Department of Energy
Office of Legacy Management

September 16, 2010

Mr. Timothy Fischer
U.S. Environmental Protection Agency
Region V-SRF-6J
77 W. Jackson Blvd.
Chicago, IL 60604-3590

Mr. Thomas Schneider, Project Manager
Ohio Environmental Protection Agency
Southwest District Office
401 East Fifth Street
Dayton, Ohio 45402-2911

Mr. David Devault
United Fish and Wildlife Services
Regional Office – Federal Building
Fort Snelling, Minnesota 55111

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

Subject: **Transmittal of the Draft Change Pages to the Comprehensive Legacy Management and Institutional Controls Plan, Revision 4**

This letter transmits the draft change pages to the Fernald Preserve Comprehensive Legacy Management and Institutional Controls Plan (LMICP), Revision 4 to the United States Environmental Protection Agency and Ohio Environmental Protection Agency.

The LMICP has been revised as a result of the annual review. Updates to the document are highlighted within the text (i.e., track changes).

The LMICP change pages will be available to all stakeholders through the Public Environmental Information Center and on the Department of Energy Office of Legacy Management's internet site (http://www.lm.doe.gov) under the Legacy Management Sites icon.

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

Sincerely,

Jane Powell

Jane Powell
Fernald Preserve Site Manager
DOE-LM-20.1

Enclosure

cc w/enclosure:
M. Cullerton, Tetra Tech
S. Helmer, ODH
T. Schneider, OEPA (3 copies of enclosure)
M. Shupe, HSI GeoTrans
Project File (Thru W. Sumner)
Administrative Records (Thru W. Sumner)

cc w/o enclosure:
J. Reising, DOE
K. Broberg, Stoller
B. Hertel, Stoller
J. Homer, Stoller
F. Johnston, Stoller
G. Lupton, Stoller
K. Voisard, Stoller
S. Walpole, Stoller
C. White, Stoller

Volume I

Legacy Management Plan

April 2010

U.S. Department of Energy

Revision 4
Final

- Attachment C—Groundwater/Leak Detection and Leachate Monitoring Plan
- Attachment D—Integrated Environmental Monitoring Plan
- Attachment E—Community Involvement Plan

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 the methods DOE will use to maintain communication with the public 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 completed site remediation (refer to Section 1.2). The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (Title 42 *United States Code* Section 9601 et seq.) 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, 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.

The PCCIP (Attachment B) includes detailed information about the OSDF, and the OMMP (Attachment A) includes detailed information about the monitoring and maintenance of the converted advanced wastewater treatment facility (CAWWT), groundwater restoration systems, and the active outfall line. Legacy management activities covered in the PCCIP and OMMP also include ensuring that restrictions on access to and use of the Fernald Preserve are enforced (for example, through 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 maintaining communication with the public and providing the public with information about the site's former production activities, its historical remediation, continuing groundwater remediation, land-use restrictions, and the future of the Fernald Preserve. Displays and programs at the Visitors Center (former Silos Warehouse) and outreach programs at local schools and organizations will help LM meet this objective.

This Legacy Management Plan describes planned legacy management activities at the Fernald Preserve as well as issues related to stewardship and is organized into the following sections:

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, and presents a discussion of production activities, remediation, and site conditions at the time of closure.

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 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 apply 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.

The LMICP will be finalized by January each year to correspond with calendar-year monitoring and reporting. Comments from EPA, Ohio 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 Report will be submitted and will include recommendations based on the previous year's monitoring information.
- Each September, 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.

1.2 Purpose of Legacy Management

In recent years, DOE has increased its focus on the need for legacy management following completion of remediation. 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." Both terms are used in this Legacy Management Plan and refer to the same process.~~

- DOE Order 144.1, *Department of Energy American Indian Tribal Government Interactions and Policy*, 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 200.1A, *Information Management Program*, provides a framework for managing information, information resources, and information technology investment.
- DOE Order 430.1B, *Real Property Asset Management*, identifies the requirements and establishes reporting mechanisms and responsibilities for real property asset management.

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 1998b), and *Historical Documentation of Facilities and Structures at the Fernald Site* (DOE 1998a).

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. The sitewide 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. Contaminated soil detected above FRLs has been excavated and appropriately disposed. Remaining soils have been certified to meet final remediation levels (with the exception of certain areas associated with utility corridors and groundwater infrastructure~~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.

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 local 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.

Pneumatic retrieval, conditioning, and packaging of Silo 3 material was initiated March 23, 2005. A total of 1,416 containers were filled via pneumatic retrieval through October 21, 2005, when mechanical retrieval was initiated. Retrieval and packaging of Silo 3 material was completed March 21, 2006. A total of 2,297 containers were filled (including 50 containers of material generated during safe shutdown of the facility) and transported to Envirocare of Utah for disposal.

Bulk processing in the Silos 1 and 2 Remediation Facility was completed March 19, 2006. A total of 3,776 containers of treated material from Silo 1 and 2 (including 80 containers produced through direct loadout in support of the safe shutdown of the facility) were packaged and shipped to the Waste Control Specialists facility in Andrews, Texas for disposal. On May 29, 2008, the State of Texas granted a byproduct license to WCS, which allowed the canisters of Silos 1 and 2 waste to be permanently disposed of at WCS. Final permanent disposal of Silos 1 and 2 treated waste materials began on October 7, 2009. The last container was placed on November 2, 2009.

OU5 includes all environmental media, such as soil, sediment, surface water, groundwater, and vegetation. *The Site-wide Excavation Plan* (SEP) (DOE 1998c) 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 with contaminants in concentrations 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 subgrade 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 discontinuation of their use (see Section 2.4.4).

The OU5 ROD (DOE 1996) describes the approved remediation method of pump-and-treat for groundwater. The OU5 ROD 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 remediation of the uranium. The OU5 ROD provides a complete list of all of the constituents identified in groundwater. The FRL for uranium in

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. 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 greater detail in Volume II of this plan (the IC Plan), and additional details are included in the PCCIP (Attachment B), OU2 ROD (DOE 1995a), and OU5 ROD (DOE 1996). Approximately 2.96 million cubic yards of impacted materials were placed in the facility. The PCCIP (Attachment B) provides a summary of the materials permitted to be placed in the OSDF. The design approach for the OSDF is described in both the OU2 ROD (DOE 1995a) and the *Final Design Calculation Package; On-site Disposal Facility* (GeoSyntec 1997). The design includes a liner system, impacted-materials placement, a final cover system, a leachate management system, a surface water management system, and other ancillary features.

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

The following are brief summaries of the habitat restorations. Details of the actual projects and further information on the restored areas are described in the *Natural Resource~~s~~ Restoration Plan* (NRRP), which is Appendix B of the *Consent Decree Resolving Ohio's Natural Resource Damage Claim against DOE* (State of Ohio 2008).

Upland Forest: Upland forest areas existed in a northern portion, in a southern portion, and on the western perimeter of the site. Restoration activities expanded 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 and shrubs used are native to southwestern Ohio and are listed in the NRRP, Table 3–1.

Figure 2–2. Fernald Land Use

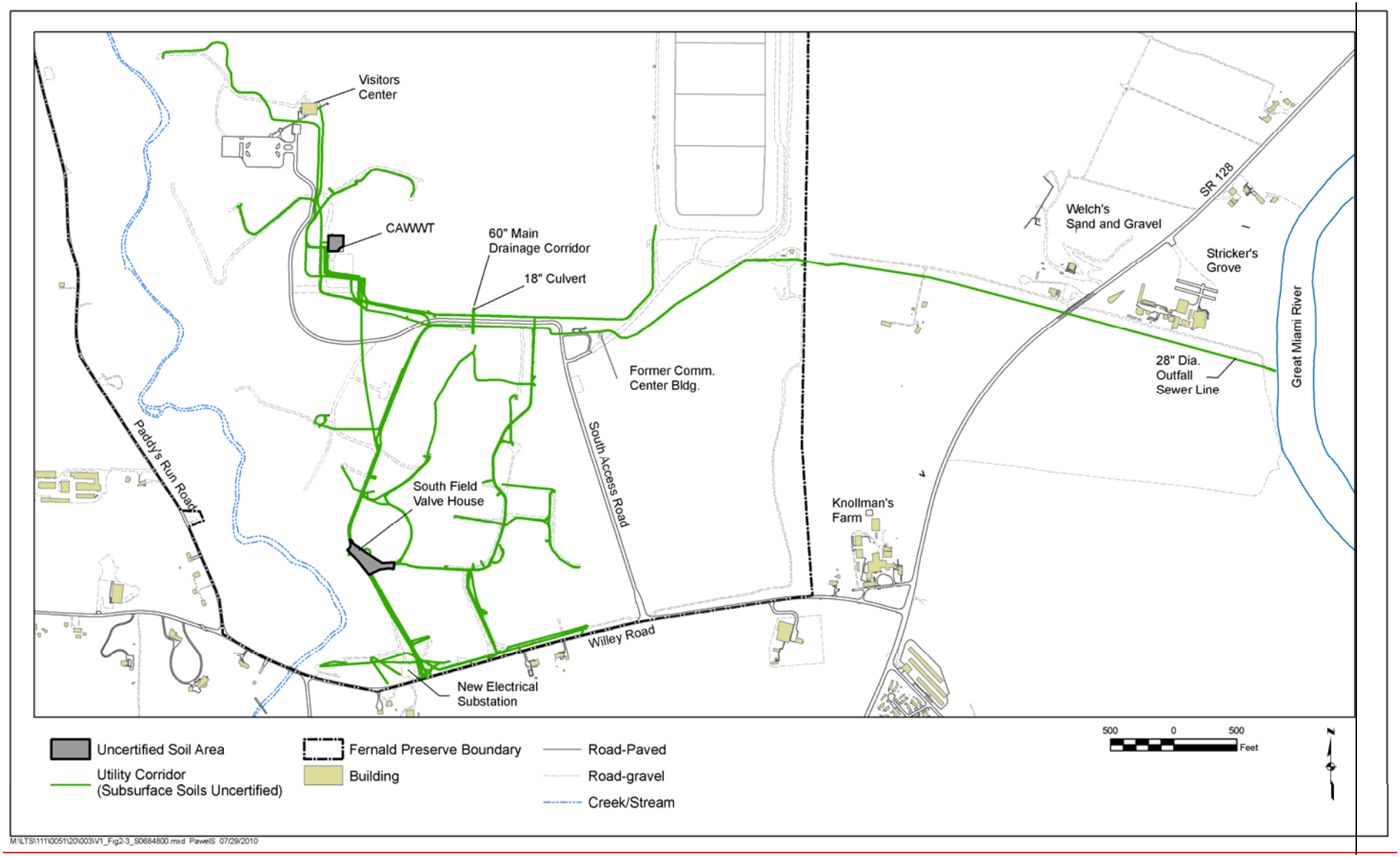

Figure 2–3. Uncertified Areas and Subgrade Utility Corridors

The 60-inch Main Drainage Corridor culvert and an adjacent 18-inch culvert were left in place even though fixed contamination remains 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. Because of their locations, these culverts could not be 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 subgrade utility corridors will be certified following the completion of groundwater remediation, when these systems are no longer needed and are removed. Soils within the footprints of the CAWWT and South Field Valve House will be certified when these facilities are no longer needed, are removed from service, and are decommissioned and dismantled. Because the groundwater remediation end date is uncertain, no firm schedule for soil certification in the corridors can be established at this time.

The existing paved 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, associated piping, and utilities; the outfall line to the Great Miami River; the restoration storage shed; the former Communications Building; and the Visitors Center.

DOE refurbished the former Silos Warehouse for use as an on-site Visitors Center, which was completed in summer 2008. The Visitors Center contains information and context on the remediation of the Fernald Preserve, including information on site restrictions, ongoing maintenance and monitoring, and residual risk. It also provides historical information and photographs, a meeting place, and other educational resources. 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 also serves as an institutional control.

The Visitors Center is maintained and operated under the direction of LM. DOE will periodically evaluate the use of the Visitors Center and the programming provided there and will obtain community input on decisions regarding changes to and the ongoing operation of the Visitors Center.

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.

DOE and OEPA signed a Consent Decree in November 2008 that settles a long-standing natural resource damage claim under Section 107 of CERCLA. As a result, the Fernald Natural Resource Trustees (DOE, OEPA, and the U.S. Department of Interior) have finalized the Natural Resource Restoration Plan (NRRP), which is Appendix B of the *Consent Decree Resolving Ohio's Natural Resource Damage Claim against DOE* (State of Ohio 2008). The NRRP specifies an enhanced monitoring program for ecologically restored areas at the site. Monitoring activities include a comprehensive wetland mitigation monitoring program and resumption of ecosystem-based functional monitoring. In addition, the Natural Resource Trustees conducted field walkdowns of all restored areas in 2009, and developed a path forward for several repair and enhancement projects. The Natural Resource Monitoring Plan, which is included as part of the Integrated Environmental Monitoring Plan (Attachment D of the LMICP Volume II), describes the Natural Resource Trusteeship process at the Fernald Preserve.

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. DOE has received no other responses from modern-day tribes and 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 LM meet this objective.

4.0 Oversight of Legacy Management at the Fernald Preserve

4.1 Office of Legacy Management Responsibilities

LM is responsible for the oversight of the Fernald Preserve during legacy management and will ensure that all legacy management activities are conducted as required. LM makes the decisions regarding changes in surveillance, maintenance, engineering, access, public use, and other issues. 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, 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 LM under the Legacy Management Support (LMS) contract, will work closely with and communicate regularly with LM, and will be the physical presence at the site. LMS contractor personnel will be responsible for operating the groundwater remediation systems; conducting inspections, monitoring, and sampling; collecting all data; developing the reports; and making those reports available to the public. Maintenance activities for the OSDF and ecologically restored areas are the LMS contractor responsibility as well. The LMS contractor will notify LM in the event of an emergency and will take action to prevent damage to the site.

~~Operation~~ Subcontractor services may be used to conduct a variety of operation and maintenance tasks, such as minor repairs to fencing, gates, signs, or components of the groundwater infrastructure~~, may be carried out by additional subcontractor services~~. Repairs that require earthwork, erosion control, seeding, mowing, clearing, herbicide application, or repair to pumps and piping ~~will~~ may also be completed by subcontractor ~~services~~s.

The LMS contractor will procure goods and services 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 technical leads identify site requirements, contractor staff will develop a scope of work and initiate a solicitation package. 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 similar existing subcontracts were issued, 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 nature of the work scope, the critical nature of the services, and the importance of historical information known only by the previous contractor. Although 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

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 DOE and EPA, in consultation with 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, a review of the remedy at that site is required every 5 years. 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, 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 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 be submitted to EPA and 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 (Title 40 *Code of Federal Regulations* Part 61, Subpart H) reporting requirements, as necessary~~. Additionally, other reporting, such as the National Pollutant Discharge Elimination System monthly discharge reports, will continue as required under other regulatory programs and will be addressed outside the annual Site Environmental Reports.

5.0 Records Management

The long-term retention of records and dissemination of information is another critical aspect of legacy management. 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. Records that have reached the end of the scheduled retention period will be reviewed and approved by management for final destruction or rescheduled for additional retention. ~~For legacy management purposes, 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.~~ Within 60 days of EPA's approval of this LMICP, the LM website will be updated to include the most recent version of the Fernald Preserve LMICP.

5.1 Types of Data Required for Legacy Management

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

In fall 2002 DOE personnel began working with stakeholder groups to identify critical records in the four categories and 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

LM assumed custodianship of the Fernald records when the site transitioned from DOE's Office of Environmental Management to LM in fiscal year 2007. 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, Illinois and the Department of Energy/Office of Legacy Management, Business Center located at Morgantown, West Virginia. Their respective websites are http://www.archives.gov/great-lakes/contact/frc-chicago.html and http://www.lm.doe.gov/Program_Contacts/Legacy_Management_Contacts.aspx.~~. Their respective websites are http://www.archives.gov/great-lakes/contact/frc-dayton.html and http://www.archives.gov/great-lakes/contact/frc-chicago.html. 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 winter 2010.~~

Volume II

Institutional Controls Plan

April 2010

U.S. Department of Energy

Revision 4
Final

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/FSs, Records of Decision (RODs) were issued outlining the selected remedy for each OU.

- **ROD 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.
- **ROD 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 of on site. The WAC are documented in the *Waste Acceptance Criteria Attainment Plan for the On-site Disposal Facility* (DOE 1998b). OU2 field activities ended November 2003.
- **Final ROD 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.
- **ROD 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.

  Pneumatic retrieval, conditioning, and packaging of Silo 3 material was initiated March 23, 2005. A total of 1,416 containers were filled via pneumatic retrieval through October 21, 2005, when mechanical retrieval was initiated. Retrieval and packaging of Silo 3 material was completed March 21, 2006. A total of 2,297 containers were filled (including 50 containers of material generated during safe shutdown of the facility) and transported to Envirocare of Utah for disposal.~~OU4 field activities ended May 2006 (field activities relate to the final shipment of OU4 waste off the Fernald Site), and the Silo 1 and 2 waste was shipped to a Waste Control Specialists, LLC (WCS) facility in Andrews, Texas. The waste has been held in interim storage at WCS since it was shipped off site.~~

  Bulk processing in the Silos 1 and 2 Remediation Facility was completed March 19, 2006. A total of 3,776 containers of treated material from Silo 1 and 2 (including 80 containers produced through direct loadout in support of the safe shutdown of the facility) were packaged and shipped to the Waste Control Specialists facility in Andrews, Texas for disposal. On May 29, 2008, the State of Texas granted a byproduct license to WCS,~~. This will~~ which allowed ~~3,766~~the canisters of Silos 1 and 2 waste to be permanently disposed of at WCS. Final

permanent disposal of Silos 1 and 2 treated waste materials began on October 7, 2009. The last container was placed on November 2, 2009.
~~The ROD has a milestone of October 31, 2009, for "initiation" of permanent disposal. WCS will require 6 months to construct the disposal cell, allowing disposal to "commence" in fiscal year 2009.~~

- **ROD 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 1998a) 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 RODs 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 2–4). Modeling results indicate that 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 presettlement southwestern Ohio. A few facilities remain on site. These include the Visitors Center (former Silos Warehouse), 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, and the former Communications Building. Figure 1–1 shows the Fernald Preserve's land use.

The DOE Office of Environmental Management (EM) was responsible for the remediation of the Fernald Site. Post-remediation responsibilities have transitioned to the DOE Office of Legacy Management (LM). 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. 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 public. This IC Plan will also be reviewed every

Figure 1–1. Fernald Land Use

The structures subject to the OU3 ROD reconciliation were those that were present solely to support the legacy management of the site. Other facilities at the site, under the authority of OU5, 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 non-business 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 open during the day to allow for public access. 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 2–1).

An on-site 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. The new on-site Visitors Center (see Section 2.1.3.1) will result in community traffic and a public presence on the site. The final site configuration includes posting contact information at access points and other strategic locations (visible to the public); members of the community may call anytime 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 as 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 obstacles such as dense vegetation and the presence of water. Beginning in 2008, p~~Portions of the site are inspected each quarter when areas are most easily and safely accessible. For example, the north woodlot and Paddys Run corridor are inspected in the winter, and the former production area is inspected in the summer. These area inspections will include verifying that no unauthorized access or use of the site is taking place, verifying that the desired results from restoration activities (e.g., seeding and planting) are being achieved, verifying that nuisance species are not out of control or are not responding to mitigation efforts, documenting the presence of newly formed erosion or debris in the area, and ensuring that institutional controls are being maintained. The distance between transects will be no more than 100 feet (ft), and may be less depending on the number of participants.

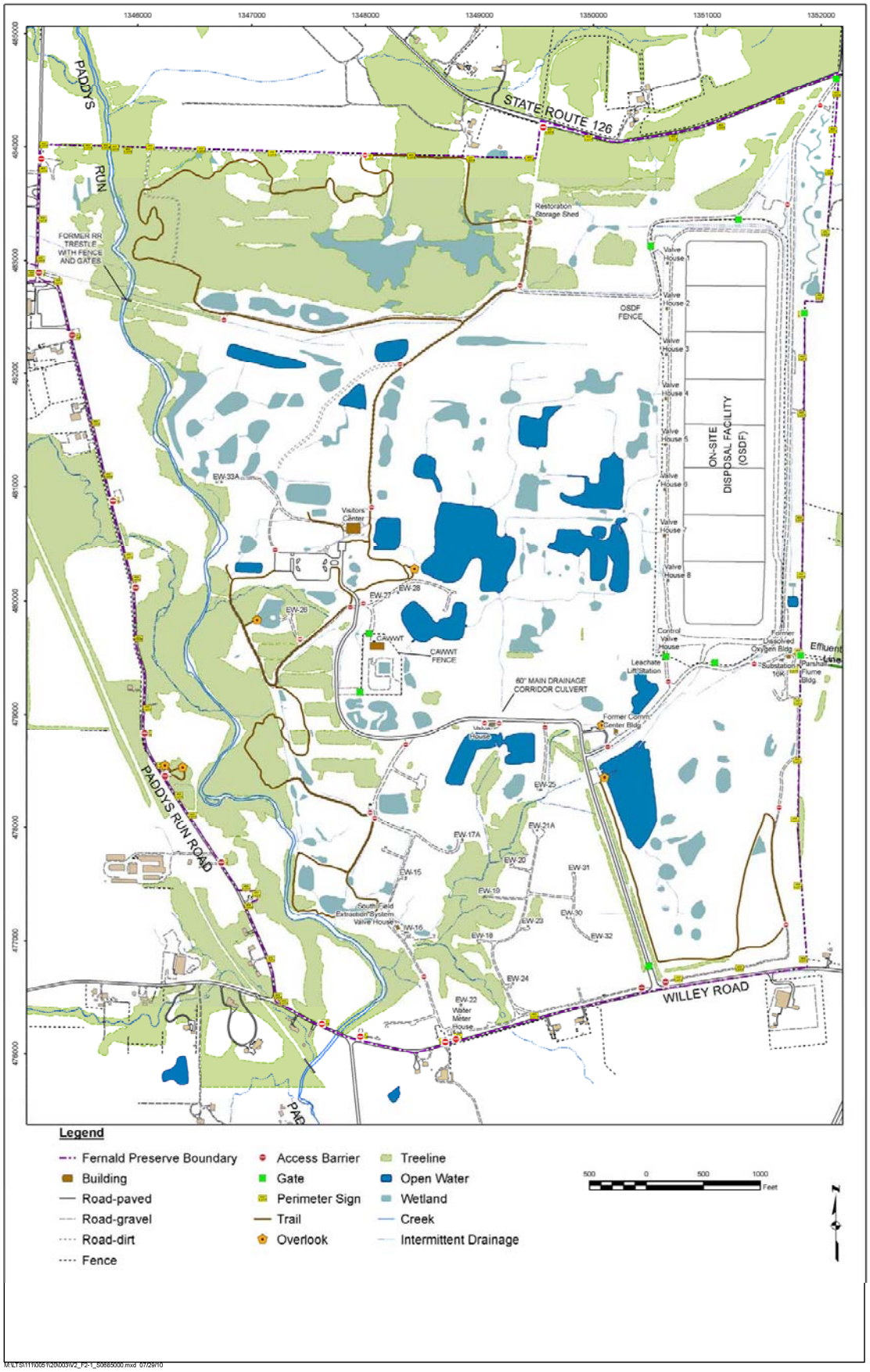

Figure 2–1. Fernald Preserve Site Configuration

All areas of the Fernald Preserve are inspected annually, with different portions of the site walked down each quarter. In addition to area walkdown inspections, point-specific institutional control inspections for the entire site occur every quarter. These point-specific inspections include the following: access points, perimeter authorized vehicle access locations, perimeter signs, fences, interior authorized vehicle access locations, buildings and structures, the 60-inch culvert, uncertified areas, and roads and parking areas (Figure 2–1). Area-specific walkthroughs occur more frequently as activities (e.g., maintenance projects, ecological monitoring) warrant. Trails and overlooks are inspected weekly to ensure they are safe for public use. Results of the site inspections are included in the annual Site Environmental Report.

Grating that was installed to prevent access to the 60-inch Main Drainage Corridor culvert is inspected as part of the quarterly point-specific institutional control inspection. This culvert, along with an adjacent 18-inch culvert that is completely buried, was left in place even though it has fixed radiological contamination. These culverts are located directly below the OSDF leachate conveyance system and the main effluent line running between the CAWWT and the Great Miami River. Because of 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 2006a).

The CAWWT and the groundwater restoration systems are also inspected. Details of this process are included in Attachment A.

Findings for the site inspection, point-specific institutional control inspection, and weekly trail inspection are recorded on inspection forms. Example inspection forms are included in Appendix D. Findings are generally mapped or identified in the field using pin flags (yellow flags are used for items of radiological concern). The pin flag must be clearly marked or labeled to correspond with the documentation of the inspector. All findings are consolidated and, if further action is warranted, logged into a maintenance action item list (Appendix D), where resolution is tracked. The site inspections, how they are conducted, and elements of the inspections will evolve and be refined as site conditions and activities change. The inspection process will be reviewed carefully each year, and revisions will be made as necessary.

DOE has a voting membership with the Ohio Utility Protection Service. With this membership, DOE will be notified anytime 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.

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

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 the remedy is 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 2006d) explains the assessment process for residual constituents. Table 6–3, "Comparison of the CRARE [Comprehensive Remedial Action Risk Evaluation] 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. Sections 3.1~~3~~.1 through 3.1.3 and Table 3–1 provide additional information about these controls.

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 reevaluated.~~ The Fernald Preserve inspections are ~~now~~ conducted annually. Specific quadrants are inspected quarterly so the entire site has been inspected during the year. 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 are performed and documented on the Fernald Preserve Field Walkdown Inspection Form or the Fernald Preserve Institutional Control Inspection Form (Appendix D), as appropriate, 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 use of a hand probe or shovel to check the depth of the line to ensure that there are at least 30 inches of cover. The soil cover check is completed every five years~~annually~~ in the fall, after the harvest. The next scheduled soil cover check is in the fall of 2012. If soil cover over the pipeline is insufficient, 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 2–3) 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.

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, with point-specific institutional controls inspected quarterly and on-site trail inspections conducted weekly. Frequency will be reevaluated through the CERCLA 5-year review process.	Inspect infrastructure in place for 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 that 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). Upgradient drainage channels may be inspected for excessive erosion and obstructions. • ~~Inspect active outfall line to ensure that 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 that the remedy is functioning properly until remedy certification is complete. Details are provided in the IEMP.

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 conducts inspections and maintenance on the OSDF cap and cover system. Inspections were conducted quarterly for 2 years following the completion of Cells 7 and 8. The frequency of inspections was to be reevaluated following the 2 years of quarterly monitoring. Beginning in spring 2009, walkover cap inspections of the entire OSDF cap ~~will~~ now occur semiannually, in the spring and fall. During the winter months, safely accessing the OSDF and scheduling of the inspection is difficult due to the frequency of inclement weather. During the summer months, vegetation on the majority of the cap is so dense that walking on the cap is difficult, and visibility of the ground surface is greatly reduced, limiting the quality of the actual inspection. Spring and fall walkdowns will be timed to take advantage of recent mowing and favorable weather conditions.

Although the frequency of complete cell cap walkdowns is now semiannual, quarterly inspections of the OSDF will continue. Areas of recent revegetation or other significant maintenance will be walked down quarterly. In addition, the cap along the toe of the slope, as well as drainage features and institutional controls related to the OSDF (e.g., fencing, signs, locks) will continue to be inspected quarterly. Custodial and preventive 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, evidence 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. Inspections also include 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 on the Cell 1 cap were collected in summer 2005, the fourth growing season after seeding. Cell 2 cap data were collected in 2007, Cell 3 cap data were collected in 2008, ~~and~~ Cells 4, 5, 6 and 7 cap data were collected in 2009, and Cell 8 was

collected in 2010; these data collection dates also correspond to the fourth growing season after seeding. Starting this year, vegetation monitoring will continue on a three-year rotation. Cells 1 to 3 will be surveyed in 2011, Cells 4 to 6 in 2012, and Cells 7 and 8 in 2013. Sample collection consists of establishing a grid on each cell cap and collecting data from random one-meter quadrat locations within the grid. Data are collected once during each sampling event in late summer. LM issues the results of data collection 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 and noxious weeds. Mowing and baling occurs on a 3-year rotation. Cells 1, 2, and 3 ~~were~~ are mowed in ~~2007~~Year One; Cells 4, 5, and 6 ~~were~~ are mowed in ~~2008~~Year Two; and Cells 7 and 8 ~~were~~ are mowed in ~~2009~~Year Three. Additional mowing may take place to manage weeds and promote native grass and forb establishment. From 2007 to 2010, mowing was conducted in the spring. Thatch accumulation and the increased presence of nesting birds have resulted in a need to switch to a fall mowing schedule. ~~-~~If ~~the spring~~fall mowing is not possible, it will be postponed until the following ~~fall~~spring. 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. Controlled burning of the cell cap would be the best management tool to maximize the growth of prairie grass. Working with the community and regulators, LM will maintain the cap vegetation (including the possibility of burning) to properly manage the selected seed mixture. Decisions regarding management of the cell caps are made after percent-native-cover data are collected.

As stated, the goal is 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 their complex root structures will provide additional stability. 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, 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 of these. 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. 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 buffer area will continue to be restricted in perpetuity by means of fences, gates, locks, and warning signs (Figure 2–1). Only the federal government will authorize access, which will be limited to personnel conducting inspections, custodial maintenance, and corrective action.

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 applicable or relevant and appropriate requirements 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 the 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~~ (the CAWWT is not expected to be decommissioned before the 2010 to 2011 time frame)~~. The quantity of leachate collected, treated, and discharged will be documented. 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 ~~re~~evaluated ~~in 2009 (~~prior to the shutdown and D&D of the CAWWT~~)~~. ~~It is expected 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.~~

4.2 Suspected Contaminated Soil, Material, or Debris

Suspected contaminated soil, material, or debris is defined as items found by either Fernald Preserve workers or visitors to the Fernald Preserve that could pose an environmental or health hazard. The potential hazard may be radiological (e.g., contaminated metal, concrete, asphalt, tile), discolored soils, unidentified objects or containers, or suspect liquids exposed by erosion or excavation.

Upon discovery, the suspect soil, material, or debris will be marked with a pin flag, and Radiological Controls or Health and Safety personnel shall be notified. The radiological control technician will follow proper protocol addressed in the *Fernald Preserve Procedure for Suspect Material or Debris Discoveries* (DOE 2009) for surveillance and disposition of the material or debris.

For debris, DOE-approved limits for contamination from residual radioactive material will be used to determine the proper disposal method. For soils with evidence of contamination (i.e., removable contamination or removed debris with instrument readings above background), these areas 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 Amended Consent Agreement and EPA's Off-Site Rule. If unexpected large-scale soil contamination is identified, the protocol in the SEP (DOE 1998a) will be followed, which is the same protocol that will be used for the uncertified areas 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 suspected to be from Fernald that are found on site or off site are to be reported by calling either the S.M. Stoller Fernald Preserve manager at (513) 648-3333 during business hours or the 24-hour LM emergency number at (877) 695-5322.

4.3 Unexpected Cultural Resource Discoveries

Although excavation activities on the Fernald Preserve are expected to be limited, several ~~planned~~ excavations ~~will be associated with public amenity construction~~are planned for ecological restoration, erosion repair, and the eventual removal of 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.

The GWLMP (Attachment C) specifies the frequencies and parameters being monitored in four horizons for each cell of the OSDF.

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 OSDF 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 fulfill National Emissions Standards for Hazardous Air Pollutants (Title 40 *Code of Federal Regulations* Part 61 [40 CFR 61], Subpart H) reporting requirements, as necessary~~. Additional continued reporting requirements under other regulatory programs 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, 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 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 an important role in the remediation process at the Fernald Preserve, and the community remains involved in legacy management. DOE has written the CIP (Attachment E) to document how DOE will ensure the public's continued involvement in a 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 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.

5.2.2 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 was completed in 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, Architecture, Art, 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. Information on the use and progress of the Visitors Center is provided through LM community meetings, Fernald Community Alliance meetings, regular e-mail updates, and the Preserve Highlights newsletter~~, and at the Public Environmental Information Center~~.

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 Visitors Center. Two subsequent presentations were given to the community with their final recommendations. Throughout 2007 and the first 6 months of 2008, the community was involved in meetings to finalize the design of the Visitors Center and the exhibit area. The Visitors Center opened on August 20, 2008.

Input on future legacy management planning decisions will occur through formal document reviews, community meetings, roundtables, workshops, and other forums. Currently, DOE holds briefings for interested stakeholders. DOE expects to continue 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 Section 121, “The National Contingency Plan” (40 CFR 300), and the Comprehensive 5-Year Review Guidance (EPA 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 was during the remediation of the site.

5.2.3 Public Access to Information

~~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. The reading room contains the CERCLA AR in hard-copy format. Additionally, t~~The Visitors Center houses computing facilities for acquisition and access to electronic copies of the CERCLA AR. The CERCLA AR documents for the Fernald Preserve were scanned into industry-standard searchable Adobe Acrobat Portable Document Format (PDF) files for viewing over the Internet. The AR documents are available to the public on the LM website (http://www.lm.doe.gov/CERCLA/SiteSelector.aspx). The documents are searchable by document number, document date, document title, and by searching the text of the document. The CERCLA AR will be updated as new documents are created.

Appendix C

Fernald Preserve Contact Information

ENVIRONMENTAL AGENCIES	
Remedial Project Manager U.S. Environmental Protection Agency Region V, SR-6J 77 West Jackson Boulevard Chicago, Illinois 60604-3590 312-886-0992 www.epa.gov	Fernald Project Coordinator Ohio Environmental Protection Agency 401 East Fifth Street Dayton, Ohio 45402-2911 937-285-6357 ~~www.epa.state.oh.us~~www.epa.ohio.gov
U.S. Fish and Wildlife Service Suite H 6950 American Parkway Reynoldsburg, Ohio 43068 www.fws.gov	
FERNALD PRESERVE COMMUNITY INVOLVEMENT COORDINATOR	
Community Relations Specialist Susan Walpole S.M. Stoller, Corporation 513-648-4026	
LOCAL POLICE AUTHORITY	
Crosby Township/Hamilton County Police Administration Office 513-825-1500	Ross Township/Butler County Police Administration Office 513-863-2337, Ext. 1

Note: This information will be updated as necessary. Additional state and local contact information can be found in Appendix A (Information Contacts) of Attachment E, Community Involvement Plan.

Attachment A

Operations and Maintenance Master Plan for Aquifer Restoration and Wastewater Treatment

Fernald Preserve

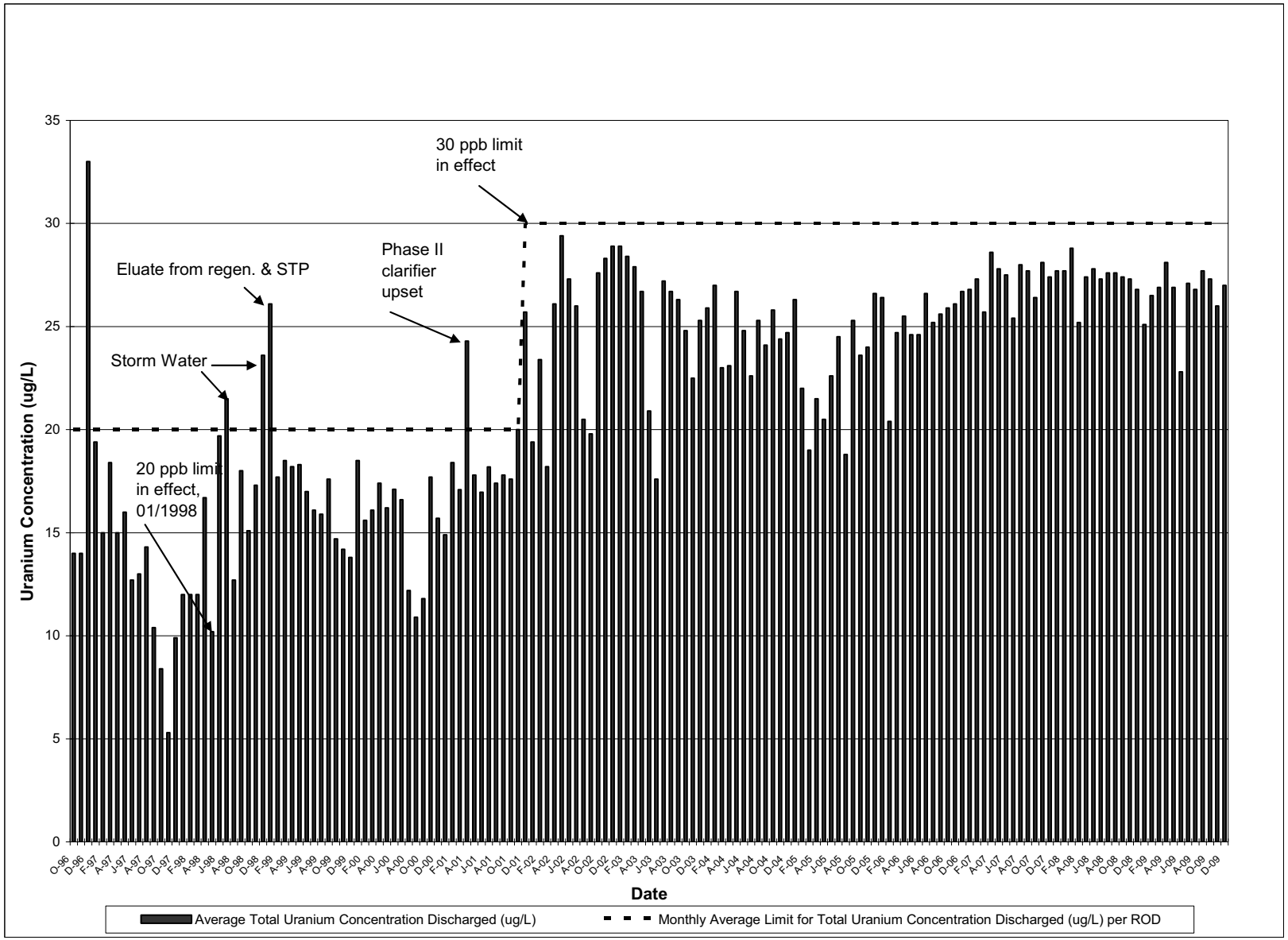

Figure 3–7. Monthly Average Uranium Concentration in the Effluent to the Great Miami River (through December 200~~8~~9)

4.0 Projected Flows

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

4.1 Groundwater

Extracted groundwater is the primary 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 micrograms per liter (µg/L) uranium plume, are achieved. The objective is to pump as aggressively as possible without exceeding discharge limits. The individual groundwater remediation modules that currently constitute 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 target 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 June 2010~~09~~, the total leachate flow from all eight cells of the OSDF had declined to about ~~3,700~~14,000 gallons per ~~week~~month, or about 0.~~4~~3 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.

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 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, ~~and~~ as necessary to meet discharge limits. ~~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 that 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 45 to 65 ppb. Groundwater is fed to two treatment systems at the 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 water from well and pump rehabilitations. Water from the basin is 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 so that the necessary treatment throughput is achieved. Operations and maintenance are performed in accordance with all appropriate standard operating procedures, standards, and specifications.

The well field downtime period will also be used 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 used 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:

1. 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.
2. Keep the CAWWT treatment trains operating at the capacity necessary to maintain compliance with the site's uranium discharge limits.
3. Keep South Plume recovery wells 1 through 4 operating at desired set points.
4. Keep all extraction wells operating at the desired set points.

Section 6.0 provides more-specific details of managing equipment operation and maintenance.

5.6 Operations Controlling Documents

Operations at the wastewater treatment facilities are controlled directly by standing orders and standard operating procedures. ~~described in *Legacy Management Fernald Operating Procedures* (DOE 2006b).~~ 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.

Section 6.1.2 provides a more extensive discussion of standard operating procedures and standing orders. 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 that uranium is still being removed by the resin. Project personnel review the results of sample analysis as necessary to evaluate 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 monthly operations reports that summarize flow rates and flow totals as well as uranium concentrations from the CAWWT and the wells. Information on required well pumping rates is communicated from the manager of the ARWWP to the operations personnel as

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. The equipment 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 walk-throughs of the facilities and systems. Potential problems and maintenance needs are reported to supervisors, 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 operated effectively.

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 that depict portions of the treatment system in piping and instrumentation diagram format and provide 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* (DOE 2006b).~~ The standard operating procedures are reviewed periodically and revised as necessary for the safe and consistent operation of treatment processes.

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 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

Because the treatment systems have spare equipment installed along with bypass piping and valving, most of the routine preventive maintenance and repair work in the systems can be accomplished without a unit shutdown. Some planned maintenance activities 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. However, most scheduled maintenance will be completed when the CAWWT is not needed to meet uranium discharge limits. As of the fall of 2009 the plant was being operated approximately 1 week per month. Decisions regarding well operations during treatment plant scheduled maintenance will be made on a case-by-case basis. For planned maintenance shutdowns, advance 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 complicated to restart.

6.4 Regulatory Issues

Current extraction well rehabilitation screen- and pump-cleaning efforts require the use of a blend of glycolic and hydrochloric acids (e.g., Cotey Chemicals Liquid Acid Descaler). The hydrochloric acid is used to break down flow-limiting mineral encrustation on the well screen/pump, and the glycolic acid removes fouling caused by bacterial growth. The spent hydrochloric-glycolic acid blend is purged from the well by pumping to a portable tank. The tank is emptied into the CAWWT backwash basin for subsequent treatment at the CAWWT and discharge to the Great Miami River via the Parshall Flume.

The use of these acids in well rehabilitation and well and pump cleaning to date has been monitored closely. OEPA 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.

Dilution of this stream in the CAWWT backwash basin is adequate to prevent turbidity and low pH from exceeding NPDES outfall limits.

Attachment B

Post-Closure Care and Inspection Plan

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 *Rainwater and Land Development: Ohio's Standards for Storm Water Management, Land Development, and Urban Stream Protection* (ODNR ~~1996~~ 2006 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.

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 and 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 inspection report.

6.2.1.4 Preparations for Conducting Site Inspections

After site familiarization, the inspection team must make preparations 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, binoculars, tape measure, GPS unit, optical ranging devices, Brunton compass or equivalent, photo scale stick, erasable board, additional signs, and wire flags.

6.2.2 Conduct of OSDF Inspection

The primary objective of the routine scheduled OSDF 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 will include the following:

- Security of fences, gates, and locks, as well as the condition of applicable warning signs.
- General health and density of the vegetation cover.
- Presence of any deep-rooted, woody species.
- Evidence of burrowing by animals on the cover.

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 that 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 preventive 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 preventive measures, if required.
Invasive vegetation	Species identification and abundance will be determined if large trees or shrubs invade the vegetation 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.~~Large trees and shrubs are not permitted on the OSDF and will be removed if present.
Creep	The occurrence of creep can be determined by setting rows of stakes parallel to contours on the side slopes, 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.

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.

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.	• Apply herbicide and/or ~~R~~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 actions and preventive measures, 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 actions and preventive measures, 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 actions and preventive measures, 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. Human intrusion has resulted in removal of cover materials.	• Reconstruction of cover or other features[1]. • Root cause analysis, evaluate corrective actions and preventive measures, 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~~9.0).	

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

Component	Inspection Frequency	Condition	Remedy	Maintenance
Drainage channels	Quarterly	• 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	• 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	• 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. Drainage system shall be inspected after the occurrence of major earthquakes (refer to Section 11.3).				

The native seed mixes used on the OSDF cover benefit from periodic mowing, baling, and prescribed burning. Mowing will normally occur in the ~~spring~~ fall 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 or grassland nesting birds. Mowing equipment shall not cause the rutting or disturbance of topsoil. If the cell cap cannot be mowed in the ~~spring~~fall, then the mowing will be postponed until the following ~~fall~~spring. 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. As described in Section 3.2.1 of Volume II, prescribed burning would be a preferred management alternative to mowing and baling.

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. DOE will evaluate the most effective method for managing woody species vegetation on the OSDF based on available equipment, expertise, and cost.

GeoSyntec, 2005. *Impacted Materials Placement Plan; On-site Disposal Facility*, 20100-PL-007, Revision 4, PCN 2, prepared for Fernald Environmental Management Project, U.S. Department of Energy, Fernald Area Office, Cincinnati, Ohio, June.

GeoSyntec, 2006. *Work Plan for Removal and In-Place Abandonment of the OSDF Cell 1 Final Cover Monitoring System*, prepared for Fernald Closure Project, U.S. Department of Energy, Fernald Area Office, Cincinnati, Ohio, March.

O.A.C. 3745-27, "Ohio Solid Waste and Infectious Waste Regulations," *Ohio Administrative Code*, November 1, 2007.

O.A.C. 3745-54, "General Facility Standards-New Facilities," *Ohio Administrative Code* December 7, 2004.

O.A.C. 3745-66, "Closure and Post-Closure under Interim Standards," *Ohio Administrative Code* December 7, 2004.

O.A.C. 3745-68. "Landfills, Incinerators, Thermal Treatment, Miscellaneous Units," *Ohio Administrative Code* December 7, 2004.

ODNR (Ohio Department of Natural Resources), ~~1996~~2006. *Rainwater and Land Development: Ohio's Standards for Storm Water Management, Land Development, and Urban Stream Protection*, ~~Second~~ Third Edition, ODNR Division of Soil and Water Conservation, Columbus, Ohio.

Attachment C

Groundwater/Leak Detection and Leachate Monitoring Plan

1.0 Introduction

This document presents the Groundwater/Leak Detection and Leachate Monitoring Plan (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 1996d). Revision 0 of the GWMLP was issued in August 1997 (DOE 1997), Revision 1 was issued in April 2005 (DOE 2005b), and draft final Revision 2 was issued in January 2006 (DOE 2006a). The GWLMP is now integrated into the *Comprehensive Legacy Management and Institutional Controls Plan* and is no longer a stand-alone document with its own review and revision cycle. It will be reviewed and, if necessary, revised each September.

The monitoring program comprises two primary components: (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. Two groundwater zones are monitored beneath the facility: the Great Miami Aquifer (GMA) (a water table found at depths ranging from 40 to 90 feet [ft] below ground surface near the OSDF) and the perched groundwater in the glacial till overlying the GMA.

Monitoring for a leak from the OSDF using water-quality data alone is challenging in that:

- The low-permeability clay beneath the facility does not readily transmit water.
- Near the OSDF, contaminant concentrations exceed background levels in surface and subsurface soil, in perched groundwater in the glacial till, and in the GMA.
- Post-construction geochemistry and constituent concentrations in water beneath the OSDF have not reached steady-state conditions, and these fluctuations complicate data interpretations.
- There is evidence that at least one of the horizontal till wells (HTWs) is in hydraulic communication with a surface water drainage ditch on the west side of the OSDF.

~~The key to a plausible potential leak determination is the presence of adequate hydraulic head within a cell of the OSDF (i.e., action leakage rate in the leak detection system [LDS]). A water quality change in either an HTW or GMA well can only be attributed to a potential leak from a cell in the OSDF if it is accompanied by a corresponding action flow rate in the LDS of that cell.~~It is unlikely that a leak would occur without a corresponding action flow rate, but significant changes in either water quality and/or flow rates will be investigated.

This OSDF monitoring plan has been developed to meet the regulatory requirements for the first tier of a three-tiered monitoring strategy required for engineered disposal facilities (i.e., [1] detection, [2] assessment, and [3] corrective action monitoring strategy). Consistent with this three-tiered requirement, follow-up groundwater quality assessment and corrective action monitoring plans will be developed and implemented as necessary.

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 the post-closure period. Table 1−1 provides a summary of key monitoring parameters.

Table 1–1. Facility Performance Key Monitoring Parameters

Parameter Type	Parameter Description	Basis	Monitoring Frequency	Action Level	Action Level Units	Regulatory Status[1]
Flow Volume	LDS Flow Volume	Each Cell	Daily	20	gpad[2]	Approved
	LCS Flow Volume	Each Cell	Daily	N/A	N/A	Approved
	LCS Containment Pipe Monitoring	Each Cell	Weekly	2270	mL	Approved
	LDS Containment Pipe Monitoring	Each Cell	Weekly	2650	mL	Approved
	~~RLCS~~ Redundant Leachate Collection System Containment Pipe Monitoring	Each Cell	Weekly	2650	mL	Approved
	LTS in each Valve House (PS-1 through 7)	Each Cell	Weekly	5300	mL	Approved
	LTS at Port V1007 (PS-9)		Weekly	18900	mL	Approved
	LTS at Port V1006 (PS-10)		Weekly	370	mL	Approved
Water Quality	LCS aqueous sample analysis for parameters listed in Table 1 of Appendix B.	Cells 1–5~~3~~	Annual	N/A	N/A	Approved
	LCS, LDS,HTW, GMA aqueous sample analysis for parameters listed in Table 2 of Appendix B.	Each Cell	Quarterly	N/A	N/A	Approved
	LCS aqueous sample analysis for parameters listed in Table 3 of Appendix B.	Cells 6~~4~~–8	Annual	N/A	N/A	Approved

[1]Regulatory status (regarding description, basis, frequency, and action level) as of the time the plan was submitted for EPA/Ohio EPA review (e.g., "proposed" or "approved")
[2]gpad (gallons per acre per day)

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 (OU) 2, 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 GMA. 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 of contaminated soil and debris generated by the Fernald Preserve's environmental restoration and building decontamination and demolition activities. The OSDF has a maximum height of approximately 65 ft. 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). 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 storm water runoff during waste placement and prevented it from entering the underlying environment. Other engineered features include a multilayer composite liner system, an 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 a 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 valve houses where the leachate and LDS fluid are collected in tanks, flow rates and 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 Enhanced Permanent Leachate Transmission System 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.

During the development of this plan, the U.S. Environmental Protection Agency (EPA) and the Ohio Environmental Protection Agency (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 GMA 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.

~~A~~ One design specification for the OSDF ~~defines the amount of water that must flow from the facility in order to have conditions needed to produce a leak from the facility.~~ is the action leakage rate. ~~This specification is called the action leakage rate.~~ The OSDF has an action leakage rate of 200 gallons per acre per day (gpad) (DOE 1997). 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 (Title 40 *Code of Federal Regulations* Part 264.302 [40 CFR 264.302]). Stated in another way, it is the flow rate that corresponds to a hydraulic head within the facility capable of producing a leak through the compacted clay layer that is present at the base of the facility.

DOE will not wait until the action leakage rate is measured to investigate the possibility of a leak from the facility. To be conservative, an initial response leakage rate has been defined for the OSDF as 1/10 of the action leakage rate (i.e., 20 gpad). If the initial response leakage rate of

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 locations, sampling frequency, and establishment of analytical parameters).

The plan considers current hydrogeologic and contaminant conditions in the glacial till and GMA beneath the facility. Preexisting contamination in the perched groundwater system and the GMA, the variable nature of the geology and hydrogeology of the clay-rich glacial deposits, and the influence of aquifer restoration activities in the GMA add complexity to the development of a groundwater monitoring program. Contaminated portions of the GMA were 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 Attachment D (Integrated Environmental Monitoring Plan [IEMP]) were used to develop the monitoring strategy and to determine monitoring locations.

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 GMA restoration activities.

A brief description of the monitoring program is as follows:

- Flow volumes in the LDS are being tracked against the initial response leakage rate of 20 gpad. Flow reaching an initial response leakage rate will be considered evidence that hydraulic conditions are 1/10 of the level needed to achieve the hydraulic head required to produce a possible leak from the OSDF. If measurements indicate an initial response leakage rate of 20 gpad, DOE will begin the process of determining the cause of the increased flow and will evaluate the potential that a release from the facility has occurred.
- Water quality in the LCS, LDS, HTW, and GMA wells of each cell is being routinely monitored. Control charts will be prepared for those constituents in the HTW and GMA wells that pass statistical screening for the preparation of control charts. Plots of concentration versus time will be prepared for constituents in the HTW and GMA wells that do not pass statistical screening for the preparation of control charts. Bivariate plots for uranium-sodium will be prepared for each cell. ~~A water quality change beneath the facility needs to be accompanied by a corresponding action leakage rate in the LDS in order for the change to be attributed to a potential leak from the facility. Unless a water quality change in an HTW or GMA well is accompanied by a corresponding action leakage rate in the LDS, the change will not be attributed to a potential leak from the facility.~~It is unlikely that a leak would occur without a corresponding action flow rate, but significant changes in either water quality and/or flow rates will be investigated.

Surface and subsurface soil within the OSDF footprint was contaminated above the soil FRLs, but certification reports (DOE 1998a; 1999; 2001c; 2004a) show that contaminant concentrations are now below FRLs. As an example, the background value of uranium is 4.56 milligrams per kilogram (mg/kg) (DOE 2001a), the FRL is 82 mg/kg (DOE 1996c), and the mean values for the 17 certification units that correspond to the locations of the HTWs range from 5.96 to 57.2 mg/kg (Table 2–1).

Table 2–1. Mean Uranium Value[1] for Certification Units at or near the HTWs, Expected Groundwater Uranium Concentrations Based on the Reported Range for Uranium Leach Coefficients (K_l) in Low-Leachability Soil[2], Maximum HTW Concentration[3], and Measured Perched-water Concentration prior to OSDF Construction[4]

Certification Unit	Uranium (mg/kg)	Cell	Uranium (mg/L)			
			K_l = 185	K_l =2700	HTW-max	Pre-const
P19	38.1	1	0.206	0.014	0.012	0.020
P18	38.9	1, 2 & 3	0.210	0.014	0.029	0.010
P18-11	18.6	3	0.101	0.007	0.029	0.003
P17-33	11.7	3 & 4	0.063	0.004	0.029	0.013
P17-31	25	4	0.135	0.009	0.008	0.013
A1P2-S2SP-01	24.3	5	0.131	0.009	0.021	0.005
A1P2-S2SP-02	32.5	5	0.176	0.012	0.021	0.005
A1P2-S2SB-04	10.9	6	0.059	0.004	0.024	0.007
A1P2-S2NI-02	21.5	6	0.116	0.008	0.024	0.007
A1P2-S2SB-02	6.64	6	0.036	0.002	0.024	0.007
A1P2-S2NI-07	8.64	6 & 7	0.047	0.003	0.024	0.007
A1P2-S2SB-01	5.96	7	0.032	0.002	0.004	0.021
A1P2-S2SP-04	17.7	7	0.096	0.007	0.004	0.021
A1P2-S2NI-08	57.2	7 & 8	0.309	0.021	0.006	0.021
A1P4-C1	28.8	8	0.156	0.011	0.006	0.019
A1P4-C2	14.7	8	0.079	0.005	0.006	0.019
A1P4-C3	16.6	8	0.090	0.006	0.006	0.019

[1]Data obtained from certification reports (DOE 1998a; 1999; 2001c; 2004a).
[2]Leach coefficients obtained from Table 2.2 of the OU5 K_l study (DOE 1995a).
[3] HTW maximum concentrations taken from 2007 Site Environmental Report (DOE 2008b).
[4]Perched groundwater results taken from OSDF pre-construction study (DOE 1995c).
mg/L = milligrams per liter

DOE has been monitoring the concentration trend of refined baseline constituents in the HTWs, and some of these trends have been increasing. Given that residual contamination below the FRLs is present in the area of the HTWs, and installation of the facility changed recharge/infiltration conditions in the area, it is ~~not un~~expected that contaminant concentrations in perched groundwater would ~~increase~~change. The OU5 leaching coefficients for contaminated soil (DOE 1995a) can be used to calculate the range of expected groundwater uranium concentrations in below-FRL soil (Table 1−1), and uranium values in the HTWs (DOE 2008a) fall near or below the lower level of this range. The maximum measured concentration for perched groundwater (0.021 mg/L) prior to OSDF construction (DOE 1995d) is slightly lower than the measured maximum HTW value (Cell 3, 0.029 mg/L). However, this is expected, as the soil was disturbed during construction, and particle surfaces exposed to the atmosphere during construction may leach more readily than less-reactive surfaces in undisturbed soil. Based on the K_l value of 185 in Table 1−1, the uranium concentration in the Cell 3 HTW could reach a maximum value near 0.2 milligram per liter (mg/L) without uranium contribution from the OSDF.

The sampling lists that will be used in 2010 are provided in Appendix B and are summarized below.

- 15 parameters quarterly in the LCS, LDS, HTW, and GMA of Cells 1–8: arsenic, boron, cobalt, iron, lithium, manganese, nickel, selenium, sodium, sulfate, uranium, zinc, TDS, total organic carbon (TOC), and total organic halogens (TOX).
- 33 parameters annually in the LCS of Cells 1–3: ammonia, antimony, barium, beryllium, cadmium, calcium, chloride, chromium, copper, lead, magnesium, mercury, nitrate/nitrite, potassium, silver, thallium, vanadium, technetium-99, pH, specific conductance, temperature, total alkalinity, turbidity, bromodichloromethane, 1,1-dichloroethene, 1,2-dichloroethene (total), tetrachloroethene, trichloroethene, vinyl chloride, carbazole, 4-nitroaniline, bis(2-chloroisopropyl)ether, and alpha chlordane.
- 80 parameters annually in the LCS of Cells 4–8: The same 33 parameters monitored for annually in the LCS of Cells 1–3, and Appendix I (OAC 3745-27-10) volatile organic compounds and PCBs (47 additional parameters).

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 wells installed after August 15, 2003, the date that the code became effective. The Ohio Hazardous Waste regulations do not specify a frequency for determining a background data set. 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 GMA 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 GMA. 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]). At the request of OEPA, sampling will remain quarterly through 2010. Sampling frequencies will be reevaluated at the end of 2010 and annually thereafter.

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 constituents and PCBs listed in OAC 3745-27-10. Ohio Solid Waste

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), 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 leachate management activities. Section 6.0 provides a summary of the notifications and potential follow-up response actions that accompany the monitoring program.

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 deemed appropriate. 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 key to a plausible potential-leak determination is the presence of an adequate hydraulic head (i.e., action leakage rate in LDS) with observed water-quality changes in either the HTW or GMA wells. However, due to preexisting background contaminant complications discussed in Section 2, the water quality of the monitored horizon is a secondary criterion that has merit if sufficient head exists to drive leachate through the liner. Unless a water quality change in an HTW or GMA well is accompanied by a corresponding action leakage flow rate in the LDS, the change will not be attributed to a potential leak from a cell in the OSDF.~~

In leak detection assessments, water quality data will be evaluated in context with preexisting contamination data and LDS flow data. The leak detection monitoring program monitors two horizons inside of each cell: the LCS and the LDS. A perched groundwater monitoring well is located and monitored beneath the secondary facility liner and 3-ft-thick compacted clay layer, directly below the LDS and LCS liner penetration boxes of each cell (Figure 4–1). A GMA groundwater monitoring well is situated on the east and west of each cell at depths ranging from

leachate through the breach. The action leakage rate is the monitoring criterion used to assess the presence of hydraulic head in the cell of the facility. The action leakage rate is the maximum design flow rate that the LDS can remove without the fluid head on the bottom liner of the facility exceeding 1 ft (40 CFR 264.302). Stated in another way, it is the flow rate that corresponds to a hydraulic head within the facility capable of driving fluid through a liner breach, if the breach occurs at the penetration box. The OSDF has an action leakage rate of 200 gpad (DOE 1997).

Flow is monitored in the LDS of each cell and reported annually in the Site Environmental Report. To be conservative, DOE uses an initial response leakage rate of 1/10 of the action leakage rate (i.e., 20 gpad). Should the initial response leakage rate of 20 gpad ever be measured, DOE will begin the process of determining why the flow is increasing so that actions can be taken long before the actual action leakage rate is ever reached.

4.3.2 Monitoring the Engineered Layers within the OSDF

Water quality samples were 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.

4.3.2.1 Leachate Collection System

The LCS drainage layer collects infiltrating water and keeps it from entering the environment. As each cell was capped, the volume of leachate draining through the LCS has decreased. At some time in the future, decreased flow may 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 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.

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. If 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.

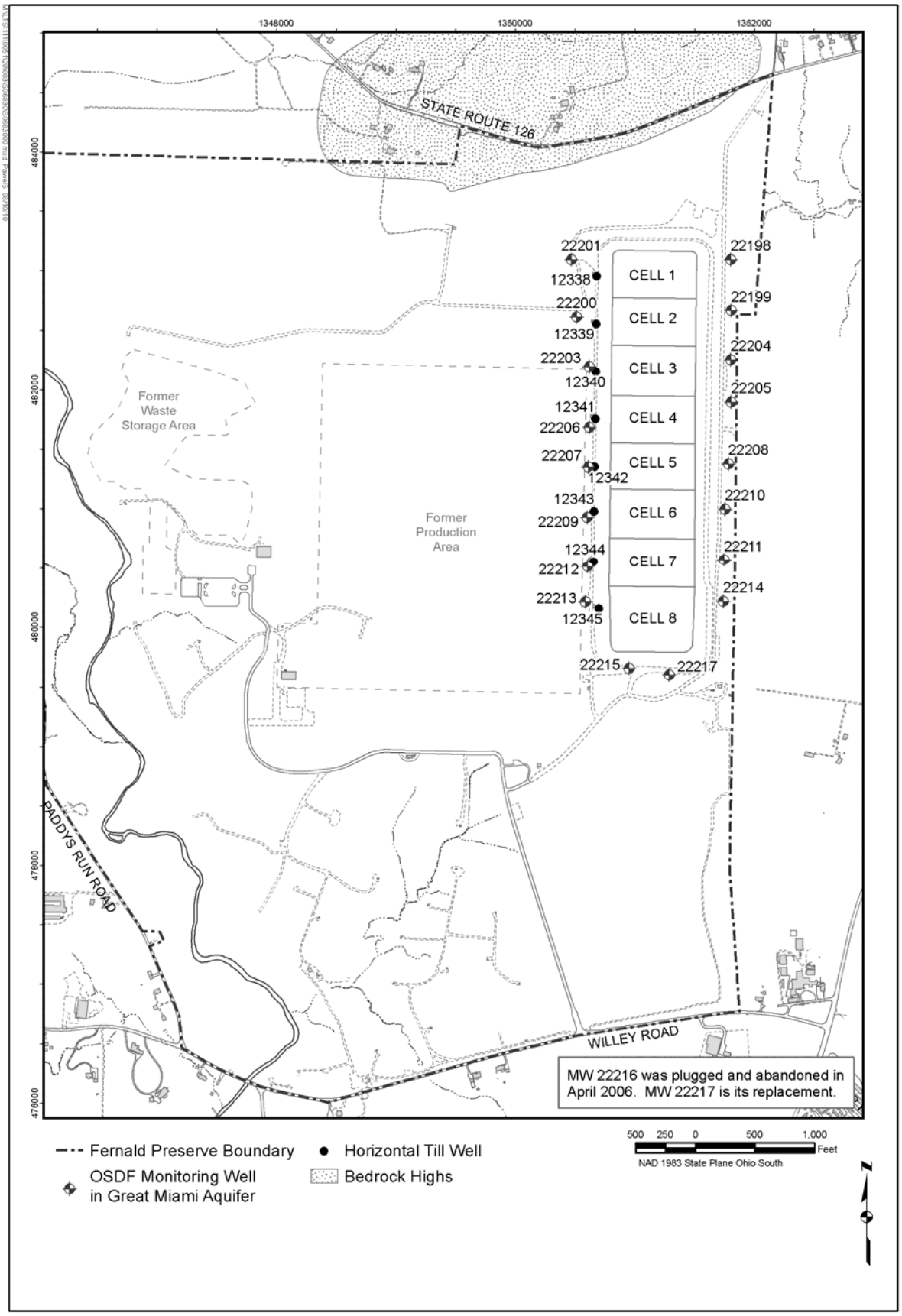

Figure 4–2. OSDF Well Locations

4.4.1.1 Baseline Conditions in the Perched Groundwater and GMA

As discussed in Section 2.4, both the perched groundwater system and the GMA near the OSDF contain uranium and other Fernald Preserve–related constituents at levels above background. Monitoring data reported over the years indicate that many of the background constituent concentrations are not stable and exhibit concentration trends. The presence of trends complicates efforts to establish a baseline. The trends also complicate a determination that, on the basis of water quality data alone, a change in water quality in either the perched groundwater or GMA groundwater is due to a potential leak from the OSDF. ~~The key to a plausible potential leak determination is the presence of an adequate hydraulic head (i.e., action leakage rate in the LDS) along with observed water-quality changes within and outside the facility~~In leak detection assessments, water quality data will be evaluated in context with preexisting contamination data and LDS flow data.

DOE's common-ion report (discussed in Section 3.2.1.2) established that several of the ions in the HTW and GMA were stable enough that a control chart could be prepared, although others remained unstable. Control charts will be prepared for those constituents identified in the report in the HTW and GMA that meet the statistical requirements for control charting. Unstable constituent concentrations in the HTW and GMA will be evaluated by plotting the concentration trend over time. When an unstable constituent in the HTW or GMA meets the requirement for control charting, control charts for the constituent will be prepared.

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 tanks located in the valve houses where the fluid volume is measured. Flow in the LDS can be attributed to several sources (i.e., top liner leakage, construction water and compression water, consolidation water, and groundwater infiltration). If fluid is present in the LDS, it also flows by gravity to tanks located in the valve houses where its volume is measured. Fluid from the tanks is then pumped into the Enhanced Permanent Leachate Transmission System line, where it flows by gravity to the PLS then is pumped to the CAWWT for treatment.

Tank levels in each of the valve houses are monitored continuously, and valve houses are checked weekly. Continuous monitoring takes place through the Human-Machine Interface system located in the CAWWT building. Continuous monitoring of LCS/LDS flow volumes is above and beyond what is required by the OAC and CFR. Leachate pumps in the LCS/LDS tanks are set to automatically pump before the tanks are full. The set point for pump activation is approximately 80 percent of the tank capacity.

The volume of leachate pumped from the LCS/LDS tanks is recorded. Flow from each cell's LCS and LDS tanks is compiled daily and trended to provide an indication of changes in system performance. An average daily LDS flow rate (in gpad) is calculated from the monthly flow rate. ~~Flow data are provided to EPA and OEPA in monthly reports and are reported annually in the Site Environmental Report.~~Flow data are available to EPA and OEPA on the Fernald Preserve website (http://www.lm.doe.gov/Fernald/Downloads.aspx) and are reported annually in the Site Environmental Report.

Monitoring in the LCS for Appendix I and PCB parameters continues after an alternate monitoring sampling list for the OSDF has been approved. DOE considers this continued annual sampling for Appendix I and PCB parameters, after approval of the alternate monitoring parameter list (initial baseline), as exceeding the requirements of Ohio Hazardous Waste and Solid Waste regulations.

A statistical analysis process was developed to evaluate the results of the continued Appendix I and PCB monitoring in the LCS. This statistical screening process was presented in the 2007 Site Environmental Report. Results from the application of this process for Cells 1 through 3 were also presented in the 2007 Site Environmental Report. The assessment process was based on showing statistically whether the average LCS concentration was greater than either the average pre-design or background concentration. If it is determined statistically that the average LCS concentration of an Appendix I or PCB constituent is greater than either the average pre-design or background concentrations, then the constituent is targeted for monitoring in deeper monitoring horizons (LDS, HTW, GMA). Results for Cells 1 through 3 identified the following additional constituents as being potentially useful for monitoring those cells: arsenic, cobalt, nickel, selenium, zinc, and TDS.

4.5 Leak Detection Data Evaluation Process

Ohio Solid and Hazardous Waste regulations require that water quality be monitored for the purpose of determining if a leak is occurring from a disposal facility. Monitoring for a leak from the OSDF using only water quality data is challenging in that (1) the low-permeability clay beneath the facility does not readily transmit water, and (2) the presence of preexisting or background contamination and post-construction water quality changes (at below FRL levels) beneath the OSDF are still taking place, and these changes complicate the data interpretation process.

DOE has developed a strategy to meet the regulatory requirements, given the unique challenges presented by soil conditions beneath the OSDF. To evaluate the potential that a cell may be leaking, DOE will first review and compare flow rates from the LDS to the design action leakage rate to determine if sufficient hydraulic head is present in the cell to drive leachate through a liner breach. The key to a plausible potential leak determination is the presence of adequate hydraulic head (i.e., action leakage rate is present) coupled with observed water-quality changes in the LDS and HTW. ~~DOE will evaluate the water quality of the HTW or GMA horizon in relation to the hydraulic head in the cells LDS. A water quality change in an HTW or GMA well accompanied by a corresponding action leakage flow rate in the LDS will indicate that a leak may have occurred.~~In leak detection assessments, water quality data will be evaluated in context with preexisting contamination data and LDS flow data. Significant changes in either water quality and/or flow rates will be investigated.

Three water quality data interpretation techniques will be used to assess changing water quality conditions in HTW and GMA wells and to compare conditions in the HTW and GMA wells to conditions inside the facility in the LCS and LDS. Concentrations will be trended over time for constituents that have not reached steady-state conditions. Control charts will be prepared for constituents that are stable. Bivariate plots will be prepared for each cell to illustrate how the water quality signature of the LCS, LDS, and HTW of a cell compare.

6.0 Reporting

6.1 Routine Reporting

Annual Site Environmental Reports will serve as the formal reporting mechanism for OSDF monitoring activities. Presenting data in one report facilitates 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 through the Geospatial Environmental Mapping System and flow data are available to EPA and OEPA on the Fernald Preserve website (http://lm.doe.gov/Fernald/Downloads.aspx).

Reporting will include:

- LCS volumes.
- LDS accumulation rates and volumes.
- Apparent liner efficiencies.
- HTW water yields.
- LCS, LDS, HTW, and GMA water quality results.

Water quality data will be evaluated to:

- Identify any new detects in the LCS and provide the results of the statistical analysis following the process described in Appendix E, Section 4.0.
- Identify if any new detects in the LCS are detected twice in a row, which would trigger sampling for the detected parameter in the LDS.
- Verify that constituents being detected in the LCS at least 25 percent of the time are being sampled for in deeper monitoring horizons.
- Identify the parameters in the HTW and GMA that pass control-charting requirements and prepare control charts for them.
- Identify the parameters in the HTW and GMA that are not stable and prepare time versus concentration plots for them.
- Prepare bivariate plots for uranium-sodium for each cell.

6.2 Notifications and Response Actions

If the flow rate into any LDS tank exceeds 20 gpad, which is 10 percent of the established OSDF 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 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 weekly or as it becomes available.

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

Appendix B

Project-Specific Plan for the On-Site Disposal Facility Monitoring Program

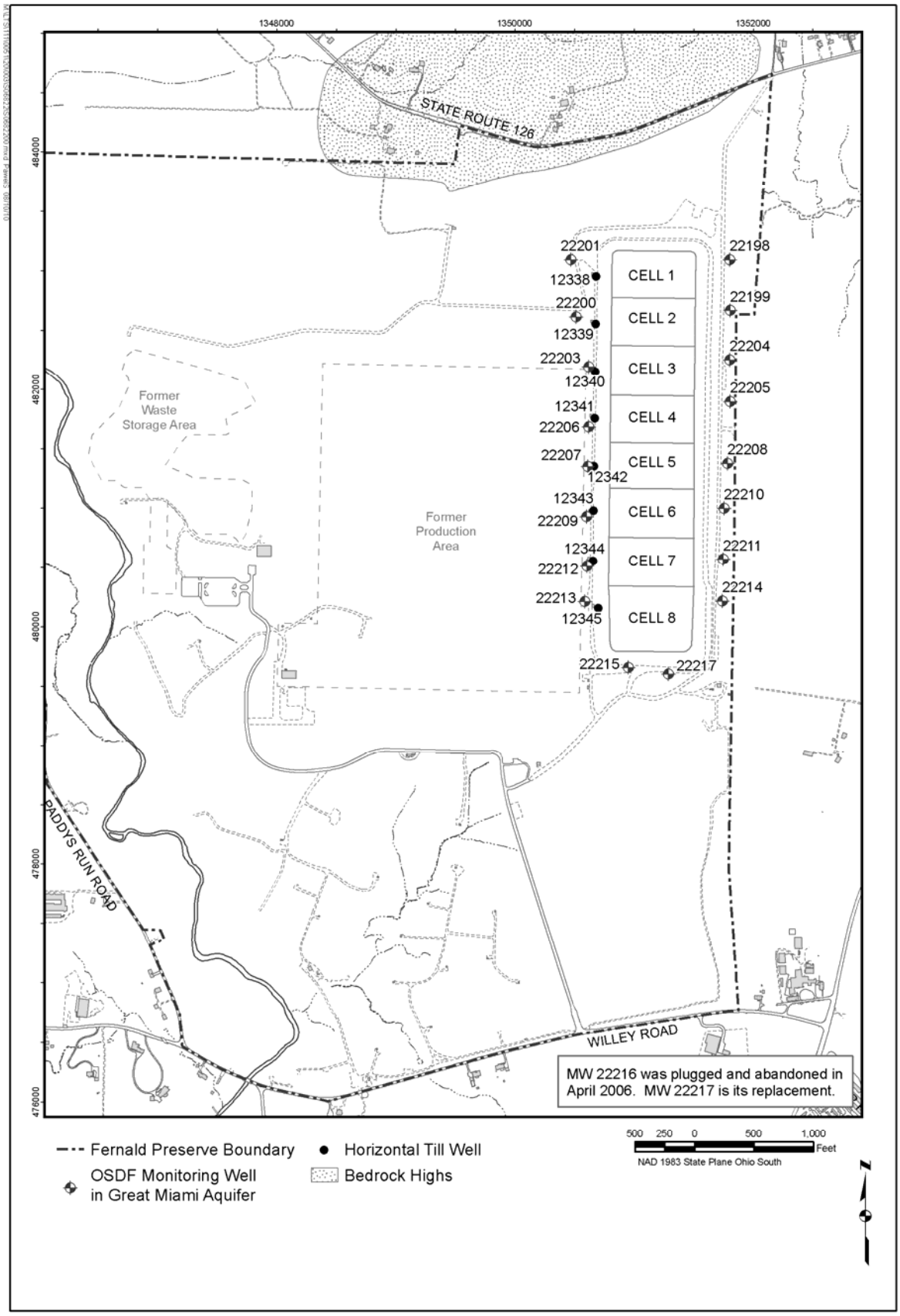

Figure 1. OSDF Well Locations

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* 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 HTWs and GMA wells were sampled bimonthly after waste placement until 12 samples were collected. This frequency was 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 a sufficient number of samples were collected for statistical analysis, samples were collected quarterly from the HTWs and the GMA.

Specific monitoring requirements for each cell are provided in Section 2.1, and the specific analytical parameters are listed in Tables 1 through 3. Analytical detection limits, at a minimum, will meet the applicable final remediation levels identified in the *Comprehensive Legacy Management and Institutional Controls Plan* (LMICP), Attachment D, "Integrated Environmental Monitoring Plan." A summary of sampling requirements for each OSDF cell is presented in Table 4.

2.1 Sampling at All Cells

Sampling will be as follows:

- Annual samples will be collected from the LCS of Cells 1–~~3~~ 5 for the parameters listed in Table 1.
- Quarterly samples will be collected from the LCS, LDS, HTW, and GMA wells of Cells 1–8 for the parameters listed in Table 2.
- Annual samples will be collected from the LCS of Cells ~~4~~6–8 for the parameters listed in Table 3.

If an analyte is detected in the annual sample from a cell's LCS, and the analyte is not being sampled for in the cell's LDS, then confirmatory sampling will be conducted for that constituent in the cell's LCS during the next sampling round. Two consecutive detects in a cell's LCS will trigger sampling in the cell's LDS during the next scheduled sampling event. Two consecutive detects in the cell's LDS will trigger sampling in the cells HTW and GMA wells. The requirements for this confirmatory sampling will be documented and approved through the established variance process.

Table 1. 2010 Annual LCS Monitoring List Requirements for Cells 1~~, 2, and 3~~ through 5

Parameter	Method	Priority[a]	ASL	Holding Time	Preservation	Standard Volume	Minimum Volume	Container
Radionuclides:								
Technetium-99	Liquid Scint.[b]	2	D	6 months	HNO_3 to pH<2	1 L	500 mL	Plastic or glass
Inorganics:	SW-846[c]	1	D	6 months	HNO_3 to pH<2	1 L	600 mL	Plastic or glass
Antimony								
Arsenic								
Barium								
Beryllium								
Boron								
Cadmium								
Calcium								
Chromium								
Cobalt								
Copper								
Iron								
Lead								
Lithium								
Magnesium								
Manganese								
Nickel								
Potassium								
Selenium								
Silver								
Sodium								
Thallium								
Uranium								
Vanadium								
Zinc								
Mercury				28 days				
Volatile Organics:								
Bromodichloromethane	SW-846[c]	3	D	14 days	Cool to 4 °C; H_2SO_4, HCl~~L~~, or solid $NaHSO_4$ to pH <2	4 × 40 mL	1 × 40 mL	Glass vial with Teflon-lined septum cap[d]
1,1-Dichloroethene								
1,2-Dichloroethene (Total)								
Tetrachloroethene								
Trichloroethene								
Vinyl Chloride								

Table 1 (continued). 2010 Annual LCS Monitoring List Requirements for Cells 1 through 5

Parameter	Method	Priority[a]	ASL	Holding Time	Preservation	Standard Volume	Minimum Volume	Container
Semivolatile Organics: Carbazole 4-Nitroaniline Bis(2-chloroisopropyl)ether	SW-846[c]	6	D	7 days to extraction/ 40 days from extraction to analysis	Cool to 4 °C	1 L	1L	Amber glass with Teflon-lined cap
Pesticides: alpha-Chlordane	SW-846[c]	7	D	7 days to extraction/ 40 days from extraction to analysis	Cool to 4 °C	1 L	1 L	Amber glass with Teflon-lined cap
General Chemistry:								
Ammonia	350.1[f], 350.3[f], 4500C[g], 4500F[g]	12	D	28 days	Cool to 4 °C, H_2SO_4 to pH<2	500 mL	200 mL	Plastic
Total Organic Halogens (TOX)	9020B[c]	4	D	28 days	Cool to 4 °C, H_2SO_4 to pH<2	500 mL	20 mL	Amber glass with Teflon-lined cap[e]
Total Organic Carbon (TOC)	9060[c]	5	D	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]	10	D	28 days	Cool to 4 °C	250 mL	100 mL	Plastic
Nitrate/Nitrite	353.1[f], 353.2[f], 4500D[g], 4500E[g]	8	D	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]	11	D	28 days	Cool to 4 °C	250 mL	100 mL	Plastic
Total Dissolved Solids (TDS)	160.1[f], 2540C[g]	9	D	7 days	Cool to 4 °C	500 mL	250 mL	Plastic or Glass
Total Alkalinity	310.1[f], 2320B[g]	13	D	14 days	Cool to 4 °C	500 mL	250 mL	Plastic

Note: Field parameters are performed at each sampling location prior to sample collection and include dissolved oxygen, oxidation-reduction potential, pH, specific conductance, temperature, and turbidity at ASL (Analytical Support Level) A, Priority 1.

[a]If sufficient volume is not available for collection of a full suite at standard volume, then the minimum volume and priority will be used to maximize the number of analytical groups collected.

[b]Radiological analyses do not have standard methods; however, the performance-based analytical specifications for these parameters are provided in the FP QAPP.

(Liquid Scint. = Liquid Scintillation)

[c]Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (EPA 1998).

[d]No head space.

[e]Minimal head space – as close to zero as possible.

[f]Methods for Chemical Analysis of Water and Wastes (EPA 1983).

[g]Standard Methods for Analysis of Water and Wastewater, 17th edition (APHA 1989).

Table 2. 2010 Quarterly LCS, LDS, HTW, and GMA Monitoring List Requirements for Cells 1~~, 2, and 3~~ through 8

Parameter	Method	Priority[a]	ASL	Holding Time	Preservation	Standard Volume	Minimum Volume	Container
Radionuclides:								
Technetium-99[b]	Liquid Scint.[c]	2	D	6 months	HNO_3 to pH<2	1 L	500 mL	Plastic or glass
Inorganics:	SW-846[d]	1	D	6 months	HNO_3 to pH<2	1 L	600 mL	Plastic or glass
Arsenic								
Barium								
Boron								
Calcium								
Cobalt								
Copper								
Iron								
Lithium								
Magnesium								
Manganese								
Nickel								
Potassium								
Selenium								
Sodium								
Uranium								
Vanadium[e]								
Zinc								
General Chemistry:								
Total Organic Halogens (TOX)	9020B[d]	3	D	28 days	Cool to 4 °C, H_2SO_4 to pH<2	500 mL	20 mL	Amber glass bottle with Teflon-lined cap[f]
Total Organic Carbon (TOC)	9060[d]	4	D	28 days	Cool to 4 °C, H_2SO_4 to pH<2	250 mL	125 mL	Amber glass bottle with Teflon-lined cap
Chloride	325.2[g], 300(all)[g]	7	D	28 days	Cool to 4 °C	250 mL	100 mL	Plastic
Nitrate/Nitrite	353.1[g], 353.2[g], 4500D[h], 4500E[h]	5	D	28 days	Cool to 4 °C, H_2SO_4 to pH<2	100 mL	20 mL	Plastic or Glass
Sulfate	375.2[g], 300.0[g], 4500E[h]	8	D	28 days	Cool to 4 °C	250 mL	100 mL	Plastic
Total Dissolved Solids (TDS)	160.1[g], 2540C[h]	6	D	7 days	Cool to 4 °C	500 mL	250 mL	Plastic or glass
Total Alkalinity	310.1[g], 2320B[h]	9	D	14 days	Cool to 4 °C	500 mL	250 mL	Plastic

Table 2 (continued). 2010 Quarterly LCS, LDS, HTW, and GMA Monitoring List Requirements for Cells 1 through 8

Note: Field parameters are performed at each sampling location prior to sample collection and include dissolved oxygen, oxidation-reduction potential, 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 and priority will be used to maximize the number of analytical groups collected.

[b]Technetium-99 is monitored at Cell 8 only.

[c]Radiological analyses do not have standard methods; however, the performance-based analytical specifications for these parameters are provided in the FP QAPP.

(Liquid Scint. = Liquid Scintillation)

[d]Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (EPA 1998).

[e]Vanadium is monitored at Cell 5 only.

[f]Minimal head space—as close to zero as possible.

[g]Methods for Chemical Analysis of Water and Wastes (EPA 1983).

[h]Standard Methods for Analysis of Water and Wastewater, 17th edition (APHA 1989).

Table 3. 2010 Annual LCS Monitoring List Requirements for Cells ~~4, 5,~~ 6, 7, and 8

Parameter	Method	Priority[a]	ASL	Holding Time	Preservation	Standard Volume	Minimum Volume	Container
Radionuclides:								
Technetium-99	Liquid Scint.[b]	2	D	6 months	HNO_3 to pH<2	1 L	500 mL	Plastic or glass
Inorganics:	SW-846[c]	1	D	6 months	HNO_3 to pH<2	1 L	600 mL	Plastic or glass
Antimony								
Arsenic								
Barium								
Beryllium								
Boron								
Cadmium								
Calcium								
Chromium								
Cobalt								
Copper								
Iron								
Lead								
Lithium								
Magnesium								
Manganese								
Nickel								
Potassium								
Selenium								
Silver								
Sodium								
Thallium								
Uranium								
Vanadium								
Zinc								
Mercury				28 days				
Volatile Organics:	SW-846[c]	3	D	14 days	Cool to 4 °C With H_2SO_4, HC~~L~~, or solid $NaHSO_4$ to pH<2	4 × 40 mL	1 × 40 mL	Glass vial with Teflon-lined septum cap[d]
Acetone								
Acrylonitrile								
Benzene								
Bromochloromethane								
Bromodichloromethane								
Bromoform								
Bromomethane								
2-Butanone								

Table 3 (continued). 2010 Annual LCS Monitoring List Requirements for Cells ~~4, 5,~~ 6, 7, and 8

Parameter	Method	Priority[a]	ASL	Holding Time	Preservation	Standard Volume	Minimum Volume	Container
Volatile Organics:	SW-846[c]	3	D	14 days	Cool to 4 °C With H_2SO_4, HCl~~L~~, or solid $NaHSO_4$ to pH<2	4 × 40 mL	1 × 40 mL	Glass vial with Teflon-lined septum cap[d]
Carbon disulfide								
Carbon tetrachloride								
Chlorobenzene								
Chloroethane								
Chloroform								
Chloromethane								
Dibromochloromethane								
1,2-Dibromo-3-chloropropane								
Ethylene dibromide[h]								
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								
Trichlorofluoromethane								
1,2,3-Trichloropropane								
Vinyl acetate								

Table 3 (continued). 2010 Annual LCS Monitoring List Requirements for Cells ~~4, 5,~~ 6, 7, and 8

Parameter	Method	Priority[a]	ASL	Holding Time	Preservation	Standard Volume	Minimum Volume	Container
Volatile Organics: Vinyl chloride Xylenes (Total)	SW-846[c]	3	D	14 days	Cool to 4 °C With H_2SO_4, HCl, or solid $NaHSO_4$ to pH<2	4 × 40 mL	1 × 40 mL	Glass vial with Teflon-lined septum cap[d]
Semivolatile Organics: Carbazole 4-Nitroaniline Bis(2-chloroisopropyl)ether	SW-846[c]	6	D	7 days to extraction/ 40 days from extraction to analysis	Cool to 4 °C	1 L	1L	Amber glass bottle w/ Teflon-lined cap
Pesticides: alpha-Chlordane	SW-846[c]	7	D	7 days to extraction/ 40 days from extraction to analysis	Cool to 4 °C	1 L	1 L	Amber glass bottle w/ Teflon-lined cap
PCBs: Aroclor 1016, 1221, 1232, 1242, 1248, 1254, and 1260	SW-846[c]	8	D	7 days to extraction/ 40 days from extraction to analysis	Cool to 4 °C	1 L	1 L	Amber glass bottle w/ Teflon-lined cap
General Chemistry:								
Ammonia	350.1[f], 350.3[f], 4500C[g], 4500F[g]	13	D	28 days	Cool to 4 °C, H_2SO_4 to pH<2	500 mL	200 mL	Plastic
Total Organic Halogens (TOX)	9020B[c]	4	D	28 days	Cool to 4 °C, H_2SO_4 to pH<2	500 mL	20 mL	Amber glass bottle w/ Teflon-lined cap[e]
Total Organic Carbon (TOC)	9060[c]	5	D	28 days	Cool to 4 °C, H_2SO_4 to pH<2	250 mL	125 mL	Amber glass bottle w/ Teflon-lined cap
Chloride	325.2[f], 300(all)[f]	11	D	28 days	Cool to 4 °C	250 mL	100 mL	Plastic
Nitrate/Nitrite	353.1[f], 353.2[f], 4500D[g], 4500E[g]	9	D	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	D	28 days	Cool to 4 °C	250 mL	100 mL	Plastic
Total Dissolved Solids (TDS)	160.1[f], 2540C[g]	10	D	7 days	Cool to 4 °C	500 mL	250 mL	Plastic or glass
Total Alkalinity	310.1[f], 2320B[g]	14	D	14 days	Cool to 4 °C	500 mL	250 mL	Plastic

Table 3 (continued). 2010 Annual LCS Monitoring List Requirements for Cells ~~4, 5,~~ 6, 7, and 8

Parameter	Method	Priority[a]	ASL	Holding Time	Preservation	Standard Volume	Minimum Volume	Container

Note: Field parameters are performed at each sampling location prior to sample collection and include dissolved oxygen, oxidation-reduction potential, 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 and priority will be used to maximize the number of analytical groups collected.

[b]Radiological analyses do not have standard methods; however, the performance-based analytical specifications for these parameters are provided in the FPQAPP. (Liquid Scint. = Liquid Scintillation)

[c]Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (EPA 1998).

[d]No head space.

[e]Minimal head space—as close to zero as possible.

[f]Methods for Chemical Analysis of Water and Wastes (EPA 1983).

[g]Standard Methods for Analysis of Water and Wastewater, 17th edition (APHA 1989).

[h]Also referred to as 1,2-dibromoethane.

Table 4. Summary of Sampling Requirements for the OSDF

Cells	Monitoring Horizons	Annually	Quarterly
1 through ~~3~~5	LCS	Table 1	Table 2
	LDS, HTW, GMA	NA	Table 2
~~4~~6 through 8	LCS	Table 3	Table 2
	LDS, HTW, GMA	NA	Table 2

LCS = leachate collection system
LDS = leak detection system
HTW = horizontal till well
GMA = Great Miami Aquifer

2.2 Additional Sampling Requirements

All horizons for a particular cell will be sampled during the same time frame to enhance the comparability of the data. If 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 1 through 3. Samples will be collected from the HTWs, GMA wells, LCS, and LDS in accordance with the *Fernald Preserve Quality Assurance Project Plan* (FPQAPP) (DOE 2009a) and the *Fernald Preserve Environmental Monitoring Procedures* (DOE 2009b).

2.3 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. If the sample is collected from the LCS or LDS tank, the tank will be pumped down to a low level after the sample is collected to help ensure the next quarterly sample is representative.

2.4 HTW Sample Collection

The glacial till is monitored under each cell using horizontal wells installed during construction of each cell. Prior to sample collection, each HTW 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.

2.5 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.

Appendix E

Selection Process for Site-Specific Leak Detection Indicator Parameters

LCS layer. Due to sulfate's high mobility and the presence of an ongoing source in the LDS/LCS layers, it was added to the leak detection sampling program in 2003.

Establishing baseline water chemistry in the perched groundwater and GMA horizon under each cell is complicated by the construction process used to install the horizontal till wells (HTWs) and the presence of past groundwater contamination in the till and GMA 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 GMA horizons surrounding the cell may be migrating and diffusing into the horizontal and GMA monitoring wells.

To address some of these uncertainties, DOE conducted a common-ion study. Results of the study were presented in a report titled *Evaluation of Aqueous Ions in the Monitoring Systems of the On-Site Disposal Facility* (DOE 2008a). The report identified four additional constituents (iron, manganese, sodium, and lithium) as potentially beneficial monitoring parameters. These four additional constituents are monitored for quarterly in all monitoring horizons of each cell in the OSDF.

DOE continues to sample the LCS of Cells 4–8 once a year for the full list of Appendix I and polychlorinated biphenyl constituents at the request of OEPA. A statistical screening process is used to evaluate the results of the continued sampling with the objective of determining if any constituent not already on the alternate monitoring list (initial baseline) might also be a useful monitoring constituent in lower monitoring horizons. The screening process ~~was presented in the 2007 annual Site Environmental Report (DOE 2008b) and~~ is illustrated in Figure 2 and Figure 3.

Results from the application of this screening process for Cells 1 through 3 were presented in the 2007 Site Environmental Report. Results for Cells 4 and 5 are presented in the 2009 Site Environmental Report. The assessment is based on showing statistically that the measured average LCS concentration is greater than either the pre-design or background average concentration. A constituent with a greater average LCS concentration than either the pre-design or background average is added to the monitoring program for the deeper monitoring horizons and sampled quarterly. Six constituents (arsenic, cobalt, nickel, selenium, zinc, and total dissolved solids [TDS]) have been identified for Cells 1 through 3. These six constituents are sampled for quarterly in all monitoring horizons of Cells 1–8~~3~~. Nine constituents (alkalinity, ammonia, chloride, nitrate/nitrite, barium, calcium, copper, magnesium, and potassium) have been identified for Cells 4 and 5. These nine constituents are sampled for quarterly in all monitoring horizons for Cells 1-8. The analysis will be conducted for Cells ~~4~~6–8 when the data set of each cell reaches eight samples. ~~For Cells 4 and 5 the data set will contain eight samples at the end of 2009.~~ For Cell 6 the data set will contain eight samples at the end of 2010. For Cells 7 and 8 the data sets will contain eight samples at the end of 2011. ~~At the request of OEPA, quarterly monitoring for the six constituents identified in Cells 1–3 will be conducted in Cells 4–8.~~

Current monitoring lists are presented in Appendix B of Attachment C.

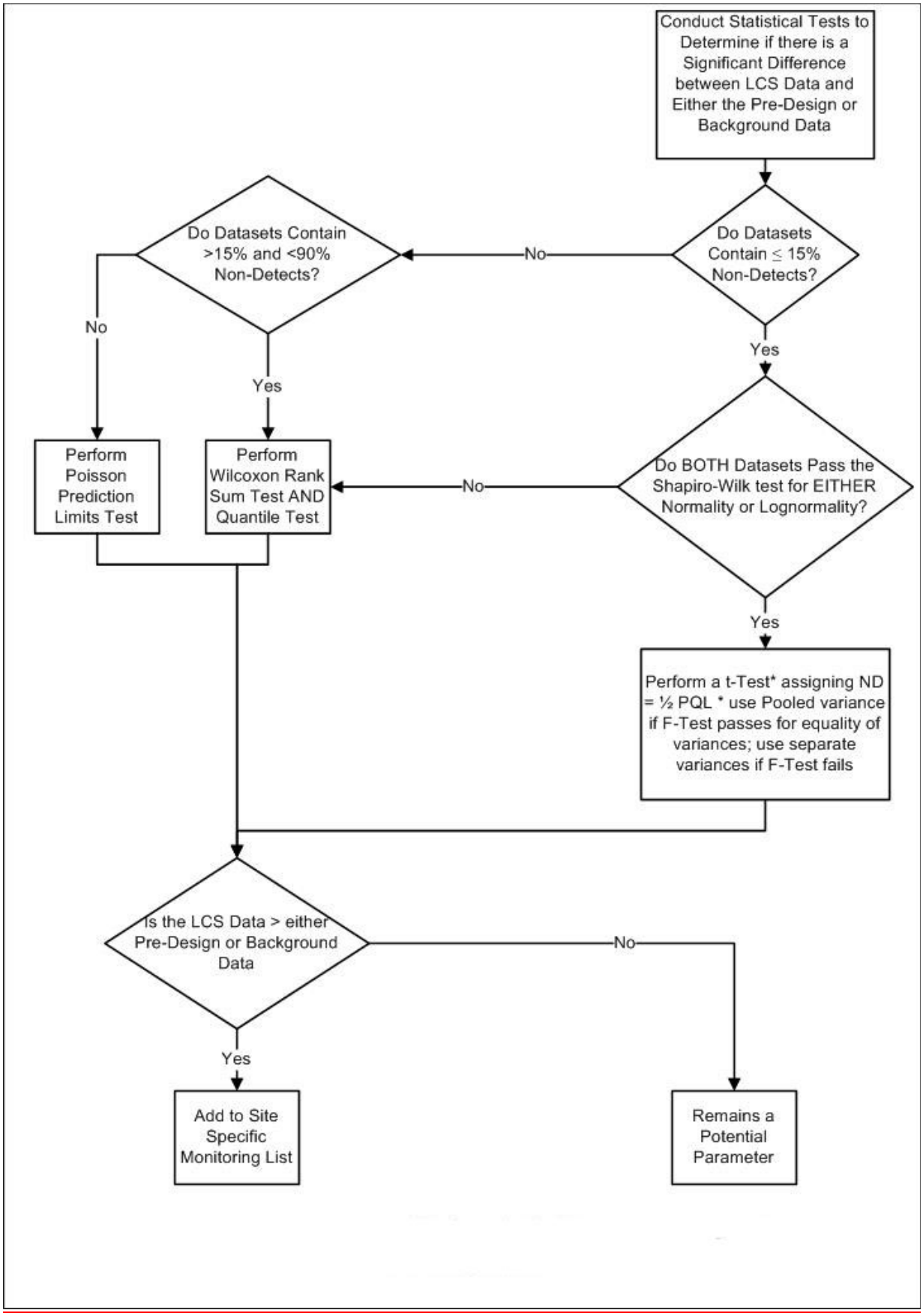

Figure 3. OSDF Site-Specific Leachate Monitoring Parameter Selection Statistical Testing Approach

Attachment D

Integrated Environmental Monitoring Plan

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 six sections and one appendix. 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; discusses the groundwater monitoring activities necessary to maintain compliance with Resource Conservation and Recovery Act (RCRA) requirements as specified in the OEPA Director's Findings and Orders dated September 2000; and provides a description of the integration with the groundwater monitoring for the OSDF.
- Section 4.0—Surface Water, Treated Effluent, and Sediment Monitoring Program: Provides a description of the routine sitewide surface water monitoring required to maintain compliance with surface water and treated effluent discharge requirements. Additionally, this section provides a description of the sediment monitoring activities to independently verify the overall effectiveness of the sediment controls.
- Section 5.0—~~Air Monitoring and~~ Dose Assessment Program: Provides a description of the sitewide ~~air monitoring,~~ external-radiation monitoring~~,~~ and dose calculations required to maintain compliance with DOE Order 5400.5.
- Section 6.0—Program Reporting: Provides a detailed accounting of the reporting elements included within the IEMP reporting framework.
- Appendix A—Natural Resource Monitoring Plan: 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 5.0.

1.3.1 Plan Implementation

A multidiscipline organization has been established to effectively implement and manage planning, sample collection and analysis, and data management activities directed in each medium-specific section. The key positions and associated responsibilities required for successful implementation are as follows:

- The environmental team leader will have full responsibility and authority for the implementation of the medium-specific plan in compliance with all regulatory specifications and sitewide programmatic requirements. Integration and coordination of all medium-specific plan activities defined in this IEMP 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 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 Project*~~ *Health and Safety Manual*~~*Plan*~~ (DOE 2010a~~6b~~).
- Quality Assurance personnel will participate on the project team, as necessary, to review project procedures and activities ensuring consistency with the requirements of the *Fernald Preserve Quality Assurance Project Plan* (DOE 2009a) (FPQAPP) or other referenced standard and assist in evaluating and resolving all quality-related concerns.

1.3.2 Plan 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 is required, it will be completed in accordance with the FPQAPP. The variance 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, variances will be incorporated in the medium-specific sections.

If a change significantly affects the scope of the plan, approval would be requested through monthly conference calls with EPA and OEPA. Afterward, a variance that documents the change and the justification for the change will be provided to EPA and OEPA.

1.3.3 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 all medium-specific plans. Hazards (physical, radiological, chemical, and biological) typically encountered by personnel when performing the specified fieldwork will be addressed during team briefings. All involved personnel will receive adequate training in the health and safety requirements prior to implementation of the fieldwork required by this medium-specific plan. Health and safety requirements ~~are addressed in the *Fernald Project Health and Safety Plan* (DOE 2006b)~~have been incorporated into *Fernald Preserve Environmental Monitoring Procedures* (DOE 2009b) and job safety analyses.

1.3.4 Data Management

Specific requirements for field and laboratory data documentation and validation are established to meet the IEMP data reporting and quality objectives and comply with the FPQAPP and the data validation procedure found in the *Environmental Procedures Catalog* (DOE 2010~~9~~b).

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 documentation review 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 analytical support levels (ASLs).

Four ASLs (ASL A through ASL D) are defined for use at the Fernald Preserve. For groundwater, sediment, and surface water~~, and air,~~ field data documentation will be at ASL A, and laboratory data documentation will be at ASL D. Laboratory data validation will consist of verifying that data generated are in compliance with specified ASL D. ASL D provides quantitative data with some quality assurance/quality control checks.

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.

1.3.5 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 with 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 and FPQAPP 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 FPQAPP. 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.

1.4 Role of the IEMP in Remedial Action Decision Making

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. The IEMP will delineate the Fernald Preserve's responsibilities for sitewide 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 (with concurrence from EPA and OEPA) that remedial action objectives for the Great Miami Aquifer are being attained.

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.

The medium-specific sections of this plan (Sections 3.0 through 5.0) 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.

Each medium section of this IEMP presents medium-specific reporting components, and Section 6.0 summarizes the overall reporting strategy for the IEMP. ~~LM information is available on the LM website (http://www.lm.doe.gov/). The Fernald Preserve data will be made available to the regulatory agencies on an ongoing basis in the form of electronic data files at http://www.lm.doe.gov/fernald/Sites.aspx.~~

The annual SERs will be furnished to EPA and OEPA in accordance with the provisions summarized in Section 6.0. The SERs will also be available for review by the Fernald Preserve's stakeholders at the Visitors Center ~~and the Public Environmental Information Center~~ and to selected 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 2010, t~~The remaining OU with continuing remediation efforts is OU5. Table 2–1 provides a summary of the OU5 remedy overview.

Active remediation of the Great Miami Aquifer will continue during the post-closure period. 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 for air particulates occurred through 2009 to ensure that all requirements were met and levels were acceptable from a closure standpoint. With regulatory agency approval of the LMICP, air monitoring will cease with this revision of the LMICP.~~

2.2 Post-Closure Organization

The post-closure organizational structure is less complex than 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 after closure as do surveillance monitoring for surface water and sediment. Natural resource restoration activities also continue after closure. Monitoring associated with the IEMP is mainly associated with these activities. Figure 2–2 shows the post-closure site configuration.

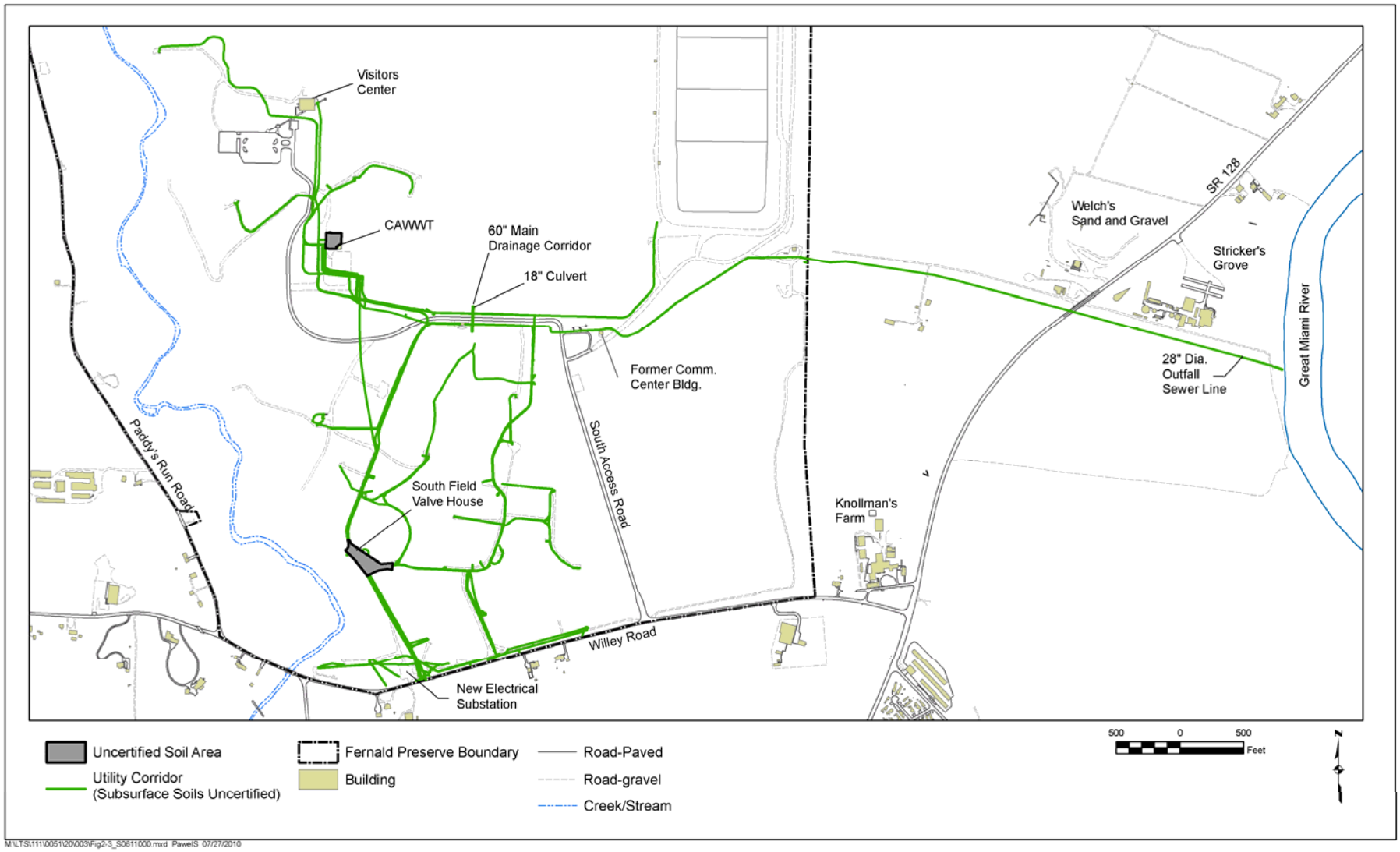

Figure 2–1. Uncertified Areas and Subgrade Utility Corridors

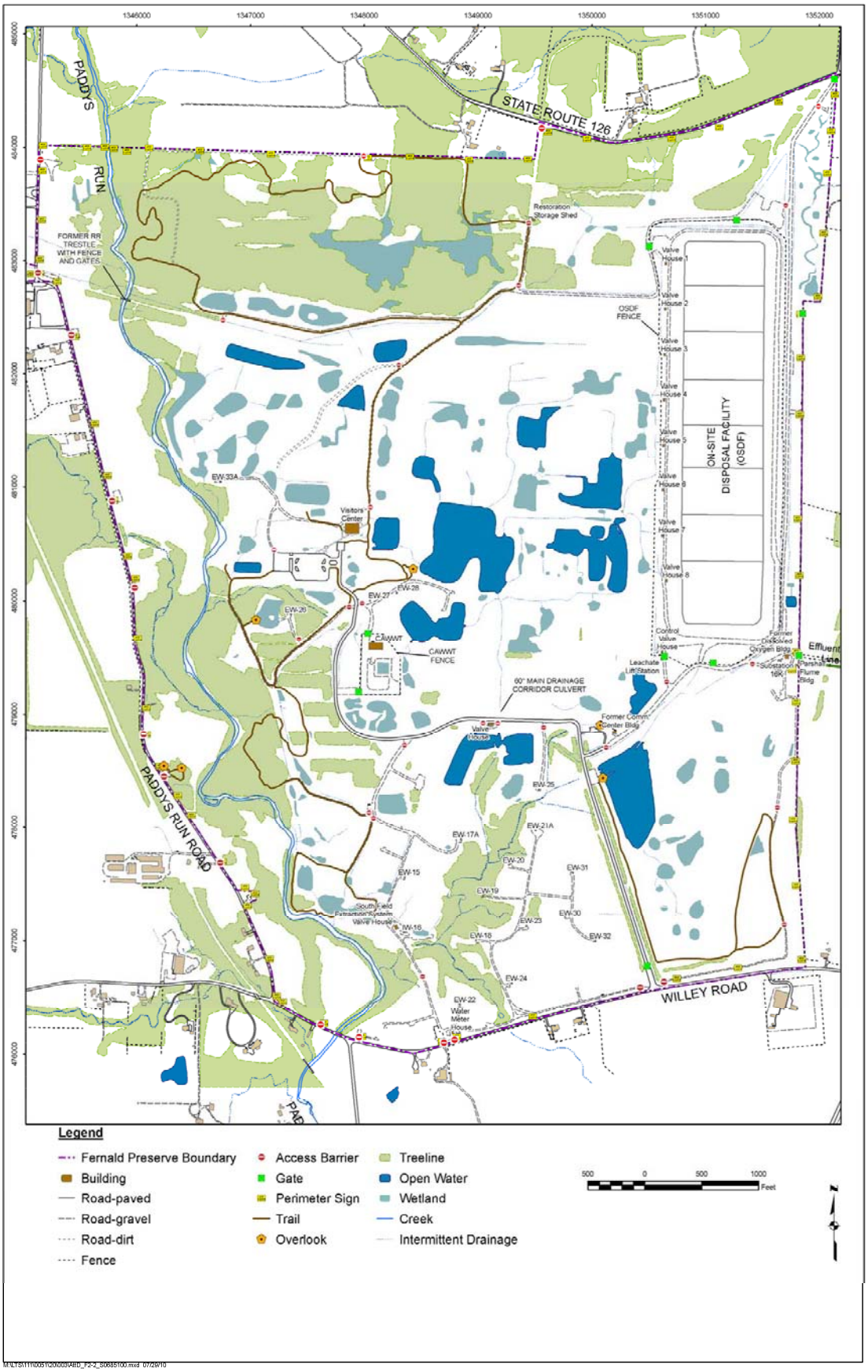

Figure 2–2. Fernald Preserve Site Configuration

3.4.2 Design Considerations

3.4.2.1 Background

The Great Miami Aquifer is contaminated with uranium and other constituents from historical operations at the Fernald Site.~~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).

Figure 3–2 shows the maximum total uranium plume map (30 µg/L uranium or higher) as of the second half of ~~2007~~2009. 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 usually 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 2000); the *Design for Remediation of the Great Miami Aquifer, South Field (Phase II) Module* (DOE 2002b), and the *Waste Storage Area (Phase II) Design Report* (DOE 2005c).

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 fly ash 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 former 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 further expansion of the plume, remove targeted contaminants to concentrations below designated FRLs, and prevent undesirable drawdown impacts beyond the Fernald Preserve.

The OU5 ROD establishes that "areas of the Great Miami Aquifer exceeding FRLs will be restored through extraction methods." The aquifer's "target certification footprint" is a term used to define those areas of the aquifer targeted for remediation.

The target certification footprint 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 target certification footprint of the aquifer (updated through 2007) is shown in Figure 3–3. The interpretation will be updated each year in the SER as new data are collected.

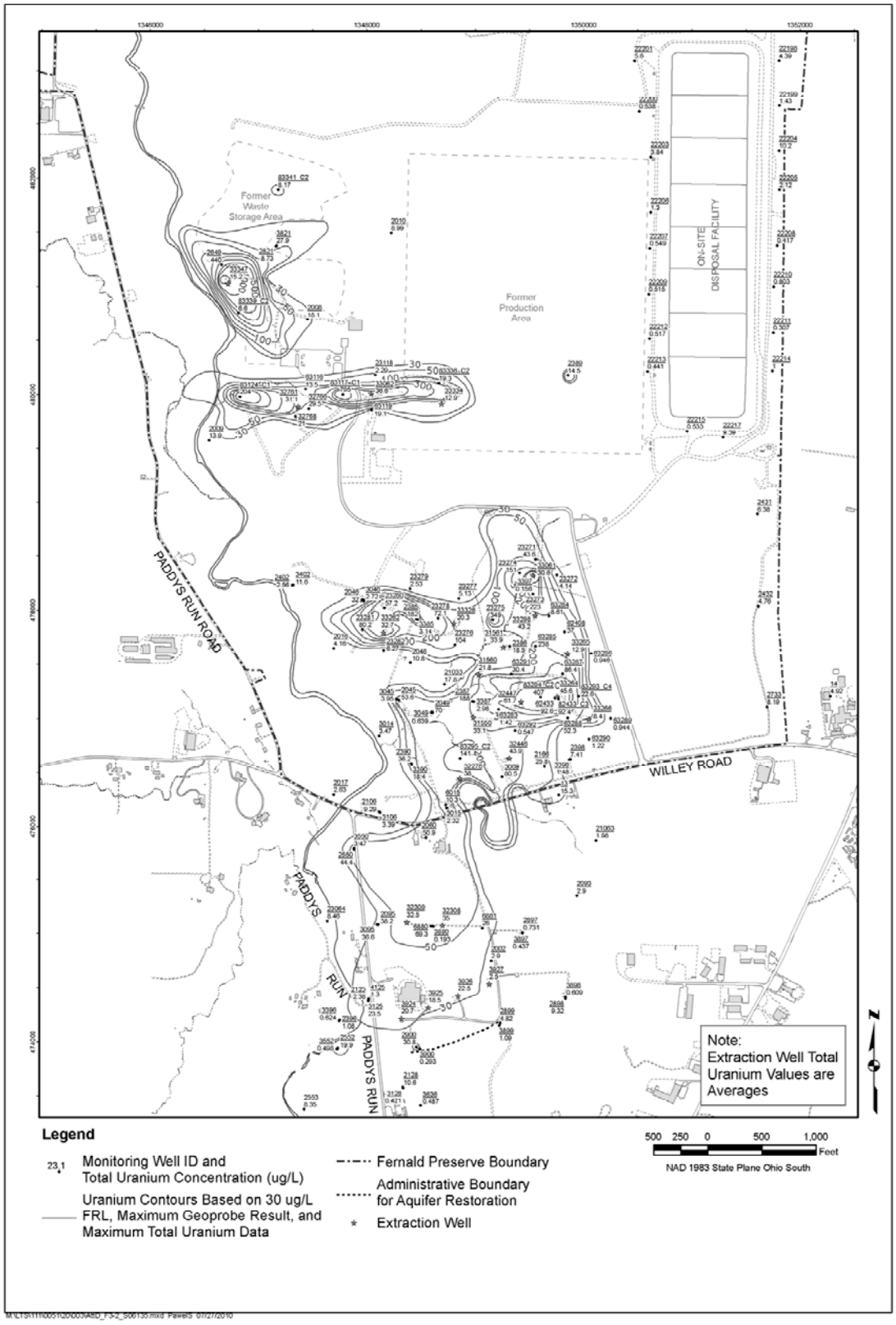

Figure 3–2. Monitoring Well Data and Maximum Total Uranium Plume Through the Second Half of 2009~~8~~

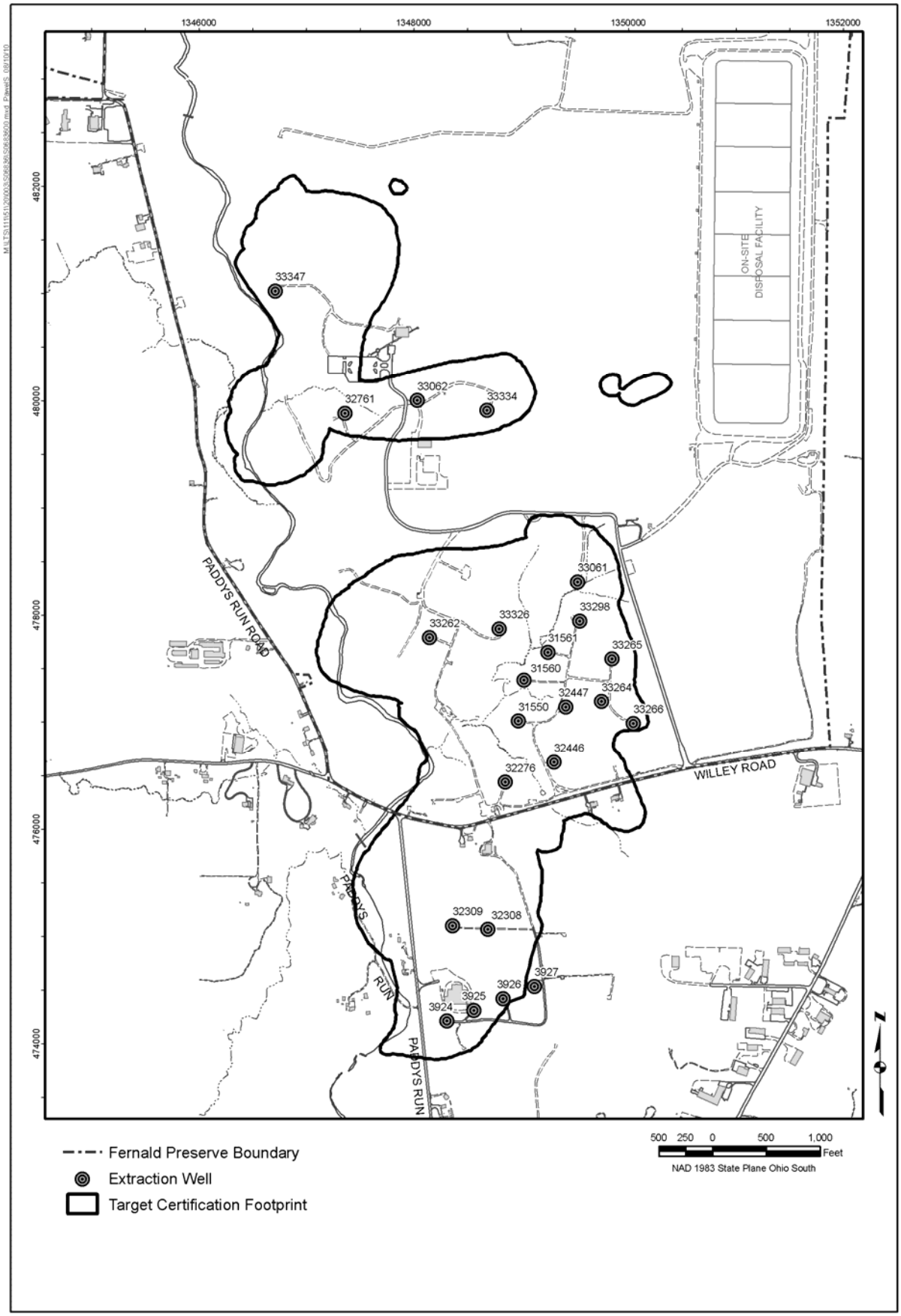

Figure 3–3. Extraction Well Locations

Table 3–2. Groundwater FRL Exceedances Based on Samples and Locations Since IEMP Inception (from August 1997 through 2007~~7~~9)

(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	5745	1508	26.25%	1(21) 2(38) 3(3) 4(17)	30.13 J/2433 -
Zinc	0.021 mg/L	B	1501	88	5.86%	0(10) 1(5) 2(14) 3(5) 4(4)	0.0212 NV/13.6 –
Manganese	0.90 mg/L	B	1830	143	7.81%	0(6) 1(14) 2(10) 3(5) 4(4)	0.916 –/105 J
Nickel	0.10 mg/L	A	1652	23	1.39%	0(1) 1(3) 2(7) 3(1)	0.101 –/1.54 –
Technetium-99	94 pCi/L	R*	1670	67	4.01%	1(5)	101.08 –/1352.266 J
Nitrate[f]	11 mg/L	B	2040	75	3.68%	1(8) 2(1)[g]	11.4 –/331 NV
Lead	0.015 mg/L	A	1386	13	0.94%	0(2) 1(2) 2(4) 3(2)	0.0157 –/0.201 -
Arsenic	0.050 mg/L	A	1728	14	0.81%	0(1) 1(1) 2(1) 4(4)	0.051 –/0.125 –
Molybdenum	0.10 mg/L	A	952	18	1.89%	1(1)	0.178 –/0.69 –
Boron	0.33 mg/L	R	2260	15	0.66%	2(2)	0.331 –/1.16 –
Antimony	0.0060 mg/L	A	1487	32	2.15%	0(15) 1(1) 2(6)4(2)	0.00601 –/0.0196 J
Trichloroethene	0.0050 mg/L	A	1436	21	1.46%	0(1) 1(3) 4(1)	0.00604 –/0.120 –
Carbon disulfide	0.0055 mg/L	A	1045	6	0.57%	0(1)[h] 1(3) 2(1)[h]	0.006 –/0.014 –
Fluoride	4 mg/L	A	1707	4	0.23%	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	586	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	792	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	1007	0	0%	NA	NA
Beryllium	0.0040 mg/L	A	877	0	0%	NA	NA
Bis(2-chloroisopropyl) ether	0.0050 mg/L	D	480	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	792	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 (continued). Groundwater FRL Exceedances Based on Samples and Locations Since IEMP Inception (from August 1997 through 200~~7~~9)

(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	902	0	0%	NA	NA
Copper	1.3 mg/L	A	86	0	0%	NA	NA
Mercury	0.0020 mg/L	A	2133	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	1015	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	792	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 2009 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).
[h]Since the IEMP inception, there has been one isolated exceedance for carbon disulfide at two locations.
[i]Since the IEMP inception, there has been only one vanadium exceedance at well 2426 (in 1998).
[j]Of the 86 samples analyzed for bis(2-ethylhexyl)phthalate, a common laboratory containment, five had results above the FRL. The above-FRL results are all considered suspect due to laboratory analysis issues, laboratory blank and field blank contamination, or field duplicate results being nondetected. 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 much less than the original sample result.

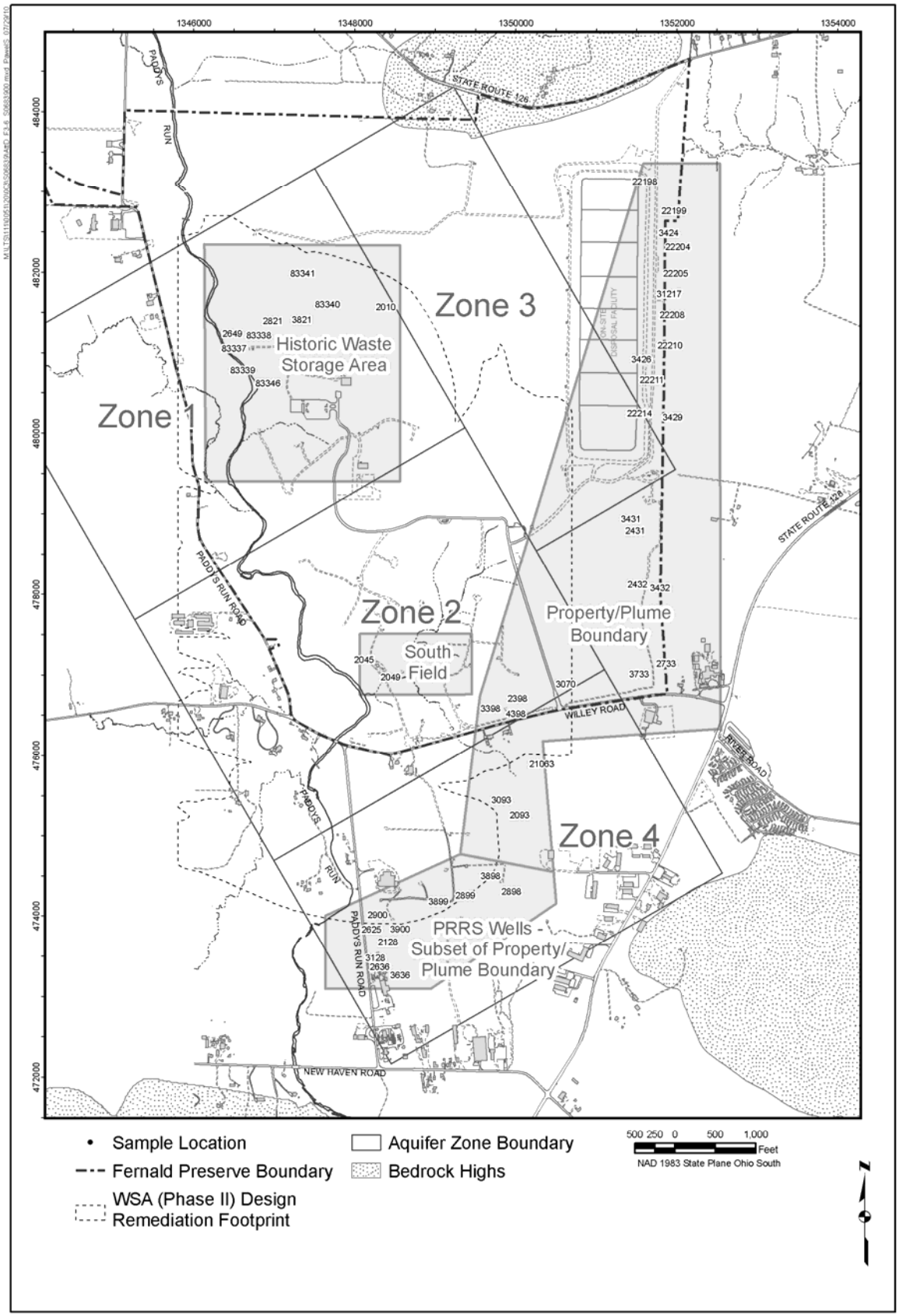

Figure 3–5. Locations for Semiannual Monitoring for Property/Plume Boundary, South Field, and Waste Storage Area

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. 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 had 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.

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.

Annual Well Field Shutdown

A 1- to ~~2~~4-week shutdown of all extraction wells (with the exception of the four leading-edge South Plume recovery wells) will be conducted each year when water levels in the aquifer are seasonally high. Water levels in the aquifer are seasonally at their highest in late spring/early summer. Shutting down the extraction wells during this time period will allow water levels in the aquifer to rise as high as possible, resulting in the saturation of as much of the aquifer sediments as possible. The well field shutdown period will also be utilized to conduct well field and water treatment system maintenance.

Uranium concentrations will be measured at six monitoring wells (2045, 2046, 23274, 83124, 83294, and 83337) to support the shutdown activity. First-half ~~2008~~ yearly total uranium measurements will serve as pre-shutdown concentrations for the six wells. The six wells will be sampled just prior to restarting the extraction wells~~ in early May~~. Type 8 wells will be sampled in both Channel 1 and Channel 2.

Table 3–5. IEMP Monitoring Requirements[a]

1. Total Uranium

2. Waste Storage Area

General Chemistry	Inorganic	Radionuclides and Uranium	Organic
Nitrate/Nitrite	Manganese Molybdenum Nickel	Technetium-99 Total Uranium[b]	Carbon Disulfide Trichloroethene

3. South Field

General Chemistry	Inorganic	Radionuclides and Uranium	Organic
NA[c]	Boron	Total Uranium[b]	NA[c]

4. Property/Plume Boundary for FRL Exceedances

General Chemistry	Inorganic	Radionuclides and Uranium	Organic
Fluoride	Antimony Arsenic Lead Manganese Nickel Zinc	Total Uranium[b]	NA[c]

5. Property/Plume Boundary for PRRS

(These wells are also monitored for Property/Plume Boundary for FRL exceedances constituents)

General Chemistry	Inorganic	Radionuclides and Uranium	Organic
Phosphorous	Arsenic[d] Potassium Sodium	NA[c]	Benzene Ethylbenzene Isopropylbenzene Toluene Total xylenes

[a]Monitoring will be conducted semiannually.
[b]Total uranium is monitored as part of the sitewide uranium monitoring.
[c]NA = not applicable
[d]Arsenic is also monitored with respect to FRL exceedances as part of the Property/Plume Boundary.

The extraction wells will be sampled just prior to shutdown, and once a week during the shutdown. Wells will be operated for approximately 10 minutes prior to the collection of a groundwater sample. The extraction wells will be sampled daily for up to approximately 4 days following restart of the extraction wells.

During the annual shutdowns, water level measurements will be recorded at selected locations using downhole pressure transducers. The transducers will be set to record a water level every hour on the top of the hour. Selected locations will be identified in the annual SER along with the collected data.

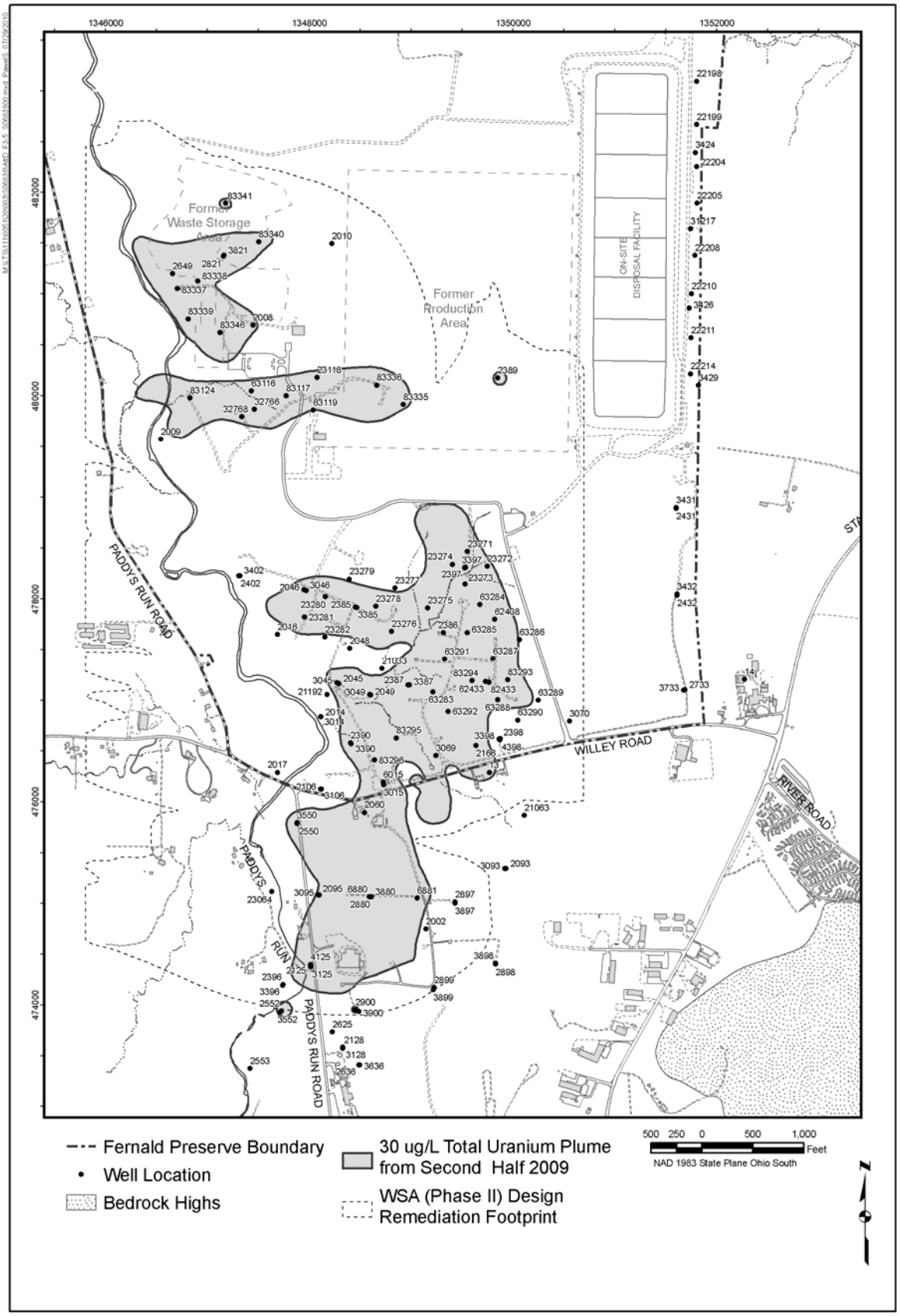

Figure 3–6. Locations for Semiannual Total Uranium Monitoring Only

To assist in the development of the scope and focus of the IEMP surface water, treated effluent, and sediment program, a review of the IEMP monitoring data is conducted periodically. ~~The last such review was based on data collected under the IEMP program from August 1997 through December 2008.~~ 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 and analyzed for those constituents and associated monitoring frequencies identified in Table 4–3.

Table 4–3. Summary of Surface Water, Treated Effluent, and Sediment Sampling Requirements by Location

Location	Constituent[a]	IEMP Characterization Requirements (reason for selection)[b,c]	NPDES Requirements[c]
SWR-01 (SWR-4801 for NPDES only) (Great Miami River Background)	**General Chemistry:**		
	Total hardness	–	Quarterly
	Inorganics:		
	Beryllium	Semiannually (B)	–
	Cadmium	Semiannually (B)	–
	Chromium, Total	Semiannually (B)	–
	Copper	Semiannually (B)	–
	Cyanide, Total	Semiannually (B)	–
	Manganese	Semiannually (B)	Quarterly
	Mercury	Semiannually (B)	Quarterly
	Silver	Semiannually (B)	–
	Zinc	Semiannually (B)	–
	Radionuclides and Uranium:		
	Uranium, Total	Semiannually(B)	–
SWP-01 (Paddys Run Background)	**Inorganics:**		
	Beryllium	Semiannually (B)	–
	Cadmium	Semiannually (B)	–
	Chromium, Total	Semiannually (B)	–
	Copper	Semiannually (B)	–
	Cyanide, Total	Semiannually (B)	–
	Manganese	Semiannually (B)	–
	Mercury	Semiannually (B)	–
	Silver	Semiannually (B)	–
	Zinc	Semiannually (B)	–
	Radionuclides and Uranium:		
	Uranium, Total	Semiannually (B)	–
SWP-02 (Paddys Run)	**Radionuclides and Uranium:**		
	Radium-226	Annually	–
	Radium-228	Annually	–
	Technetium-99	Annually	–
	Thorium-228	Annually	–
	Thorium-230	Annually	–
	Thorium-232	Annually	–
	Uranium, Total	Semiannually (PC)	–
SWP-03 (Paddys Run at Downstream Property Boundary) (continued on next page)	**Inorganics:**		
	Beryllium	Semiannually (S)	–
	Cadmium	Semiannually (S)	–
	Chromium, Total	Semiannually (S)	–
	Copper	Semiannually (S)	–
	Cyanide, Total	Semiannually (M)	–
	Manganese	Semiannually (S)	–
	Mercury	Semiannually (M)	–

Table 4–3 (continued). Summary of Surface Water, Treated Effluent, and Sampling Requirements by Location

Location	Constituent[a]	IEMP Characterization Requirements (reason for selection)[b,c]	NPDES Requirements[c]
4007 (Biowetland Emergency Overflow to Paddys Run)	Flow rate	–	Daily during overflow
SWD-04[f], SWD-05[f], SWD-06[f], SWD-07[f], SWD-08[f]	**Radionuclides and Uranium:**		
	Radium-226	Annually	–
	Radium-228	Annually	–
	Technetium-99	Annually	–
	Thorium-228	Annually	–
	Thorium-230	Annually	–
	Thorium-232	Annually	–
	Uranium, Total	Semiannually	–
SWD-09	**Radionuclides and Uranium:**		
	Uranium, Total	Semiannually	–
SWD-10, SWD-11, SWD-12, SWD-13	**Radionuclides and Uranium:**		
	Uranium, Total	Annually	–
SWR-4902 (Downstream of Fernald Preserve Effluent)	**General Chemistry:**		
	Total Hardness	–	Quarterly
	Inorganics		
	Manganese	–	Quarterly
	Mercury	–	Quarterly
G10[g] (Great Miami River—downstream sediment)	Uranium, Total	Every five years	–
G2[g] (Great Miami River—sediment background)	Uranium, Total	Every five years	–

[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]This constituent is sampled under the OU5 ROD.
[e]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 it is otherwise not accessible.
[f]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.
[g]Sampling will be conducted every 5 years per DOE/EH-0173T, Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance (January 1991).

Table 4–5 (continued). Surface Water, Treated Effluent, and Sediment Analytical Requirements for Constituents at Sample Locations PF 4001, STRM 4003, STRM 4004, STRM 4005, STRM 4006, SWR-4801, SWR-4902, G2, and G10

Constituent[a]	Analytical Method[b]	Sample Type[c]	ASL[b]	Holding Time[b]	Preservative[b]	Container[b]
Radionuclides and Uranium:						
Radium-226	EML HASL 300[j]	Grab	D	6 months	HNO_3 to pH <2	Plastic or glass
Radium-228						
Technetium-99						
Uranium, Total	6020[h], D5174-91[k]	Composite[l]	D		HNO_3 to pH <2	Plastic or glass
Uranium, Total[q]	6020[h]	Grab[p]	D	6 months	None	500 mL plastic or glass
Semivolatiles:						
Bis(2-ethylhexyl)phthalate	625[m]	Grab	D	**7** days to extraction 40 days from extraction to analysis	Cool 4°C	Glass (amber with teflon-lined cap)
Other:						
Flow rate	NA	24 hour total	NA	NA	NA	NA
Field Parameters[n]	FPQAPP[o]	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 consist of four samples collected at intervals of at least 30 minutes but not more than 2 hours.
[d]Methods for Chemical Analysis of Water and Wastes
[e]Standard Methods for the Examination of Water and Wastewater
[f]Grab samples are collected at locations SWR-4801 and SWR-4902 for this constituent.
[g]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.
[h]Test Methods for Evaluating Solid Waste, Physical/Chemical Methods
[i]Methods for the Determination of Metals in Environmental Samples
[j]Procedures Manual of the Environmental Measurements Laboratory.
[k]American Society for Testing and Materials (ASTM)
[l]Total uranium is a grab sample at STRM 4003, STRM 4004, STRM 4005, and STRM 4006 and a composite sample at all other locations.
[m]40 CFR 136, Appendix A
[n]Field parameters include dissolved oxygen, pH, specific conductance, and temperature.
[o]The FPQAPP provide field analytical methods.
[p]Grab sample for sediment is collected at locations G2 and G10 for this constituent.
[q]Covers sediment only.

- 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 whether immediate reporting of noncompliance to OEPA is necessary and to determine the appropriate corrective actions 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 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.

- Have the residual contaminant concentrations detected in sediment samples from the Great Miami River changed 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.

- 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 historical ranges and the sediment FRLs. Data evaluation to address any remaining expectations identified in Section 4.3.1 is encompassed in the data evaluation techniques described above.

- Are the program and reporting requirements of DOE Order 450.1A being met?

  DOE Order 450.1A 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 sitewide IEMP monitoring program. This IEMP and the annual SER fulfill the requirements of this DOE order.

- Are community concerns being met through the surface water, treated effluent, and sediment IEMP program?

  The IEMP fulfills the needs of the Fernald Preserve community by presenting surface water and treated effluent environmental results in the annual SER. ~~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 SER in the surface water and treated effluent section.

4.5.2 Reporting

The IEMP surface water, treated effluent, sediment, and semiannual FFCA data will be reported in the annual SER and on the LM website at http://www.lm.doe.gov/fernald/Sites.aspx.

Data on the LM website will be in the format of searchable data sets and downloadable data files. Additional information on IEMP data reporting is provided in Section 6.0.

5.0 Dose Assessment Program

Section 5.0 discusses the reasons for eliminating the air particulate monitoring, the monitoring strategy for direct radiation, and the technical approach for conducting and reporting the annual sitewide radiological dose assessment to meet the intentions of DOE Order 5400.5 and monitoring requirements of DOE Order 450.1A. The sources associated with air monitoring requirements were removed in 2006; however, limited monitoring occurred through 2009, as identified in previous IEMP revisions, to ensure that all air monitoring requirements were met and levels were acceptable from a closure standpoint. With agency approval, air particulate monitoring will cease with this revision of the LMICP.

5.1 Integration Objectives for the Dose Assessment Program

The IEMP dose assessment-program objectives ~~for 2010~~ are consistent with program objectives in previous IEMP revisions. The objectives include assessing the annual effective radiation dose to a human receptor to demonstrate compliance with the requirements of DOE orders. A reporting plan is provided in Section 6.0 to define the integration and reporting strategy for all media.

5.2 Background, Regulatory Drivers, and Requirements

Past assessments were prepared to confirm that radiological doses to the public from routine operations and emissions comply with the dose limits set by EPA and DOE regulations and orders. With the completion of remedial activities in October 2006, operational sources for the emission of particulates to the air pathway no longer exist. ~~Therefore, NESHAPs (40 CFR 61) compliance is no longer applicable, and the annual dose assessment will only address the requirements of DOE Order 5400.5.~~

~~Before 1998, yearly dose assessments 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. Environmental monitoring results were collected from a limited number of monitors (five boundary monitors and one background monitor) through December 2009. Beginning in 2010, dose assessments for DOE Order 5400.5 will use the post-remediation air-monitoring data from 2007 through 2009 to calculate the air dose.~~Dose assessments for DOE Order 5400.5 use the air dose from 2009 (as reported in the 2009 SER), annual direct radiation measurements, and annual surface water results for radionuclides to calculate the total dose to the public. Two years of post-remediation (soil remediation was completed in 2006) air monitoring have shown that the air inhalation dose at the Fernald Preserve boundary is orders of magnitude lower than the NESHAP limit of 10 mrem/yr (the value was 0.034 mrem/yr in 2009; see Appendix D of 2009 SER). Additionally, the measured post-remediation values are well below 1 mrem/yr, which is the NESHAP threshold for the monitoring requirement. That is, NESHAP monitoring is no longer required because the dose is less than 1 mrem/yr. As DOE Order 5400.5 follows NESHAP requirements for air inhalation, there is no significant dose to the public from the air inhalation pathway when the values are less than 1 mrem/yr.

5.3.1 Approach

The analysis of additional regulatory drivers and policies for dose 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 dose assessment requirements. This subset was further divided to identify requirements with sitewide implications (i.e., those within the scope of the IEMP [DOE 1997d]). Sections 5.11 and 6.0 outline the plan for complying with the reporting requirements invoked by the IEMP regulatory drivers.

5.3.2 Air Requirements

The air monitoring program described in previous IEMPs was developed with full consideration of the regulatory drivers and policies. Table 5–1 lists the air-monitoring drivers, the previous monitoring conducted to comply with them, and results for the path forward. The results indicate that 3 years of post-remediation monitoring for air particulates have provided sufficient data to discontinue future monitoring of particulate levels.

5.3.3 Dose Requirements

A sitewide radiological dose assessment is required to demonstrate compliance with DOE Order 5400.5. Table 5–2 lists the sitewide dose tracking and annual assessment tasks. The dose assessment described here and in Appendix C of previous IEMPs was developed with full consideration of the regulatory drivers and policies, as discussed in previous IEMPs.

The exposure to all radiation sources, as a consequence of routine activities at a DOE site, shall not cause an effective dose equivalent of greater than 100 millirem (mrem) per year (yr) to any member of the public. The annual effective dose equivalent is a weighted summation of doses to various organs of the body, which is incorporated in the derived concentration guidelines (DCGs) used to assess dose from the air and water pathways. For the Fernald Preserve, it is defined as the sum of external-radiation exposure plus the dose derived from the air and surface water pathways. These pathways are the only potential exposures to the public that could exceed 1 percent (1 mrem) of the 100-mrem/yr limit.

Exposure to direct radiation (gamma, X-ray and beta) is assessed quarterly using optically stimulated luminescence (OSL) dosimeters placed along the site trails and boundary (Section 5.8.1). Previous monitoring for direct radiation was performed using thermoluminescent dosimeters (TLDs), which had a nominal energy response of 0.03 to 1.25 million electron volts (MeV). OSL dosimeters have a wider energy-response range (0.005 to 20 MeV). DOE Order 5400.5 is not prescriptive on the monitoring devices that must be used to assess the direct radiation dose, but analytical integrity must be maintained, and the yearly dose to members of the public, from all pathways, must be less than 100 mrem above background.

For the air pathway, public exposure to radioactive particulate released to the atmosphere from activities at a DOE site shall not result in an effective dose equivalent greater than 10 mrem/yr. This will be demonstrated using air monitoring data ~~obtained between 2007 and~~collected in 2009, and reported in the 2009 SER. Because radium-226 sources were removed from the site, there is no significant source for radon-222, and doses caused by radon-222 and its decay products are not included in the assessment.

Table 5–1. Air Monitoring Regulatory Drivers, Required Actions, and Results

IEMP		
DRIVER	**REQUIRED ACTION**	**RESULTS**
DOE Order 450.1A, Environmental Protection Program Environmental Monitoring Plan for all media	• Requires DOE facilities that use, generate, release, or manage significant pollutants or hazardous materials to develop and implement an environmental monitoring plan • The previous IEMPs described effluent and surveillance monitoring as required by DOE Order 450.1A.	The final year of soil remediation at the Fernald Preserve was 2006. By the end of October 2006, all major sources of airborne contamination were removed from the site or placed in the OSDF. In recognition of the removal of emissions sources from the site, the number of air monitoring stations was decreased from 17 to 11 in April 2006 (DOE 2006c and from 11 to 6 in November of 2006 (DOE2006d). Three years of continued monitoring have shown that no additional air particulate monitoring is required for airborne contamination.
DOE Order 5400.5, Proposed 10 CFR 834 Radiation Protection of the Public and Environment	• 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). • Provides radon concentration limits for interim storage of sources during remediation.	• In 2008, the maximally exposed individual, standing at the eastern boundary monitor with the highest above-background reading, could receive a dose of ~~6~~9 mrem. The contributions to the estimated dose are 0.034~~17~~ mrem from air inhalation and ~~6~~9 mrem from direct radiation. This dose is ~~6~~9 percent of the adopted DOE limit, which is 100 mrem/yr above background (exclusive of radon), as established by the International Commission on Radiological Protection. • Three years of post-monitoring data have demonstrated that the Fernald Preserve no longer has the potential to expose members of the public to an effective dose equivalent of 100 mrem/yr. • The final year of soil remediation at the Fernald Preserve was 2006. By the end of October 2006, all major sources of airborne contamination were removed from the site or placed in the OSDF. Three years of post-monitoring data have demonstrated that the Fernald Preserve no longer has the potential to expose members of the public to an effective dose equivalent of 10 mrem/yr.

Table 5–2. Sitewide Dose Tracking and Annual Assessment Tasks

IEMP	Tasks
Evaluate planned activities and conditions at beginning of the year	Annual Sitewide Planning
Conduct routine OSL monitoring at background, Trail, and site boundary locations; collect surface-water samples	Routine Site Monitoring
Directly compare routine monitoring results to annual dose benchmarks; report and evaluate any exceedances	Preventive Tracking/Feedback
Based on monitoring data, calculate annual doses at monitoring locations.	DOE Order 5400.5 Compliance Demonstration
Prepare summaries and the annual dose assessment report	Reporting

Public exposure due to the ingestion of a DOE drinking water source shall not result in an effective dose equivalent greater than 4 mrem/yr. Although there is no DOE drinking water source at the Fernald Preserve, an on-site visitor may illegally wade in the ponds and incidentally ingest the surface water. This scenario will be treated as a member of the public drinking from a DOE drinking water supply.

DOE Order 5400.5 states that the absorbed dose to native aquatic organisms shall not exceed 1 rad per day from exposure to the radioactive material in liquid wastes discharged to natural waterways. DOE has issued a technical standard entitled *A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota* (DOE 2002a), and supporting software (RAD-BCG) for use in the evaluation and reporting of biota dose limits. A biota dose assessment divides the radionulcide concentration in surface water by a biota concentration guide (BCG) and sums the BCGs for all radionuclides. If the resulting sum is less than 1.0, compliance with the biota dose limit is achieved. Since 1999, the sum has been below 0.06, and in 2007 (the first year after closure) the sum dropped to 0.009 (DOE 2008b). There is no reasonable basis to assume that post-closure discharges in future years will exceed the 0.06 sum observed during active remediation. Therefore, dose calculations for aquatic organisms have been discontinued.

5.4 Program Expectations and Design Considerations

5.4.1 Program Expectations

The IEMP dose assessment program is required by DOE Order 5400.5 and will meet the following expectations~~ for 2010~~:

- The 2009 air monitoring results are as low as reasonably achievable (ALARA) and will be used to assess the inhalation dose.~~Post-remediation air-monitoring results (2007 through 2009) are as low as reasonably achievable (ALARA) and will be used to assess the inhalation dose.~~
- Direct radiation exposure will be measured using OSL dosimeters to support the annual dose calculation.
- Incidental ingestion of surface water will be assessed as part of the annual dose calculation.

- Provide a program that promotes the continued confidence of the public and is responsive to concerns raised by stakeholders.

5.4.2 Design Considerations

The assessment of air dose in previous years relied on a monitoring design that included collection of particulate samples, readings from continuous radon monitors, and TLD measurements. Particulate samples ~~will be~~were discontinued in 2010 because post-remediation data from 2007 through 2009 indicate that radionuclide levels are similar to background. Radon monitoring was discontinued in 2009. The direct-radiation component of the monitoring program will continue.

The direct-radiation component of the monitoring program is designed to assess the external environmental dose from gamma ray, X-ray, and beta radiation. This is accomplished using 12 OSL dosimeters: six are collocated with the former air-particulate monitors and six are placed along the hiking trails (Figure 5–1). At each location, three OSL devices are placed approximately one meter above the ground to assess the precision of the data. The OSL devices are processed quarterly at a DOE–approved laboratory.

The OSL devices deployed in 2009 replace the TLDs used in previous years. OSL dosimeters have a superior energy-response range (0.005 to 20 MeV), relative to TLDs (0.03 to 1.25 MeV), and the stored energy can be measured many times (without losing the exposure record) because the radiation dose is measured using a light-emitting diode, rather than the thermal annealing process used to read TLDs. Thermal annealing erases the exposure record held in the TLD.

The monitoring plan meets the following criteria:

- Provide quarterly analysis to evaluate direct radiation levels.
- Account for the annual dose from direct radiation to support the annual dose assessment required by DOE Order 5400.5.

Table 5–3 summarizes the sampling and analysis plan for the direct radiation monitoring program.

Table 5–3. Analytical Summary for Direct Radiation

Analyte	Sample Matrix	Sample Frequency	ASL
Gamma and Beta Radiation	OSL	Quarterly	B

5.5 Plan for External-Radiation Monitoring

This plan is for implementation of the sampling, analytical, and data-management activities associated with external-radiation monitoring. The program expectations and design presented in Section 5.4 were used as the framework for developing the monitoring approach presented in this section. The activities described here were designed to provide environmental data of sufficient

5.5.1 Sampling Program

Sample analysis will be performed at off-site contract laboratories. Laboratories will be selected based on analyses required, laboratory capacity, turnaround time, and performance of the laboratory. The laboratories used for analytical testing will meet DOECAP requirements, as specified in FPQAPP. These criteria include performance evaluation samples, pre-acceptance audits, performance audits, and an internal quality assurance program.

5.5.1.1 Sampling Procedures

External-radiation monitoring will be performed following the requirements specified in the FPQAPP, which have been incorporated into the *Fernald Preserve Environmental Monitoring Procedures* (DOE 2009b).

Table 5–3 provides a sample and analytical summary for the external-radiation monitoring program. Environmental dosimeters must meet the following criteria, according to DOE guidance:

- Environmental dosimeters shall be mounted at 1 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.
- Calibration, readout, storage, and exposure periods used should be consistent with the American National Standard Institute standard recommendations.

All OSL dosimeters 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.

5.5.1.2 Quality Control Sampling Requirements

Triplicate OSL dosimeters will be placed at each location and collected and analyzed to evaluate precision in the external-radiation measurement. Quarterly data from the three dosimeters at each location must agree within 15 percent, or the results will be considered suspect and invalid.

5.6 Data Evaluation

This section provides the methods to be used in analyzing the data generated by the external-radiation monitoring~~ in 2010~~. It summarizes the data evaluation process and actions associated with various monitoring results. The planned reporting structure for data provided in the annual SER is also discussed.

Data produced from the external-radiation monitoring will be evaluated to meet the program expectations identified in Section 5.4.1. Based on these expectations, the following questions will be answered:

- Are the program and reporting requirements of DOE Order 450.1A being met?

location will be summed to obtain the annual external dose due to gamma radiation. The highest gamma dose will be used to assess the 100 mrem/yr limit for all pathways. Fence line locations for the OSL dosimeters are shown on Figure 5–1.

Ponds and wetlands sampled semiannually for total uranium and annually for isotopes of thorium, radium, and technetium will provide the data to assess the site dose for a visitor that illegally wades and incidentally ingests surface water. Figure 4–2 provides the surface water sample locations.

~~5.9.2 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. The majority of uranium and thorium received and processed at the former Feed Material Production Center (FMPC) did not contain decay-chain daughters. Considering the half-lives of the daughters and the 40-year production history of the FMPC, a number of the daughters with half-life greater than a few hours (thorium-234, protactinium-234, radium-228, actinium-228, thorium-228, radium-224, and thorium-231) will be present at an activity equal to that of the parent, and this activity will be used in the dose assessment.~~

5.9.2 Managing Analytical Results

The analysis of environmental samples may result in reported contaminant concentrations that are at or below the minimum detectable concentration (MDC). Contaminant concentrations that are at or below the MDC are statistically indistinguishable from concentrations found in a blank sample. Therefore, results that are reported at or below the MDC will be set to zero for the dose assessment.

All MDCs must meet the limits established in the FPQAPP. Detectable contaminant concentrations will be converted to net concentrations by subtracting the background concentration from the measured result.

5.10 All-Pathway Dose Calculations

This section describes the calculations for demonstrating compliance with the 100-mrem/yr, all-pathway dose limit in DOE Order 5400.5. Estimates of annual dose are based on the background-corrected concentration of a contaminant in each environmental medium.

The general form of the dose assessment equation is:

$$D = C_{i,m} \times I_m \times DCF_i$$

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 or L/year)

DCF_i = Dose conversion factor for radionuclide "i" (mrem/pCi)

6.0 Program Reporting

6.1 Introduction

This section summarizes how the reporting discussions in Sections 3.0 through 5.0 are integrated and provides an overview of the entire environmental data reporting strategy.

6.2 IEMP Monitoring Summary

The IEMP monitoring scope for groundwater, surface water, sediment, and dose has been described in detail in Sections 3.0 through 5.0. 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 Preserve'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 nonradiological 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 every 5 years at the Great Miami River sample points for uranium to verify that no adverse impacts have occurred to sediment.

Dose: The dose assessment program is designed to assess the annual effective radiation dose to a human receptor to demonstrate compliance with the requirements of DOE orders. There are 12 OSL dosimeters located at the Fernald Preserve: six are collocated with the former air particulate monitors and six are placed along the hiking trails. The air monitoring data collected ~~between 2007 and~~in 2009 and the surface water data are used to assess the annual sitewide radiological dose from these pathways.

The IEMP will be reviewed and revised each September. Revisions will identify any program modifications and any changes to existing regulatory agreements or requirements applicable to sitewide 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. Any environmental data collected independently by OEPA are provided to DOE. 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.

6.3 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 sitewide environmental monitoring and associated reporting under a single controlling document.

The IEMP reporting frequency will be annual with a continued emphasis on timely data reporting in the form of electronic files (i.e., the LM website). The annual SER 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.

LM Website

The LM website (http://www.lm.doe.gov/Fernald/Sites.aspx) allows the regulatory agencies and members of the public to access Fernald Preserve data in a timely manner. The data are available after analysis and entry into the SEEPro environmental database. The OSL dosimeter data, OSDF Leachate Collection System and Leak Detection System volumes, and groundwater operational data are ~~available upon request~~provided as downloadable files on the LM website. Groundwater, surface water, and sediment data are available through user-defined queries that use the Geospatial Environmental Mapping System (GEMS). GEMS is a Web-based application that provides the ability to query LM environmental data. Once the user is on the GEMS website, the environmental data can be queried by selecting Environmental Reports from the menu. A tutorial is available under Help, which is also on the menu. The use of the 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 LM website.

Based on the objective of the dose assessment described in Section 5.0, the dose assessment results will be presented via two reporting mechanisms: regulatory interfaces and annual reporting.

Annual Site Environmental Reports

The annual SER will continue to be submitted to EPA and OEPA on June 1 of each year. It will continue to document the technical monitoring approach and to summarize the data for each environmental medium. 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 appendixes are a compilation of the information reported on the LM website and are intended for a more technical audience, including the regulatory agencies.

Table 6–1 identifies the media that are being reported under the IEMP and the associated reporting schedule.

Table 6–1. IEMP Reporting Schedule ~~for 2010~~

	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	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦
Dose						●						

*= 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.

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Appendix A

Natural Resource Monitoring Plan

Acronyms and Abbreviations

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	*Code of Federal Regulations*
DOE	U.S. Department of Energy
LM	DOE Office of Legacy Management
EPA	U.S. Environmental Protection Agency
FQAI	Floristic Quality Assessment Index
IEMP	Integrated Environmental Monitoring Plan
NEPA	National Environmental Policy Act
NRMP	Natural Resource Monitoring Plan
NRRP	Natural Resource Restoration Plan
OEPA	Ohio Environmental Protection Agency
U.S.C.	*United States Code*
WMMP	Wetland Mitigation Monitoring Plan

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 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, as represented by the U.S. Fish and Wildlife Service; 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 1994 to 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.

DOE and OEPA signed a Consent Decree in November 2008 that settles a long-standing natural resource damage claim under Section 107 of CERCLA. As a result, the Fernald Natural Resource Trustees (DOE, OEPA, and the U.S. Department of Interior) have finalized the NRRP, which is Appendix B of the *Consent Decree Resolving Ohio's Natural Resource Damage Claim against DOE* (State of Ohio 2008). The NRRP specifies an enhanced monitoring program for ecologically restored areas at the site. ~~The~~ In 2009, the Natural Resource Trustees ~~will~~ collectively evaluated restored areas by conducting field walkdowns and reviewing monitoring data. In addition, an enhanced wetlands mitigation monitoring program ~~will be~~was developed, along with the resumption of functional-phase monitoring in restored areas. As stated in Section 1.0, this monitoring will be summarized in the annual 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.

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 that requirements of the NRRP are being met and that 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. If results indicate that a restored area is not functioning as intended, DOE's Office of Legacy Management (LM), in consultation with EPA, OEPA, and the Natural Resource Trustees, will decide the 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 or endangered species, wetlands/floodplains, and cultural resources. To accommodate natural resource monitoring, priority natural resource areas have been established across the Fernald Preserve (Figure 1).

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 or endangered species to have habitat ranges that encompass or occupy the Fernald Preserve. Monitoring will continue to track the status of the Indiana brown bat populations and their habitat. If activities at the Fernald Preserve 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~~Several populations of Sloan's crayfish ~~is~~ have been found at the Fernald Site in ~~the northern reaches of~~ Paddys Run and the Storm Sewer Outfall Ditch. 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.

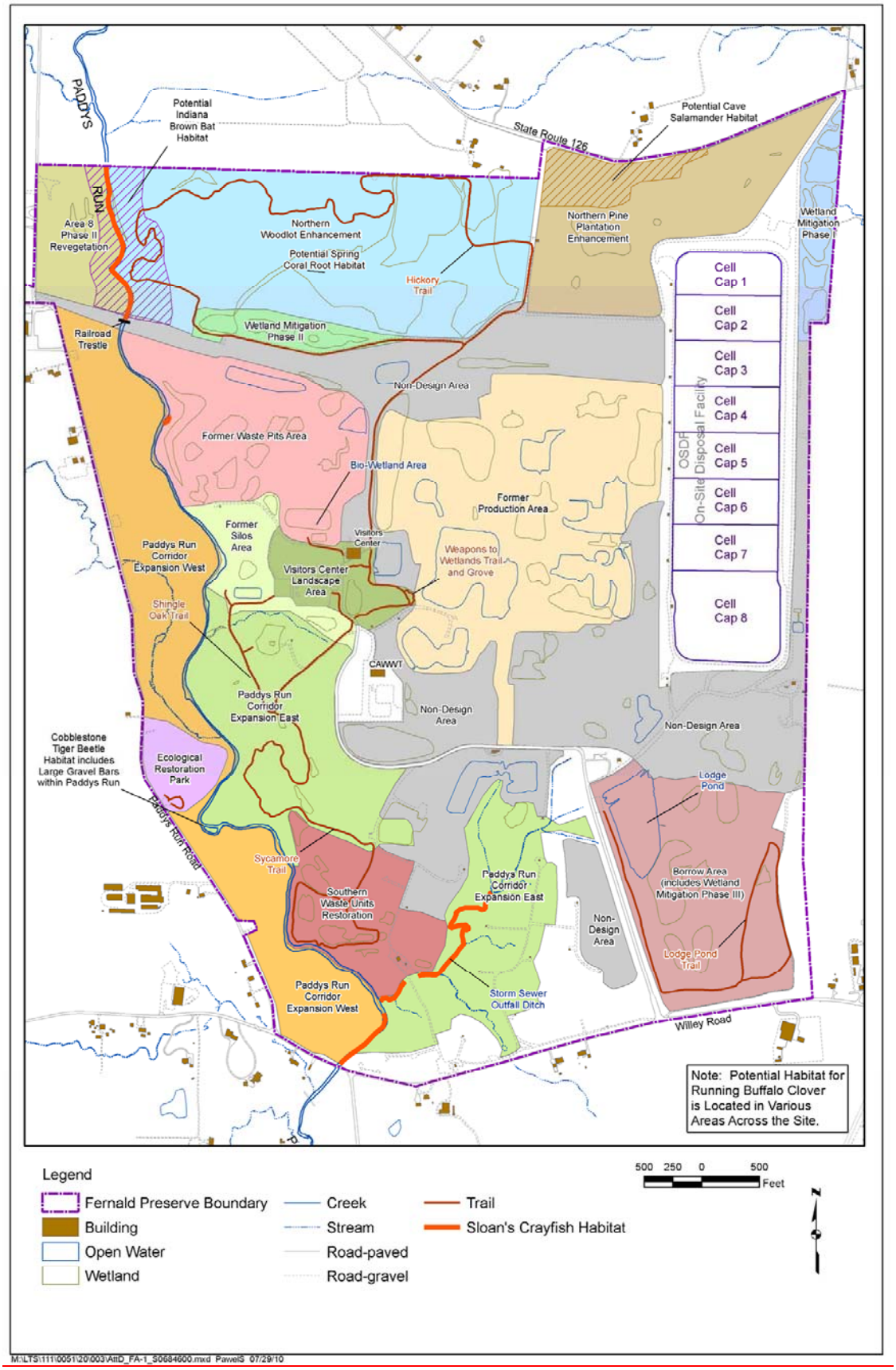

Figure 1. Priority Natural Resource Areas

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. If 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 suspected areas to identify the running buffalo clover. If populations are discovered, then best management practices will be used to minimize any impending impacts.

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 that no individuals were ~~present~~found, 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 n~~No spring coral root was ~~present in the northern woodlot~~observed during this survey.

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 was established to compensate for the impacts during remediation.

To ensure compliance with this requirement, an enhanced wetland mitigation monitoring program has been established. On-site created wetlands are evaluated pursuant to existing OEPA performance standards and monitoring protocols. ~~A~~The *Fernald Preserve* ~~wetland~~ *Wetland* ~~mitigation~~ *Mitigation* ~~monitoring~~ *Monitoring* ~~plan~~ *Plan* (WMMP) (DOE 2009a) ~~is being~~has been developed by the Fernald Natural Resource Trustees ~~(DOE, OEPA, and the U.S. Department of Interior)~~ that establishes the site wetland monitoring requirements. The WMMP details performance standards and remaining monitoring requirements for completed wetland mitigation projects. In addition, this plan identifies additional on-site wetlands that may contribute to compensatory wetland acreage. Performance standards and monitoring requirements are set forth for these areas as well.

Wetland mitigation monitoring will be conducted through 2011 in order to compare on-site created wetlands to a variety of performance standards, including size, morphology, hydrology, vegetation, soil chemistry, and wildlife. After 2011, the Natural Resource Trustees will determine whether additional monitoring is warranted.

4.3 Cultural Resource Management

All field personnel must comply with the *Procedure for Unexpected Discovery of Cultural Resources* (DOE 2009b) if cultural resources are uncovered during ground-disturbing activities. If 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 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

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 to ensure adequate herbaceous cover and vegetation survival, following large-scale re-seeding efforts or new ecological restoration projects.

4.4.2 Functional Monitoring

Functional monitoring focuses on an entire habitat (e.g., prairie, wetland, forest) instead of an individual project. Functional monitoring helps determine if restored habitats at the Fernald Preserve are progressing when compared to baseline conditions and established reference sites. Functional monitoring has a longer duration (2003 to 2011) and a lower frequency of data collection (e.g., every 3 years). Functional monitoring will quantitatively evaluate progress of restored habitat against a baseline and toward an established reference site.

Functional monitoring is not a pass/fail determination like implementation-phase monitoring. Instead, functional monitoring is a means of evaluating the progress of the restored community against pre-restoration baseline conditions and target reference sites already achieving high ecological function. Vegetation indices will be used for comparisons, as well as several wildlife-based evaluations. Evaluation of woody and herbaceous vegetation is the main focus of functional monitoring. Floristic Quality Assessment Index (FQAI) is the primary monitoring parameter that has been and will continue to be used in functional monitoring.

Baseline conditions were measured at the Fernald Preserve in 2001 and 2002. To establish the needed reference site data, DOE teamed with the University of Dayton and collected the data outlined above from reference sites agreed upon by the Natural Resource Trustees in 2002. Restored habitats on the Fernald Closure Project were grouped together as wetlands, prairies/savannas, or forest/riparian. Functional monitoring data on site wetlands were collected in 2003, data on prairies/savannas were collected in 2004, and data on woodlands were collected in 2005.

Information collected during baseline and reference site characterizations include species richness, density, and frequency. Woody vegetation size was also recorded. From these parameters, sites are evaluated through FQAI, the extent of native species present, and the extent of hydrophytic species present (for wet areas).

DOE teamed with the University of Dayton to conduct reference site characterizations and refine sampling methodologies. From these efforts, the Natural Resource Trustees agreed that the final monitoring parameters summarized above will best represent the extent of native species establishment, development of hydric conditions, and quality of vegetation communities restored at the Fernald Preserve.

Several wildlife evaluations have been conducted in addition to vegetation surveys. These include amphibian and macroinvertebrate sampling and migratory waterfowl observations. Casual wildlife observations have also been recorded in each study area. Amphibian and macroinvertebrate sampling was conducted by the OEPA and is outside the scope of this Monitoring Plan.

Specific parameters measured include species richness, density, and frequency. Woody vegetation size is also recorded. From these parameters, sites are evaluated through FQAI, the extent of native species present, and the extent of hydrophytic species present (for wet areas). The success of functional monitoring depends on the collection of the same data on baseline sites, reference sites, and restored areas of the Fernald Preserve so that progress of the restoration can be evaluated.

The schedule for functional monitoring at the Fernald Preserve is as follows:

Baseline Data Collection	2001/2002
Reference Site Data Collection	2002
Wetlands	2003 and 2009[a]
Prairies/Savannas	2004 and 2010
Woodlands	2005 and 2011

[a]Wetland mitigation data collected in 2009 serve as the functional monitoring for wetlands.

The data collected during functional monitoring ~~will~~ provided a comparison of restored habitats with baseline and reference sites. Functional monitoring data will be evaluated by the Natural Resources Trustees to determine if any corrective action is needed. Any corrective actions identified by the NRTs will be jointly agreed upon using the "Adaptive Management" concept identified in the NRRP. Following completion of the functional monitoring in 2011, the Natural Resource Trustees will jointly determine whether to continue further monitoring.

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). The annual Site Environmental Report will include a summary of the findings. A detailed discussion and evaluation of the available data will be presented in an appendix to the Site Environmental Report. Significant findings as a result of natural resource monitoring will be communicated to EPA and OEPA as needed.

5.0 References

Note: Tasks associated with this plan are performed under the most current revision of plans, procedures, and documents.

DOE (U.S. Department of Energy), 2009a. *Fernald Preserve Wetland Mitigation Monitoring Plan*, Revision 0, Office of Legacy Management, Grand Junction, Colorado.

DOE (U.S. Department of Energy), 2009b. *Procedure for Unexpected Discovery of Cultural Resources*, Revision 0, Office of Legacy Management, Grand Junction, Colorado.

State of Ohio, 2008. *Consent Decree Resolving Ohio's Natural Resource Damage Claim against DOE*, State of Ohio v. United States Department of Energy, et al., Civil Action No. C-1-86-0217, Judge Spiegel.

Attachment E

Community Involvement Plan

Appendix A

Information Contacts

Emergency Contact	
Grand Junction 24-hour Monitored Security Telephone Number **(877) 695-5322**	
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