location Map

Hamilton County is situated in the extreme southwestern corner of Ohio and covers an area of 414 square miles. The county is the economic nucleus of the 13-county Cincinnati metropolitan area. As of 2003, Hamilton County supported a population of 823,472, which is a decrease of 2.6 percent since 2000. Within the county are 37 municipalities, including 21 cities, 16 villages and 12 townships.

Butler County is directly north of Hamilton County and covers an area of 467 square miles. This county contains more wide-open spaces and is therefore less densely populated. However, Butler County is showing a growth trend. In 2003, the population estimate was 343,207, which is up 3.2 percent since 2000.

Most of the Fernald Preserve lies within Crosby Township, which has a population of 2,748. Ross Township supports a population of 6,900, and Morgan Township has a population of 6,215. All three townships are expecting dramatic population growth in the near term.

The Great Miami River is located to the east of the Fernald Preserve. Land use in the area consists primarily of residential, agricultural, and gravel excavation operations. Some land in the vicinity of the Fernald Preserve is dedicated to housing developments, light industry, and parks. Local history also includes settlement of the area by Native Americans. DOE agreed to make land available for the reinterment of Native American remains with the following understandings:

- The land remains under federal ownership.
- DOE will not take responsibility for, or manage, the reinterment process. Maintenance and monitoring will not be funded or implemented by DOE.
- The remains must be culturally affiliated with a modern day tribe. The National Park Service had no objections to the reinterment process as long as the "repatriation associated with the reburials comply with the Native American Graves Protection and Repatriation Act as applicable."
- Records must be maintained for all repatriated items reinterred under this process. DOE is not responsible for these records.

Thus far, several federally recognized tribes have been contacted regarding this offer of land for reinterment purposes. To date, only one response has been received from a modern-day tribe with repatriated remains under the Native American graves Protection and Repatriation Act. The Miami Tribe of Oklahoma has informed DOE that they are not interested in use of the site. No other responses from modern-day tribes have been received, and DOE is no longer pursuing the effort. The proposal may be reconsidered in the future if other modern day tribes with repatriated remains come forward.

DOE consulted with appropriate stakeholders, including site labor unions, retirees, other former employees, the Crosby Township Historical Society, and Fernald Living History Inc. to create a Cold War Garden located on the Fernald Preserve property. To facilitate cleanup activities, this memorial was dismantled and placed in storage. The final location for the memorial will be near the Visitors Center on the Fernald Preserve.

4.1 Highlights of Community Involvement

During most of the production era, not much thought was given to public participation or community involvement. When public concerns about contamination problems peaked in the 1980s, site management was unprepared to handle these concerns. There were no public forums to discuss concerns and issues and there were no site contacts for people to call if they had questions. In 1985, the first public relations professional was hired at Fernald. During the first few years, the new Public Affairs department focused primarily on creating public information channels so people could learn about the site operations and on establishing contacts with the community. DOE opened several reading rooms to make site documents available to the public and management started holding community meetings to begin a dialogue with the public.

Within a few years, a new strategy for public participation was developed, exceeding the textbook style found in the regulations. In November 1993, Fernald adopted its public involvement program. The basic precepts of this program were:

- People have a fundamental desire to participate in decisions that affect their lives.
- Many people working together can often find better solutions to difficult problems.
- Fernald management is responsible for including public involvement in decision making.

With the new emphasis on public involvement, the public became more aware of the scope of the site's contamination and changes began to occur. The public insisted on a greater role in cleanup decisions and project managers began to realize that the public could help them find answers to difficult questions, such as, "How clean is clean?" Citizen groups such as the Fernald Citizens Advisory Board, the Fernald Community Reuse Organization, the Fernald Health Effects Subcommittee, Fernald Living History Inc., and Fernald Residents for Environmental Safety and Health were formed to provide avenues for citizen participation in the two-way communication path that was established. Stakeholders have been instrumental in the cleanup progress at Fernald.

The Public Environmental Information Center, located at the Delta Building, 10995 Hamilton-Cleves Highway, Harrison, Ohio 45030, provides easy public access to documents about the cleanup and is a resource center for anyone who wants to conduct research on the Fernald Preserve. The public reading room will eventually be moved to the Visitors Center, once it is completed (Summer 2008).

Fernald also established support programs for both charitable causes and education. Created in 1996, the Fernald Community Involvement Team was a volunteer task force composed of employees, their family members, and friends who are active in social service projects within the local community. In addition, Fernald sponsored educational programs for local students and teachers by establishing strong partnerships with area schools.

Now that site activities have shifted to the long-term surveillance and maintenance phase, so too has the community involvement focus shifted. Community awareness of the remaining contamination is vital to the continued protection of human health and the environment at the Fernald Preserve. Ensuring community awareness of the site's history and maintaining environmental controls will require outreach to new residents and future generations. DOE remains committed to its public involvement program.

4.2 Interested Community Members, Local, City, and State Elected Officials

DOE recognizes that stakeholders may be any affected or interested party, including, but not limited to:

- Local elected officials.
- Fernald Citizens Advisory Board (FCAB).
- Fernald Residents for Environmental Safety and Health (FRESH).
- Fernald Community Alliance.
- Fernald Community Health Effects Committee (FCHEC).
- Current and retired Fernald contractor employees.
- Citizens of Hamilton and Butler counties.
- State and local government agencies, including Ohio EPA.
- Elected State of Ohio officials.
- Federal agencies, including EPA.
- Congressional delegations for Ohio and part of Indiana.
- Local media.
- Local elementary and secondary schools.
- Environmental organizations.
- Business owners.
- Service organizations.
- Other interested individuals.

The FCAB was originally established in August 1993 as the Fernald Citizens Task Force. In 1997, the task force changed its name to the Fernald Citizens Advisory Board to coincide with citizen advisory board at other DOE sites. The FCAB was a DOE Site-Specific Advisory Board chartered by the Federal Advisory Committee Act to advise DOE on activities pertaining to the remediation and future use of the Fernald Preserve. The board consisted of members of the public, including local residents, labor representatives, local government, academia, business representatives, and ex-officio members from DOE, EPA, OEPA, and the Agency for Toxic Substances and Disease Registry. The FCAB was disbanded in September 2006.

FRESH was an environmental activist group that was formed in 1984 to monitor Fernald activities. The stated purposes of the organization was to ensure the Fernald site was cleaned up, to communicate and educate the surrounding communities about the site, and to advocate for responsible environmental restoration and human health and safety. FRESH was a member of the Alliance for Nuclear Accountability (formerly known as the Military Production Network) and the Ohio Environmental Council and Environmental Community Organization. The group's motto was "Making a Difference Since 1984." FRESH held its last public meeting in November 2006.

Fernald Living History Inc. is dedicated to ensuring that the history of Fernald, its importance to the Cold War effort, the facilities that existed at the site, and its cultural significance, are available for future generations. This organization has played an important role is establishing institutional controls as a means of protecting the cleanup remedy at Fernald. The group has changed its name to the Fernald Community Alliance to reflect a change is mission and emphasis.

The organizations described above have played integral roles in the cleanup and legacy management planning of Fernald. The Ronald W. Reagan National Defense Authorization Act for fiscal year 2005 includes language that specifies the development of local stakeholder Organizations (LSOs) at three closure sites, including Fernald. The purpose of the LSOs is to provide a formal mechanism for local communities to continue to be involved in DOE's decision-making process as it relates to the sites post-closure. LM met with stakeholder groups representing each of these three closure sites to gather input on the potential LSO membership and transition to LSOs. LM has developed policies and processes for establishing and managing these organizations and has secured funding for the creation and maintenance of a Fernald LSO.

Public meetings to discuss the formation of a Fernald LSO were held on August 31, 2005, November 16, 2005, and February 8, 2006. Local stakeholders decided to defer formation of an LSO at this time.

4.3 Roles and Responsibilities

EM was responsible for completing cleanup and closure of Fernald. This cleanup and closure included the decontamination and decommissioning of 255 former production plants, support structures and associated components; the shipment of all nuclear waste offsite; the remediation of five operable units; the removal of waste from three silos; the extraction and treatment of contaminated ground water; the transfer of excess government property to state and local agencies; and the preparation of the property for long-term management by LM.

LM is responsible for the long-term care of legacy liabilities at former nuclear weapons production sites, following completion of the EM cleanup effort. The primary goals are to:

- Protect human health and the environment through effective and efficient long-term surveillance and maintenance.
- Manage legacy land assets, emphasizing safety, reuse, and disposition.
- Maintain the remedy, including the continuing groundwater remediation.
- Mitigate community impacts resulting from the cleanup of legacy waste and changing departmental missions.
- Administer post-closure benefits for former contractor employees.
- Manage site records.

Following the cleanup and closure of Fernald, as an EM site, responsibility for maintaining the CERCLA remedies transferred to LM. LM is responsible for compliance with the legacy management requirements and protocols that are documented in the site specific LMICP. At other DOE sites, the LMICP is known as the Long-Term Surveillance and Maintenance (LTS&M) Plan. Fernald's post closure LTS&M requirements fall into three categories: operation and maintenance of the remedy, legacy management in restored areas, and public involvement.

Legacy management activities related to the maintenance of the remedy include monitoring and maintaining the on-site disposal facility (OSDF), ensuring that site access and use restrictions are enforced, the continuing groundwater remediation, and managing records. Maintaining institutional controls, safeguards that effectively protect human health and the environment, will be a fundamental component of LTS&M at Fernald, and will include ensuring no residential, agricultural, hunting, swimming, camping, fishing, or any other prohibited activity occur on the property. In addition, appropriate wildlife management techniques and processes may also be necessary.

Legacy management in restored areas will include ensuring that natural and cultural resources will be protected in accordance with applicable laws and regulations. Wetlands and threatened and endangered species are examples of natural resources that will be monitored.

Legacy management activities related to public involvement include continued communication with the public regarding the continuing groundwater remediation, legacy management activities, and the future of the Fernald Preserve. Emphasis will also be placed on education of the public regarding the site's former production activities, the site's remediation, and land use restrictions. Education will include displays and programs at the Visitors Center and outreach programs at local schools and organizations.

5.0 Public Participation Activities

Public participation is an important part of the CERCLA process. As a testament to that fact, the Community Involvement Plan is included in Volume II, the enforceable portion of the LMICP. DOE will offer opportunities for public involvement beyond those required by regulations. Public participation activities are conducted in support of the DOE goal of actively informing the public about the FCP and site transition and to provide opportunities for open, ongoing, two-way communication between DOE and the public.

DOE has been conducting public participation activities to meet citizen expectations for involvement in the decision-making process for areas not specified by statutes and regulations. In such cases, DOE has successfully used the consultative process by inviting the general public, special interest groups, and the local government to participate early in the decision-making process and the prioritization of Fernald activities. The consultative process supplements the public involvement activities required by law. By engaging the community early in decision-making processes, DOE is better able to integrate community values into its decisions and build trust among stakeholders.

The following are general descriptions of post-closure, public participation activities LM planned. As activities at the site decrease, DOE anticipates a corresponding reduction in topics that warrant communication to stakeholders. Table 5–1 shows the public participation activities anticipated.

5.1 Meetings

DOE provides briefings, workshops, and presentations on site activities in a variety of public forums.

5.1.1 Public Meetings

LM has an on-site manager as of January 2006. LM will hold public meetings quarterly for the first year post-closure and at least annually thereafter to address post-closure issues of importance to stakeholders. These meetings will provide information about long-term surveillance and maintenance activities being conducted at the site and will present the results of annual site inspections.

5.1.2 Briefings for Local, State, and Federal Elected Officials

LM will brief elected officials as needed to discuss new data trends or the evaluation of post-ROD changes.

5.1.3 Meetings with Citizens Groups

LM will meet with post-closure stakeholder groups to discuss topics of interest and concern.

Table 5–1. Matrix of Public Participation Activities

Activity	Post-Closure
Meetings	
Public Meetings	• LM placed an on-site manager January 2006. • Quarterly public meetings for the first year post-closure and annually thereafter. • Address post-closure issues, including LTS&M activities and annual inspection results.
Briefings for Elected Officials	• Continue briefings. • Discuss new data trends or evaluation of post-ROD changes.
Meetings With Citizens Groups	• LM will meet with stakeholders. • Local stakeholders decided to defer formation of an LSO at this time.
Administrative Record and Public Reading Room	• Maintain the Public Reading Room at least 2 years . • Future location will be in the Visitors Center on the Fernald Preserve.
On-Site Education Facility	• A Visitors Center will be located on site. • The educational and information function serves an institutional control. • Complete installation of Cold War Memorial.
Internet Website	• LM will maintain web page for Fernald Preserve and will include CERCLA documents prepared post-closure. • Administrative Record will be available electronically through the Internet.
Site Tours	• LM will conduct site tours as requested.
Documents for Public Review and Comment	• CERCLA requirements will be followed for public comment. • Stakeholders will be consulted on review of non-regulatory documents. • Anticipate minimal number of documents created. • Changes required post-closure to significant cleanup documents will be discussed with stakeholders.
News Releases and Editorials	• LM will continue to issue news releases post-closure.
Publications	• LM will prepare fact sheets as needed. • Distributed through mailings and posted on website.
Public Outreach Presentations	• Public outreach presentations will be given as requested.
Emergency Contacts	• In case of an emergency dial 911. • Established contacts will be notified in emergency situations. • Signs with toll-free number will be posted around site. • 24-hour Emergency Number is 970-248-6070 or 877-695-5322.
Mailing Lists	• LM is responsible for maintaining Fernald Preserve contacts.

5.2 Administrative Record and Public Reading Room

DOE will establish a Visitors Center on site. The Visitors Center will contain information and documents about remediation of the Fernald Preserve, including information on site restrictions, ongoing maintenance and monitoring, and residual risk data. The Visitors Center will provide storage for historical information and photographs, other educational information, a reading room, and meeting accommodations. A primary goal of the Visitors Center is to fulfill an informational and educational function within the surrounding community. The information made available at the Visitors Center serves as an institutional control for the site.

5.3 On-Site Education Facility

LM will continue to work with interested stakeholders who desire to preserve and tell the story of Fernald. The established Visitors Center will serve as an on-site education facility for school and community groups. DOE will support community efforts to develop and provide historical preservation programs and complete installation of the Cold War Garden.

5.4 Internet Website

LM will maintain a Web page for Fernald post-closure, will post site documents created after closure, and will make available online key documents associated with the cleanup and remedy. When the Administrative Record is available electronically, these documents will be accessible through the Internet. CERCLA documents prepared post-closure will be posted on the LM website soon after they are released.

5.5 Site Tours

Tours provide an important forum to help the community understand post-closure site conditions and the controls in place to protect human health and the environment. Official visits or tours are scheduled based on specific requests and can focus on environmental restoration activities and ongoing operations. Access to the OSDF is limited to authorized personnel only. Because of their value, LM will continue stakeholder and media tours as requested.

5.6 Documents for Public Review and Comment

LM will provide opportunities for stakeholders to review and comment on post-closure documents as required by CERCLA regulations, including 5-year reviews. For documents not specified by statutes and regulations, LM will consult with stakeholders to address citizen expectations for involvement in public reviews and comments. DOE anticipates the number of documents developed post-closure to be minimal.

The LMICP explains how DOE will fulfill its surveillance and maintenance obligation at the site. The public has been provided an opportunity to comment on the LMICP and will continue to have the opportunity to comment on revisions to the plan. Changes required post-closure to significant site documents will be discussed with stakeholders.

5.7 News Releases and Editorials

LM will continue to issue news releases and/or community advisories to announce public meetings regarding LM documents or significant post-closure activities.

5.8 Publications

LM will prepare fact sheets and newsletters as needed to describe LM post-closure activities. These fact sheets will be provided to stakeholders on the mailing list and will be posted on the LM website.

5.9 Public Outreach Presentations

LM will continue with public outreach presentations on Fernald as requested.

5.10 Emergency Contacts

In the event of an emergency, LM will make notifications to established points of contact, regulators, local elected officials, and community officials. Congressional offices will be informed promptly if an emergency situation arises. The 911 service will be used when requesting emergency assistance on or near the site. Signs with a toll free number for citizens to register concerns about the site will be posted at visible locations around the site. The public may use the 24-hour security telephone numbers monitored at the DOE Office at Grand Junction, Colorado, to notify LM of site concerns. The 24-hour security telephone numbers will be posted at site access points and other key locations on the site. The 24-hour emergency number is 877-695-5322.

5.11 Mailing Lists

LM maintains a contact database of all stakeholders associated with any LM site. LM is responsible for maintaining the list of Fernald stakeholders post-closure.

Appendix A

Information Contacts

<table>
<tr><th colspan="2">U.S. Department of Energy (DOE)</th></tr>
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The Honorable Patricia Clancy Senator Ohio Senate Senate Building Room 143 Columbus, OH 43215 (614) 466-8068 E-mail: SD08@mailr.sen.state.oh.us	The Honorable Tyrone Yates Representative Ohio House of Representatives 77 S. High Street, 11th Floor Columbus, OH 43215-6111 (614) 466-1308 E-mail: district33@ohr.state.oh.us
The Honorable Gary Cates Senator Ohio Senate Senate Building Room 042 Columbus, OH 43215 (614) 466-8072 E-mail: SD04@mailr.sen.state.oh.us	The Honorable Steve Driehaus Representative Ohio House of Representatives 1157 Overlook Avenue Cincinnati, OH 45238 (513) 921-6511 or (614) 466-5786 E-mail: district31@ohr.state.oh.us
The Honorable Tom Brinkman, Jr. Representative Ohio House of Representatives 3215 Hardisty Avenue Cincinnati, OH 45208 (513) 321-6591 or (614) 644-6886 E-mail: district34@ohr.state.oh.us	The Honorable Courtney Combs Representative Ohio House of Representatives 77 S. High Street, 14th Floor Columbus, OH 43215-6111 (614) 644-6721 E-mail: district54@ohr.state.oh.us
The Honorable Louis W. Blessing Representative Ohio House of Representatives 77 S. High Street, 13th Floor Columbus, OH 43215-6111 (614) 466-9091 E-mail: district29@ohr.state.oh.us	The Honorable Catherine Barrett Representative Ohio House of Representatives 5300 Hamilton Avenue Cincinnati, OH 45224 (513) 681-0050 or (614) 466-1645 E-mail: district32@ohr.state.oh.us

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Mr. Warren Strunk President Crosby Township 9129 New Haven Road Harrison, OH 45030 (513) 367-6556 No e-mail address available	Ms. Nancy Poe Chairman Morgan Township Trustees P.O. Box 189 Okeana, OH 45053 513-738-2270 No e-mail address available
Mr. Dennis Conrad, Jr. Chairman Reily Township 6376 Peoria-Reilly Oxford, OH 45056 (513) 757-4113 No e-mail address available	Mr. Tom Willsey President Ross Township 2941 Layhigh Road Hamilton, OH 45013 (513) 738- 2543 E-mail: rosstwp@aol.com
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Environmental/Interest Groups	
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Fernald Community Alliance Graham Mitchell President [redacted]	