

## **Appendix B**

### **Supplemental Surface Water and Treated Effluent Information**

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## Abbreviations

FFCA	Federal Facilities Compliance Agreement
FRL	final remediation level
GMA	Great Miami Aquifer
IEMP	Integrated Environmental Monitoring Plan
LMICP	<i>Comprehensive Legacy Management and Institutional Controls Plan</i>
NPDES	National Pollutant Discharge Elimination System
OU5 ROD	<i>Final Record of Decision for Remedial Actions at Operable Unit 5</i>

## Measurement Abbreviations

cfs	cubic feet per second
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
pCi/L	picocuries per liter
µg/L	micrograms per liter

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Appendix B presents additional surface water and treated effluent data in support of Section 4 of this *Fernald Preserve 2010 Site Environmental Report*. This appendix provides an evaluation of the final remediation level (FRL) exceedances for surface water and treated effluent, including an assessment of potential cross-media impacts to the groundwater pathway. Surface water data are available through the Department of Energy Office of Legacy Management's Geospatial Environmental Mapping System (<http://www.lm.doe.gov/Fernald/Sites.aspx>).

## References

DOE/EH-0173T, 1991. *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance*, U.S. Department of Energy, Washington, D.C., January.

DOE (U.S. Department of Energy), 1996. *Final Record of Decision for Remedial Actions at Operable Unit 5*, 7478 U-007-501.4, prepared by S.M. Stoller Corporation for DOE, Fernald Area Office, Cincinnati, Ohio, January.

DOE (U.S. Department of Energy), 2001. *Explanation of Significant Differences for Operable Unit 5*, Final, Fernald Environmental Management Project, DOE, Fernald Area Office, Cincinnati, Ohio, November.

DOE (U.S. Department of Energy), 2010a. *Comprehensive Legacy Management and Institutional Controls Plan*, LMS/FER/S03496, Revision 4, prepared by S.M. Stoller Corporation for DOE, Fernald Area Office, Cincinnati, Ohio, April.

DOE (U.S. Department of Energy), 2010b. *Fernald Preserve 2009 Site Environmental Report*, LMS/FER/S06109, prepared by S.M. Stoller Corporation for DOE, Fernald Area Office, Cincinnati, Ohio, May.

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## B.1.0 Surface Water and Treated Effluent

During 2010, surface water and treated effluent samples were collected under the Integrated Environmental Monitoring Plan (IEMP), which is Attachment D of the *Comprehensive Legacy Management and Institutional Controls Plan* (LMICP) (DOE 2010a). Figures B.1–1 and B.1–2 show all surface water monitoring locations. The following information is discussed in this attachment:

- Surveillance monitoring (see Section B.1.1).
- Federal Facilities Compliance Agreement (FFCA)/*Final Record of Decision for Remedial Actions at Operable Unit 5* (OU5 ROD) (DOE 1996) compliance (see Section B.1.2).
- Controlled and uncontrolled areas (see Section B.1.3).

The National Pollutant Discharge Elimination System (NPDES) permit sampling is not discussed in this attachment because it is discussed in detail in Section 4, “Surface Water and Treated Effluent Pathway,” of this report.

### B.1.1 Surveillance Monitoring

Surveillance monitoring is the comparison of surface water and treated effluent analytical results to the surface water final remediation levels (FRLs) to determine effects of remediation activities on the surface water pathway. Surveillance monitoring also includes an assessment of the effects surface water may have on the groundwater pathway (referred to as cross-media impacts).

All 2010 data were compared to FRLs. Samples collected at the Parshall Flume (PF 4001) are used in the surveillance evaluation because this is the last point treated effluent is sampled prior to discharge to the Great Miami River.

Water discharges to the Great Miami River are required to be below the FRLs at the point where discharged water is completely mixed with water in the Great Miami River (i.e., outside the mixing zone). In cases where the Parshall Flume data are already below the FRLs, no further action is taken. When the Parshall Flume data are above the FRLs, to make a determination of each constituent’s concentration at this point in the Great Miami River, the following calculation is applied:

$$C_{PF4001} = \frac{[Q_{10}][C_{GMR}] + [Q_{PF}][C_{PF}]}{[Q_{10}] + [Q_{PF}]}$$

where:

- $C_{PF4001}$  = Flow-weighted average concentration outside the mixing zone in the Great Miami River, picocuries per liter (pCi/L) or milligrams per liter (mg/L)
- $Q_{10}$  = 7-day, 10-year low flow, 706 cubic feet per second (cfs)
- $C_{GMR}$  = Background concentration in Great Miami River from Table 4–2 in Attachment D of the 2010 LMICP, pCi/L or mg/L (zero was used when no background concentration was available)
- $Q_{PF}$  = Daily flow at PF 4001, cfs
- $C_{PF}$  = Daily concentration at PF 4001, pCi/L or mg/L

**Note:** Flow conditions at the Hamilton Dam gauge are periodically reviewed to determine if there is a lower flow than the 7-day, 10-year low flow of 706 cfs. The lowest daily flow measured at the Hamilton Dam gauge (if lower than 706 cfs) is used in the equation to see if an exceedance could potentially occur. The lowest daily flow recorded during 2010 was 461 cfs, which occurred on October 23. The low flow of 706 cfs went into effect during the 2003 NPDES permit renewal process.

#### **B.1.1.1 Evaluation of Constituents above FRLs for 2010**

As shown in Table B.1-1, there were 25 exceedances in 2010 of surface water FRLs. The following are general observations:

- No FRL exceedances occurred at PF 4001, thus there was no need to run the mixing equation to determine the concentration in the Great Miami River.
- Two surface water analytical results from sampling location SWD-05 and 23 results from sampling location SWD-09 exceeded the surface water FRL for total uranium (530 micrograms per liter [ $\mu\text{g/L}$ ]). Figures B.1-3 through B.1-9 are plots of the total uranium concentration versus time for the surface water sampling locations that either had results that exceeded the surface water FRL or are cross-media impact sampling locations that exceeded the groundwater FRL.

#### **B.1.1.2 Evaluation of Cross-Media Impacts for 2010**

Another objective of the IEMP surveillance monitoring program is to provide an ongoing assessment of the potential for cross-media impacts from surface water to the underlying Great Miami Aquifer (GMA). To conduct this assessment, sampling locations were selected to evaluate contaminant concentrations in surface water just upstream from those areas where site drainages have eroded through the protective glacial overburden (e.g., the Storm Sewer Outfall Ditch, Pilot Plant Drainage Ditch, and certain reaches of Paddys Run). In areas where the glacial overburden is absent, a direct pathway exists for contaminants to reach the aquifer. Key sampling locations associated with these areas of direct infiltration are SWP-02, SWD-02, SWD-03, SWD-04, SWD-05, SWD-07, SWD-08, and STRM 4005.

Because it is the primary contaminant at the site, total uranium is used as an indicator to evaluate the impact of surface water on the GMA. A conservative assumption is used in this assessment, which considers the total uranium concentration (and all other constituent concentrations) in the surface water to be at the same concentration when the water reaches the GMA through infiltration. However, the more likely scenario is that the total uranium concentration (and all other constituent concentrations) would decrease through dilution and adsorption as the water infiltrates through the ground and mixes with the groundwater in the GMA.

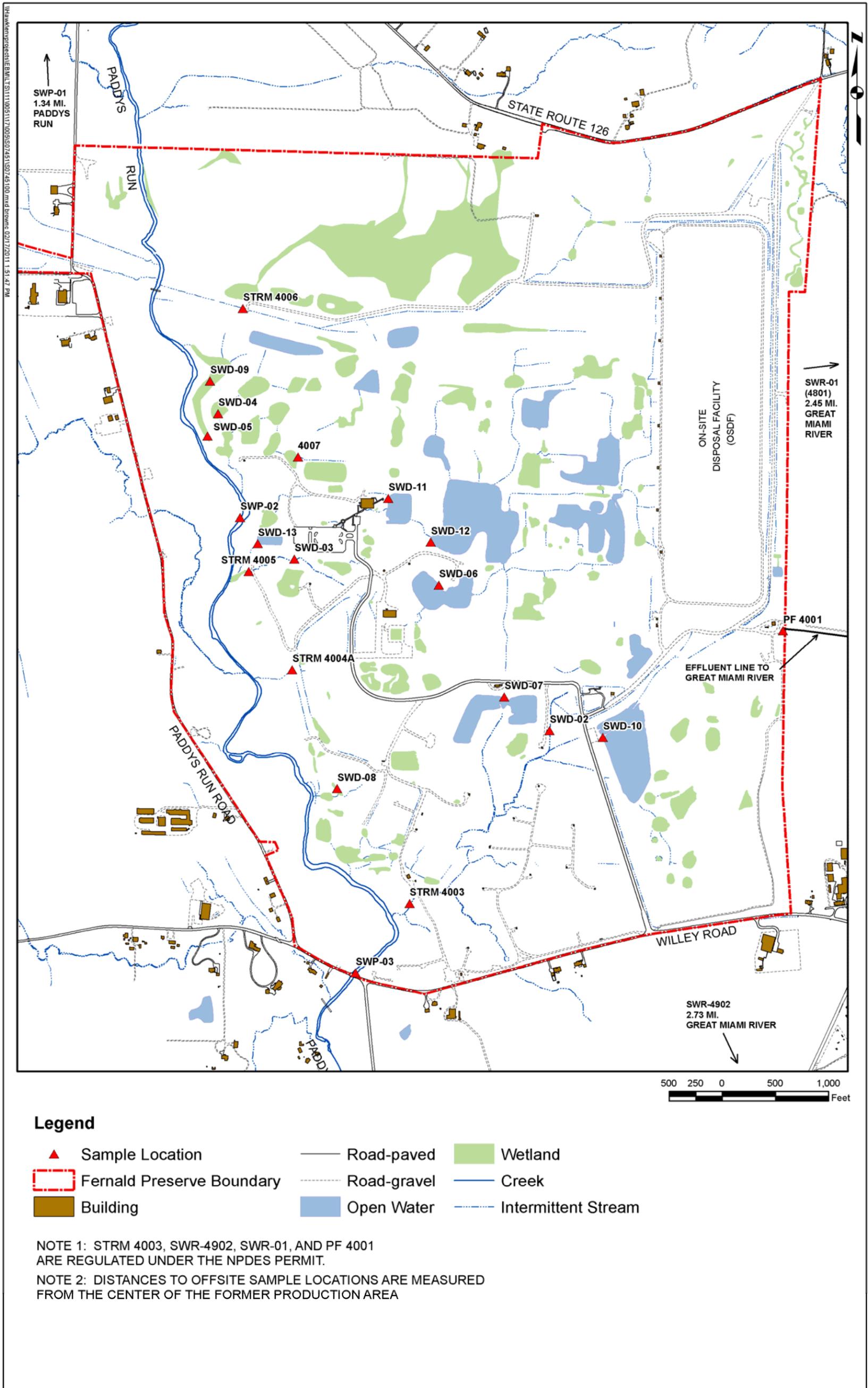


Figure B.1-1. IEMP/NPDES Surface Water and Treated Effluent Sample Locations

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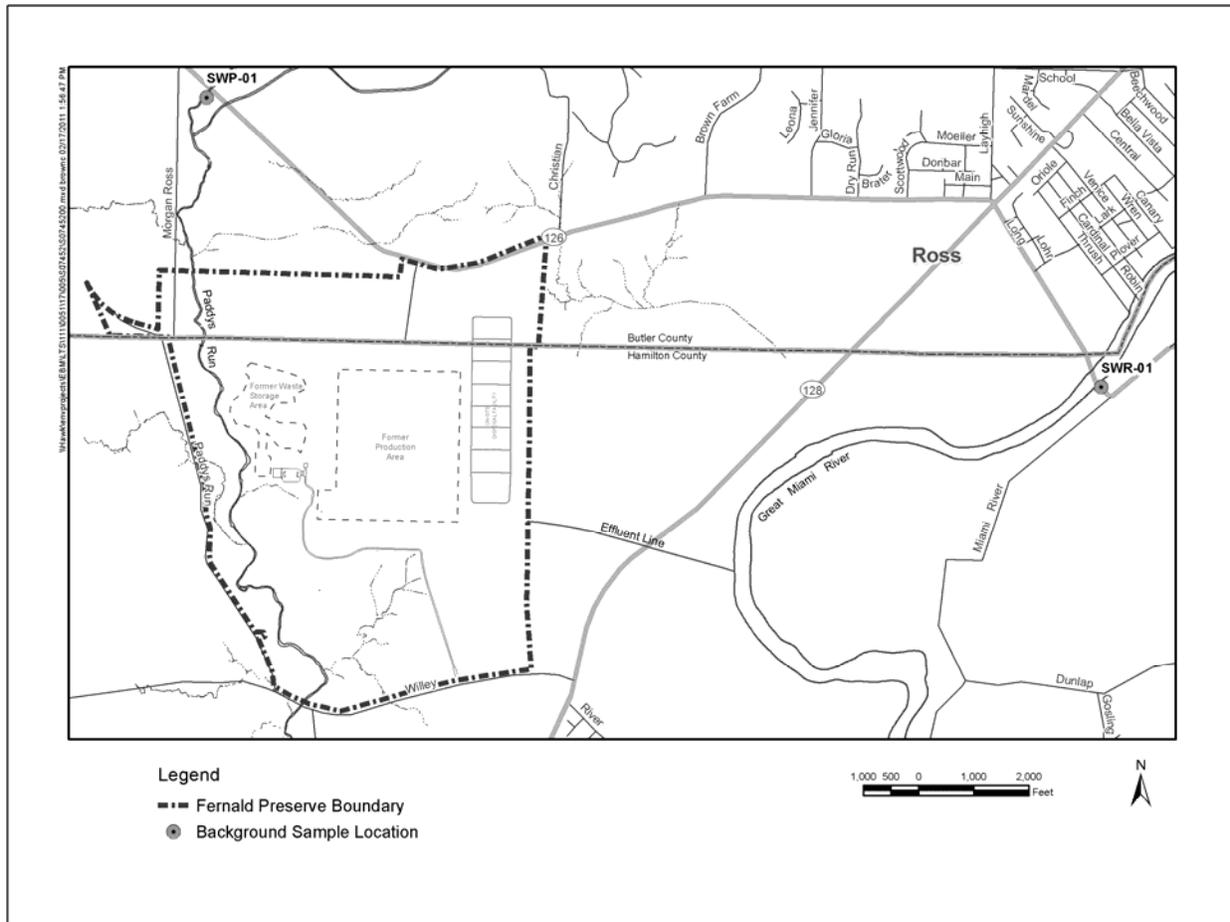


Figure B.1–2. IEMP Background Surface Water Sample Locations

The results of the cross-media impact assessment for 2010 indicate that six of the eight surface water locations (STRM 4005, SWD-03, SWD-04, SWD-05, SWD-07, and SWD-08) evaluated had results that exceeded the total uranium groundwater FRL of 30 µg/L.

Location SWD-05 is the point at which drainage from the swale area adjacent to former Waste Pit 3 collects and infiltrates into the underlying aquifer. As discussed in Section 3 and Appendix A of the *2009 Site Environmental Report* (DOE 2010), this may be contributing to increased uranium concentrations in adjacent groundwater monitoring wells. However, the area in question remains within the capture zone of Waste Storage Area Module extraction wells. The design of the groundwater restoration systems has accounted for this potential contaminant pathway by installing extraction wells downgradient of these areas where direct infiltration can occur.

### B.1.2 FFCA/OU5 ROD Compliance

The OU5 ROD and subsequent *Explanation of Significant Differences for Operable Unit 5* (DOE 2001) stipulate compliance with a monthly flow-weighted average total uranium concentration of 30 µg/L at the Great Miami River via PF 4001. In addition to the concentration limitation, the OU5 ROD stipulated that the total mass discharged during a year not exceed 600 pounds.

During 2010, the total uranium concentrations were monitored daily at PF 4001 to demonstrate compliance with these limitations. The Fernald Preserve was in compliance with the total mass limitation, as uranium discharges totaled 565 pounds, which is below the 600-pound limit. The Fernald Preserve was in compliance with the monthly flow-weighted concentration limit every month in 2010, as identified on Figure B.1–10.

### **B.1.3 Controlled and Uncontrolled Storm Water Runoff Areas**

In 2010, there were no previously uncontrolled areas that were added to the Fernald Preserve controlled storm water system (refer to Figure B.1–11). At the conclusion of remediation in October 2006, control of storm water runoff is no longer required. The only storm water collected for treatment is that which falls on the controlled pad of the Converted Advanced Wastewater Treatment Facility.

Table B.1–1. Summary Statistics and Trend Analysis for Constituents with 2010 Results above Surface Water Final Remediation Levels

Location <sup>a</sup>	Constituent	No. of Samples <sup>b,c,d</sup>	No. of Samples Above FRL <sup>b,c,d</sup>	No. of Samples Above FRL for 2010 <sup>c,d</sup>	FRL <sup>e</sup> (µg/L)	Min. <sup>b,c,d,f,g</sup> (µg/L)	Max. <sup>b,c,d,f,g</sup> (µg/L)	Avg. <sup>b,c,d,f,g</sup> (µg/L)	SD <sup>b,c,d,f,g</sup> (µg/L)	Trend <sup>b,c,d,f,g</sup> (µg/L)
SWD-05 (Waste Storage Area)	Uranium	65	13	2	530	4.8	988	306	250	Down, Significant
SWD-09 (Waste Storage Area)	Uranium	93	74	23	530	40.8	1,710	848	341	No Significant Trend

<sup>a</sup>Refer to Figure B.1–1.

<sup>b</sup>Based on samples collected from January 3, 2007, through December 31, 2010.

<sup>c</sup>If more than one sample is collected per surface water location per day (e.g., duplicate, grab, composite), then only one sample is counted for the number of samples, and the sample with the maximum concentration is used for determining the summary statistics (minimum, maximum, average, and standard deviation), Mann-Kendall test for trend, and in determining FRL exceedances.

<sup>d</sup>Rejected data qualified with either an R or Z were not included in the count, the summary statistics, or Mann-Kendall test for trend.

<sup>e</sup>From OU5 ROD, Table 9–5.

<sup>f</sup>For results where the concentrations are below the detection limit, the results used in the summary statistics and Mann-Kendall test for trend are each set at half the method detection limit.

<sup>g</sup>If the number of samples is greater than or equal to four, then all of the summary statistics and the Mann Kendall test for trend are reported. If the total number of samples is equal to three, then the minimum, maximum, and average are reported. If the total number of samples is equal to two, then the minimum and maximum are reported. If the total number of samples is equal to one, then the data point is reported as the minimum.

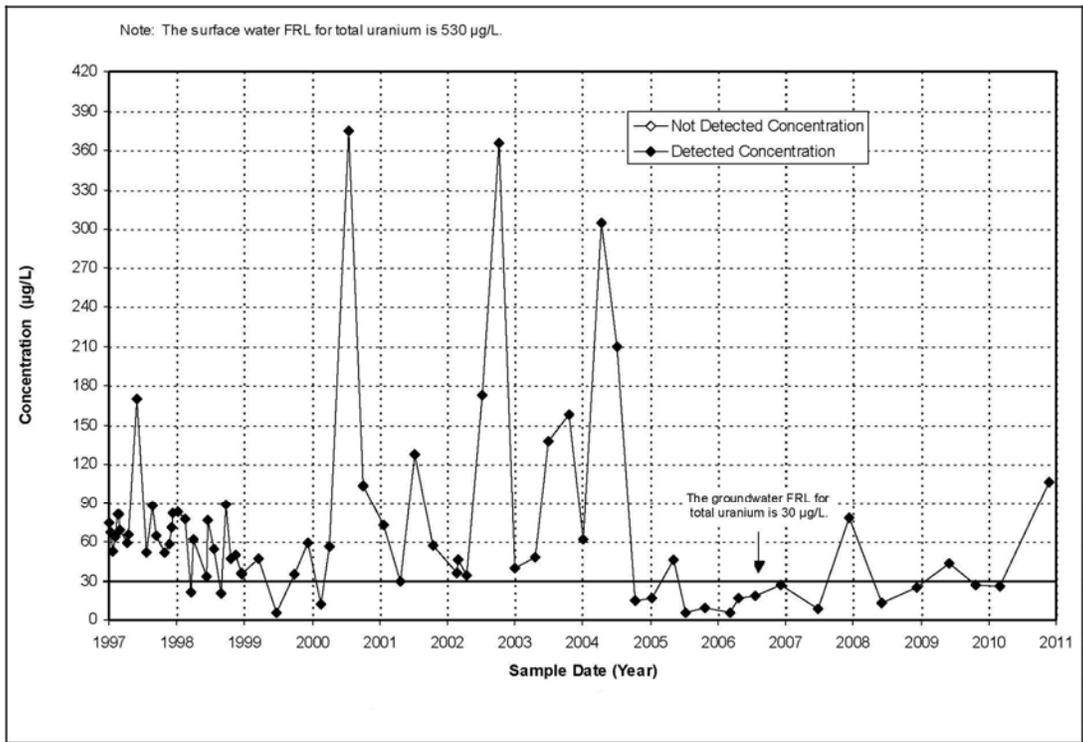


Figure B.1-3. Plot of Total Uranium Concentration versus Time for Location STRM 4005 (Drainage to Paddys Run) for Cross-Media Impact Evaluation

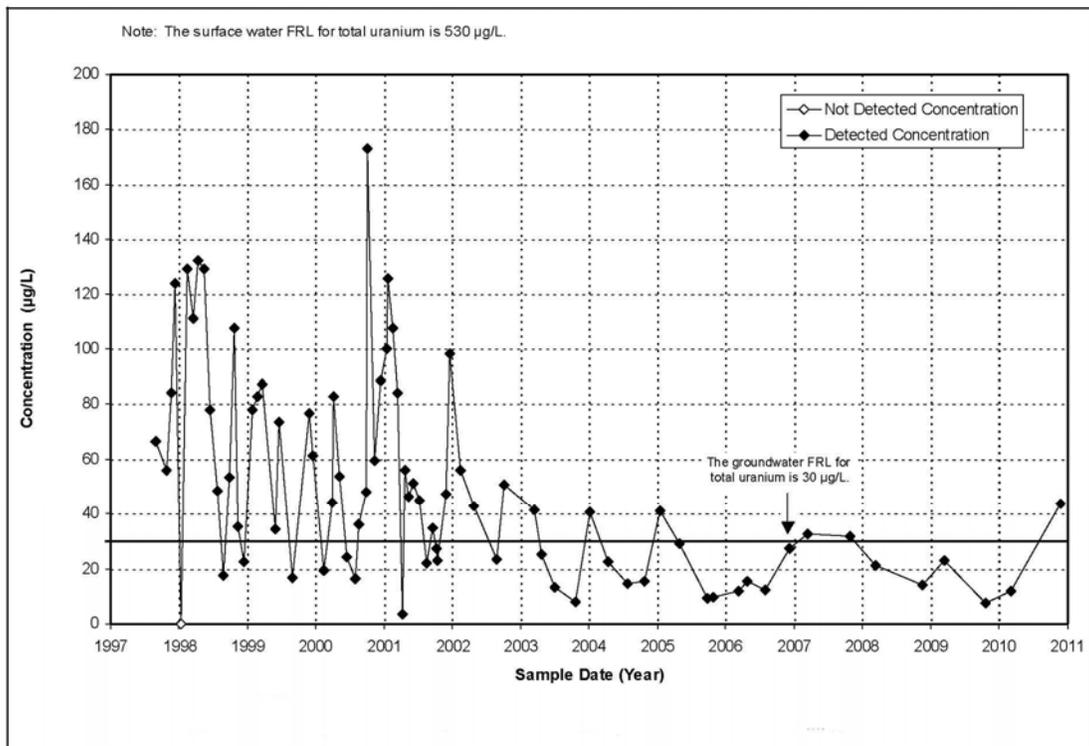


Figure B.1-4. Plot of Total Uranium Concentration versus Time for Location SWD-03 (Waste Storage Area) for Cross-Media Impact Evaluation

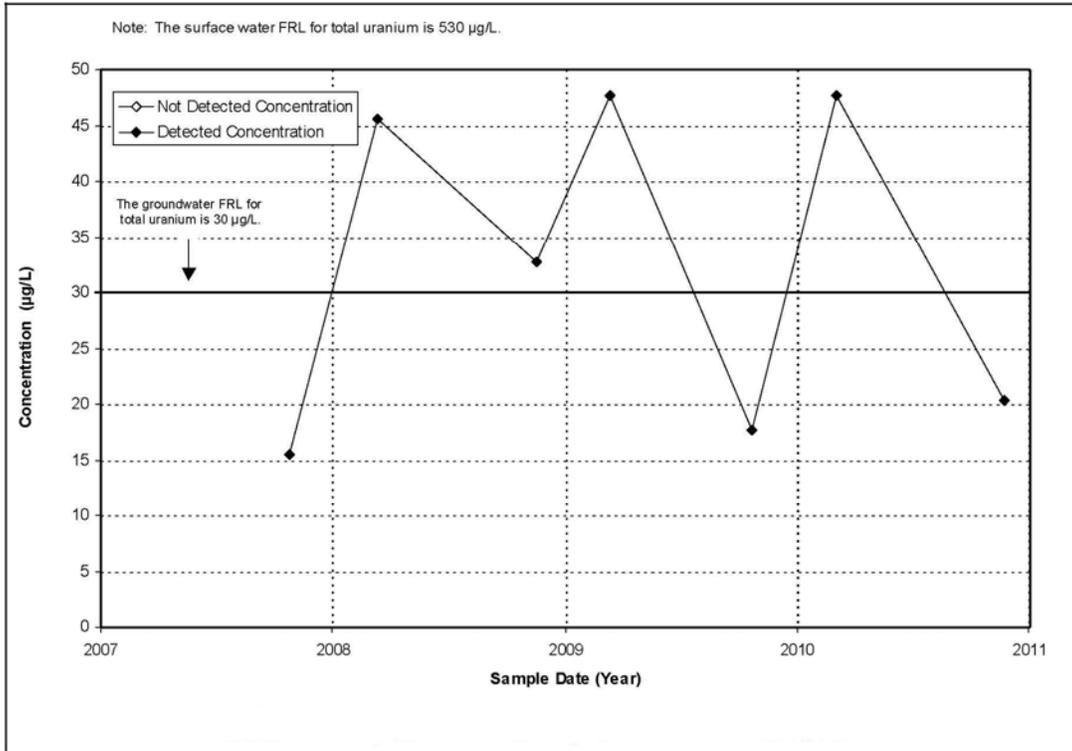


Figure B.1-5. Plot of Total Uranium Concentration versus Time for Location SWD-04 (Former Waste Pit 3) for Cross-Media Impact Evaluation

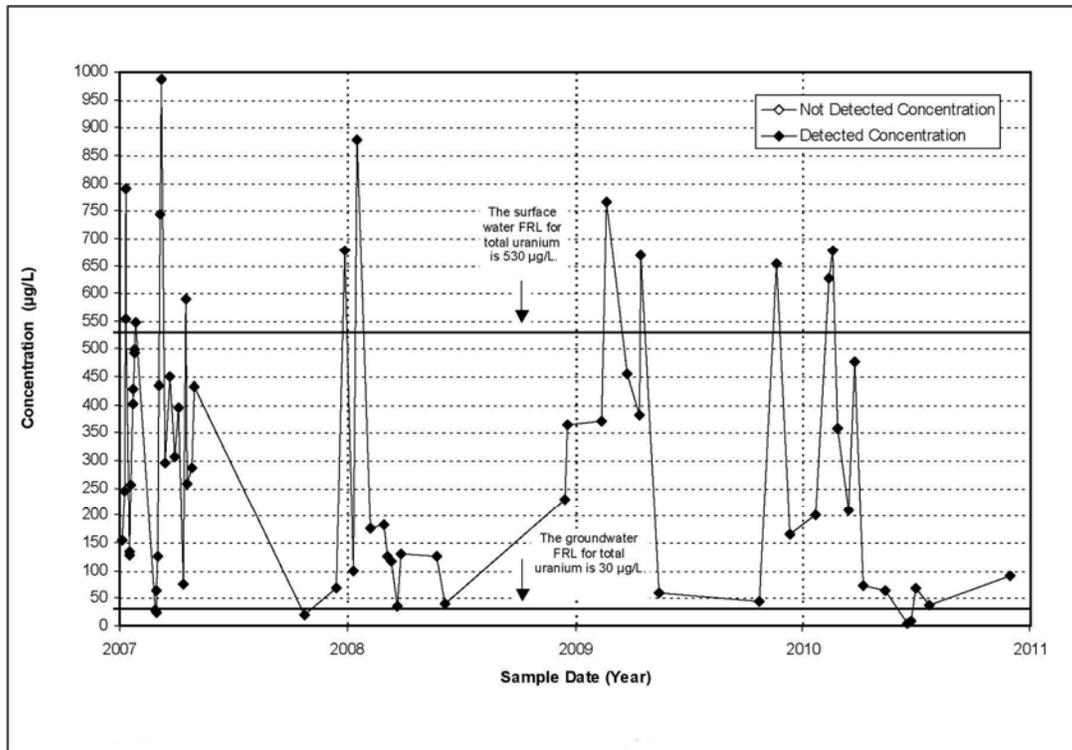


Figure B.1-6. Plot of Total Uranium Concentration versus Time for Location SWD-05 (Former Waste Storage Area) for Cross-Media Impact Evaluation

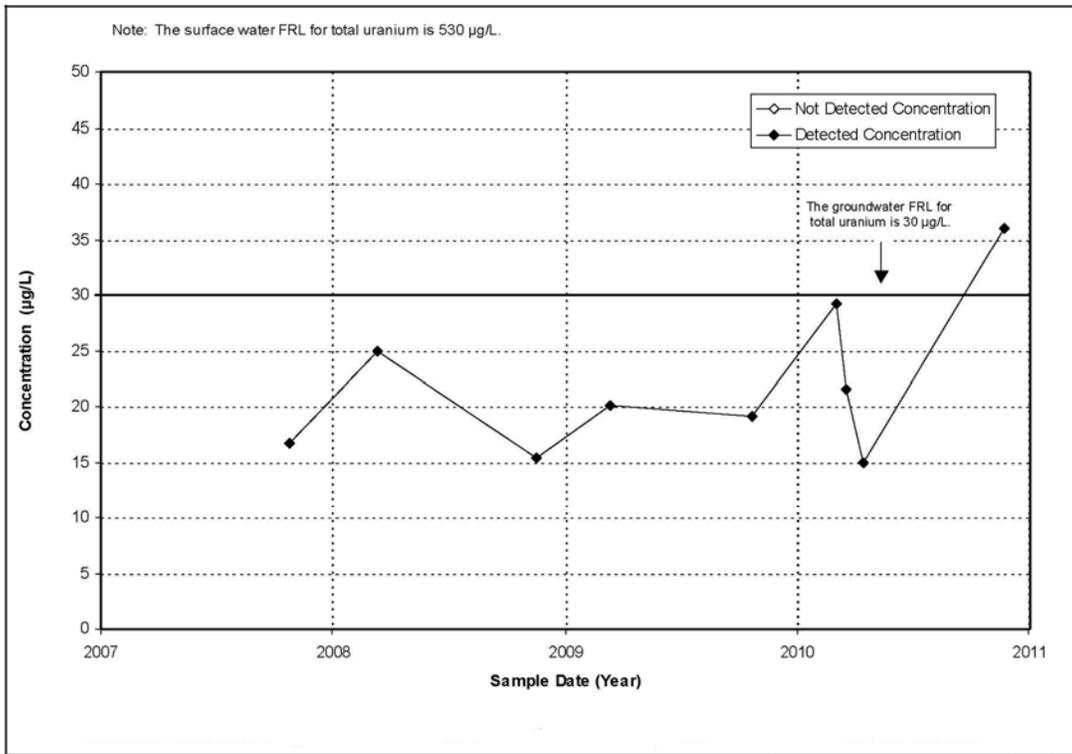


Figure B.1-7. Plot of Total Uranium Concentration versus Time for Location SWD-07 (Former Production Area Drainage) for Cross-Media Impact Evaluation

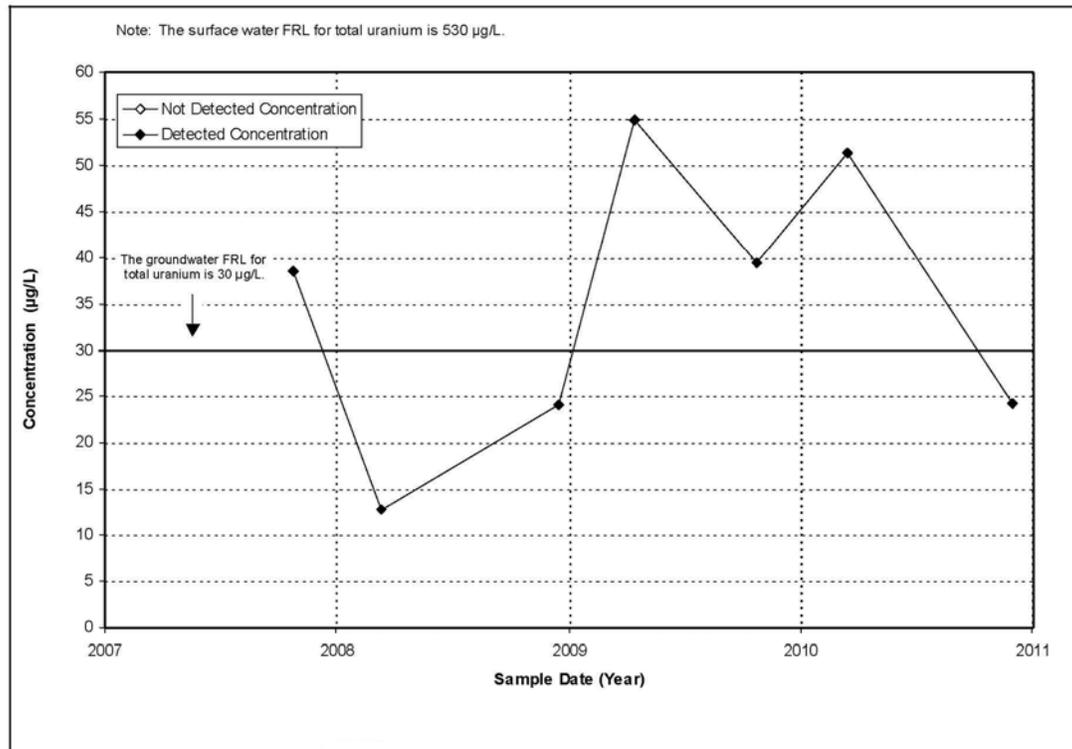


Figure B.1-8. Plot of Total Uranium Concentration versus Time for Location SWD-08 (Former Southern Waste Units) for Cross-Media Impact Evaluation

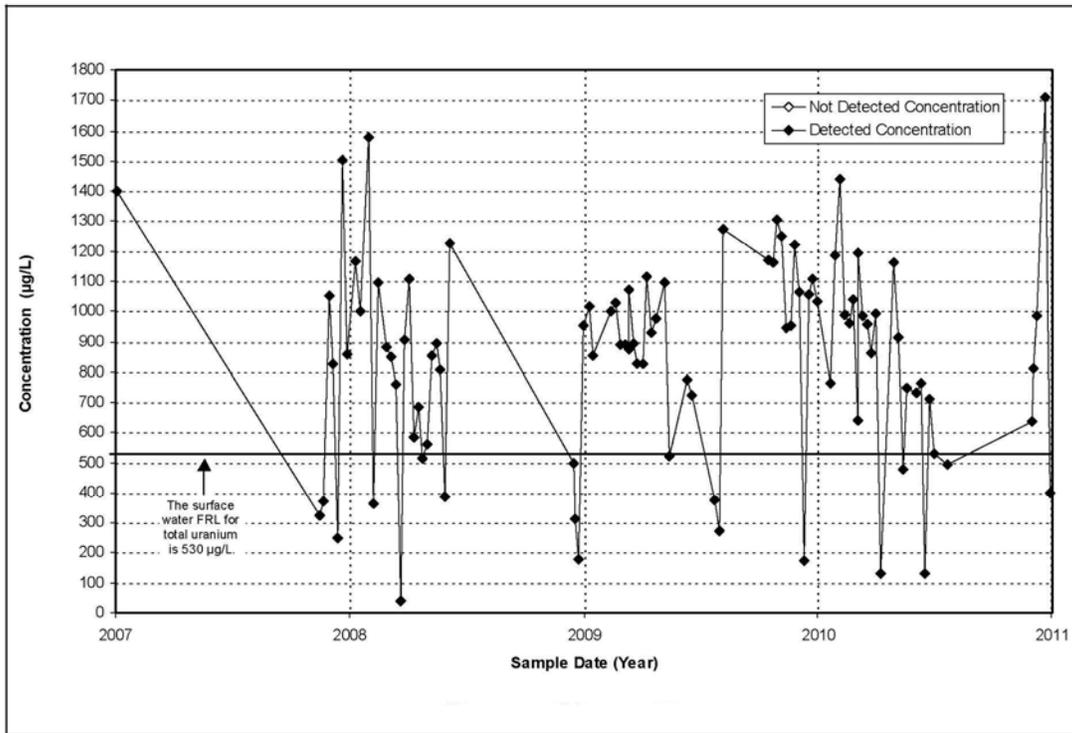


Figure B.1-9. Plot of Total Uranium Concentration versus Time for Location SWD-09 (Former Waste Storage Area)

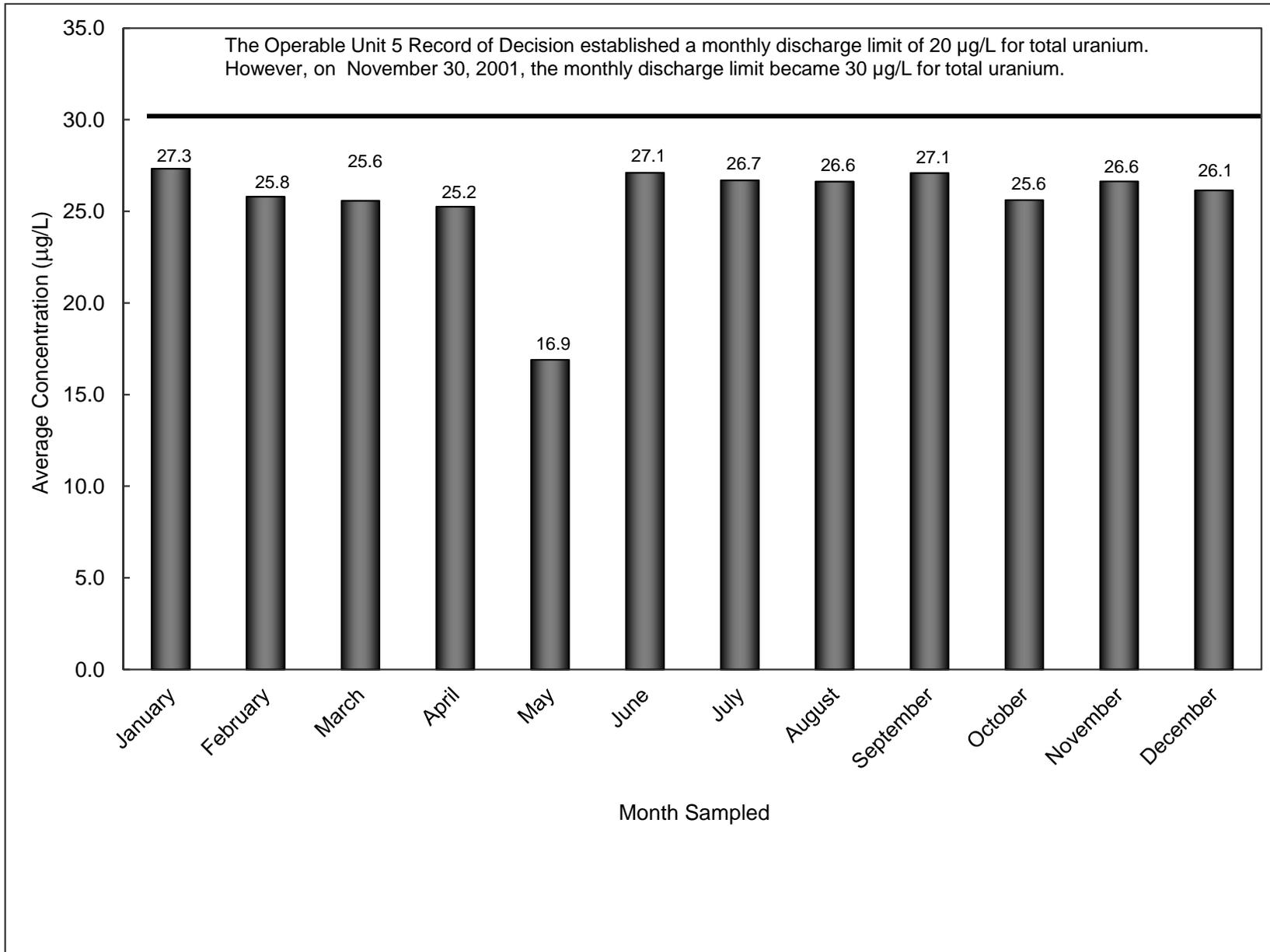


Figure B.1-10. 2010 Monthly Average Total Uranium Concentration in Water Discharged from PF 4001 to the Great Miami River

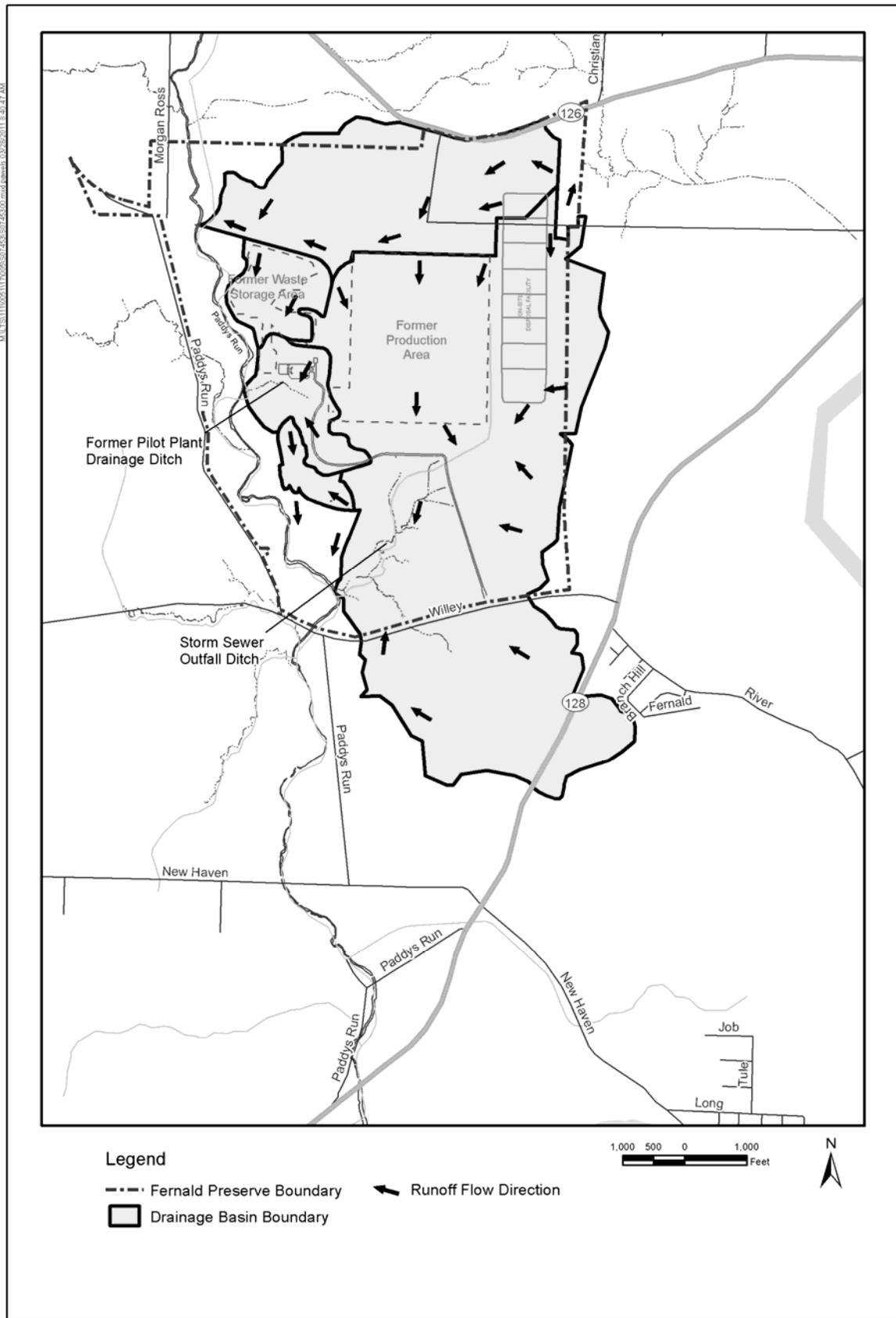


Figure B.1-11. Controlled Surface Water Areas and Uncontrolled Runoff Flow Directions

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