

4.0 Surface Water and Treated Effluent Pathway

Results in Brief: 2009 Surface Water and Treated Effluent Pathway

Surveillance Monitoring—No treated effluent analytical results from samples collected in 2009 exceeded the surface water FRL for total uranium, the primary site contaminant. Thirty-two surface water analytical results exceeded the surface water FRL for total uranium. Sample results from four surface water cross-media locations exceeded the groundwater FRL for total uranium.

Uranium Discharges—In 2009, 586 lb (266 kg) of uranium were discharged in treated effluent to the Great Miami River. Approximately 78.4 lb (35.6 kg) of uranium were released to the environment through uncontrolled storm water runoff. The estimated total pounds of uranium released through the surface water and treated effluent pathway (approximately 664 lb [302 kg]) increased 2 percent from the 2008 estimate.

Sediment—In 2009, there were no FRL exceedances for any sediment result.

This chapter presents the 2009 monitoring activities and results for surface water, treated effluent, and sediment to determine the effects of site activities on the surface water pathway.

In general, low levels of contaminants enter the surface water pathway at the Fernald Preserve by two primary mechanisms: treated effluent that is monitored as it is discharged to the Great Miami River, and uncontrolled runoff entering the site's drainages from remediated areas that are now certified and restored. Because these discharges have continued through remediation and legacy management, the surface water and sediment pathways will continue to be monitored. Effective use of the site's wastewater treatment capabilities and implementation of runoff and sediment controls minimize the site's impact on the surface water pathway.

4.1 Summary of Surface Water and Treated Effluent Pathway

To assist in the understanding of this chapter, the following key definitions are provided:

- **Controlled runoff** is contaminated storm water that is collected and, under normal circumstances, treated and discharged to the Great Miami River as treated effluent. However, the only storm water controlled is currently that associated with the footprint of the outdoor processing activities at the wastewater treatment facility.
- **Uncontrolled runoff** is storm water that is not collected for treatment, but enters the site's natural drainages.
- **Treated effluent** is water that is treated through the site's wastewater treatment facility and then discharged to the Great Miami River.
- **Surface water** is water that flows within natural drainage features.

The treated effluent pathway consists of flows discharged to the Great Miami River via the Parshall Flume (PF 4001). Discharges through this point are considered under the control of wastewater operations. Treated effluent is currently composed of treated and untreated groundwater, leachate from the OSDF, and storm water associated with the footprint of the outdoor processing activities at the wastewater treatment facility.

The volume and flow rate of uncontrolled runoff depends on the amount of precipitation within any given period of time. Figure 1–10 in Chapter 1 shows monthly precipitation totals for 2009. Figure 4–1 shows the site's natural drainage features. The site's natural surface water drainages include several

tributaries to Paddys Run (e.g., SSOD) as well as the northeast drainage that flows to the Great Miami River. The arrows on Figure 4–1 indicate the general flow direction of uncontrolled runoff that is determined from the topography. Uncontrolled runoff from the Fernald Preserve leaves the property via two drainage pathways: Paddys Run and the northeast drainage ditch.

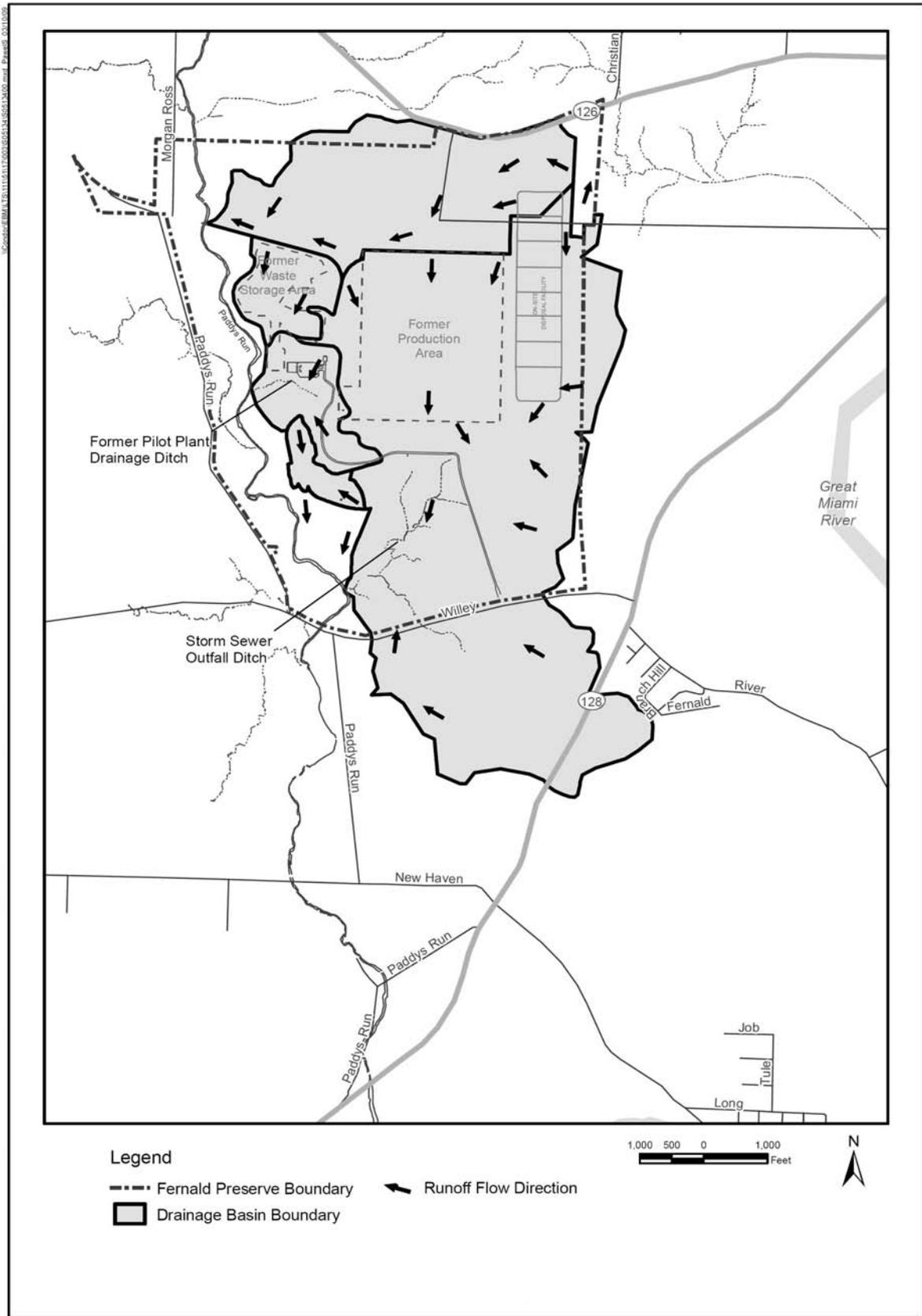


Figure 4-1. Controlled Surface Water Areas and Uncontrolled Runoff Flow Directions

4.2 Remediation Activities Affecting the Surface Water Pathway

Activities that had the potential to affect the surface water pathway included routine operation and maintenance activities of the OSDF and the Converted Advanced Wastewater Treatment facility, and ecological restoration activities conducted throughout the property, including repairing areas of erosion.

Now that remediation has been completed and the infrastructure to continue the groundwater remedy has been installed, the restored areas of the Fernald Preserve will be the primary focus relative to uncontrolled runoff. Controls to mitigate sediment leaving the site will be primarily based on the vegetation and stabilization practices within the restored areas.

Surface water monitoring conducted in a small area west of the former waste pits continued to show elevated uranium concentrations. The location in question is a series of small puddles and drainage ditches due west of the center of former waste pit 3, which drain generally south to a depression near the former cement pond. This area does not drain directly to Paddys Run.

After a limited maintenance activity was completed in the fall of 2007, DOE committed to continued monitoring of the area. Two monitoring points (SWD-05 and SWD-09) were added to the surface water program to fulfill this monitoring commitment. These two locations are sampled weekly, when water is present.

4.3 Surface Water, Treated Effluent, and Sediment Monitoring Program for 2009

Surface water, treated effluent, and sediment are sampled to determine the effect of the Fernald Preserve's activities on the environment. Surface water is sampled at several locations in the site's drainages and analyzed for various radiological and nonradiological constituents. Treated effluent is sampled prior to discharge into the Great Miami River. Sediment is sampled for total uranium in the Great Miami River.

The key elements of the surface water and treated effluent program design are:

- **Sampling**—Sample locations, frequency, and constituents were selected to address requirements of the NPDES Permit, the FFCA, and the OU5 ROD and to provide a comprehensive assessment of surface water quality at key locations, including two background locations (refer to Figure 4-2 and Figure 4-3). Surface water is monitored for 16 FRL constituents.
- **Data Evaluation**—The integrated data evaluation process focuses on tracking and evaluating data compared with background and historical ranges, FRLs, and NPDES limits. This information is used to assess impacts on surface water due to site remediation activities affecting uncontrolled runoff or treated effluent. The assessment also includes identifying the potential for impacts from surface water to the groundwater in the underlying Great Miami Aquifer. The ongoing data evaluation is designed to support remedial action decision making.

- **Reporting**—Surface water and treated effluent data are reported through the annual Site Environmental Report. Monthly discharge monitoring reports required by the NPDES permit are submitted to OEPA.

In 2009, the IEMP sediment monitoring sampling frequency was changed from annual to once every five years at the suggestion of OEPA per DOE/EH-0173T, Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance (January 1991). The data are reported through the annual Site Environmental Report.

Data from samples collected under the IEMP are used to fulfill surveillance and compliance monitoring functions. Surveillance monitoring results of the IEMP surface water and treated effluent program are used to assess the collective effectiveness of site storm water controls and wastewater treatment processes in preventing unacceptable impacts to the surface water and groundwater pathways. Compliance monitoring includes sampling at storm water and treated effluent discharge points and is conducted to comply with provisions in the NPDES permit, the FFCA, and the OU5 ROD. The data are routinely evaluated to identify any unacceptable trends and to trigger corrective actions when needed to ensure protection of these critical environmental pathways. Figure 4–2 depicts IEMP/NPDES surface water and treated effluent sample locations; Figure 4–3 shows IEMP background sample locations. In 2009, four new surface water sampling locations (SWD-10, SWD-11, SWD-12, and SWD-13) were added to the surface water monitoring program. These locations were added to monitor bodies of water near public access areas.

4.3.1 Surveillance Monitoring

Treated effluent is discharged to the Great Miami River through the effluent line identified on Figure 4–2. Samples of the treated effluent are collected at the Parshall Flume (PF 4001). The resulting data are used to calculate the concentration of each FRL constituent after the effluent water mixes with the water in the Great Miami River.

Data resulting from 2009 semiannual sampling events were evaluated to provide surveillance monitoring of site activities. This evaluation indicated that during 2009, 32 surface water analytical results from established sampling locations exceeded the surface water FRL for total uranium. Three results from SWD-05 and 29 results from SWD-09 exceeded the surface water FRL for total uranium. SWD-05 and SWD-09 are surface water monitoring points established to

monitor the area west of the former waste pits where elevated surface water uranium concentrations have been detected in the past. There were no exceedances of total uranium in any of the treated effluent samples, and there were no non-uranium FRL exceedances.

The following two key sample locations represent points where surface water or treated effluent leaves the site:

- Paddys Run at the Willey Road property boundary (surface water sample location SWP-03).
- PF 4001 is located at the entry point of the treated effluent line leading to the Great Miami River.

There were no exceedances of the surface water FRLs during 2009 at these two locations.

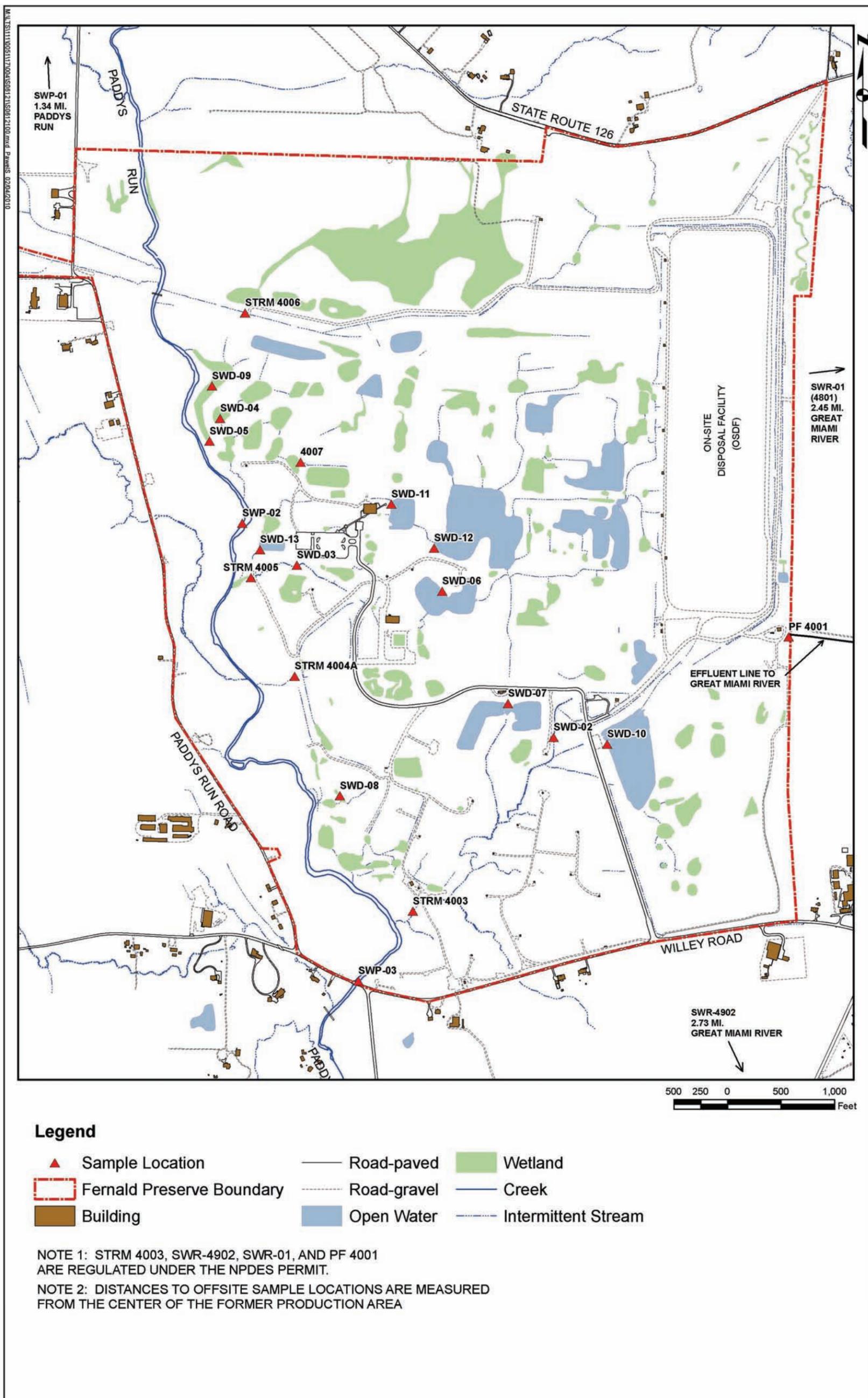


Figure 4-2. IEMP/NPDES Surface Water and Treated Effluent Sample Locations

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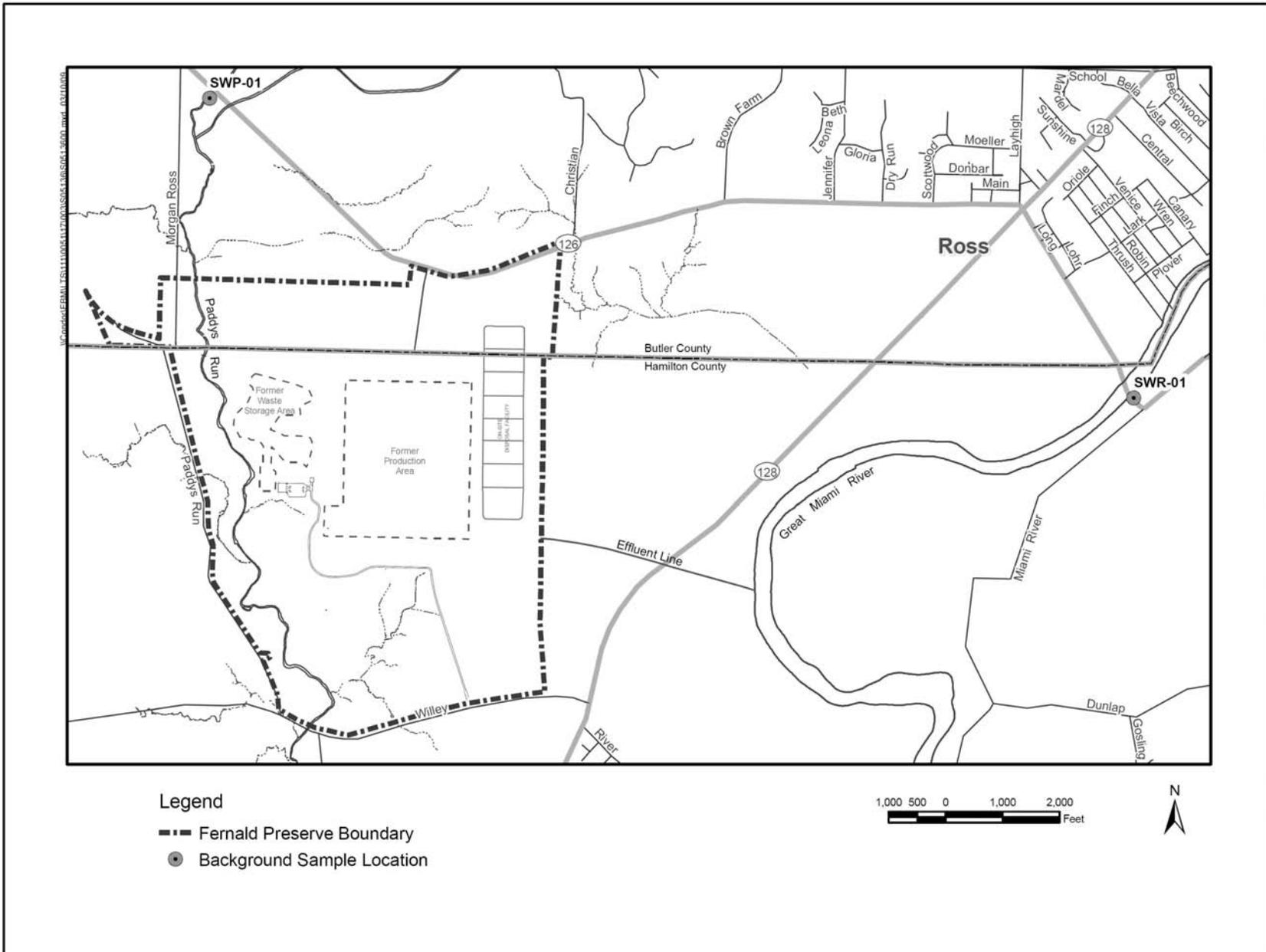


Figure 4-3. IEMP Background Surface Water Sample Locations

The maximum total uranium concentration at SWP-03 during 2009 was 2.97 µg/L, well below the surface water total uranium FRL of 530 µg/L. Figure 4–4 shows the annual average total uranium concentration in Paddys Run at Willey Road for the period 1985 through 2009. This figure illustrates the decrease of the total uranium concentration in Paddys Run from 1986.

Samples collected at PF 4001 are used in the surveillance evaluation because this is the last point where treated effluent is sampled prior to discharge to the Great Miami River. The maximum daily total uranium concentration at PF 4001 in 2009 was 34.3 µg/L, well below the surface water total uranium FRL of 530 µg/L. Data collected from this location cannot directly be compared to the surface water FRL without considering the effect of the effluent waters mixing with the Great Miami River. This comparison is done through the use of a mixing equation when constituents exceed the FRL. After the actual flow rate in the Great Miami River and the discharge flow rate in which this maximum uranium concentration was observed were accounted for, the resulting concentration in the river was estimated to be 2.71 µg/L.

Evaluation of surface water data is also performed to provide an ongoing assessment of the potential for cross-media impacts from surface water to the underlying Great Miami Aquifer. In areas where there is no glacial overburden, a direct pathway exists for contaminants to reach the aquifer. This contaminant pathway to the aquifer was considered in the design of the groundwater remedy. The groundwater remedy includes placing groundwater extraction wells downgradient of these areas where direct infiltration occurs in order to mitigate any potential cross-media impacts during surface remediation. To provide this assessment, sample locations were selected to evaluate contaminant concentrations in surface water just upstream of, or within, those areas where site drainages have eroded through the protective glacial overburden. The locations are SWP-02, SWD-02, SWD-03, SWD-04, SWD-05, SWD-07, SWD-08, and STRM 4005.

In 2009 surface water cross-media impact locations STRM 4005, SWD-04, SWD-05, SWD-08 had sample results that exceeded the total uranium groundwater FRL of 30 µg/L. Additional details of the FRL exceedances are presented in Appendix B, Attachment B.1.

4.3.2 Compliance Monitoring

4.3.2.1 FFCA and OU5 ROD Compliance

The Fernald Preserve is required to monitor treated effluent discharges at PF 4001 for total uranium mass discharges and total uranium concentrations. This requirement is identified in the July 1986 FFCA and the OU5 ROD. The OU5 ROD requires treatment of effluent so that the mass of total uranium discharged to the Great Miami River through PF 4001 does not exceed 600 lb (272 kg) per year. The OU5 ROD (DOE 1996) and the subsequent *Explanation of Significant Differences for Operable Unit 5* (DOE 2001d) also require that the monthly average total uranium concentration in the effluent must be at or below 30 µg/L.

Figure 4–5 shows that the cumulative mass of total uranium discharged to the Great Miami River during 2009 was 586 lb (266 kg), which is below the annual discharge limit of 600 lb (272 kg). Figure 4–6 shows that the monthly average total uranium concentration was below the 30 µg/L limit every month during 2009.

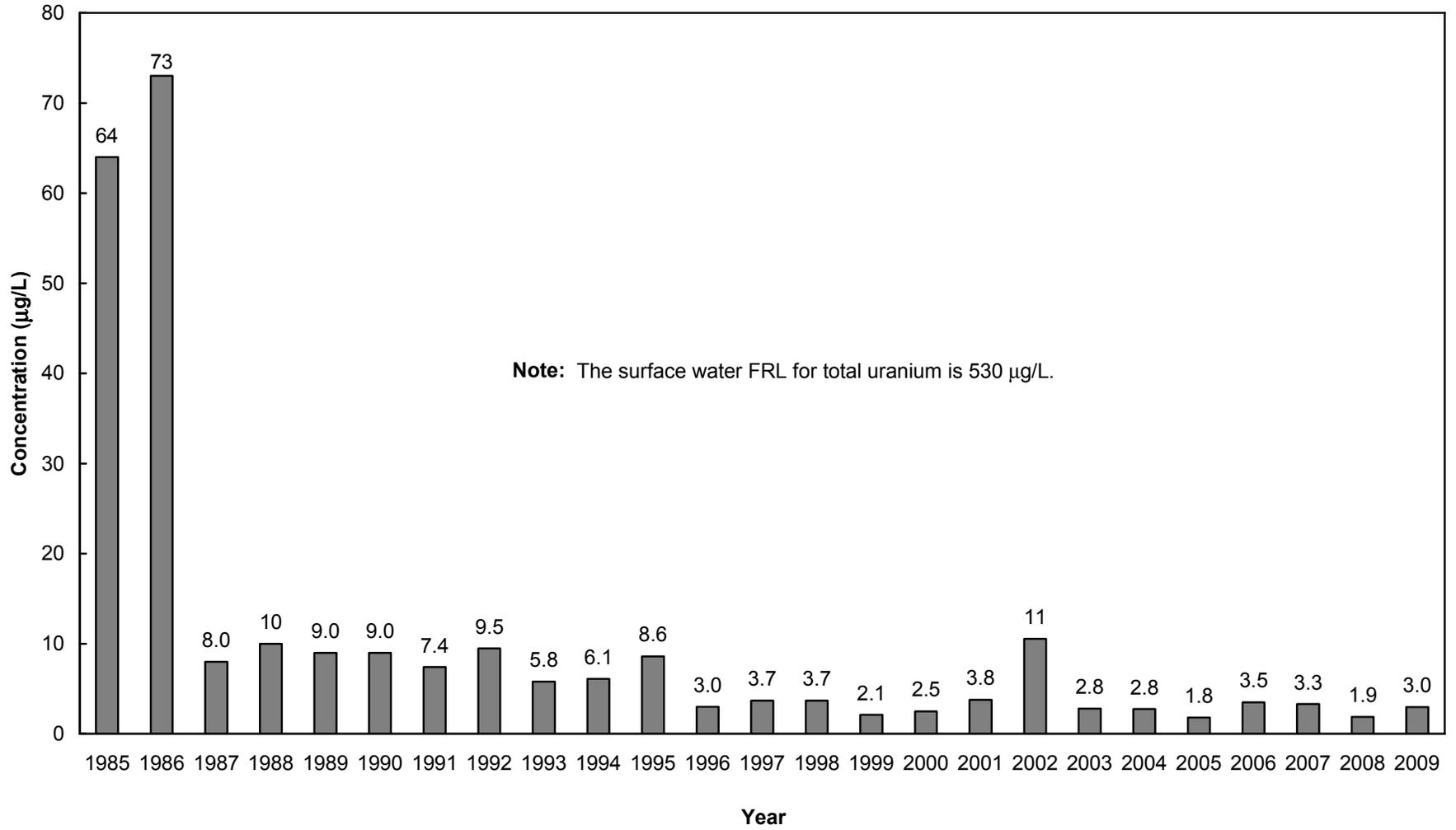


Figure 4-4. Annual Average Total Uranium Concentrations in Paddys Run at Willey Road (SWP-03) Sample Location, 1985-2009

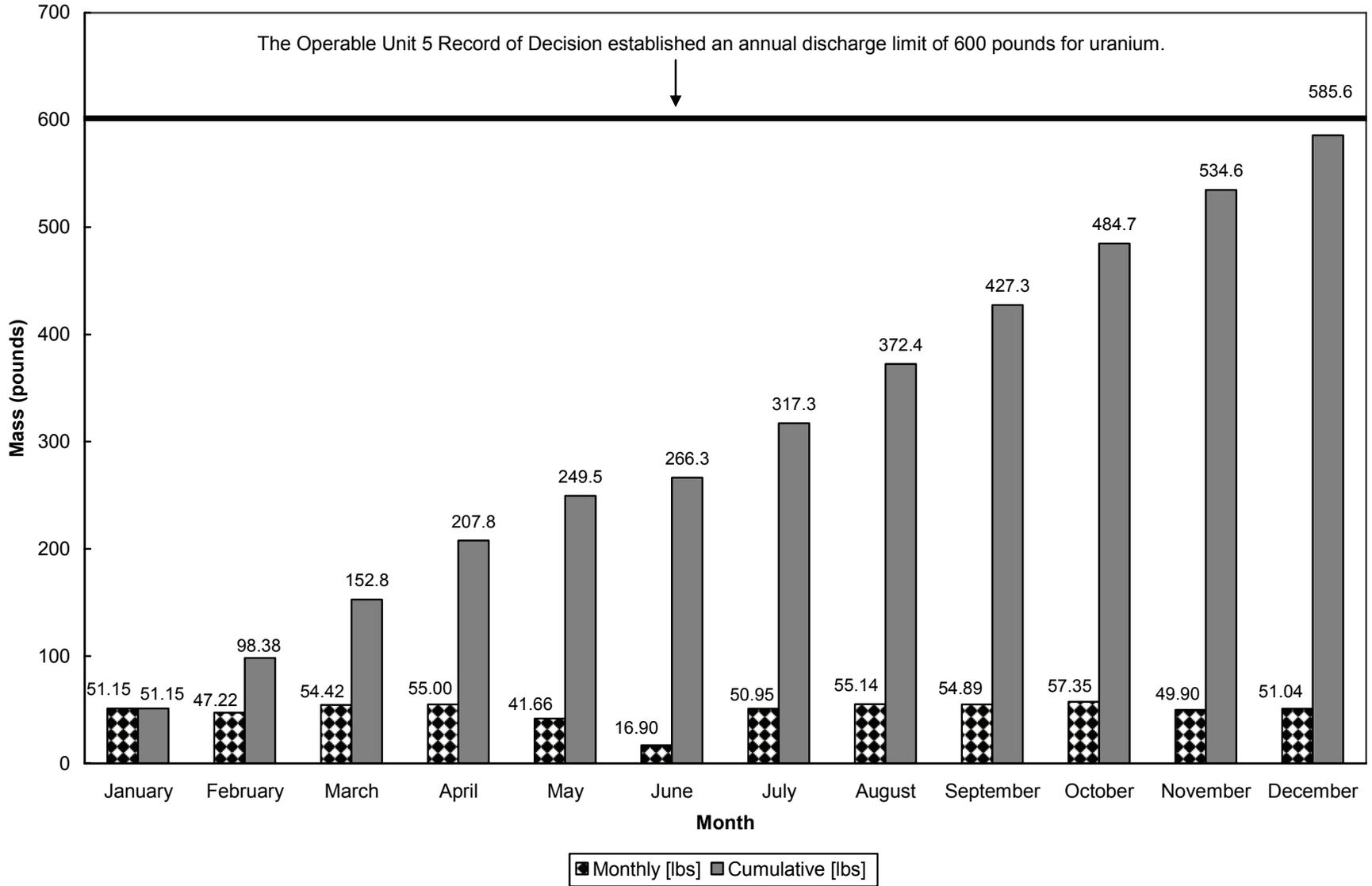


Figure 4-5. Pounds of Uranium Discharged to the Great Miami River through the Parshall Flume (PF 4001) in 2009

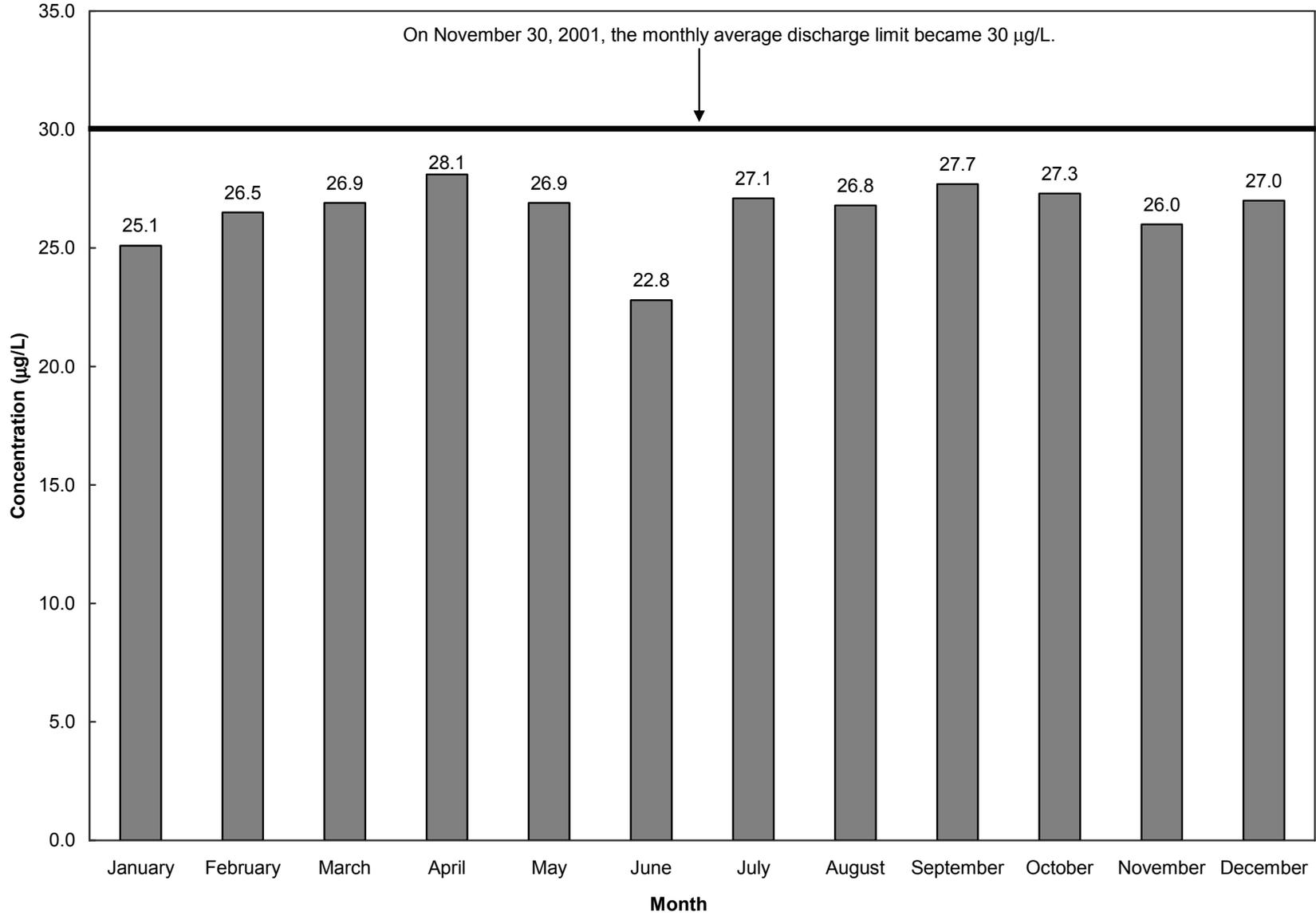


Figure 4-6. 2009 Monthly Average Total Uranium Concentration in Water Discharged Through the Parshall Flume (PF 4001) to the Great Miami River

4.3.2.2 NPDES Permit Compliance

Compliance sampling, consisting of sampling for nonradiological pollutants from uncontrolled runoff and treated effluent discharges from the Fernald Preserve, is regulated under the state-administrated NPDES program. A new permit was received from OEPA on April 1, 2009, and is effective until March 31, 2014. There were no incidents of NPDES noncompliance in 2009.

4.3.3 Uranium Discharges in Surface Water and Treated Effluent

As identified in Figure 4–5, 586 lb (266 kg) of uranium in treated effluent were discharged to the Great Miami River through PF 4001 in 2009. In addition to the treated effluent, uncontrolled runoff is also contributing to the amount of uranium entering surface water. Figure 4–7 presents the pounds of uranium from the uncontrolled runoff and controlled discharges from 1993 through 2009.

A loading term is used to estimate the pounds of uranium discharged to Paddys Run via uncontrolled runoff. This loading term was revised and approved in August 2004 based on total uranium data, which reflect the decreasing total uranium concentrations measured at points discharging to Paddys Run. Total uranium concentrations measured in Paddys Run were decreasing through remediation as a result of significant improvements in the capture of contaminated storm water and should remain low now that soil remediation has been completed. The loading term is 2.1 lb of uranium per inch of rainfall.

During 2009, 37.35 inches (94.87 cm) of precipitation fell at the Fernald Preserve; therefore, an estimated 78.4 lb (35.6 kg) of uranium entered the environment through uncontrolled runoff.

The estimated total amount of uranium discharged to the surface water pathway for the year, including controlled treated effluent discharges and uncontrolled runoff, was approximately 664 lb (301 kg).

4.4 Sediment Monitoring

In 2009, the IEMP sediment monitoring sampling frequency was changed from annual to once every five years at the suggestion of OEPA per DOE/EH-0173T, *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance* (January 1991). Sediment is a secondary exposure pathway and is monitored to assess the impact of remediation activities on sediments deposited along surface water drainages. Sediment samples are collected at strategic locations in the Great Miami River (i.e., upgradient and downgradient of the effluent line). In 2009, the downstream location was moved to the opposite side of the river and closer to the effluent line because of accessibility issues with the old downstream location. The new location is designated G10. Sediment samples analyzed for total uranium were collected in October 2009 at two locations in the Great Miami River (Figure 4–8). Table 4–1 presents the 2009 results, which show that all uranium results were below the sediment FRL of 210 milligrams per kilogram (mg/kg). Appendix B, Attachment B.2 contains additional details of the sediment monitoring results.

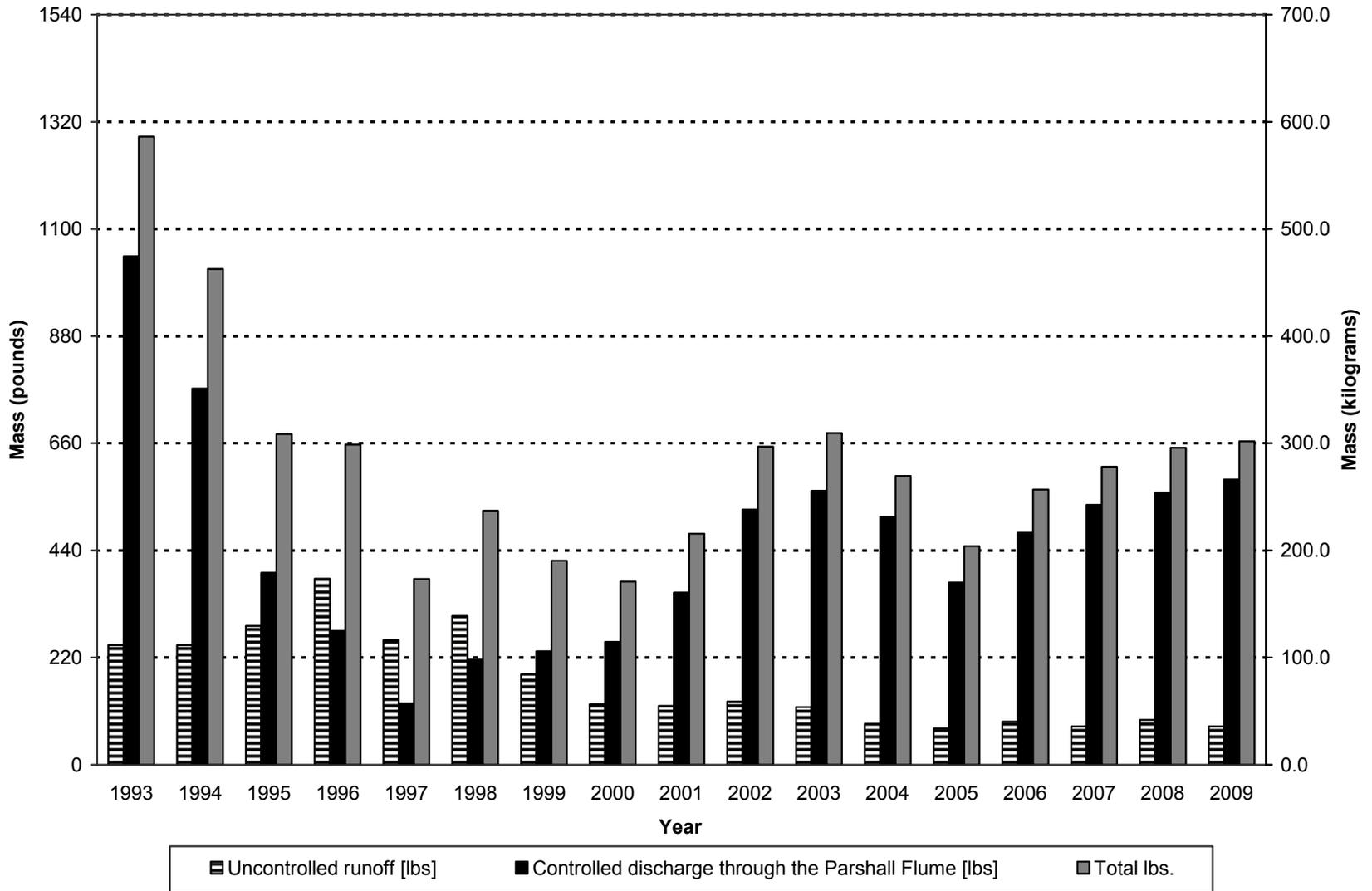


Figure 4-7. Uranium Discharged via the Surface Water Pathway, 1993-2009

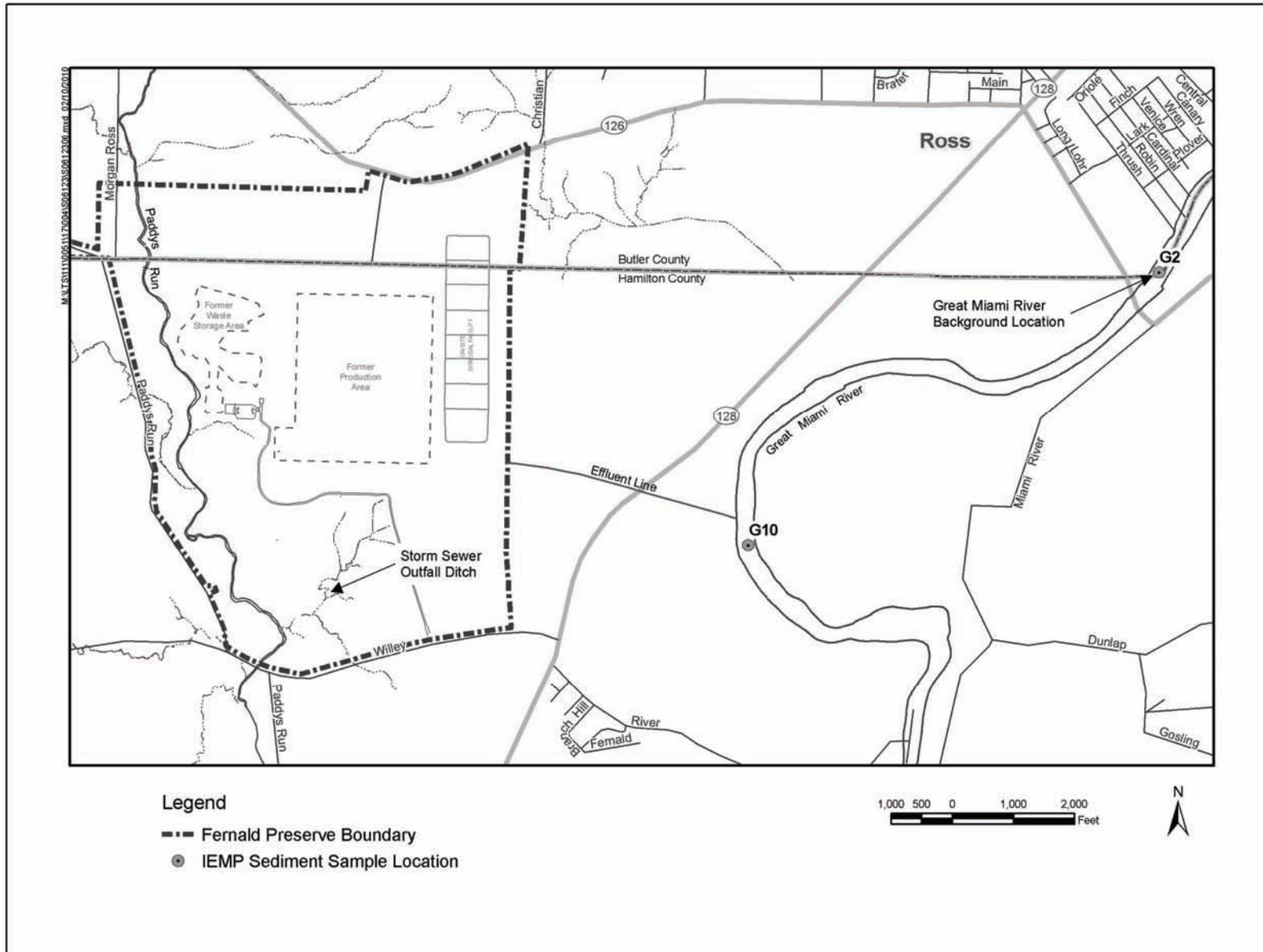


Figure 4-8. 2009 Sediment Sample Locations

Table 4-1. 2009 Summary Statistics for the Sediment Monitoring Program

Radionuclide	Sediment FRL	No. of Samples	2009 Concentration (dry weight)
Great Miami River, North of the Effluent Line (G2)			
Total Uranium	210 mg/kg	1	0.625 mg/kg
Great Miami River, South of the Effluent Line (G10)			
Total Uranium	210 mg/kg	1	0.777 mg/kg

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