LMS/RFS/S03037-0.0

# Rocky Flats Site Operations Guide

U.S. Department of Energy

Office of Legacy Management

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# Rocky Flats Site Operations Guide

## Disclaimer

**The information in this document represents the most current and best understanding of technical and regulatory issues and responsibilities regarding the Rocky Flats Site. This document will be revised as necessary to reflect changes based on newly obtained information.**

# Contents


| | | Revision Date | Rev. No. |
|---|---|---|---|
| Acronyms and Abbreviations | xiii | 09/30/2008 | 0 |
| 1.0 Introduction | 1–1 | 09/30/2008 | 0 |
| 1.1 Purpose | 1–1 | | |
| 1.2 Rocky Flats Background | 1–4 | | |
| 1.3 RFSOG Organization | 1–4 | | |
| 2.0 Environmental Setting | 2–1 | 09/30/2008 | 0 |
| 2.1 Geology | 2–1 | | |
| 2.2 Hydrology | 2–1 | | |
| 2.2.1 Walnut Creek | 2–2 | | |
| 2.2.2 Woman Creek | 2–3 | | |
| 2.2.3 Other Drainages | 2–3 | | |
| 2.3 Hydrogeology | 2–3 | | |
| 2.4 Ecology | 2–5 | | |
| 2.4.1 Xeric Mixed Grassland | 2–5 | | |
| 2.4.2 Mesic Mixed Grassland | 2–6 | | |
| 2.4.3 High-Quality Wetlands | 2–6 | | |
| 2.4.4 Tall Upland Shrubland | 2–7 | | |
| 2.4.5 Great Plains Riparian Woodland Complex | 2–7 | | |
| 2.4.6 Reclaimed Grasslands | 2–7 | | |
| 2.4.7 Aquatic Community | 2–8 | | |
| 2.4.8 Preble's Mouse Habitat and Populations | 2–8 | | |
| 2.4.9 Revegetation Areas | 2–8 | | |
| 3.0 Access Controls | 3–1 | 09/30/2008 | 0 |
| 3.1 Institutional Controls | 3–1 | | |
| 3.2 Physical Controls | 3–2 | | |
| 3.3 Requirements for Site Access | 3–2 | | |
| 3.3.1 Training | 3–2 | | |
| 3.3.2 Protective Equipment | 3–2 | | |
| 3.3.3 Keys and Badges | 3–2 | | |
| 3.3.4 Accountability | 3–3 | | |
| 3.4 Requirements for Office Access | 3–5 | | |
| 4.0 Routine Site O&M | 4–1 | 09/30/2008 | 0 |
| 4.1 Ponds and Surface Water Control Features | 4–1 | | |
| 4.1.1 Data Collection Protocols | 4–2 | | |
| 4.1.2 Data Evaluation | 4–5 | | |
| 4.2 Landfills | 4–7 | | |
| 4.3 Groundwater Plume Treatment Systems | 4–7 | | |
| 4.4 Erosion Control and Revegetation | 4–9 | | |
| 5.0 Routine Site Inspections | 5–1 | 09/30/2008 | 0 |
| 5.1 Annual Inspection | 5–1 | | |
| 5.1.1 Frequency/Timing of Annual Inspection | 5–1 | | |
| 5.1.2 Specific Site Surveillance and Maintenance Features | 5–1 | | |

5.1.3 Inspection Checklist and Map.....5–2
5.1.4 Inspection Procedure.....5–2
5.1.5 Personnel.....5–3
5.1.6 Reports.....5–3
5.2 Other Routine Inspections.....5–4
5.3 Observation Log.....5–4
6.0 Routine Environmental Monitoring.....6–1 09/30/2008 0
6.1 Water Monitoring.....6–1
6.1.1 POC Monitoring.....6–7
6.1.2 POE Monitoring.....6–10
6.1.3 AOC Wells and SW018.....6–12
6.1.4 Boundary Wells.....6–14
6.1.5 Sentinel Wells.....6–16
6.1.6 Evaluation Wells.....6–19
6.1.7 Investigative Monitoring.....6–22
6.1.8 PLF Monitoring.....6–27
6.1.9 OLF Monitoring.....6–28
6.1.10 Groundwater Treatment System Monitoring.....6–31
6.1.11 Pre-Discharge Monitoring.....6–41
6.1.12 No Name Gulch Flow Monitoring.....6–42
6.1.13 Indicator Parameter Monitoring for Assessment of Analytical Water-Quality Data.....6–43
6.1.14 Water Level Wells and Water Level Measurement.....6–46
6.2 Ecological Monitoring.....6–48
6.2.1 Regulatory Issues.....6–49
6.2.2 Natural Resource Management.....6–51
6.2.3 Ecological Monitoring Planning Process6–53
6.3 Air Quality Monitoring.....6–56
6.3.1 Data and Sample Collection Protocols..6–57
6.3.2 Data Evaluation.....6–58
6.4 Exit Strategy for Water Monitoring.....6–58
7.0 O&M of Monitoring Locations.....7–1 09/30/2008 0
7.1 Surface Water Monitoring Stations.....7–1
7.1.1 Operation and Maintenance.....7–1
7.1.2 Telemetry System.....7–2
7.1.3 Applicable Instructions and Resources....7–2
7.2 Groundwater Monitoring Wells.....7–3
7.2.1 Well Maintenance.....7–3
7.2.2 Well Abandonment.....7–4
7.2.3 Well Replacement.....7–5
7.2.4 New Well Installation.....7–5
7.2.5 Documentation.....7–6
7.3 Air Sampling Stations.....7–6
7.3.1 Operation and Maintenance.....7–6

8.0 Environmental Data Collection, Evaluation, and Management....8–1 09/30/2008 0
8.1 Sampling and Data Collection....8–1
8.1.1 Automated Surface Water Sample Collection....8–1
8.1.2 Surface Water Field Data Collection....8–4
8.1.3 Groundwater Monitoring Considerations 8–6
8.1.4 Groundwater Field Data Collection....8–9
8.2 Data Evaluation....8–9
8.2.1 Surface Water Hydrologic Data....8–9
8.2.2 Groundwater Data....8–11
8.2.3 Surface Water Data....8–20
8.3 Data Management....8–26
8.3.1 Water and Air....8–26
8.3.2 Ecology....8–27
8.4 Data QA/QC....8–28
8.4.1 QC Objectives for Collection of Water Data....8–28
9.0 Work Planning Processes....9–1 09/30/2008 0
9.1 LMS Work Planning Process....9–1
9.2 Rocky Flats Work Planning Process....9–1
9.2.1 Routine Activities....9–1
9.2.2 Nonroutine Activities....9–2
9.2.3 Emergency Response....9–3
9.3 Intrusive Work and Soil Disturbance Evaluation ...9–3
9.4 Nonroutine Sampling/Characterization....9–3
9.5 Controlled Burns....9–4
9.6 Source Evaluations....9–5
10.0 Health and Safety/Training....10–1 09/30/2008 0
10.1 Training....10–1
10.2 HAZCOM....10–2
10.3 Sample Handling....10–2
11.0 Emergencies and Corrective Action....11–1 09/30/2008 0
11.1 Site Emergencies....11–1
11.2 Dam Emergency Response....11–1
11.3 Office Emergencies....11–1
11.4 Corrective Actions and Lessons Learned....11–2
12.0 Information Management....12–1 09/30/2008 0
12.1 Rocky Flats Site Records....12–1
12.2 AR and Post-Decision Record....12–2
12.2.1 Administrative Record....12–2
12.2.2 Post-Decision Record....12–2
12.3 Records Maintenance....12–3
12.3.1 Records Access....12–3
13.0 Regulatory Compliance....13–1 09/30/2008 0
13.1 RCRA Program....13–1
13.2 NPDES Stormwater Program....13–2
13.3 Clean Air Act....13–2

13.4 SARA Title III ....13–2
13.5 P2 Program....13–3
13.6 NEPA Planning....13–3
13.7 Well Construction and Water Use Permits ....13–3
13.8 DOT and IATA Regulations....13–4
13.9 EPA Guidance to Management of IDW ....13–4
14.0 Waste Management....14–1 09/30/2008 0
14.1 Sanitary Wastes....14–1
14.2 Other Wastes....14–1
15.0 Reporting....15–1 09/30/2008 0
15.1 RFLMA Reportable Conditions....15–1
15.2 Routine Reporting....15–1
15.2.1 RFLMA-Required Reporting....15–1
15.2.2 DOE-Required Reporting ....15–4
15.2.3 Other Routine Reporting....15–4
15.3 Emergency Notification....15–7
15.4 CERCLA 5-Year Review ....15–8
16.0 Public Involvement ....16–1 09/30/2008 0
17.0 References....17–1 09/30/2008 0

# Figures

Figure 1−1. Location of the Rocky Flats Site, Colorado ....1–2
Figure 1−2. Site Map for the Rocky Flats Site, Colorado ....1–3
Figure 1−3. Subsurface Features—Remaining Infrastructure (reproduced from RFLMA)....1–7
Figure 1−4. Subsurface Features—Pits and Trenches (reproduced from RFLMA)....1–8
Figure 1−5. Remaining Gas, Electric, and Dataline Utilities Extending into the COU and Including Indiana Street Points of Compliance....1–9
Figure 1−6. Rocky Flats Before and After Closure ....1–11
Figure 2−1. Preble's Mouse Protection Areas at Rocky Flats....2–9
Figure 4−1. Rocky Flats Dams and Surface Water Features....4–3
Figure 6−1. Water Monitoring Locations in Relation to Groundwater Contamination ....6–3
Figure 6−2. Water Monitoring Locations and Precipitation Gages....6–4
Figure 6−3. POC Monitoring Locations ....6–7
Figure 6−4. POE Monitoring Locations ....6–10
Figure 6−5. AOC Well and SW018 Locations ....6–13
Figure 6−6. Boundary Well Locations ....6–15
Figure 6−7. Sentinel Well Locations ....6–17
Figure 6−8. Evaluation Well Locations....6–20
Figure 6−9. Investigative Monitoring Locations ....6–23
Figure 6−10. Investigative Monitoring Flowchart....6–26
Figure 6−11. PLF Monitoring Locations....6–27
Figure 6−12. OLF Monitoring Locations ....6–29
Figure 6−13. MSPTS Monitoring Locations ....6–32
Figure 6−14. ETPTS Monitoring Locations ....6–35
Figure 6−15. SPPTS Monitoring Locations ....6–37
Figure 6−16. PLFTS Monitoring Locations ....6–39

Figure 6−17. PLFTS Sampling Locations (Detail) ..... 6–40
Figure 6−18. Pre-Discharge Sampling Locations ..... 6–41
Figure 6−19. No Name Gulch Flow Monitoring Location ..... 6–43
Figure 6−20. Indicator Parameter Monitoring Locations ..... 6–44
Figure 6−21. Air Sampling Locations ..... 6–57
Figure 8−1. Example Hydrograph Showing Continuous Flow-Paced Composite Sampling ..... 8–2
Figure 8−2. Uranium Threshold Flowchart ..... 8–17

# Tables

Table 3−1. Institutional Controls for the COU ..... 3–1
Table 4−1. Monitoring and Inspection Requirements for Safe Operation of Site Dams ..... 4–6
Table 6−1. Generalized Water Monitoring Objectives ..... 6–5
Table 6−2. POC Monitoring Locations ..... 6–8
Table 6−3. POC Field Data Collection: Parameters and Frequency ..... 6–8
Table 6−4. POC Sample Collection: Type and Analytes ..... 6–8
Table 6−5. Annual POC Monitoring Targets (Number of Composite Samples) ..... 6–9
Table 6−6. POE Monitoring Locations ..... 6–11
Table 6−7. POE Field Data Collection: Parameters and Frequency ..... 6–11
Table 6−8. POE Sample Collection: Type and Analytes ..... 6–11
Table 6−9. Annual POE Monitoring Targets (Number of Composite Samples) ..... 6–12
Table 6−10. AOC Wells and SW018 ..... 6–14
Table 6−11. Sampling Frequency for AOC Wells and SW018 ..... 6–14
Table 6−12. Boundary Wells ..... 6–15
Table 6−13. Sampling Frequency of Boundary Wells ..... 6–15
Table 6−14. Sentinel Wells ..... 6–18
Table 6−15. Sampling Frequency for Sentinel Wells ..... 6–18
Table 6−16. Evaluation Wells ..... 6–21
Table 6−17. Sampling Frequency for Evaluation Wells ..... 6–22
Table 6−18. Investigative Monitoring Locations ..... 6–23
Table 6−19. Investigative Field Data Collection: Parameters and Frequency ..... 6–24
Table 6−20. Investigative Sample Collection: Type and Analytes ..... 6–24
Table 6−21. Investigative Monitoring Targets (Number of Composite Samples) ..... 6–24
Table 6−22. RCRA Monitoring Wells at the PLF ..... 6–28
Table 6−23. Sampling Frequency for RCRA Wells at the PLF ..... 6–28
Table 6−24. OLF Surface Water Monitoring Locations ..... 6–29
Table 6−25. OLF Surface Water Sample Collection: Type and Analytes ..... 6–30
Table 6−26. RCRA Monitoring Wells at the OLF ..... 6–30
Table 6−27. Sampling Frequency for RCRA Wells at the OLF ..... 6–30
Table 6−28. MSPTS Sampling Locations ..... 6–33
Table 6−29. Sampling Frequency for MSPTS Sampling Locations ..... 6–33
Table 6−30. ETPTS Sampling Locations ..... 6–35
Table 6−31. Sampling Frequency for ETPTS Sampling Locations ..... 6–35
Table 6−32. SPPTS Sampling Locations ..... 6–38
Table 6−33. Sampling Frequency for SPPTS Sampling Locations ..... 6–38
Table 6−34. PLFTS Water Monitoring Locations ..... 6–39
Table 6−35. PLFTS Sample Collection: Type and Analytes ..... 6–40

Table 6−36. Pre-Discharge Sample Collection: Type and Analytes .....6–42
Table 6−37. No Name Gulch Flow Monitoring Location .....6–43
Table 6−38. Indicator Parameter Monitoring Sample Field Data and Sample Collection .....6–45
Table 6−39. Select Data Evaluation for Indicator Parameter Monitoring Data .....6–46
Table 6−40. Conservation and Management Goals .....6–52
Table 6−41 Regulatory Issues to Consider .....6–54
Table 6−42. Ambient Air Monitoring Locations .....6–57
Table 8−1. Scheduling Monitoring Location Groups for Optimal Data Usability .....8–8
Table 8−2. Crosswalk of Original and Replacement Well Identifications .....8–13
Table 8−3. Activity to Mass Conversion Factors for Uranium Isotopes .....8–18
Table 8−4. Uranium Lookup Table: Highest Pre-CY05 Results .....8–19
Table 15−1. RFLMA Reportable Conditions .....15–1
Table 15−2. Other Routine Site Reporting .....15–5
Table 15−3. Contact Information for Emergency Notifications .....15–7

## Appendixes

Appendix A Emergency Contact Information
Appendix B Annual Site Inspection Checklist
Appendix C Example Contact Record
Appendix D Rocky Flats System Closure Plans and Sector Closeout Reports
Appendix E Real Property Records
Appendix F Rocky Flats Site Soil Disturbance Evaluation Procedure
Appendix G Rocky Flats Sample Preparation Room Procedures
Appendix H Site-Specific Checklist
Appendix I Rocky Flats Health and Safety Addendum
Appendix J Program Manager Directive PM-08-02
Appendix K Rocky Flats, Colorado, Site Erosion Control Monitoring and Maintenance Inspection Procedure
Appendix L Migratory Bird Treaty Act Issues, Natural Resource Management Activities, and Maintenance and Project Activities at the Rocky Flats Site

## Attachments (under separate cover)

Attachment A1 Corrective Action Decision/Record of Decision for Rocky Flats Plant (USDOE) Peripheral Operable Unit and Central Operable Unit
Attachment A2 Rocky Flats Legacy Management Agreement
Attachment A3 Environmental Covenant
Attachment A4 Lease Agreement of September 26, 2006, Between Broomfield, Colorado, and DOE (includes Substitute Water Supply Plan [SWSP])
Attachment A5 Use Agreement between DOE and the Woman Creek Reservoir Authority
Attachment A6 Rocky Flats Refuge Act
Attachment A7 Ronald W. Reagan Defense Authorization Act for Fiscal Year 2005, Sec. 3118, Local Stakeholder Organizations for 2006 Closure Sites

Attachment A8 H.R. 1815 National Defense Authorization Act for Fiscal Year 2006 (Mining Rights at Rocky Flats)
Attachment B1 Operations and Maintenance Plan for the Rocky Flats Surface Water Control Project
Attachment B2 Emergency Response Plan for Rocky Flats Site Dams
Attachment C1 Operation and Maintenance Manual for Rocky Flats Groundwater Treatment Systems
Attachment D1 Final Landfill Monitoring and Maintenance Plan for the Original Landfill
Attachment D2 Present Landfill Monitoring and Maintenance Plan and Post-Closure Plan
Attachment E1 Master Rocky Flats Site Ecology Reports Reference List
Attachment E2 Memorandum of Agreement for the Administration of a Wetland Bank at Rocky Flats
Attachment E3 Programmatic Biological Assessment for Department of Energy Activities at the Rocky Flats Environmental Technology Site, Part I
Attachment E4 Programmatic Biological Assessment for Department of Energy Activities at the Rocky Flats Environmental Technology Site, Part II
Attachment E5 Rocky Flats, Colorado, Site Revegetation Plan
Attachment E6 Rocky Flats, Colorado, Site Vegetation Management Plan
Attachment E7 Rocky Flats, Colorado, Site Wetland Mitigation Monitoring and Management Plan
Attachment E8 Erosion Control Plan for Rocky Flats Property Central Operable Unit
Attachment E9 Ecological Monitoring Methods Handbook for the Rocky Flats, Colorado, Site
Attachment E10 Wildland Fire Management Plan for the Rocky Flats Site
Attachment F1 Rocky Flats Environmental Technology Site Survey Control Network Report
Attachment F2 Memorandum of Understanding between the Jefferson County Sheriff and the DOE
Attachment F3 Rocky Flats, Colorado, Site Chemical Management Plan

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# Acronyms and Abbreviations

| | |
|---|---|
| Ag | silver |
| alpm | air liters per minute |
| Am | americium |
| ANSI/ASQ | American National Standards Institute/American Society for Quality |
| AOC | Area of Concern |
| AR | Administrative Record |
| ARAR | applicable or relevant and appropriate requirement |
| BA | Biological Assessment |
| Be | beryllium |
| BMP | best management practice |
| BO | Biological Opinion |
| BZ | Buffer Zone |
| CAA | Clean Air Act |
| CAD/ROD | Corrective Action Decision/Record of Decision |
| CCR | Code of Colorado Regulations |
| Cd | cadmium |
| CDOW | Colorado Division of Wildlife |
| CDPHE | Colorado Department of Public Health and Environment |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (42 USC 9601, et seq.) |
| CESQG | conditionally exempt small quantity generator |
| CFR | *Code of Federal Regulations* |
| CHWA | Colorado Hazardous Waste Act |
| CMP | Chemical Management Plan |
| CNWA | Colorado Noxious Weed Act |
| COU | Central Operable Unit |
| CPR | cardiopulmonary resuscitation |
| Cr | chromium |
| CWA | Clean Water Act |
| CWQCC | Colorado Water Quality Control Commission |
| CY | calendar year |
| DER | Duplicate Error Ratio |
| DOE | U.S. Department of Energy |
| DOT | U.S. Department of Transportation |
| DQA | data quality assessment |
| ECP | Erosion Control Plan |
| EMS | Environmental Management Systems |
| EPA | U.S. Environmental Protection Agency |
| EPCRA | Emergency Planning and Community Right-to-Know Act |
| ERP | *Emergency Response Plan for the Rocky Flats Site Dams* |
| ESA | Endangered Species Act |
| ET | evapotranspiration |
| ETPTS | East Trenches Plume Treatment System |
| FC | functional channel |
| FDCS | Field Data Collection System |
| FRC | Federal Records Center |

| | |
|---|---|
| $ft^3$ | cubic feet |
| $ft^3$/min | cubic feet per minute |
| FY | fiscal year |
| GEMS | Geospatial Environmental Mapping System |
| GIS | Geographic Information System |
| gpm | gallons per minute |
| GWIS | Groundwater Intercept System |
| H&S | health and safety |
| HAZCOM | hazardous communication |
| HQ | headquarters |
| HR ICP/MS | high-resolution inductively coupled plasma/mass spectrometry |
| HRC® | Hydrogen Release Compound® |
| HRR | Historical Release Report |
| IA | Industrial Area |
| IATA | International Air Transportation Association |
| IDW | investigation-derived waste |
| IHSS | Individual Hazardous Substance Site |
| IM/IRA | interim measure/interim remedial action |
| IMP | Integrated Monitoring Plan |
| JSA | job safety analysis |
| K-H | Kaiser-Hill Company, L.L.C. |
| L | liter |
| LANL | Los Alamos National Laboratory |
| LM | Legacy Management |
| LMS | Legacy Management Support |
| $m^3$ | cubic meter |
| M&M | monitoring and maintenance |
| M-K | Mann-Kendall |
| MBTA | Migratory Bird Treaty Act |
| MG | million gallons |
| mg/L | milligrams per liter |
| mL | milliliter |
| MP | measuring point |
| mrem | millirem |
| MSDS | Material Safety Data Sheet |
| MSPTS | Mound Site Plume Treatment System |
| NA | not applicable |
| NARA | National Archives and Records Administration |
| NEPA | National Environmental Policy Act |
| NPDES | National Pollutant Discharge Elimination System |
| NPH | no public hazard |
| NSQ | nonsufficient quantity |
| NWTC | National Wind Technology Center |
| O&M | operation and maintenance |
| ODBC | Open Database Connectivity |
| OLF | Original Landfill |
| ORP | oxidation-reduction potential |
| OSHA | Occupational Safety and Health Administration |

| | |
|---|---|
| OU | Operable Unit |
| P2 | pollution prevention |
| PBA | programmatic biological assessment |
| pCi/g | picocuries per gram |
| pCi/L | picocuries per liter |
| PIP | Public Involvement Plan |
| PLF | present landfill |
| PLFTS | Present Landfill Treatment System |
| POC | point of compliance |
| POD | plan of the day |
| POE | point of evaluation |
| POU | peripheral operable unit |
| POW | Plan of the Week |
| PPA | Pollution Prevention Act |
| PPE | personal protective equipment |
| PQL | practical quantitation limit |
| Pu | plutonium |
| PU&D | Property Utilization and Disposal |
| PVC | polyvinyl chloride |
| QA | quality assurance |
| QAPP | Quality Assurance Project Plan |
| QC | quality control |
| RAAMP | Radioactive Ambient Air Monitoring Program |
| RCRA | Resource Conservation and Recovery Act (42 USC 6901, et seq.) |
| RFCA | Rocky Flats Cleanup Agreement |
| RFETS | Rocky Flats Environmental Technology Site |
| RFLMA | Rocky Flats Legacy Management Agreement |
| RFP | Rocky Flats Site Plant |
| RFSOG | Rocky Flats Site Operations Guide |
| RFSRP | Rocky Flats Site, Colorado, Revegetation Plan |
| RFSVMP | Rocky Flats Site, Colorado, Vegetation Management Plan |
| RFSWP | Rocky Flats Site, Colorado, Wetland Mitigation Monitoring and Management Plan |
| RI/FS | Remedial Investigation/Feasibility Study |
| ROD | Record of Decision |
| RPD | relative percent difference |
| S-K | Seasonal-Kendall |
| SAP | Sampling and Analysis Plan |
| SARA | Superfund Amendments and Reauthorization Act |
| SCADA/HMI | supervisory control and data acquisition/human machine interface |
| SED | Sitewide Ecological Database |
| SEEPro | Site Environmental Evaluation for Projects |
| SEP | Solar Evaporation Ponds |
| SID | South Interceptor Ditch |
| Site | Rocky Flats Site |
| SME | subject matter expert |
| SPP | Solar Ponds Plume |
| SPPTS | Solar Ponds Plume Treatment System |

| | |
|---|---|
| SVOC | semivolatile organic compound |
| SWSP | Substitute Water Supply Plan |
| TIMS | thermal ionization mass spectrometry |
| TM | temporary modification |
| TSS | total suspended solids |
| U | uranium |
| µg/L | micrograms per liter |
| UHSU | upper hydrostratigraphic unit |
| USACOE | U.S. Army Corps of Engineers |
| USC | U.S. Code |
| USFWS | U.S. Fish and Wildlife Service |
| USGS | U.S. Geological Survey |
| VOC | volatile organic compound |
| VSP | Visual Sample Plan |
| ZVI | zero-valent iron |

# 1.0 Introduction

The U.S. Department of Energy (DOE) Office of Legacy Management (LM) is responsible for implementing the final response action specified in the final Corrective Action Decision/Record of Decision (CAD/ROD) for Rocky Flats (EPA, DOE, and CDPHE 2006) issued on September 29, 2006. (The CAD/ROD is provided in Attachment A1 for reference.) Figure 1−1 shows the location of the Rocky Flats property.

Under the CAD/ROD, two Operable Units (OUs) were established within the boundaries of the Rocky Flats property: the Central OU (COU) and the Peripheral OU (POU). The COU consolidates all areas of the Site requiring additional remedial or corrective actions, while also considering the practicalities of future land management. The CAD/ROD determined that the appropriate response actions for the COU were institution controls, physical controls, and continued monitoring. The POU surrounds the COU and includes the remaining, generally unaffected, portions of the Site. The final CAD/ROD indicated that conditions in the POU are suitable for unrestricted use and no response action was required. The U.S. Environmental Protection Agency (EPA) subsequently published a Notice of Partial Deletion from the National Priorities List for the POU on May 25, 2007.

On July 12, 2007, most of the property outside the COU was transferred to the U.S. Department of the Interior for the establishment of a national wildlife refuge to be managed by the U.S. Fish and Wildlife Service (USFWS), pursuant to the Rocky Flats National Refuge Act of 2001 (Public Law 107-303). EPA certified that cleanup and closure of Rocky Flats were complete and the COU remedy was operating properly and successfully, in accordance with requirements for DOE to transfer land to USFWS for establishing the refuge. The COU is the site governed by *Rocky Flats Legacy Management Agreement* (RFLMA; DOE 2007a) requirements.

Figure 1−2 is a map of Rocky Flats showing the location of the COU, the lands retained by DOE-LM outside of the COU, and the remaining property that has been transferred to USFWS.

DOE, EPA, and the Colorado Department of Public Health and Environment (CDPHE) have chosen to implement the monitoring and maintenance requirements of the CAD/ROD as described in RFLMA, executed on March 14, 2007. RFLMA Attachment 2 defines the COU remedy surveillance and maintenance requirements. The requirements include environmental monitoring; maintenance of the erosion controls, access controls (signs), landfill covers, and groundwater treatment systems; and operation of the groundwater treatment systems.

RFLMA Attachment 2 stipulates that DOE employ administrative procedures to control activities in accordance with the institutional controls and to meet quality assurance and control program requirements. RFLMA also recognizes that other procedures are established to guide work and implement best management practices (BMPs).

## 1.1 Purpose

The *Rocky Flats Site Operations Guide* (RFSOG) was prepared by DOE-LM to serve as the primary internal document to guide work, satisfy the requirements of RFLMA, and implement BMPs at the Site. As a “desktop procedure,” the RFSOG explains how DOE-LM will fulfill its long-term surveillance and maintenance obligations at the Site.

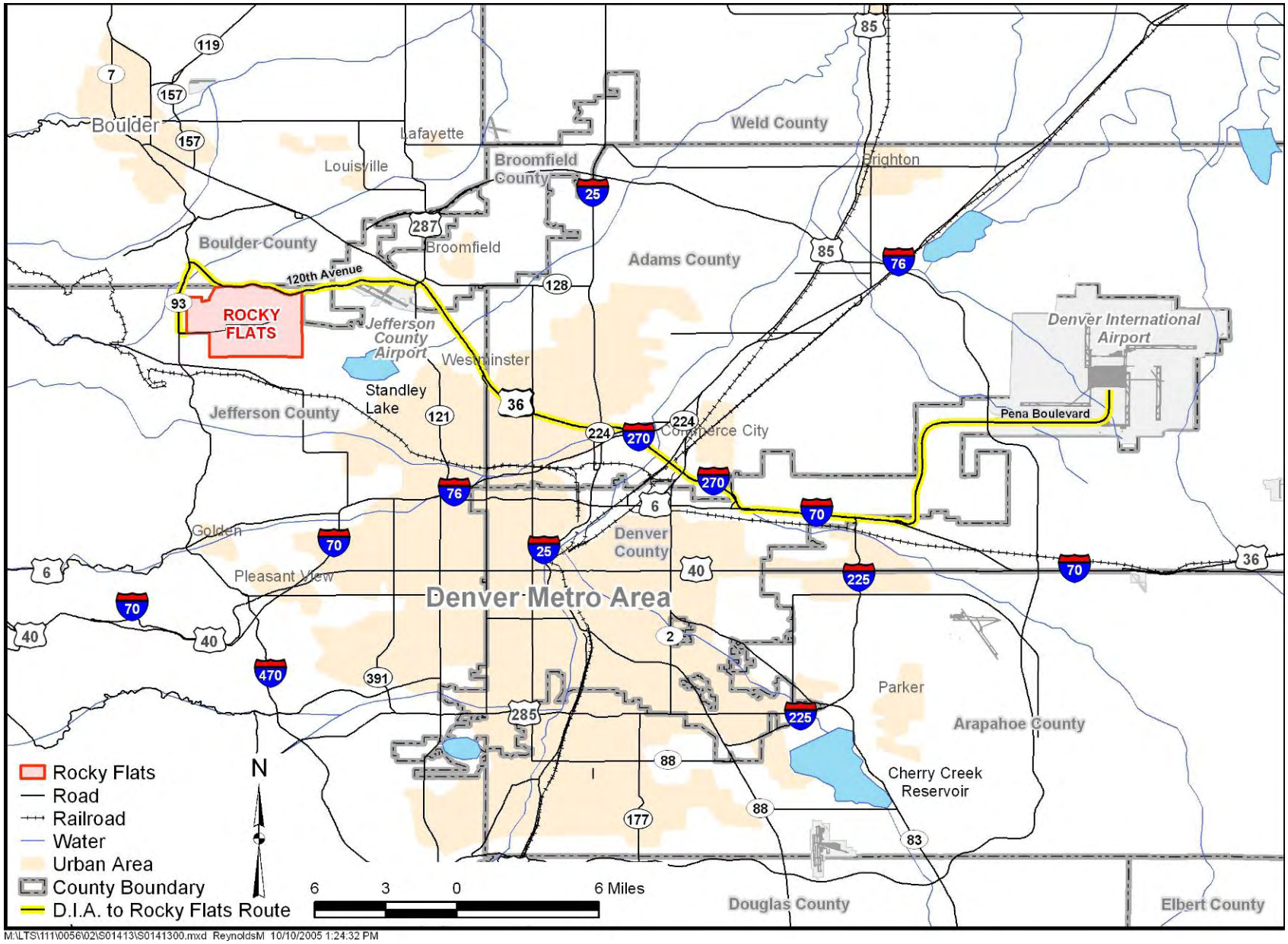


*Figure 1−1. Location of the Rocky Flats Site, Colorado*

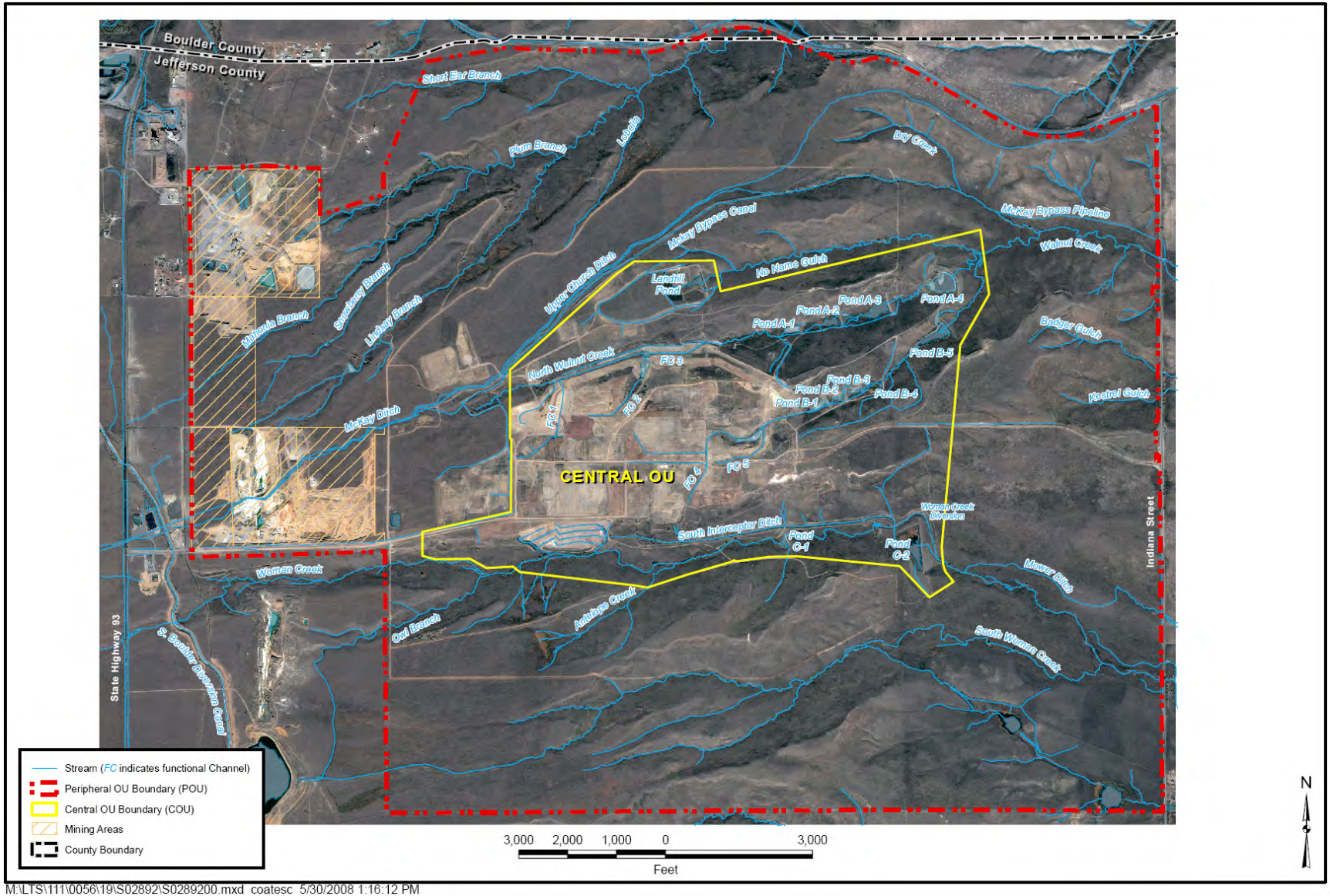


*Figure 1−2. Site Map for the Rocky Flats Site, Colorado*

The RFSOG incorporates applicable DOE-LM policy and guidance and meets the 10-Year Site Plan requirement of DOE Order 413.3. DOE-LM is responsible for radiological and other hazardous substances that remain at the Site. Implementation of surveillance and maintenance activities at the Site is guided by this RFSOG and other specific documents that are attached, appended, and referenced herein.

## 1.2 Rocky Flats Background

Rocky Flats was established in 1951 as part of the United States' nationwide nuclear weapons complex to manufacture nuclear weapons components from various radioactive and hazardous materials. DOE (or its predecessor, the Atomic Energy Commission) and its contractors managed and operated Rocky Flats under authorization of the Atomic Energy Act. Overall, nuclear weapons production activities within the former Industrial Area (IA) resulted in contamination of environmental media including surface water, groundwater, soil, and air. The nature and extent of Rocky Flats Plant (RFP)-related contamination, potential impacts to human health and the environment, and actions performed to mitigate the risk to human health and the environment are described in the *RCRA Facility Investigation-Remedial Investigation/Corrective Measures Study-Feasibility Study Report for the Rocky Flats Environmental Technology Site* (Remedial Investigation/Feasibility Study [RI/FS] Report) (DOE 2006a) and summarized in the *Rocky Flats Environmental Technology Site Proposed Plan* (Proposed Plan) (DOE 2006b); the final action was selected in the CAD/ROD.

Additional information related to the setting and features of the Rocky Flats Site is included in Section 2.0.

## 1.3 RFSOG Organization

The RFSOG is organized as follows:

- Section 1.0, "Introduction," presents the purpose and organization of the RFSOG, as well as a regulatory overview and a brief Site history.
- Section 2.0, "Environmental Setting," describes the geology, hydrology, hydrogeology, and ecology of the Site.
- Section 3.0, "Access Controls," includes a discussion of the Site's institutional and physical controls, as well as the requirements for both on- and off-Site (office) access.
- Section 4.0, "Routine Site Operations and Maintenance," details the operation and maintenance (O&M) of the Site's ponds and surface water control features, the Present and Original Landfills, and the groundwater treatment systems. Erosion control and revegetation at the Site are also included.
- Section 5.0, "Routine Site Inspections," describes how and when Site personnel will perform routine inspections at the Site.
- Section 6.0, "Routine Environmental Monitoring," provides a discussion of the various routine monitoring activities conducted at the Site, including water (surface water and groundwater), ecological, and air quality monitoring.

- Section 7.0, "Operation and Maintenance of Monitoring Locations," covers the necessary O&M of the surface water monitoring locations, groundwater monitoring wells, and air sampling stations.
- Section 8.0, "Environmental Data Collection, Evaluation, and Management," describes the actual sample and data collection procedures, as well as data evaluation and data management. Data quality assurance (QA) and quality control (QC) are also discussed.
- Section 9.0, "Work Planning Processes," focuses on the Legacy Management Support (LMS)- and Rocky Flats-specific work planning processes. The section also includes discussion of Site activities considered to be non-routine, which will require additional consideration and planning. Such activities include intrusive work, non-routine sampling and characterization, controlled burns, and source evaluations.
- Section 10.0, "Health and Safety/Training," includes a discussion of the Site-specific training requirements as well as hazard communication and sample handling.
- Section 11.0, "Emergencies and Corrective Action," covers both Site and office emergencies, including dam emergency response. This section also includes a discussion of corrective actions and lessons learned.
- Section 12.0, "Information Management," provides an overview of how the Rocky Flats records, both active and inactive, are maintained. A discussion of the Administrative Record (AR) and the corresponding post-closure record system is also included.
- Section 13.0, "Regulatory Compliance," describes activities at the Site that may require regulatory compliance activities, notification, or reporting in addition to that required by RFLMA.
- Section 14.0, "Waste Management," describes how Site personnel will handle the various wastes generated during the monitoring and surveillance activities described in this RFSOG.
- Section 15.0, "Reporting," describes the various reporting requirements for the Site, including RFLMA reportable conditions, routine reporting, emergency notification, and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) 5-Year Review.
- Section 16.0, "Public Involvement," describes the public participation activities being conducted to support the DOE goal of actively informing the public about Rocky Flats activities.
- Section 17.0, "References," lists the references used in generating this RFSOG.

This RFSOG also includes several appendices as follows:

- Appendix A, "Emergency Contact Information";
- Appendix B, "Annual Site Inspection Checklist";
- Appendix C, "Example Contact Record";
- Appendix D, "Rocky Flats System Closure Plans and Sector Closeout Reports";
- Appendix E, "Real Property Records";
- Appendix F, "Rocky Flats Site Soil Disturbance Evaluation Procedure";

- Appendix G, “Rocky Flats Sample Preparation Room Procedures”;
- Appendix H, “Site-Specific Checklist”;
- Appendix I, “Rocky Flats Health and Safety Addendum”;
- Appendix J, “Program Manager Directive PM-08-02”;
- Appendix K, “Rocky Flats, Colorado, Site Erosion Control Monitoring and Maintenance Inspection Procedure”; and
- Appendix L, “Migratory Bird Treaty Act Issues, Natural Resource Management Activities, and Maintenance and Project Activities at the Rocky Flats Site.”

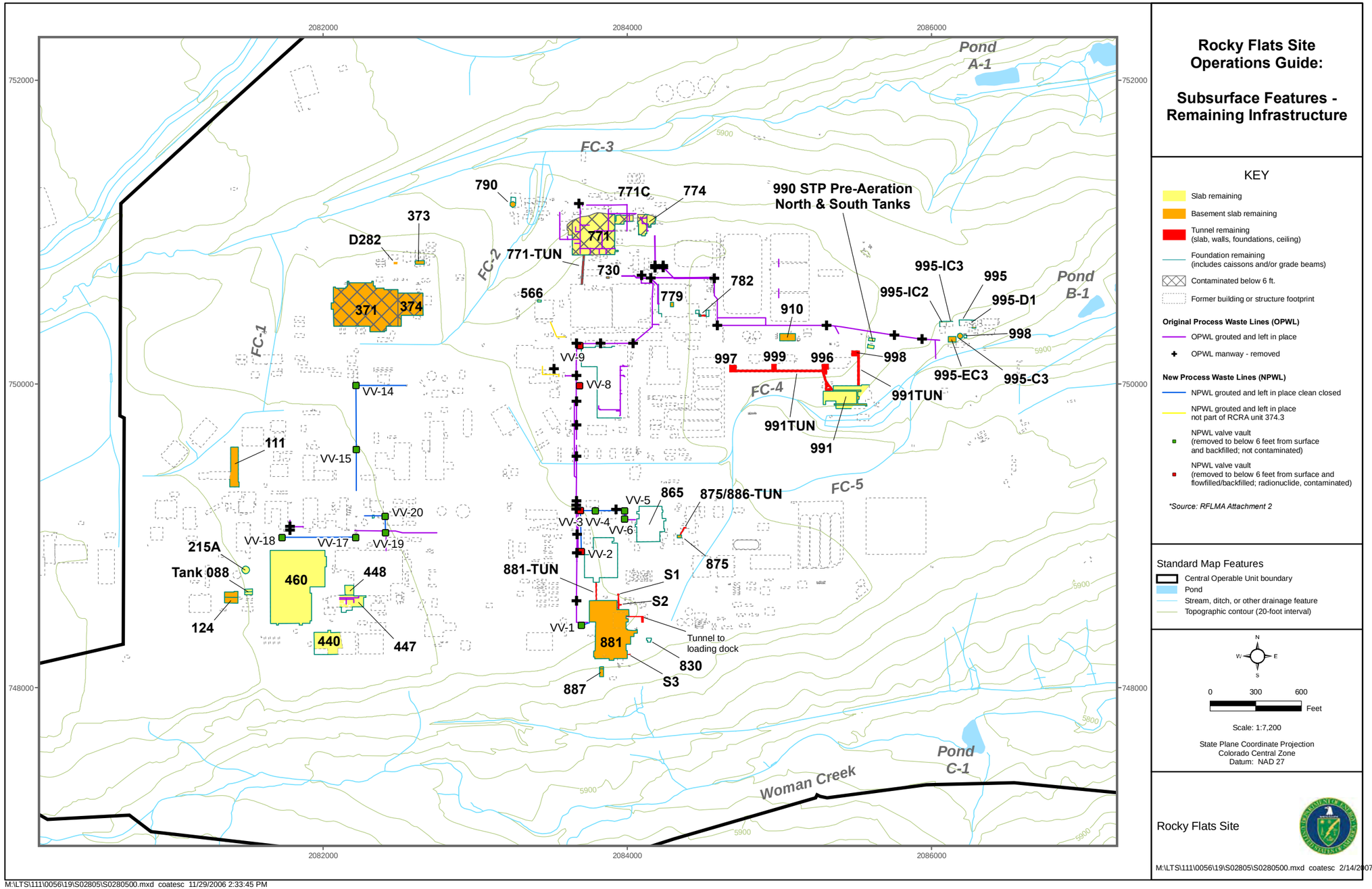


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*Figure 1−3. Subsurface Features—Remaining Infrastructure (reproduced from RFLMA)*

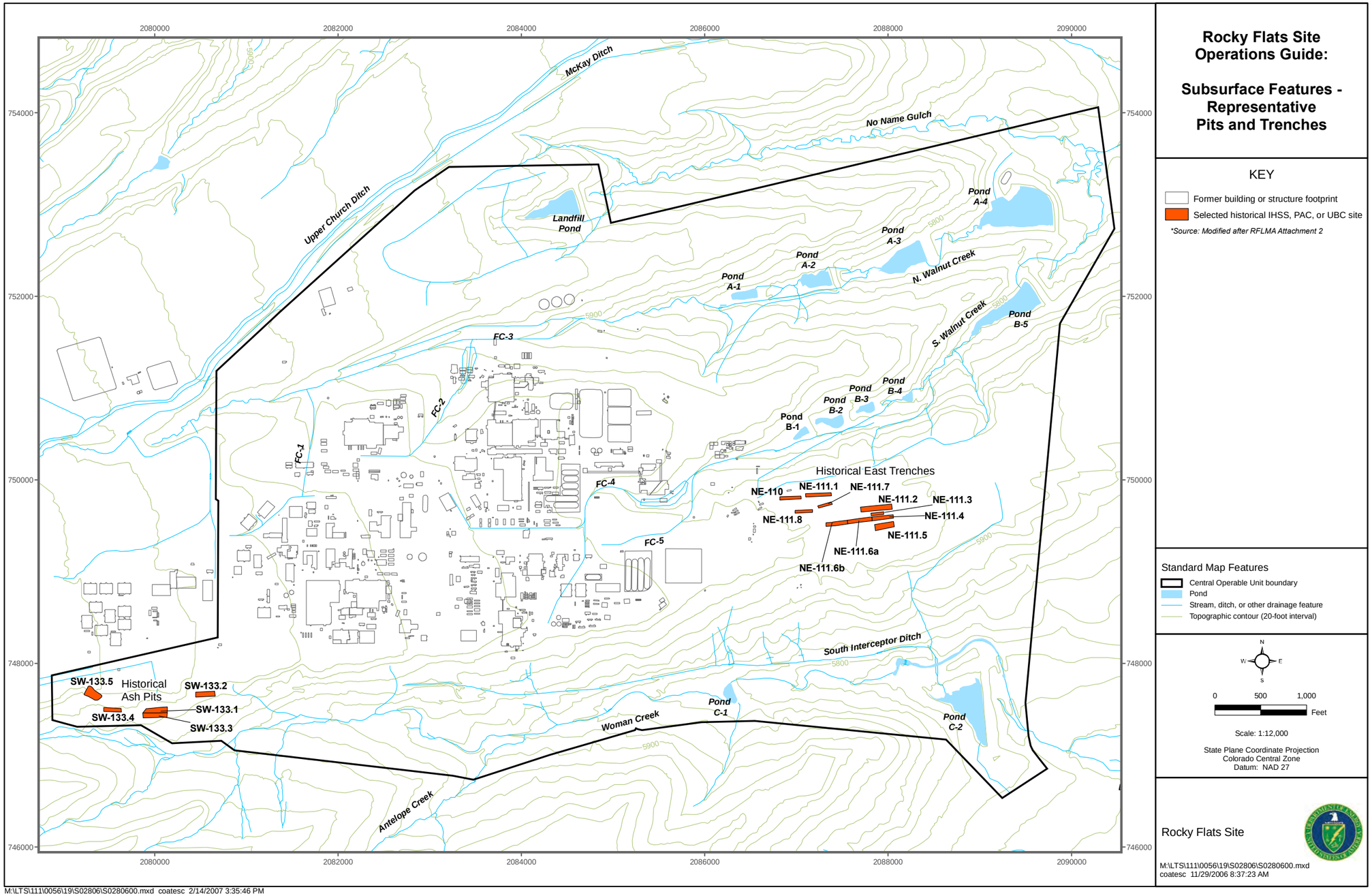


*Figure 1−4. Subsurface Features—Pits and Trenches (reproduced from RFLMA)*

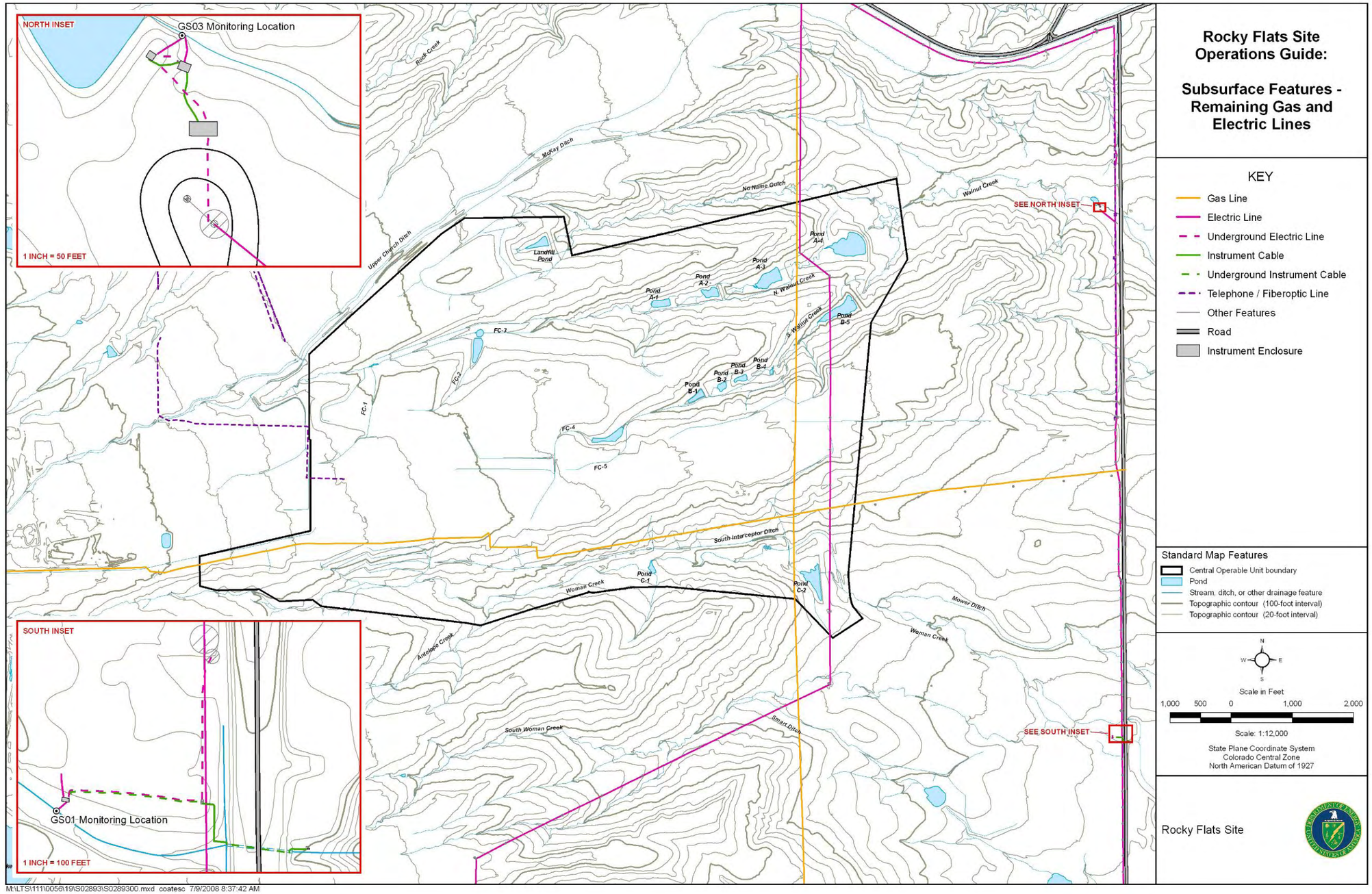


*Figure 1−5. Remaining Gas, Electric, and Dataline Utilities Extending into the COU and Including Indiana Street Points of Compliance*

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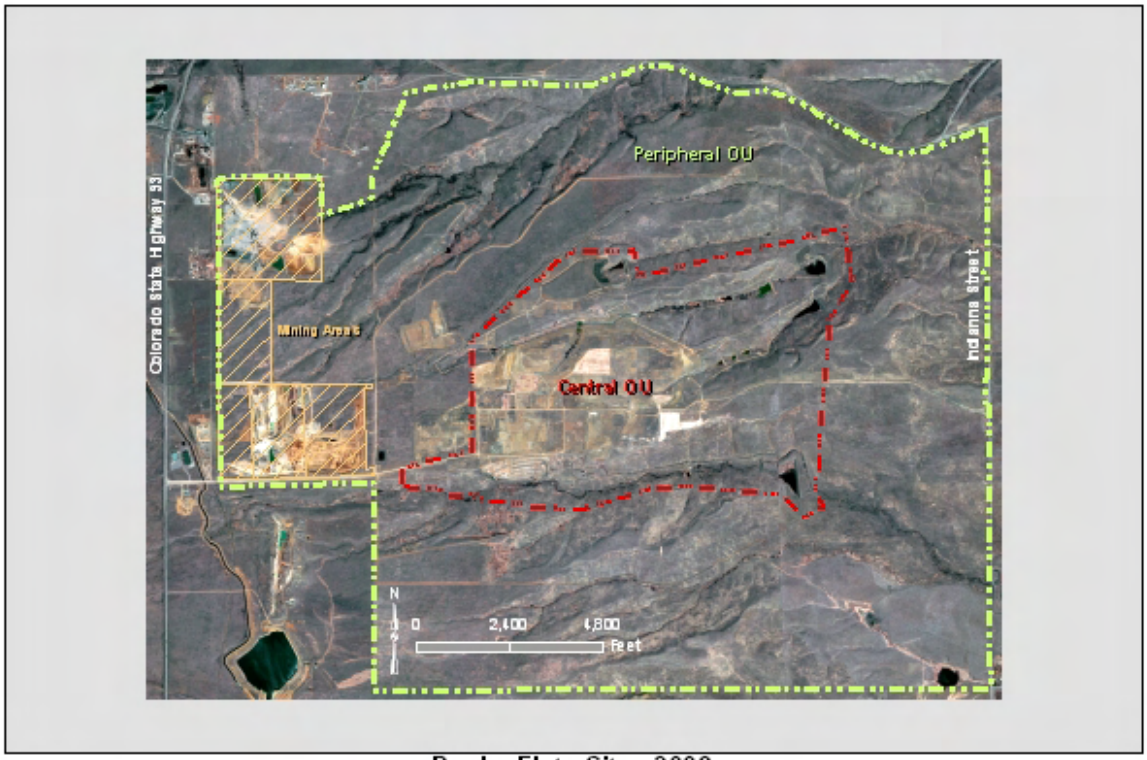
Rocky Flats Environmental Technology Site - 1994




Rocky Flats Site - 2008

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*Figure 1−6. Rocky Flats Before and After Closure*

In an effort to ensure that this RFSOG is a complete, stand-alone operations guide, copies of the applicable documents used by Site personnel are included as attachments to this report. These attachments, grouped by subject matter, are as follows:

***General***

- Attachment A1, "Corrective Action Decision/Record of Decision for Rocky Flats Plant (USDOE) Peripheral Operable Unit and Central Operable Unit"
- Attachment A2, "Rocky Flats Legacy Management Agreement"
- Attachment A3, "Environmental Covenant"
- Attachment A4, "Lease Agreement of September 26, 2006, Between Broomfield, Colorado, and DOE (Includes Substitute Water Supply Plan [SWSP])"
- Attachment A5, "Use Agreement between DOE and the Woman Creek Reservoir Authority"
- Attachment A6, "Rocky Flats Refuge Act"
- Attachment A7, "Ronald W. Reagan Defense Authorization Act for Fiscal Year 2005, Sec. 3118, Local Stakeholder Organizations for 2006 Closure Sites"
- Attachment A8, "H.R. 1815 National Defense Authorization Act for Fiscal Year 2006 (Mining Rights at Rocky Flats)"

***Surface Water***

- Attachment B1, "Operations and Maintenance Plan for the Rocky Flats Surface Water Control Project"
- Attachment B2, "Emergency Response Plan for Rocky Flats Site Dams"

***Groundwater***

- Attachment C1, "Operation and Maintenance Manual for Rocky Flats Groundwater Treatment Systems"

***Landfills***

- Attachment D1, "Final Landfill Monitoring and Maintenance Plan for the Original Landfill"
- Attachment D2, "Present Landfill Monitoring and Maintenance Plan and Post-Closure Plan"

***Ecology***

- Attachment E1, "Master Rocky Flats Site Ecology Reports Reference List"
- Attachment E2, "Memorandum of Agreement for the Administration of a Wetland Bank at Rocky Flats"
- Attachment E3, "Programmatic Biological Assessment for Department of Energy Activities at the Rocky Flats Environmental Technology Site, Part I"
- Attachment E4, "Programmatic Biological Assessment for Department of Energy Activities at the Rocky Flats Environmental Technology Site, Part II"

- Attachment E5, *Rocky Flats, Colorado, Site Revegetation Plan*
- Attachment E6, *Rocky Flats, Colorado, Site Vegetation Management Plan*
- Attachment E7, "Rocky Flats, Colorado, Site Wetland Mitigation Monitoring and Management Plan"
- Attachment E8, "Erosion Control Plan for Rocky Flats Property Central Operable Unit"
- Attachment E9, "Ecological Monitoring Methods Handbook for the Rocky Flats, Colorado, Site"
- Attachment E10, *Wildland Fire Management Plan for the Rocky Flats Site*

***General Operations***

- Attachment F1, "Rocky Flats Environmental Technology Site Survey Control Network Report"
- Attachment F2, "Memorandum of Understanding between the Jefferson County Sheriff and the DOE"
- Attachment F3, *Rocky Flats, Colorado, Site Chemical Management Plan*

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# 2.0 Environmental Setting

## 2.1 Geology

The Site is located along Colorado's Front Range on the western margin of the Colorado Piedmont section of the Great Plains Physiographic Province (Spencer 1961), which also coincides with the western limit of the Denver Basin. The COU is primarily located on an alluvium-covered pediment; the general topography of this stream-bisected alluvial fan is evident on Attachment 1 to RFLMA. The surface of this alluvial deposit slopes approximately 1 to 2 degrees to the east.

The geologic history of the Colorado Rocky Mountain region, of which the Site is a part, is summarized in Haun and Kent (1965). Comprehensive geologic studies were performed as part of the Site characterization (e.g., EG&G 1991, 1995a, 1995b). Through these and other resources, including lithologic cores, geophysical logs, field geologic mapping, aerial photographs, and mine development (particularly along the western margin of the Site), a large quantity of lithologic and stratigraphic information was collected about the Site.

Surficial deposits at the Site predominantly include unconsolidated clastics of the Quaternary-age Rocky Flats Alluvium, hillslope colluvium, valley fill alluvium, and artificial fill. These deposits are often collectively and informally referred to as "alluvium;" they unconformably overlie the Cretaceous-age Arapahoe and Laramie Formations. Where present at Rocky Flats, the Arapahoe Formation often contains a basal sandstone unit that is important to groundwater transport; elsewhere, the dense claystones of the Laramie Formation (which also includes isolated lenses of siltstone and fine-grained sandstone) underlie surficial deposits. Underlying the Laramie Formation are the Fox Hills Sandstone and Pierre Shale. These units are steeply east-dipping and are not exposed at the Site except in the quarries along its western edge.

Structure at the Site is controlled by the Rocky Mountain uplift on the west and the Denver Basin on the east. The north-south trending Denver Basin is an asymmetrical feature containing Paleozoic, Mesozoic, and Cenozoic strata that dip steeply eastward along this western margin. In the area of the Site, the Denver Basin-related strata include Pennsylvanian to Cretaceous formations that are exposed in mines and stream valleys west of the Site.

Several faults have been identified in the area of the Site using seismic and stratigraphic techniques, and some are inferred (EG&G 1995a). These faults appear to be inactive and limited to bedrock formations rather than extending into the overlying surficial deposits. At the Site, the inferred faults appear to have limited hydrologic significance (RMRS 1996).

## 2.2 Hydrology

Streams and seeps at the Site are largely ephemeral, with stream reaches gaining or losing flow depending on the season and precipitation amounts. Surface water flow across the Site is primarily from west to east, with three major drainages traversing the Site. Fourteen retention ponds (plus several small stock ponds) collect surface water runoff, although only 12 ponds are within the COU and maintained by DOE-LM. The Site drainages and retention ponds, including their respective pertinence to this report, are described below and shown on Figure 1−2.

The major stream drainages leading off Site, from north to south, are Rock Creek, Walnut Creek, and Woman Creek. North Walnut Creek flows through the A-Series Ponds and South Walnut Creek flows through the B-Series Ponds; both are tributaries to Walnut Creek.

### 2.2.1 Walnut Creek

Walnut Creek receives surface water flow from the central third of the Site, including the majority of the COU. It consists of several tributaries: McKay Ditch, No Name Gulch, North Walnut Creek, and South Walnut Creek. These tributaries join Walnut Creek upstream of the Site's eastern boundary (Indiana Street). East of Indiana Street, Walnut Creek flows through a diversion structure normally configured to divert flow to the Broomfield Diversion Ditch around Great Western Reservoir and into Big Dry Creek. The Walnut Creek tributaries, from north to south, are described below.

***McKay Ditch***

McKay Ditch was formerly a tributary to Walnut Creek within the Site boundaries but was diverted in July 1999 into a new pipeline to keep McKay Ditch water from commingling with Site water in Walnut Creek. Although no longer a contributor to Walnut Creek, the McKay Ditch drainage is described here to clarify water routing at the Site. The new configuration allows the City of Broomfield to transport water from the South Boulder Diversion Canal, across the northern portion of the POU and directly into Great Western Reservoir, without entering Walnut Creek. This configuration prevents commingling of McKay Ditch water with discharged water from the Site retention ponds. McKay Ditch, the McKay Bypass Canal, and the McKay Bypass Pipeline are outside the COU; these features are not maintained by DOE-LM.

***No Name Gulch***

This drainage is located downstream of the Landfill Pond, referred to historically as the East Landfill Pond. A surface water diversion ditch is constructed around the perimeter of the Present Landfill (PLF) to divert surface water runoff around the landfill to No Name Gulch. Effluent from the Present Landfill Treatment System (PLFTS) and runoff from the area surrounding the pond are the sole surface water sources to the Landfill Pond. The pond is normally operated in a flow-through configuration, although the pool level periodically drops below the outlet works.

***North Walnut Creek***

Runoff from the northern portion of the COU flows into this drainage, which has four retention ponds (Ponds A-1, A-2, A-3, and A-4). The combined capacity of the A-Series Ponds is approximately 197,000 cubic meters ($m^3$) (52 million gallons [MG] or 160 acre-feet). In the normal operational configuration, Ponds A-1 and A-2 are bypassed and maintained for supplemental stormwater control and wetland habitat; water levels in these ponds are controlled by evaporation or transfer. North Walnut Creek flow is diverted through the North Walnut Creek Bypass Pipeline around Ponds A-1 and A-2 to Pond A-3 for retention. Pond A-3 is discharged in batches to the A-Series "terminal pond," Pond A-4. When routine discharge of retained water in Pond A-4 is warranted, Pond A-4 is isolated, sampled, and water is released if surface water quality criteria are met (see Section 6.1.11 for a discussion on surface water quality criteria). Criteria for emergency discharge, regardless of pre-discharge pond sampling results, are detailed in the *Emergency Response Plan for the Rocky Flats Site Dams* (ERP) (Attachment B2).

***South Walnut Creek***

Runoff from the central portion of the COU flows into this drainage, which has five retention ponds (Ponds B-1, B-2, B-3, B-4, and B-5). The combined capacity of the South Walnut Creek B-Series Ponds is approximately 102,000 $m^3$ (27 MG or 83 acre-feet). Ponds B-1, B-2, and B-3 are bypassed and maintained for supplemental stormwater control and wetland habitat; evaporation or transfer controls water levels in these ponds. South Walnut Creek flow is diverted through the South Walnut Creek Bypass Pipeline around Ponds B-1, B-2, and B-3 and into Pond B-4, which flows directly into "terminal pond" Pond B-5. If routine discharge of retained water in Pond B-5 is warranted, Pond B-5 is sampled and water is released if surface water quality criteria are met (see Section 6.1.11). Criteria for emergency discharge, regardless of pre-discharge pond sampling results, are detailed in the ERP (Attachment B2).

### 2.2.2 Woman Creek

In the southern portion of the COU is Woman Creek, which flows through Pond C-1 and off Site onto Refuge lands toward Indiana Street. The Woman Creek drainage basin extends eastward from the base of the foothills, near Coal Creek Canyon, to Standley Lake. In the current configuration, Woman Creek flows into the Woman Creek Reservoir located east of Indiana Street and upstream of Standley Lake, where the water is held until it is pump-transferred to Big Dry Creek by the Woman Creek Reservoir Authority.

***South Interceptor Ditch***

The South Interceptor Ditch (SID) drainage is located in the southern portion of the COU and is a tributary to Woman Creek. Surface water runoff from the southern portion of the COU is captured by the SID, which flows from west to east into Pond C-2. If routine discharge of retained water in Pond C-2 is warranted and surface water quality criteria are met (see Section 6.1.11), Pond C-2 is sampled and water is released to Woman Creek. Criteria for emergency discharge, regardless of pre-discharge pond sampling results, are detailed in the ERP (Attachment B2).

### 2.2.3 Other Drainages

The third major drainage, in addition to Walnut and Woman Creeks, is Rock Creek. The Rock Creek drainage covers the northwestern portion of the former RFP/Rocky Flats Environmental Technology Site (RFETS). East-sloping alluvial plains to the west, several small stock ponds within the creek bed, and multiple steep gullies and stream channels to the east characterize the drainage channel. This entire basin is located in USFWS Refuge lands outside the COU.

Smart Ditch/South Woman Creek, located south of Woman Creek, is also completely outside the COU. The D-Series Ponds (D-1 and D-2) are located on the Smart Ditch. This drainage and these ponds are not maintained by DOE-LM.

## 2.3 Hydrogeology

Groundwater flow at the Site occurs in the upper hydrostratigraphic unit (UHSU), which comprises the surficial deposits and subcropping weathered bedrock of the Arapahoe and/or

Laramie Formations. The UHSU is roughly analogous to the "upper aquifer" at the Site, although in many areas the amount of groundwater available is insufficient to meet the definition of an aquifer in 40 *Code of Federal Regulations* (CFR) 260.10 (K-H 2005).

The Site is in a regional groundwater recharge area (EG&G 1991). Direct precipitation and baseflow along the upgradient portion of the Site's drainage basin (which extends west to Coal Creek) are the source of UHSU recharge. Infiltrating precipitation is reduced significantly by evapotranspiration (ET) (K-H 2002a); this loss increases near streams due to the shallower groundwater and more abundant vegetation.

The bedrock surface closely resembles the surface topography and represents the main control on groundwater migration. Groundwater flows laterally through the unconsolidated surficial materials because its vertical transport is limited by the relatively low-permeability bedrock claystones. Groundwater resources in the regional Laramie/Fox Hills Aquifer are separated from the UHSU by several hundred feet of these upper Laramie Formation claystones, which act as an aquitard and restrict the occurrence of contaminated groundwater to shallower intervals.

The general direction of groundwater flow Site wide is from west to east. Locally, this is modified by the presence of drainages. As groundwater within the UHSU of a pediment flows toward the east and nears a drainage, the topographic depression represented by that drainage diverts the groundwater toward it, and the groundwater discharges to surface water either as seepage or baseflow. This results in considerable hydraulic connection between surface water and groundwater at the Site. Segments of streams have been shown to either gain or lose water as groundwater is discharged to streams, or stream water is discharged to groundwater from the stream channel. Gaining reaches of streams are more likely to be contaminated by groundwater discharges, because impacted groundwater discharges to surface water prior to leaving the Site. Therefore, streams nearest to the COU are more likely to receive groundwater impacted by past RFP/RFETS activities, and have traditionally been the focus of most groundwater monitoring.

In addition to natural hydrologic processes, groundwater can also be transported to surface water directly through former utility corridors, building sumps, foundation drains, and sanitary sewers. While these systems have been removed or disrupted as part of RFP/RFETS closure, the trenches in which they were installed may still represent preferential pathways for groundwater. Overall, water-quality data pertaining to these corridors have indicated that their importance as preferential pathways for contaminated groundwater migrating to surface water is relatively minor.

Depth to groundwater is greatest in the western portion of the Site, where the Rocky Flats Alluvium can exceed 100 feet in thickness. As the Rocky Flats Alluvium thins toward the east, the depth to groundwater and the saturated thickness decrease. In some portions of the Site, groundwater is absent from the UHSU or is present only within the weathered bedrock, decreasing groundwater flow velocities due to the lower hydraulic conductivity of the weathered claystones. However, where the basal Arapahoe Formation sandstone (informally referred to in geologic and hydrologic studies at Rocky Flats as the Arapahoe Sandstone No. 1) forms part of the UHSU, flow velocities tend to increase due to the higher conductivity of this material. This sandstone unit therefore comprises a preferential flow path, such as in the East Trenches area and elsewhere. Maps of this sandstone are included in earlier RFP/RFETS reports. For example, refer to the isopach and isolith maps in the *Geologic Characterization Report for the Rocky Flats*

*Environmental Technology Site* (EG&G 1995a). (Note that this depiction was not updated following the collection of additional lithologic information.)

Numerous potentiometric surface maps have been generated for the RFP/RFETS and for smaller areas (DOE 2006c; K-H 1997, 1998, 1999, 2000a, 2001, 2002b, 2004c, 2004d, 2005; EG&G 1995a, 1995b). Potentiometric surface maps and groundwater flow velocities for the second and fourth calendar quarters of each year will be produced and included in future annual reports.

## 2.4 Ecology

Vegetation communities at Rocky Flats provide specific habitats for associated wildlife, rare plants, and unusual plant associations. These communities include the xeric mixed grassland, mesic mixed grassland, high-quality wetlands, tall upland shrubland, Great Plains riparian woodland complex, and reclaimed grassland communities. The aquatic ecosystem at the Site consists primarily of ephemeral and intermittent streams, old stock ponds, and several water management impoundments. The Preble's meadow jumping mouse (hereafter referred to as the Preble's mouse) (*Zapus hudsonius preblei*) is of particular concern because it is a federally listed threatened species under the Endangered Species Act (ESA), which provides special protection for the species.

The descriptions that follow describe the ecology in both the COU and POU areas and are referred to as occurring at "the Site." Although the RFSOG is written to address the COU activities, the ecological setting of the COU is part of the larger, regional historical Rocky Flats Site and is therefore described as such.

### 2.4.1 Xeric Mixed Grassland

There are two types of xeric mixed grassland units at the Site: the xeric tallgrass prairie and the xeric needle-and-thread grass prairie. Identification of the xeric tallgrass vegetation community is based on the presence of big bluestem (*Andropogon gerardii*), little bluestem (*Andropogon scoparius*), prairie dropseed (*Sporobolus heterolepis*), Indian-grass (*Sorghastrum nuntans*), and switchgrass (*Panicum virgatum*). These five species are considered to be tallgrass prairie relicts. Of these species, only big bluestem and little bluestem are abundant at the Site. When the foliar cover of these five species is approximately 10 percent or more of a xeric mixed grassland community, the community is classified as xeric tallgrass prairie. The soil in a xeric tallgrass prairie is visibly cobbly on the surface, and is considered to be a sandy clay loam. This vegetation community covers the high, rocky pediment on the western one-third of the Site. The xeric tallgrass prairie has been classified as a rare plant community type for Colorado and North America by the Colorado Natural Heritage Program.

The other type of xeric mixed grassland, the xeric needle-and-thread grass prairie, is also considered rare at the Site. Xeric needle-and-thread grass prairie is differentiated from xeric tallgrass prairie by a greater cover of needle-and-thread grass (*Stipa comata*) and New Mexico feather grass (*Stipa neomexicana*) than big bluestem and little bluestem or other tallgrass species. The soils beneath the xeric needle-and-thread grass prairie are not as cobbly as those in the xeric tallgrass prairie, and have a higher visible component of caliche at the soil surface. This vegetation community occupies the tops of many of the easternmost ridges of the Site.

### 2.4.2 Mesic Mixed Grassland

Mesic mixed grassland is characterized by western wheatgrass (*Agropyron smithii*) and blue grama grass (*Bouteloua gracilis*). Other common species include green needlegrass (*Stipa viridula*), Canada bluegrass (*Poa compressa*), and Kentucky bluegrass (*Poa pratensis*). The mesic grassland has a more solid turf appearance in contrast to the bunchgrass appearance of the xeric mixed grasslands. Surficial soils are clay loams that do not have the cobbly appearance typical of xeric mixed grassland soils. Most hillsides at the Site are considered mesic mixed grassland habitat.

The quality of these grasslands varies considerably across the Site depending on the annual precipitation received. Non-native species such as diffuse knapweed (*Centaurea diffusa*), Japanese brome (*Bromus japonicus*), dalmatian toadflax (*Linaria dalmatica*), alyssum (*Alyssum minus*), musk thistle (*Carduus nutans*), common mullein (*Verbascum thapsus*), Scotch thistle (*Onopordium acanthium*), and others are often very abundant in wet years. For classification purposes, a grassland is designated as mesic mixed if western wheatgrass and blue grama grass form an understory beneath non-native species, regardless of dominance by non-native species.

Mesic mixed grasslands comprise one of the largest contiguous vegetation communities at the Site. In addition to its essential role as a foraging habitat, the size and isolation of the mesic mixed grassland often makes it very important to certain wildlife species. A wide variety of grassland birds breed and forage in this habitat. Small mammals are abundant and diverse, and provide a suitable prey base for a variety of avian and mammalian predators. Many of the species supported by this vegetation community are rare or of special concern.

### 2.4.3 High-Quality Wetlands

Several high-quality wetlands are present at the Site with the largest contiguous areas and the most complex plant associations found at the Rock Creek and Antelope Springs/Apple Orchard Springs Complexes.

The Rock Creek wetlands are a large, seep-fed wetland complex extending approximately 1 mile from the foot of the easternmost seep-fed wetlands to the westernmost short marsh areas. The Antelope Springs/Apple Orchard Wetland Complex encompasses the predominantly wet meadow, short marsh, and tall marsh habitat mosaic of the upper Woman Creek Drainage Basin. These are also seep-fed wetlands that depend on groundwater discharge for their continued existence.

Predominant vegetation in these wetlands includes cattails (*Typha sp.*) and bulrush (*Scirpus sp.*) in tall marsh community; Nebraska sedge (*Carex nebraskensis*) and Baltic rush (*Juncus balticus*) in short marsh habitat; and prairie cordgrass (*Spartina pectinata*), redtop (*Agrostis stolonifera*), showy milkweed (*Asclepias speciosa*), and Missouri iris (*Iris missouriensis*) in wet meadow habitat.

These wetlands support a variety of terrestrial and aquatic organisms. Portions of these wetlands have been designated as prime Ute Ladies'-tresses (*Spiranthes diluvialis*) habitat (a federally listed threatened plant that may occur at the Site). Searches for this species have never documented its existence at the Site, however. Other portions support sensitive amphibian

species and waterfowl. Many predatory mammals and bird species depend on these areas as hunting and foraging grounds due to their high prey species productivity.

### 2.4.4 Tall Upland Shrubland

The tall upland (seep) shrubland comprises stands of hawthorn (*Crataegus erythropoda*), chokecherry (*Prunus virginiana*), and occasionally wild plum (*Prunus americana*). Tall upland shrubland is found primarily on north-facing slopes above seeps, wetlands, and streams in the Rock Creek drainage north of the Site, but small units also occur across the Site. This vegetation community may be unique, because no similar units have been identified outside the general Site vicinity. It is important habitat for the resident mule deer (*Odocoileus hemionus*) population. Mule deer are highly reliant on tall upland shrubland for fawning cover, winter thermal cover and browse, and summer shade and isolation cover. A number of rare bird species (e.g., bluegray gnatcatchers [*Polioptila caerulea*] and chestnut-sided warblers [*Dendroica pensylvanica*]) occupy this community as well. Some units of tall upland shrubland also provide habitat for the rare Preble's mouse.

### 2.4.5 Great Plains Riparian Woodland Complex

Riparian areas are well known for the diversity of plant and animal species they support. The riparian woodland complex at Rocky Flats is a combination of two vegetation community classifications: riparian woodland and riparian shrubland, which form a complex mosaic habitat along the drainage bottoms at the Site. Due to its contiguous mixture of both trees and shrubs, the riparian areas are described as a complex. The woodland component of the complex is characterized by stands of plains cottonwood (*Populus deltoides*), peach leaf willow (*Salix amygdaloides*), Siberian elm (*Ulmus pumila*), and silver poplar (*Populus albus*). The shrubland component of the complex includes chokecherry, snowberry (*Symphoricarpos occidentalis*), coyote willow (*Salix exigua*), leadplant (*Amorpha fruticosa*), and other shrubs.

The riparian woodland complex is an important habitat for a different songbird association than the grasslands and shares some species with the tall upland shrubland. Several of the bird species using the riparian woodland complex as foraging and nesting cover are rare species (e.g., blue grosbeak [*Guiraca caerulea*]). Like the tall upland shrubland community, this vegetation community is also seasonally important to the resident mule deer herd as shelter, forage source, and fawning grounds. Large cottonwood trees embedded within this unit provide nesting habitat for several raptor species, including the great horned owl (*Bubo virginianus*), red-tailed hawk (*Buteo jamaicensis*), Swainson's hawk (*Buteo swainsoni*) (a Colorado "at-risk" species), and American kestrel (*Falco sparverius*). The riparian woodland complex supports the greatest number of Preble's mice at the Site and is considered typical habitat for this species.

### 2.4.6 Reclaimed Grasslands

The reclaimed grassland communities are areas that were disturbed and planted with non-native graminoid species. These areas are dominated by species such as smooth brome (*Bromus inermis*), intermediate wheatgrass (*Agropyron intermedium*), and crested wheatgrass (*Agropyron cristatum*). They are typically low in diversity for both plants and animals.

### 2.4.7 Aquatic Community

The aquatic ecosystem at Rocky Flats consists of a network of primarily ephemeral and intermittent streams and several scattered old stock ponds. In the Walnut Creek and Woman Creek drainages, there are several water management impoundments that retain large bodies of water. Several mitigation wetland areas were created for mitigation of wetland disturbances related to Site closure activities. These are located primarily in the COU in the North and South Walnut Creek drainages. Numerous seep springs feed streams at the Site and provide limited wetland habitat. Other than the outflow of the seeps and the water in the existing ponds and larger pools, very little permanent water exists at the Site. Macroinvertebrate populations typical of ephemeral streams and limited small populations of fish are found in the various waters at the Site.

### 2.4.8 Preble's Mouse Habitat and Populations

The Preble's mouse is a species of particular concern at the Site because it is listed as threatened by USFWS. This listing provides special protection for the species under the ESA, and actions must be evaluated for potential impact to the mouse.

Preble's mice have been recorded in the major drainages of the Site: Walnut Creek and Woman Creek drainages. Native plant communities in these areas provide a suitable habitat for this small mammal. Preble's mouse populations are found in association with the riparian zone and seep wetlands and apparently prefer multistrata vegetation with abundant herbaceous cover. The vegetation communities that provide Preble's mouse habitat include the Great Plains riparian woodland complex, tall upland shrubland, the wetlands adjacent to these communities, and some of the upland grasslands surrounding these areas. All activities occurring in Preble's mouse habitat require approval from USFWS prior to initiation. Figure 2−1 shows the locations of Preble's mouse habitat at Rocky Flats.

### 2.4.9 Revegetation Areas

During previous cleanup and closure activities, large areas of the former IA were disturbed and reconfigured. These areas were revegetated using native plant species common to the native grasslands at the Site. As of the end of the 2007 growing season, most of the revegetated areas were in the early successional stages of returning to a natural, native ecosystem. Proactive management of these areas through weed control and reseeding efforts will be required for many years before these areas resemble the native grasslands at the Site.

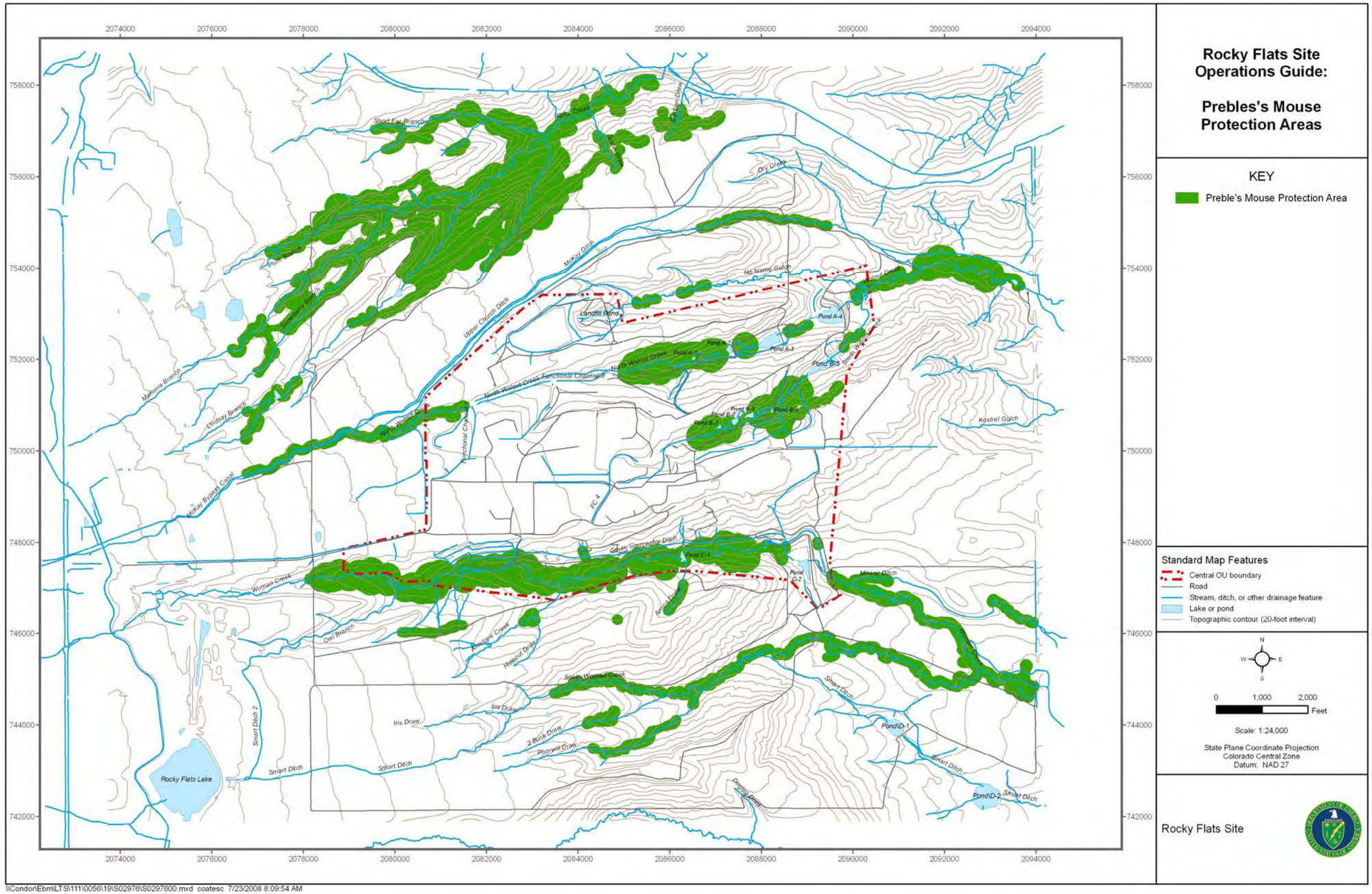


*Figure 2−1. Preble's Mouse Protection Areas at Rocky Flats*

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# 3.0 Access Controls

The effectiveness of access controls at the Site will be monitored regularly. DOE will document inspections of the access controls in the annual report. During the inspections, DOE will note any repairs and maintenance needed for physical controls and will perform those repairs and maintenance promptly. If DOE finds evidence of activities that violate land-use restrictions (see Section 3.1), DOE will immediately commence repairs or other corrective action in consultation with EPA and CDPHE.

## 3.1 Institutional Controls

Institutional controls for the COU include land-use restrictions that are established in the CAD/ROD (Attachment A1), embodied in the Environmental Covenant (Attachment A3), and implemented through RFLMA (Attachment A2). The institutional controls are summarized in Table 4 of Attachment 2 to RFLMA and are included below for convenience (Table 3−1).

*Table 3−1. Institutional Controls for the COU*

| Controls | Use Restrictions |
|---|---|
| 1 | The construction and use of buildings that will be occupied on a permanent or temporary basis (such as for residences or offices) is prohibited. The construction and use of storage sheds or other, non-occupied structures is permitted, consistent with the restrictions contained in controls 2 and 3 below, and provided such use does not impair any aspect of the response action at Rocky Flats. |
| 2 | Excavation, drilling, and other intrusive activities below a depth of 3 feet are prohibited, except for remedy-related purposes and routine or emergency maintenance of existing utility easements, in accordance with pre-approved procedures. |
| 3 | No grading, excavation, digging, tilling, or other disturbance of any kind of surface soils is permitted, except in accordance with an erosion control plan (including Surface Water Protection Plans submitted to EPA under the Clean Water Act) approved by CDPHE or EPA. Any such soil disturbance will restore the soil surface to preexisting grade. |
| 4 | Surface water may not be used for drinking water or agricultural purposes. |
| 5 | The construction or operation of groundwater wells is prohibited, except for remedy-related purposes. |
| 6 | Digging, drilling, tilling, grading, excavation, construction of any sort (including construction of any structures, paths, trails, or roads), and vehicular traffic are prohibited on the covers of the Present Landfill and the Original Landfill, except for authorized response actions. |
| 7 | Activities that may damage or impair the proper functioning of any engineered component of the response action, including but not limited to any treatment system, monitoring well, landfill cap, or surveyed benchmark, are prohibited. |

Signs are posted at each gate to the COU listing the land-use restrictions. In accordance with Section 5.3.6 of Attachment 2 to RFLMA, the COU must be inspected at least annually for evidence of violation of institutional controls; however, all personnel are expected to be observant during their daily activities and immediately report any evidence of violation of institutional controls to DOE-LM Site manager.

Section 5.3.6 of Attachment 2 to RFLMA also requires that an annual check be performed to ensure that the Environmental Covenant remains on file with Jefferson County and that no unauthorized changes have been made to the covenant. This check is documented in the annual report (see Section 15.0).

## 3.2 Physical Controls

Physical controls required by RFLMA include those controls necessary to protect engineered elements of the remedy, such as landfill covers, groundwater treatment systems, and monitoring equipment.

Section 3.2 of Attachment 2 to RFLMA provides requirements for signs around the perimeter and at access points to the COU. These signs must be inspected quarterly to ensure they remain legible and meet the requirements of RFLMA. The inspections are documented in the quarterly reports.

As a BMP, the following additional controls will be implemented:

- Monitoring wells will be locked.
- Treatment system hatches will be locked.
- Monitoring stations will be locked or fenced as necessary if vandalism, intrusion, or tampering appear to be a problem.
- The East Shed will be locked.
- After the Rocky Flats Wildlife Refuge opens to visitors, gates to the COU will remain locked unless attended by authorized personnel. Until that time, it is sufficient to maintain the West Access Gate in locked (or properly attended) condition.
- Surveillance patrols by subcontract personnel will be performed during evening and weekend hours; however, this requirement will be reevaluated quarterly by the DOE-LM Site manager and the patrols will be reduced or discontinued when deemed no longer necessary.

## 3.3 Requirements for Site Access

### 3.3.1 Training

Section 10.1 provides information on training requirements for Site access.

### 3.3.2 Protective Equipment

Many of the former hazards at the Site are no longer present; however, some hazards remain. Minimum protective equipment for casual Site access consists of sturdy work boots or shoes and clothing appropriate to the conditions and specific work activity. Additional equipment, such as eye protection, sunscreen, additional layers of clothing, and gloves, is recommended based on the weather and type of activity. For some types of work (e.g., construction projects), hard hats, safety vests, safety toed boots, and safety glasses may be required by the Job Safety Analysis (JSA). Refer to the *Health and Safety Manual* (LMS/POL/S04321), Standard 7.6.

### 3.3.3 Keys and Badges

Gates to the Site are to remain locked unless attended by Site personnel. Keys are numbered and checked out to individuals. The administrative assistant keeps a log that includes the key number, name of the individual, date the key is checked out, and date the key is returned.

Personnel entering the Site are required to wear a badge. Permanent LM and LMS personnel will be issued a DOE badge. Temporary personnel or visitors will be issued a Rocky Flats Site-specific visitor badge. These temporary badges are numbered and are checked out to individuals. The administrative assistant keeps a log that includes the badge number, name of the individual, date the badge is issued, date the badge is returned, and signature of the sponsor. The badge should be worn in a clearly visible location. Badges are to be returned to the administrative assistant when the individual no longer requires the badge.

The Rocky Flats Site office is located off Site in a commercial office building. Doors to the off-Site DOE-LM office must remain locked at all times unless attended by office personnel. Keys are numbered and are checked out to individuals. The administrative assistant keeps a log that includes the key number, name of the individual, date the key is checked out, and date the key is returned. Visitors and subcontractors are issued a Rocky Flats Site-specific badge when visiting the office building. Visitors wearing badges from other governmental agencies may use the badge issued by their organization. Visitors must sign in at the front desk and remain with their host at all times, unless the "Rocky Flats Site Unescorted Office Access Read and Sign Agreement" has been completed. The administrative assistant will maintain a visitor sign-in log.

The administrative assistant and LMS Site manager will review the badge and key logs quarterly to determine whether any badges and keys that are checked out are no longer needed by the individual. The administrative assistant will contact the individual if necessary to arrange for the return of the badge and/or key.

### 3.3.4 Accountability

All personnel and subcontractors performing work for Rocky Flats, both at the Site and the off-Site DOE-LM office, must be accounted for when present at the Site or the office. This section outlines accountability requirements for the office and the Site.

All office personnel are required to sign in and out using the accountability board near the administrative assistant's office. The accountability board will serve as a roster, in addition to form LMS 2122e, Site Accountability Checklist, in the event of an office emergency (see Section 11.3).

Maintenance and monitoring requirements for the Site specify frequent field visits to the Site. Personnel and subcontractors performing work at the Site must be accounted for. This measure, which is required for health and safety (H&S) purposes, helps reduce the potential for workers being stranded at the Site. The fundamental concepts of the accountability process are maintaining adequate communication and using common sense. Subcontractors may choose to implement their own accountability procedure or may use the Site procedure, but they must abide by the minimum requirements outlined below.

The minimum requirements for every worker at the Site are to notify a responsible individual upon departing for and returning from the Site, describe the general scope of work to be performed, and provide an estimated time of return. Notification requirements are described in greater detail below.

- The responsible individual may be the administrative assistant, H&S specialist, or an employee designated by the H&S specialist. The responsible individual must be off Site for the duration of the worker's visit that day; no one at the Site may act as the responsible individual.
- During weekends (Friday through Sunday) and other non-business hours, the H&S specialist (or designee) will be notified by the worker before any Site visit. The worker must also notify the H&S specialist upon leaving the Site at the end of the off-hours work period. Should the H&S specialist be unavailable for off-hours notification, responsibility will be transferred to another responsible individual, and all workers will be notified of the temporary change in advance.
- The same responsible individual who was notified of a worker's departure shall be notified of the worker's return. Exceptions may be needed from time to time; if so, changes to the responsible individual shall be discussed collectively among the worker and the former and new responsible individuals to ensure there are no safety issues or stranded workers at the Site.
- The worker shall provide the responsible individual with an estimated duration and general description of expected work scope for each Site visit. If changes occur, the worker shall communicate the nature of these changes (particularly if they include additional risks or extend the length of the Site visit) to the responsible individual.

During the Site visit, the following requirements shall be met:

- The responsible individual must be available for direct communication via cell phone for the entire duration of the Site visit. If the responsible individual will be temporarily unavailable, a change to a different responsible individual is necessary and must be discussed among all affected parties as described above.
- All workers will be furnished with cell phones during visits to the Site or, in some instances (e.g., temporary employees), will be accompanied full-time by a worker so equipped (thereby utilizing the "buddy system").
- All workers must keep their cell phones on their person) and turned on throughout their activities at the Site.
- All workers are responsible for keeping their cell phones fully charged.
- If conditions warrant (e.g., extreme weather), all workers are instructed to maintain more frequent communication based on professional judgment.

If the responsible individual has not received notice of the worker's return or a revised estimate of return within 30 minutes following the time estimated by the worker upon departure, the responsible individual shall attempt to contact the worker. If unable to make contact within one hour following the estimated time of return, the responsible individual shall treat this as a possible H&S issue and shall respond as described below:

- Upon being unable to contact or locate a worker understood to be at the Site, the H&S specialist (or designee) shall contact all other personnel currently understood to be located at the Site for assistance in locating the worker.
- If the missing worker is a Site employee, the H&S specialist (or designee) shall devise and implement a plan to locate the worker and provide assistance as necessary. If the missing

worker is a subcontractor, the H&S specialist (or designee) shall maintain communication with that worker's responsible individual and shall provide assistance as necessary.

- The LMS Site manager shall be notified immediately regarding any gap in accountability of Site employees and subcontractors and shall be kept informed of progress toward resolving the issue.

All subcontractors must ensure that accountability requirements are appropriately maintained as follows:

- All subcontract workers must be instructed in these accountability requirements.
- The subcontractor will be provided with a Site contact.
- The subcontractor shall provide their Site contact the appropriate contact number(s) for their designated responsible individual(s).

## 3.4 Requirements for Office Access

The Rocky Flats Site office is located off Site in a commercial office building. Details regarding keys and badges are described in Section 3.3.3.

Visitors to the Rocky Flats Site office will use the doorbell located at Suite 1000 to access the building. Alternatively, records and other deliveries may use the doorbell at the back door (Suite 900). Visitors (other than delivery/vendor personnel) are required to complete the "Rocky Flats Site Unescorted Office Access Read and Sign Agreement" to remain in the office unescorted or sign in at the front desk and be escorted throughout the duration of their visit by a Site employee.

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# 4.0 Routine Site O&M

Routine operation and maintenance (O&M) at the Site apply to facilities and structures remaining after closure. These include the ponds and surface water control features, landfills, passive groundwater treatment systems, erosion controls, and revegetation efforts. These O&M activities are summarized below with detailed procedures and manuals provided in attachments or referenced documents.

## 4.1 Ponds and Surface Water Control Features

Ongoing O&M of Site surface water retention ponds and surface water control features will continue in order to provide ecological benefits, stormwater retention capacity, and dam safety. Some control features (i.e., flumes and weirs) are also important to the remedy, via their use in water quality considerations. The ponds will continue to be used primarily as stormwater management facilities. Ponds and other structures will be operated and maintained in accordance with the *Operations and Maintenance Plan for the Rocky Flats Surface Water Control Project* (O&M Plan for Site Dams) (Attachment B1) and the ERP (Attachment B2).

The O&M Plan for Site Dams details water management practices, operations, maintenance, and monitoring for the 12 surface water retention ponds and other major stormwater management structures. The following details are provided:

- Infrastructure descriptions—Detailed descriptions of dams, ponds, spillways, outlet works, diversion structures, functional channels (FCs), and canals;
- Pond management practices—Overview of water management strategies under both normal and emergency[1] conditions for all Site ponds;
- Operating instructions—Instructions for pond drawdown rates, drain bed valve operation, outlet works operation, and methods for evaluating and reporting unusual conditions;
- Maintenance and inspection instructions—Discussion of operating record generation and maintenance/inspection instructions for dams, ponds, spillways, outlet works, pipe crossings, diversion dams, FCs, and canals;
- Monitoring instructions—Detailed instructions for monitoring data collection associated with pond water levels, piezometer water levels, seepage, and dam structures (displacement, movement monuments, and inclinometers); and
- Appendixes—Detailed information for dam characteristics, operation logs, monthly observation reports, piezometer field data collection logs, flume ratings, inspection and maintenance schedules, engineering drawing references, report references, contractor and supplier references, capacity charts and graphs, dam location and access, permanent instrumentation characteristics, piezometer characteristics, and routine data reports.

The Site retention pond dams are all earthen structures that are monitored, maintained, and inspected to ensure dam safety. State dam hazard classifications range from “High Hazard Dam” (highest concern with loss of human life expected if dam fails) to “No Public Hazard (NPH)

[1]Detailed emergency response procedures are contained in the ERP (Attachment B2). Any references to emergency operations in the O&M Plan are subject to modification by the ERP. In case of discrepancies between the O&M Plan and the ERP, the ERP will take precedent.

Dam" (lowest concern with no loss of human life expected if dam fails, and damage only to the dam owner's property expected). The Landfill Dam and Dams A-4, B-5, and C-2 are "Low Hazard Dams" (no loss of human life or significant downstream damage expected); all other dams are "NPH." As a BMP, a series of action levels and corresponding response actions have been developed to prevent overtopping, uncontrolled discharge, and/or actual dam failure. These action levels and response actions are delineated in the ERP (Attachment B2). The ERP also describes response actions required in the event of an actual or potential unplanned release, the emergency discharge of water from retention ponds at the Site, or the actual or potential failure of a dam.

Only water containment/conveyance structures within the COU are managed by the DOE-LM (Figure 4−1). Diversion structures and canals/ditches located in the POU that have the potential to affect DOE facilities in the COU will be periodically inspected by DOE-LM. Any unacceptable observations will be reported to USFWS. DOE also actively maintains any RFLMA-required monitoring equipment located outside of the COU (e.g., flumes, flow meters, and so forth).

### 4.1.1 Data Collection Protocols

The actual decision process for managing pond operations and conducting pond and dam monitoring and maintenance activities is detailed in the O&M Plan for Site Dams (Attachment B1) and the ERP (Attachment B2). This section provides a summary of field and telemetry data collection for decision support.

Decision factors include safe pond capacity, actual pond elevation, current and projected flow rates into and out of the ponds, and several indicators of dam integrity such as piezometer readings, inclinometer readings, and cracks or sloughs of embankment material. The information needs are as follows:

- Pond inflow rates into Ponds A-3, A-4, B-5, and C-2 (can be continuously monitored with telemetry for daily to hourly averages with instantaneous measurement capability);[2]
- Pond elevations for Ponds A-3, A-4, B-5, and C-2 and the Landfill Pond (can be continuously monitored with telemetry for daily to hourly averages with instantaneous measurement capability);
- Measurements from piezometers within dams (as an indication of water pore pressure in dam structures; can be continuously monitored with telemetry for periodic averages with instantaneous measurement capability at Ponds A-3, A-4, B-5, and C-2 and the Landfill Pond);

[2] Critical measurements, such as pond inflow rates and elevations, require hourly monitoring capability.

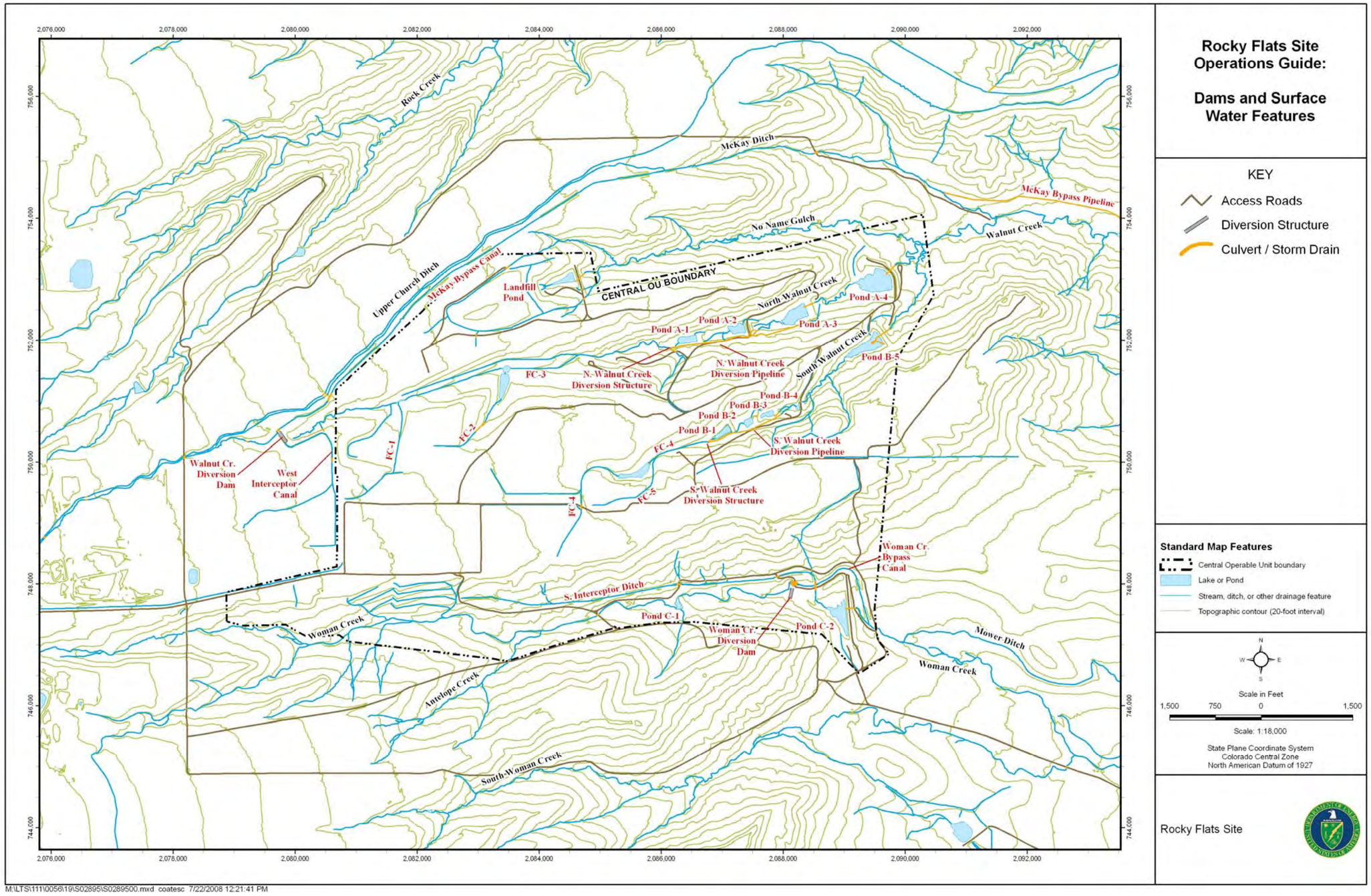


*Figure 4−1. Rocky Flats Dams and Surface Water Features*

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- Results from an expert system that rates the above inputs to determine whether to release water from a dam under emergency conditions (the ERP provides details that describe this logic);
- Pond discharge (outflow) rates from Ponds A-3, A-4, B-5, and C-2 (pumped or through outlets; daily to hourly averages with instantaneous measurement capability using telemetry);
- Weather predictions (affects the weighting factors in the expert system);
- Routine periodic dam inspections and observations as detailed in Attachment B1;
- Annual dam inspections by a qualified engineer for Dams A-3, A-4, B-5, C-2, and the Landfill Dam;
- Triennial dam inspections by a qualified engineer for Dams A-1, A-2, B-1, B-2, B-3, B-4, and C-1;[3]
- Crest monument movement monitoring; and
- Inclinometer monitoring.

Monitoring and inspection requirements to safely operate the dams are presented in Table 4−1.

### 4.1.2 Data Evaluation

The actual decision process for managing pond operations and conducting pond and dam monitoring and maintenance activities is detailed in the O&M Plan for Site Dams (Attachment B1) and the ERP (Attachment B2).

[3] Dam C-1 was breached in 2005; breaching of Dams A-1, A-2, and B-1 through B-4 is scheduled to be complete in 2009. Once concurrence is received from the Colorado State Engineer that these dams are no longer jurisdictional under the State Dam Regulations, most aspects of maintenance and inspection will no longer be required. These changes will be reflected in future revisions of the O&M Plan for Site Dams, the ERP, and this RFSOG.

*Table 4−1. Monitoring and Inspection Requirements for Safe Operation of Site Dams*

| Data Types Monitored | Dam A-1 | Dam A-2 | Dam A-3 | Dam A-4 | Dam B-1 | Dam B-2 | Dam B-3 | Dam B-4 | Dam B-5 | Dam C-2 | Landfill Dam |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Inflow rate (telemetry measurement) | — | — | 24/day [GS13] | 24/day [GS12] | — | — | — | — | 24/day [GS10] | 24/day [SW027] | — |
| Discharge rate (telemetry measurement) | — | — | 24/day [GS12] | 24/day [GS11] | — | — | — | — | 24/day [GS08] | 24/day [GS31] | — |
| Discharge rate (field measurement during discharge) | — | — | 1/day | 1/day | — | — | | | 1/day | 1/day | — |
| Pond elevation (telemetry measurement) | — | — | 24/day | 24/day | — | — | — | — | 24/day | 24/day | 24/day |
| Pond elevation (field measurement) | 1/month | 1/month | 2/month | 2/month | 1/month | 1/month | 1/month | — | 2/month | 1/month | 2/month |
| Piezometers (telemetry measurement) | — | — | 4/day | 4/day | — | — | — | — | 4/day | 4/day | 4/day |
| Piezometers (field measurement) | — | — | 1/month | 1/month | 1/month | — | 1/month | — | 1/month | 1/month | 1/month |
| Routine dam observation | 1/month | 1/month | 1/month | 1/month | 1/month | 1/month | 1/month | 1/month | 1/month | 1/month | 1/month |
| Detailed dam inspection | 1/3 years | 1/3 years | 1/year | 1/year | 1/3 years | 1/3 years | 1/3 years | 1/3 years | 1/year | 1/year | 1/year |
| Inclinometer (field measurement) | — | — | — | 2/year | — | — | — | — | 2/year | 2/year | — |
| Crest monument movement (field measurement) | — | — | — | 2/year | — | — | — | — | 4/year | 2/year | — |
| Assessment of pond volumes and estimated evaporative losses for Broomfield Water Lease | 1/month | 1/month | 2/month* | 2/month* | 1/month | 1/month | 1/month | 1/month | 2/month* | 1/month | 2/month* |
| Use of computer expert system to predict pond filling and discharge events | as needed | as needed | as needed | as needed | as needed | as needed | as needed | as needed | as needed | as needed | as needed |

Notes: Specific automated gauging station locations are, for example, shown as [GS12]
— = Not applicable
* Special “event” reports may be required by the Lease Agreement based on change in stored volumes.

## 4.2 Landfills

The PLF consists of approximately 22 acres with an engineered Resource Conservation and Recovery Act (RCRA) Subtitle C-compliant cover. A diversion channel surrounds the landfill and diverts runoff away from the landfill to No Name Gulch. The PLF has a seep collection and passive aeration treatment system that discharges into the Landfill Pond. A gas extraction system is also built into the landfill and allows subsurface gas to vent out into the atmosphere. The PLF will be managed in accordance with the *Present Landfill Monitoring and Maintenance Plan and Post-Closure Plan, Rocky Flats Environmental Technology Site* (PLF M&M Plan) (Attachment D2).

The Original Landfill (OLF) consists of approximately 20 acres with an engineered soil cover. The final cover consists of a 2-foot-thick Rocky Flats Alluvium soil layer that was constructed over both a regraded surface and buttress fill. The original surface was regraded to provide a consistent slope. A 20-foot-high, 1,000-foot-long soil mass buttress fill was placed at the toe of the landfill. Erosion is controlled by a series of diversion berms that divert runoff from the cover and into lined perimeter channels. The two perimeter channels collect runoff from the diversion berms and carry it away from the landfill. The OLF will be managed in accordance with the *Landfill Monitoring and Maintenance Plan, Rocky Flats Environmental Technology Site, Original Landfill* (OLF M&M Plan) (Attachment D1).

Inspections of the PLF and OLF will be conducted on a set frequency as set forth in the corresponding monitoring and maintenance plans referenced above (Attachments D2 and D1, respectively) and RFLMA (Attachment A2). Changes to the inspection frequency can be developed and documented through the RFLMA consultation process. Results will be evaluated during the periodic CERCLA review process. The findings and observations of the landfill inspections will be submitted to EPA and CDPHE and presented in the annual report. As outlined in the controlling documents, results of the inspections, except water monitoring results, will be transmitted to EPA and CDPHE within 1 month of completion of the inspection. Water monitoring results will be included in the appropriate quarterly report. Inspections and monitoring activities will include groundwater and surface water sampling, and observations of subsidence/consolidation, slope stability, soil cover, vegetation, stormwater management structures, institutional controls, and erosion in surrounding features so that corrective actions can be taken in a timely manner.

Settlement monuments that monitor for settlement or slope instability will be surveyed by a land surveyor at a frequency designated by each landfill's respective monitoring and maintenance plan. In addition to the settlement monuments, the OLF has seven inclinometers that were installed in boreholes to monitor for slope changes over time. The inclinometers will be monitored periodically, per the monitoring frequency prescribed in the OLF M&M Plan. The OLF inclinometer boreholes also have piezometers with data loggers installed, and the data will be downloaded periodically at the time the inclinometer monitoring is done.

## 4.3 Groundwater Plume Treatment Systems

Contaminated groundwater beneath the Site is currently being treated in four systems: the Mound Site Plume Treatment System (MSPTS), the East Trenches Plume Treatment System

(ETPTS), the Solar Ponds Plume Treatment System (SPPTS), and the PLFTS. The groundwater treatment systems are designed to treat contaminated groundwater containing volatile organic compounds (VOCs) or elevated nitrates and uranium.

The MSPTS, ETPTS, and SPPTS each consist of a groundwater collection trench with a collection sump that feeds water to the treatment cells. Under normal operations, the treatment cells are configured so that water flows through the cells in series for treatment and then to the metering manholes for release to the subsurface or surface.

The fourth system, the PLFTS, receives the diverted flow from the north and south components of the Groundwater Intercept System (GWIS) and flow from the PLF Seep. This combined flow is routed across an engineered aerating surface that causes VOCs in the water to volatilize.

Sampling and analysis at these treatment systems are addressed in Section 6.1 and are performed in compliance with RFLMA (Attachment A2).

O&M requirements for these treatment systems and a guide for media replacement are contained in the *Operation and Maintenance Manual for Rocky Flats Groundwater Treatment Systems* (O&M Manual for Groundwater Treatment Systems) (Attachment C1) and the PLF M&M Plan (Attachment D2). Each system must be routinely inspected and maintained to ensure continued flow and treatment. The effectiveness of the treatment cells is influenced by the permeability of the media. At the MSPTS and ETPTS, the surface of the media can develop a crust that must be broken up regularly to ensure an even flow through the media in the treatment cell. This is not a concern at the SPPTS or the PLFTS. The MSPTS, ETPTS, and to a lesser extent the SPPTS, are also equipped with automated instrumentation that allows more detailed evaluation of system performance, and these components require occasional maintenance.

Routine inspection and maintenance at the MSPTS and ETPTS include:

- Checking water levels;
- Servicing flow meters;
- Checking valves and piping;
- Cleaning effluent lines;
- Disaggregating the top surface of reactive media; and
- Inspecting the instruments and plumbing in the associated instrument vaults.

Where system effluent flow is monitored using a flume and bubbler line, as is currently the case at the MSPTS, ETPTS, and SPPTS, the related components will be inspected on a monthly basis and cleaned/adjusted/recalibrated as warranted. This requires confined space entry; only properly trained and authorized personnel shall perform this task, and all the requirements associated with the confined space being worked shall be followed.

Data transmission from the instrument vaults will be checked weekly, and instruments will be calibrated quarterly as appropriate; portions of these activities require connection to the data loggers with a computer.

At the SPPTS, routine inspection and maintenance include:

- Checking water levels;
- Servicing flow meters;
- Checking valves and piping;
- Cleaning effluent lines; and
- Checking and servicing the solar panels, batteries, and pump.

At the PLFTS, routine inspection and maintenance include:

- Checking piping, manholes, grates, and steps for damage and proper operation; and
- Removing anything that may be blocking flow.

In addition, replacement of the reactive media is occasionally needed at the MSPTS, ETPTS, and SPPTS. See Section 14.0 for information on waste disposal.

## 4.4 Erosion Control and Revegetation

The final phase of closure included the implementation of erosion controls, including revegetation. Revegetation requirements for the Site have been established and are described in the *Rocky Flats, Colorado, Site Revegetation Plan* (RFSRP) (Attachment E5). The selection and application of erosion control materials varied throughout the former RFP/RFETS, depending on area-specific contaminant levels, physical conditions, proximity to surface water, and slope and soil characteristics. The primary goals of erosion control and revegetation will continue to be protection of surface water quality and enhancement of wildlife habitat.

The *Erosion Control Plan for Rocky Flats Property Central Operable Unit* (ECP) (Attachment E8) provides the regulatory approach, applicability, and scope of erosion control activities for the Site. It also lists various BMPs and how erosion controls will be implemented and monitored at the Site. Erosion controls serve to protect the reclaimed areas from significant erosion and promote infiltration and ET of surface water. These areas are designed to require minimal maintenance but will be inspected on a routine basis (per the ECP) to ensure they are functioning correctly. If a revegetated area is seriously affected by any surface erosion or deposition, such as from a heavy storm event, the area will be repaired. Repairs may include placing and grading fill material or topsoil. After the erosion feature is repaired, the area will be reseeded, and an appropriate erosion control material applied.

Erosion control inspections are made weekly in the Preble's mouse habitat (as required in the *Programmatic Biological Assessment for Department of Energy Activities at the Rocky Flats Environmental Technology Site* [PBA] Part II [Attachment E4]) until the area has become revegetated to the point where the vegetation has established and the erosion controls no longer serve a purpose. At other Site locations, erosion controls are inspected and observed as LMS personnel go about their day-to-day business, after significant storm events, and per the ECP.[4] Areas that have problems or appear susceptible to erosion will be reported. Conducting routine, ad-hoc, and after-storm inspections is important and will minimize the cost of maintenance or

[4] Significant storm events are defined as 1 inch or more of rain in a 24-hour period or significant melt of a 10-inch or more snowstorm.

repairs. The erosion control monitoring methodology is outlined in the *Rocky Flats, Colorado, Site Erosion Control Monitoring and Maintenance Inspection Procedure* (Appendix K). Erosion control inspections are also performed during the annual Site inspection.

# 5.0 Routine Site Inspections

Routine Site inspections are performed by technical and field personnel. Regularly scheduled routine inspections are described below. In addition to the inspections and monitoring occurring periodically throughout the year, an annual inspection and monitoring of other remedy components is also required.

## 5.1 Annual Inspection

The following categories are inspected or monitored:

- Evidence of significant erosion in the COU and evaluation of the proximity of significant erosion to subsurface features on RFLMA Attachment 2, Figures 3 and 4. This monitoring includes visual observation for precursor evidence of significant erosion (cracks, rills, slumping, subsidence, sediment deposition, and so forth);
- The effectiveness of institutional and physical controls as determined through any evidence of the violation of any of these controls;
- Evidence of adverse biological conditions, such as unexpected morbidity or mortality, observed during the inspection and monitoring activities; and
- Verification that the Environmental Covenant for the COU remains in the Administrative Record and is on file with Jefferson County Planning and Zoning Department through the recorded land records.

### 5.1.1 Frequency/Timing of Annual Inspection

This inspection of the surface of the COU is scheduled in late winter or early spring to allow adequate observation of surface features after snow cover has melted and the surface is dry enough to avoid muddy conditions and before vegetation growth might obscure land surface features.

The annual inspection includes items that are not otherwise inspected throughout the year. Individual inspections for ponds and dams, landfills, groundwater treatment systems, erosion control, and revegetation occur within a reasonable timeframe prior to the overall Site inspections. At any time through the consultative process or during the CERCLA 5-Year Review, DOE may propose modifications to the inspection frequencies.

### 5.1.2 Specific Site Surveillance and Maintenance Features

Specific surveillance and maintenance items are listed in the annual inspection checklist (Appendix B). Other routine surveillance and maintenance items are inspected at frequencies more often than annually and documented in accordance with the procedures relevant to those items.

***Ash Pits***

A survey marker was installed in the immediate vicinity of the Ash Pits prior to closure. The purpose of this marker, which is identified as marker 1001, is to enable the evaluation of slope instability that might affect the Ash Pits.

The Ash Pits area will be inspected, at a minimum, during each annual Site inspection to look for signs of potential slumping (fractures and subsidence). If any such signs are identified, the RFLMA parties will be notified; the survey marker will be surveyed to determine the amount of movement at the location, if any; and a geotechnical engineer will inspect the area. Response actions will be determined through the consultative process.

Survey marker 1001 will be surveyed whenever Site facilities (e.g., monitoring wells, surface water stations, survey markers, and roads) are surveyed. More frequent surveys, such as during surveys of settlement monuments at the landfills, may also be performed if desired or if conditions at the Ash Pits have been observed that suggest this would be prudent. Survey results will be compared with the original coordinates generated during the installation of the marker, as documented in the *Rocky Flats Environmental Technology Site Survey Control Network Report* (Attachment F1). If coordinates differ by more than 0.5 foot (X, Y, or Z direction), a detailed inspection of the area will be performed to look for signs of potential slumping (fractures and subsidence). If any such signs are identified, the RFLMA parties will be notified and a geotechnical engineer will inspect the area. Response actions will be determined through the consultative process.

### 5.1.3 Inspection Checklist and Map

Annual Site inspections are guided by a checklist that addresses the conditions of the features to be inspected. The annual inspection checklist and inspection map for the Site are presented in Appendix B. The map is used to record field notes, photograph locations, and other annotations of inspection findings. The field maps will become part of the permanent Site record.

At the conclusion of a Site inspection, inspectors will recommend revisions to the applicable checklist in anticipation of the next Site inspection. The inspectors may also recommend consultation with the RFLMA parties to amend inspection requirements or discuss the response to a problem discovered during the inspection. The checklist will be reviewed and revised as necessary before each inspection to incorporate changes in RFLMA requirements or changes to Site features or systems. Revisions to the checklist may include instructions addressing new observations, notes about maintenance conducted since the previous inspection, changes to requirements for the inspection, and/or descriptions of progressive changes in Site conditions.

The inspection checklist will support the preparation of appropriate protocols and procedures necessary to satisfy the requirements of this RFSOG and RFLMA. Concurrent with each annual inspection, inspectors will review the *Comprehensive 5-Year Review Guidance* (EPA 2001a) to ensure inspection objectives are consistent with requirements for the CERCLA 5-Year Review.

### 5.1.4 Inspection Procedure

To conduct this work, knowledgeable DOE and Stoller team staff members (the inspection team) will walk down the COU surface to observe the conditions. The areas walked down are designated as Areas A through E as shown on the maps included in Appendix B. These areas generally coincide with the location of the subsurface features in RFLMA Attachment 2, Figures 3 and 4, or afford adequate viewing of the surface in these locations (e.g., sloping areas). Several team members are assigned to walk down a particular area or areas identified on the maps.

DOE may invite the RFLMA project coordinator from CDPHE to participate in the inspections. DOE will conduct a pre-inspection meeting with the inspection participants before inspecting the Site. The checklist will be reviewed at the meeting and information will be discussed to inform inspection participants of Site conditions and issues.

Overall conditions of the Site will be inspected in consideration with corresponding regulatory and Site management requirements. Attachment 2 to RFLMA provides specific items that must be included in the annual inspection.

Inspectors will compare current results with previous inspection results to determine whether inspection areas remain consistent over time or whether additional degradation or other changes have occurred. If inspectors identify problems with any of the features or conditions at the Site, DOE will consult with the RFLMA parties in accordance with RFLMA.

Evidence of vandalism, changed conditions, or maintenance needs will be documented with photographs. Inspectors will record photograph information on a field photograph log, which will become part of the permanent record of the annual inspection. The results of the annual inspection will be included in the annual report prepared as required by RFLMA.

Marker flags will be placed wherever there is evidence of the three condition categories listed above, to track their location for follow-up by Site subject matter experts. Rocky Flats field operations subject matter experts will subsequently visit the areas to determine whether items are significant indications of erosion or exposure of the subsurface. Marker flags will also be placed in areas where debris or trash is noticed so that these may be collected.

### 5.1.5 Personnel

It is anticipated that a team of inspectors will typically perform annual inspections. Inspectors will be experienced personnel who have the required knowledge, skills, and abilities to evaluate Site conditions and recognize potential or actual problems. The team will be led by the DOE-LM Site manager or designee.

Inspectors will be assigned to a specific component of the inspection on the basis of Site conditions and inspector expertise. Areas of expertise include civil, geotechnical, and geological engineering; as well as geology, hydrology, biology, and environmental science (e.g., ecology, soils, or range management). Additional Site staff may assist with the inspection, but unless trained in one or more relevant area of expertise, they will mainly act as “additional eyes” and assist with recordkeeping and tracking.

### 5.1.6 Reports

Results of the annual Site inspections will be included in the RFLMA quarterly report or annual report for the period during which the inspection was completed (see Section 15.0).

## 5.2 Other Routine Inspections

Other routine inspections are performed throughout the year, as discussed in other sections of this RFSOG.

Monthly inspections of the Dover Street office and the Site are conducted by the Rocky Flats technical staff. Portions of Form LMS 2114e, Routine Health and Safety Inspection Checklist, are rotated to ensure that a comprehensive picture of general workplace safety is achieved. Staff are assigned a month to perform either the Site or office inspection; both inspections are performed monthly.

Once inspections are complete, they are given to the H&S specialist, who reviews any concerns or comments. Issues to be resolved are noted and either immediately remedied or given a date for completion and compliance. The LMS Site manager then reviews the inspection checklist prior to its delivery to the H&S Workbox email address. The inspection checklists can be found on the LM Portal, Health and Safety page.

## 5.3 Observation Log

A Site observation log has been developed and is maintained on the Rocky Flats RF-share drive. When items at the Site are identified that require attention, maintenance, or repair, they are noted in this log. The log contains additional information such as the individual making the observation, the date on which it was observed, what was observed, its priority (i.e., something that needs urgent attention versus something that can be checked occasionally over time), and what category the observation falls into. Completion of the required maintenance, repair, or other action, closeout personnel, and closeout date are also recorded in the log.

# 6.0 Routine Environmental Monitoring

Environmental monitoring has been conducted at Rocky Flats since approximately 1954 and peaked in the early 1990s. Environmental data were collected for surface water, groundwater, soil, sediment, geologic materials, vegetation, fauna, air, wastes and contaminants, and most any other medium that could be quantified and/or described. In the late 1990s and early 2000s, the monitoring program was streamlined and, by 2005, closely resembled the current program.

The RFLMA consultative process will be followed to discuss any modifications to the monitoring that is performed in accordance RFLMA (i.e., as defined in Attachment 2 to RFLMA). Consultation will be documented in a RFLMA Contact Record (see Section 15.2.1) and incorporated into Attachment 2 to RFLMA during the next revision of RFLMA.

The current scope of environmental monitoring addresses water (both surface water and groundwater), ecology, and air. Section 6.1 addresses water monitoring, Section 6.2 describes ecological monitoring, and Section 6.3 summarizes air monitoring.

## 6.1 Water Monitoring

The primary objective of all water monitoring at the Site is protection of surface water resources. Groundwater is monitored because groundwater contaminant plumes occur within the COU boundaries (Figure 6−1) and have the potential to degrade surface water quality. Groundwater is monitored along pathways to surface water to provide early detection of potential impacts to the surface water quality. The contaminants of interest include various VOCs, nitrate, and uranium. This contamination is the result of decades of production-related activities including waste storage, disposal practices that were acceptable at the time, spills, and leaks.

The *Interim Measure/Interim Remedial Action for Groundwater at the Rocky Flats Environmental Technology Site* (Groundwater IM/IRA) (K-H 2005) and the RI/FS (DOE 2006a) provide thorough discussions of groundwater contamination at the Site. Summary information about the Individual Hazardous Substance Sites (IHSSs) and the effect of contaminated areas on groundwater during fiscal year (FY) 2004 is presented in Appendix D and earlier versions of the *Integrated Monitoring Plan* (IMP) (K-H 2004a, 2004b), in the *Rocky Flats Cleanup Agreement* (RFCA) Annual Groundwater Monitoring Reports issued for the years 1996 through 2003 (K-H 1997, 1998, 1999, 2000a, 2001, 2002b, 2004c, 2004d), and in the *Fate and Transport Modeling of Volatile Organic Compounds at the Rocky Flats Environmental Technology Site* (VOC Modeling Report) (K-H 2004e). More thorough information on IHSSs and other contaminant source areas is presented in the original and annual updates to the *Historical Release Report* (HRR) (DOE 1992 and, for example, DOE 2006d, respectively).

Accelerated actions that are currently monitored include the soil removal actions at IHSS 118.1, Trenches T3/T4, Ryan's Pit, the Mound, and Oil Burn Pit #2; the groundwater enhancements at the Property Utilization and Disposal (PU&D) Yard, 903 Pad, and Ryan's Pit; and the groundwater plume treatment systems installed downgradient of the Mound, East Trenches (former OU 2), the former Solar Evaporation Ponds (SEP) (former OU 4), and the PLF. See RFLMA Attachment 2, Figure 2 for corresponding location information.

Surface water is similarly monitored to detect impacts from groundwater and runoff and to confirm the water quality is consistent with expected conditions. Surface water is defined here as water flowing above ground in natural or manmade channels and water detained in Site retention ponds. Surface water may originate as water flowing from upgradient sources, precipitation, or groundwater discharge to the surface via seeps.

A consultative process was used to define the water monitoring network, determine the function of each location in the network, and identify the decisions supported by information from each location. DOE, CDPHE, EPA, and other stakeholder entities were directly involved in this process. RFLMA (Attachment A2) addresses water monitoring and specifies the locations, analytical requirements, and frequencies of data collection. This RFSOG provides additional information to assist Site staff in meeting the requirements of RFLMA and the CAD/ROD (Attachment A1).

Groundwater and surface water monitoring will be conducted using methods and procedures established for the Site, in accordance with the *Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites* (LMS/PLN/S04351) (SAP). This document describes procedures, methods, and QA requirements for collecting and validating monitoring data. Regulatory standards for surface water and groundwater at the Site are provided in Table 1 of Attachment 2 to RFLMA. Laboratory detection limits need to be set to enable comparison with the corresponding standards. Specific monitoring locations, analyte suites, and sampling frequencies are provided in Table 2 of Attachment 2 to RFLMA. Note that the monitoring and maintenance plans for the PLF and OLF (Attachments D2 and D1, respectively) specify analytical methods that must be employed for water samples collected from monitoring locations supporting those features.

Figure 6−2 shows specific monitoring locations referenced under each monitoring objective. In the interest of fiscal and operational efficiency, some of these locations collect data to support multiple monitoring objectives. The location codes on Figure 6−2 are those used in the Site Environmental Evaluation for Projects (SEEPro) database and the Geospatial Environmental Mapping System (GEMS). SEEPro contains both post-closure and pre-closure locations and data; GEMS is limited to post-closure locations and data.

Specific data collection protocols are discussed in the following water monitoring sections. Each section includes a brief description of the monitoring objective, a map of the locations, and tables detailing the data collection and evaluation protocols. RFLMA requires that analyte concentrations be compared against the greater of the standard, practical quantitation limit (PQL), or temporary modification (TM) listed in Table 1 of Attachment 2 to RFLMA, or to the appropriate uranium threshold also defined in the attachment and discussed further below. The surface water standards, PQLs, and TMs are hereafter referred to collectively as “surface water standards” or “standards.”

Water monitoring objectives are summarized in Table 6−1.

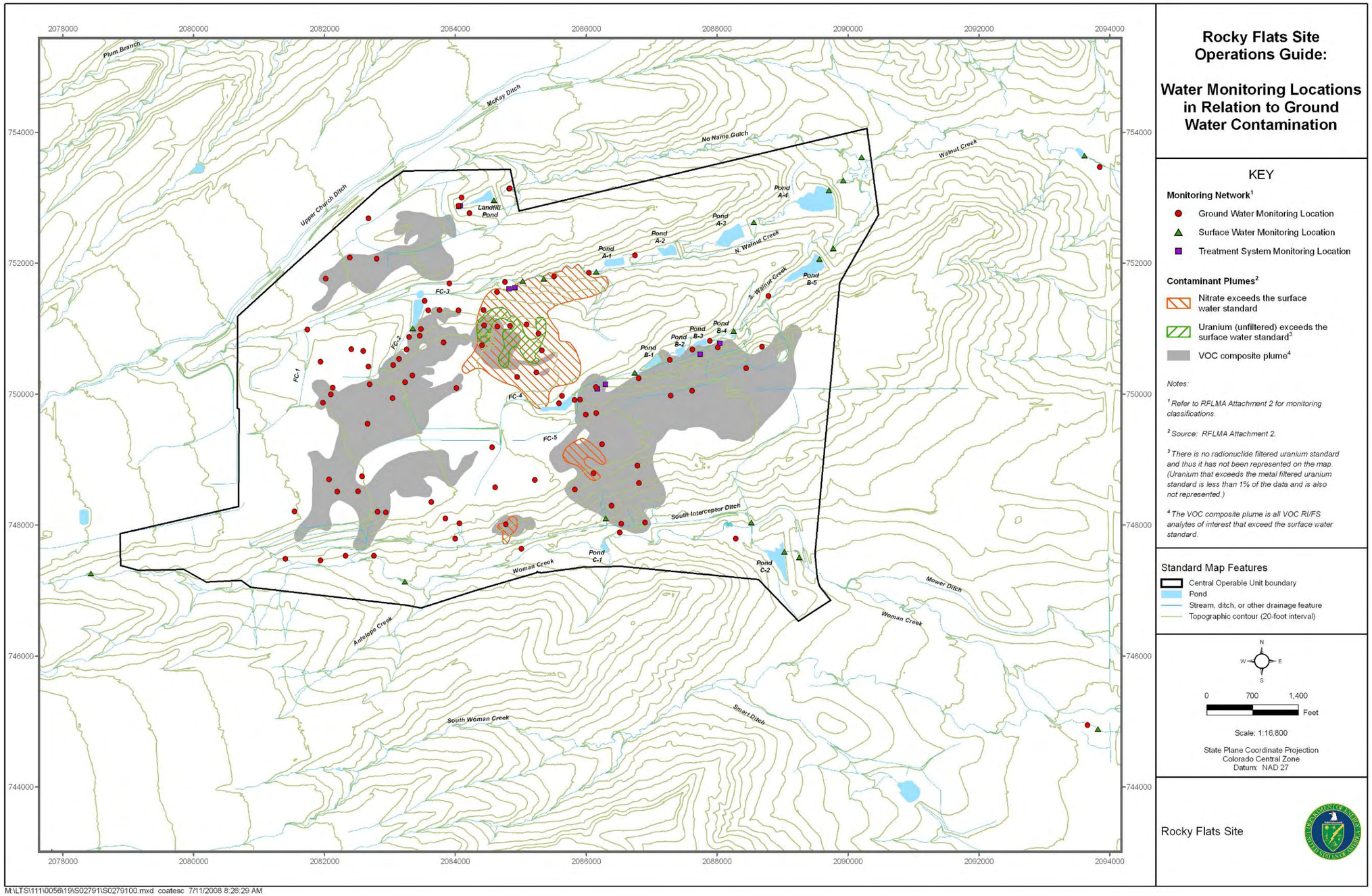


*Figure 6−1. Water Monitoring Locations in Relation to Groundwater Contamination*

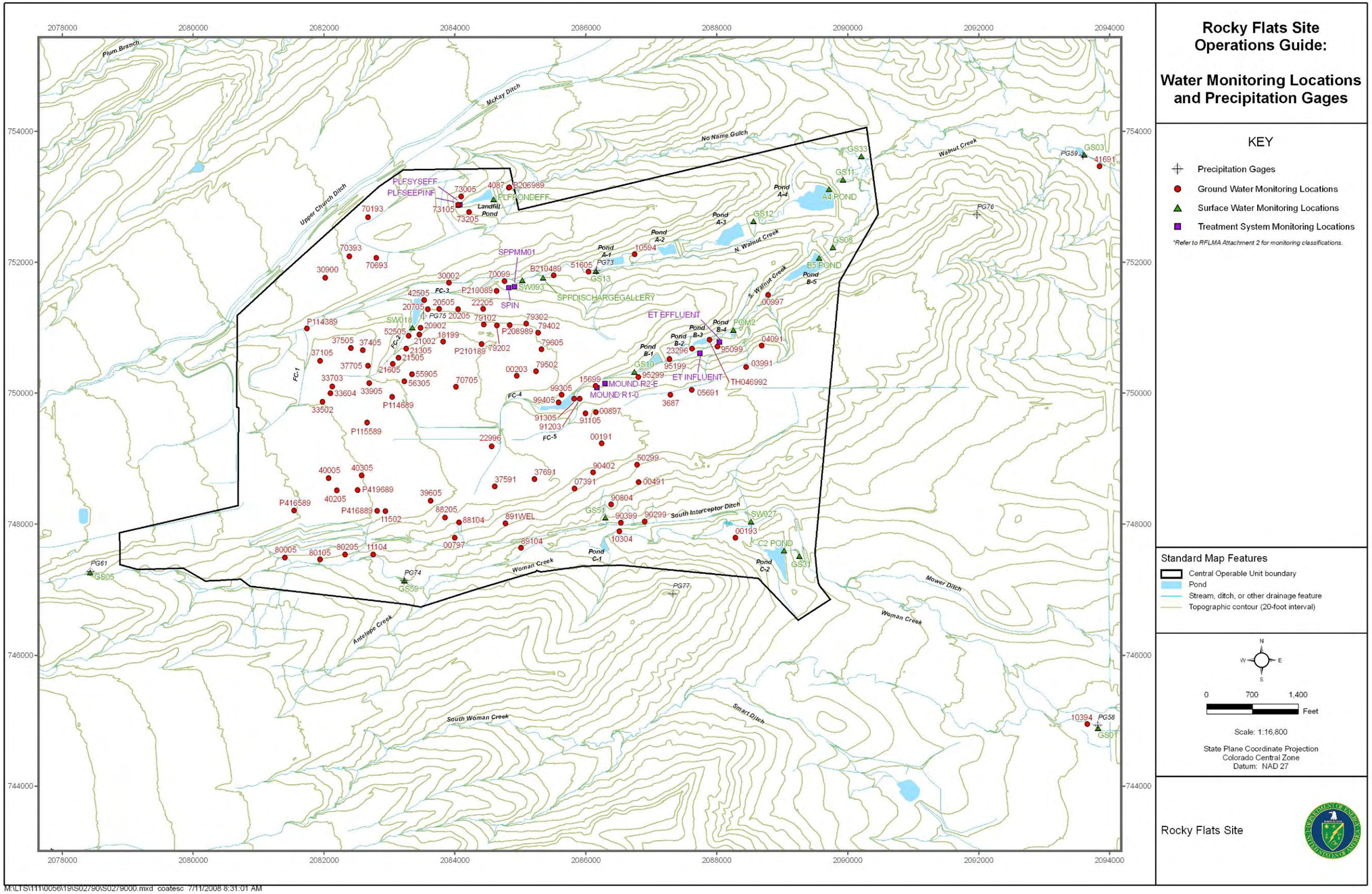


*Figure 6−2. Water Monitoring Locations and Precipitation Gages*

*Table 6−1. Generalized Water Monitoring Objectives*

| Monitoring Objective[a] | Media | General Description | Number of Locations[b] | Sampling Frequency |
|---|---|---|---|---|
| **Point of Compliance (POC)** | **SW** | **Monitoring of discharges from the terminal ponds into Woman and Walnut Creeks and streamflow downstream at Indiana Street to demonstrate compliance with surface water quality standards.** | **5** | **Flow-paced (varies)** |
| **Point of Evaluation (POE)** | **SW** | **Monitoring of runoff and baseflow from the COU to the A-, B-, and C-Series Ponds to evaluate water quality in comparison to surface water quality standards.** | **3** | **Flow-paced (varies)** |
| **Area of Concern (AOC) and Surface Water Performance** | **GW, SW** | **Wells within a drainage and downgradient of a contaminant plume or group of contaminant plumes; also surface water monitored downgradient of a source-removal action. Monitored to determine whether the plume(s) may be discharging to surface water.** | **10** | **Semiannually** |
| **Boundary** | **GW** | **Located on the east boundary of the POU, where Walnut Creek and Woman Creek cross Indiana Street. Used to demonstrate that contaminants are not migrating off federal land. These wells are not required by the CAD/ROD, but are included in RFLMA as operational monitoring.** | **2** | **Annually** |
| **Sentinel** | **GW** | **Typically located near downgradient edges of contaminant plumes, in drainages, and downgradient of groundwater treatment systems. Monitored to determine whether concentrations of contaminants are increasing, which could indicate plume migration or treatment system problems.** | **38** | **Semiannually** |
| **Evaluation** | **GW** | **Typically located within groundwater plumes and near plume source areas, or in the interior of the COU. Data from these wells will help determine when monitoring of an area or plume can cease. A subset of these wells is located in areas that may experience significant changes in groundwater conditions as a result of closure activities.** | **42** | **Biennially (every 2 years)** |
| Investigative | SW | Monitoring upstream of POCs and POEs to provide support for source evaluations. This monitoring objective is not required by the CAD/ROD or RFLMA, but is included as operational monitoring. | 5 | Flow-paced (varies) |
| **RCRA** | **GW** | **Dedicated to monitoring the PLF and OLF.** | **10** | **Quarterly** |
| **OLF Surface Water** | **SW** | **Dedicated to monitoring surface water upgradient and downgradient of the OLF to confirm the effectiveness of the remedy.** | **2** | **Flow-paced (varies), and quarterly grabs** |
| **Treatment System** | **GW, SW** | **Four groundwater treatment systems collect and treat contaminated groundwater and discharge the treated water to surface water. Each system is monitored, at a minimum, for influent and effluent water quality, and for impacts to surface water downstream of the effluent discharge point. Not all locations are required by the CAD/ROD or RFLMA; some are included in the network as operational monitoring.** | **13** | **GW: Semiannually<br>SW: Semiannually, quarterly, monthly (varies by monitoring objective)** |
| **Pre-discharge** | **SW** | **Pre-discharge sampling of Ponds A-4, B-5, and C-2, or any other upstream pond functioning as a terminal pond, as a BMP to indicate compliance with surface water quality standards. This monitoring objective is not required by the CAD/ROD, but is included in RFLMA as operational monitoring.** | **3** | **Varies – based on discharge frequency** |
| No Name Gulch Flow Monitoring | SW | Monitoring streamflow in No Name Gulch at the confluence with Walnut Creek to determine relative streamflow contributions. This monitoring objective is not required by the CAD/ROD or RFLMA, but is included as operational monitoring. | 1 | Not applicable |
| Indicator Parameter Monitoring | SW | Monitoring for general water quality and quantity information to be used for various data assessments. This monitoring objective is not required by the CAD/ROD or RFLMA, but is included as operational monitoring. | 10 | Varies by primary monitoring objective[2] |
| Water Level | GW | Located between areas being actively monitored and in areas subject to changing flow conditions. Also available to support groundwater evaluations if needed. Only water level data will typically be collected from these wells. These wells are not required by the CAD/ROD or RFLMA, but are included in the network as operational monitoring. | 8 | Varies – minimum of quarterly to semiannually |

Notes: [a]Monitoring objectives for groundwater wells are also referred to as well classifications. Objectives listed in **bold** are required by RFLMA.
[b]Surface water locations can serve multiple monitoring objectives. Groundwater wells may also serve multiple data needs, but are only assigned a single well classification.

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### 6.1.1 POC Monitoring

This objective deals with monitoring discharges from the terminal ponds into Woman and Walnut Creeks and streamflow downstream at Indiana Street, to demonstrate compliance with surface water quality standards (see Table 1 of Attachment 2 to RFLMA). Terminal pond discharges will be monitored by Points of Compliance (POCs) GS11, GS08, and GS31. Walnut Creek will be monitored at Indiana Street by POC GS03. Woman Creek will be monitored at Indiana Street by POC GS01. These locations are shown on Figure 6−3.

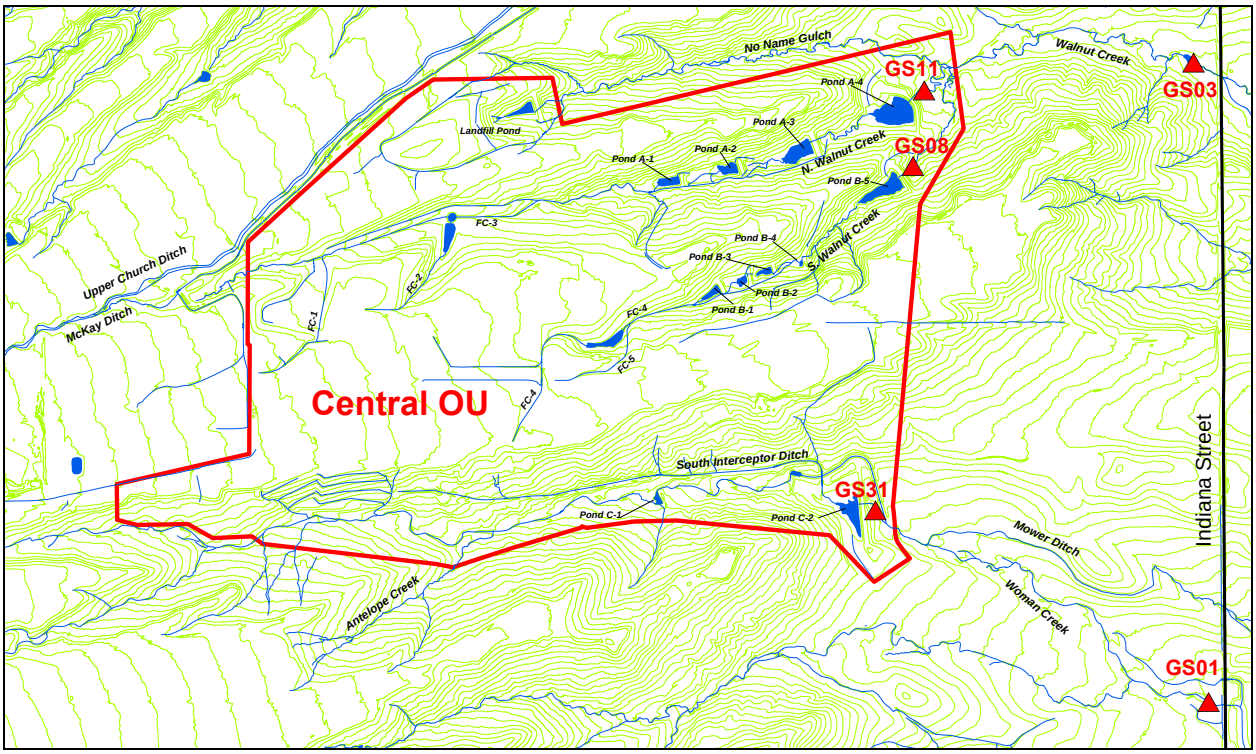



*Figure 6−3. POC Monitoring Locations*

#### *Data and Sample Collection Protocols*

Details on the instrumentation for the five POC locations are provided in Table 6−2. Continuous flow and precipitation data are collected using automated instrumentation (Table 6−3).[5] POCs collect continuous flow-paced composite samples for select analytes (Table 6−4). The method used to determine appropriate flow-pacing for composite samples is discussed in Section 8.1.1. Sample scheduling targets are listed in Table 6−5. Composite samples must be segregated based on water origin (natural creek flows or terminal pond discharges commingled with natural flows).

[5] Precipitation data are not required for this objective; flow measurement is required to flow-pace the automated samplers.

*Table 6−2. POC Monitoring Locations*

| Location Code | Location Description | Primary Flow Measurement Device | Telemetry? |
|---|---|---|---|
| GS01 | Woman Creek and Indiana Street | 18-inch Parshall Flume[a] | Yes |
| GS03 | Walnut Creek and Indiana Street | 3-foot HL-Flume | Yes |
| GS08 | Pond B-5 outlet | 24-inch Parshall Flume | Yes |
| GS11 | Pond A-4 outlet | 24-inch Parshall Flume | Yes |
| GS31 | Pond C-2 outlet | 24-inch Parshall Flume | Yes |

Notes: [a] This flume is located east on Indiana Street and is owned by the Woman Creek Reservoir Authority; DOE has a Use Agreement with the Woman Creek Reservoir Authority to use this flume (see Attachment A5); sampling for POC GS01 takes place west of Indiana Street within the Refuge boundary.

*Table 6−3. POC Field Data Collection: Parameters and Frequency*

| Location Code | Flow Rate | Precipitation |
|---|---|---|
| GS01 | 15-minute continuous | 5-minute continuous |
| GS03 | 15-minute continuous | 5-minute continuous |
| GS08 | 15-minute continuous | NA |
| GS11 | 15-minute continuous | NA |
| GS31 | 15-minute continuous | NA |

Notes: All locations collect both 5- and 15-minute interval flow data.
NA = not applicable

*Table 6−4. POC Sample Collection: Type and Analytes*

| Location Code | Type[a] | Analytes |
|---|---|---|
| GS01 | Continuous flow-paced composites | Pu-239,240; Am-241; isotopic U[b] |
| GS03 | Continuous flow-paced composites | Pu-239,240; Am-241; isotopic U[b]; nitrate[c] |
| GS08 | Continuous flow-paced composites | Pu-239,240; Am-241; isotopic U[b]; nitrate[c] |
| GS11 | Continuous flow-paced composites | Pu-239,240; Am-241; isotopic U[b]; nitrate[c] |
| GS31 | Continuous flow-paced composites | Pu-239,240; Am-241; isotopic U[b] |

Notes: [a]Sample types are defined in Section 8.1.1.
[b]Isotopes U-233,234; U-235; U-238
[c]Nitrate will be analyzed *only* at Walnut Creek POCs and *only* during terminal pond discharges. Nitrate is analyzed as nitrate+nitrite as N; this result is conservatively compared to the nitrate standard only.

*Table 6−5. Annual POC Monitoring Targets (Number of Composite Samples)*

| Time Period | Pond A-4 (GS11) | Pond B-5 (GS08) | Pond C-2 (GS31) | Walnut Creek at Indiana Street (GS03) | Woman Creek at Indiana Street (GS01) | Total Number of Samples |
|---|---|---|---|---|---|---|
| Discharges | 14 | 14 | 7 | 14 | 7 | 56 |
| **Storm and Baseflow[a]** | | | | | | |
| October | NA | NA | NA | 1 | 1 | 2 |
| November | NA | NA | NA | 1 | 1 | 2 |
| December | NA | NA | NA | 0 | 2 | 2 |
| January | NA | NA | NA | 0 | 2 | 2 |
| February | NA | NA | NA | 1 | 2 | 3 |
| March | NA | NA | NA | 4 | 4 | 8 |
| April | NA | NA | NA | 7 | 6 | 13 |
| May | NA | NA | NA | 4 | 6 | 10 |
| June | NA | NA | NA | 1 | 1 | 2 |
| July | NA | NA | NA | 0 | 0 | 0 |
| August | NA | NA | NA | 1 | 1 | 2 |
| September | NA | NA | NA | 0 | 0 | 0 |
| **Annual Total** | 14 | 14 | 7 | 34 | 33 | 102 |

Notes: [a]The storm and baseflow monthly sample distribution is based on expected water availability that is predicted from historic flow data. This distribution is intended to be periodically modified as additional flow data are collected.
NA = not applicable

With the removal of impervious surfaces at the Site, flow volumes have decreased significantly. In addition, hydrologic modeling and recent monitoring data have indicated that in a typical year with discharges taking place, estimated discharge volumes from Ponds A-4, B-5, and C-2 would be approximately 10 to 15, 5 to 10, and 3 to 5 MG, respectively. Based on variability of past monitoring data, and to achieve sufficient confidence for decision making, annual frequency targets for Pond A-4 will be one composite for every 900,000 gallons of discharge volume, targets for Pond B-5 will be one composite for every 500,000 gallons, and targets for Pond C-2 will be one composite for every 500,000 gallons. Additionally, no more than one composite per day of discharge will be collected for logistical purposes. For annual planning purposes, 14 composites will be collected from Pond A-4, 14 from Pond B-5, and 7 from Pond C-2, resulting in the collection of 35 total composite samples from terminal pond POCs (see Table 6−5).

The Indiana Street POCs collect the same number of samples as the terminal ponds during discharges, plus additional samples from storm runoff and baseflow between discharges. GS01 will collect seven samples for the expected Pond C-2 discharges. Storm runoff and baseflow samples will be collected based on historic flow data. Based on variability of past monitoring data and to achieve sufficient confidence for decision making, the frequency target for storm runoff and baseflow sampling at GS01 is 26 composites per year, with a maximum target of six samples during any one month (see Table 6−5).

GS03 will collect the targeted 14 samples during Pond A-4 and Pond B-5 discharges. GS03 will collect the same number of composite samples as the terminal pond POCs for each discharge. Ponds A-4 and B-5 will be discharged concurrently, where possible. Based on variability of past monitoring data and to achieve sufficient confidence for decision making, the frequency target

for storm runoff and baseflow sampling at GS03 is 20 composites per year, with a maximum target of seven samples during any one month (see Table 6−5).

The sample counts given in Table 6−5 are annual targets only. During dry years, it is unlikely the targets will be achieved.

***Data Evaluation***

Compliance with surface water quality standards (see Table 1 of Attachment 2 to RFLMA) at POCs is demonstrated according to the Figure 5 flowchart in RFLMA. Methods for calculating the appropriate compliance values are discussed in Section 8.2.1.

Generally, analytical data evaluation is performed as data become available. If an initial qualitative screening indicates an analytical result is higher than the standard for a particular analyte, then the compliance values are calculated immediately. If the compliance values suggest a reportable condition, then validation is requested for all data packages used in the calculation. The desired evaluation frequency is semimonthly, within 1 week of the 15th and last day of any given month.

### 6.1.2 POE Monitoring

This objective deals with monitoring runoff and baseflow from the interior of the COU to the A-, B-, and C-Series Ponds to evaluate water quality in comparison to surface water quality standards (see Table 1 of Attachment 2 to RFLMA). Surface water will be monitored by Points of Evaluation (POEs) SW093, GS10, and SW027 on North Walnut Creek, South Walnut Creek, and the SID, respectively. These locations are shown on Figure 6−4.

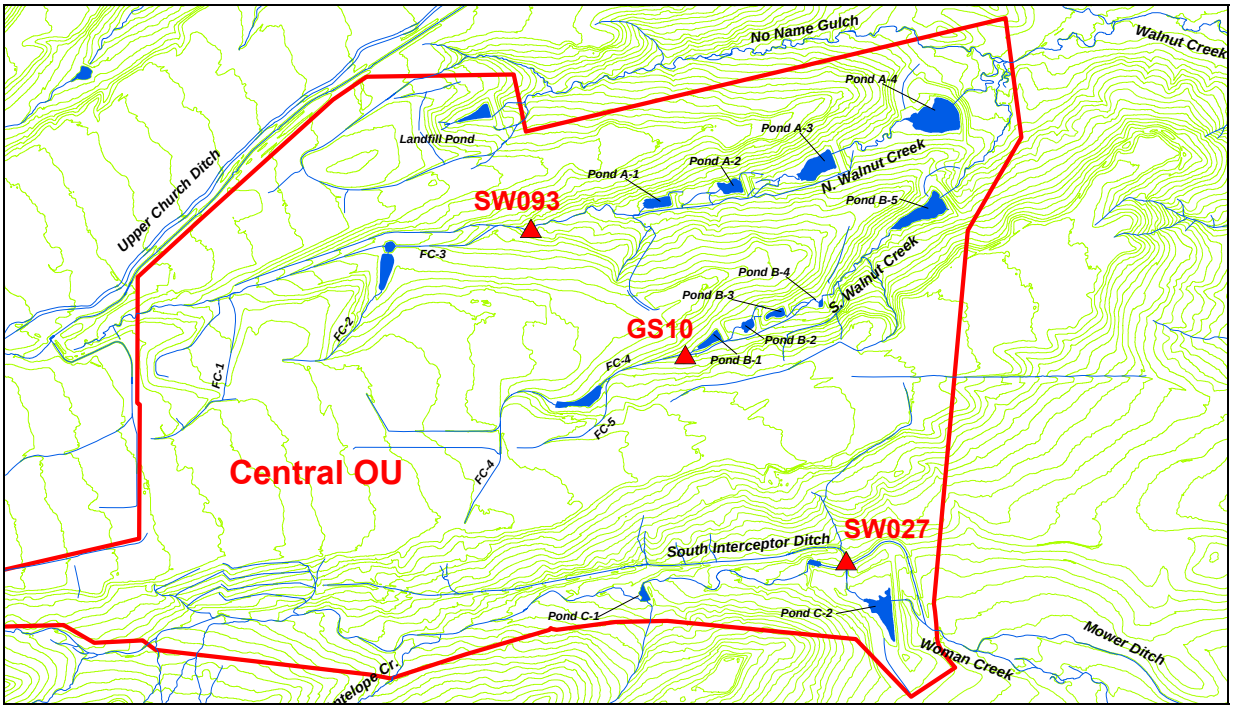



*Figure 6−4. POE Monitoring Locations*

### *Data and Sample Collection Protocols*

Details on instrumentation for the three POE locations are provided in Table 6−6. Continuous flow data are collected using automated instrumentation (Table 6−7). POEs collect continuous flow-paced composite samples for select analytes (Table 6−8). The method used to determine appropriate flow-pacing for composite samples is discussed in Section 8.1.1. Sample scheduling targets are listed in Table 6−9.

*Table 6−6. POE Monitoring Locations*

| Location Code | Location Description | Primary Flow Measurement Device | Telemetry? |
|---|---|---|---|
| GS10 | South Walnut Creek upstream from the B-1 Bypass | 9-inch Parshall Flume with weir insert | Yes |
| SW027 | SID just upstream of Pond C-2 | Dual Parallel 120° V-Notch Weirs | Yes |
| SW093 | North Walnut Creek 1,300 feet upstream from the A-1 Bypass | 3-foot H-Flume | Yes |

*Table 6−7. POE Field Data Collection: Parameters and Frequency*

| Location Code | Flow Rate |
|---|---|
| GS10 | 15-minute continuous |
| SW027 | 15-minute continuous |
| SW093 | 15-minute continuous |

Note: All locations collect both 5- and 15-minute interval flow data.

*Table 6−8. POE Sample Collection: Type and Analytes*

| Location Code | Type[a] | Analytes |
|---|---|---|
| GS10 | Continuous flow-paced composites | Pu-239,240; Am-241; isotopic U[b]; total Be and Cr; dissolved Cd and Ag |
| SW027 | Continuous flow-paced composites | Pu-239,240; Am-241; isotopic U[b]; total Be and Cr; dissolved Cd and Ag |
| SW093 | Continuous flow-paced composites | Pu-239,240; Am-241; isotopic U[b]; total Be and Cr; dissolved Cd and Ag |

Notes: [a]Sample types are defined in Section 8.1.1.
[b]Isotopes U-233,234; U-235; U-238

*Table 6−9. Annual POE Monitoring Targets (Number of Composite Samples)*

| Month | Number of Samples[a] | | | |
|---|---|---|---|---|
| | SW093 | GS10 | SW027 | Total |
| October | 1 | 2 | 1 | 4 |
| November | 1 | 1 | 0 | 2 |
| December | 1 | 1 | 0 | 2 |
| January | 1 | 0 | 0 | 1 |
| February | 0 | 1 | 1 | 2 |
| March | 2 | 2 | 2 | 6 |
| April | 2 | 4 | 5 | 11 |
| May | 2 | 3 | 3 | 8 |
| June | 1 | 1 | 0 | 2 |
| July | 1 | 2 | 1 | 4 |
| August | 2 | 2 | 1 | 5 |
| September | 0 | 1 | 0 | 1 |
| **Annual Total** | 16 | 20 | 14 | 50 |

Notes: [a] Monthly sample distribution is based on expected water availability that is predicted from historic flow data. This distribution is intended to be periodically modified as additional flow data are collected.

Based on variability of past monitoring data, and to achieve sufficient confidence for decision making, annual frequency targets for SW093, GS10, and SW027 will be 16, 20, and 14 composites, respectively. Additionally, no more than six composites per month will be targeted (see Table 6−9).

The sample counts listed in Table 6−9 are annual targets only. During dry years, it is unlikely the targets will be achieved.

***Data Evaluation***

Evaluation of analytical results in comparison to surface water quality standards (see Table 1 of Attachment 2 to RFLMA) at POEs is performed according to the Figure 6 flowchart in RFLMA. Methods for calculating the appropriate values for comparison are discussed in Section 8.2.1.

Generally, analytical data evaluation is performed as data become available. If an initial qualitative screening indicates an analytical result is higher than the standard for a particular analyte, then the compliance values are calculated immediately. If the compliance values suggest a reportable condition, then validation is requested for all data packages used in the calculation. The desired evaluation frequency is semimonthly, within a week of the 15th and the last day of any given month.

### 6.1.3 AOC Wells and SW018

Area of Concern (AOC) wells (Figure 6−5) are located to evaluate potential groundwater impacts to surface water. Impacts will be based on a minimum of two routinely scheduled sampling events in a row, not on a single data point. Analytical results from AOC wells are compared directly against the appropriate surface water standards in Table 1 of Attachment 2 to

RFLMA or the uranium threshold. Analytical data from surface water performance location SW018, where grab samples for VOCs are collected to support groundwater objectives, are assessed in a manner similar to data from AOC wells.

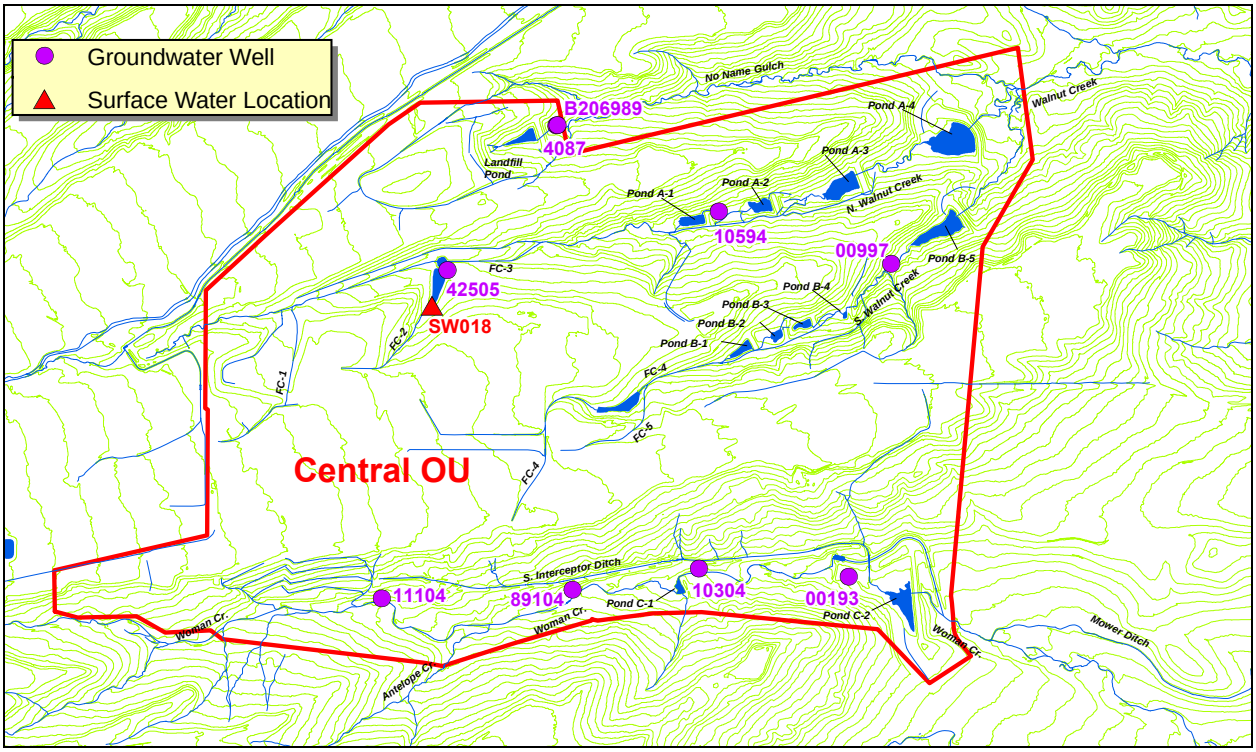



*Figure 6−5. AOC Well and SW018 Locations*

### *Data and Sample Collection Protocols*

General monitoring information for AOC wells and SW018 is provided in Table 6−10. Sampling frequencies are summarized in Table 6−11.

The data evaluation process guiding the use of analytical data from AOC wells and SW018 is shown on the Figure 7 flowchart in RFLMA (Attachment A2); because similar rules guide the use of data at Boundary wells, this figure applies to both well classifications.

Additional explanation is warranted for surface water station SW018, discussed here along with AOC wells. This location is in the unnamed tributary to North Walnut Creek that is part of the larger FC-2 drainage and is generally downgradient (west-northwest) of IHSS 118.1. This IHSS was the site of historic spills of carbon tetrachloride that created a pool of dense nonaqueous-phase liquid within an excavation formed in the lower-permeability claystone, in which a carbon tetrachloride tank was installed. The IHSS was remediated by source removal followed by backfilling the excavation with Hydrogen Release Compound® (HRC®) in 2004; however, an associated plume of VOC-contaminated groundwater persists. The historic flow direction of this plume was toward the west and the tributary to North Walnut Creek. The predicted post-closure flow direction is more northerly, generally toward Sentinel well 20505. To assess whether the plume is impacting surface water in the unnamed drainage, SW018 is monitored for VOCs.

*Table 6−10. AOC Wells and SW018*

| Location Code | Location Description | Analytes[a] |
|---|---|---|
| 00193 | Woman Creek upstream of Pond C-2 | VOCs, U |
| 00997 | South Walnut Creek upstream of Pond B-5 | VOCs, U, nitrate |
| 10304 | Southeast of 903 Pad/Ryan's Pit Plume at Woman Creek | VOCs, U, nitrate |
| 10594 | North Walnut Creek downstream of Pond A-1 | VOCs, U, nitrate |
| 11104 | Downgradient, downstream of the OLF; and downgradient of the IA Plume | VOCs, U |
| 4087 | Below Landfill Pond | VOCs, U, nitrate |
| 42505 | Terminus of FC-2 | VOCs |
| 89104 | Downgradient of OU 1 Plume at Woman Creek | VOCs |
| B206989 | Below Landfill Pond | VOCs, U, nitrate |
| SW018 | Upstream of FC-2 wetland | VOCs |

Notes: [a]Samples for the analysis of U will be field-filtered using a 0.45 micron in-line filter.
Nitrate is analyzed as nitrate+nitrite as N; this result is conservatively compared to the nitrate standard only.

*Table 6−11. Sampling Frequency for AOC Wells and SW018*

| Sampling Frequency | Timing | Schedule Considerations |
|---|---|---|
| Semiannual | Second and fourth calendar quarters (high- and low-water conditions, respectively) | Attempt to sample with other locations monitoring the same plume(s) |

### *Data Evaluation*

Compliance with surface water quality standards (see Table 1 of Attachment 2 to RFLMA) at AOC wells and SW018 is demonstrated by the Figure 7 flowchart in RFLMA. Analytical data evaluation is performed as data become available; this is necessary because of the strict timeline attached to “reportable conditions” for AOC wells (the requirement for SW018 is slightly different, as shown on the flowchart). In accordance with and as defined in RFLMA, if the data are confirmed to be valid and meet the requirements of a reportable condition, the reporting process is initiated.

The data will be reviewed to determine whether monitoring may be discontinued as upgradient monitoring ceases and analytical results at a given AOC well (or SW018) reach the exit requirements described on the data evaluation flowchart in RFLMA (Figure 7, Attachment A2). Once monitoring has ceased, corresponding data reviews, data reporting, and monitoring decisions will no longer be required.

## 6.1.4 Boundary Wells

Boundary wells (Figure 6−6) are located at the Walnut Creek/Indiana Street and Woman Creek/Indiana Street intersections and are monitored to assure surrounding stakeholders that groundwater leaving the historic RFP in these drainages is not adversely impacted by the Site.

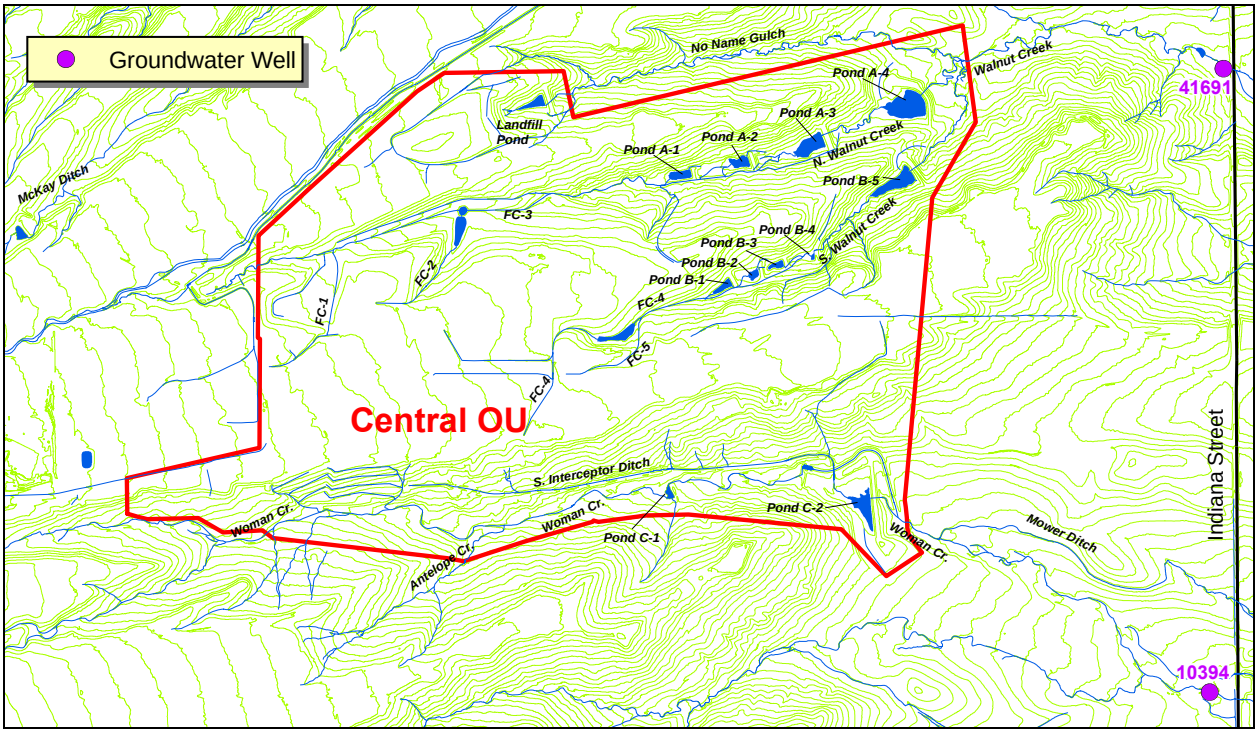



*Figure 6−6. Boundary Well Locations*

Boundary wells are not required by the CAD/ROD, nor have they supported the technical groundwater monitoring requirements defined by the preceding IMPs (e.g., DOE 2006e, 2006f). However, these wells are included in the network to satisfy operational monitoring requirements in RFLMA (Attachment A2).

### *Data and Sample Collection Protocols*

General monitoring information on Boundary wells is provided in Table 6−12. Sampling frequencies are summarized in Table 6−13.

*Table 6−12. Boundary Wells*

| Location Code | Location Description | Analytes[a] |
|---|---|---|
| 10394 | Woman Creek at Indiana Street | VOCs, U, nitrate |
| 41691 | Walnut Creek at Indiana Street | VOCs, U, nitrate |

Notes: [a]Samples for the analysis of U will be field-filtered using a 0.45 micron in-line filter.
Nitrate is analyzed as nitrate+nitrite as N; this result is conservatively compared to the nitrate standard only.

*Table 6−13. Sampling Frequency of Boundary Wells*

| Sampling Frequency | Timing | Schedule Considerations |
|---|---|---|
| Annual | Second calendar quarter (high-water conditions) | None |

The data evaluation process guiding the use of analytical data from Boundary wells is shown on the Figure 7 flowchart in RFLMA (Attachment A2); because similar rules guide the use of data at AOC wells and SW018, this figure applies to both well classifications.

***Data Evaluation***

Compliance with surface water quality standards (see Table 1 of Attachment 2 to RFLMA) at Boundary wells is demonstrated by the Figure 7 flowchart in RFLMA. Analytical data evaluation is performed as data become available; this is necessary because of the strict timeline attached to "reportable conditions" for Boundary wells. In accordance with and as defined in RFLMA, if the data are confirmed to be valid and meet the requirements of a reportable condition, the reporting process is initiated.

The determination of whether monitoring a Boundary well may cease will be made as upgradient monitoring ceases and analytical results at the Boundary well approach exit requirements. When upgradient wells are no longer monitored and concentrations in the Boundary well meet the applicable standards and/or uranium threshold, conditions will be reviewed with the regulatory agencies to seek approval to cease monitoring by well or analyte suite, as appropriate. Once monitoring has ceased, corresponding data reviews, data reporting, and monitoring decisions will no longer be required.

### 6.1.5 Sentinel Wells

Sentinel wells (Figure 6−7) are located near downgradient edges of contaminant plumes, in drainages, at groundwater treatment systems, and along contaminant pathways to surface water. These wells are monitored to determine whether concentrations of contaminants are increasing, thereby providing advance warning of potential groundwater quality impacts to the downgradient AOC well(s). Confirmation of a potential impact to downgradient wells will require an analytical record that consistently indicates an impact, not a single data point that indicates a contaminant has been detected.

Sentinel wells are used to monitor the performance of an accelerated action (including soil/source removals, in situ contaminant plume treatment, groundwater intercept components of treatment systems, and facility demolitions) and assess contaminant trends at important locations. Data from Sentinel wells are supplemented by those from Evaluation wells and are used to determine when monitoring may cease or additional remedial work should be considered.

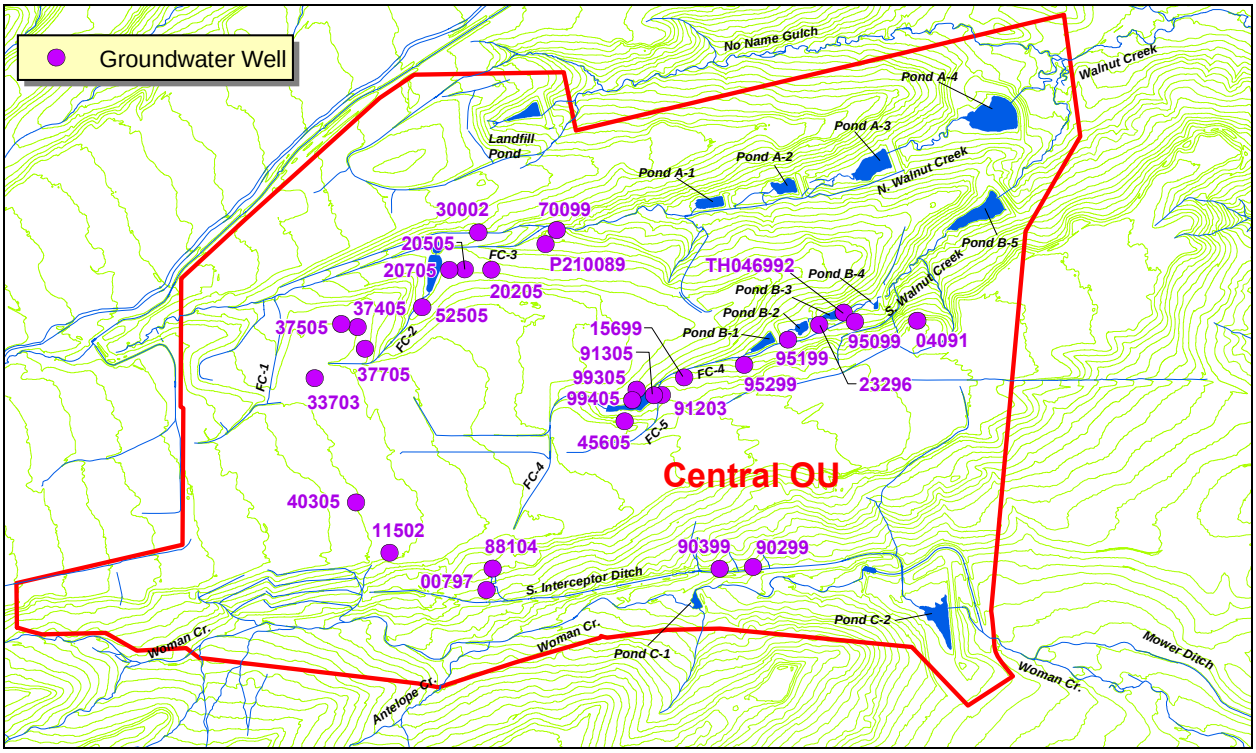



*Figure 6−7. Sentinel Well Locations*

### *Data and Sample Collection Protocols*

General monitoring information for Sentinel wells is provided in Table 6−14. Sampling frequencies are summarized in Table 6−15.

*Table 6−14. Sentinel Wells*

| Location Code | Location Description | Analytes[a] |
|---|---|---|
| 00797 | South of former Building 881 (B881) area | VOCs, U |
| 04091 | East of source area | VOCs |
| 11502 | Southeast of former B444 area | VOCs, U |
| 15699 | Downgradient of MSPTS intercept trench | VOCs |
| 20205 | North/northeast of former B771/774 area | VOCs, U, Pu, Am |
| 20505 | North of former B771/774 area | VOCs, U, Pu, Am |
| 20705 | North/northwest of former B771 area | VOCs, U, nitrate, Pu, Am |
| 23296 | Downgradient of ETPTS intercept trench | VOCs, U |
| 30002 | Downgradient at North Walnut Creek | VOCs |
| 33703 | Downgradient of source area | VOCs |
| 37405 | North/northeast part of former B371/374 area | VOCs, U, nitrate, Pu, Am |
| 37505 | North part of former B371 area | VOCs, U, nitrate |
| 37705 | East/southeast of former B371/374 area at foundation drain confluence | VOCs, U, nitrate, Pu, Am |
| 40305 | East part of former B444 area | VOCs, U |
| 45608 | Adjacent to remnants of SW056 French drain and drain interruption[b] | VOCs |
| 52505 | West of former IHSS 118.1 area | VOCs |
| 70099 | Northwest (sidegradient) of SPPTS intercept trench | U, nitrate |
| 88104 | South part of former B881 area | VOCs, U |
| 90299 | Southeast part of 903 Pad/Ryan's Pit Plume at SID | VOCs |
| 90399 | Southeast part of 903 Pad/Ryan's Pit Plume at SID | VOCs |
| 91203 | Downgradient of Oil Burn Pit #2 source area | VOCs |
| 91305 | South of confluence of FC-4 and FC-5 | VOCs, U, nitrate |
| 95099 | Downgradient of ETPTS intercept trench | VOCs |
| 95199 | Downgradient of ETPTS intercept trench | VOCs |
| 95299 | Downgradient of ETPTS intercept trench | VOCs |
| 99305 | East part of former B991 area | VOCs, U, nitrate |
| 99405 | Southeast part of former B991 area | VOCs, U, nitrate |
| P210089 | Downgradient (north) portion of SPP | VOCs, U, nitrate |
| TH046992 | Downgradient of ETPTS intercept trench | VOCs |

Notes: [a]Samples for the analysis of U, Pu, and Am will be field-filtered using a 0.45 micron in-line filter.
Nitrate is analyzed as nitrate+nitrite as N; this result is conservatively compared to the nitrate standard only.
[b]Until RFLMA is updated to reflect a well replacement made in 2008, the requirements applying to well 45608 refer instead to well 45605.
SPP = Solar Ponds Plume

*Table 6−15. Sampling Frequency for Sentinel Wells*

| Sampling Frequency | Timing | Schedule Considerations |
|---|---|---|
| Semiannual | Second and fourth calendar quarters (high- and low-water conditions, respectively) | Attempt to sample with other locations monitoring the same plume(s)/area(s) |

***Data Evaluation***

Analytical data from Sentinel wells are evaluated according to the Figure 8 flowchart in the RFLMA (Attachment A2).Analytical data evaluation may be performed as data become available, but only needs to be reported in the corresponding annual report. For a discussion on the statistical analysis of data, see Section 8.2.2

If groundwater quality is worsening and fails the criteria described on the Figure 8 flowchart in RFLMA, more thorough assessment and investigation is required. If the 85th percentile concentration of a constituent of interest is greater than the corresponding surface water standard or uranium threshold, as appropriate (Criterion 1), **and** concentrations exhibit a statistically significant increasing trend at 95 percent confidence (Criterion 2), data from the Sentinel wells and upgradient wells will be reviewed. Possible causal factors and conditions will be identified, and actions that may either alleviate these factors and conditions or characterize them adequately for the appropriate action to be identified will be proposed. The analytical data and this discussion will be included in the subsequent periodic report.

Conversely, as monitoring ceases in upgradient wells (i.e., wells monitoring an area of interest or source area where there is a potential for groundwater contamination to migrate to a given Sentinel well), consideration of the exit strategy is warranted. When upgradient monitoring ceases (either entirely or for a given analyte or suite of analytes) and groundwater quality in the given Sentinel well meets both criteria described on the Figure 8 flowchart in RFLMA (Attachment A2), discussions with the regulatory agencies regarding exiting monitoring (again, either entirely or for a given analyte or suite of analytes) will be initiated. If more than one Sentinel well is in the same downgradient direction of the area or plume of interest (as is the case with Sentinel wells 88104 and 00797 downgradient of former Building 881, or wells 90299 and 90399 monitoring the Ryan's Pit/903 Pad Plume), it may be that each of these wells will need to satisfy the exit criteria before discontinuing monitoring. Review of data to determine whether monitoring may cease will be performed as upgradient monitoring and analytical results approach exit requirements. Once monitoring has ceased, corresponding data reviews, data reporting, and monitoring decisions will no longer be required.

### 6.1.6 Evaluation Wells

Evaluation wells (Figure 6−8) are located within groundwater contaminant plumes and near plume source areas, and within the interior of the COU at the Site. As such, they may monitor the effects of accelerated actions that have been performed (e.g., source removal and in-situ treatment). Data from these Evaluation wells are therefore appropriate to determine whether monitoring of a particular plume and source area may cease, and provide data to support the determination of whether corresponding groundwater plume treatment systems may be decommissioned. In addition, Evaluation wells are used to support any groundwater evaluations that may be needed as a result of changing contaminant characteristics in downgradient Sentinel and/or AOC wells. Data from these wells also assist evaluations of predictions made through groundwater modeling efforts.

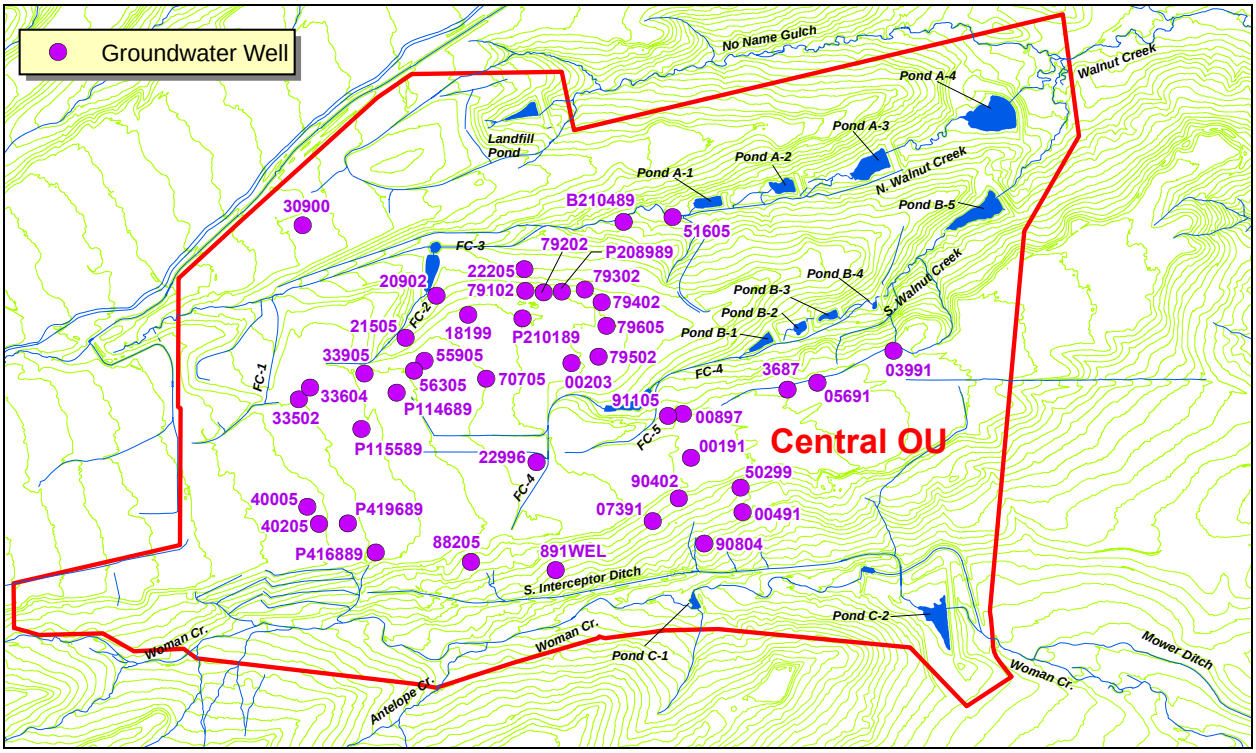



*Figure 6−8. Evaluation Well Locations*

### *Data and Sample Collection Protocols*

General monitoring information for Evaluation wells is provided in Table 6−16. Sampling frequencies are summarized in Table 6−17.

*Table 6−16. Evaluation Wells*

| Location Code | Location Description | Analytes[a] |
|---|---|---|
| 00191 | East of former 903 Pad area | VOCs |
| 00203 | Downgradient (south) portion of SPP | VOCs, U |
| 00491 | Southeast of former 903 Pad area | VOCs |
| 00897 | Mound Site source area | VOCs |
| 3687 | East Trenches source area | VOCs |
| 03991 | East of East Trenches source area | VOCs |
| 05691 | East Trenches source area | VOCs |
| 07391 | Ryan's Pit source area | VOCs |
| 18199 | North of former IHSS 118.1 source area | VOCs |
| 20902 | Northwest of former IHSS 118.1 source area | VOCs |
| 21505 | West of former B776/777 area | VOCs |
| 22205 | Downgradient (north) portion of SPP | VOCs, U |
| 22996 | East/northeast part of former B886 area | U, nitrate |
| 30900 | PU&D Yard Plume source area | VOCs, U, nitrate |
| 33502 | Oil Burn Pit #1 source area | VOCs, U, nitrate |
| 33604 | Oil Burn Pit #1 source area | VOCs, U, nitrate |
| 33905 | North of former 231 Tanks area | VOCs |
| 40005 | West part of former B444 area | VOCs |
| 40205 | South part of former B444 end | VOCs, U |
| 50299 | East of former 903 Pad area | VOCs |
| 51605 | Downgradient, adjacent to GS13 | VOCs, U |
| 55905 | North part of former B559 area | VOCs |
| 56305 | West part of former B559 area | VOCs |
| 70705 | East part of former B707 area | VOCs |
| 79102 | SPP source area - north | VOCs, U, nitrate |
| 79202 | SPP source area - north | VOCs, U, nitrate |
| 79302 | SPP source area - northeast | U, nitrate |
| 79402 | SPP source area - northeast | U, nitrate |
| 79502 | SPP source area - east | VOCs, U, nitrate |
| 79605 | SPP source area - east | VOCs |
| 88205 | South part of former B881 area | U, nitrate |
| 891WEL | OU1 Plume source area | U, nitrate |
| 90402 | Southeast of former 903 Pad area | VOCs, U |
| 90804 | Southeast part of 903 Pad/Ryan's Pit Plume | VOCs |
| 91105 | Oil Burn Pit #2 source area | U, nitrate |
| B210489 | Downgradient of SPPTS | VOCs, U |
| P210189 | SEP-area VOC plume source area | VOCs, U, nitrate |
| P208989 | SPP source area - north | VOCs, U, nitrate |
| P114689 | Southwest of former B559 area | VOCs, U |
| P115589 | West part of former B551 Warehouse area | VOCs, U |
| P419689 | Southeast of former B444 area | VOCs |
| P416889 | Southeast of former B444 area | VOCs |

Notes: [a]Samples for the analysis of U will be field-filtered using a 0.45 micron in-line filter.
Nitrate is analyzed as nitrate+nitrite as N; this result is conservatively compared to the nitrate standard only.

*Table 6−17. Sampling Frequency for Evaluation Wells*

| Sampling Frequency | Timing | Schedule Considerations |
|---|---|---|
| Biennial (every 2 years) | Second calendar quarter (high-water conditions) | Attempt to sample with other locations monitoring the same plume(s)/area(s) |

***Data Evaluation***

Analytical data from Evaluation wells are assessed according to the Figure 9 flowchart in RFLMA (Attachment A2). Analytical data evaluation may be performed as data become available, but only need to be reported in the corresponding annual report.

Review of data to determine whether monitoring may cease will be performed as analytical results approach exit requirements. When concentrations in a well exhibit a statistically significant decreasing trend at the 95 percent confidence level, **or** the 85th percentile concentration is less than the corresponding surface water standard or Evaluation well uranium threshold, then conditions will be reviewed with the regulatory agencies to seek approval to exit monitoring by well or analyte suite, as appropriate. Once monitoring has ceased, corresponding data reviews, data reporting, and monitoring decisions will no longer be required.

### 6.1.7 Investigative Monitoring

When reportable water-quality measurements are detected by surface water monitoring at POEs or POCs, additional monitoring may be required to identify[6] the source and evaluate for mitigating action. Although not required by RFLMA, this investigative monitoring objective is intended to provide upstream water-quality information if reportable water-quality values are detected at POEs or POCs. Data collection is generally limited to POE and POC analytes and is intended to be discontinued once acceptable water quality has been demonstrated at POEs and POCs for an extended period.

Data collection is currently implemented at the locations shown on Figure 6−9 and described in Table 6−18. The majority of these locations are sampled primarily to satisfy other monitoring objectives, although the data are used for this investigative objective. The current locations were not chosen in response to a specific source evaluation. They were chosen preemptively as a BMP immediately following completion of the RFP/RFETS Closure Project and are intended to be discontinued under this monitoring objective based on data evaluation. Any future data collection upstream of POEs and POCs, subject to the consultative process, is not limited to the locations on Figure 6−9. The parties may also elect to collect data using other methods, subject to the characteristics of the reportable water-quality values and through the consultative process.

[6] Note that the term “identify” is used here to mean “locate.” Characterization is also implied.

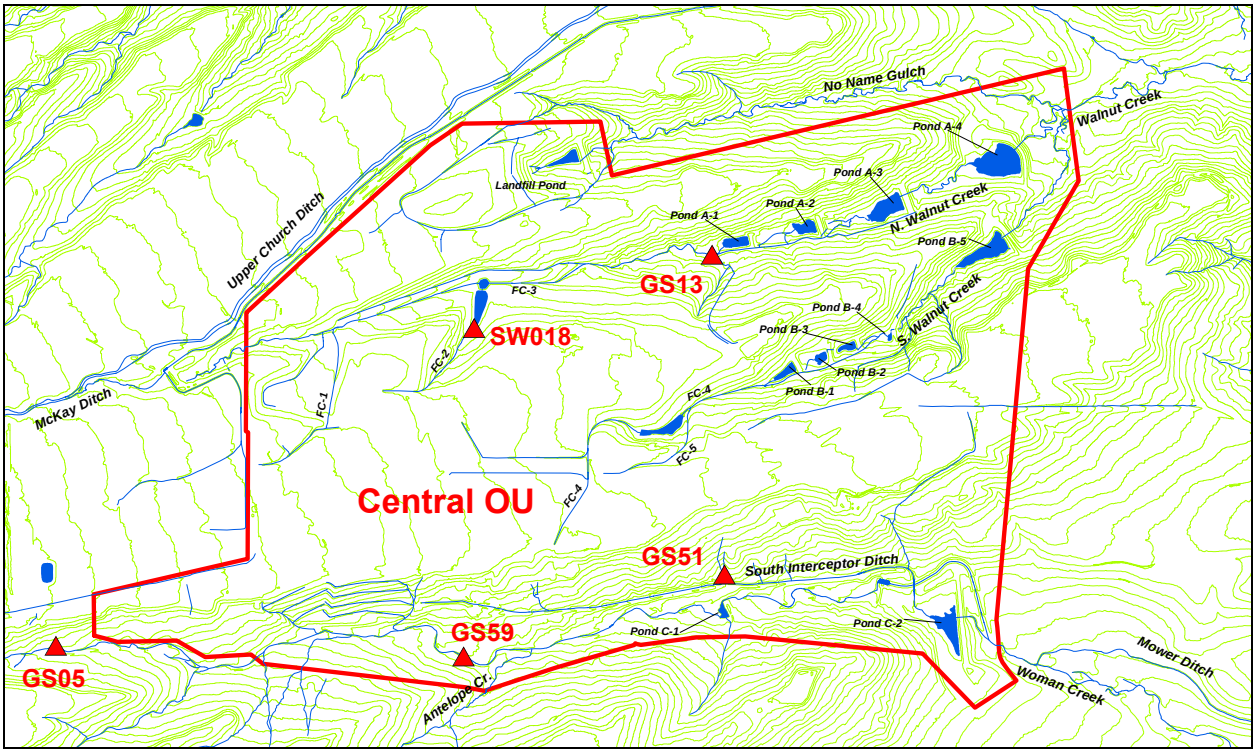



*Figure 6−9. Investigative Monitoring Locations*

*Table 6−18. Investigative Monitoring Locations*

| Location Code | Location Description | Primary Flow Measurement Device | Telemetry? |
|---|---|---|---|
| GS05 | Woman Creek at western Site boundary | 9-inch Parshall flume with weir insert | Yes |
| GS13 | North Walnut Creek just upstream of A-Series Bypass | 6-inch Parshall flume | Yes |
| GS51 | Drainage area south of 903 Pad/Lip tributary to the SID | 0.75-foot H-flume | Yes |
| GS59 | Woman Creek 700 feet east of Original Landfill | 1.5-foot Parshall flume | Yes |
| SW018 | North Walnut Creek tributary west of former B771 area | 1-foot H-flume | Yes |

### *Data and Sample Collection Protocols*

Details on instrumentation for the five current investigative locations are provided in Table 6−18. Continuous flow and precipitation data are currently collected using automated instrumentation (Table 6−19). Investigative locations currently collect continuous flow-paced composite samples for select analytes (Table 6−20). Table 6−20 also lists the primary monitoring objectives as applicable; these are the objectives required by RFLMA. Although the primary monitoring objective may require fewer samples than specified under this investigative objective, the additional data are expected to also be used under the primary objective. The method used to determine appropriate flow-pacing for composite samples is discussed in Section 8.1.1. Sample scheduling targets are listed in Table 6−21.

*Table 6−19. Investigative Field Data Collection: Parameters and Frequency*

| Location Code | Flow Rate | Precipitation |
|---|---|---|
| GS05 | 15-minute continuous | 5-minute continuous |
| GS13 | 15-minute continuous | 5-minute continuous |
| GS51 | 15-minute continuous | NA |
| GS59 | 15-minute continuous | 5-minute continuous |
| SW018 | 15-minute continuous | 5-minute continuous |

Note: All locations collect both 5- and 15-minute interval flow data. NA = not applicable

*Table 6−20. Investigative Sample Collection: Type and Analytes*

| Location Code | Type[a] | Analytes | Primary Monitoring Objective |
|---|---|---|---|
| GS05 | Continuous flow-paced composites[b] | isotopic U[c] | OLF Monitoring |
| GS13 | Continuous flow-paced composites[b]; grabs[d] | isotopic U[c]; nitrate[d] | Groundwater Treatment System Monitoring |
| GS51 | Continuous flow-paced composites | Pu-239,240; Am-241; TSS[e] | Investigative Monitoring |
| GS59 | Continuous flow-paced composites[b] | isotopic U[c] | OLF Monitoring |
| SW018 | Continuous flow-paced composites | Pu-239,240; Am-241; TSS[e] | Investigative Monitoring |

Notes: [a]Sample types are defined in Section 8.1.1.
[b]Only grab sampling, not flow-paced sampling, is required by the primary monitoring objective; flow-paced sampling is implemented at these locations for the Investigative objective.
[c]Isotopes U-233,234; U-235; U-238
[d]Nitrate will be collected at GS13 as semiannual grab samples. Nitrate is analyzed as nitrate+nitrite as N; this result is conservatively compared to the nitrate standard only.
[e]Total suspended solids (TSS) is analyzed when the composite sampling period is within TSS hold-time limits.

*Table 6−21. Investigative Monitoring Targets (Number of Composite Samples)*

| Month | Number of Samples | | | | |
|---|---|---|---|---|---|
| | GS05 | GS13 | GS51 | GS59 | SW018[a] |
| October | 1 | 1 | 1 | 1 | 1 |
| November | 0 | 0 | 0 | 0 | 1 |
| December | 1 | 1 | 0 | 1 | 0 |
| January | 0 | 0 | 0 | 0 | 0 |
| February | 0 | 0 | 1 | 0 | 1 |
| March | 2 | 1 | 1 | 2 | 0 |
| April | 3 | 2 | 2 | 3 | 2 |
| May | 1 | 1 | 1 | 1 | 1 |
| June | 0 | 1 | 1 | 0 | 1 |
| July | 0 | 0 | 0 | 0 | 1 |
| August | 0 | 1 | 1 | 0 | 0 |
| September | 0 | 0 | 0 | 0 | 0 |
| **Annual Total** | 8 | 8 | 8 | 8 | 8 |

Notes: [a]According to Figure 6−10 and through the consultative process, samples collected at SW018 will no longer be routinely analyzed starting in FY 2008. Samples at SW018 will continue to be collected and archived for 6 months. If reportable values are subsequently observed at a downstream POE or POC, the archived samples may be analyzed as part of a source evaluation (see Section 9.6) subject to the consultative process.

Based on variability of past monitoring data and to achieve sufficient confidence for decision making, frequency targets for all investigative locations will be eight composites annually. Additionally, no more than six composites per month will be targeted (see Table 6−21).

The sample counts listed in Table 6−21 are targets only. During dry years, it is unlikely the targets will be achieved.

***Data Evaluation***

Data collected at investigative monitoring locations are evaluated based on their ability to aid in a specific source evaluation. These evaluations include, but are not limited to, loading, fate and transport, correlations and trending, and other statistical evaluations (see Section 9.6 for additional information).

As stated previously, the current locations were not chosen in response to a specific source evaluation. They were chosen preemptively as a BMP immediately following completion of the RFP/RFETS Closure Project and are intended to be discontinued under this monitoring objective based on data evaluation. Decisions regarding the termination of data collection in support of investigative monitoring at the current locations (Figure 6−9) will be made according to the flowchart on Figure 6−10.

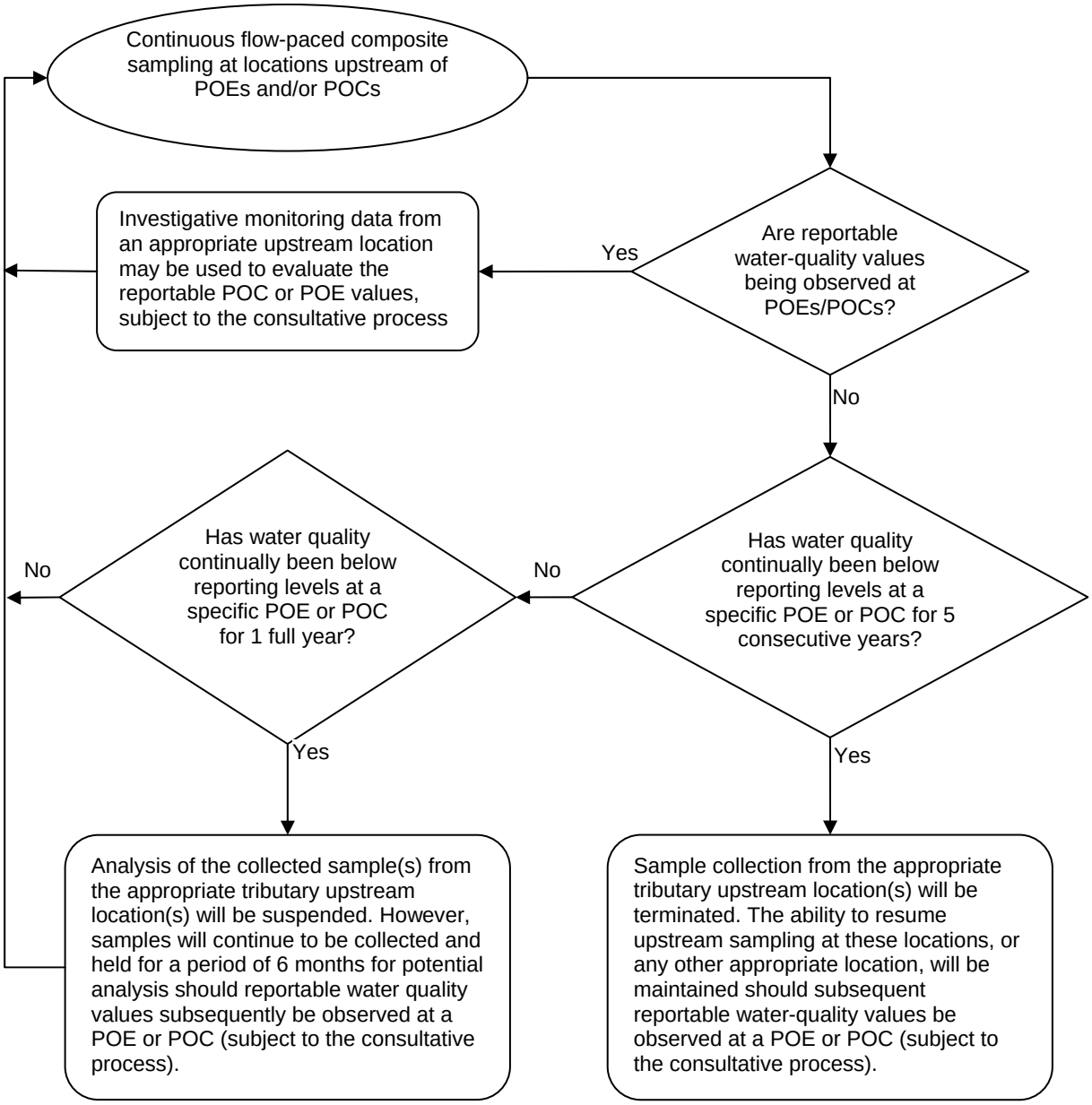
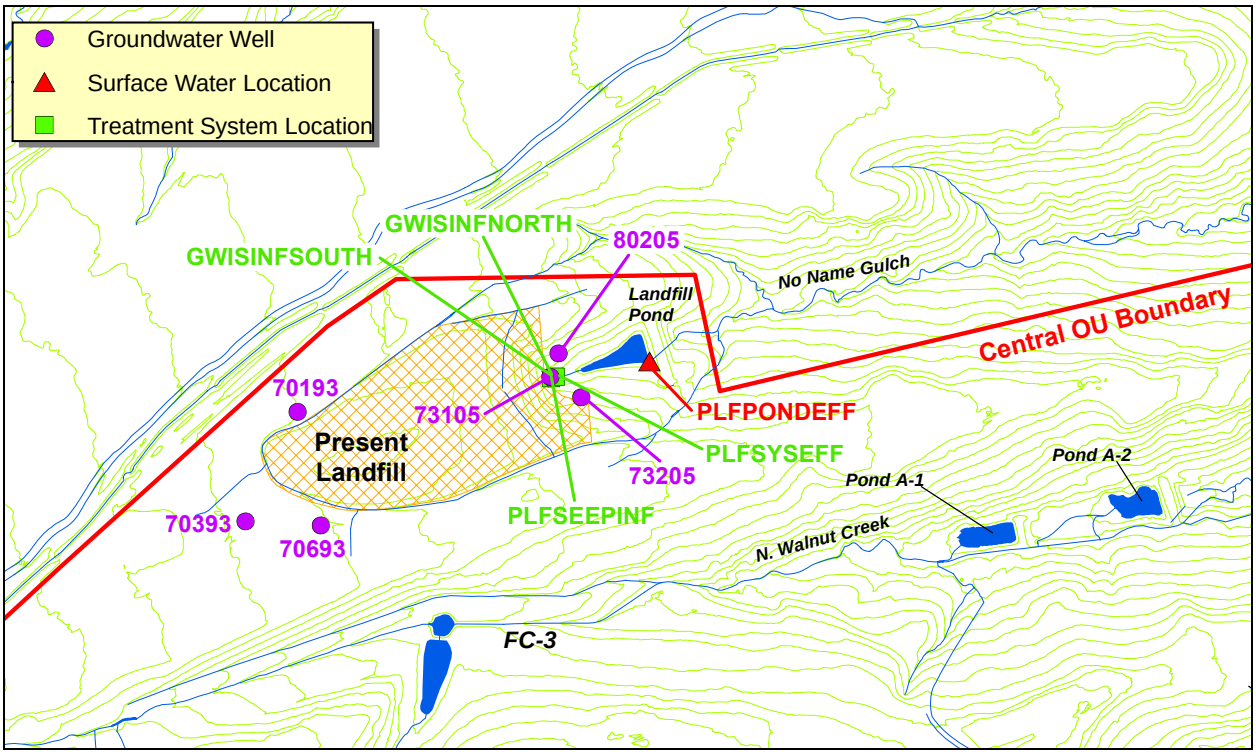



*Figure 6−10. Investigative Monitoring Flowchart*

### 6.1.8 PLF Monitoring

This objective deals with monitoring surface water and groundwater at the PLF to determine the short- and long-term effectiveness of the remedy. These requirements were initially identified in Appendix B of the *Final Interim Measure/Interim Remedial Action for IHSS 114 and RCRA Closure of the RFETS Present Landfill* (DOE 2004a) and finalized in the PLF M&M Plan (Attachment D2).

Water monitoring locations for the PLF are shown on Figure 6−11. The surface water and treatment system monitoring requirements that deal specifically with the PLFTS are discussed in detail in Section 6.1.10. Details regarding general groundwater monitoring are provided below.




Note: PLFSYSEFF serves as both the treatment system effluent and performance surface water location. Routine monitoring of GWISINFNORTH and GWISINFSOUTH has been discontinued as of FY 2008.

*Figure 6−11. PLF Monitoring Locations*

#### *Data and Sample Collection Protocols*

Monitoring wells supporting the PLF are classified as RCRA wells. Three of these wells are located upgradient of the landfill, and three are downgradient of the landfill but upgradient of the Landfill Pond. This network and the monitoring requirements are specified in the PLF M&M Plan (Attachment D2). Prior to late 2005 when this network was finalized, a different set of monitoring wells comprised the RCRA network for the PLF. As a result of this change, data from the current network cannot be compared accurately against data from the older network. Additional monitoring wells are present in the general vicinity of the PLF; however, they do not contribute to the RCRA monitoring of the facility and therefore are addressed elsewhere.

General monitoring information for the RCRA wells at the PLF is provided in Table 6−22. Sampling frequencies are summarized in Table 6−23.

*Table 6−22. RCRA Monitoring Wells at the PLF*

| Location Code | Location Description | Analytes[a] |
|---|---|---|
| 70193 | Upgradient (northwest) of the upgradient end of the PLF | VOCs, metals |
| 70393 | Upgradient (west/southwest) of the upgradient end of the PLF | VOCs, metals |
| 70693 | Upgradient (southwest) of the upgradient end of the PLF | VOCs, metals |
| 73005 | Downgradient (northeast) of the downgradient end of the PLF | VOCs, metals |
| 73105 | Downgradient (east) of the downgradient end of the PLF at the PLFTS | VOCs, metals |
| 73205 | Downgradient (southeast) of the downgradient end of the PLF | VOCs, metals |

Notes: [a]Samples for the analysis of metals will be field-filtered using a 0.45 micron in-line filter. Laboratory analytes and analytical methods are limited to those listed in the PLF M&M Plan (Attachment D2).

*Table 6−23. Sampling Frequency for RCRA Wells at the PLF*

| Sampling Frequency | Timing | Schedule Considerations |
|---|---|---|
| Quarterly | Each calendar quarter | Attempt to sample all RCRA wells at the PLF as a group; if possible, also sample other PLF-area wells at the same time |

***Data Evaluation***

Analytical data from RCRA wells at the PLF are assessed according to the Figure 10 flowchart in RFLMA (Attachment A2). Because similar rules guide the use of data at the OLF RCRA wells, this figure applies to both sets of RCRA wells.

Groundwater analytical data are generally reviewed as they become available and are formally evaluated annually. As shown on the Figure 10 flowchart in RFLMA (Attachment A2), this evaluation is designed to assess whether mean concentrations in downgradient wells are statistically different from those in upgradient wells, and whether concentrations show a significant increasing trend.

Review of data to determine whether monitoring may cease will be performed as described on the Figure 10 flowchart in RFLMA (Attachment A2) and will be based on the two previous periodic reviews. If the 85th percentile concentrations in each downgradient well are less than or equal to the applicable standards and indicate an indeterminate or decreasing trend at the 95 percent confidence level, termination of monitoring will be sought in discussions with the regulatory agencies. Once monitoring has ceased, corresponding data reviews, data reporting, and monitoring decisions will no longer be required.

### 6.1.9 OLF Monitoring

This objective deals with monitoring surface water and groundwater at the OLF to determine the short- and long-term effectiveness of the remedy. These requirements were initially identified in

the *Draft Final IM/IRA of IHSS Group SW-2, IHSS 115, Original Landfill and IHSS 196, Filter Backwash Pond*, Appendix B: Post-Accelerated Action Monitoring and Long-Term Surveillance and Monitoring Considerations (DOE 2004b). They were finalized in the OLF M&M Plan (Attachment D1). Water monitoring locations for the OLF are shown on Figure 6−12.

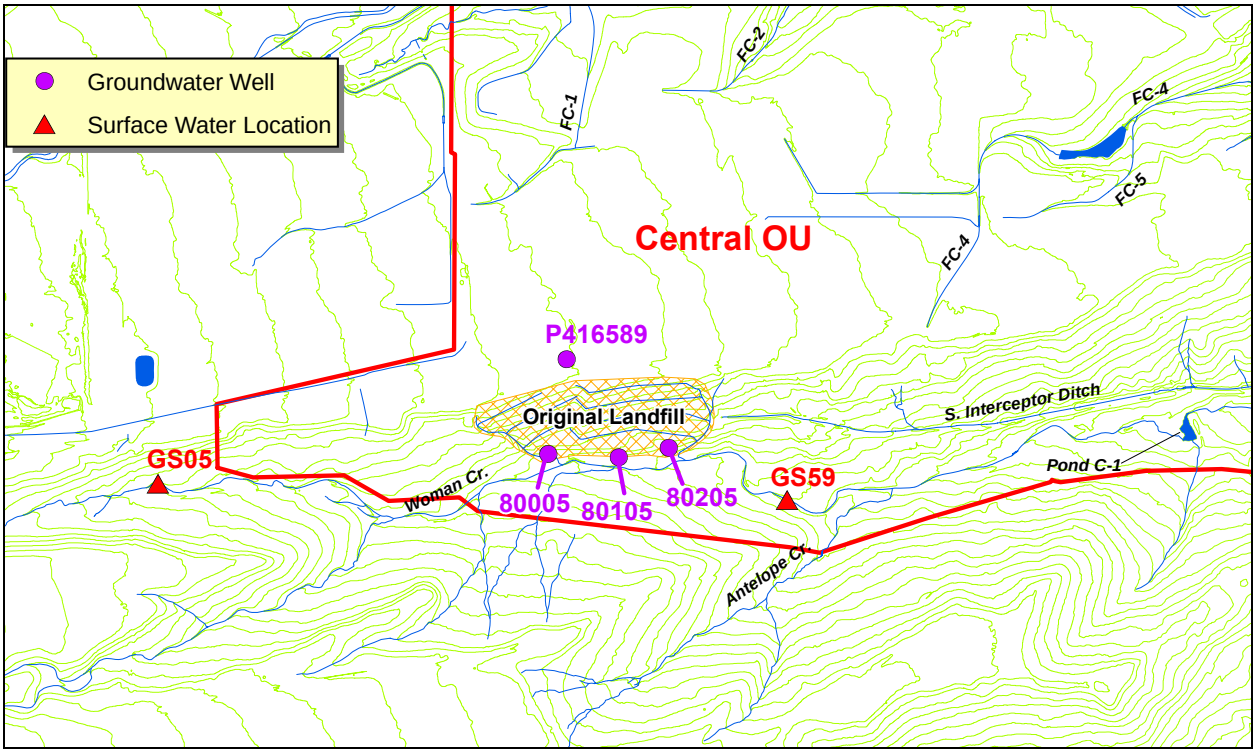



*Figure 6−12. OLF Monitoring Locations*

### *Data and Sample Collection Protocols*

Surface water in Woman Creek will be sampled both upstream (GS05) and downstream (GS59) of the OLF (Table 6−24). Table 6−25 presents a list of the analytes sampled for as part of the OLF surface water sampling.

*Table 6−24. OLF Surface Water Monitoring Locations*

| Location Code | Location Description | Primary Flow Measurement Device | Telemetry? |
|---|---|---|---|
| GS05 (upstream) | Woman Creek at western Site boundary | 9-inch Parshall flume with weir insert | Yes |
| GS59 (downstream) | Woman Creek 700 feet east of the OLF | 1.5-foot Parshall flume | Yes |

*Table 6−25. OLF Surface Water Sample Collection: Type and Analytes*

| Location Code | Type | Frequency | Analytes[a] |
|---|---|---|---|
| GS05 | Grabs | Quarterly | isotopic U[b]; total and dissolved metals; VOCs |
| GS59 | Grabs | Quarterly | isotopic U[b]; total and dissolved metals; VOCs |

Notes: [a]Laboratory analytes and analytical methods are limited to those listed in the OLF M&M Plan (Attachment D1).
[b]Isotopes U-233,234; U-235; U-238

Because complying with RCRA is an applicable or relevant and appropriate requirement (ARAR) at the OLF, the monitoring wells supporting the OLF are classified as RCRA wells. One is located upgradient of the landfill, and three are downgradient of the landfill but upgradient of Woman Creek. This network and the monitoring requirements are specified in the OLF M&M Plan (Attachment D1). Although earlier groundwater data exist for the OLF, RCRA monitoring at the landfill was not performed prior to late 2005 when this network was finalized. Additional monitoring wells are present in the general vicinity of the OLF; however, they do not contribute to the RCRA monitoring and are addressed elsewhere.

General monitoring information for RCRA wells at the OLF is provided in Table 6−26. Sampling frequencies are summarized in Table 6−27.

*Table 6−26. RCRA Monitoring Wells at the OLF*

| Location Code | Location Description | Analytes[a] |
|---|---|---|
| P416589 | Upgradient (north) of the OLF | VOCs, SVOCs, metals |
| 80005 | Downgradient (south) of the western portion of the OLF | VOCs, SVOCs, metals |
| 80105 | Downgradient (south) of the central portion of the OLF | VOCs, SVOCs, metals |
| 80205 | Downgradient (south) of the eastern portion of the OLF | VOCs, SVOCs, metals |

Notes: [a]Samples for the analysis of metals will be field-filtered using a 0.45-µm in-line filter.
Laboratory analytes and analytical methods are limited to those listed in the OLF M&M Plan (Attachment D1).
SVOC = semivolatile organic compound

*Table 6−27. Sampling Frequency for RCRA Wells at the OLF*

| Sampling Frequency | Timing | Schedule Considerations |
|---|---|---|
| Quarterly | Each calendar quarter | Attempt to sample all RCRA wells at the OLF as a group; if possible, also sample other OLF-area wells at the same time |

### *Data Evaluation*

Compliance with surface water quality standards at the OLF is demonstrated by the Figure 12 flowchart in RFLMA (Attachment A2). Generally, surface water analytical data evaluation is performed as data become available. If an initial qualitative screening indicates an analytical result is higher than the standard for a particular analyte, then the compliance values are

calculated immediately. If the compliance values suggest initiation of the consultative process, then validation is requested for all data packages used in the calculation.

Analytical data for RCRA wells at the OLF are assessed according to the Figure 10 flowchart in RFLMA (Attachment A2). Because similar rules guide the use of data at the PLF RCRA wells, this figure applies to both sets of RCRA wells.

Groundwater analytical data are generally reviewed as they become available, and are formally evaluated annually. As shown on the Figure 10 flowchart in RFLMA (Attachment A2), this evaluation is designed to assess whether mean concentrations in downgradient wells are statistically different from those in upgradient wells, and whether downgradient concentrations show a significant increasing trend and the 85th percentile concentration is above the applicable standard. This latter component of the comparison is modeled after the statistical evaluation of Sentinel well data; see the Figure 10 flowchart in RFLMA (Attachment A2) for the associated data evaluation process.

Data will be reviewed, as described on the Figure 10 flowchart in RFLMA (Attachment A2), to determine whether monitoring may cease. This review will be based on the results of upgradient/downgradient water quality comparisons, 85th percentile concentrations in each downgradient well, and trending. Once monitoring has ceased, corresponding data reviews, data reporting, and monitoring decisions will no longer be required.

### 6.1.10 Groundwater Treatment System Monitoring

Contaminated groundwater is intercepted and treated in four areas of the Site. Three of the treatment systems (MSPTS, ETPTS, and SPPTS) include a groundwater intercept trench (collection trench), which is similar to a French drain with an impermeable membrane on the downgradient side. Groundwater entering the trench is routed through a drain pipe into one or more treatment cells, where it is treated and then discharged to surface water. The fourth system (PLFTS) treats water from the north and south components of the GWIS and flow from the PLF Seep.

The MSPTS was installed in 1998, the ETPTS and SPPTS were installed in 1999, and the PLFTS was installed in 2005. Additional information on these systems is provided below and in the O&M Manual for Groundwater Treatment Systems (Attachment C1). Although additional information for these systems is available in many documents, the following original decision documents may be most helpful:

- *Final Mound Site Plume Decision Document* (DOE 1997);
- *Final Proposed Action Memorandum for the East Trenches Plume* (DOE 1999a);
- *Final Solar Ponds Plume Decision Document* (DOE 1999b); and
- PLF M&M Plan (Attachment D2).

Water monitoring for the MSPTS, ETPTS, and SPPTS includes a minimum of three sample collection points each: untreated influent entering the treatment system, treated effluent exiting the system, and a surface water performance location. At the PLFTS, the treated effluent and surface water sampling locations are typically the same; this is discussed in further detail below.

The fundamental questions at each system are whether (1) influent water quality indicates treatment is still necessary, (2) effluent water quality indicates system maintenance is required, and (3) surface water quality suggests impacts from inadequate treatment of influent.

***Mound Site Plume Treatment System***

As noted above, the MSPTS was installed in 1998; it was the first such system at the Site. Because components of this passive treatment system represented new technology at the time, EPA partially funded its installation. VOC-contaminated groundwater collects in the intercept trench and is piped to treatment cells filled with zero-valent iron (ZVI), which treats the VOCs by means of reductive dechlorination. Because this system experienced a significant change in 2005 in the amount of water it receives, the following information is included to provide additional background.

The MSPTS was originally designed to intercept and treat a plume of contaminated groundwater migrating toward South Walnut Creek from the Mound Site (also referred to simply as the Mound and designated as IHSS 113), from which contaminated soils were removed in 1997 (Figure 6−13). Since 2005, the MSPTS also intercepts and treats contaminated groundwater from Oil Burn Pit #2 (IHSS 153) as it migrates toward South Walnut Creek. Contaminated soil was removed from Oil Burn Pit #2 in 2005. Groundwater at both of these source areas is monitored using Evaluation wells (well 00897 for the Mound, 91105 for Oil Burn Pit #2).

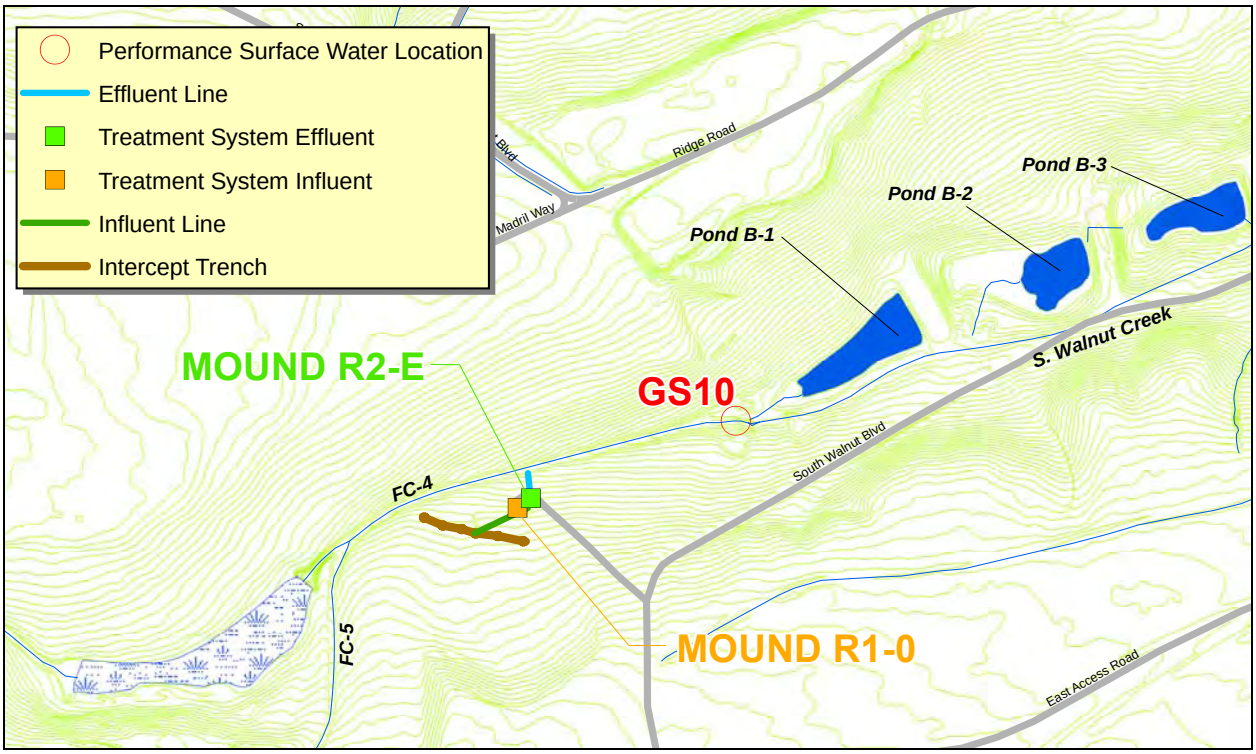



*Figure 6−13. MSPTS Monitoring Locations*

During Site closure efforts in 2005, a 72-inch storm drain that extended north from the area of Oil Burn Pit #2 to South Walnut Creek was removed. To address the potential for contaminants

discharging to South Walnut Creek via the preferential flow path represented by the remaining backfilled trench, a gravel drain was installed to divert groundwater from this trench to the MSPTS intercept trench. Influent to the MSPTS increased by roughly an order of magnitude following this activity, from approximately 0.1 to 0.2 gallon per minute (gpm) or less to slightly more than 1.0 gpm. It has since decreased to approximately 0.6 to 0.7 gpm, based on data for 2007.

Shortly after this linkage was formed, the MSPTS effluent water quality degraded. Constituents such as tetrachloroethene, trichloroethene, and cis-1,2-dichloroethene were detected in the effluent, and concentrations appeared to be increasing (DOE 2006c). Simultaneously, crusting and solidification of the ZVI in the cells significantly decreased media permeability. The MSPTS media was replaced in summer 2006 to address the decrease in treatment effectiveness. At the same time, additional automated instrumentation was installed at the MSPTS to support the O&M of this system by allowing Site personnel to optimize the performance of the treatment cells, thereby reducing the frequency of costly ZVI replacements. For additional information on system maintenance and operation, refer to the O&M Manual for Groundwater Treatment Systems (Attachment C1).

#### *Data and Sample Collection Protocols*

Monitoring locations specific to the MSPTS are displayed on Figure 6−13. General monitoring information for these locations is provided in Table 6−28. Sampling frequencies are summarized in Table 6−29. In addition to the monitoring locations shown, several piezometers are present within the collection trench. Although these are no longer routinely monitored, they are retained for troubleshooting purposes as described in the O&M Manual for Groundwater Treatment Systems (Attachment C1).

*Table 6−28. MSPTS Sampling Locations*

| Location Code | Location Description | Analytes[a] |
|---|---|---|
| Mound R1-0 | Influent sampling location | VOCs |
| Mound R2-E | Effluent sampling location | VOCs |
| GS10 | Downgradient surface water performance location | VOCs |

Notes: [a]Samples for the analysis of VOCs at all of the above locations will be collected as grab samples. Other required GS10 monitoring objectives and samples are not addressed here.

*Table 6−29. Sampling Frequency for MSPTS Sampling Locations*

| Sampling Frequency | Timing | Schedule Considerations |
|---|---|---|
| Semiannual | Second and fourth calendar quarters (high- and low-water conditions) | Attempt to sample all MSPTS-area locations as a group |

#### *Data Evaluation*

The data evaluation process guiding the use of analytical data for the MSPTS locations is shown on the Figure 11 flowchart in RFLMA (Attachment A2). Because similar rules guide the use of data at the ETPTS, SPPTS, and PLFTS, this figure applies to those systems as well.

Compliance with surface water quality standards (Table 1 of Attachment 2 to RFLMA) at the MSPTS is demonstrated by the Figure 11 flowchart in RFLMA. Generally, analytical data evaluation is performed as data become available. This is particularly important for VOC data from performance location GS10, as described below. If the data suggest additional system maintenance is required, additional inspections and data collection are performed to confirm and support this issue. Data are reported in the corresponding quarterly report and evaluated in the annual report.

In addition to the increase in flows, influent water quality also changed significantly following connection of the Oil Burn Pit #2 pathway to the MSPTS intercept trench. Residual contamination in the Oil Burn Pit #2 source area was addressed during the accelerated action at that location via the addition of HRC® to the excavation backfill. As a result, degradation byproducts are seen at markedly higher concentrations in MSPTS influent than was the case prior to the connection with the Oil Burn Pit #2 pathway. Some of these byproducts are recalcitrant and resist complete removal via ZVI treatment, which can result in their detection in treated effluent. Consultation on this subject with CDPHE was held in 2008; the conclusion at that time was that as long as surface water performance samples continue to show water quality meets RFLMA Table 1 standards, no action beyond continued monitoring and evaluation is required. Therefore, prompt review of GS10 VOC data is warranted, and regular communication with the lead regulatory agency is important to ensure awareness of current conditions.

The determination of whether the MSPTS may be closed is made using influent water quality data and in consultation with the regulatory agencies. Once monitoring has ceased, corresponding data reviews, data reporting, and monitoring decisions will no longer be required.

***East Trenches Plume Treatment System***

The ETPTS treated an annual average of approximately 1.8 gpm in 2007; however, previous annual averages have ranged from approximately 1 to 4 gpm. This system was installed in 1999. It is modeled after the MSPTS and consists of a groundwater intercept trench that collects and diverts VOC-contaminated groundwater to cells containing ZVI, which treats the water (Figure 6−14). Completion of the groundwater intercept trench was difficult because of repeated sloughing of the trench sides, particularly where the trench intersects the basal Arapahoe Formation sandstone. Since installation, the ETPTS has required more frequent ZVI replacement than originally anticipated due to reduced permeability of the iron caused by the media becoming clogged with mineral precipitates. Following completion of the RFP/RFETS Closure Project and transfer of operations to DOE-LM, additional automated instrumentation was installed at the ETPTS. This instrumentation is intended to support the O&M of this system by allowing Site personnel to optimize the performance of the treatment cells, thereby reducing the frequency of costly ZVI replacements. For additional information on system maintenance and operation, refer to the O&M Manual for Groundwater Treatment Systems (Attachment C1).

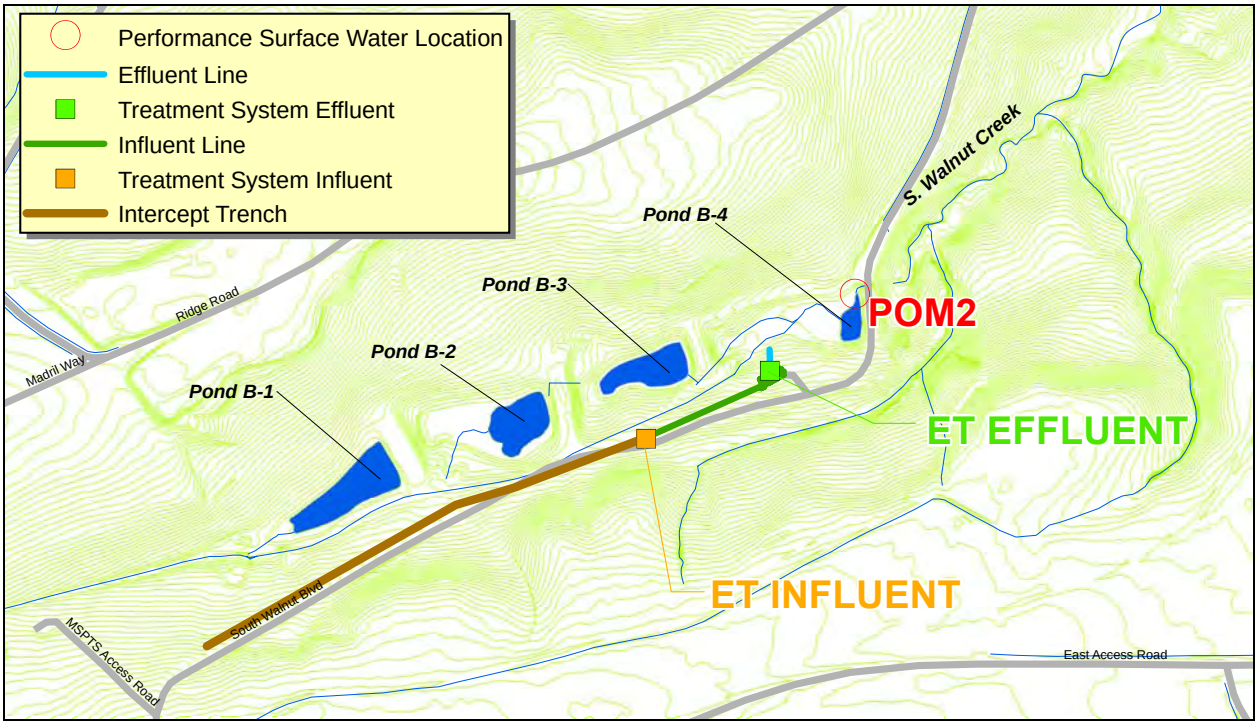



*Figure 6−14. ETPTS Monitoring Locations*

### *Data and Sample Collection Protocols*

Monitoring locations specific to the ETPTS are displayed on Figure 6−14. General monitoring information for these locations is provided in Table 6−30. Sampling frequencies are summarized in Table 6−31. In addition to the monitoring locations shown, several piezometers are present within the collection trench. Although these are no longer routinely monitored, they are retained for troubleshooting purposes as described in the O&M Manual for Groundwater Treatment Systems (Attachment C1).

*Table 6−30. ETPTS Sampling Locations*

| Location Code | Location Description | Analytes[a] |
|---|---|---|
| ET INFLUENT | Influent sampling location | VOCs |
| ET EFFLUENT | Effluent sampling location | VOCs |
| POM2 | Downgradient surface water performance location | VOCs |

Notes: [a]Samples for the analysis of VOCs at all of the above locations will be collected as grab samples.

*Table 6−31. Sampling Frequency for ETPTS Sampling Locations*

| Sampling Frequency | Timing | Schedule Considerations |
|---|---|---|
| Semiannual | Second and fourth calendar quarters (high- and low-water conditions) | Attempt to sample all ETPTS-area locations as a group |

### *Data Evaluation*

The data evaluation process guiding the use of analytical data from ETPTS locations is shown on the Figure 11 flowchart in RFLMA (Attachment A2). Because similar rules guide the use of data at the MSPTS, SPPTS, and PLFTS, this figure applies to those systems as well.

Compliance with surface water quality standards (Table 1 of Attachment 2 to RFLMA) at the ETPTS is demonstrated by the Figure 11 flowchart in RFLMA. Generally, analytical data evaluation is performed as data become available. If the data suggest additional system maintenance is required, additional inspections and data collection are performed to confirm and support this issue. Data are reported in the corresponding quarterly report and are evaluated in the annual report.

As with the MSPTS, VOCs may be detected in ETPTS effluent, a condition that was discussed with CDPHE in 2008. The conclusion at that time was that as long as surface water performance samples continue to show water quality meets RFLMA Table 1 standards, no action beyond continued monitoring and evaluation are required. Prompt review of POM2 VOC data is therefore warranted, and regular communication with the lead regulatory agency is important to ensure awareness of current conditions.

In FY 2009, the dams for Ponds B-1, B-2, B-3, and B-4 (as well as several in the A-series) will be breached. This should not affect operation of the ETPTS, but will require replacement of POM2 given that the original location will be within the footprint of the construction activities. As with the replacement of any required monitoring location, CDPHE shall be consulted in advance of establishing the replacement location to ensure it is acceptable.

The determination of whether the ETPTS may be closed is made using influent water quality data and in consultation with the regulatory agencies. Once monitoring has ceased, corresponding data reviews, data reporting, and monitoring decisions will no longer be required.

### *Solar Ponds Plume Treatment System*

The SPPTS was installed in 1999 to treat elevated concentrations of nitrate and uranium in groundwater (Figure 6−15). The media in this system includes one cell containing sawdust and ZVI, and a second containing gravel and ZVI. Treated effluent is routed through a perforated line remaining from the older Intercept Trench System and discharged to the subsurface. This is why samples collected from the discharge area have elevated nitrate and uranium levels even though system effluent itself is adequately treated. Planning is underway to address this condition by installing a sump, collecting the untreated water downgradient of the system, and pumping it up to the system for treatment. Additionally, a new effluent line will be used so that treated water is not recontaminated before discharge. Revisions to the content, design, and operation of the treatment cells are also under consideration.

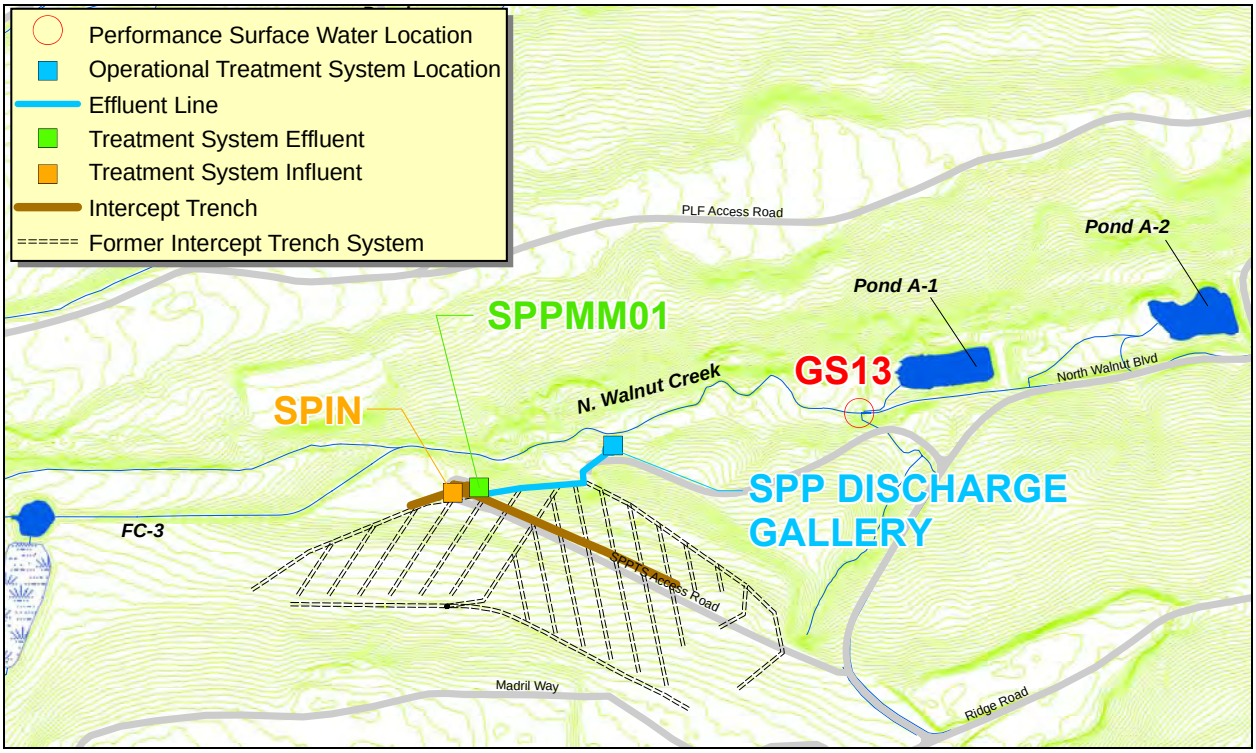



*Figure 6−15. SPPTS Monitoring Locations*

In 2005, the gravel/ZVI media was replaced in the second cell of the SPPTS, just prior to completion of the RFP/RFETS Closure Project. This was in response to plugging of the media with wood fragments from the first cell. Following this activity, effluent water quality with respect to nitrate was poor. After several unsuccessful attempts to address this issue using less-intrusive means, excavation and inspection of the system in the summer of 2006 identified numerous plumbing problems. These were repaired, and since that time, effluent water quality has met treatment objectives; however, periods in which flows are relatively high caused the objectives to be temporarily exceeded.

Flow through the SPPTS has historically varied from 0 gpm (no flow) to at least 7 gpm; annual averages are under 1 gpm (the average for 2007 was approximately 0.5 gpm). However, following construction of the collection sump and addition of water from downgradient of the system, it is expected that higher flow rates will be observed.

When this RFSOG is updated in 2009, the text addressing the SPPTS will be updated to reflect the changes to the system that are ultimately made. Changes will also be made to the O&M Manual for Groundwater Treatment Systems (Attachment C1). Refer to that document for additional information on system maintenance.

***Data and Sample Collection Protocols***

Monitoring locations specific to the SPPTS are presented on Figure 6−15. General monitoring information for these locations is provided in Table 6−32. Sampling frequencies are summarized in Table 6−33. In addition to the monitoring locations, several piezometers were installed within

the collection trench. Although these are no longer routinely monitored, they are retained for troubleshooting purposes as described in the O&M Manual for Groundwater Treatment Systems (Attachment C1).

*Table 6−32. SPPTS Sampling Locations*

| Location Code | Location Description | Analytes[a] |
|---|---|---|
| SPIN | Influent sampling location | U, nitrate |
| SPPMM01 | Effluent sampling location | U, nitrate |
| GS13 | Downgradient surface water performance location | U, nitrate |

Notes: [a]Influent and effluent samples for the analysis of U will be filtered in the field using a 0.45 µm in-line filter. Samples collected for U at GS13 will typically be flow-paced, unfiltered, and analyzed for U isotopes; however, if desired they may be collected as grab samples and filtered consistent with influent and effluent collection methods. U data at GS13 support other monitoring objectives that are not addressed here.
Nitrate is analyzed as nitrate+nitrite as N; this result is conservatively compared to the nitrate standard only.

*Table 6−33. Sampling Frequency for SPPTS Sampling Locations*

| Sampling Frequency | Timing | Schedule Considerations |
|---|---|---|
| Semiannual | Second and fourth calendar quarters (high- and low-water conditions) | Attempt to sample all SPPTS-area locations as a group |

#### *Data Evaluation*

The data evaluation process guiding the use of analytical data from SPPTS locations is shown on the Figure 11 flowchart in RFLMA (Attachment A2). Because similar rules guide the use of data at the MSPTS, ETPTS, and PLFTS, this figure applies to those systems as well.

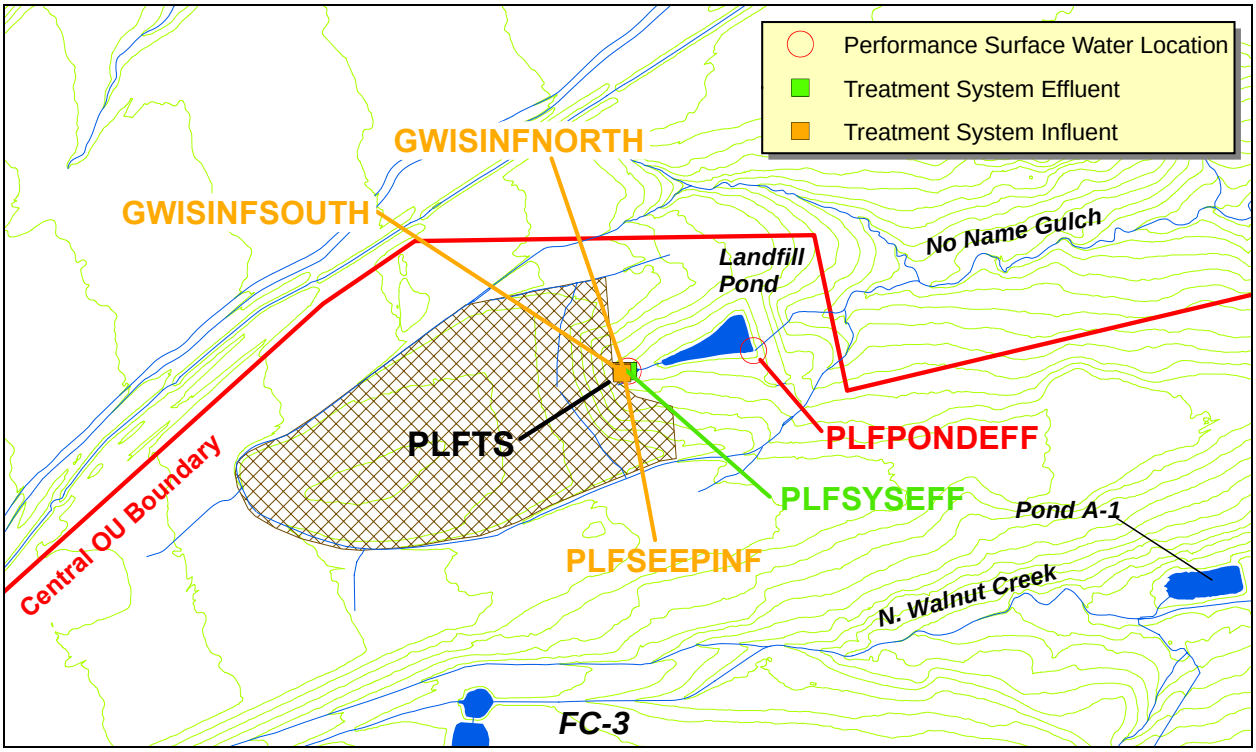
Compliance with surface water quality standards (Table 1 of Attachment 2 to RFLMA) at the SPPTS is demonstrated by the Figure 11 flowchart in RFLMA. Generally, analytical data evaluation is performed as data become available. If the data suggest additional system maintenance is required, additional inspections and data collection are performed to confirm and support this issue. Data are reported in the corresponding quarterly report and are evaluated in the annual report.

The determination of whether the SPPTS may be closed is made using influent water quality data and in consultation with the regulatory agencies. Once monitoring has ceased, corresponding data reviews, data reporting, and monitoring decisions will no longer be required.

### *Present Landfill Treatment System*

This objective deals with monitoring the PLFTS to determine the short- and long-term effectiveness of the remedy. These requirements were initially identified in the *Final Interim Measures/Interim Remedial Action for IHSS 114 and RCRA Closure of the RFETS Present Landfill*, Appendix B: Post-Accelerated Action Monitoring and Long-Term Surveillance and Monitoring Considerations (DOE 2004a), and finalized in the PLF M&M Plan (Attachment D2).

Water monitoring locations for the PLFTS and sampling location details are shown on Figure 6−16. Groundwater monitoring for the PLF is discussed in detail in the section above. Details regarding PLFTS monitoring are provided below.




Note: PLFSYSEFF serves as both the treatment system effluent and a performance surface water monitoring location.

*Figure 6−16. PLFTS Monitoring Locations*

### *Data and Sample Collection Protocols*

The PLFTS is routinely sampled at the treatment system influent and effluent sampling location (National Pollutant Discharge Elimination System [NPDES] outfall (Table 6−34 and Table 6−35). Routine sampling of GWISINFNORTH and GWISINFSOUTH has been discontinued but is included in the evaluations required in RFLMA Attachment 2, Figure 11. These sampling locations may be used for investigation purposes. Additional monitoring detail is included in the PLF M&M Plan (Attachment D2).

*Table 6−34. PLFTS Water Monitoring Locations*

| Location Code | Location Description |
|---|---|
| PLFSEEPINF | Seep influent to treatment system |
| GWISINFNORTH | North GWIS influent to treatment system |
| GWISINFSOUTH | South GWIS influent to treatment system |
| PLFSYSEFF | PLFTS effluent |
| PLFPONDEFF | Landfill Pond water near pond discharge location (east end) |

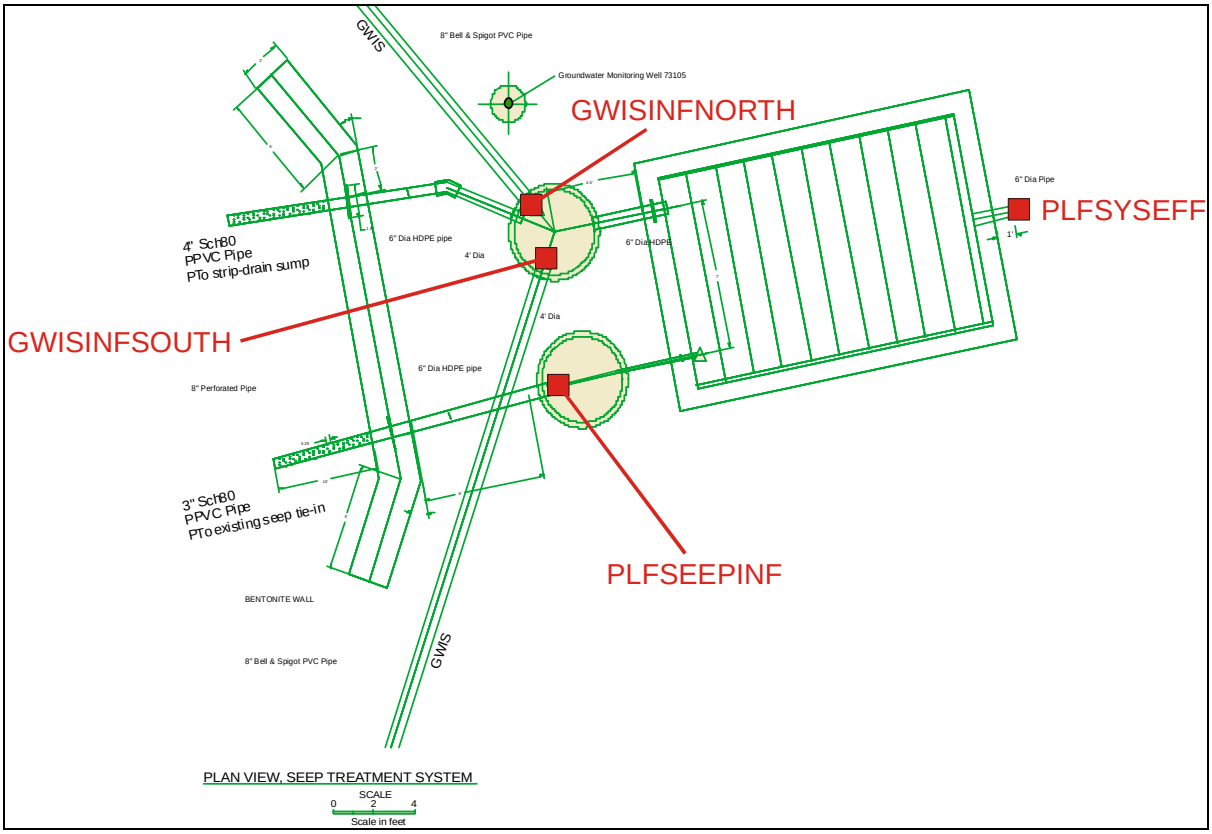



*Figure 6−17. PLFTS Sampling Locations (Detail)*

*Table 6−35. PLFTS Sample Collection: Type and Analytes*

| Location Code | Type | Frequency | Analytes[a] |
|---|---|---|---|
| PLFSEEPINF | Grabs | Quarterly | Isotopic U[b]; total and dissolved metals; VOCs; manual flow measurement (field) |
| GWISINFNORTH[d] | Grabs | Discontinued | NA |
| GWISINFSOUTH[d] | Grabs | Discontinued | NA |
| PLFSYSEFF | Grabs | Quarterly; monthly by decision[c] | Isotopic U[b]; total and dissolved metals; VOCs; SVOCs |
| PLFPONDEFF | Grabs | Determined by decision[c] | Determined by decision[c] |

Notes: [a]Laboratory analytes and analytical methods are limited to those listed in the PLF M&M Plan (Attachment D2).
[b]Isotopes U-233,234; U-235; U-238
[c]Refer to the decision logic on the Figure 11 flowchart in RFLMA (Attachment A2).
Nitrate is analyzed as nitrate+nitrite; the nitrate+nitrite result is conservatively compared to the nitrate standard only.
[d]According to the Figure 11 flowchart in RFLMA (Attachment A2) and through the consultative process, samples will no longer be collected from the GWIS starting in FY 2008.

### *Data Evaluation*

Compliance with surface water quality standards (Table 1 of Attachment 2 to RFLMA) at the PLFTS is demonstrated by the Figure 11 flowchart in RFLMA. Because similar rules guide the use of data at the MSPTS, ETPTS, and PLFTS, this figure applies to those systems as well.

Generally, analytical data evaluation is performed as data become available. If an initial qualitative screening indicates an analytical result is higher than the standard for a particular analyte, then the compliance values are calculated immediately. If the compliance values suggest initiation of the consultative process, then validation is requested for all data packages used in the calculation.

The determination of whether the PLFTS may be closed is made using influent water quality data and in consultation with the regulatory agencies. Once monitoring has ceased, corresponding data reviews, data reporting, and monitoring decisions will no longer be required. The decision to end monitoring at the PLFTS will be documented in a RFLMA Contact Record and incorporated into Attachment 2 to RFLMA during the next revision of RFLMA. The PLF M&M Plan (Attachment D2) would also need to be modified to reflect the end of operation of the treatment system.

### 6.1.11 Pre-Discharge Monitoring

This monitoring objective deals with pre-discharge sampling of Ponds A-4, B-5, and C-2, or any other upstream pond functioning as a terminal pond, as a BMP to indicate compliance with surface water quality standards (Table 1 of Attachment 2 to RFLMA) at the downstream POCs. Pre-discharge samples will be collected at Ponds A-4, B-5, and C-2 on North Walnut Creek, South Walnut Creek, and Woman Creek, respectively. These locations are shown on Figure 6−18.

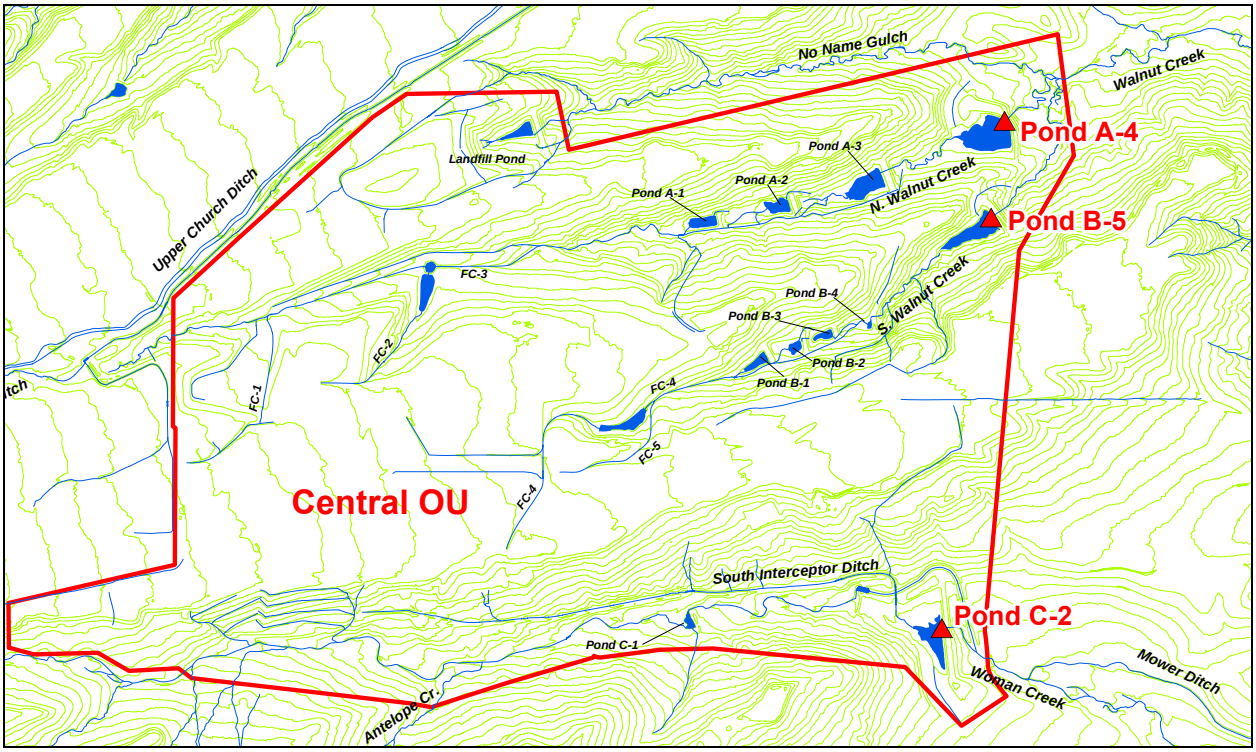



*Figure 6−18. Pre-Discharge Sampling Locations*

### *Data and Sample Collection Protocols*

Pre-discharge samples are collected as grab samples for POC analytes only (Table 6−36). Samples should represent the water to be discharged (i.e., grab sample locations in each pond should be Sited appropriately, and any addition of water to the discharge should be minimized after the grab sample is collected[7]).

*Table 6−36. Pre-Discharge Sample Collection: Type and Analytes*

| Location Code | Sample Type | Analytes |
|---|---|---|
| Pond A-4 | Grab | Pu-239,240; Am-241; isotopic U[a]; nitrate |
| Pond B-5 | Grab | Pu-239,240; Am-241; isotopic U[a]; nitrate |
| Pond C-2 | Grab | Pu-239,240; Am-241; isotopic U[a] |

Notes: [a]Isotopes U-233,234; U-235; U-238
Nitrate is analyzed as nitrate+nitrite; the nitrate+nitrite result is conservatively compared to the nitrate standard only.

This pre-discharge monitoring is limited to Ponds A-4, B-5, and C-2, or any other upstream pond temporarily functioning as a terminal pond. Site personnel will notify the appropriate parties in accordance with the Figure 13 flowchart in RFLMA (Attachment A2) in advance of pre-discharge pond sampling. CDPHE and EPA will be allowed the opportunity to collect duplicate or split samples. Samples will be analyzed far enough in advance of a routine discharge to allow action to be taken if unacceptable water quality is indicated, but near enough to the time of discharge to be representative of the discharge composition. Note that the ponds will be operated to maintain dam safety regardless of the status or results of pre-discharge sampling.

### *Data Evaluation*

Pre-discharge sampling results are evaluated according to the Figure 13 flowchart in RFLMA (Attachment A2).

## 6.1.12 No Name Gulch Flow Monitoring

This monitoring objective deals with the measurement of streamflow in No Name Gulch at the confluence with Walnut Creek. No Name Gulch is a small tributary to Walnut Creek, north of the COU, comprising a drainage area of approximately 300 acres. Flow in No Name Gulch is characterized by intermittent periods of baseflow in the spring, with extended periods of no flow at other times of the year. During these dry periods, a significant precipitation event can result in short-term direct runoff periods. The PLF is located in the upper reaches of No Name Gulch. Flow monitoring at the downstream end of No Name Gulch (location GS33) is conducted to quantify contributions to Walnut Creek. The location of GS33 is shown on Figure 6−19.

[7] Pond A-4 is the only terminal pond that can be easily isolated from significant upstream inflows. However, pre-discharge samples will be routinely analyzed on short turnaround to limit the amount of inflow to Ponds B-5 and C-2 after sampling.

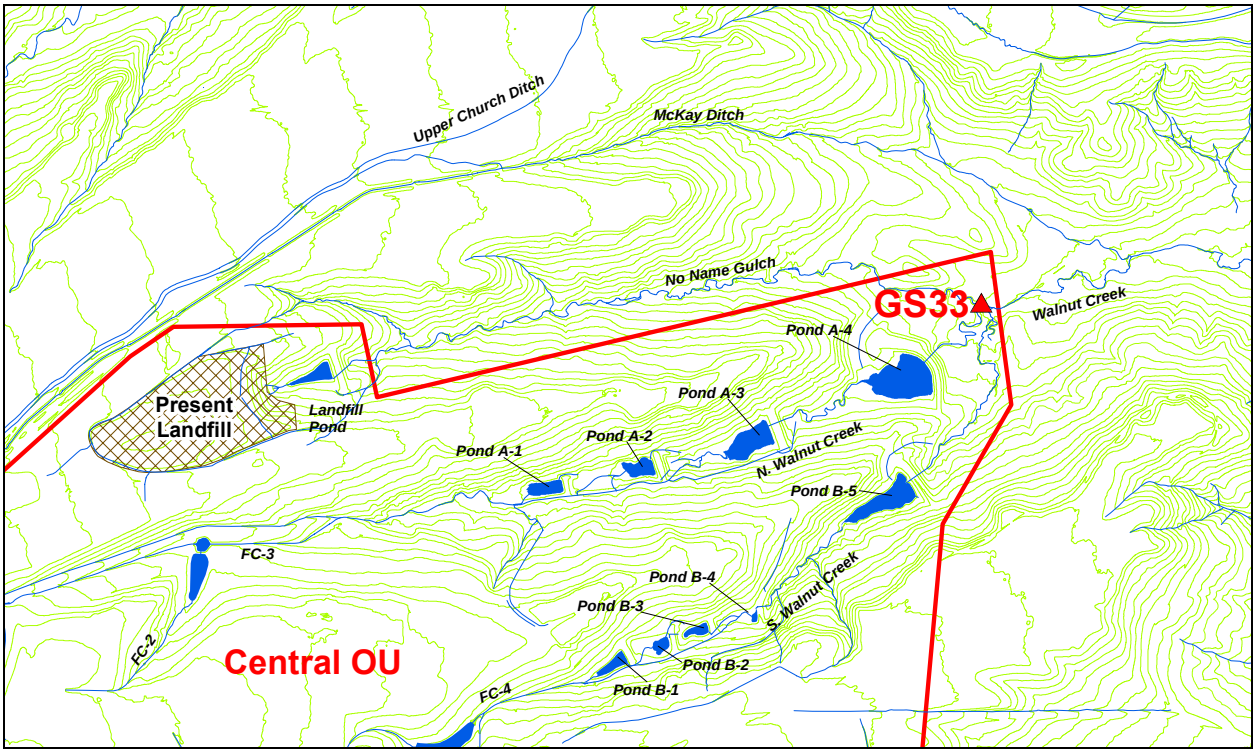



*Figure 6−19. No Name Gulch Flow Monitoring Location*

### *Data Collection Protocols*

Details on instrumentation for the No Name Gulch flow monitoring location are provided in Table 6−37. Continuous flow data are collected using automated instrumentation.

*Table 6−37. No Name Gulch Flow Monitoring Location*

| Location Code | Location Description | Sample Collection | Field Data Collection | Primary Flow Measurement Device | Telemetry |
|---|---|---|---|---|---|
| GS33 | No Name Gulch at confluence with Walnut Creek | None | Continuous flow data at 15-minute intervals | 9.5-inch Parshall flume | Yes |

Note: Both 5- and 15-minute interval flow data are collected.

### *Data Evaluation*

No specific data evaluation is required. Flow data at GS33 will be collected for information purposes only and for relative comparisons to total Walnut Creek flows.

## 6.1.13 Indicator Parameter Monitoring for Assessment of Analytical Water-Quality Data

This monitoring objective provides for the collection of general water quality and quantity information at select locations (Figure 6−20) to be used for various data assessments. Indicator parameter data collected will be used to assess analytical measurements of constituents such as

radionuclides and metals to determine whether stormwater runoff is affecting water quality. The targeted indicator parameters include total suspended solids (TSS), precipitation, and flow rate. The collection of these data will also support evaluation of erosion control measures, design of water management options, investigations into actinide transport, assessment of statistically significant changes in water quality, and management decision making.

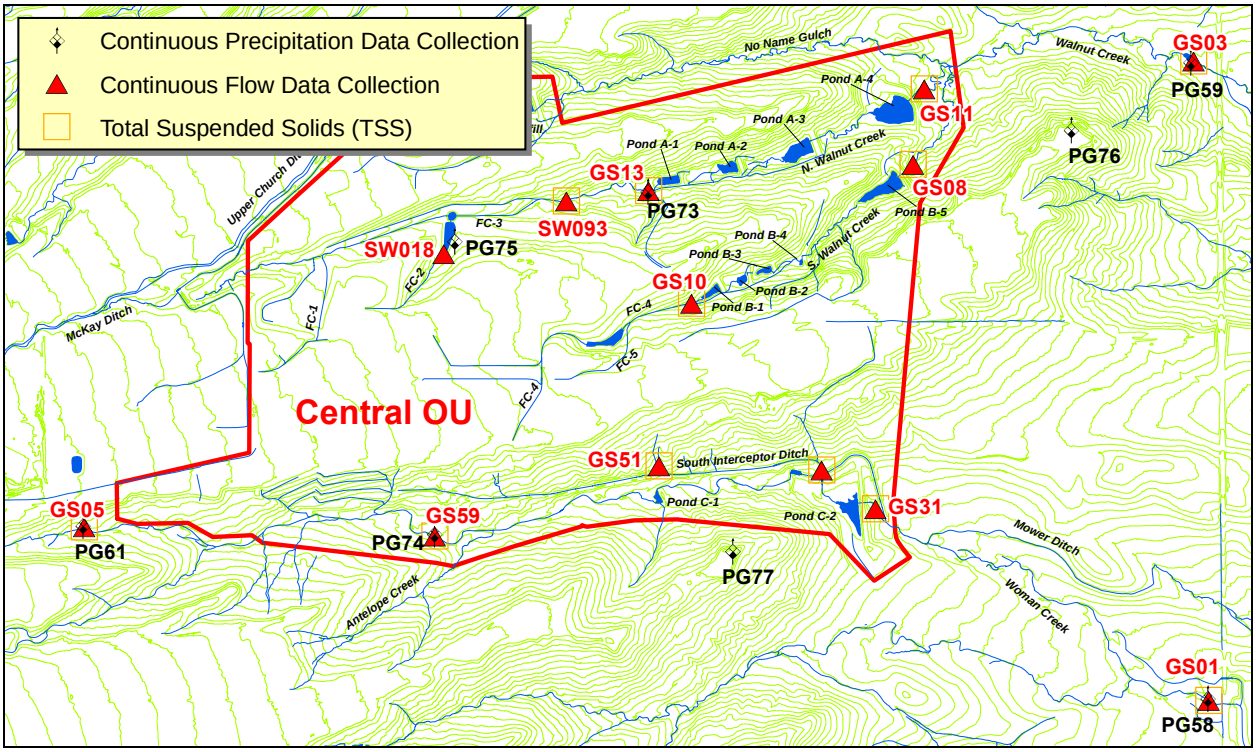



*Figure 6−20. Indicator Parameter Monitoring Locations*

### *Data and Sample Collection Protocols*

To evaluate actinides in conjunction with TSS, TSS would ideally be analyzed for in all actinide samples collected at the locations covered by the other surface water monitoring objectives (Table 6−38). However, automated sampling protocols (continuous, flow-paced composites) often result in samples collected over periods exceeding the 7-day hold time for TSS analyses. Therefore, TSS cannot be analyzed for in all composite samples, but will be analyzed for when possible.

*Table 6−38. Indicator Parameter Monitoring Sample Field Data and Sample Collection*

| Monitoring Location | Analytical Analyses | TSS Analyses | Flow Measurement Frequency |
|---|---|---|---|
| All automated locations | As required by primary monitoring objectives | For all samples when meeting 7-day TSS holdtime requirement when also analyzing for Pu and/or Am | 15-minute continuous |

Notes: Sampling frequency is specified by the primary monitoring objective for each automated location.
The data collection shown above includes current parameters. Additional parameters may be added or deleted as needs arise.
Pu = Pu-239,240; Am = Am-241

To evaluate analytical constituents in conjunction with precipitation, precipitation will be monitored at eight locations across the Site (Figure 6−20). The location of precipitation gages allows for the calculation of aerial precipitation for any drainage area tributary to each monitoring location. Each of these locations is equipped with a continuously recording precipitation gage.

To evaluate analytical constituents in conjunction with flow rate, flow is currently monitored at all automated monitoring locations at the Site. Each of these locations is equipped with a continuously recording flow-measurement device.

### *Data Evaluation*

Table 6−39 outlines the anticipated or past data uses associated with this monitoring objective. This list provides examples of data uses; future data uses may be developed as needs arise. No specific decisions using these data are required.

This monitoring objective does not limit the data uses to those given below. Evaluations may be determined for any data combinations as required. For example, assessments using flow and precipitation or precipitation and TSS may be useful depending on the specific data evaluation.

*Table 6−39. Select Data Evaluation for Indicator Parameter Monitoring Data*

| Data Use | Targeted Parameters | Description |
|---|---|---|
| Rainfall-runoff relationships | Precipitation, flow rate, flow volume | Determine hydrologic characteristics for specific drainage areas |
| Evaluation of TSS with flow rate | TSS, flow rate | Use flow rate measurements to predict TSS concentrations |
| Assessment of actinide measurements | Actinides, TSS, flow rate | Determine if cause of unusual actinide measurement is likely due to Site conditions or extreme hydrologic conditions |
| Modeling | Flow rate, flow volume | Perform model design, calibration, and verification |
| BMP assessment | TSS, flow rate | Determine effectiveness of various erosion control measures |
| Land configuration | Flow rate, flow volume, TSS | Assess land configuration options: determine flow routing, size hydraulic components, assess sedimentation rates, and design maintenance and operation protocols |
| Long-term stewardship | Flow rate, flow volume, TSS, actinides | Assess post-closure conditions |

### 6.1.14 Water Level Wells and Water Level Measurement

The water table within the UHSU (which comprises alluvium and other unconsolidated surficial materials together with the underlying weathered portion of the bedrock) responds to seasonal and event-related changes in groundwater recharge. Water-level data are used to determine hydraulic gradients, which define groundwater flow directions. Interpretations of the fate and transport of contaminants, and potential effects of groundwater on surface water and wetlands, depend on knowledge of the hydraulic gradient, the saturated thickness of the aquifer, and the hydraulic conductivity of the geologic materials through which the groundwater flows.

Data on groundwater quantity and the magnitude and direction of groundwater flow are necessary to assess the effects of Site closure and historic operations on surface water quality. Compiling water-level information from wells supports the following routine analyses:

- Assessment of the potential impact of contaminant plumes on surface water quality through the creation of potentiometric surface maps from which horizontal hydraulic gradient and flow direction can be derived; and
- Evaluation of the groundwater monitoring network's effectiveness, using groundwater flow directions and contaminant plume information, to ensure critical data gaps do not exist.

These data can also support the following analyses, should they be necessary:

- Evaluation of impacts to downgradient habitat and endangered species caused by changes in groundwater recharge to fluvial systems as a result of Site closure and remediation activities;
- Calculation of contaminant mass flux and loading to a surface water receptor that may be impacted by a groundwater plume; and
- Development of groundwater flow and contaminant transport models to assess the effect of groundwater contamination on surface water.

### *Data Collection Protocols*

All wells in the network will be monitored for water levels. The minimum frequency of this monitoring will be quarterly at RCRA wells supporting the PLF and OLF and semiannually at all other wells in the routine monitoring network. However, more frequent data collection can be helpful, and as a result this activity, is typically performed at the start of each quarter.

Water levels may be measured manually or using automated equipment such as pressure transducers and data loggers. If the latter method is selected, the equipment will be calibrated and checked periodically according to the manufacturer's instructions; specific items to check include battery life, reported versus measured water level (i.e., real-time, using manual methods), and data storage capacity. Data will be downloaded at a frequency that supports their use and is appropriate given equipment limitations (such as battery life), but no less frequently than annually. Automated equipment will typically be dedicated to a given well for a period of time. Before inserting dedicated equipment in a well, the appropriateness of the equipment and suitability of the well will be confirmed. Items to check include whether the groundwater at a given well is compatible with all components of the equipment (e.g., flexible insulation on data logger cables may degrade if exposed to elevated concentrations of certain VOCs), and whether the equipment is appropriately sized for the well (diameter and total length). The equipment will be carefully and gently decontaminated before it is installed in the well.

In some wells, installation of automated water level monitoring equipment may interfere with groundwater sample collection. If so, the automated equipment will be carefully removed from the well at the start of sampling activities and stored in such a manner as to prevent contamination (e.g., a large, clean plastic bag). If the equipment contacts the ground, sampling vehicle, or other potential source of cross contamination, it shall thoroughly decontaminated in accordance with the manufacturer's instructions. Following the conclusion of sampling activities for that visit, the equipment will be reinstalled to the same depth as before. If problems arise, the sampling personnel will immediately contact the groundwater subject matter expert (SME) or designee to resolve the issues.

All measurements of groundwater elevations will be made with respect to the top of the inner well casing on its north side. Manual collection of water level data will be performed during the first 10 business days of the appropriate calendar quarter. This will ensure that the data are as temporally related as possible. In addition, water level measurements at each well will precede any groundwater sampling activities for which that well is scheduled. If a well was sampled a short time before these water level measurements were conducted, this shall be noted. This is especially important for low-producing wells, which may take weeks to months to recover. As feasible, sampling activities at those wells may be scheduled for earlier in a given quarter to allow the next water level measurement to more closely represent the water level in the formation.

### *Data Evaluation*

Water level data will be evaluated at least annually and the results of the evaluation included in the annual report. Data from a single well are not particularly useful for flow monitoring, but instead must be compared to corresponding data from other wells in the area. Hydraulic gradients will be estimated for wells along a flowpath (which may be estimated from

potentiometric surface maps) that have no intervening features that would strongly affect groundwater flow, such as groundwater intercept trenches related to the treatment systems. Refer to previously published annual reports (e.g., DOE 2008) for additional discussion and example well pairs.

If potentiometric surface maps indicate flow directions or hydraulic gradients are changing unexpectedly with time, the monitoring network will be reviewed for data gaps or impacts to surface water that may result from these changes. If critical data gaps result from changes in flow directions, the RFLMA parties will be consulted and the monitoring network revised as appropriate.

Water level measurement is not required by RFLMA, but is performed as a BMP. This activity may be discontinued at the direction of the client; alternatively, it may be discontinued if analytical samples are not required at a well or the next downgradient well and there is no other reason to continue water level measurements. Once this monitoring has ceased, corresponding data reviews, data reporting, and monitoring decisions will no longer be required.

## 6.2 Ecological Monitoring

This section describes the technical and regulatory basis for the approach to ecological monitoring in the COU. The Ecological Monitoring Program (Ecology Program) at Rocky Flats has historically focused on the characterization of ecological components in the former Buffer Zone (BZ, roughly equivalent to the current POU), natural resource conservation and management, and compliance with laws and regulations (e.g., the ESA, the Migratory Bird Treaty Act [MBTA], wetlands regulations, and weed control acts).

Ecological monitoring has been conducted continuously at Rocky Flats (both COU and POU areas) since the early 1990s with occasional earlier studies. Rocky Flats has been well characterized in terms of both the flora and fauna. Summaries of these data can be found in the various ecology reports that have been produced over the years. A bibliography is available that lists many of the reports dealing with the ecology of the Site (Attachment E1).

Management of natural resources has been conducted since Rocky Flats became DOE property in the early 1950s. However, until the 1990s, natural resource management was mostly conducted on an occasional basis as different issues arose. With the advent of the Ecology Program at the Site in the early 1990s, management of the natural resources (weed control, revegetation, and prescribed burns) has been more proactive. Compliance with environmental regulations has been carried out by various groups depending on the media under consideration. The Ecology Program in recent years has been largely responsible for ensuring compliance with the ESA and MBTA, and focusing on wetland and noxious weed issues

Ecological conservation and management goals include the protection of currently viable ecosystems, unique and ecologically valuable natural resources, and special-concern species, as well as compliance with wildlife and natural resource protection regulations. Early detection and management of undesirable impacts to the Site's ecological resources before they become problematic is extremely important. The Ecology Program focuses on the collection of data necessary to ensure regulatory compliance and to assess the effectiveness of DOE's natural resource conservation and habitat management efforts. These efforts are intended to comply with

DOE's demonstrated desire to practice natural resource conservation (DOE 1994) and ecosystem management (Congressional Research Service 1994) on its properties.

The role of the Ecology Program at the Site is to:

- Ensure compliance with ecological environmental regulations (federal, state, and local);
- Collect ecological monitoring data, analyze data, interpret data, and prepare technical reports and other documents per specific project/regulatory requirements;
- Manage the ecological resources for long-term sustainability;
- Maintain ecological datasets for the Site; and
- Maintain historical ecology information for the Site.

Currently, ecological monitoring is conducted at the Site to:

- Ensure regulatory compliance (e.g., Preble's mouse mitigation reporting requirements and wetland mitigation reporting requirements);
- Provide useful information for management of revegetated areas and demonstrate when success criteria have been met;
- Provide information necessary to assist with the control of noxious weeds and for compliance with state noxious weed control reporting requirements (if needed); and
- Provide information necessary for wise management and conservation of native flora and fauna.

### 6.2.1 Regulatory Issues

The information presented below briefly outlines the regulatory issues associated with the Site's Ecology Program.

***ESA Issues—Preble's Mouse Mitigation Monitoring and Management***

The Ecology Program oversees and addresses the various activities that take place under the federal ESA at the Site. Currently, the species of concern at the Site is the Preble's mouse, which resides in the drainages at the Site. Although other listed species may occur nearby, they do not occur at the Site. The Preble's mouse is a federally listed, threatened species under the ESA of 1973, as amended. As a result, all activities or projects that occur in Preble's mouse habitat (defined in the PBA, Parts I and II; Attachments E3 and E4) must be consulted on as part of the Section 7 consultation requirements of the ESA. During Site closure, the PBA was written to address potential impacts to the Preble's mouse and other federally listed species resulting from cleanup and closure activities. Many DOE-LM activities are also addressed in the PBA. Four additional Biological Assessments (BAs) were written separately prior to or after the PBA documents to address other projects not included in the PBA. New activities or projects not included in the PBA must be consulted on prior to project initiation.

As part of the consultation process, after submitting the BA the USFWS issues a Biological Opinion (BO), which allows the project to proceed. The project must abide by the conservation measures, activity-specific measures, reasonable and prudent measures, and terms and conditions listed in the BO. In some cases, the BO specifies mitigation measures that must be taken by DOE

to offset the impacts to Preble's mouse habitat. In these cases, mitigation monitoring and reporting requirements typically must be fulfilled annually. Until concurrence is received from USFWS that mitigation efforts are successful, the monitoring and reporting requirements continue indefinitely. The Site must request concurrence from USFWS when successful mitigation has been achieved.

After concurrence is received, the mitigation monitoring is removed from the annual monitoring list of activities. The Preble's Meadow Jumping Mouse Mitigation Tracking Spreadsheet for PBA Part II Activities is the debit/credit ledger for tracking disturbances (debits) to Preble's mouse habitat and mitigation efforts (credits) for restoring or enhancing habitat. It also contains information on how the calculations for disturbances have been made. The tracking spreadsheet is found in the annual Preble's mouse reports submitted to USFWS by December 1 of each year. (Refer to Section 15.2 for information on routine reporting.) Past annual reports submitted to USFWS provide a good overview of the type of information contained in each report. Specific monitoring, management, and reporting requirements are outlined for each project in the appropriate BA/BO.

***Wetland Mitigation Monitoring and Management***

During the RFP/RFETS Closure Project several wetlands were disturbed by project activities. Jurisdictional wetlands are protected under the Clean Water Act (CWA) and other regulations. At the Site, a Memorandum of Agreement (Attachment E2) between the federal agencies designates both EPA and the U.S. Army Corps of Engineers (USACOE) as having jurisdictional authority over the wetland issues at the Site. For wetland issues that result from CERCLA actions, EPA is the lead agency. For non-CERCLA actions that may impact wetlands, USACOE is typically the lead agency. Any new projects that have the potential to impact wetlands require consultation first to ensure the appropriate approvals/permits are obtained prior to project initiation. Typically EPA is contacted first; they may defer to USACOE if the project is a non-CERCLA activity. Depending on the type of activity, EPA/USACOE will request submittal of a short document that describes the project activities and potential impacts to wetlands. In response, they may choose to cover the activity under a nationwide permit. If the project is larger, a Section 404 Permit may be required. In the latter case, a more detailed document, describing project activities and outlining potential disturbances and mitigation efforts that will be taken, is required before a permit is issued. In either case, depending on the project, the permit may list monitoring/mitigation requirements or other requirements that must be followed.

The *Rocky Flats, Colorado, Site Wetland Mitigation Monitoring and Management Plan* (RFSWP) (Attachment E7) outlines a strategy for determining whether wetland mitigation efforts have been successful and for managing the mitigation wetlands. A debit/credit spreadsheet for tracking disturbances and wetland mitigation credits is located at the end of the RFSWP. The RFSWP also contains the wetland monitoring and reporting requirements for the Site. Past annual reports submitted to EPA provide a good overview of the type of information contained in each report.

***Migratory Bird Treaty Act***

The Ecology Program oversees and addresses MBTA issues at the Site. The MBTA protects all migratory birds and their parts (including eggs, nests, and feathers). Therefore, projects at the

Site need to be assessed to determine whether any potential "take" may occur. (The MBTA defines take as "any attempt at hunting, pursuing, wounding, killing, possessing or transporting any migratory bird, nest, egg, or part thereof.") Because the removal of most of the buildings at the Site eliminated much of the nesting habitat for urban birds, MBTA issues have become much less of an issue at the Site. However, nesting birds still occur across the Site in various habitats ranging from the grasslands to the shrublands/woodlands, and a project evaluation must still be made to determine whether any impacts or "take" may occur. If project impacts are unavoidable, then the USFWS migratory bird permit office is contacted for further information and direction. In some cases a permit is required prior to proceeding with the project. In other cases modification of the project is required. Any specific monitoring conducted pursuant to the MBTA is addressed on a case-by-case basis. The document "*Migratory Bird Treaty Act Issues and Natural Resource Management Activities/Maintenance and Project Activities at the Rocky Flats Site*" (Appendix L) provides guidance for MBTA issues at the Site

***Colorado Noxious Weed Act***

In general, the Colorado Noxious Weed Act (CNWA) designates state noxious weeds, classifies these weeds into categories, and develops and implements management plans for control of noxious weeds in Colorado. The Ecology Program oversees and addresses CNWA issues at the Site. Depending on the species of noxious weeds found at the Site, there are potentially different control activities that must or may be conducted in addition to monitoring and reporting requirements. In recent years the CNWA has been updated annually to incorporate changes in the noxious weed list as well as new state species-specific management plans. Updates to the CNWA are posted on the Colorado Department of Agriculture website. The latest version should be evaluated prior to the field season to determine what, if any, monitoring, control efforts, and reporting requirements may be required. As changes are made to environmental rules or regulations that apply to the ecological resources at the Site, the scope of the Ecology Program may be modified to address these changes.

***Notifications/Consultations***

Depending on project locations and planned activities, notifications may be required for ESA, wetland, and/or MBTA issues. All planned projects should be evaluated for these issues during the early planning stages and prior to scheduling activities to prevent project delays, should consultation and permits be required prior to conducting the project. For some projects, notifications prior to project initiation are required under existing agreements or permits. For other projects, new consultation will be required because they have not been previously addressed with the regulatory agencies.

### 6.2.2 Natural Resource Management

The Ecology Program also oversees and directs the natural resource management activities at the Site. The natural resource management goal at the Site is to exercise good stewardship for the preservation and long-term sustainability of the natural resources while complying with applicable federal, state, and local regulations. Prior to completion of the RFP/RFETS Closure Project, the total area that DOE managed was approximately 6,400 acres. After the transfer of land to USFWS for the Rocky Flats National Wildlife Refuge, the DOE-retained lands comprise approximately 2,240 acres with most of that consisting of the former IA, the western BZ near the mines, and a small portion of the undisturbed BZ. The COU is approximately 1,300 acres in size.

General goals for different community types, species of particular interest, and regulatory compliance issues are presented in Table 6−40.

*Table 6−40. Conservation and Management Goals*

| Community | Goal |
|---|---|
| Grasslands | Maintain the quantity and quality of the vegetation community, and maintain the populations of bird and mammal species characteristic of the grasslands |
| Wetlands | Maintain the quantity and quality of the vegetation community, and maintain the populations of bird and mammal species characteristic of the wetlands |
| Great Plains Riparian Woodland Complex | Maintain the quantity and quality of the vegetation community, maintain populations of bird and mammal species characteristic of the riparian woodland complex, and maintain the abundance and extent of Preble's mice within the habitat |
| Mitigation Wetlands | Manage the mitigation wetlands for reestablishment of native plant and wildlife species |
| Revegetation Areas | Manage the revegetation areas for reestablishment of native plant and wildlife species |
| Aquatic Community[a] | Maintain the quality of aquatic communities at the Site, including macro-invertebrate and vertebrate species characteristic of the community |
| | |
| **Species of Particular Interest** | **Goal** |
| Preble's Mouse Populations | Maintain the quantity and quality of Preble's mouse habitat, and protect existing populations of the Preble's mouse |
| | |
| **Regulatory Compliance** | **Goal** |
| Threatened and Endangered Species and Species of Special Concern | Protect threatened and endangered species and species of special concern at the Site, and comply with applicable state and federal threatened and endangered species protection regulations and policies |
| Threatened and Endangered Species Habitat Mitigation | Reestablish Preble's mouse habitat at project disturbances per requirements of USFWS regulatory documents |
| Migratory Birds | Protect migratory birds at the Site, and comply with applicable state and federal migratory bird protection requirements |
| Wetlands | Protect Site wetlands, and comply with applicable state and federal wetland protection requirements |
| Wetland Mitigation | Reestablish wetlands (where required) at project disturbances per requirements of EPA and USACOE regulatory documents |
| Noxious Weeds | Protect the plant communities from invasion by noxious weeds and comply with the CNWA and other applicable noxious weed regulatory regulations and policies |

### *Vegetation Management*

Vegetation management activities have been conducted for many years at the Site. These activities have included revegetation of disturbed areas, integrated weed management (including use of administrative, cultural, mechanical, biological, and chemical controls), prescribed burns, and mowing. These activities, as well as grazing, may be options for future vegetation management at the Site. Two plans are currently available that provide basic vegetation management guidance at the Site: the RFSRP (Attachment E5) and the *Rocky Flats, Colorado, Site Vegetation Management Plan* (RFSVMP) (Attachment E6).

The RFSRP provides basic guidance for revegetation activities at the Site and includes specific seed mixes for different plant communities. It is not a regulatory document and is occasionally

updated to reflect changes to improve revegetation techniques and/or methods. It also includes some basic criteria for evaluating revegetation success.

The RFSVMP provides basic guidance for an integrated weed management approach to noxious weed control at the Site. It includes discussions of the use of administrative, cultural, mechanical, biological, and chemical noxious weed controls. It also notes the potential use of prescribed burns and grazing for vegetation management; introduction of either of these actions would require development of more specific plans before either could be conducted. The RFSVMP is not a regulatory document but is occasionally updated to reflect changes to improve weed control techniques and/or methods at the Site.

General monitoring methods that are currently in use and have been used in the past are discussed in the *Ecological Monitoring Methods Handbook for the Rocky Flats, Colorado, Site* (Attachment E9). Depending on the data needs, additional methods may be developed or used.

***Wildlife Management***

Wildlife monitoring has been conducted in the past to inventory the fauna, provide an indication of the abundance of the various wildlife species that occur at the Site, and/or answer specific wildlife questions. Past studies have included small mammal trapping, Preble's mouse surveys, relative abundance surveys, breeding bird surveys, aquatic surveys (fish surveys), prairie dog surveys, raptor surveys, herpetological surveys, aquatic and terrestrial arthropod surveys, and annual deer counts. Depending on the type of monitoring conducted, special collection permits from the regulatory agencies are sometimes required prior to monitoring.

Potential future wildlife monitoring issues may be related to chronic wasting disease, prairie dog relocations, or other unforeseen activities. Coordination with the Colorado Division of Wildlife (CDOW) and/or USFWS may be required for some of these activities. General wildlife monitoring methods that have been used in the past are discussed in the *Ecological Monitoring Methods Handbook for the Rocky Flats, Colorado, Site* (Attachment E9). Depending on the data needs, additional methods may be developed or used.

### 6.2.3 Ecological Monitoring Planning Process

Ecological monitoring at the Site consists of monitoring conducted for regulatory compliance as well as BMP monitoring. Regulatory compliance monitoring consists of the monitoring required by regulatory agreements—primarily Preble's mouse and wetland mitigation monitoring. Additional monitoring for MBTA compliance issues may also be required depending on specific project needs. Monitoring for BMPs is conducted to provide information for wise management of the natural resources at the Site. Examples of this type of monitoring include identifying weed infestation locations, evaluating weed control efforts, identifying locations of active prairie dog towns in relation to the landfills, and assessing revegetation success and the need for additional management actions. The latter type of monitoring varies from year to year depending on the information needed.

The decision to conduct a specific type of ecological monitoring should be based on a need for information, not just for the sake of monitoring. As mentioned above, there are regulatory requirements that have specific information "needs," in addition to natural resource management

where monitoring information can help improve techniques and methodologies and determine whether objectives are being met. Issues that should be considered for both types of monitoring when developing the annual ecological monitoring schedule are provided below. Note that the lists are simply a starting point for consideration. Other aspects may be added, and over time some of the regulatory drivers will no longer apply as agency concurrence for mitigation projects is received and monitoring is no longer a requirement. BMP monitoring may also vary from year to year based on changing conditions at the Site and resource management needs.

### *Regulatory Monitoring Issues*

Questions to be addressed when devising monitoring to meet regulatory requirements include:

- What regulatory agreements or documents does DOE have currently that require ecological monitoring at the Site?
- Are there any other regulations that apply to the Site that require ecological monitoring?
- What specific types of ecological monitoring are required in these agreements or documents?
- Are specific monitoring methodologies required? What are they?
- Is monitoring required to be conducted during specific timeframes? If so, when?
- What reporting requirements are there? If any, when are reports due?

The typical types of ecological regulatory issues and their regulating agencies are presented in Table 6−41.

*Table 6−41 Regulatory Issues to Consider*

| Issue | Agency | Comments |
|---|---|---|
| ESA | USFWS | Preble's mouse mitigation monitoring, Adaptive Management Plan monitoring |
| Wetlands | EPA and/or USACOE | Wetland mitigation monitoring |
| MBTA | USFWS | Nesting birds, etc. |
| Nationwide Permits | USACOE | Certificates of Completion |
| CNWA | State of Colorado | Noxious weed issues |
| Wildlife | CDOW/USFWS | Prairie dog issues, wildlife management issues |

### *BMP Monitoring Issues*

#### *Vegetation Monitoring Issues—Things to Consider*

- Revegetation—Establishment, success/failure, and management actions (impacts, effectiveness);
- Weed control—Effectiveness on target species, impacts to non-target species, targeting control efforts, evaluating specific species, and searches for new noxious weed species;
- Prescribed burn/wildfire—Effects, success/failure, and management actions;

- Grazing—Effects, success/failure, and management actions;
- Mapping—Vegetation, wetland, weed, and Preble's mouse habitat;
- Photopoint monitoring;
- Native plant community management—Weed control, prescribed fire, grazing, drought, and interseeding; and
- Additional issues that may arise or have informational needs.

#### *Wildlife Monitoring Issues—Things to Consider*

- Preble's mouse issues—See regulatory issues;
- Prairie dog issues/impacts—Locations of prairie dog towns in relation to landfills (mapping), other remedy locations, and population counts;
- Deer/elk populations—Herd size, carrying capacity, habitat impacts, and chronic wasting disease;
- Raptors—Nesting Sites and abundance (see MBTA regulatory issues);
- Waterfowl, songbird—Abundance and nesting areas (see MBTA regulatory issues);
- Amphibian/reptile—Abundance and habitat areas;
- Mosquito control issues; and
- Additional issues that may arise or have informational needs.

### *Ecological Monitoring Methodology*

Various types of ecological monitoring methodologies are available and should be chosen on the basis of information needs, cost-effectiveness, ease of data collection, and practicality. The typical ecological monitoring methodologies that have been used in the past and continue to be used at the Site are provided in the *Ecological Monitoring Methods Handbook for the Rocky Flats Site* (Attachment E9). If comparison to older data sets is required, the same monitoring methodologies used to collect the earlier data should be used so that the data are directly comparable. If long-term monitoring is being implemented, the choice of methodologies should minimize subjectivity between observers and provide for repeatability. Many resources are available that provide additional detail for both vegetation and wildlife monitoring methodologies. These should be utilized as needed. Several suggested resources are provided below. Others are available from libraries or online resources.

Additional ecological monitoring methodology resources:

Avery, T.E., 1975. *Natural Resources Measurement*, McGraw Hill, New York, 331 p.

Avery, T.E., and H.E. Burkhart, 1995. *Forest Measurements*, 3rd Edition. McGraw-Hill Publishing Company, New York.

Bonham, C.D., 1989. *Measurements for Terrestrial Vegetation*, Wiley, New York.

Bureau of Land Management, 1996. S*ampling Vegetation Attributes: Interagency Technical Reference, BLM National Applied Resource Sciences Center*, BLM/RS/ST-96/002+1730, Supersedes BLM Technical Reference 4400-4, Trend Studies, dated May 1995, 163 p.

Cooperrider, A.V., R.J. Boyd, and H.R. Stuart, 1986. *Inventory and Monitoring of Wildlife Habitat*, U.S. Department of Interior, Bureau of Land Management Service Center, Denver, Colorado, 858 p.

Greig-Smith, P., 1983. *Quantitative Plant Ecology*, 3rd Edition, University of California Press, Berkeley, California., 347 p.

Holthausen, R., R. Czaplewski, D. DeLorenzo, G. Hayward, W. Kessler, P. Manley, K. McKelvey, D. Powell, L. Ruggiero, M. Schwartz, B. Van Horne, and C. Vojta, 2005. *Strategies for monitoring terrestrial animals and habitats*, Gen. Tech. Rep. RMRS-GTR-161. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, Colorado, 34 p.

Husch, B., C.I. Miller, and T.W. Beers, 1982. *Forest Mensuration*, John Wiley and Sons, New York, 402 p.

Mueller-Dombois, D., and H. Ellenberg, 1974. *Aims and Methods of Vegetation Ecology*, Wiley, New York, 547 p.

Pilz, D., H. Ballard, and E. Jones, 2006. *Broadening participation in biological monitoring: handbook for scientists and managers*, Gen. Tech. Rep. PNW-GTR-680. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, Portland, Oregon, 131 p.

Tueller, P.T., 1988. *Vegetation Science Applications for Rangeland Analysis and Management*, Kluwer Academic Publishers, Boston, 642 p.

USDA Forest Service, 1997. *Vegetation monitoring: an annotated bibliography*, Caryl Elzinga and Angela Evenden (compilers), Intermountain Research Station Gen. Tech. Report INT-GTR-352, Ogden, Utah, 184 p.

Winward, A., 2000. *Monitoring the vegetation resources in riparian areas*, Gen. Tech. Rep. RMRSGTR-47, U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Ogden, Utah.

## 6.3 Air Quality Monitoring

In the past, the air monitoring program at the RFP/RFETS has included ambient (Radioactive Ambient Air Monitoring Program [RAAMP]), effluent, and meteorological monitoring activities. As of September 2005, only ambient monitoring is performed, although representative meteorological data continue to be gathered adjacent to the Site from the National Wind Technology Center (NWTC). DOE-LM currently conducts ambient air monitoring at two locations voluntarily to confirm low emissions (Figure 6−21).

Figure 6−21 illustrates the current perimeter RAAMP sampler locations. DOE has continued monitoring at locations S-136 and S-138 to evaluate expected changes in downwind air quality as the Site soil weathers. Representative meteorological data are downloaded from NWTC data files for the NWTC M2 tower, located approximately 1.5 miles northwest of the COU. The NWTC M2 tower data are queried by Site staff as needed.

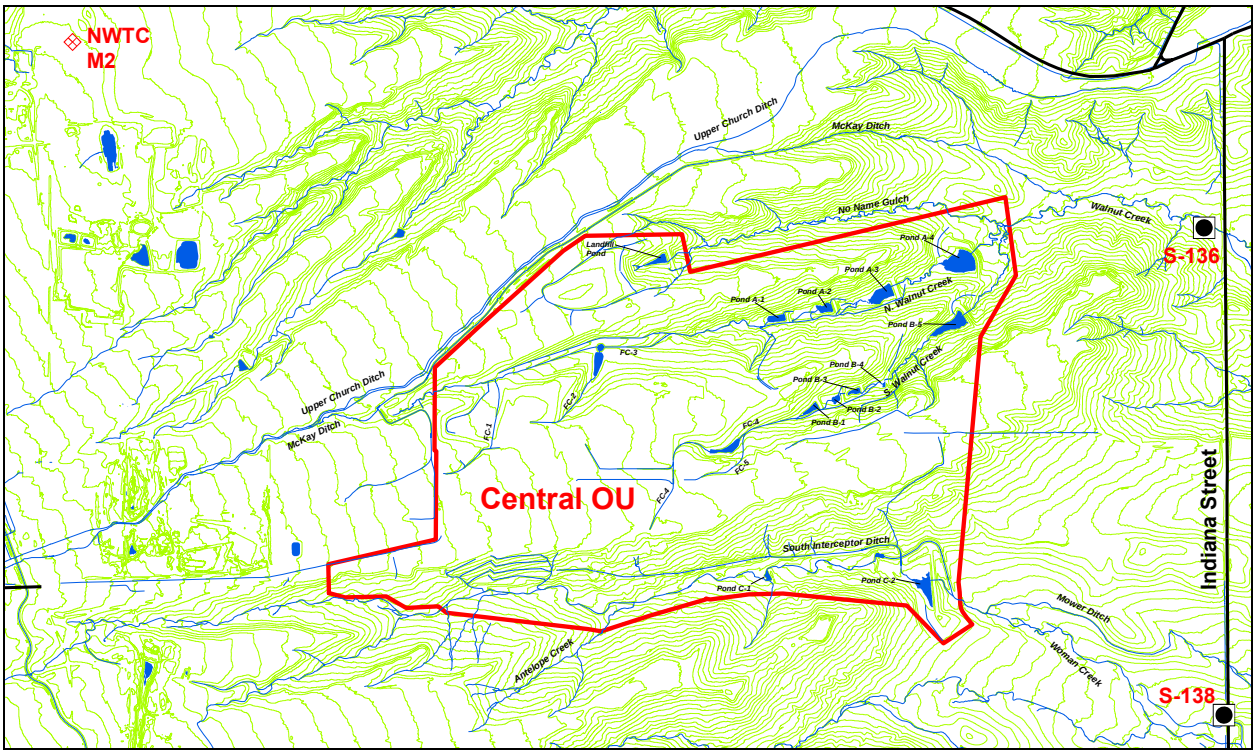



*Figure 6−21. Air Sampling Locations*

### 6.3.1 Data and Sample Collection Protocols

The RAAMP samplers, located at two historically key locations along Indiana Street, monitor dispersed airborne radioactive particles. These two locations typically have shown the highest ambient concentrations of Site-derived radionuclides under past operating conditions, representing continuous emissions from fugitive sources. Location S-136 is relatively close to a residence near Walnut Creek and Indiana Street; S-138 is located along an air pathway between the former 903 Pad/Lip Area and areas near several residences east-southeast of the Site (Table 6−42).

*Table 6−42. Ambient Air Monitoring Locations*

| Location Code | Location Description | Analytes[a] | Telemetry? |
|---|---|---|---|
| S-136 | Walnut Creek at Indiana Street | Pu, Am, isotopic U[b] | Yes |
| S-138 | 470 feet north of Woman Creek at Indiana Street | Pu, Am, isotopic U[b] | Yes |

Notes: [a]Samples will be analyzed on an as-needed basis.
[b]Isotopes U-233,234; U-235; U-238

These samplers operate continuously at a volumetric flow rate of approximately 40 cubic feet per minute ($ft^3$/min). Exchangeable cartridges collect airborne particles on two collection surfaces. Coarse, noninhalable particles (larger than approximately 10 micrometers aerodynamic equivalent diameter) are collected on an oiled impactor surface; fine, more readily inhalable particles (smaller than 10 micrometers) are collected on glass fiber filters. The paired, size-partitioned samples are analyzed independently to characterize differences in radioparticulate partitioning between inhalable and noninhalable airborne particles.

Sample cartridges are exchanged monthly. Cartridges are subsequently sent to the analytical laboratory for replenishment[8] and sample preparation (filter and impactor surface). The samples and replenished cartridges are then returned to the Site. Filters and impactor samples are archived at the Site for a minimum of six months for possible analysis.[9] If analysis is desired to determine air emissions, samples will be analyzed for americium-241, plutonium-239,240, and isotopic uranium.

Procedures for O&M of the air samplers are provided in Section 7.3.

Continuous meteorological monitoring is conducted at the NWTC M2 tower, located approximately 1.5 miles north of the former Site meteorological tower location. Collected data consist of wind speed, wind direction, temperature, relative humidity (dew point), precipitation, and a calculated sigma-theta (used to determine Pasquill-Gifford stability classes).

The air monitoring program is expected to be discontinued at the end of September 2008.

### 6.3.2 Data Evaluation

No specific data evaluation is required. Samples from S-136 and S-138 will be analyzed for information purposes only should air emission data be desired.

Meteorological data may be used as inputs for air quality and emergency response dispersion modeling.

## 6.4 Exit Strategy for Water Monitoring

Water monitoring at the Site will not be required forever because contaminant concentrations are expected to decrease through natural attenuation mechanisms. Therefore, rules have been established to logically guide termination of water monitoring. The logical process by which this monitoring is terminated is referred to as the “exit strategy.”

Concentrations below which monitoring for the various water contaminants is no longer needed will vary based on analyte, media (groundwater versus surface water), and monitoring classification. For example, wells at a groundwater discharge area will be held to stricter requirements than wells within a pediment-top contaminant source area because of the importance of protecting surface water quality at the discharge area. Similarly, exit criteria for surface water locations and groundwater treatment systems vary from those for monitoring wells.

[8] The laboratory installs new filters and impactor surfaces in the cartridges.
[9] Samples will be discarded on a quarterly basis.

Ceasing to monitor water may take place area-by-area, rather than for the Site as a whole, and may also occur by analyte suite (for example, discontinuing monitoring a given well or group of wells for uranium but continuing to monitor for VOCs). As concentrations of contaminants in groundwater in a given area decrease to the point that they meet exit criteria, there will no longer be a need to monitor groundwater in that area. Similarly, as groundwater in an area ceases to be a threat to surface water quality and is no longer monitored, nor is upstream surface water, corresponding surface water monitoring reductions are appropriate.

Specific exit criteria are presented in the flowcharts in Attachment 2 to RFLMA (Attachment A2 to this document). The consultative process will be employed to make sure the RFLMA parties are included in the decision to stop monitoring. The decision to exit monitoring will be documented in a RFLMA Contact Record and incorporated into Attachment 2 to RFLMA during the next revision.

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# 7.0 O&M of Monitoring Locations

## 7.1 Surface Water Monitoring Stations

Typical equipment for each surface water monitoring station includes a primary flow-control structure (e.g., Parshall flume), an ISCO® flow meter controlling an ISCO® automated sampler, a power system, and a telemetry unit. Where possible, instrumentation is installed in a secure, weather-resistant housing. Sampler intakes are positioned such that representative samples are collected at each station.[10] Geomation® I/O interface assemblies connected via digital spread-spectrum radio telemetry equipment are used to transmit data in real-time to Site personnel for remote monitoring-network management. Select locations are also equipped with dedicated precipitation gages. Precipitation gages are installed such that nearby structures do not interfere with precipitation collection. Power for the instrumentation is provided by AC line power (where available) with battery backup. For locations without AC power, solar/DC power systems are used. Each station includes a primary flow-control structure; flumes or weirs are installed in natural stream channels and ditches, or fastened to existing concrete or metal stormwater conveyance structures.

Detailed specifications for each monitoring station are recorded in a field logbook. Monitoring station installation must be adequately documented to ensure flow-control structures meet specifications and provide quality flow records. Written notes documenting the specifications for each flow-control structure, including dimensions, relative elevations, and photographs showing the completed monitoring station, are required to document that the monitoring station record is technically defensible.

Discharge ratings are generated for each flow-control structure. Locations are surveyed using a global positioning system or screen-digitized using Geographic Information Systems (GIS).

### 7.1.1 Operation and Maintenance

Instrument programming information, field observations, repair/modification records, and calibration records are also recorded in a field logbook.[11] This information is subsequently used for computation of the discharge records for each station.

Qualitative checks of structure integrity are conducted during every field visit, which occur at least semimonthly. Flow-control structures must be as level, plumb, and leak-free as practical. Instrumentation must be powered, performance-checked, and recording representative data. The equipment must be secured and sealed to prevent weather and animal damage and minimize the potential for tampering.

Flow-control structures will have relative elevations surveyed annually to ensure proper operation and provide input data for the generation of discharge ratings.

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[10] Intakes are positioned to collect only water that flowed through the flow-control structure. The intakes must be secured high enough off the streambed so as not to collect nonrepresentative sediment quantities, but low enough to be submerged during near-zero flow rates. Consideration is also given such that intake position minimizes the effects of winter freezing conditions.

[11] The telemetry system is also used to detect equipment malfunctions prior to an actual field visit. Receipt of anomalous data may initiate a field visit.

### 7.1.2 Telemetry System

The Site telemetry system centrally monitors the status of the automated monitoring locations. Telemetry is a valuable tool for the efficient operation of extensive automated monitoring networks, significantly reducing the number of time-consuming field visits. The system is fully flexible to allow for changing management needs. The data transmission needs are determined by the Site personnel responsible for the O&M of the monitoring network. The telemetry system also serves as a secondary data-collection platform in addition to management decision support.[12]

Telemetry provides real-time information routinely used to manage systems such as the Site retention ponds. Data streams for pond operations include pond water elevation, inflow/outflow rates, and piezometer levels (Section 4.1). Power levels, flow rates, and precipitation data are also transmitted for decision-making support and to confirm proper operation of instrumentation.

Similarly, telemetry provides the status of automated sampling equipment. Because the rate of sample collection is determined by the weather (e.g., runoff volumes from precipitation events control the sampling rate), real-time sampler status transmission greatly reduces the need for field visits. Data streams include sampler status (enabled or waiting) and current composite-sample volume (i.e., the number of grab samples and corresponding bottle volume).

### 7.1.3 Applicable Instructions and Resources

All flow-control structures, precipitation gages, ISCO® instrumentation, telemetry equipment, and power supplies will be installed, programmed, and performance-checked per the manufacturer's instructions.

The applicable manufacturer manuals are as follows:

Geomation Measurement and Control Systems, Inc., 2000. *Geonet Suite Operation and Reference*, Geomation, Inc., Colorado;

Geomation Measurement and Control Systems, Inc., 2001. *2380 MCU Technical Manual*, Geomation, Inc., Colorado; and

Geomation Measurement and Control Systems, Inc., 2004. *Operation and Maintenance: 3300 & 3310 Remote Terminal Units (RTUs), OutDAQ Options & Accessories*, Geomation, Inc., Colorado.

ISCO, Inc., 2004. *FLOWLINK4 for Windows*, ISCO, Inc., Nebraska, July;

ISCO, Inc., 2006a. *4230 Flow Meter, Installation and Operation Guide*, Rev. X, ISCO, Inc., Nebraska, May;

ISCO, Inc., 2006b. *4220 Submerged Probe Flow Meter, Installation and Operation Guide*, Rev. U, ISCO, Inc., Nebraska, May;

ISCO, Inc., 2006c. *3700 Portable Samplers Installation and Operation Guide*, Rev. CC, ISCO, Inc., Nebraska, May;

[12] Primary data collection of most data is performed by field-downloading the data directly from the instrumentation. The telemetry also serves as a redundant data collection system should field instrumentation memory malfunction.

ISCO, Inc., 2006d. *3710 Portable Samplers Installation and Operation Guide*, Rev. V, ISCO, Inc., Nebraska, May;

Additional resources are as follows:

Grant, D.M., 1992. *ISCO Open Channel Flow Measurement Handbook*, Third Edition, ISCO Environmental Division, Lincoln, Nebraska;

Kennedy, E.J., 1984. *Techniques of Water Resource Investigations of the United States Geological Survey, Chapter A10 Discharge Ratings at Gaging Stations*, Book 3 Applications of Hydraulics, U.S. Department of the Interior, U.S. Geological Survey, U.S. Government Printing Office, Alexandria, Virginia;

Rantz, S.E., 1982a. *Measurement and Computation of Streamflow: Volume 1, Measurement of Stage and Discharge,* U.S. Geological Survey Water-Supply Paper 2175, U.S. Department of the Interior, U.S. Government Printing Office, Washington, D.C.;

Rantz, S.E., 1982b. *Measurement and Computation of Streamflow: Volume 2, Computation of Discharge,* U.S. Geological Survey Water-Supply Paper 2175, U.S. Department of the Interior, U.S. Government Printing Office, Washington, D.C.; and

U.S. Department of Interior, 1984. *Water Measurement Manual*, Revised Reprint, U.S. Department of the Interior, Bureau of Reclamation, U.S. Government Printing Office, Denver, Colorado.

## 7.2 Groundwater Monitoring Wells

Monitoring wells, piezometers, well points, and other such groundwater monitoring devices (collectively referred to herein as "wells") have been installed at Rocky Flats since 1954 or earlier, with over 1,460 wells installed since the 1950s. Periodically over the years, obsolete, unnecessary, and damaged wells have been abandoned. This section describes maintenance, abandonment, replacement, and installation of wells. Some of these activities may require notification or permitting with the State Engineer's office; refer to the Colorado Division of Water Resources website for current requirements. Note that monitoring wells at CERCLA and RCRA Sites are exempt from permit requirements (State of Colorado 2006). However, previous practice at the Site has been otherwise, and for wells installed, replaced, or abandoned through the end of 2005 the Site obtained well permits and provided the associated forms, as well as Construction and Abandonment reports, as applicable.

Prior to initiating intrusive work, all intrusive activities that extend to a depth of more than 18 inches will be evaluated for the potential of intercepting contaminated soils. This is in keeping with the land use restrictions as further detailed in the soil disturbance requirements of Section 9.3 and Appendix F.

### 7.2.1 Well Maintenance

Monitoring wells will be routinely maintained. Wells will be redeveloped as necessary to remove sediment accumulation and decrease turbidity of samples. Instructions for well maintenance and development are provided in the SAP. Well components including surface protection (well pad, protective casing, locking cap, and any other surficial components), well cap, annulus between well stickup and protective casing, and the belowground portions of the well will be inspected as

feasible during each visit. Surface protection will be maintained to guard against climate-related deterioration and otherwise ensure continued protection of the well within. The well cap will be removed and replaced carefully; if damaged, a new well cap will be installed as soon as practicable.

Some of the wells at the Site are installed within soils that are settling and thus, over time, the well cap may protrude from the protective casing. This makes locking the casing difficult. When this occurs, the groundwater lead will be informed and the well casing will be trimmed as follows:

1. The amount of well casing to be removed will be measured.
2. Using appropriate tools to create a flat, horizontal cut, the casing will be cut. Personnel performing this activity will take care to keep the cut even and horizontal, and to minimize the amount of cuttings that enter the well bore.
3. A new measuring point (MP) will be cut or marked on the north edge of the well casing. If a permanent marker is used, care will be taken to prevent markings on the inside of the well casing, given the high concentrations of VOCs in these markers. If the field crew feels it is appropriate, measures (such as allowing the well to vent for a few minutes) will be taken to allow VOCs that may have entered the well bore to dissipate. If a well is scheduled for sampling and during the same visit a permanent marker will be used to mark the MP, the MP will be marked after sample collection has concluded.
4. The amount of casing removed will be carefully measured, with the results conveyed to the groundwater and data management leads as soon as possible.

The groundwater and data management leads will ensure the necessary changes are made to SEEPro regarding the new top of casing elevation, with appropriate references to the date the cut was made so that data collected prior to the change are not affected but all subsequent data reference the appropriate casing elevation.

Well extensions will follow a similar, but reversed, procedure. The groundwater lead will be notified of any such need and will be involved in designing the extension and identifying the appropriate technique so as to minimize the potential for cross-contamination of or damage to the well.

The aboveground annulus will be kept free of biohazards such as wasp nests and spiders. If accumulated water is present within the annular space, it will be evacuated and, if approved by the groundwater lead, a vent hole will be drilled in the protective casing to allow water to drain freely from the annular space.

Observations of subsurface or other serious damage to a well (casing kinks, suspected screen breach, failure of the bottom cap, inability to completely remove sediment from a well, and so forth) will be immediately relayed to the groundwater lead; brief notes on sample collection forms or other field logs are not in and of themselves sufficient for this communication.

### 7.2.2 Well Abandonment

Wells determined to be damaged beyond repair or no longer necessary for groundwater monitoring purposes will be properly abandoned. This activity eliminates the well from the

monitoring network in such a manner that the well will not remain a conduit for groundwater or contaminant migration. Wells are abandoned in accordance with the current Colorado Water Well Construction Rules (2 Code of Colorado Regulations [CCR] 402-2; State of Colorado 2005). Where needed for the network, wells that are damaged or not appropriately constructed for long-term monitoring will be replaced as discussed in Section 7.2.3. The groundwater lead will supervise the selection of wells for abandonment and the abandonment method.

Proper abandonment of wells is required under the following circumstances:

- When the potential for cross-contamination from the well exists;
- When the well is poorly constructed or damaged;
- When the well is in the way of proposed activities; and
- When the well has no identified purpose for future monitoring.

### 7.2.3 Well Replacement

Replacement wells will be installed if necessary and a unique identification code will be applied to the replacement well. The identification code will ensure data from other wells, both existing and historic, are not erroneously applied to the replacement well. The monitoring well identification code format in use at the Site was defined in the early 1990s and was in use through closure; it should continue to be followed for consistency. Under this method, each well is assigned a unique five-digit code. The last two digits of the well identification code represent the calendar year (CY) of installation (e.g., the identification of a well installed in CY 2009 should end in "09"), although this has not been rigorously followed in some cases. The first three digits are arbitrary; in the past, attempts have been made to select a code that contains some logical reference (e.g., well 88104 at former Building 881), although those references are often not intuitive in the post-closure era. Other well identification schemes were used in the decades of well installation at the RFP/RFETS, and several wells in the current network do not conform to this identification code format, as they were installed prior to establishment of the format. However, these well names do contain the year of installation as the last two digits. (Examples include several wells installed in the 1980s.)

Replacement wells will typically conform to the design of the original well, although this is not required. The groundwater lead will supervise the design and location of each well replacement, which will be installed in accordance with the current SAP and Water Well Construction Rules (2 CCR 402-2; State of Colorado 2005).

### 7.2.4 New Well Installation

New well installations will follow the nomenclature described above. These wells will be installed following development of an appropriate work-control document (e.g., a SAP or work plan) that specifies the objectives and specific requirements including well location and design. Geologic logging should be performed due to the heterogeneous nature of the UHSU (strongly affecting groundwater flow) and, in particular, the importance of the bedrock contact and the nature of the bedrock (lithology, fracturing, evidence of fluid flow, and so forth) to Site hydrology and groundwater monitoring. Similarly, if possible, geologic core rather than cuttings should be logged. Wells will be installed in accordance with the SAP and the current Water Well

Construction Rules (2 CCR 402-2; State of Colorado 2005). As with replacement wells, the groundwater lead will supervise the design and location of each new well.

### 7.2.5 Documentation

SEEPro will be updated appropriately following any change to a well's construction (such as extending or shortening the well casing). This database is the primary source of all monitoring location information and must be kept current. User-maintained databases or spreadsheets may also be useful, but are not the primary source of this information. In addition, each well abandonment, replacement, and installation will be added to this database, which includes such information as the well identification, location, design details, and summary geologic information. The data management lead will supervise updates to SEEPro.

Additional documentation required by the SAP will also be completed as appropriate.

## 7.3 Air Sampling Stations

The RAAMP samplers, located at two historically important locations near Indiana Street, monitor dispersed airborne radioactive particles. These samplers operate continuously at a volumetric flow rate of approximately 40 $ft^3$/min. Exchangeable cartridges collect airborne particles on two collection surfaces. Coarse, noninhalable particles (larger than approximately 10 micrometers aerodynamic equivalent diameter) are collected on an oiled impactor surface; fine, more readily inhalable particles (smaller than 10 micrometers) are collected on glass fiber filters. The paired, size-partitioned samples are analyzed independently to characterize differences in radioparticulate partitioning between inhalable and noninhalable airborne particles.

### 7.3.1 Operation and Maintenance

***Monthly Maintenance***

Sampling cartridges are exchanged monthly. During these routine visits the following maintenance steps are also followed:

[1] Visually check the air sampler for external damage or evidence of electrical or mechanical malfunction.

[2] Visually check the air sampler for internal damage or evidence of electrical or mechanical malfunction.

[3] Record the following information:

- Field technician's name;
- Date and time;
- Air sampler number;
- Critical flow orifice serial number;
- Ambient air temperature;
- Ambient pressure;
- Sampling start time;

- Sampling end time;
- Hour meter reading;
- Digital pressure gauge zero reading; and
- Any maintenance activities.

***Annual Air Sampler Flow Rate Verification***

The annual flow-rate verification includes the following steps:

[1] Perform monthly check as detailed above.

[2] Turn off sampler.

[3] Attach precalibrated air flow element and turn on sampler.

[4] Verify that airflow rate is 1,130 air liters per minute (alpm) (+ or - 113 alpm), then turn off sampler.

[5] Remove precalibrated air flow element and turn sampler back on.

[6] If airflow is out of spec, service or replace pump to achieve proper flow rate.

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# 8.0 Environmental Data Collection, Evaluation, and Management

## 8.1 Sampling and Data Collection

The following sections provide detailed instructions for the collection of samples and field data.

### 8.1.1 Automated Surface Water Sample Collection

The majority of surface water sampling at the Site is accomplished through the use of automated samplers. These samplers operate in an unattended mode, collecting flow-paced composite samples continuously. This section outlines the methodology for flow-pacing the automated samplers according to manufacturer's instructions (see Section 7.1). The following list of assumptions regarding automated sampling acknowledges that monitoring under all potential Site conditions may not be possible:

- For purposes of computation in regulatory reporting, the sample date for a multi-day composite sample will be the date that the sample was started. Although this will give the impression that multi-week samples are being reported months late, this convention is consistent with other Site data.
- Successful completion of a flow-paced composite sample is determined by several factors that are evaluated by the sampling team. These include, but are not limited to, the required sample volume for analysis (normally at least approximately 4 liters [L]; see nonsufficient quantity [NSQ] discussion below), equipment failures, off-normal conditions (e.g., emergencies, severe weather, other *force majeure*), or H&S concerns.
- If sample accumulation is terminated for cause, and sample volume is inadequate for routine laboratory analyses, then no analyses are required, and the sample will not be used in the computation of compliance values. For example, routine laboratory analysis for plutonium and americium currently require 4.0 L. Therefore, samples of less than 4.0 L may be discarded (if necessary) and not used in the computation and evaluation of compliance parameters, but must be reported. This requirement may be referred to as the NSQ requirement regarding insufficient quantity of sample.
- Where there is no significant flow, there may be no composite samples completed within a compliance calculation period (see NSQ above). However, flow-paced sampling will continue during dry periods, even though flows may be so low that it may take longer than the required compliance period to fill the composite sample container.
- If no samples are collected during a compliance interval due to a low- or no-flow condition, then no sample result will be available for use in the computation of compliance values, and no such compliance value will be reported for that period.
- Samples collected for RFLMA monitoring must be reported, even if they are not analyzed, and the reason for not analyzing (e.g., NSQ) must also be reported.

***Continuous Flow-Paced Composite Samples***

Continuous flow-paced composite samples are collected during all flow conditions. Automated samplers collect grab samples year-round at all times. When a composite sample is removed from the sampler for analysis, the next composite sample starts filling immediately, if flow is available. If the location is dry at the initiation of a new composite sample, the flow meter is

programmed to trigger sample collection at the next available flow period. A composite sample consists of multiple grab samples[13] that are flow-paced. In other words, one grab sample is deposited in the composite sample bottle each time a specified volume of stream discharge is measured by the flow meter. Figure 8−1 is an example of flow-pacing of grab samples every 4,390 cubic feet ($ft^3$) of stream discharge for a continuous flow-paced sampling event. The chosen flow pace depends on expected stream discharge, the composite volume desired, and the desired composite-sampling period. Details on the method used to determine the desired flow pace are provided below (see "Flow Pacing of Automated Samplers").

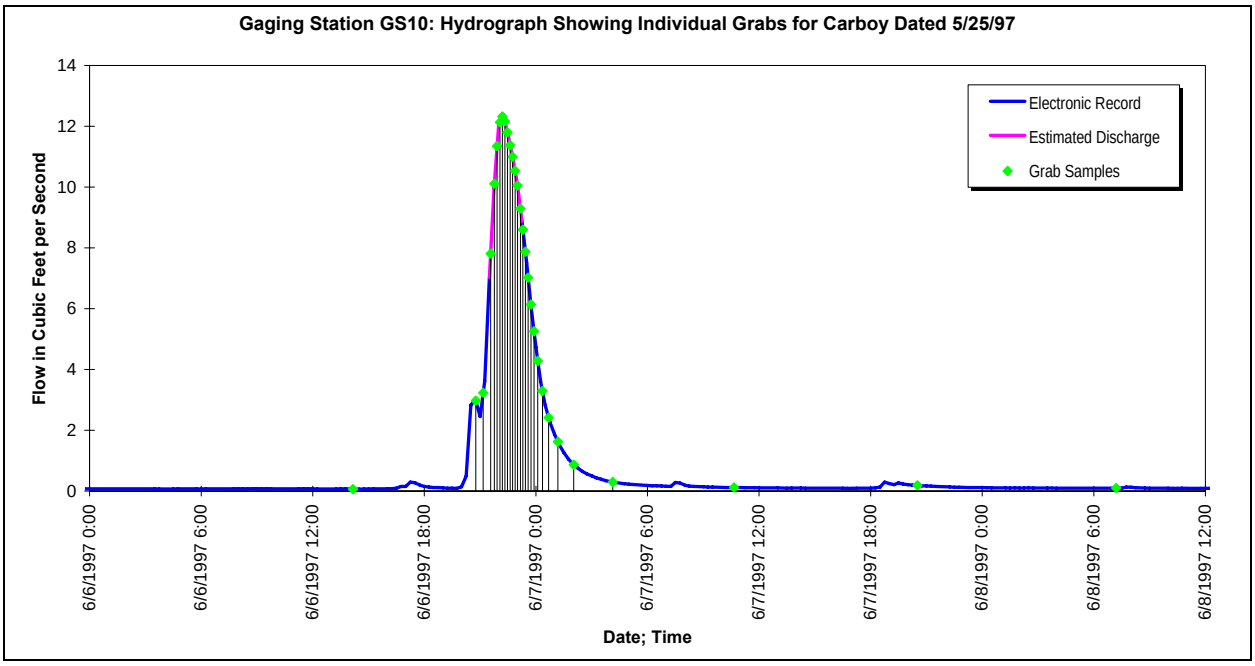


*Figure 8−1. Example Hydrograph Showing Continuous Flow-Paced Composite Sampling*

Ideally, by flow-pacing composite samples and effectively collecting more frequent grabs during higher flow rates, an analytical result—in terms of concentration (e.g., milligrams per liter [mg/L] or activity (e.g., picocuries per liter [pCi/L]—that is representative of the entire sampling period is obtained. This result can then be used with the corresponding discharge volume to calculate a constituent load and the appropriate compliance values.

[13] The current grab sample volume for continuous flow-paced composite samples is 200 milliliters (mL). This volume was chosen to maximize the number of grabs while achieving adequate repeatability. ISCO® samplers have a sample volume repeatability of ±10 mL. Therefore, a volume error of ±5 percent can be expected.

### *Flow Pacing of Automated Samplers*

The chosen flow pacing for a composite sample must satisfy the following criteria:

- The composite sample should fill during the specified time period as determined by the targeted sample collection frequencies.[14,15]
- The collected sample volume must be adequate such that the location-specific analyses can be conducted by the laboratory.[16]

The following steps are used to determine the appropriate flow pace for a continuously collected composite sample:

[1] The location-specific targeted time period for the composite sample must be known. For example, typically four composite samples are targeted for the month of May at GS10.

[2] The expected discharge volume for the targeted time period must then be calculated using historic flow record.[17] For locations with limited historic flow record, professional judgment, estimations related to basin size, and/or flow record at upstream/downstream locations are used to determine expected discharge volumes.

For example, at GS10 the expected discharge volume for May is 5.48 MG. In order to collect four composite samples for the month, one composite sample is collected for every 1.37 MG.

[3] The targeted number of 200-mL grab samples for the composite sample is then determined. The targeted number of grabs is set using professional judgment to collect a composite volume between the minimum required sample volume[16] and the maximum volume that can be contained in the sample bottle.[18] This allows for variation in actual measured discharge (from the expected discharge based on historic record), while still collecting the composite sample in the targeted time period.

For example, at GS10 the composite sample bottles can contain a maximum of 22 L, and the minimum required sample volume for complete laboratory analysis at GS10 is 4.8 L. Consequently, the sampler at GS10 is normally paced to collect sixty 200-mL grab samples if the stream discharge volume is average for the target period, resulting in a composite sample volume of 12 L. The actual stream discharge volume would be expected to vary from historical averages. Therefore, composite samples are collected from the field with a total number of grabs varying from 24 (4.8 L) to 110 (22 L).

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[14] Annual composite sample totals are determined by statistically evaluating historical data. Software programs such as Visual Sample Plan© (VSP; Batelle Memorial Institute; http://dqo.pnl.gov/index.htm) are used to determine appropriate sample counts to achieve a level of confidence in the results such that decisions can be made. Annual sample counts are distributed monthly based on historical flow data.

[15] Samples are flow-paced based on average expected discharge rates calculated from historic discharge records. Consequently, samples may fill in periods shorter than the targeted period when flow rates are significantly higher than normal. Similarly, samplers may not fill during the targeted period if flow rates are significantly lower than predicted by historical flow record.

[16] Specific analyses each require some minimum volume of sample. Therefore, the minimum required sample volume depends on the location-specific analyte suite.

[17] The expected discharge volume is the historic average volume. Generally, all available flow record after October 1, 1992, is used (data prior to October 1, 1992, is considered less reliable). The actual period of record depends on monitoring location. Due to the significant reduction in runoff following Site closure, professional judgment is used where appropriate.

[18] The Site currently employs 15- and 22-L composite bottles (carboys).

[4] The expected discharge volume is then divided by the targeted number of grab samples to obtain a discharge volume per grab sample. This is the flow pace for the composite sample.

Continuing with the GS10 example, collecting 60 grab samples for a stream discharge of 1.37 MG results in a flow pace of 22,833 gallons per grab sample.

### 8.1.2 Surface Water Field Data Collection

***Manual Field Data Collection***

The following sections describe data and information collected by field personnel, as opposed to automated equipment.

#### *Field Parameters*

QC objectives for the collection of field parameters and representative samples of surface water are established to ensure that data are of sufficient quality to support the decisions identified in the following sections. The QC objectives for field data collection are the following:

- Sampled water is representative of surface water;
- Sampling techniques do not introduce contaminants into samples;
- Sampling techniques are generally standardized for improved reproducibility and comparability of results; and
- Water levels are measured precisely enough to detect minor fluctuations (approximately ±0.005 foot) in stage.

The SAP and this RFSOG are followed to ensure that quality samples are collected for use in environmental decision making.

#### *Routine Monitoring Station Inspections*

The types of information that are routinely recorded in logbooks during a monitoring station visit include the following:

- Records of meter water level readings and actual staff gage elevations, and calibration notes where appropriate;[19]
- Surface water sample information including the sample flow pacing, enable levels for sample triggering, grab volumes, and missed grab samples (including likely cause, e.g., frozen automated sampler intakes);
- Routine instrument inspection and performance check notes; [20] and
- Crest stage indicator data to allow for flow estimates when the capacity of the primary structure is exceeded.

[19] Flow meters are adjusted to match staff gages on an as-needed basis. Equipment may be performance-checked and adjusted, repaired, or replaced as needed based on data trends and professional judgment.
[20] Equipment may be performance-checked and adjusted, repaired, or replaced as needed based on data trends and professional judgment. This includes status of power systems, precipitation gages, flow-control structures, and telemetry instrumentation.

### *Automated Field Data Collection*

The types of data that the station instrumentation automatically collects include the following depending on the location-specific monitoring objective:

- Continuous record of stream stage (later converted to discharge) on 5-minute intervals.[21] These data are continuously logged by the flow meter.
- Surface water sample record, indicating date and time of the collection of individual grab samples that are composited in the sample bottles. These data are continuously logged by both the flow meter and the automated sampler.
- Continuous record of precipitation at 5-minute intervals.[22]

#### *Flow and Precipitation Data Collection*

As stated previously, routine inspection and maintenance of the monitoring stations are required to detect leaks or damage to the flow-control structures, troubleshoot problems with the instrumentation, and provide calibration notes for subsequent computation of the discharge records for each station. Flow meter levels are adjusted to match staff gages on an as-needed basis. Flow measurement equipment may be performance-checked, repaired, or replaced as needed based on data trends and professional judgment. The flow meters log stream stage continuously, storing data points at 5-minute intervals. Particular care is needed during winter freezing conditions to prevent damage to the flow meters. This may involve temporary suspension of flow data collection until more favorable weather conditions resume, providing substantially ice-free conditions such that flow meters and flumes/weirs can be operated effectively.

At select locations, continuous records of precipitation are collected at 5-minute intervals. Precipitation gages are positioned across the Site to collect representative sitewide variations and allow for areal precipitation calculations. Precipitation gages are performance-checked monthly to manufacturer's recommendations. Precipitation equipment may be performance-checked, repaired, or replaced as needed based on data trends and professional judgment.

At least once a month, the water level and precipitation data are downloaded from the flow meters to a laptop PC. These data are then transferred to Site servers for compilation and evaluation (see Section 8.2.1). All data are backed up to multiple electronic media to avoid accidental data loss. All flow data are also uploaded to the Site's SEEPro database for archival purposes. Many of the collected data are also logged via telemetry as a secondary (redundant) data collection platform. In addition, flow meters are equipped with real-time paper strip chart recorders that record water levels, precipitation, and sample event marks.

[21] Flow data are subsequently calculated using the 5-minute data summarized on 15-minute intervals; the higher resolution 5-minute data are collected to allow for more detailed evaluation if needed.
[22] Precipitation gages are positioned across the Site to collect representative Sitewide variations and allow for areal precipitation calculations.

#### *Applicable Software*

The ISCO® monitoring equipment operates on proprietary Flowlink software. This software operates on a laptop computer, which is used to program the instrumentation and download field data. This software is also operated on office workstations for subsequent data evaluation.

The Geomation® telemetry operates with the Model 3106 OPC Data Access Server with a remote terminal unit (RTU) configurator. This software is used to program the instrumentation and interface with data logging and evaluation software. The Geomation Model 3106 is OPC-compliant, providing an industry-standard interface for the entire OutDAQ product line. OPC (OLE—Microsoft's Object Linking & Embedding—for Process Control) is a set of industry standards providing interoperability between field equipment, such as RTUs, with automation software for logging, archiving, and displaying data. The 3106 OPC Data Access Server provides a Modbus serial interface to 3300/3310 RTU networks, and provides a uniform data access interface to leading client software packages for Supervisory Control and Data Acquisition/Human Machine Interface (SCADA/HMI), data acquisition, trending, and archiving. For the OPC Client, the Site currently uses the OPC Systems.NET software package for tagging and logging of data. The Site has developed several Visual Basic applications and Open Database Connectivity (ODBC)-linked Excel spreadsheets for routine data evaluation and reporting.

#### *Applicable Instructions and Resources*

Data collection procedures are further outlined in manufacturer instruction manuals. The applicable manufacturer manuals and other resources are listed in Section 7.1. Additional applicable resources are as follows:

Chow, V.T., D.R. Maidment, and L.W. Mays, 1988. *Applied Hydrology*, McGraw-Hill, Inc., New York, New York.

### 8.1.3 Groundwater Monitoring Considerations

#### *Scheduling*

Wells that are sampled semiannually will be sampled during the spring and winter quarters (second and fourth calendar quarters, respectively) because these generally represent high- and low-water conditions at the Site. Data from these wells will therefore reflect a broad range of conditions. Wells scheduled for annual sampling will be sampled during the spring quarter, as will wells scheduled for biennial sampling.

To the extent that it is feasible, all groundwater samples (and corresponding surface water grabs, where appropriate) collected in support of a given plume or source area should be collected together, over a short period of time, so that data from the individual locations correspond closely in time with each other. This allows a more accurate "snapshot" of groundwater conditions (and, in some cases, related surface water conditions) in each area, and also enhances the efficiency of the monitoring program. If feasible, wells that are consistently low producers should be sampled in the early part of a sampling period to allow more time for the water level to equilibrate before the next-scheduled water level measurement. Table 6−1 lists the required sampling frequency, and Table 8−1 summarizes groundwater sample collection schedule considerations via suggested well groupings.

Sampling per the suggested groupings is not required but may enhance the usability of the data. Some locations fall outside the areas of interest and may be monitored when convenient. This applies to the Boundary wells, as shown in Table 8−1, but also applies to other wells that, because of a correlation between locations and monitoring objectives, are listed within groups (such as well 30002 in the PLF/PU&D Yard group, well 22996 in the 903 Pad/Ryan's Pit Plume group, and well 45608 in the Oil Burn Pit #2/B991/Mound group; the latter two wells could alternatively be monitored together to support the last of these groups). Finally, note that only a subset of the wells in each group may need to be monitored in any given quarter.

### *Sampling*

Guidelines for the collection of groundwater samples are provided in the SAP. Basic requirements include:

- Groundwater samples will generally be collected using peristaltic pumps, bladder pumps, or freshly decontaminated, reusable bailers. Bailed wells will be purged and sampled gently to reduce the agitation caused by use of a bailer.
- Groundwater samples to be analyzed for total uranium, plutonium, and americium, or metals (which must include uranium) will be field-filtered; those to be analyzed for VOCs, semivolatile organic compounds (SVOCs), or nitrate will be unfiltered. Where surface water samples are collected in support of groundwater objectives, the sampling requirements imposed by surface water methodologies will be allowable unless the Groundwater lead determines this to be inappropriate, in which case the sampling methods will be changed or additional samples will be collected. For example, at GS13, analytical data for isotopic uranium in unfiltered samples are reported, and are converted to total uranium mass, with any necessary notations made regarding this conversion and the unfiltered condition of the samples. If this was deemed inappropriate, either the sampling method would be changed or grab samples would be collected and filtered for the analysis of total uranium.
- Field parameters that will be measured include temperature, pH, specific conductance, turbidity, and total alkalinity. These will be measured during the purging process and will be used to confirm the completion of purging. Other parameters may be requested on occasion.
- If limited groundwater sample volumes prevent collection of the full suite assigned to a given well, samples for analysis generally will be collected in the order defined below. (Note that samples for many of the listed analytes are only collected at a very few locations. Refer to Table 2 of Attachment 2 to RFLMA for well-specific analytical suites.)

  — VOCs;

  — SVOCs;

  — Nitrate;

  — Metals;

  — Total uraniumU; and

  — Plutonium-239,240 and americium-241.

*Table 8−1. Scheduling Monitoring Location Groups for Optimal Data Usability*

| ***North Supergroup*** | ***North Supergroup (continued)*** | ***East Supergroup (continued)*** |
|---|---|---|
| **Oil Burn Pit #1 / B371 Group** | **PLF / PU&D Group** | **East Trenches Plume Group** |
| 33502 | 70193 | 3687 |
| 33604 | 70393 | 05691 |
| 33703 | 70693 | 03991 |
| 33905 | 73005 | 04091 |
| 37405 | 73105 | 95099 |
| 37505 | 73205 | 95199 |
| 37705 | 4087 | 95299 |
| **North-Central IA Group** | B206989 | 23296 |
| P114689 | 30900 | TH046992 |
| 55905 | 30002 | ET INFLUENT |
| 56305 | | ET EFFLUENT |
| 21505 | | POM2 (grab) |
| P115589 | | 00997 |
| 70705 | | |
| **B771 / IHSS 118.1 Group** | ***East Supergroup*** | |
| 20205 | **Oil Burn Pit #2 / B991 / Mound Group** | |
| 20505 | 45608 | |
| 20705 | 91105 | ***South Supergroup*** |
| 42505 | 91203 | **B444 Group** |
| 18199 | 91305 | 40005 |
| 20902 | 99305 | 40205 |
| 52505 | 99405 | 40305 |
| SW018 (grab) | 00897 | P419689 |
| **SEP Group** | 15699 | P416889 |
| P210189 | MOUND R1-0 | 11502 |
| 79102 | MOUND R2-E | **OLF Group** |
| 79202 | GS10 (grab) | P416589 |
| P208989 | **903 Pad / Ryan's Pit Plume Group** | 80005 |
| 79302 | 22996 | 80105 |
| 79402 | 00191 | 80205 |
| 79502 | 07391 | 11104 |
| 79605 | 90402 | **B881 / 881 Hillside Group** |
| 00203 | 50299 | 88104 |
| 22205 | 00491 | 88205 |
| P210089 | 90804 | 00797 |
| 70099 | 90299 | 891WEL |
| B210489 | 90399 | 89104 |
| 51605 | 10304 | |
| 10594 | 00193 | |
| SPPMM01 | | |
| SPP DIS GAL | | ***Wells that aren't in any group*** |
| SP IN | | 10394 |
| GS13 (grab) | | 41691 |

The order in which analytical samples are to be collected may be altered to fit statistical needs or for specific wells/areas. Field-filtered samples for the analysis of dissolved plutonium and americium are included in the analytical suite for several wells located downgradient of former Buildings 371 and 771. These data will be used to confirm that closure of those facilities has not impacted downgradient groundwater with these radionuclides. Groundwater monitoring for plutonium and americium is included in response to community concerns; there is no technical reason for this monitoring. For additional discussion of this topic, refer to the *Actinide Migration Evaluation Pathway Analysis Report* (K-H 2002c) or the report *Interim Measures/Interim Remedial Action for Groundwater at the Rocky Flats Environmental Technology Site*, (K-H 2005).

### 8.1.4 Groundwater Field Data Collection

Field parameters such as pH, temperature, specific conductance, alkalinity, and turbidity will be measured during groundwater sample collection activities. Other parameters may also be measured if desired, such as dissolved oxygen, Eh or oxidation-reduction potential (ORP), and others. In all cases, instructions supplied by the instrument manufacturer will be followed to generate quality data. Similarly, these instruments will be maintained as instructed by the manufacturer. Maintenance may include such activities as disassembly and cleaning, adjustment, calibration, and/or return to the manufacturer or a third party for maintenance. When an instrument is deemed faulty, it will be taken out of service immediately, and any suspect data it may have generated will be flagged as such. The instrument will be repaired or replaced as soon as possible if necessary for the continued efficient operation of the program. If not repaired or replaced, it will be disposed of so that it is not inadvertently used for data collection at a later time. Refer to the SAP for additional information.

## 8.2 Data Evaluation

### 8.2.1 Surface Water Hydrologic Data

Flow and precipitation data are compiled and evaluated using industry standard criteria, manufacturer recommendations, and the resources discussed in Sections 7.1.3 and 8.1.2. Data are routinely considered and evaluated in the following ways:

- Values are checked using the radio telemetry equipment for project management decision support.
- A detailed workup of 15-minute interval data is generated and archived.
- A detailed workup and evaluation of daily averages is compiled and archived.

Additional evaluation may be performed for a variety of reasons including source evaluations, special requests, project-specific monitoring evaluations, and hydrologic studies.

#### *Discharge Data Compilation and Computation*

Data obtained at a continuous surface water gaging station on a stream or conveyance, such as an irrigation ditch, consist of a continuous record of stage,[23] individual measurements of discharge

[23] Stage is the water level (in units such as feet or meters) in a conveyance structure.

throughout a range of stages, and notations regarding factors that might affect the relation of stage to discharge. These data, together with supplemental information such as climatological records (e.g., temperature and precipitation), are used to compute daily mean discharges.

Continuous records of stage are obtained with electronic recorders that store stage values at select time intervals or secondarily with radio-telemetry data-collection platforms that transmit near-real-time data at select time intervals to a central database for subsequent processing. Direct field measurements of discharge are made with current meters, using methods adapted by the U.S. Geological Survey (USGS), or with flumes or weirs that are calibrated to provide a relation of observed stage to discharge. These methods are described by Carter and Davidian (1968) and Rantz (1982a, 1982b).

For standard flow-measurement devices (e.g., flumes and weirs), rating tables indicating the discharge for any stage within the range of the device are prepared based on the geometry of the device. If it is necessary to define extremes of discharge outside the range of the device, the curves can be extended using (1) logarithmic plotting, (2) velocity-area studies, (3) the results of indirect measurements of peak discharge, such as slope-area or contracted-opening measurements, and computation of flow over dams or weirs, or (4) step-back-water techniques.

Daily mean discharges are computed by averaging the individual discharge measurements calculated from the stage-discharge curves or tables. If the stage-discharge relation is subject to change because of frequent or continual change in the physical features that form the control, the daily mean discharge is determined by the shifting-control method, in which correction factors based on the individual discharge measurements and notes by personnel making the measurements are applied to the gage heights before the discharges are determined from the curves or tables. This shifting-control method also is used if the stage-discharge relation is changed temporarily because of aquatic vegetation growth or debris on the control. For some gaging stations, formation of ice in the winter can obscure the stage-discharge relations so that daily mean discharges need to be estimated from other information, such as temperature and precipitation records, notes of observations, and records for other gaging stations in the same or nearby basins for comparable periods.

For most gaging stations, there may be periods when no gage-height record is obtained or the recorded gage height is faulty so that it cannot be used to compute daily mean discharge or contents. This record loss occurs when recording instruments malfunction or otherwise fail to operate properly, intakes are plugged, the stilling well is frozen, or various other reasons. For such periods, the discharges are estimated from the recorded range in stage, previous or following record, discharge measurements, climatological records, and comparison with other gaging-station records from the same or nearby basins.

### *Applicable Instructions and Resources*

Data evaluation procedures are further discussed in the resources listed in Sections 7.1.3 and 8.1.2. Additional applicable resources are as follows:

- Bedient, P.B. and W.C. Huber, 1992. *Hydrology and Floodplain Analysis*, Second Edition, Addison-Wesley Publishing Company, Reading, Massachusetts.
- Chow, V.T., D.R. Maidment, and L.W. Mays, 1988. *Applied Hydrology*, McGraw-Hill, Inc., New York.

- Thomann, R.V. and J.A. Mueller, 1987. *Principles of Surface Water Quality Modeling and Control*, Harper and Row, Publishers, Inc., New York.

### 8.2.2 Groundwater Data

Routine chemical analysis of groundwater identifies the contaminants present and the concentrations of contaminants with respect to applicable water quality standards. These data are compared against predetermined and/or well-specific concentrations to identify whether reported concentrations in groundwater are indicative of worsening conditions.

Depending on the well classification and analyte, concentrations are compared in accordance with one or more of the following criteria:

- Individual analytical results are compared with surface water standards identified in Table 1 of Attachment 2 to RFLMA.
- Statistically derived 85th percentile concentrations are compared with the same surface water standards.
- Specific statistical methods are used to determine concentration trends.
- Concentrations in downgradient wells are compared against those in upgradient wells.

In addition to these criteria, a "threshold concentration" is used for comparison of uranium results. Data from wells associated with monitoring for RCRA purposes are evaluated differently, as discussed in their respective sections.

These concepts are discussed below. Well classifications, which determine which of the criteria above apply, are listed in Table 6−1.

***Data Usage***

Of the analytical data received from laboratories, 100 percent will be validated and verified. In addition, analytical results that appear anomalous or are of special interest may receive more detailed validation on request. The groundwater lead will make the final determination of whether this additional validation is warranted, and if so, will work with the Analytical Data lead to have this done. Data qualified as "rejected" during the validation process (validation qualifier containing an "R") will not be used in any of the data evaluations.

Analytical data for any analyte in which the result is qualified with a "U" (not detected at the reported detection limit), either by the laboratory or via data validation, will be considered "nondetects."

Groundwater data evaluations will be based on water sampling performed since January 1, 2000. This period of record allows sufficient historical data for evaluation of recent groundwater quality trends without the bias introduced by including much older data collected when the Site was far from closure. Exceptions to this date may be made if necessary and if supported by professional judgment. In particular, all uranium data generated using high-resolution inductively coupled plasma/mass spectrometry (HR ICP/MS) or thermal ionization mass spectrometry (TIMS) analytical methods have been included, regardless of the date of analysis. These data were collected from select locations for characterization purposes beginning in 1999.

Analytical data for primary ("FIELD SAMPLE" or "F" in SEEPro) samples will be used for evaluating groundwater quality trends and 85th percentile calculations. Samples collected to meet quality assurance/quality control (QA/QC) requirements (e.g., field duplicates, trip blanks, and equipment blanks) may be used in performing data quality assessments (DQAs), but are not used for groundwater quality evaluation.

Numerous wells were replaced as a result of Site closure activities. The appropriateness of pooling data from the "original" well with those from the "replacement" well (or wells, if the well has been replaced more than once) will be determined on a case-by-case basis, using professional judgment, and will typically depend on the objective of the data evaluation (e.g., simple time-series plots as opposed to statistical trending). Three examples illustrate why inflexible data-pooling requirements would be inappropriate:

1. Some wells were replaced because the original well was inadvertently damaged or had to be removed to accommodate demolition activities. Construction, design, and location of the replacement well may be essentially identical to that of the original well. In cases such as this, analytical data from the original and replacement wells should probably be pooled.
2. In some cases, original wells were installed within a contaminant source area that was subsequently remediated via source removal, thereby also removing the original well. A replacement well may then have been installed at the downgradient edge of the excavation boundary after source removal activities were completed. Pooling of analytical data from the original and replacement wells in this case would typically not be appropriate, at least for such purposes as trend calculations.
3. If the geochemical conditions indicated by the analytical data from the replacement well are markedly inconsistent with those from the original well (as may be evident in time-series plots, for example), it may be appropriate to discontinue data pooling. Discontinuous trend plot behavior would be evident in the second example above, but in some instances the reason for the inconsistencies may not be known (e.g., there was no source removal).

Table 8−2 provides a crosswalk of original and replacement well identifications.

*Table 8−2. Crosswalk of Original and Replacement Well Identifications*

| Original Well | Replacement Well | General Location Description |
|---|---|---|
| 00200 | 70705 | East side of B707 |
| 00297 | 00203 | South side of SEP |
| 1386 | 51605 | North Walnut Creek west of Pond A-1 |
| 1986 | 52505 | West of B771/774 in unnamed drainage |
| 20298 | 20205 | North of B771/774 |
| 20598 | 20505 | North of B771/774 |
| 20798 | 20705 | North of B771/774 |
| 20998 | 20902 | West of B771 in unnamed drainage |
| 21098 | 21002 | West of B771 in unnamed drainage |
| 21398 | 21305 | West of B776 in unnamed drainage |
| 21598 | 21505 | West of B776 in unnamed drainage |
| 21698 | 21605 | West of B559, B776 in unnamed drainage |
| 2187 | 91305 | South Walnut Creek southeast of B991 |
| 22298 | 22205 | North of SEP |
| 33603 | 33604 | South of B371/374 near Oil Burn Pit #1 source area |
| 33904 | 33905 | Southeast of B371/374 |
| 37101 | 37105 | West of B371/374 |
| 37401, 37402 | 37405 | North of B371/374 |
| 37501 | 37505 | North of B371/374 |
| 37701 | 37705 | East of B371/374 |
| 39691 | 39605 | West of B881 |
| 40099 | 40005 | West of B444 |
| 40299 | 40205 | South of B444 |
| 40399 | 40305 | East of B444 |
| 45605 | 45608 | South of B991 |
| 5187 | 88205 | South of B881 |
| 55901 | 55905 | North of B559 |
| 56301 | 56305 | West of B559 |
| 88101 | 88104 | South of B881 |
| 891COLWEL | 891WEL (see notes, below) | OU 1 Plume source area |
| 90803 | 90804 | 903 Pad/Ryan's Pit Plume |
| 91103, 91104 | 91105 | Oil Burn Pit #2 source area |
| 99301 | 99305 | East of B991 |
| 99401 | 99405 | East of B991 |
| P207989 | 79605 | East of SEP |

Notes: 891COLWEL was a large-diameter collection well equipped with a dedicated industrial pump. The pump was removed and a 2-inch polyvinyl chloride (PVC) well was installed within the larger-diameter casing of the collection well. This PVC well is named 891WEL. A new name was required because of the changes in downhole conditions and sampling methods.
Source: 2006 IMP (DOE 2006f) except information related to original well 45605, which was replaced in 2008 due to a slump that developed and damaged the original well.

### *Comparing Data with Standards*

RFLMA requires that analyte concentrations in groundwater be compared against the greater of the standard, PQL, or TM listed in Table 1 of Attachment 2 to RFLMA, or to the appropriate uranium threshold also defined in that attachment and discussed further below. Because Site

groundwater quality must be protective of surface water quality, the groundwater quality data for constituents other than uranium will be compared with surface water standards, PQLs, and TMs as described below. The surface water standards, PQLs, and TMs are hereafter referred to collectively as "surface water standards." Analyte concentrations in groundwater may also be compared against concentrations reported at other wells.

Concentrations of a particular analyte in a particular monitoring well are referred to as an "analyte-well" combination. Except in specific instances concerning results from AOC and Boundary wells, as provided on the Figure 7 flowchart in RFLMA (Attachment A2), concentrations of an analyte-well will not be considered greater than the applicable surface water standard until the 85th percentile of the data for that analyte-well are above the standard. This will prevent a single data point, with its associated uncertainty in sampling and analysis, from causing unnecessary follow-up actions.

The 85th percentile of the analyte-well data is estimated by the nonparametric method described by the Colorado Water Quality Control Commission (CWQCC) guidance (CWQCC 2004, p. 4). This procedure is as follows:

1. Nondetect[24] concentrations are replaced by zeros for the procedure.
2. Potential data outliers are retained in the working dataset.
3. The concentration data are grouped by analyte and then by well.
4. Within each group of "n" data points, the concentrations are sorted in ascending order from smallest to largest concentration.
5. Each concentration is assigned an integer rank or "order statistic." The first nondetect (or smallest detect if there are no nondetects) is assigned rank 1. The largest concentration is assigned rank n.
6. The 85th percentile is estimated by the concentration whose rank is 0.85(n+1), if the rank is an integer.
7. If the above percentile rank is not an integer, the rank is rounded to the closest integer rank. The 85th percentile is then taken as the concentration of the closest integer rank.
8. In cases where the direction of rounding is ambiguous, interpolation between the ranks is suggested. This issue is not addressed by CWQCC guidance (2004).
9. Percentiles are not estimated until there are a minimum of eight regularly scheduled concentration measurements (i.e., eight successful sampling events from the routine semiannual or other applicable schedule) for an analyte-well. This is consistent with the minimum dataset for trending, discussed below. CWQCC does not address the minimum sample size for estimating percentiles.

The CWQCC procedure (2004) is nearly identical to that given by the widely cited statistical text, Snedecor and Cochran (1967, p. 125) for estimating percentiles of any continuous frequency distribution. The difference is that Snedecor and Cochran (1967) call for linear interpolation of the percentile when the order statistic is not a whole number. CWQCC guidance (2004) calls for "rounding down"; water quality comparisons at the Site employ ordinary rounding to the nearest integer, rather than truncation to the next lower integer.

[24] Any analyte not detected at the reported detection limit is considered nondetect.

### *Trend Analysis*

Groundwater quality data will be compiled into a database and evaluated for trend as follows:

1. Trends are not estimated until there are a minimum of eight regularly scheduled concentration measurements (i.e., eight successful sampling events from the RFLMA-required semiannual or other applicable schedule) for an analyte-well. Trends based on fewer routinely collected data will not drive compliance decisions. For example, 2 years of quarterly results at a location where the RFLMA-required monitoring frequency is semiannual may provide eight results, but actually only four routine results; another 2 years of semiannual monitoring data would be necessary to collect the minimum of eight routine results.

   Trend analysis requires a minimum of four data points per sampled season.

2. Potential data outliers are retained in the working dataset.

3. Nondetect concentrations are replaced by zeros so that nondetects are lower than detects at the reporting limit. This also treats all nondetects as ties when multiple reporting limits are present in the data. However, some statistical calculations cannot proceed if zeroes are in the dataset; in such cases, nondetects are typically replaced with a near-zero value such as 0.001. (The RFLMA standard will need to be considered when replacing nondetects, to ensure the replacement value does not cause an unacceptable bias in the statistical results.)

   It is not necessary to test for trend if all of the concentrations for an analyte-well are nondetect. There is no evidence of trend in this case.

4. Data for each analyte-well is tested for trend by applying the nonparametric Seasonal-Kendall (S-K) test and the associated S-K slope estimator (K-H 2004f). The S-K test is described by Hirsch et al. (1982) and Gilbert (1987, Chapter 17). If the well is sampled on an annual or biennial schedule (once per year or once every other year, respectively), the Mann-Kendall (M-K) test may be used if desired, since seasonality will not be a factor.

5. The S-K (or M-K, if applicable) test is applied at the 95 percent level of confidence for a one-tailed test (i.e., false positive error level $\alpha = 0.05$).

   It is recommended that the S-K (or M-K) method be calculated by commercially available statistical software.

The null hypothesis ($H_0$) of the S-K test is that there is no trend. The S-K test statistic is identified as "Z." The one-tailed S-K test for an uptrend at the $\alpha = 0.05$ level finds sufficient evidence to reject $H_0$ if test statistic Z is positive and greater than table value $Z_{0.95}$. Table values for the test may be found in Gilbert (1987, Table A1). Similarly, statistically significant evidence of a downtrend is found when Z is negative and the absolute value of Z is greater than $Z_{1-\alpha}$. Further considerations on trend testing of Site groundwater data are found in K-H (2004f).

### *Comparison with "Threshold" Concentration of Uranium*

Rocky Flats is located in an area with high background levels of uranium in soil and groundwater. These background levels are naturally occurring. Therefore, because the

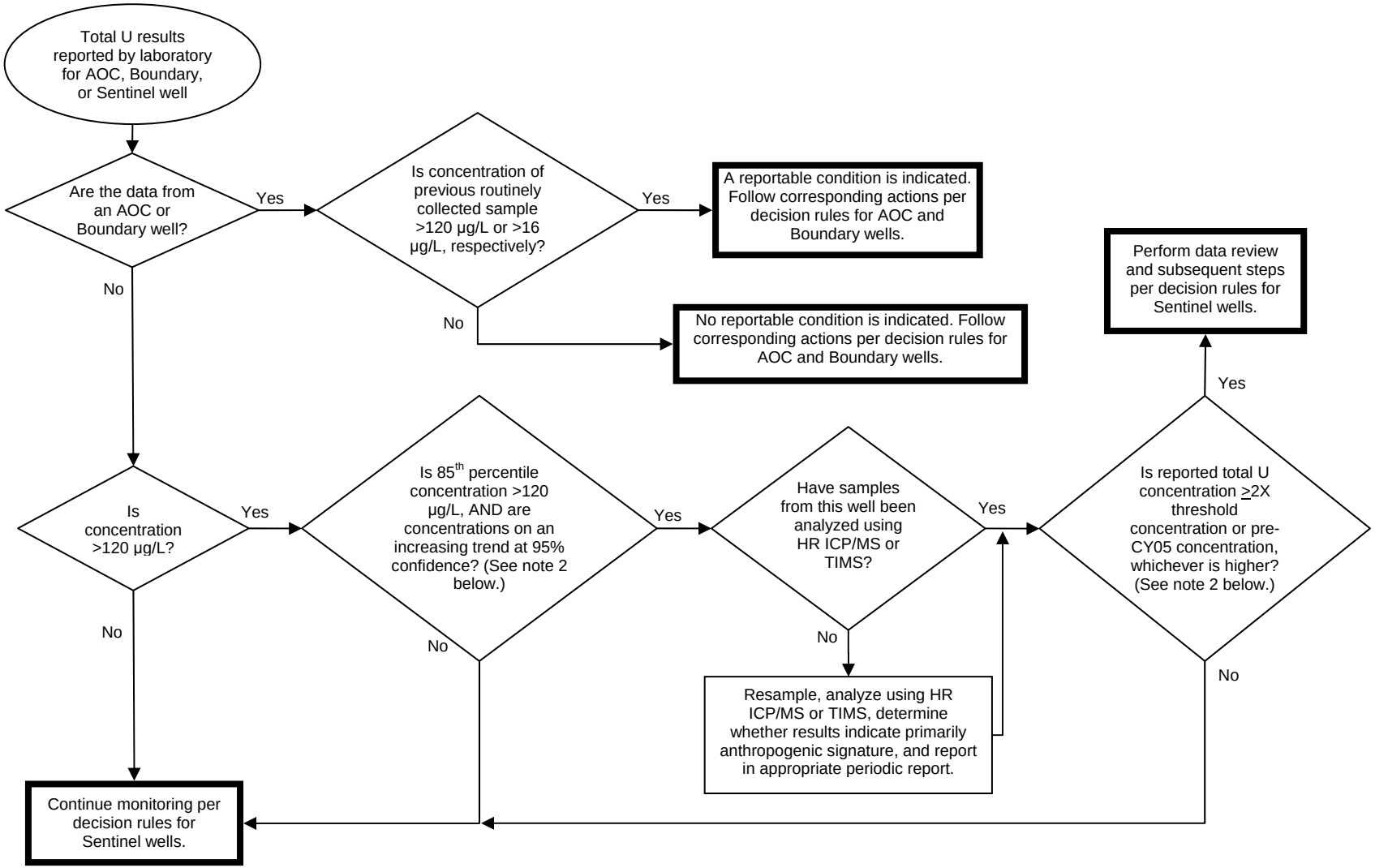
corresponding uranium surface water standard is relatively low, a separate rule has been created for uranium concentration comparisons in groundwater.

Concentrations of total uranium from a given AOC or Boundary well will be compared directly with the corresponding uranium threshold (120 and 16 micrograms per liter [µg/L], respectively). Concentrations of total uranium from a given Sentinel well will be assessed using statistical trending, calculation of the 85th percentile concentration, and comparison of the 85th percentile concentration with the 120 µg/L uranium threshold. In addition, high-resolution isotopic data collected during uranium characterization efforts may apply at Sentinel wells, as shown on Figure 8−2.

These threshold values were selected in consultations with CDPHE and EPA. The 16 µg/L concentration is based on a conversion of the 11 pCi/L Site-specific surface water standard for Woman Creek. The 120 µg/L concentration is rounded from the grand mean of samples collected at RFETS and analyzed using HR ICP/MS or TIMS through groundwater characterization efforts of 1999−2003. As part of these efforts, over 50 wells in areas of contamination as well as the former BZ were sampled for the analysis of uranium using HR ICP/MS or TIMS. Results of HR ICP/MS and/or TIMS analysis can be assessed to determine whether the isotopic signature is indicative of natural uranium (i.e., naturally present in the water, soils, and rocks) or shows anthropogenic (manmade) influence. Due to the elevated natural uranium concentrations at Rocky Flats, this determination is important in designing a response to elevated uranium concentrations.

If the total uranium concentration at a given AOC or Boundary well exceeds the corresponding uranium threshold, or the 85th percentile total uranium concentration at a given Sentinel well exceeds the threshold concentration, additional inspection of the data will be required. Figure 8−2 guides this process.

The total reported pCi value may be converted to micrograms (µg) using the conversion factors in Table 8−3. To convert total natural uranium reported in mass units to activity units, the factor is 0.68596 pCi/µg (derived from Friedlander 1981).




Notes: see RFLMA Attachment 2 Figure 1 and Tables 1 and 2 for locations, standards, and sampling criteria (Attachment A2).

1. For Boundary wells, the 16 µg/L concentration is based on the 11 pCi/L surface water standard converted to mass units, assuming a natural isotopic signature.
2. For AOC and Sentinel wells, the 120 µg/L concentration is based on a grand mean of HR ICP/MS and TIMS data collected Sitewide from the late 1990s through mid-2000s.
3. "Highest pre-CY05" concentration is the maximum of either the reported total uranium (i.e., in mass units) or as converted from activity units to mass units.

*Figure 8−2. Uranium Threshold Flowchart*

*Table 8−3. Activity to Mass Conversion Factors for Uranium Isotopes*

| Analyte | Mass/Activity (g/Ci) |
|---|---|
| U-233,234 | 1.6 E+02 |
| U-235 | 4.63 E+05 |
| U-238 | 2.98 E+06 |

Notes: These conversion factors for U-233,234, U-235, and U-238 were taken from 40 CFR, Chapter I, Part 302.4, Appendix B, October 7, 2000.

At AOC and Boundary wells, confirmatory results will be required; these will be obtained during the next regularly scheduled sampling event. If the second sample confirms the initial concentration (i.e., the second result also exceeds the uranium threshold for AOC or Boundary wells, as applicable), this second result suggests a reportable condition exists. The second result will be thoroughly validated and, if confirmed, the steps defined on the Figure 7 flowchart in RFLMA (Attachment A2) for a reportable condition will be taken.

At Sentinel wells, the statistical trend of the uranium data will be calculated to determine whether uranium is increasing at the 95 percent confidence level. If this condition is true at a given Sentinel well, the next consideration will be whether samples from the well have previously been analyzed using HR ICP/MS or TIMS; if not, this will be one component of the follow-up. If samples from this Sentinel well have been analyzed using either of these methods, the just-reported total uranium result will be compared against two times the highest pre-CY 2005 concentration and two times the associated uranium threshold. Concentrations exceeding these values will signal off-normal conditions that warrant careful inspection.

The highest pre-CY 2005 concentration data may be reported as total uranium (i.e., in units of mass) or as isotopic activities that are then converted to mass and summed for an equivalent total uranium concentration. Data to be used for this comparison include isotopic and total uranium data from samples collected January 1, 2000, through December 31, 2004, and all HR ICP/MS and TIMS data reported by Los Alamos National Laboratory (LANL) prior to December 31, 2004. Table 8−4 is a total uranium lookup table listing the highest pre-CY 2005 uranium concentrations for AOC, Boundary, and Sentinel wells that are represented by pre-CY 2005 data.

When HR ICP/MS or TIMS data are required, samples will be collected and delivered to the appropriate laboratory; to date, all such data have been generated by LANL. Upon receipt of the corresponding results, the isotopic data will be reviewed to determine whether they indicate a predominantly natural or anthropogenic signature. Next, one of the following two options will be taken:

- If a natural signature is indicated, the regulatory agencies will be informed and normal sampling and analysis will resume.
- If a definitive anthropogenic signature is indicated, the action specified for that well classification will be performed.

*Table 8−4. Uranium Lookup Table: Highest Pre-CY05 Results*

| Well/Replacement Well[a] | IMP Classification | Maximum Uranium Concentration (µg/L)[b] |
|---|---|---|
| 11104 | AOC | 61.1 |
| 10594 | AOC | 155.0 |
| 10304 | AOC | 11.7 |
| 00997 | AOC | 21.2 |
| 00193 | AOC | 114.1 |
| B206989 | AOC | 144.8 |
| 4087 | AOC | 63.6 |
| 41691 | Boundary | 8.2 |
| 10394 | Boundary | 10.2 |
| P210089 | Sentinel | 12.8 |
| 99401/99405 | Sentinel | 831.5 |
| 99301/99305 | Sentinel | 544.0 |
| 91203 | Sentinel | 3.7 |
| 90399 | Sentinel | 21.1 |
| 90299 | Sentinel | 118.0 |
| 88101/88105 | Sentinel | 629.1 |
| 70299 | Sentinel | 22.2 |
| 40399/40305 | Sentinel | 0.6 |
| 37701/37705 | Sentinel | 18.7 |
| 37501/37505 | Sentinel | 2.6 |
| 37401/37402/37405 | Sentinel | 73.6 |
| 23296 | Sentinel | 53.8 |
| 2187/91305 | Sentinel | 36.0 |
| 20798/20705 | Sentinel | 1.0 |
| 20598/20505 | Sentinel | 9.6 |
| 20298/20205 | Sentinel | 40.2 |
| 1986/52505 | Sentinel | 10.6 |
| 15699 | Sentinel | 44.6 |
| 1386/51606 | Sentinel | 35.6 |
| 11502 | Sentinel | 3.1 |
| 04091 | Sentinel | 4.7 |
| 00797 | Sentinel | 27.4 |

Notes: [a]The maximum value for a given location is used regardless of whether it is from a replacement well or its predecessor.
[b]The value shown represents the maximum of three possible values: data reported as total uranium in µg/L; data reported as isotopic uranium in parts per billion and then summed; or data reported as isotopic uranium in pCi/L and summed, then converted to µg/L using the conversion factor for natural uranium. In each case, the result is rounded to the nearest 0.1 µg/L.
Source: Modified after the 2006 IMP (DOE 2006f), with appropriate RFLMA-required changes in well classifications

Decisions that may be required in response to detection of elevated concentrations of total uranium will generally be made following the data evaluation flowchart shown on Figure 8−2, as required by the flowchart for the corresponding well classification.

### 8.2.3 Surface Water Data

Routine chemical analysis of surface water identifies the contaminants present and the concentrations of contaminants with respect to applicable water quality standards. These data are compared against standards to identify whether measured water quality is acceptable.

Depending on the monitoring objective and analyte, concentrations are compared using one or more of the following criteria:

- Compliance parameters[25] are compared with surface water standards identified in Table 1 of Attachment 2 to RFLMA according to the applicable data evaluation flowcharts in RFLMA (Attachment A2);
- Individual results are compared with surface water standards identified in Table 1 of Attachment 2 to RFLMA according to the applicable data evaluation flowcharts in RFLMA (Attachment A2); and/or
- Results from downstream locations are compared against those in upstream locations according to the applicable data evaluation flowcharts in RFLMA (Attachment A2).

These concepts are discussed below. Monitoring objectives, which determine which of the criteria above apply, are summarized in Table 6−1; details can be found in the specific objective sections above.

***Data Usage***

Of the analytical data received from laboratories, 100 percent will be validated and verified. In addition, analytical results that appear anomalous or are of special interest may receive more detailed validation on request. The surface water lead will make the final determination of whether additional validation is warranted. Data qualified as "rejected" during the validation process (validation qualifier containing an "R") will not be used in any of the data evaluations.

Interpretation of analytical data for any analyte in which the result is qualified with a "U" (not detected at the reported detection limit) will be considered nondetect. When a nondetect result is returned from the lab, then one-half the detection limit is used for calculation purposes. All radionuclide results will be used, regardless of a "U" qualifier.

When a negative radionuclide result (e.g., −0.002 pCi/L) is returned from the lab due to blank correction, a value of 0.0 pCi/L is used for calculation purposes.

Data pairs (e.g., a real result and its corresponding duplicate) for radionuclides will be screened using the duplicate error ratio (DER) to determine the representativeness of the values;[26] all other analyte pairs will be screened using the relative percent difference (RPD).[27]

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[25] Applicable compliance parameters are detailed in the specific monitoring objective sections (e.g., 12-month rolling averages, 30-day averages, and so forth). Methods for calculating these compliance parameters are given below.

[26] Significant differences in values for a data pair are an indication of potential problems with sample preparation and/or analysis. Under these circumstances, an applicable value to be used for comparison cannot be determined with sufficient confidence to make compliance decisions. As such, an evaluation is required to assess the representativeness of the sample and its usability for compliance decisions.

[27] Details regarding the handling of data pairs is given below for POC and POE data evaluation.

Analytical data for primary ("FIELD SAMPLE" in SEEPro) and duplicate[28] samples will be used for evaluating surface water data. Samples collected to meet QA/QC requirements (e.g., field duplicates, trip blanks, and equipment blanks) may be used in performing DQAs.

### *Comparing Data With Standards*

RFLMA requires that analyte concentrations in surface water be compared against the greater of the standard, PQL, or TM listed in Table 1 of Attachment 2 to RFLMA. The surface water standards, PQLs, and TMs are hereafter referred to collectively as "surface water standards."

### *POC and POE 30-Day Averages*

Evaluation of analytical data using 30-day volume-weighted moving averages is currently performed for the POE and POC monitoring objectives. The method is as follows:

- Calculations are performed using daily time steps. The 30-day average for a particular day is calculated using a "window" of time that includes the previous 30 days that had both flow and analytical measurements. Therefore, for a location with continuous flow and complete analytical results, 365 (366 in a leap year) 30-day average values are calculated annually. For a location that flows intermittently, the 30-day window includes the previous 30 days with greater than zero flow. Therefore, the 30-day average at an intermittently flowing location will include more than 30 *calendar* days.
- When no analytical result or measured flow value is available for a particular day, then no 30-day average is calculated for that day. No analytical result may be available either due to NSQ for analysis (Section 8.1.1) or a failed lab analysis. Flow measurement may be missing due to equipment failures or adverse weather conditions (e.g., winter freezing).
- When a negative radionuclide result (e.g., −0.002 pCi/L) is returned from the lab due to blank correction, then a value of 0.0 pCi/L is used for calculation purposes. When a nondetect result is returned from the lab for metals and water quality parameter analyses, then one-half the detection limit is used for calculation purposes.
- When a sample has a corresponding duplicate or reanalysis ("re-run"), **AND** *neither* result is greater than the applicable water-quality standard, **THEN** the value used in calculations is the arithmetic average of the values.
- When a sample has a corresponding duplicate or reanalysis ("re-run"), **AND** *either* result is greater than the applicable water-quality standard, **THEN** an evaluation of the data pair is performed to determine the representativeness of the sample results.[29] The method for determining representativeness is given below.

[28] When both the "real" and "duplicate" results are from the same sampling event, results will be arithmetically averaged, subject to DER and RPD calculation. Similarly, results from a valid reanalysis will also be included.
[29] Significant differences in values for a data pair are an indication of potential problems with sample preparation and/or analysis. Under these circumstances, an applicable value to be used for the calculation of 30-day averages cannot be determined with sufficient confidence to make compliance decisions. As such, an evaluation is required to assess the representativeness of the sample and its usability for compliance decisions.

***Determining Representativeness for Metals and Water-Quality Parameters***

1. The RPD for the data pair is calculated:

$$RPD(\%) = \frac{|R_1 - R_2|}{(R_1 + R_2)/2} * 100$$

*where* (Equation 8−1)

$R_1$ = *value of initial result*

$R_2$ = *value of duplicate result*

2a. **IF** the RPD is greater than or equal to 100 percent ([higher result] ≥ 3x [lower result]), **THEN** the results will be determined to be nonrepresentative. The results will not be used for the calculation of 30-day averages, and no 30-day average values will be computed for the days during which the sample was collected.

2b. **IF** the RPD is less than 100 percent ([higher result] < 3x [lower result]), **THEN** the results will be determined to be sufficiently representative. The arithmetic average of the results will be used for the calculation of 30-day average values.

***Determining Representativeness for Radionuclides***

1. The DER for the data pair is calculated:

$$DER = \frac{|R_1 - R_2|}{\sqrt{(2\sigma_{R1})^2 + (2\sigma_{R2})^2}}$$

*where*

$R_1$ = *value of initial result* (Equation 8−2)

$R_2$ = *value of duplicate result*

$2\sigma_{R1}$ = 2 *sigma error of initial result*

$2\sigma_{R2}$ = 2 *sigma error of duplicate result*

2a. **IF** the DER is greater than or equal to 1.5, **THEN** the results will be determined to be nonrepresentative. The results will not be used for the calculation of 30-day averages, and no 30-day average values will be computed for the days during which the sample was collected.

2b. **IF** the DER is less than 1.5, **THEN** the results will be determined to be sufficiently representative. The arithmetic average of the results will be used for the calculation of 30-day average values.

- Each calendar day is assigned the activity or concentration (analytical result in pCi/L or µg/L, as determined above) of the composite sample that was in progress at the end of that day (specifically, at 23:59:59).

- Each calendar day has an associated surface water volume (liters) that was measured by the flow meter. The flow record may contain estimated values for certain conditions.[30]
- The daily surface water volume is then multiplied by the corresponding activity/concentration to calculate a load (in pCi, mg, or μg) for each day.
- The sum of the daily loads (pCi, mg, or μg) for the preceding 30 days (with both flow and an analytical result) is divided by the sum of the daily surface water volumes (liters) for the preceding 30 days to calculate the volume-weighted 30-day average (pCi/L, mg/L, or μg/L). The equation can be given as follows:

$$\frac{\sum_{day=0}^{day=-29}[picocuries\ \ or\ micrograms]}{\sum_{day=0}^{day=-29}[liters]} = 30day\ \ Average_{day=0}[pCi/L, mg/L, or\ \ \mu g/L] \qquad \text{(Equation 8−3)}$$

- The 30-day average values are then rounded to two significant figures. No rounding occurs with the measured input numbers prior to calculation of the 30-day averages. Only the final calculated value is rounded. For example, a calculated value of 0.124 pCi/L would be rounded to 0.12 pCi/L. Similarly, a value of 0.246 pCi/L would be rounded to 0.25 pCi/L.
- These 30-day averages are then compared to the appropriate water-quality standards according to the criteria in the applicable data-evaluation flowcharts in RFLMA (Attachment A2).

### *POC and POE 12-Month Rolling Averages*

Evaluation of analytical data using 12-month volume-weighted rolling averages is currently performed for the POE and POC monitoring objectives (radionuclides and nitrate only). The method is as follows:

- Rolling 12-month averages are calculated monthly for each location (on the last day of each month).
- Calculations are performed using daily time steps. The rolling 12-month average for a particular day (specifically the last day of each month) is calculated using a "window" of time that includes the previous 365 calendar days. Therefore, for a location with continuous flow and complete analytical results, 365 (366 in a leap year) daily values are included in each window (12 windows per year). For a location that flows intermittently, the rolling 12-month window will include fewer than 365 daily values, because days of zero flow have no applicable analytical result or discharge volume.
- When no analytical result or measured flow value is available for a particular day, then the day is not included in the rolling 12-month window. No analytical result may be available either due to NSQ for analysis (Section 8.1.1) or a failed lab analysis. Flow measurement

[30] Estimation is required when flow rates exceed the capacity of the flow-control structure (e.g., a flume), winter ice conditions result in an inaccurate measurement, or there is an equipment failure.

may also be missing due to equipment failures or adverse weather conditions (winter freezing).

- When a negative radionuclide result (e.g., −0.002 pCi/L) is returned from the lab due to blank correction, then a value of 0.0 pCi/L is used for calculation purposes. When a nondetect is returned from the lab for nitrate analyses, then one-half the detection limit is used for calculation purposes.
- When a sample has a corresponding duplicate or reanalysis ("re-run"), **AND** *neither* result is greater than the applicable water-quality standard, **THEN** the value used in calculations is the arithmetic average of the values.
- When a sample has a corresponding duplicate or reanalysis ("re-run"), **AND** *either* result is greater than the applicable water-quality standard, **THEN** an evaluation of the data pair is performed to determine the representativeness of the sample results.[31] The method for determining representativeness is given below.

***Determining Representativeness for Nitrate***

1. The RPD for the data pair is calculated:

$$RPD(\%) = \frac{|R_1 - R_2|}{(R_1 + R_2)/2} * 100$$

*where* (Equation 8−4)

$R_1$ = *value of initial result*

$R_2$ = *value of duplicate result*

2a. **IF** the RPD is greater than or equal to 100 percent ([higher result] ≥ 3x [lower result]), **THEN** the results will be determined to be nonrepresentative. The results will not be used for the calculation of 30-day averages, and no 30-day average values will be computed for the days during which the sample was collected.

2b. **IF** the RPD is less than 100 percent ([higher result] < 3x [lower result]), **THEN** the results will be determined to be sufficiently representative. The arithmetic average of the results will be used for the calculation of 30-day average values.

[31] Significant differences in values for a data pair are an indication of potential problems with sample preparation and/or analysis. Under these circumstances, an applicable value to be used for the calculation of 30-day averages cannot be determined with sufficient confidence to make compliance decisions. As such, an evaluation is required to assess the representativeness of the sample and its usability for compliance decisions.

***Determining Representativeness for Radionuclides***

1. The DER for the radionuclide data pair is calculated:

$$DER = \frac{|R_1 - R_2|}{\sqrt{(2\sigma_{R1})^2 + (2\sigma_{R2})^2}}$$

*where*

$R_1$ = *value of initial result* (Equation 8−5)

$R_2$ = *value of duplicate result*

$2\sigma_{R1}$ = 2 *sigma error of initial result*

$2\sigma_{R2}$ = 2 *sigma error of duplicate result*

2a. **IF** the DER is greater than or equal to 1.5, THEN the results will be determined to be nonrepresentative. The results will not be used for the calculation of 12-month rolling averages.

2b. **IF** the DER is less than 1.5, **THEN** the results will be determined to be sufficiently representative. The arithmetic average of the results will be used for the calculation of 12-month rolling average values.

- Each calendar day is assigned the activity (analytical result in pCi/L or mg/L) of the composite sample that was in progress at the end of that day (specifically, at 23:59:59).
- Each calendar day has an associated surface water volume (liters) that was measured by the flow meter. The flow record may contain estimated values for certain conditions.[32]
- The daily surface water volume is then multiplied by the corresponding activity to calculate a load (in pCi or mg) for each day.
- The sum of the daily loads (pCi or mg) for the preceding 365 calendar-days (with both flow and an analytical result) is divided by the sum of the daily surface water volumes (liters) for the preceding 365 calendar-days to calculate the 12-month rolling average (pCi/L or mg/L). The equation can be given as follows:

$$\frac{\sum_{day=0}^{day=-364} [picocuries\ or\ micrograms]}{\sum_{day=0}^{day=-364} [liters]} = Rolling\ 12-Month\ Average_{day=0}[pCi/L\ or\ mg/L]$$

*where day = 0 is the last day of each month* (Equation 8−6)

- The 12-month rolling average values are then rounded to two significant figures. No rounding occurs with the measured input numbers prior to calculation of the 12-month rolling averages. Only the final calculated value is rounded. For example, a

[32] Estimation is required when flow rates exceed the capacity of the flow-control structure (e.g., a flume), winter ice conditions result in an inaccurate measurement, or there is an equipment failure.

calculated value of 0.124 pCi/L would be rounded to 0.12 pCi/L. Similarly, a value of 0.246 pCi/L would be rounded to 0.25 pCi/L.

- These 12-month rolling averages are then compared to the appropriate water-quality standards according to the criteria in the applicable data-evaluation flowcharts in RFLMA (Attachment A2).

## 8.3 Data Management

LMS is responsible for managing and maintaining the electronic monitoring data and geospatial data in compliance with DOE-LM requirements. Environmental monitoring data are produced mainly from sampling and automated monitoring systems.

Electronic or hard-copy field-data books and forms are assembled for most sampling events, recording relevant data for tracking purposes. These data are kept on file.

Data will be accessible over the Internet at www.lm.doe.gov through GEMS. Spatial data in GEMS include physical features and roads, nonphysical features such as the Site boundary and access control boundaries, and imagery such as orthorectified aerial photography and satellite imagery.

### 8.3.1 Water and Air

Data from samples submitted to an analytical laboratory are received as both hard copy and as an electronic data deliverable. The electronic data are loaded into an Oracle®-based relational database, which also contains historical monitoring data for RFP/RFETS. The environmental monitoring data are accessible using SEEPro. The hard-copy analytical reports are archived in the Site records library in Grand Junction, Colorado. The original field data forms and other relevant hard-copy forms or documents containing project data are archived in the Rocky Flats Site Central Files at the Westminster, Colorado, offices. Well construction and lithology logs are maintained for previously drilled wells and are produced for all new wells drilled. These logs are archived in the Site records library and can also be accessed electronically via the SEEPro database and GEMS.

SEEPro uses Oracle® software for data management and Microsoft® Access for data retrieval and display. It compiles water quality, air quality, field parameter, sample tracking, sample location, and water level data for groundwater, surface water, boreholes, soils, and sediment samples. Field parameter data include such information as sample location, sample date, pH, turbidity, conductivity, and temperature. Chemical information (Chemical Abstracts Service registry numbers, analytical results, and detection limits) is also included.

Specific procedures for verification of database information received from subcontractors, or input directly into SEEPro, are followed. These procedures provide QA documentation, which ensures that available data have been incorporated and entered or uploaded properly into SEEPro. Data integrity is maintained with standardized error checking routines used when loading data into SEEPro. Other procedures address database system security and software change control.

The hard copies of the Site field data are entered through the FieldPar field data entry system. This system is a data entry module that is compatible with the SEEPro database, and is used in the office by field personnel. Data entered into FieldPar are verified by the sampler before loading into the main SEEPro database. An electronic field data collection system is scheduled to be implemented at the Rocky Flats Site and will replace hard-copy field forms for some activities (e.g., groundwater sampling). After full implementation, data collected with the electronic Field Data Collection System (FDCS) will be automatically uploaded into FieldPar when the sampler uploads the collected data at the end of each sampling day.

Spatial information for Site features is located in the GIS database. Some of the data features included are monitoring locations, potentiometric surfaces, plume configurations, streams/creeks, lakes/ponds, topographic contours, and historic RFP/RFETS facilities. This system uses an ESRI® ArcGIS™ suite of software to store and present data. Automated monitoring locations and other sample location data features are derived from location information stored in the SEEPro database.

### 8.3.2 Ecology

Ecological data have been collected at Rocky Flats for many years. Since the early 1990s ecological data have been kept in electronic files for easier access, retrieval, and analysis. In the mid-1990s, the Sitewide Ecological Database (SED) was established as a master dataset for the various types of ecological data collected at the Site. The SED is a Microsoft Access® database that contains all quality-assured ecological data for RFETS from early 1993 through the end of 2001. The SED is located on the "Robin" server at the Rocky Flats office in Westminster, Colorado. Data that did not meet the QA objectives are not included in the database. Ecology data in the SED include vegetation monitoring, weed control and controlled burn vegetation monitoring, wildlife surveys (including birds, small mammals, frogs, insects, and fish), Preble's mouse habitat characterization and telemetry tracking, a small amount of soil characterization survey data (for revegetation issues), and a few other types of ecological data. The SED does not contain data on potential contaminants nor is it linked to any GIS or other spatial tool. Data in the SED are primarily observational or catch-and-release (e.g., small mammal or fish sampling); they are raw data taken directly from field logbooks and datasheets. The SED is not intended as a reference for the layperson. It is a repository of quality-assured raw field data collected by Site ecologists and should not be taken out of context of the methods used to collect the data. Data collection methods are not stored in the database; they are described in reports and field sampling plans.

From 2002 to the present, ecology data have been stored as separate datasets by sample type, event, and year. Depending on the dataset, the data may be in a Microsoft Access® database or a Microsoft Excel® spreadsheet format. The nonspatial electronic ecology data are stored on the "Robin" server at the Rocky Flats office in Westminster, Colorado, or on backup electronic media.

Spatial ecology data for the Site are available for several data types and are stored in the GIS on the "Gull" server in Grand Junction, Colorado. The types of ecological spatial data that are available include annual weed distribution data (for select species), annual weed control locations, biocontrol release locations, vegetation and wildlife monitoring locations (transect endpoints and sample points), vegetation community classifications, revegetation project

locations, wetland locations, wildfire/prescribed burn locations, Preble's mouse habitat, Preble's mouse and wetland mitigation work, and rare plant locations. These data are available in various ArcGIS®-compatible formats. In addition to these types of spatial data, orthorectified aerial and satellite imagery of the Site is also available for different timeframes (pre- and post-closure).

***Historical Ecology Information for Rocky Flats***

A master reference list of reports that contain information on the ecology of Rocky Flats is maintained by the Ecology Program (Attachment E1). The reference list contains documents dating back to the 1970s. Most of these documents have been scanned and are available electronically. Additionally, a variety of historical hard-copy aerial photographs of the Site are available that may be used for ecological evaluations. Electronic aerial and satellite imagery is also available through the GIS. Although a large amount of ecological information about the Site is available through the Ecology Program, additional information may be found in the federal archives through the Records Group.

## 8.4 Data QA/QC

### 8.4.1 QC Objectives for Collection of Water Data

General requirements for water monitoring activities are covered under the *Legacy Management CERCLA Sites Quality Assurance Project Plan* (LMS/PLN/S04353) (QAPP). The QAPP is consistent with the QA Program requirements of DOE Order 414.1C, *Quality Assurance* (DOE 2005.); environmental data operations requirements in EPA QA/R-5, *EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations* (EPA 2001b); and American National Standards Institute/American Society for Quality (ANSI/ASQ) E-4-2004, *Quality Systems for Environmental Data and Technology Programs: Requirements with Guidance for Use* (ANSI/ASQ 2004). The QA Program covers environmental activities and describes the requirements, methods, and responsibilities of environmental management, staff, contractors, and vendors for achieving and ensuring quality. The SAP presents the methods by which water monitoring is performed at the Site. Nonroutine evaluations and special sampling projects will be governed by task-specific work plans, SAPs, or other work control documents (Section 9.0).

The QAPP generally covers QC for the following components of the surface water and groundwater programs:

- Collecting and analyzing samples according to approved procedures; and
- Reducing, reporting, and managing data and records in a controlled manner.

QC objectives for the collection of field parameters and representative samples of groundwater are established to ensure that data are of sufficient quality to support the decisions identified in the previous section. The fundamental QC objectives for field data collection are the following:

- Sampled water is representative of UHSU groundwater.
- Sampling techniques do not introduce contaminants into samples or wells.
- Sampling techniques are generally standardized for improved reproducibility and comparability of results.

- Water elevations are measured precisely enough to detect minor fluctuations (+/-0.01 foot) in the water table.

QC objectives for the collection of field parameters and representative samples of surface water are established to ensure that data are of sufficient quality to support the decisions identified in the previous section. The QC objectives for field data collection are the following:

- Sampled water is representative of surface water.
- Sampling techniques do not introduce contaminants into samples.
- Sampling techniques are generally standardized for improved reproducibility and comparability of results.
- Water levels are measured precisely enough to detect minor fluctuations (approximately ±0.005 foot) in flow.

The SAP and this RFSOG are followed to ensure that quality samples are collected for use in environmental decision making.

QC samples typically consist of field duplicates and equipment blanks (also known as equipment rinse or rinsate samples); trip blanks may also be collected. Field duplicates and equipment blanks are generally collected at a frequency of 1 each for every 20 real samples. Trip blanks, which are only analyzed for VOCs, may be collected at a rate of one per shipment of samples to be analyzed for VOCs.

Field duplicates will be collected using the exact same methods and equipment as real samples ("FIELD SAMPLE" in SEEPro). These samples provide information on overall precision, reflecting the cumulative effects of field and laboratory precision. The typical procedure is to collect a real and field duplicate sample at the same time, by filling the real sample bottle part way, then the field duplicate bottle the same amount, then the real bottle, and so on. Unless instructed otherwise, bottles may be filled one-third or one-half at a time. Note that this manner of filling bottles partway does NOT apply to samples to be analyzed for VOCs; instead, due to concerns regarding volatilization, VOC samples will be completely filled in one pass.

Equipment blank samples are collected following completion of sampling and decontamination at a given location. These samples provide an indication of cross-contamination resulting from inadequate decontamination methods. The freshly decontaminated equipment used to collect a real sample is rinsed with distilled or deionized water. That water is poured into a sample bottles for analysis of the same suite of constituents as the real sample. Equipment blank samples are not filtered. Collecting equipment blank samples at a well equipped with a dedicated bladder pump is not practicable, as it would require removal and decontamination of the pump, then pumping deionized or distilled water into the sample bottles.

Equipment blank samples for the automated surface water locations are prepared by filling a reusable composite sample carboy[33] with distilled or deionized water. The carboy water is then poured into sample bottles for analysis of the routine suite of constituents for a given location. Carboy blank samples are not filtered.

[33] Composite carboys are reused for automated sampling. The carboys are dedicated to a specific location.

Trip blanks may be collected to assess the potential for cross-contamination during sample handling and shipping, from packaging at the Site shipping office to analysis at the laboratory. Blank samples may be prepared using deionized or distilled water and placed within the sample cooler as it is packed with other samples for VOC analysis. The sample will be handled in the same manner as all other VOC samples in that batch.

QC samples will be shipped "blind" to the laboratory, with no indication of the source of water or the QC objectives of the sample. Sources of distilled and deionized water will be reputable and will supply complete analytical results for each batch of water received. These results will be reviewed whenever QC sample results show unexpected detections that may be attributable to this source water.

In the case of equipment rinse samples, a comparison with the source water analysis will indicate whether the water itself may be the cause of any contaminants that may be reported in these rinse samples. For equipment rinse samples collected to support groundwater samples and surface water grab samples, a comparison with the results for the real (FIELD in SEEPro) samples that were collected immediately prior to the collection of those equipment blanks is also appropriate, as the presence of contaminants in a rinse blank may be due to inadequate decontamination at that location. If the latter is suggested, field personnel will improve their attention to detail and more thoroughly decontaminate sampling equipment following completion of sampling at each location. If the source water is suggested as the cause of the detections, potential sources of the contaminants that are not attributable to the source water itself (e.g., contaminants in a trip blank resulting from the use of solvents in the sample prep room) will be evaluated. Where this is not applicable and the source water supply is the most reasonable suspect for the source of the contamination, alternatives include securing an alternate source of water and discussing necessary improvements with the water supplier; failure to correct the condition will require that an alternate source of water be secured.

# 9.0 Work Planning Processes

This RFSOG is intended to provide guidance for all activities that may be performed at the Site. The LMS Work Planning process, discussed in Section 9.1, applies to all activities at Rocky Flats; however, it is applied using a graded approach based on the nature of the activity. The work planning process is described in the following sections, followed by discussions of some of the more unusual types of nonroutine activities that may be necessary at the Site in order to ensure protectiveness of the remedy and continued compliance with the requirements of RFLMA. Due to the unforeseen nature of nonroutine activities, this section is not intended to provide complete, detailed, prescriptive requirements for any given situation, but rather some general requirements that must be met, and general topics that must be considered, in order to proceed.

## 9.1 LMS Work Planning Process

The LMS Work Planning process is described in Program Manager Directive PM-08-02, which will be incorporated into the appropriate LMS procedure manuals. **All activities** are subject to this process on a graded approach. This section provides some Site-specific guidance on implementation of this directive. The directive is provided in the Appendix J for reference until it is incorporated into the LMS manuals.

ALL field activities and all nonroutine office activities MUST be listed on the Rocky Flats Plan of the Week (POW) to be authorized. During the POW meeting, activities may be discussed and additional planning or H&S evaluation/refresher may be initiated prior to the performance of the activity. If an activity that is not on the POW is scheduled after the POW is complete, the LMS Site manager or designee should be contacted to add the activity to the POW before the activity is performed.

A POW meeting is held each week on Monday morning to authorize the activities for the week. Plan of the Day (POD) or daily tailgate meetings are required for many projects as defined in the Program Manager Directive.

## 9.2 Rocky Flats Work Planning Process

### 9.2.1 Routine Activities

Activities are considered routine if they are performed frequently and are covered by an LMS or Rocky Flats procedure. JSAs for routine activities should be reviewed and revised, if necessary, at least every 6 months or if the procedure for the activity changes. Routine activities require the same planning steps as nonroutine activities; however, these planning steps are not required each time the routine activity is performed. Instead, the planning steps, as described in the Directive and supplemented by requirements in Section 9.2, should be performed once a year for simple activities that occur frequently, and every 6 months for more complex activities or those that occur infrequently.

### 9.2.2 Nonroutine Activities

This section is not intended to be all-inclusive; any construction project or major maintenance project is considered a nonroutine field activity, even though they may be considered routine from the perspective of maintaining the remedy and managing the Site. (For example, replacing treatment media in a groundwater treatment system is considered a routine maintenance activity from the perspective of system operation and remedy maintenance, but is considered a nonroutine field activity from the perspective of the work planning process.) However, many small projects are also considered nonroutine activities. All nonroutine activities will require detailed evaluation by qualified individuals in accordance with processes outlined in this section. Specific qualifications for the personnel performing the evaluation will depend on the nature of the activities to be performed. The evaluation will consider the nature of the condition to be addressed or corrected, possible methods of achieving the appropriate endstate, potential hazards involved (chemical, radiological, environmental, biological, and so forth—those that would apply if the activity was performed anywhere, as well as any Site-specific hazards that may apply), and how to control those hazards. An appropriate path forward will be developed with input from LMS and DOE-LM personnel; in addition, consultation with and input from CDPHE may be necessary.

Nonroutine activities must be evaluated during the early planning stages to ensure that all required evaluations, notifications, permits, and safety requirements are incorporated into procurement documents and project procedures. Individuals performing the evaluation should be aware that some projects may require additional steps not included on the provided checklists.

Two checklists are used for evaluating nonroutine projects or for the periodic evaluation of routine activities. The first checklist, LMS 1005e, Project/Activity Evaluation, is required by the Program Manager Directive and must be completed with all required signatures before the project or activity is implemented. (A Rocky Flats-specific work process flowchart was developed to guide activities at the Site and includes links to the applicable checklists and forms; this flowchart is available on the Rocky Flats RF-share drive on the Robin server.) Form LMS 1005e includes a wide variety of environmental and safety topics that must be considered. However, it does not include some Site-specific topics. In addition, it does not document the completion of evaluations, notifications, and other requirements; it merely indicates that a topic must be considered.

A second checklist, *LMS Project/Activity Evaluation—Rocky Flats Site Supplement* (Appendix H), includes Rocky Flats-specific topics that must be considered when planning an activity. This checklist provides a mechanism for determining additional requirements for notifications, approvals, evaluation, or other planning. As each item is completed, the responsible individual initials and dates the form. When all items are complete, the LMS Site manager reviews the two forms, plus any additional documentation required to fully understand the project and the planning completed to support that project. The LMS Site manager then signs the Site-specific form, indicating that the project or activity can be added to the POW for final approval to implement. Projects or activities are not approved for implementation unless listed on the appropriate signed POW.

Completed checklists will be maintained in the project file.

### 9.2.3 Emergency Response

Emergency response for some activities, such as a dam emergency, has been worked out in advance (Attachment B2). General responses are provided in the *Comprehensive Emergency Management System* (LMS/POL/S04326). Planning documents and JSAs can be developed in advance for these emergency response activities that may be reasonably anticipated. However, other emergencies cannot be anticipated. For real emergencies, such as tornadoes or fires, it is not reasonable or possible to stop and plan the immediate response. Personnel must take action as necessary to protect the H&S of themselves and those around them. However, when the immediate emergency has been resolved sufficiently that there is time to step back, pause, and evaluate the next steps, personnel involved in the emergency response should begin to implement, on a graded approach with assistance from H&S and Site Management, those activity planning steps that are useful in safely resolving the emergency situation.

Urgent activities that are not true emergencies involving danger to personnel should, at a minimum, be discussed with H&S and the LMS Site manager prior to implementation. The H&S representative and the LMS Site manager will determine the level of pre-planning required for the activity. An evaluation and verbal briefing by H&S will be required for even very urgent activities unless taking time for this step could result in injury to personnel or bystanders or to the environment.

## 9.3 Intrusive Work and Soil Disturbance Evaluation

One of the institutional controls in effect at the Site is the prohibition of intrusive activities that are not related to the remedy. In addition, the existing buried gas pipelines, residual contamination, remaining subsurface infrastructure, and electrical lines may present hazards when intrusive work is performed. Soil disturbance in some areas may also require evaluation and notification because of wetlands or endangered species habitat designations. A Soil Disturbance Evaluation, in accordance with the *Rocky Flats Site Soil Disturbance Evaluation Procedure* as provided in Appendix F, shall be performed before intrusive work is conducted, unless specifically exempted by the procedure. The Soil Disturbance Evaluation for each project or activity shall be documented and approved by the appropriate SMEs and LMS Site manager in accordance with the procedure. The evaluation will be maintained in the project file.

Due to the institutional control prohibiting soil disturbances to depths of 3 feet or more below ground surface, excavations that will extend to this depth require advance notice and consultation with CDPHE.

## 9.4 Nonroutine Sampling/Characterization

In many cases, one of the first responses to off-normal contaminant concentrations at high-priority sampling locations (such as POCs) will be to design and implement nonroutine sampling to evaluate the potential causes of the observed conditions. This nonroutine sampling may be limited to collecting grab samples, or it may involve more detailed characterization (e.g., soil sampling, installation of new monitoring wells or surface water stations).

Nonroutine sampling and characterization activities must be evaluated carefully prior to commencement in accordance with the LMS and Site work planning processes. Historical data

from the immediate vicinity of any locations being considered for sampling or other characterization work will be reviewed, as will their proximity to features shown on Figure 1−3, Figure 1−4, Figure 1−5, and Figure 6−1. These figures display subsurface features and contamination still present at the Site; note that they are not intended to show all remaining contamination.

Nonroutine samples will also be evaluated for any special handling or shipping requirements that may apply. This evaluation must include input from staff with detailed knowledge of these requirements. In addition, the laboratory where these samples are shipped must be able to perform the necessary analyses, which may be a concern if the concentrations or radiological activities exceed a certain threshold. If necessary, a qualified radiological engineer will be involved in the project to ensure radiological requirements are met.

## 9.5 Controlled Burns

In order to maintain healthy, robust communities of native vegetation at the Site, it may be desirable to conduct controlled burns. Despite its obvious and well-documented success, use of this once-natural process has been very controversial at the Site due to stakeholder and community concerns about mobilization of contamination via the resulting smoke and ash from the fire, and the potential for increased soil erosion due to the absence of vegetation.

Studies performed in the 1990s and early 2000s, including data collection from actual controlled burns, wild fires, and modeling, have shown that there is no significant increase in radiological risk to downwind residents associated with smoke from these fires. As a worst-case scenario, one modeling effort considered the hypothetical effects on a firefighter with no respiratory protection who is standing directly in the smoke plume immediately downwind of the former 903 Pad (K-H 2000b). Unless activities in the soil are significantly greater than 100 picocuries per gram (pCi/g) of plutonium, americium, or uranium[34], this firefighter would receive a dose of less than 1 millirem (mrem) from the fire. (The average annual dose across the United States is 360 mrem.). Therefore, due to dispersion of the smoke plume, the dose to downwind residents from the smoke would be many orders of magnitude lower.

Increased erosion from a burned area may be a concern if not properly addressed. Erosion may be minimized via application of an appropriate control, such as erosion mats or sprayed FlexTerra. Application of wattles, straw bales, silt fences, and so forth may also be effective. The specific control will be selected based on the topography and ease of application, season, and other factors, and will be maintained until vegetation has been reestablished. Refer to Section 4.4 for a discussion of erosion control and revegetation.

Evaluation of the proposed burn must be evaluated in accordance with Section 9.2.2. In addition, DOE Order 450.1, *Environmental Protection Program*, requires all DOE elements to incorporate an Environmental Management Systems (EMS) approach into their Integrated Safety Management Systems (DOE Policy 450.4). DOE Order 450.1 defines an EMS as a continuing cycle of planning, implementing, evaluating, and improving processes and actions undertaken to achieve environmental goals. The Order also mandates the inclusion of policies, procedures, and training to identify activities with significant environmental impacts in the EMS, as well as

[34] The activity varies by isotope, ranging from 102 pCi/g for depleted uranium to 188 pCi/g for enriched uranium, with plutonium and americium within this range.

methods for managing, controlling, and mitigating the impacts of these activities. The Order specifically states that the protection of resources from wildland and operational fires should be considered (DOE Order 450.1 § b[1][e]). In addition, a February 24, 2003, memorandum, "Department of Energy (DOE) Wildfire Management Policy," from the Secretary of Energy to the Under Secretary for Energy, Science and Environment and the Administrator of the National Nuclear Security Administration directed each Program Secretarial Officer to ensure that sites have wildland fire management plans in place that are consistent with 2001 Federal Wildland Fire Management Policy and Implementing Actions. The *Rocky Flats Site Wildland Fire Management Plan* (Attachment E10) meets this requirement.

Discussions related to conducting controlled burns will be held with the appropriate external parties, which include the state and EPA regulators and USFWS. The Fire Chief at the Rocky Mountain Fire District will also be informed and consulted prior to any controlled burn at the Site. The burn must be conducted by an appropriately certified, professional wildland fire contractor, according to a burn plan prepared by the contractor. Site personnel will ensure the contractor has access to any historical data needed, and will provide copies of Figure 1−3, Figure 1−4, Figure 1−5, and Figure 6−1 in case these features affect burn activities or preparations. The Rocky Flats Stewardship Council will be informed of the burn during the planning phase. Although the Stewardship Council does not have approval authority, DOE-LM may choose to accept comments and modify plans accordingly.

## 9.6 Source Evaluations

Routine water monitoring is defined and discussed elsewhere in this document (Section 6.1) and in RFLMA. Additional monitoring that may be deemed necessary due to recognition of potential impacts to surface water and exceedances of surface water standards is performed as a source evaluation. Designing and implementing a source evaluation in response to a RFLMA reportable condition (Section 15.1) requires that the regulatory agencies be consulted.

The primary purpose of monitoring groundwater at the Site is to protect surface water quality. The Site's hydrologic setting, particularly its low groundwater flow rates and the physical separation of shallow, Site-impacted groundwater from deeper groundwater resources, leads to relatively well-contained groundwater contamination. However, because Site-impacted groundwater discharges to surface water before leaving the Site, monitoring groundwater in the vicinity of downgradient contaminant plume edges and along pathways to surface water is particularly important.

Special groundwater investigations may be required in response to indications of increased contaminant concentrations that may have the potential to impact surface water. These projects are referred to as "groundwater source evaluations," and are typically of limited duration and focused scope. Their primary purpose is to investigate observed conditions, identify possible causes, and estimate the potential impact on surface water. In areas where an impact to surface water has been previously recognized and evaluated, a significant increasing trend adjacent to surface water may require the performance of another evaluation. Numerous groundwater evaluations are described in the pre-closure RFCA Annual Groundwater Monitoring Reports.

When reportable water-quality measurements are detected by surface water monitoring at POEs or POCs, additional monitoring may be required to identify[35] the source and evaluate for mitigating action. Analyte suites for source evaluation are determined based on the contaminant of current concern that has initiated the source evaluation activities, or related indicators. The information types are entirely dependent on the results of other monitoring objectives under which the source was detected. The analyte suites are limited to parameters that will aid in the identification and evaluation of a contaminant source. Source evaluation activities may be implemented anywhere within the Site surface water drainage area where a previously unidentified contaminant source is suggested. The distribution of monitoring points is determined by the details of the specific source evaluation to determine source location and efficiently use resources. For example, if POE monitoring suggests a previously unidentified source within the COU, then monitoring may be implemented within the COU to locate the source. Source evaluation monitoring should begin as soon as practical after source detection and continue until the source is identified and evaluated or is no longer detected. The source evaluation scope will be based on the status of the source evaluation, taking into account, but not limited to, weather conditions, water availability, and process knowledge. CDPHE may make requests that affect the monitoring that is performed, or its duration.

In general, a source evaluation will begin by generating focused objectives through the RFLMA consultative process that apply to the concern being investigated. These objectives are qualitative and quantitative statements that specify the type, quality, and quantity of the data required to support the decision-making process. Objectives are established to ensure a source evaluation has been logically defined and planned, and that the scope and data collection will support the eventual decisions required. QC objectives are established to ensure data generated by a source evaluation will be gathered or developed using procedures appropriate for the intended use of the data. The objective development process is generally derived from EPA guidance documents (e.g., EPA 1994), but has been used primarily as a decision support tool as opposed to a sample optimization tool.

Objectives developed for a given source evaluation will consider such factors as relative impact, priority, and risk to the public. This approach will identify areas with the highest potential for surface water contamination. Each source evaluation will be implemented under a project-specific SAP, work plan, or other work control document, which will identify the specific investigation objectives, data collection methods and locations, and follow-up actions that apply to the existing circumstances. If a significant impact to surface water is identified, the findings will be provided to CDPHE and further action will be discussed. Where modeling results form part of the basis of decisions, these predictive components of the evaluation will be weighed against actual field data in setting the priority for action. Monitoring to be performed following the selected action will also be determined in consultation with CDPHE.

In most if not all cases, a preliminary data review will be performed immediately upon recognition of a potential concern. Sources of data and other information may include the analytical database (SEEPro, which contains data from the historic Rocky Flats Soil and Water Database), recent quarterly and annual reports, the HRR (DOE 1992 and annual updates concluding with DOE 2006d), the Groundwater IM/IRA, the RI/FS, individual Closeout Reports for buildings or IHSSs of interest, and any other source of information that may be applicable. The results of this review may be sufficiently clear to indicate a cause of the given concern

[35] Note that the term "identify" is used here to mean "locate." Characterization is also implied.

without need for additional sampling and analysis. In such cases, CDPHE will be notified and discussions will be held on the conclusions reached through the reviews.

In other cases, more intrusive activities may be required, such as well installations, excavation, and so forth. These intrusive activities must be evaluated in accordance with Section 9.3 before implementation. In cases where surface water quality is threatened, these activities will be selected and discussed in coordination with CDPHE.

An evaluation of surface water impact may include, but not be limited to, any or all of the following possible components:

- Review of historical data from the well(s) indicating a potential surface water impact and other wells nearby (including abandoned wells if appropriate);
- Review of historical data from the surface water location indicating a surface water impact and other locations nearby (including discontinued locations if appropriate);
- Review of the HRR (DOE 1992, with annual updates through DOE 2006d) to identify possible sources of the contamination observed;
- Inspection of the area surrounding and upgradient of the well or surface water location to investigate any physical changes that could be factors in the reported data;
- Contaminant fate and transport modeling;
- Definition of extent of contaminants and/or the contaminant pathway through additional sampling of soil, groundwater, surface water, and/or seeps, and through additional well, borehole, or surface water monitoring station installations;
- Measurement or estimation of contaminated groundwater flow velocity, flow direction, and discharge to surface water;
- Measurement of surface water flow rate in the area of the impact;
- Measurement of the area of surface water directly impacted by the contaminated groundwater;
- Determination of nature and extent of ecological impact from contaminated groundwater discharging to a surface water receptor;
- Determination of concentration loadings and mass flux of contaminants to the surface water receptor; and
- Estimation of impacts due to seasonal variations, discharges, or removal of groundwater collection systems.

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# 10.0 Health and Safety/Training

H&S procedures for Site activities are described in the *Health and Safety Manual* and the *Integrated Safety Management System Description with Embedded Worker Safety and Health Program* (LMS/POL/S04328) and are consistent with DOE orders, regulations, codes, and standards. Additional Site-specific H&S information is provided in Appendix I.

Before performing work activities, the work will be evaluated in accordance with the LMS work flow processes (Section 9.0) and appropriate H&S documentation will be developed.

## 10.1 Training

Site personnel will be trained in accordance with LMS Site-specific and position-specific requirements. A training plan will be prepared for each individual outlining the training required. The employee's functional manager and the LMS Site manager will provide input to the individual training plan for each employee who is assigned to the Site. The LMS Training Department will notify each employee of the required training, and will track completion of the required classes. Training or qualifications that require periodic update or recertification will be tracked and the individual will be notified that action is required to remain current in the training or qualification.

LMS training as specified by the training department is required for all LMS employees, including subcontractors. In addition, all occupants of the Rocky Flats office building that are not classified as visitors must view a Building Indoctrination presentation that includes emergency response information and hazardous communication (HAZCOM) information. The administrative assistant and H&S specialist will audit the files maintained at Rocky Flats on a semiannual basis to confirm that all required individuals have completed the training. HAZCOM training will be refreshed on an annual basis.

All personnel, subcontractors, and visitors who will have unescorted access to the Site must also complete Site-specific orientation training. This training is available through the LMS Training Department. Records of the training will be maintained by the training department, with a copy maintained at the Rocky Flats office. The administrative assistant and H&S specialist will audit the files maintained at Rocky Flats on a semiannual basis to determine that all required individuals have completed the orientation.

Read-and-sign training is also required for ALL individuals who will enter the Site or the Rocky Flats office. The read-and-sign training records are maintained by the Site's H&S specialist.

Project safety meetings will be held on a periodic basis for Site personnel and a training roster will be completed to document attendance. The rosters will be maintained in the Rocky Flats office. In addition, personnel will receive safety information at weekly staff meetings conducted by their assigned functional organization.

Occupational Safety and Health Administration (OSHA) training (OSHA 29 CFR 1910.120) ("HAZWOPER" training) is not required for work at the Site, but is recommended for personnel who routinely work in the field. First aid/cardiopulmonary resuscitation (CPR) training is required for all field personnel.

## 10.2 HAZCOM

The purpose of HAZCOM is to ensure that hazards at a site are communicated to all personnel according to 29 CFR 1910.1200 and 1926.59. A written HAZCOM program is included in the *Health and Safety Manual* (Standard 5.3) and includes the following:

- Container Labeling—Personnel will ensure that all containers (both primary and secondary) are labeled according to contents. These labels can be provided by the manufacturers or produced by Site personnel. All labels will be checked for identity and hazard warning and should generally conform to the requirements of 29 CFR 1910.1200.
- Chemical List—A chemical list will be maintained that includes any hazardous chemical used at the Site and/or office.
- Material Safety Data Sheets (MSDSs)—There will be an MSDS for each hazardous chemical used at the Site and/or office. MSDSs will be located at the Site office and will be kept with the master chemical list. MSDSs for Site projects will be kept on Site, as well as in the office, for the duration of the project.
- Employee Information Training—Information about specific chemical hazards is communicated through a pre-evolution briefing or periodic safety meetings. Employees will be briefed anytime a new hazardous chemical is introduced on the Site.

Field personnel who use acids, bases, or other hazardous chemicals shall consult the *Rocky Flats Site Chemical Management Plan* (CMP) (Attachment F3) for the procurement, handling, storage, spill response, and disposal of the hazardous chemicals. Many chemical products used in routine office activities must also be tracked and managed as chemicals in accordance with the CMP.

## 10.3 Sample Handling

Samples will be collected, identified, handled, and transported according to the SAP which includes the following:

- Personal Protective Equipment (PPE)—Field personnel shall wear the PPE that is identified in the applicable JSAs. Consumables will not be allowed where sample collection and preparation activities are performed.
- Sample Collection—Samples will be collected by the methods described in the SAP using certified sample containers. Reusable sample containers will be decontaminated before being transported and will be preserved according to the SAP. See Section 8.4 for additional information.
- Sample Identification—Each sample will be assigned a unique identifier that will correspond to the sample time, date, and sampling location. Custody of the sample will be maintained in accordance with procedure GT-3 (P), "Standard Practice for Chain-of-Custody Control and Physical Security of Samples," of the *Environmental Procedures Catalog* (LMS/POL/S04325). See Section 8.4 for additional information.
- Transportation—Based on process knowledge, including analytical results since closure, samples are not U.S. Department of Transportation (DOT) hazardous materials, nor are they regulated by DOT or the International Air Transportation Association (IATA)

regulations. In addition, samples are not DOE-regulated radiological materials. This evaluation has been performed using process knowledge for the environmental samples normally collected under the current sampling program; this evaluation must be reviewed annually with the results documented in the Rocky Flats project file. Samples must be packaged and labeled in accordance with BMPs to ensure they arrive at their destination intact and not compromised for analysis. The packaging and shipping procedures recommended by the normal carriers (e.g., UPS, FedEx, and DHL) are used for transportation. H&S personnel must review release evaluations for new sample locations and historical sampling locations when conditions of samples or locations indicate conditions may have changed. See Section 13.8 for additional information.

- Excess Sample Disposition—Excess sample water will be disposed of in accordance with directive number RF-2006-03 of the SAP.

Supplemental Site-specific information for sample management is included in the Rocky Flats Sample Preparation Room Procedures (Appendix G).

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# 11.0 Emergencies and Corrective Action

## 11.1 Site Emergencies

General emergency response information and procedures are included in the *Comprehensive Emergency Management System* and the *Health and Safety Manual*.

Rocky Flats Site-specific emergency response information is contained in the Site-specific appendixes to the above-referenced documents. Notification and reporting requirements for emergencies, accidents, and incidents are discussed in Section 15.3.

The Rocky Flats Adverse Weather Policy, included in the Rocky Flats Health and Safety Addendum in Appendix I, describes emergency procedures for various weather activities that may occur at the Site, including tornadoes, hail, strong winds, lightning, and snow.

Office building emergency response is covered in Section 11.3.

## 11.2 Dam Emergency Response

Rocky Flats emergency response information for the Site dams is contained in the *Emergency Response Plan for the Rocky Flats Site Dams* (Attachment B2). Notification and reporting requirements for emergencies, accidents, and incidents are discussed in Section 15.3.

## 11.3 Office Emergencies

For emergencies requiring outside responders (fire, medical, bomb threat, and so forth), any employee may call 911 for assistance. As soon as practical, notify supervisors or the LMS Site manager; however, safety and medical assistance take priority over all other actions. If building evacuation is indicated, the administrative assistant's telephone has a paging feature that can be used to notify all building occupants to evacuate to the designated assembly area. The fire alarm system at the Rocky Flats office will automatically summon the fire department to respond if activated.

The administrative assistant will maintain form LMS 2122e, Site Accountability Checklist, that names personnel assigned to the office building (this also includes people that travel to the Site). Forms are also located next to the accountability board at the main entrance of the office. As personnel reach the designated assembly area, the administrative assistant will indicate that the person has safely evacuated the building. If it can be performed safely and if there is any concern that unaccounted-for personnel may be in the building, the building wardens shall check the building for remaining personnel. In accordance with the *Comprehensive Emergency Management System*, building wardens have been identified who are aware of the Rocky Flats office layout and various alternative escape routes.

The primary assembly point for the Rocky Flats Dover Street office will be the northwest corner of the parking lot. If access to this area is blocked or this area is unsafe, the secondary assembly point will be the far southwest corner of the parking lot at the intersection of Wadsworth and 108th Avenue.

The LMS Site manager will notify management and initiate necessary notification and reporting in accordance with Section 15.3. Additional emergency response information is provided in the *Comprehensive Emergency Management System*.

## 11.4 Corrective Actions and Lessons Learned

After the immediate response and notification activities are completed in an emergency, the LMS Site manager and other appropriate personnel will perform an investigation in accordance with the *Health and Safety Manual*. After completion of the investigation, the LMS Site manager will determine, in consultation with QA and/or H&S personnel, if a root cause analysis or a corrective action plan is required.

Any incident or emergency will be evaluated by the LMS Site manager or designee for lessons learned that can be transmitted to other DOE-LM and LMS organizations. The Lessons Learned program is outlined in the *Quality Assurance Manual* (LMS/POL/S04320). Note that lessons learned may be developed for any issue or activity; they are not limited to emergency situations, but are intended to result in general and specific improvements to how work is performed.

# 12.0 Information Management

## 12.1 Rocky Flats Site Records

The Rocky Flats project generated both records and non-records. Records include all books, papers, maps, photographs, machine-readable materials, or other documentary materials, regardless of physical form or characteristics, made or received by an agency of the Government under federal law or in connection with the transaction of public business and preserved or appropriate for preservation by that agency or its legitimate successor as evidence of the organization, functions, policies, decisions, procedures, operations, or other activities of the government or because of the informational value of data in them. In contrast, non-records include U.S. Government-owned informational materials excluded from the legal definition of records or not meeting the requirements of that definition. Non-records include extra copies of documents kept only for convenience of reference, stocks of publications and of processed documents, and library or museum materials intended solely for reference or exhibition. Examples of non-records include:

- Copies of documents/correspondence kept for convenience and/or to manage work;
- Working and pre-decisional drafts created for team review/comment;
- Duplicates, drafts, and extra copies of documents;
- Correspondence and other items of short-term value that have no further value after an action has been completed; and
- Library materials, publications, and the like kept for reference.

The DOE-LM office administers all Site records generated throughout the Site's pre- and post-closure existence.

Site-specific post-closure records are generated as required by the CAD/ROD, signed in September 2006, or RFLMA, signed in March 2007. In addition to these records, DOE Orders require daily activity records such as H&S, procurement, office management, and so forth.

All records, hard copy and electronic, generated at Rocky Flats are subject to the retention periods established by the National Archives and Records Administration (NARA) General Records Schedules and/or NARA-approved DOE Administrative and Program records retention schedules. Temporary (i.e., nonpermanent) records having a potential use for epidemiological (long-term health) studies, litigation, and/or other requirements are subject to moratoriums that preclude destruction authorized by the schedules. Records determined to have permanent value are transferred to NARA in accordance with those same schedules.

The Rocky Flats records program is administered in accordance with the following directives:

- 36 CFR Parts 1220-1238, NARA;
- 44 U.S. Code (USC), Chapters 29, 31, and 33;
- LMS/POL/S04327, *Records Management Manual*;
- LMS/PRO/S04345, *Records Management Desk Instructions*; and
- LMS/POL/S04320, *Quality Assurance Manual*.

## 12.2 AR and Post-Decision Record

### 12.2.1 Administrative Record

An AR is a collection of documents that establishes the basis for the selection and performance of environmental removal and remedial actions at a closure site. An AR File may contain correspondence, results of the RI/FS, the Record of Decision (ROD), and public comments. An AR File may also consist of a public portion that includes documents available to the public and any stakeholders, and a confidential portion that includes documents that may be restricted from release due to the sensitive information they contain.

> **NOTE:** If new information is received after a ROD is approved that could affect the implementation of the remedy or indicate that reassessment of the remedy is necessary, the lead agency must respond to this information and place all comments in the AR. This is necessary if comments contain significant information, the new information is not contained elsewhere in the AR, it was not possible to submit the information during the public comment period, or the new information supports the need to significantly alter the remedial action. The type of documentation required for a post-ROD change depends on the extent of the change. A minor change requires a memo or note. A significant change requires an explanation of major differences. A fundamental change requires a ROD amendment.

The Rocky Flats AR has been formally closed. Any addition to the AR must be approved by the DOE-LM Site manager.

### 12.2.2 Post-Decision Record

The Rocky Flats Post-Decision Record consists of records required by the CAD/ROD or RFLMA after approval of the CAD/ROD, particularly surveillance and monitoring documentation that supports the long-term activity requirements of the CAD/ROD. The Post-Decision Record is maintained in conjunction with the AR, but all post-decision records are flagged with the “PD” identifier to distinguish them from the AR documents. Post-decision documents include, but are not limited to:

- Periodic reports on the Site surveillance and maintenance activities;
- Contact records;
- Communications with the regulatory agencies including e-mails and correspondence;
- Meeting minutes from public meetings;
- Newspaper advertisements; and
- RFLMA compliance documents.

The Post-Decision Record is available to the public in the same formats and accessibility requirements as the AR.

## 12.3 Records Maintenance

Active hard-copy and electronic records are maintained by the Rocky Flats office. Hard-copy records are tracked in the DOE-LM Records Management "Hummingbird" database. When no longer needed for daily activity, these records become inactive and are archived at the Denver, Colorado, Federal Records Center (FRC).

Electronic records are entered and maintained in the DOE-LM Records Management Hummingbird database. When no longer needed for daily activity, they are designated as "inactive" and maintained in the database.

Newly generated records are managed in accordance with the annotated file plan located on the Rocky Flats RF-Share drive.

### 12.3.1 Records Access

Access to publicly available Rocky Flats records (AR and post-decision documents) is via the LM website at http://www.lm.doe.gov/land/Sites/co/rocky_flats/rocky.html

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# 13.0 Regulatory Compliance

Some activities at the Site may require regulatory compliance activities, notification, or reporting in addition to that required by RFLMA. In accordance with the CAD/ROD, the selected remedy for the COU must achieve compliance with ARARs. Activities that are not required as a component of the remedy (for example, work in the POU or work that is not related to the maintenance of a remedy component) are potentially subject to various environmental laws and implementing regulations. The work planning and authorization process in Section 9.0 includes the Project Activity Evaluation checklist, Form LMS 1005e, to guide inquiry into the regulatory compliance aspects of work.

This section presents a comprehensive overview of the regulatory requirements that may be applicable to long-term maintenance and routine monitoring at the Site. The purpose of this section is to provide guidance to (1) maintain continuity of past, current, and future compliance activities associated with Site activities; (2) manage long-term maintenance activities in compliance with applicable permits, state and federal regulations, and local requirements; and (3) compliantly manage and minimize wastes derived from maintenance activities for the protection of human health and the environment.

The information presented here is intended to be a guide to situations or activities that may require input from regulatory compliance personnel so that actions impacting the environment are conducted in accordance with the terms and conditions specified in existing agreements, RODs, and applicable DOE Orders, in compliance with applicable federal, state, and local regulations, laws, and ordinances, or, in the case of ARARs, through the use of BMPs.

Federal regulations applicable to Site maintenance activities may include requirements promulgated under RCRA, CWA, the Clean Air Act (CAA), the National Environmental Policy Act (NEPA), the Pollution Prevention Act (PPA), and the Emergency Planning and Community Right-to-Know Act (EPCRA), as well as DOT regulations, EPA guidance documents, and DOE Orders.

## 13.1 RCRA Program

RCRA Section 3016 is a biennial reporting requirement for all federal agencies that are required to provide an inventory of all facilities they currently own or operate, or have previously owned or operated at which hazardous waste is stored, treated, or disposed, or was disposed at any time. This report is due in January of even-numbered years, and submitted to EPA by DOE-Headquarters (HQ). A RCRA 3016 Report is submitted to the respective state by individual sites.

RCRA and the Colorado Hazardous Waste Act (CHWA) also regulate management of hazardous wastes. To ensure that a hazardous waste generator identification number for LM work and a permit for treatment, storage, or disposal is not required, the type and quantity of chemicals and other materials that may become solid wastes are controlled through the Rocky Flats CMP (Attachment F3). The volume of chemicals allowed under the CMP Authorized Chemicals List is strictly limited so that the amount of hazardous chemical waste generated, including waste that could be generated in a spill response, qualifies as “conditionally exempt small quantity generator” (CESQG) hazardous waste under the Colorado Hazardous Waste Regulations. Any

hazardous wastes will be accumulated and managed for disposal so that the CESQG status is maintained. Section 14.0 provides additional information on waste handling and disposition.

## 13.2 NPDES Stormwater Program

40 CFR 122.26, Stormwater Permit for Construction Activities, and 40 CFR 122.28, General Permits, are identified as ARARs. On-site remedial actions do not require permits; however, remedies that discharge pollutants from point sources or that involve stormwater discharges must meet substantive requirements for a site-specific or general NPDES permit. Substantive requirements for an NPDES permit are identified for the PLFTS.

The ECP (Attachment E8) addresses the BMP aspects of the regulatory requirements, which among other things are designed to adequately control stormwater runoff of soils that could ultimately discharge into surface water. The purpose of these controls at Rocky Flats is to address the objective and rationale of the institutional control that prohibits soil disturbing activities so that the RFLMA remedy performance standard for surface water is met.

Stormwater runoff from construction activities can have a significant impact on water quality by contributing sediment and other pollutants to water bodies. If work is not subject to ARARs, construction activities at Rocky Flats may require a stormwater permit in addition to the ECP. This permit is issued by EPA for another federal agency. The permit requires completion of a notice of intent, application, and fee, and a stormwater pollution prevention plan prior to commencing construction activities. Periodic documented inspections are required until the area has been adequately stabilized using permanent erosion control measures.

## 13.3 Clean Air Act

Fugitive dust emissions during construction activities at the Site require best management controls. If a non routine activity is initiated that may act as an emissions source, the activity will be reviewed by environmental compliance personnel to determine whether the activity is exempt from notification requirements.

## 13.4 SARA Title III

EPCRA, also known as the Superfund Amendments and Reauthorization Act (SARA), Title III, was signed into law in October 1986. It was established to inform the public of hazardous chemicals that may affect their communities and assist local emergency planners to prepare for possible emergencies involving hazardous chemicals.

40 CFR 355 requires that notification be made to state and local emergency planning organizations if a listed hazardous substance that exceeds a reportable quantity is released to the environment. Additionally, emergency officials are to be notified for planning purposes if any listed chemicals will be used or stored at the facility that may exceed a threshold planning quantity. The volume of chemicals allowed under the CMP Authorized Chemicals List is strictly limited so that the amount of chemicals that constitute a reportable quantity or otherwise trigger EPCRA reporting are known in advance of authorized uses. As of 2007, Site activities and chemical use no longer trigger EPCRA reporting.

40 CFR 370 requires that MSDSs be maintained for chemicals present at a facility, and that personnel be trained on the hazards of using these chemicals. A list of chemicals maintained at the facility must be made available to local and state emergency response officials. This list should include chemicals that are used in maintenance activities at the Site. For Rocky Flats, the Site-specific CMP addresses these requirements and shall be followed.

## 13.5 P2 Program

The annual report on Waste Generation and Pollution Prevention (P2) Progress and the Environmentally Preferred Purchases Report are required under DOE Order 450.1. These annual reports are submitted electronically and are typically due to DOE-HQ during the first week of December.

The PPA, established in 1990, requires EPA to develop and implement a strategy that promotes source reduction and other practices that reduce or eliminate the creation of pollutants. The Act amended EPCRA reporting requirements, and required facilities to provide information on pollution prevention and recycling for each toxic chemical. EPA published its P2 Strategy to integrate pollution prevention objectives into all aspects of its existing programs.

## 13.6 NEPA Planning

An annual NEPA Planning Summary is due at the start of the fiscal year for submittal to DOE-HQ, as requested by DOE-LM. Rocky Flats Site input will be included in the annual DOE-LM report. NEPA requires federal agencies to assess the impacts that major federal actions may have on the quality of human health and the environment. DOE procedures for implementing NEPA are contained in 10 CFR 1021, 40 CFR 1500-1508, and DOE Order 451.1B. The purpose of DOE Order 451.1B is to establish requirements and responsibilities, and foster teamwork within DOE for cost-effective implementation of NEPA. Rocky Flats will follow DOE Policy to implement CERCLA requirements when conducting remedy activities in a manner that incorporates NEPA values; separate NEPA review is not required.

In some cases, a large project at the Site may require a NEPA review to establish that the activity is eligible for a categorical exclusion from NEPA evaluation. Environmental compliance personnel should be notified prior to beginning large, nonroutine projects that may change or disturb the Site environment.

## 13.7 Well Construction and Water Use Permits

The Colorado State Engineer's Office added content to their website in early 2006 (State of Colorado 2006) that recognized that wells installed at RCRA and CERCLA sites do not need permits. Unless the Site's status or state requirements change, new monitoring wells will not require permitting. However, wells will be installed in accordance with methods defined by the Colorado State Engineer's Office. Well abandonment will also be conducted in accordance with state-defined methods.

Well Management is a DOE-LM program to track well permits for installation and ensure that all DOE-owned wells are properly abandoned and documented. All new well installation logs, well

numbers, and notices of intent should be copied and submitted to Environmental Compliance to be entered into the LMS well tracking database.

## 13.8 DOT and IATA Regulations

DOT regulations regarding transporting, packaging, placarding, and manifesting hazardous and radioactive materials and wastes are found in 49 CFR 171 through 178. These regulations pertain to the transportation in commerce (e.g., on U.S. highways) of process waste, contaminated media, and investigation-derived waste (IDW) that are contaminated with RCRA-regulated levels of constituents upon disposal. These regulations also pertain to samples and off-specification products meeting the definition of hazardous materials. This evaluation has been performed using process knowledge for the environmental samples normally collected under the Site's current sampling program, and must be reviewed annually with the results documented in the Rocky Flats Project File. However, samples or wastes from new areas, or when conditions of samples or locations indicate conditions may have changed, must be evaluated by a trained shipper prior to transport off Site.

IATA regulations are based on International Civil Aviation Organization Technical Instructions (Doc 9284-AN/905) pertaining to the transportation of dangerous goods by air. The packaging and shipping procedures recommended by the normal carriers (e.g., UPS, FedEx, and DHL) are used for transportation with the carriers. All DOE air shipments from the Site must be evaluated for compliance with IATA by a shipper trained in IATA regulations.

A trained shipper must evaluate all DOE shipments involving these materials from the Rocky Flat Site at least annually to ensure compliance with hazardous materials transportation regulations.

## 13.9 EPA Guidance to Management of IDW

EPA developed guidance in January 1992 (EPA 1992) to ensure that management of IDW generated by CERCLA field investigations is protective of human health and the environment and complies with applicable regulatory requirements.

EPA's guidance describes the allowable disposal of IDW within an area of contamination as follows (1992):

> Storing IDW in a container… within the (area of contamination) and then returning it to its source… **is** allowable without meeting the specified (Land Disposal Restriction) treatment standards…. Therefore, returning IDW that has been stored in containers… within the (area of contamination) to its source does not constitute land disposal, as long as containers are not managed in such a manner as to constitute a RCRA storage unit as defined in 40 CFR 260.10. In addition, sampling and direct replacement of waste within an (area of contamination) do **not** constitute land disposal.

This management scenario is a viable option for environmental monitoring work at the Site, as long as best professional judgment and available information indicate that dispersal of solid IDW such as drill cuttings and excess soil samples in or around wells will not increase the threat to human health or the environment.

# 14.0 Waste Management

Various wastes will be generated during the monitoring and surveillance activities described in this RFSOG. This section provides a summary of routine waste types and their management. However, this section is not all-inclusive. The work planning and authorization process in Section 9.0 includes the Project/Activity Evaluation checklist, Form LMS 1005e, to guide inquiry into the waste management aspects of work.

Any types of wastes not addressed herein that may be generated will require review by a suitably qualified individual to determine the appropriate management requirements, and new waste management requirements for the wastes that are described here will supersede the general summary below.

## 14.1 Sanitary Wastes

By far the wastes that are most commonly generated during routine activities are sanitary wastes that must be managed and disposed of accordingly. Examples of these wastes include, but are not limited to, used paper towels; used bottles (which will be rinsed before disposal if potentially contaminated or if previously used to store a hazardous substance such as acids to preserve water samples); scraps of wire, rebar, plastic, wood, and so forth; broken tools and equipment (which will be decontaminated if warranted, for example as a result of exposure to contaminated groundwater); and paper, bags, and other office trash. These wastes will be contained and disposed of in a dumpster or other suitable receptacle designated for project and office trash.

Sanitary wastes that may be generated less frequently include spent media from the groundwater treatment systems. The media from these systems may be hauled to a local sanitary waste landfill if the LMS waste specialist concurs. This was the case during the 2006 MSPTS media replacement. Prior to RFETS closure, waste requirements for spent media from the ETPTS (which should have been consistent with those for the MSPTS media in 2006, because the media and groundwater contaminants are very similar) and the SPPTS may have been unnecessarily conservative. Consultation with the LMS waste specialist will be undertaken early in the planning phase of any media replacement activity to ensure the spent media will be disposed of properly. This may require collection and analysis of waste characterization samples.

## 14.2 Other Wastes

Nonsanitary wastes that may be generated include, but are not limited to, soils from intrusive activities that require disposal; soils from cleanup of spills (e.g., gasoline spills); excess waters from decontamination, purging, and samples; spent or damaged lead-acid batteries; and other wastes that are not appropriate for uncontrolled disposal in a dumpster that receives predominantly office trash.

Management and disposal of excess waters is addressed in the SAP. The process defined therein was set forth at Site closure in coordination with the regulatory agencies.

Management and disposal of the other wastes listed above, and other nonsanitary wastes that are not described here, will be performed in accordance with instructions from the LMS waste specialist.

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# 15.0 Reporting

## 15.1 RFLMA Reportable Conditions

Section 6.0 of Attachment 2 to RFLMA defines reportable conditions and the required response if a reportable condition is observed. These conditions are provided for convenience in Table 15−1; however, RFLMA (Attachment A2) should be consulted for the legally binding list of conditions and responses.

*Table 15−1. RFLMA Reportable Conditions*

| Reportable Condition | Response |
|---|---|
| Exceedances of surface water standards at surface water and groundwater monitoring locations consistent with the flowcharts in Attachment 2 to RFLMA | Inform CDPHE and EPA within 15 days of receiving inspection reports or validated data. See Section 6.0 of Attachment 2 to RFLMA for additional actions. |
| Evidence of significant erosion in areas of residual subsurface contamination | Inform CDPHE and EPA within 15 days of receiving inspection reports or validated data. See Section 6.0 of Attachment 2 to RFLMA for additional actions. |
| Evidence of adverse biological conditions | Inform CDPHE and EPA within 15 days of receiving inspection reports or validated data. See Section 6.0 of Attachment 2 to RFLMA for additional actions. |
| Conditions affecting the effectiveness of the landfill covers | Inform CDPHE and EPA within 15 days of receiving inspection reports or validated data. See Section 6.0 of Attachment 2 to RFLMA for additional actions. |
| Evidence of violation of the institutional controls | See Section 6.0 of Attachment 2 to RFLMA for reporting requirements. (Note: First report is required within 2 days.) |
| Physical control failure that adversely affects the remedy | Inform CDPHE and EPA within 15 days of receiving inspection reports or validated data. See Section 6.0 of Attachment 2 to RFLMA for additional actions. |
| Other abnormal conditions that adversely affect the remedy | Inform CDPHE and EPA within 15 days of receiving inspection reports or validated data. See Section 6.0 of Attachment 2 to RFLMA for additional actions. |

When a reportable condition is observed and reported, the RFLMA parties will consult. The results of the consultation process will be recorded and approved in accordance with the process described in Section 15.2.1 of this RFSOG.

## 15.2 Routine Reporting

### 15.2.1 RFLMA-Required Reporting

***Record of Consultative Agreement***

RFLMA references the use of contact records to document CDPHE oral approvals of field modifications to implement approved response actions (see RFLMA paragraph 34). RFLMA Attachment 2 also references the use of contact records to document the outcome of consultation related to addressing any reportable conditions (see RFLMA Attachment 2, Section 6.0). Finally, the *Rocky Flats Site Legacy Management Public Involvement Plan* (PIP), RFLMA Appendix 2, also provides that a contact record of consultative process discussions between the RFLMA parties will be made available to the Rocky Flats Stewardship Council and other interested stakeholders as early in the process as is practicable following signature approval by the parties.

The PIP process to make contact records available is implemented by posting contact records on the Rocky Flats public website, and providing timely notice to stakeholders that the contact record is posted by an e-mail message.

The RFLMA parties agreed, as documented in RFLMA Contact Record 2007−08, that the status of actions or activities in RFLMA contact records will be documented by DOE from time to time, and included in RFLMA quarterly and/or annual surveillance and maintenance reports for tracking purposes. The RFLMA parties also agreed that to facilitate the status reporting contact records should include a short discussion of the anticipated actions or activities to close out the RFLMA contact record.

An example of a complete contact record is provided in Appendix C.

A draft contact record will be prepared by Rocky Flats staff responsible for the subject matter within 1 week of the completion of consultation and contain, at a minimum, the following information:

- Date of the consultation;
- Unique number of the contact record (YEAR-unique sequential number);
- Description of the topic of the consultation;
- Technical backup information as required;
- Description of the resolution including technical justification as required; and
- Criteria to complete the actions covered by the consultation and close out the contact record.

The draft contact record will be reviewed by the LMS Site manager and DOE-LM Site manager for approval to send to CDPHE via email. CDPHE is responsible for coordinating review, as necessary, with EPA. The appropriate representative from each of the three RFLMA parties is the individual listed in Attachment 3 to RFLMA. The staff person responsible for preparing the contact record (the originator) will send the approved draft to CDPHE for review and approval and coordinate with staff and the DOE-LM Site manager in making any changes necessary to obtain approval.

Upon approval, the originator will add the approval date to the contact record and remove the draft designation. The draft contact record, approval documentation, and final contact record will be kept in an electronic Contact Record share folder maintained by Rocky Flats. The share folder will also contain a contact record tracking log sheet organized by contact record number.

The LMS Site manager will review the tracking log sheet monthly and direct staff, as appropriate, to properly maintain accuracy and timeliness of entries.

When a contact record has been approved and is final, the originator will coordinate with the Rocky Flats public affairs staff to have it posted to the Rocky Flats public website following the DOE-LM protocol for posting documents. Rocky Flats public affairs staff will also notify stakeholders when the contact record is posted, in accordance with the PIP.

### *Environmental Monitoring*

Results of environmental monitoring will be reported in three quarterly reports and one annual report each year. The quarterly reports will provide data; the annual report will provide the evaluation of those data. The required contents of each report are provided in Section 7.2 of Attachment 2 to RFLMA.

Each quarterly report will be posted on the DOE-LM website by the 15th of the fourth month after completion of the quarter covered by the report. The annual report will be posted on the DOE-LM website by April 30 of the following year. If the official required date for posting falls on a weekend or holiday, the report will be posted on the first business day after the required date. The final report will be provided to the DOE-LM Site manager for review at least five business days before the report is posted on the website; at least two to three business days are required after DOE-LM review for the report to be finalized by Document Production and approved for posting on the website.

A summary presentation of each report will be provided to the Rocky Flats Stewardship Council at an appropriate regularly scheduled meeting. Additional technical discussions on data contained in the reports will be scheduled with members of the Stewardship Council or the public as requested by DOE-LM.

### *Annual Site Inspections and Maintenance*

RFLMA requires an annual report documenting Site inspection and maintenance. This report will be included in the annual report discussed above and will include information identified in RFLMA as well as information compiled as a result of the Site inspections performed in accordance with Section 5.0 of this RFSOG.

### *Landfill Monitoring and Maintenance*

Annual reports are required for the OLF and PLF, as described in the M&M Plan for each landfill (Attachments D1 and D2, respectively). These reports will be included in the annual report discussed above.

### *Pond Discharge Notification*

For routine pond discharges, downstream water users will be notified in accordance with Figure 13 of Attachment 2 to RFLMA (Section 6.1.11). Ponds will be operated to maintain dam safety regardless of the status of pond sampling or notification status; however, downstream users will be notified promptly even if an emergency discharge is required.

### *Geospatial Environmental Mapping System*

Environmental monitoring data will be posted to the GEMS website (available to the public via the DOE-LM website) after data validation and QA are complete. Procedures for data validation, QA, and loading into SEEPro/GEMS are described in Sections 8.3 and 8.4.

### 15.2.2 DOE-Required Reporting

Monthly reports to DOE are prepared in accordance with contract and task order requirements.

### 15.2.3 Other Routine Reporting

Other routine reports are required by various agencies and organizations. Table 15−2 summarizes routine reports not otherwise discussed earlier in this section.

***Monitoring Wells***

Monitoring wells will be installed and abandoned in accordance with the applicable requirements in the SAP and Water Well Construction Rules (State of Colorado 2005). In addition, associated documentation that may be required will be completed. Documents that may be required by the State of Colorado are described in the Colorado Division of Water Resources, Groundwater Information and Well Permitting web page (see http://water.state.co.us/groundwater/groundwater.asp; see also State of Colorado 2006 for additional clarification with respect to monitoring wells at CERCLA and RCRA sites). This topic is discussed further in Section 7.2 and Section 13.7.

*Table 15−2. Other Routine Site Reporting*

| Report | Agency | Driver | Due Date |
|---|---|---|---|
| Preble's Mouse Mitigation Monitoring Report for the Programmatic Biological Opinion at the Rocky Flats Environmental Technology Site. Annual Report. Biological Opinion: ES/LK-6-CO-04-F-012. | USFWS | Biological Opinion: ES/LK-6-CO-04-F-012 | Annually on 12/1 |
| Preble's Mouse Mitigation Monitoring Report for the East Shooting Range Remediation Project at the Rocky Flats Environmental Technology Site. Annual Report. Biological Opinion: ES/LK-6-CO-04-032. | USFWS | Biological Opinion: ES/LK-6-CO-04-032 | Annually on 12/1 |
| Preble's Mouse Mitigation Monitoring Report for the Incinerator Project at the Rocky Flats Environmental Technology Site. Annual Report. USFWS Letter: ES/CO: BZ Concrete Flow (April 28, 2003). | USFWS | Letter: ES/CO: BZ Concrete Flow (April 28, 2003) | Annually on 12/1 |
| Preble's Mouse Mitigation Monitoring Report for the Phytoremediation Project at the Rocky Flats Environmental Technology Site. Annual Report. Biological Opinion: ES/LK-6-CO-05-F-014. | USFWS | Biological Opinion: ES/LK-6-CO-05-F-014 | Annually on 12/1 |
| Preble's Mouse Adaptive Management Plan (plan has still to be finalized with USFWS and DOE) | USFWS | Biological Opinion: ES/LK-6-CO-04-F-012 | 2008 and 2010 reports based on current language in plan |
| Annual Wetland Mitigation Progress Report. Rocky Flats, Colorado, Site Wetland Mitigation Monitoring and Management Plan. | EPA | Rocky Flats, Colorado, Site Wetland Mitigation Monitoring and Management Plan | Annually on 3/1 |
| 903 Lip Area Wetland Monitoring Report | EPA | Letter from EPA | 3/1/07 last report unless required to continue |
| USACOE Nationwide Permit #27 Certificate of Completion (from dam breach activities) | USACOE | USACOE Nationwide Permit #27 | Due in 3 to 5 years after mitigation wetlands establish |
| USACOE Nationwide Permit #27 Certificate of Completion (from Site closure land configuration activities) | USACOE | USACOE Nationwide Permit #27 | Due in 3 to 5 years after mitigation wetlands establish |
| Colorado Noxious Weed Act monitoring/reporting | CDA | Colorado Noxious Weed Act | Annually (if due) |
| Dam Safety Inspection Report | Colorado State Engineer | Colorado Rules and Regulations for Dam Safety and Dam Construction | Every 6 years starting in 2007 |

*Table 15−2 (continued). Other Routine Site Reporting*

| Report | Agency | Driver | Due Date |
|---|---|---|---|
| Monthly Water Lease Report | City of Broomfield | Water Lease Agreement between DOE and the City of Broomfield | Monthly on the 1st business day of each month (covers previous calendar month) |
| Bi-Weekly Water Lease Report | City of Broomfield | Water Lease Agreement between DOE and the City of Broomfield | Monthly on the 1st business day 2 weeks following the Monthly Report (covers preceding period back through 1st calendar day of current month) |
| Event Water Lease Report | City of Broomfield | Water Lease Agreement between DOE and the City of Broomfield | EVENT: Daily during a significant runoff event (see Lease) |
| Event Water Lease Report Summary | City of Broomfield | Water Lease Agreement between DOE and the City of Broomfield | EVENT: Following a significant runoff event (see Lease) |
| Pond Status Reports | See O&M Plan for Site Dams | Informal agreement | Monthly on the 1st business day of each month |
| RCRA 3016 Report | DOE and CDPHE | RCRA | Biannually |

Note: Regulatory reports will be deleted from the list once concurrence from the agencies that no longer require the reports is received.

## 15.3 Emergency Notification

Emergency notification should be initiated as soon as possible; however, the first priority is to obtain emergency assistance as required to address the problem. Personnel safety and medical treatment ALWAYS take first priority. Emergency response is covered in Section 11.0 of this RFSOG. Prompt notification of management is important given that some types of emergencies require notification to DOE-HQ within 2 hours of the incident.

Emergency notification is addressed in the following DOE-LM and LMS documents and procedures:

- LMS/POL/S04321, *Health and Safety Manual*;
- LMS/POL/S04326, *Comprehensive Emergency Management System*; and
- *Emergency Response Plan for the Rocky Flats Site Dams* (Attachment B2).

In general, the emergency notification procedure for the Site includes the following steps:

[1] Immediately notify your supervisor or the LMS Site manager.

[2] The LMS Site manager notifies DOE-LM and LMS management.

[3] DOE-LM, with assistance from the LMS Site manager or other Site personnel as necessary, notifies the regulatory agencies and/or local communities.

[4] H&S personnel evaluate to determine whether DOE occurrence reporting is necessary in accordance with Section 4.1 of the *Health and Safety Manual*.

Table 15−3 provides contact information for emergency notifications. In general, notification to outside agencies such as EPA and CDPHE is performed by DOE-LM, not by Site personnel. Exceptions may occur at the discretion of the DOE-LM Site manager and the LMS Site manager. An emergency notification call tree has been established for notification of DOE and LMS Site management in emergencies and has been provided to personnel who are responsible for notification.

*Table 15−3. Contact Information for Emergency Notifications*

| Name | Organization | Telephone | Email |
|---|---|---|---|
| Scott Surovchak | DOE-LM Site Manager | 720-377-9682 office<br>303-653-6750 cell | scott.surovchak@lm.doe.gov |
| Carl Spreng | CDPHE | 303-692-3358 | carl.spreng@state.co.us |
| Vera Moritz | EPA Region 8 | 303-312-6981 | moritz.vera@epa.gov |
| Linda Kaiser | LMS Site Manager | 720-377-9679 office<br>303-862-0140 cell | linda.kaiser@lm.doe.gov |
| Rick DiSalvo | Deputy LMS Site Manager | 720-377-9674 office<br>303-819-7150 cell | rick.disalvo@lm.doe.gov |
| 24-hour emergency telephone | | 877-695-5322 | |
| MIE Properties | Owner of Rocky Flats Dover Street office building | 303-278-7676<br>(provides after-hours emergency number) | |

## 15.4 CERCLA 5-Year Review

The CERCLA process requires a periodic review, generally at 5-year intervals, to evaluate whether the implemented remedy remains protective of human health and the environment. The 5-year review will determine whether remedy components will be continued, modified, or discontinued. EPA has published a guidance document (EPA-OSWER Directive 9355.7-03B-P or subsequent EPA directives; EPA 2001a) on the review process used to assist in preparation of the review and associated report.

The schedule for the Rocky Flats Site CERCLA 5-year reviews was established by the first 5-year review, issued in July 2002. RFLMA established the dates for the second CERCLA 5-year review process in 2007, and subsequent reviews will follow the same submittal schedule. The review report is to be submitted to the EPA by August 1 of the fifth year after the previous review to allow for EPA approval by September 17 of that year.

The second 5-year review (issued in September 2007) documented that the periodic review addresses the COU.

In accordance with Attachment 2 to RFLMA, the public will be notified when the reviews are conducted and results of the reviews will be made public; however, there will be no formal public comment process.

Subsequent reviews will be conducted at 5-year intervals until such time as EPA determines that CERCLA periodic reviews are no longer required.

# 16.0 Public Involvement

Public participation activities are conducted in support of the DOE goal of actively informing the public about Site activities and the preparation of documents to provide opportunities for open, ongoing, two-way communication between DOE and the public.

DOE invites the general public, special interest groups, and local governments to participate early in the discussion of Site activities and the decision-making process. Public involvement on the Rocky Flats project includes the following:

- Specific public involvement activities are described in the PIP (DOE 2007b), included as an appendix to RFLMA.
- LM will maintain a Rocky Flats web page on the LM website (http://www.lm.doe.gov/land/Sites/co/rocky_flats/rocky.htm) and will post applicable Site documents soon after they are released. Electronic, digitized copies of the AR and Post-Decision Records are also available on the LM website.
- DOE designed GEMS to provide dynamic mapping and environmental monitoring data display for LM sites. A GEMS link for Rocky Flats is accessible on the LM Rocky Flats web page.

Additional information may be obtained by contacting the Rocky Flats Public Affairs office at 720-377-9672.

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# Appendix A

# Emergency Contact Information

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*Table A−1. Rocky Flats Site Emergency Response Information*

| Call Order | Name | Roll | Office | Cell |
|---|---|---|---|---|
| **1** | Linda Kaiser | LMS Site Manager | 720/377-9679 | 303/862-0140 |
| | | | | |
| **2** | Rick DiSalvo | Deputy LMS Site Manager | 720/377-9674 | 303/891-7150 |
| | | | | |
| **3** | Jeremiah McLaughlin | Groundwater Sampling | 720/377-3676 | 303/994-5133 |
| | | | | |
| **4** | John Boylan | Groundwater Monitoring | 720/377-9678 | 303/994-0310 |
| | | | | |
| **5** | Stephanie Harris | Health & Safety | 720/377-9681 | 303/564-0210 |
| | | | | |
| **6** | 24-Hour Emergency Phone Number | Emergency | 1-877-695-5322 | |

Numbers are listed by priority of calling order. Wackenhut is available if any on-Site assistance is needed. Everyone on the list does not need to be called in the case of an emergency, but please make sure that someone is actually reached.

Wackenhut Security Services 303/356-4074

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# Appendix B

# Annual Site Inspection Checklist

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Annual Site Inspection Check List (See RFLMA Attachment 2, section 5.3.4; 5.3.6 and 5.4.3)

Date:_____ Inspection Area: _____

**INSPECTION PERFORMED BY (print each name):** _____

| CHECK ALL BOXES THAT APPLY. PUT ID# ON FLAG AND PLACE FLAG MARKER IN LOCATION OF OBSERVATION FOR FOLLOW UP. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Flag ID#** | **Evidence of Soil Erosion or Deposition** | **Evidence of cracks, Rills, Gullies** | **Evidence of Sink Holes or Burrows** | **Evidence of Depressions or Subsidence** | **Evidence of Institutional Control Violation[1]** | **Problem with signs or other physical controls[2]** | **Adverse biological condition** | **Photo(s) taken?[3]** |
| | | | | | | | | |
| | | | | | | | | |
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| | | | | | | | | |
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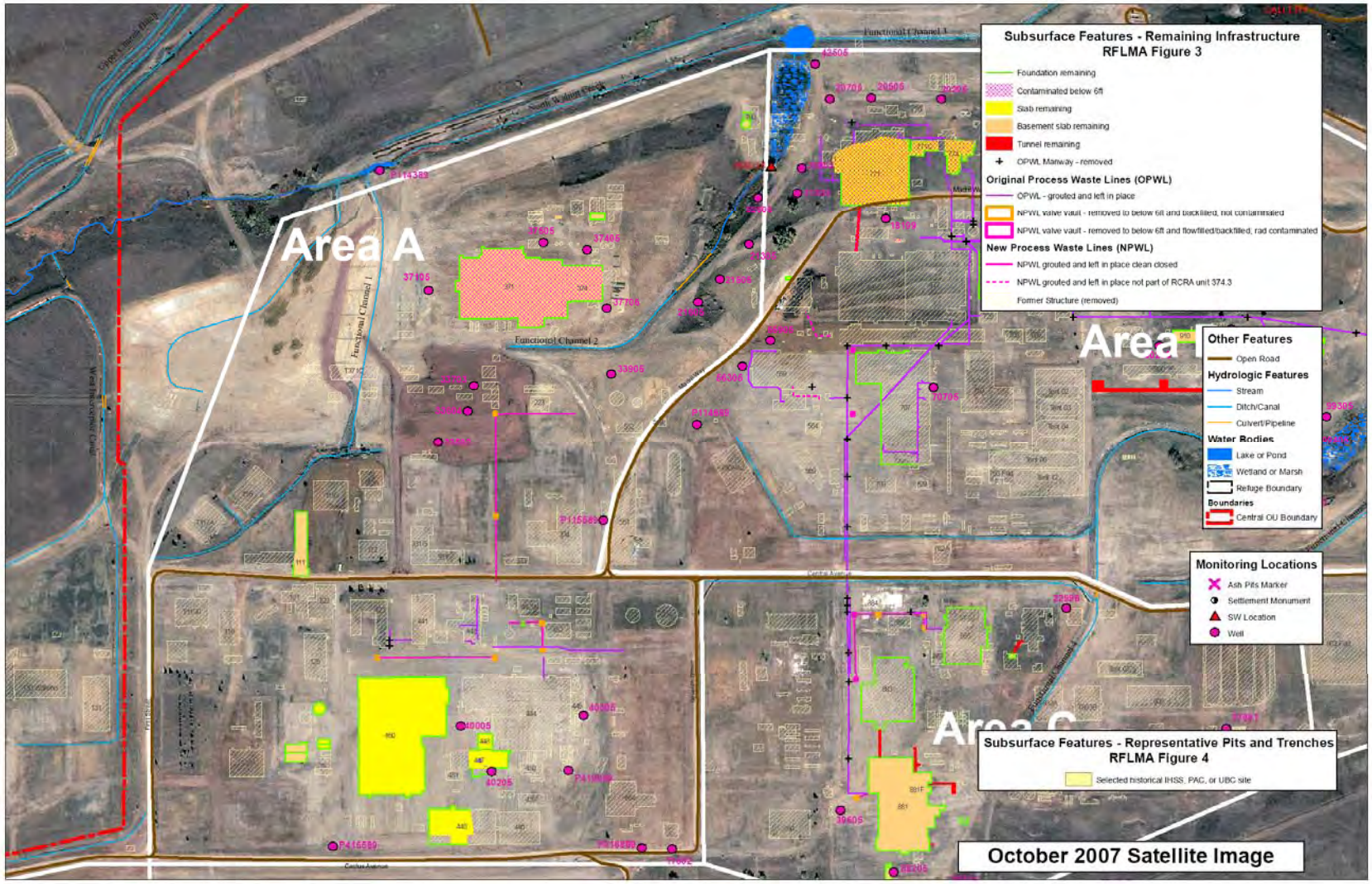
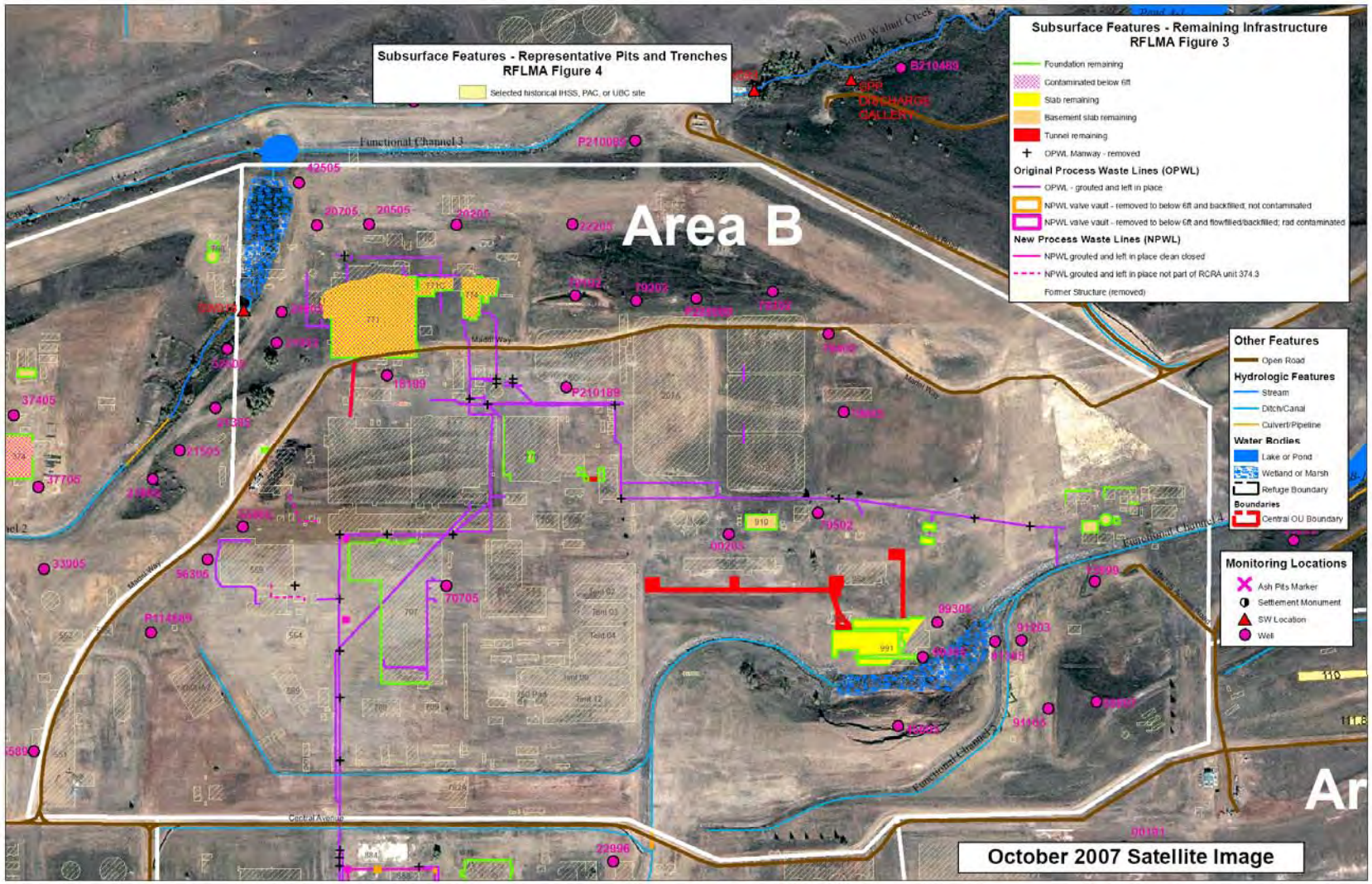
| | | | | | | | | |

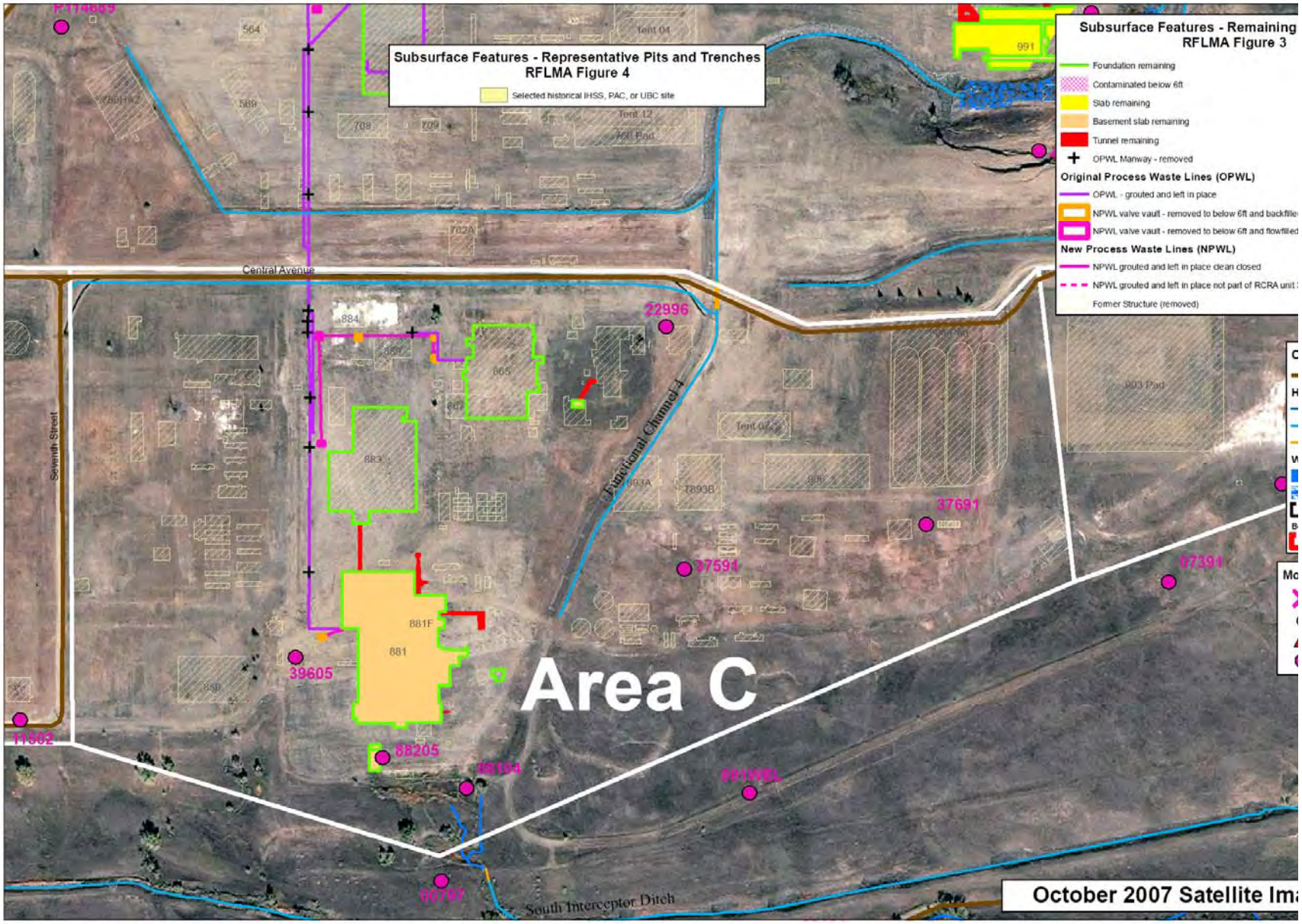
**Notes (Reference Flag ID #):**

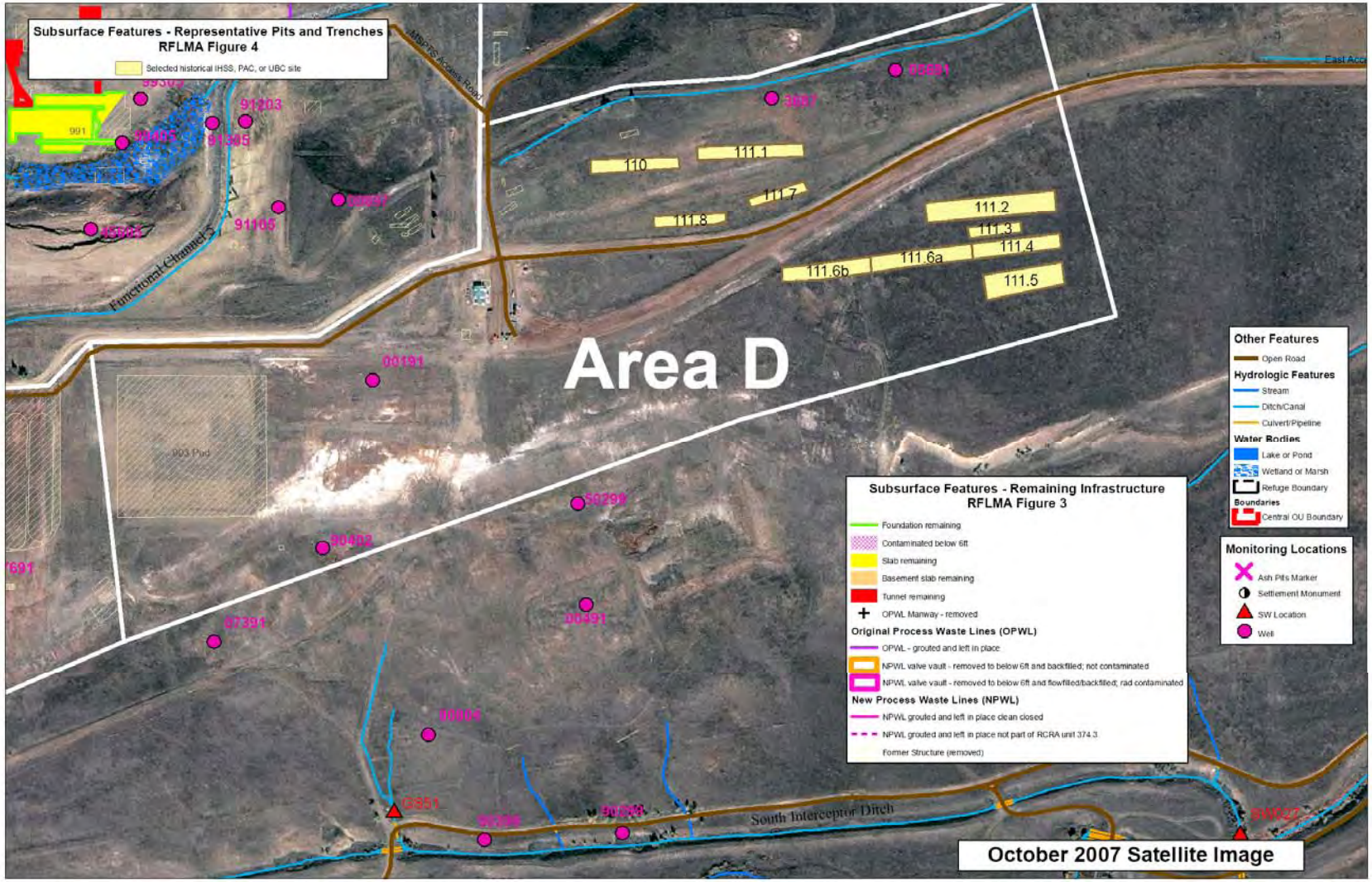
[1] Indicate the RFLMA IC# (RFLMA Attachment 2, Table 1-7) for which violation is indicated.
[2] These are required to be inspected Quarterly per RFLMA Attachment 2 section 5.3.5, and completion is documented separately – documented here if problem noted during Annual inspection.
[3] If photo taken, show location and orientation of photo on Area map.

Page ____ of _____


Subsurface Features - Remaining Infrastructure
RFLMA Figure 3
Foundation remaining
Contaminated below 6ft
Slab remaining
Basement slab remaining
Tunnel remaining
OPWL Manway - removed
Original Process Waste Lines (OPWL)
OPWL - grouted and left in place
NPWL valve vault - removed to below 6ft and backfilled, not contaminated
NPWL valve vault - removed to below 6ft and flowfilled/backfilled; rad contaminated
New Process Waste Lines (NPWL)
NPWL grouted and left in place clean closed
NPWL grouted and left in place not part of RCRA unit 374.3
Former Structure (removed)
Other Features
Open Road
Hydrologic Features
Stream
Ditch/Canal
Culvert/Pipeline
Water Bodies
Lake or Pond
Wetland or Marsh
Refuge Boundary
Boundaries
Central OU Boundary
Monitoring Locations
Ash Pits Marker
Settlement Monument
SW Location
Well
Subsurface Features - Representative Pits and Trenches
RFLMA Figure 4
Selected historical IHSS, PAC, or UBC site
Area A
Area B
Area C
Functional Channel 1
Functional Channel 2
Functional Channel 3
North Walnut Creek
West Tributary Canal
Central Avenue
October 2007 Satellite Image


Subsurface Features - Representative Pits and Trenches
RFLMA Figure 4
Selected historical IHSS, PAC, or UBC site
Subsurface Features - Remaining Infrastructure
RFLMA Figure 3
Foundation remaining
Contaminated below 6ft
Slab remaining
Basement slab remaining
Tunnel remaining
OPWL Manway - removed
Original Process Waste Lines (OPWL)
OPWL - grouted and left in place
NPWL valve vault - removed to below 6ft and backfilled; not contaminated
NPWL valve vault - removed to below 6ft and flowfilled/backfilled; rad contaminated
New Process Waste Lines (NPWL)
NPWL grouted and left in place clean closed
NPWL grouted and left in place not part of RCRA unit 374.3
Former Structure (removed)
Other Features
Open Road
Hydrologic Features
Stream
Ditch/Canal
Culvert/Pipeline
Water Bodies
Lake or Pond
Wetland or Marsh
Refuge Boundary
Boundaries
Central OU Boundary
Monitoring Locations
Ash Pits Marker
Settlement Monument
SW Location
Well
Area B
Functional Channel 3
Functional Channel 4
North Walnut Creek
Madill Way
Central Avenue
SPR DISCHARGE GALLERY
October 2007 Satellite Image


Subsurface Features - Representative Pits and Trenches
RFLMA Figure 4
Selected historical IHSS, PAC, or UBC site
Subsurface Features - Remaining
RFLMA Figure 3
Foundation remaining
Contaminated below 6ft
Slab remaining
Basement slab remaining
Tunnel remaining
OPWL Manway - removed
Original Process Waste Lines (OPWL)
OPWL - grouted and left in place
NPWL valve vault - removed to below 6ft and backfille
NPWL valve vault - removed to below 6ft and flowfilled
New Process Waste Lines (NPWL)
NPWL grouted and left in place clean closed
NPWL grouted and left in place not part of RCRA unit
Former Structure (removed)
Area C
Central Avenue
Seventh Street
Functional Channel 4
South Interceptor Ditch
881
881F
883
884
865
22996
37691
37591
97391
39605
88205
88164
00797
881WEL
October 2007 Satellite Ima


Subsurface Features - Representative Pits and Trenches
RFLMA Figure 4
Selected historical IHSS, PAC, or UBC site
Area D
Subsurface Features - Remaining Infrastructure
RFLMA Figure 3
Foundation remaining
Contaminated below 6ft
Slab remaining
Basement slab remaining
Tunnel remaining
OPWL Manway - removed
Original Process Waste Lines (OPWL)
OPWL - grouted and left in place
NPWL valve vault - removed to below 6ft and backfilled; not contaminated
NPWL valve vault - removed to below 6ft and flowfilled/backfilled; rad contaminated
New Process Waste Lines (NPWL)
NPWL grouted and left in place clean closed
NPWL grouted and left in place not part of RCRA unit 374.3
Former Structure (removed)
Other Features
Open Road
Hydrologic Features
Stream
Ditch/Canal
Culvert/Pipeline
Water Bodies
Lake or Pond
Wetland or Marsh
Refuge Boundary
Boundaries
Central OU Boundary
Monitoring Locations
Ash Pits Marker
Settlement Monument
SW Location
Well
Functional Channel 5
South Interceptor Ditch
East Acc
Ash Pits Access Road
991
903 Pad
110
111.1
111.2
111.3
111.4
111.5
111.6a
111.6b
111.7
111.8
91203
91305
91405
91105
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00806
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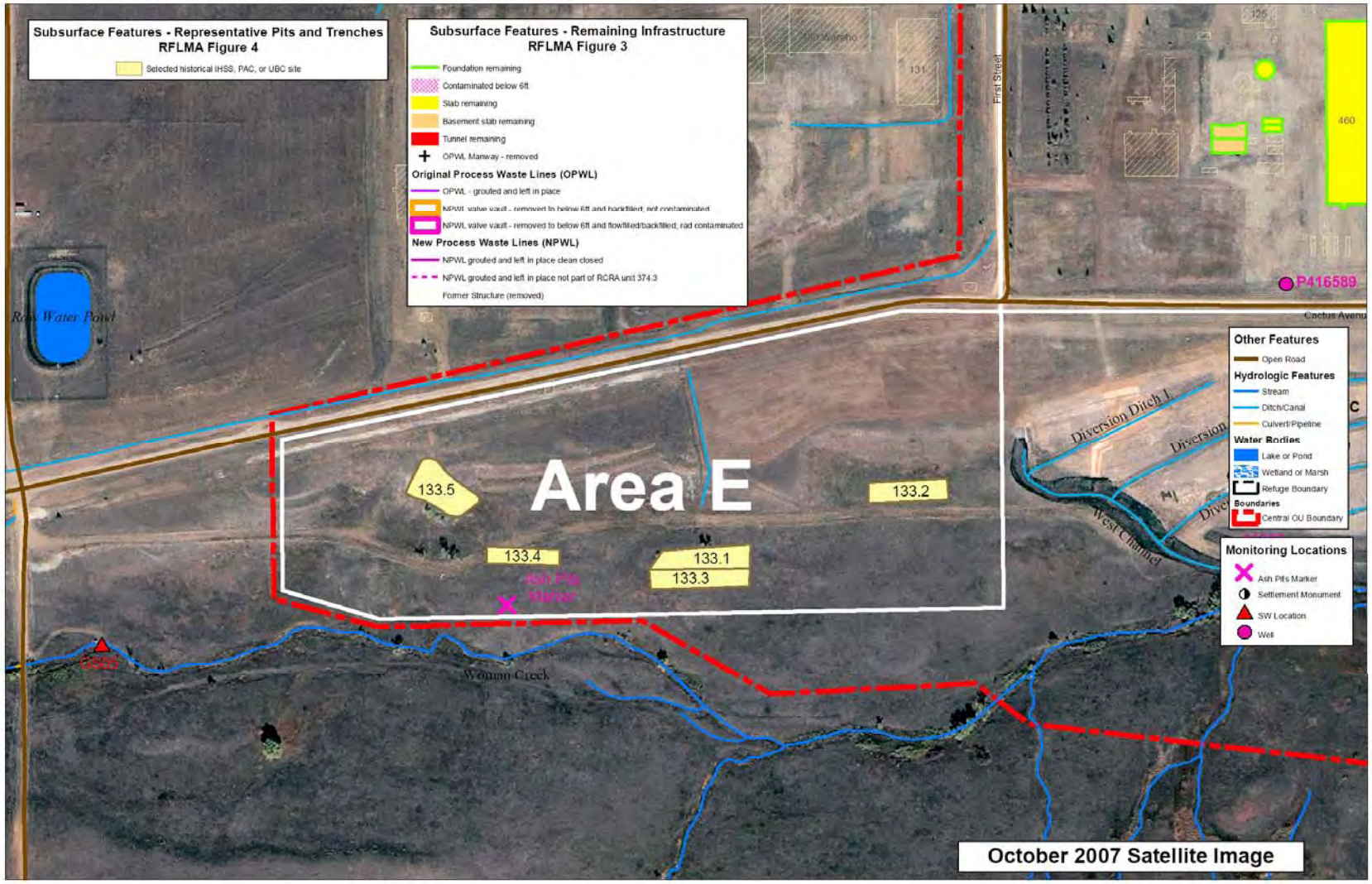
3687
00891
October 2007 Satellite Image


Subsurface Features - Representative Pits and Trenches
RFLMA Figure 4
Selected historical IHSS, PAC, or UBC site
Subsurface Features - Remaining Infrastructure
RFLMA Figure 3
Foundation remaining
Contaminated below 6ft
Slab remaining
Basement slab remaining
Tunnel remaining
OPWL Manway - removed
Original Process Waste Lines (OPWL)
OPWL - grouted and left in place
NPWL valve vault - removed to below 6ft and backfilled; not contaminated
NPWL valve vault - removed to below 6ft and flowfilled/backfilled; rad contaminated
New Process Waste Lines (NPWL)
NPWL grouted and left in place clean closed
NPWL grouted and left in place not part of RCRA unit 374.3
Former Structure (removed)
Raw Water Pond
First Street
Cactus Avenue
P416589
Area E
133.5
133.2
133.4
133.1
133.3
Ash Pits Marker
Woman Creek
Diversion Ditch 1
West Channel
Other Features
Open Road
Hydrologic Features
Stream
Ditch/Canal
Culvert/Pipeline
Water Bodies
Lake or Pond
Wetland or Marsh
Refuge Boundary
Boundaries
Central OU Boundary
Monitoring Locations
Ash Pits Marker
Settlement Monument
SW Location
Well
October 2007 Satellite Image

# Appendix C

# Example Contact Record

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**ROCKY FLATS SITE**
**REGULATORY CONTACT RECORD**

---

**Purpose:** Exploratory excavations to greater than 3 feet below grade generally between the former Interceptor Trench Pump House and Solar Ponds Plume Treatment System

---

**Contact Record Approval Date:**
May 20, 2008

**Site Contact(s) / Affiliation(s):**
Scott Surovchak, DOE; John Boylan, S.M. Stoller; Linda Kaiser, S.M. Stoller; Jody Nelson, S.M. Stoller; Rick DiSalvo, S.M. Stoller

**Regulatory Contact(s) / Affiliation(s):**
Carl Spreng, CDPHE

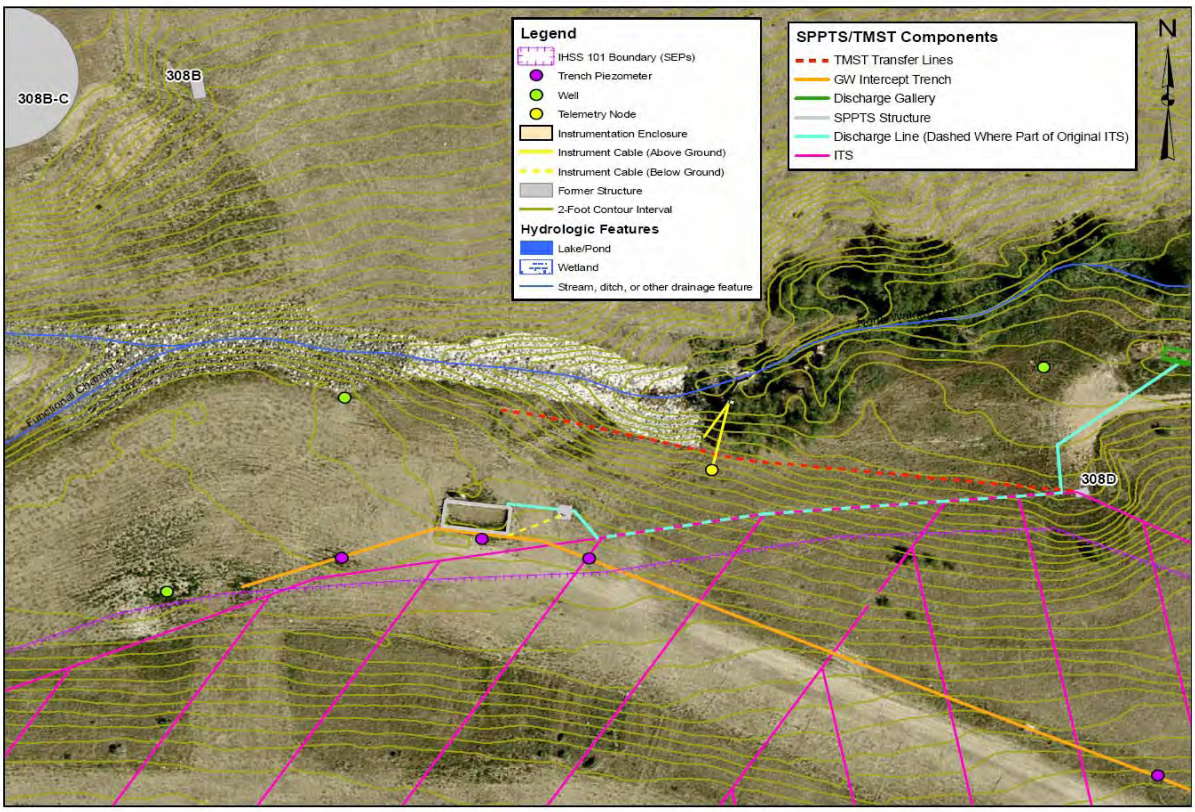
---

**Discussion:** The Solar Ponds Plume Treatment System (SPPTS) will be modified in the coming months. Part of this modification will include installing a groundwater collection sump near the former Interceptor Trench Pump House (ITPH) to collect contaminated groundwater that currently mixes with the treatment system effluent and issues at the Solar Ponds Plume Discharge Gallery, and routing this collected water up to the SPPTS for treatment. This water will be pumped to the SPPTS via buried lines. The area between the ITPH and the SPPTS is sensitive habitat (Preble's meadow jumping mouse). Installing these lines will require excavating a trench from the sump up to the SPPTS and burying the lines in the trench, thereby disturbing the habitat.

Two parallel lines are present in the subsurface near the ITPH. These lines were located during the exploratory excavations in spring 2007 (see *Contact Record 2007-02*) and appear to consist of HDPE pipe (non-perforated). Their purpose prior to site closure was to transfer water from the ITPH to the Temporary Modular Storage Tanks (TMSTs) and subsequently transfer the water from the tanks back through the ITPH into the Protected Area and finally to the evaporators within B-374 for treatment. Portions of these lines nearest the TMSTs and FC-3 have been removed, but the portion nearest the ITPH, extending to near the SPPTS, remains.

Engineering drawings that were generated before closure depict these lines as double-walled and show them running from the ITPH to the vicinity of the SPPTS before turning more northerly toward the TMSTs. They may be buried closer to the base of the hill (i.e., nearer surface water monitoring station SW093 than the SPPTS itself). Figure 1 shows the approximate location of the TMST transfer lines in relation to other features in the area. Regardless of whether the nearest portion is closer to the SPPTS or SW093, if these lines are in serviceable condition, they should be considered for use in the upcoming SPPTS modifications. Using them to transfer water from the new collection sump to the SPPTS could significantly reduce how much habitat is disrupted: the most sensitive portion of the habitat along the valley bottom, from the general vicinity of SW093 to the new sump, would not be directly impacted by the construction activities.

Figure 1. Approximate Location of TMST Transfer Line




These lines will be investigated by using a backhoe or similar equipment and utility-locating equipment as follows:

1. Form a pothole at the ITPH to locate the two MST transfer lines.
2. Sever the lines and send a tape/sounder up the lines (to the west) to allow them to be located along their subsurface extent.
3. Temporarily mark the locations of the lines along the surface.
4. Form a pothole where locating equipment indicates the lines either turn northward or end, and expose the lines.
5. Backfill the potholes, mark the locations and depths of the lines, apply erosion controls and revegetate as appropriate, and demobilize.

The potholing excavation involves actions prohibited by the institutional controls (ICs) incorporated in the Rocky Flats Legacy Management Agreement (RFLMA). The excavation work will exceed the 3-foot-depth limit prohibited by ICs (RFLMA, Attachment 2, Table 4, Control 2) and thus requires pre-approved procedures.

The objective of IC 2 regarding excavations with a depth that exceeds 3 feet is to maintain the current depth to subsurface contamination or contaminated structures. This IC also results in achieving

compliance with the CDPHE risk management policy of ensuring that residual risks to the site user are at or below $1x10^{-6}$. As discussed further, below, the proposed work achieves the risk management policy goal.

The excavation targets described above may be deeper than 3 feet below ground surface, and it is expected that the excavations will need to be deeper in order to allow personnel to perform the utility locates and pressure tests. The excavations are not expected to be deeper than approximately 5 feet below ground surface. However, if the lines are longer than the tape/sounder, an intermediate pothole may be required to allow these tools to be sent up the balance of their useful reach.

The best management practices in the *Erosion Control Plan for Rocky Flats Property Central Operable Unit, DOE-LM/1497-2007* (July 2007) will also be implemented to provide erosion controls for the excavated materials so that run-on and runoff will be minimized.

CDPHE has requested that the following information be included in contact records for soil excavation:

*1 - Provide information about any remaining subsurface structures in the vicinity so that the minimum cover assumption won't be violated (or state that there are none if that is the case)-*

The exploratory excavation is in the vicinity of the former ITPH, known as building 308D. The building was removed as documented in the *Type 1 Facility Closeout Report for Buildings 308B and 308D* (September 22, 2003). The closeout report indicates that utilities were disconnected and capped three feet below grade.

*2 - Provide information about any former IHSSs/PACs or other known soil or groundwater contamination in the vicinity (or state that there is no known contamination)-*

The closeout report indicates that there is no contamination present in the remaining soils and that this area was not an IHSS. The *RI/FS Nature and Extent of Soil Contamination* figures do not indicate soil contamination in this area. Groundwater in the vicinity is impacted by the Solar Ponds Plume. Any groundwater that is encountered will be collected from the excavation, if necessary, to conduct the investigative work. The groundwater will be pumped from the excavation to the surface generally south of the excavation area to allow this water to seep back into the ground.

*3 - Resurvey any new surface established in subsurface soil, unless sufficient existing data is available to characterize the surface (or state that the excavated soil will be replaced and the original contours restored)*

All excavated soils will be returned to the excavation, and original contours will be restored.

**Closeout of Contact Record:** This contact record will be closed when the excavations are backfilled and when revegetation and erosion controls are completed.

**Resolution:** Carl Spreng, CDPHE, approved the potholing work as described in this contact record.

**Contact Record Prepared by:** John Boylan and Rick DiSalvo

**Distribution:**

RFLMA Contact Record 2008-03 3 of 4

Carl Spreng, CDPHE
Scott Surovchak, DOE
Linda Kaiser, S.M. Stoller
Rocky Flats Contact Record File

# Appendix D

# Rocky Flats System Closure Plans and Sector Closeout Reports

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**Background:** During the final stages of Rocky Flats cleanup and closure, DOE and the closure Contractor developed a process of documentation and confirmation of conditions of major infrastructure systems. The documentation was to inform the decision making on completion of contract scope, and was not part of the Rocky Flats Cleanup Agreement decision document process to achieve cleanup and closure.

The documents prepared were identified as closure plans and sector closeout reports. These documents contain historical information on subsurface conditions that may be used to identify hazards or other aspects that may be important in work planning.

*Table D−1. Closure Plans*

| Title | Date | Revision # |
|---|---|---|
| Alarm System, HW-2 System Closure Plan | February 21, 2005 | Rev. 0.0 |
| Alarm System, Original Alarm System Closure Plan | April 5, 2005 | Rev. 0.0 |
| Alarm System, Alarm PIDAS System | March 1, 2005 | Rev. 0.0 |
| Alarm System, Second Alarm System Closure Plan | April 6, 2005 | Rev. 0.0 |
| Classified Data System Closure Plan | March 11, 2005 | Rev. 0.0 |
| Classified LAN System Closure Plan | March 10, 2005 | Rev. 0.1 |
| Domestic Water System Closure Plan | July 14, 2005 | Rev. 1 |
| Fuel Oil System Closure Report | March 31, 2005 | Rev. 0.0 |
| Electrical Distribution System Closure Plan | April 30, 2005 | Rev. 0.0 |
| Natural Gas System Closure Plan | February 5, 2005 | Rev. 1.1 |
| Nitrogen System Closure Plan | February 8, 2005 | Rev. 1.0 |
| Sanitary Sewer System Closure Plan | June 13, 2005 | Rev. 1 |
| Telephone System Closure Plan | April 7, 2005 | Rev. 0 |
| Underground Steam System Closure Plan | June 30, 2005 | Rev. 2 |

*Table D−2. Sector Closeout Reports*

| Sector Number | Title | Date | Revision # |
|---|---|---|---|
| 1A | Sector 1A, 130 Trailer Complex | September 26, 2005 | Rev. 0.0 |
| 1B | Sector 1B, 130 Complex | September 22, 2005 | Rev. 0.0 |
| 1C | Sector 1C, Southwest Most Sector of the Site | July 6, 2005 | Rev. 1.0 |
| 2A | Sector 2A, North-Northwest Buffer Area | July 26, 2005 | Rev. 0.0 |
| 2B | Sector 2B, Northeast Buffer Area | July 27, 2005 | Rev. 0.0 |
| 3A | Sector 3A, Southwest Buffer Area | July 26, 2005 | Rev. 0.0 |
| 3B | Sector 3B, Southwest Buffer Area | July 26, 2005 | Rev. 0.0 |
| 4A | Sector 4A, General Administration Area, Buildings. 111, 112, 113, 115, T115A, T115B, T115C, 116 and T117A | May 18, 2005 | Rev. 0.0 |
| 4B | Sector 4B, 331, 334, and 551 Area | September 7, 2005 | Rev. 0.0 |
| 4C | Sector 4C, 223, 223A, 231, 549, and 552 Area | August 23, 2005 | Rev. 0.0 |
| 4D | Sector 4D, 551 Area, Buildings 551, 553, 554, 556, and 551 Pad | July 20, 2005 | Rev. 0.0 |
| 4E | Sector 4E, 555, 558, and 681 Area | August 25, 2005 | Rev. 0.0 |
| 4F | Sector 4F, 371 Area | October 5, 2005 | Rev. 0.0 |
| 5A | Sector 5A, 371 Area | August 23, 2005 | Rev. 0.0 |
| 5B | Sector 5B, 771 Area | May 2, 2005 | Rev. 0.0 |
| 5C | Sector 5C, 750 Pad Area | September 1, 2005 | Rev. 0.0 |
| 5D | Sector 5D, 500 Area | September 7, 2005 | Rev. 0.0 |
| 5E | Sector 5E, 700 Area | September 22, 2005 | Rev. 0.0 |
| 6A | Sector 6A, Solar Ponds, Bldg. 964 and 964 Laydown Area | February 25, 2005 | Rev. 1.0 |
| 6B | Sector 6B, Manufacturing and Warehouse 991 Sewage Treatment 990-995 Construction Support facility 980 | February 24, 2005 | Rev. 1.0 |
| 6C | Sector 6C, 928 Area | July 6, 2005 | Rev. 1.0 |
| 7A | Sector 7A, 800 Area | August 3, 2005 | Rev. 0.0 |
| 7B | Sector 7B, 902, 903, and 904 Pads, 865, and 906 Area | August 3, 2005 | Rev. 0.0 |
| 7C | Sector 7C, 891 Area | August 30, 2005 | Rev. 0.0 |
| 8A | Sector 8A, 440 and 460 Area | August 4, 2005 | Rev. 0.0 |
| 8B | Sector 8B, 444 and 664 Area | August 21, 2005 | Rev. 0.0 |
| 9A | Sector 9A, 124 Area | September 12, 2005 | Rev. 0.0 |
| 9B | Sector 9B, Buildings 119, 119B 121, T121A, 122, 122S, T122A, 125, 126, 127, 128, 119 Helicopter Pad, and the Jogging Track | July 20, 2005 | Rev. 0.0 |
| 9C | Sector 9C, 400 Area | August 23, 2005 | Rev. 0.0 |
| 10A | Sector 10A, East Access Area | July 6, 2005 | Rev. 1.0 |
| 10B | Sector 10B, West Access Road | August 30, 2005 | Rev. 0.0 |
| 10C | Sector 10C, Rail Spur Area | October 7, 2005 | Rev. 0.0 |
| 10D | Sector 10D, Central Avenue Corridor | September 26, 2005 | Rev. 0.0 |

# Appendix E

# Real Property Records

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## Real Estate Records

Real estate records include the original acquisition files for the Rocky Flats Site, the legal boundary survey, records of transfer of jurisdiction of the National Wildlife Refuge lands to the U.S. Fish and Wildlife Survey, and information on easements and other outgrants. A directory of the location of this information follows:

- Hard-copy real estate records are currently stored in the Fire King file cabinets at the Rocky Flats office.
- Electronic real estate records will be entered into Hummingbird in late FY 2008.
- Working-copy real estate records will be maintained in Hummingbird and in hard copy at the Rocky Flats office and the Grand Junction office.
- Gap analysis and easement/encumbrance closeout information will be added as completed.
- Legal survey—same as real estate records.
- Issues resolution and other documents—same as real estate records.
- Transfer to USFWS—same as real estate records.

Note: This section will be revised at the completion of the real estate records work to be performed during the last half of 2008. The real estate records work will include organizing the records, performing a gap analysis, closing out inactive easements, establishing the files and records retention, and documenting history/information acquired during issues resolution.

## Mining Permits

This section includes copies of documents pertaining to the active mining permits on the western edge of the Rocky Flats Site. The documents are maintained in the Rocky Flats working file. An index of the file is included with the working file. A record file will be developed and maintained as the information is obtained and evaluated.

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# Appendix F

# Rocky Flats Site Soil Disturbance Evaluation Procedure

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Soil Disturbance Evaluation Process

Purpose: The purpose of this Soil Disturbance Evaluation Process is to identify hazards and regulatory requirements so that appropriate work control steps are implemented to mitigate the hazard and/or meet regulatory requirements. The soil disturbance evaluation process is a part of the Rocky Flats Site Operations Guide (RFSOG) work planning process (see Section 9.0). This paper provides guidance on what constitutes a soil disturbance and the items to consider when the work planning process requires that an evaluation be conducted.

Background: Soil disturbance means activities that, by design, will penetrate the existing surface by digging, ripping, tilling, or driving rods, stakes, or similar sturdy items (i.e., stronger than a pin flag) to a depth deeper than 6 inches.

This type of disturbance could encounter subsurface infrastructure present in the soil disturbance area, which may create a hazard if severed or penetrated. This type of disturbance may also have remedy performance implications because of the possibility that contaminants could be mobilized and/or physical or institutional controls (ICs) may be involved.

Soil disturbance is prohibited by the Rocky Flats Legacy Management Agreement (RFLMA) ICs (see RFLMA Attachment 2, Table 4), unless conducted in accordance with the Erosion Control Plan (ECP) requirements; disturbance deeper than 3 feet must be approved by the Colorado Department of Public Health and Environment (CDPHE). Soil disturbance activities could impair the functioning of physical controls, treatment systems, and/or monitoring wells or stations. The RFLMA ICs are intended to mitigate the possibility of exposure from access to or mobilization of contaminants that may remain in or under the soil, and preserve various aspects of the remedy to ensure it remains protective of human health and the environment.

Soil disturbance could involve use of tools or equipment that could pose worker or environmental hazards that must be evaluated, such as fugitive dust emissions or destruction of vegetation or habitat. These hazards may also include the potential for people or equipment to come into contact with hazards that are below the soil surface such as buried utilities or remaining infrastructure.

Evaluation Process and Documentation: The evaluation is based on a graded approach that considers the area, depth, and location of the disturbance. Any soil disturbance that involves activities prohibited by RFLMA ICs must be evaluated to determine the implementation of the ECP and whether specific regulatory approval is required. The rationale for each IC is discussed below, and the rationale shall be considered in applying the graded approach.

After the RFLMA IC evaluation, a hazards evaluation may also be required. The hazards review shall consider the following:

- Residual contamination
  - — Closeout reports and former Individual Hazardous Substance Site proximity
  - — Maps
- Active gas pipeline
  - — Map with prohibitions
- Inactive utilities
  - — Closeout reports (See RFSOG Appendix D)
  - — Maps
- Active utilities
- Results of line locate

Based on known and documented subsurface conditions, experience with construction projects that involved soil disturbance and water monitoring at Rocky Flats, and regulatory requirements, soil disturbance activities that meet the following criteria do not require specific hazards evaluation or mitigation plans:

- Outside of Preble's meadow jumping mouse (PMJM) habitat area
- Outside of wetlands or surface waters
- Does not involve use of excavation or other heavy equipment (e.g., placement of pin flags, placement of erosion control materials, and picking up debris exposed on the surface)
- Total area disturbed is less than 0.5 acre
- Depth is less than 6 inches

The rationale for ICs is contained in the Corrective Action Decision/Record of Decision (CAD/ROD), which specifies:

> As part of the selected remedy/corrective action, DOE will institute a series of institutional controls. These controls will extend throughout the Central OU …. In general, these controls are needed so that the assumptions incorporated into the risk assessments for the likely future users (the WRW and WRV) are not violated, and in turn these users do not receive unacceptable levels of exposure to residual contamination. Certain controls are also needed to prevent damage to engineered components of the remedy.

The ICs, objective, and rationale for each are:

> 1) The construction and use of buildings that will be occupied on a permanent or temporary basis (such as for residences or offices) is prohibited. The construction and use of storage sheds or other, non-occupied structures is permitted, consistent with the restrictions contained in controls 2 and 3 below, and provided such use does not impair any aspect of the response action at Rocky Flats. *(Objective: prevent unacceptable*

*exposures via the indoor air pathway. Rationale: The analysis of the indoor air pathway in the CRA indicated that subsurface VOCs were at levels in certain portions of the Central OU that could pose a risk of unacceptable exposure to the WRW if occupied structures were built in these areas.)*

2) Excavation, drilling, and other intrusive activities below a depth of three feet are prohibited, except for remedy-related purposes and routine or emergency maintenance of existing utility easements, in accordance with pre-approved procedures. *(Objective: prevent unacceptable exposure to residual subsurface contamination. Rationale: Contaminated structures, such as building basements, exist in certain areas of the Central OU, and the CRA did not evaluate the risks posed by exposure to this residual contamination. Thus, this restriction eliminates the possibility of unacceptable exposures. Additionally, it prevents damage to subsurface engineered components of the remedy.)*

3) No grading, excavation, digging, tilling, or other disturbance of any kind of surface soils is permitted, except in accordance with an erosion control plan (including Surface Water Protection Plans submitted to EPA under the Clean Water Act) approved by CDPHE or EPA. Any such soil disturbance will restore the soil surface to preexisting grade. *(Objective: prevent migration of residual surface soil contamination to surface water. Rationale: Certain surface soil contaminants, notably plutonium-239/240, were identified in the fate and transport evaluation in the RI as having complete pathways to surface water if disturbed. This restriction minimizes the possibility of such disturbance and resultant impacts to surface water. Restoring the soil surface to preexisting grade maintains the current depth to subsurface contamination or contaminated structures.)*

4) Surface water may not be used for drinking water or agricultural purposes. *(Objective: prevent unacceptable exposure to local surface water contamination above the terminal ponds. Rationale: While the CRA did not evaluate the risks posed by the use of surface water for drinking or agricultural purposes, the nature and extent of contamination evaluation in the RI showed that certain contaminants were found at levels exceeding standards above the terminal ponds. This restriction reduces the possibility of unacceptable exposures to the future users from this source.)*

5) The construction or operation of groundwater wells is prohibited, except for remedy-related purposes. *(Objective: prevent unacceptable exposure to contaminated groundwater. Rationale: While the CRA did not evaluate the risks posed by the use of ground water for drinking or agricultural purposes, the nature and extent of contamination evaluation in the RI identified areas in the Central OU where groundwater contaminants exceeded water quality standards or MCLs. This restriction reduces the possibility of unacceptable exposures to future users from this source. Additionally, it prevents the disruption of groundwater flow paths so as to avoid impacts to groundwater collection and treatment systems.)*

6) Digging, drilling, tilling, grading, excavation, construction of any sort (including construction of any structures, paths, trails or roads), and vehicular traffic are prohibited on the covers of the Present Landfill and the Original Landfill, except for authorized response actions. *(Objective: ensure the continued proper functioning of the landfill covers. Rationale: This restriction helps ensure the integrity of the landfill covers.)*

7) Activities that may damage or impair the proper functioning of any engineered component of the response action, including but not limited to any treatment system, monitoring well, landfill cap, or surveyed benchmark, are prohibited. (*Objective: ensure the continued proper functioning of engineered portions of the remedy. Rationale: This restriction helps ensure the integrity of other engineered components of the remedy, including monitoring and survey points.)*

The CRA was based on a specific land use, a wildlife refuge. Per the Rocky Flats National Wildlife Refuge Act, the majority of the Site is to have jurisdiction transferred to the U.S. Fish and Wildlife Service (USFWS) for the purpose of becoming a National Wildlife Refuge. The lands retained by DOE, which contain the Central Operable Unit are expected to be managed consistent with the Refuge, unless the needs of the remedy dictate otherwise (See the CAD/ROD Section 9.0). Thus, Legacy Management worker activities that are encompassed within the wildlife refuge worker exposure scenario parameters would entail the same parameters.

Evaluation Documentation: When soil disturbance is expected as part of an activity, the determination shall be noted in the RFSOG checklist (see RFSOG Appendix H) and a brief discussion of the evaluation (generally 1 to 2 pages) shall be documented for Rocky Flats Site Manager review as part of the work approval process (see RFSOG Section 9.0). The discussion may reference design drawings, maps, sketches, RFLMA Contact Records, and so forth to provide information.

The discussion paper shall address the following topics:

**Work:** Provide the name of the activity as shown on the Project Activity Evaluation Form (LMS 1005e).

**Reason for soil disturbance:** State briefly why the scope includes a need for soil disturbance.

**Depth of penetration/cut/excavation:** Describe location and amount of soil to be disturbed.

**Material being placed in ground:** If material will be left in the ground, provide brief description.

**IC review:** Note that a review of ICs has been done and provide conclusion.

**Hazard review:** Discuss the types of work hazards expected. Typically, this will mention:

- Remains of infrastructure that might be encountered, and whether it may be contaminated requiring monitoring or controls; and
- Line locate that has been completed, or plans for line locate.

**PMJM areas**—If disturbance is in a PMJM area, discuss USFWS Notification requirements per the Programmatic Biological Assessment (Part II, Section 3.2) or whether consultation is needed.

**Wetlands areas**—If disturbance is in or may impact wetland areas, discuss whether permit requirements must be met.

**Evaluation completed by:** Document who performed the evaluation.

**Additional subject matter expert review (if needed):** Indicate whether other items may need to be considered, such as whether existing line locates are sufficient, or hazard review.

**Site Manager Review: _____**

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# Appendix G

# Rocky Flats Sample Preparation Room Procedures

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# Introduction

This procedure provides instruction for activities conducted in the sample preparation room of the Rocky Flats Westminster, Colorado, facility, and provides Rocky Flats-specific information to supplement the requirements of the following *Rocky Flats Site Operations Guide* (RFSOG) sections, manuals, and plans:

- RFSOG Section 9.0—Work Planning Processes
- RFSOG Section 10.0—Health and Safety/Training
- RFSOG Section 11.0—Emergencies and Corrective Action
- RFSOG Section 13.0—Regulatory Compliance
- RFSOG Section 14.0—Waste Management
- RFSOG Attachment F3—*Rocky Flats Site Chemical Management Plan*
- LMS/PLN/S04353, *Legacy Management CERCLA Sites Quality Assurance Project Plan*
- LMS/PLN/S04351, *Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites*
- LMS/POL/S04320, *Quality Assurance Manual*

  — Personnel Training and Qualification

  — Work Processes

  — Procurement
- LMS/POL/S04321–*Health and Safety Manual*

  — Fire Prevention and Protection

  — Personal Protective Equipment

  — Compressed Gas Cylinders

  — Job Safety Analysis

  — Hazard Communication Program
- LMS/POL/S04325, *Environmental Procedures Catalog*

  — Chain-of-Custody Control

  — Physical Security of Samples
- LMS/POL/S04326, *Comprehensive Emergency Management System*
- LMS/POL/S04328, *Integrated Safety Management System Description with Embedded Worker Safety and Health Program*

  — Appendix A, General Approach to Worker Safety and Health Functional Areas
  LMS/POL/S04329—*Environmental Management Program Implementation Manua*l

  — Chemical Management Program
- LMS/POL/S04334—*Procurement Manual*

  — Preparation and Review of Purchase Requisitions

# General Operating Rules

Periodic, routine facility health and safety inspections are conducted and documented in accordance with the RFSOG. In addition to specific standard operating procedures, the following general requirements shall be met when any sample preparation activities are being conducted:

- Routes of emergency egress shall be clearly indicated and unobstructed.
- All fire extinguishers shall remain functional and accessible. (Fire extinguishers shall be stored, inspected, and serviced as required by the corresponding procedure.)
- Access to the sample preparation room shall be restricted to authorized personnel only.
- Personal protective equipment shall be used as required by the Job Safety Analysis (JSA), to prevent and mitigate any possible skin or eye contact with chemicals.
- Eye wash station shall be operating properly. Remove the protective caps from the faucets and run the water for several seconds.
- Smoking, food, and beverages are prohibited in the room at all times. This includes chewing gum, mints, and other similar substances.
- Good housekeeping practices shall be followed and countertops and work benches shall be maintained clean, neat, and orderly.
- Incidental spills shall be cleaned up immediately and properly.
- If a significant spill or leak occurs, the room shall be evacuated immediately and the emergency response plan for the Rocky Flats Chemical Management Plan will be instituted.
- No manufacturer's label shall be removed or defaced from the original container.
- Equipment which is damaged or malfunctioning shall not be used, particularly chipped glassware.
- Pipetting by mouth is strictly prohibited.
- Chemicals shall be procured, managed, and disposed of according to the Rocky Flats Chemical Management Plan.
- All personnel shall wash their hands prior to leaving the room.

# Refrigerators

The refrigerators in the sample preparation room are used to store samples and blue ice only. Chemicals, food, and drinks are not allowed to be stored in them. They will be maintained at 4 °C ± 2 °C while samples are being stored in them. Thermometers used to monitor the refrigerators will be checked against a NIST-certified thermometer on a monthly basis and documented.

Refrigerators that are not in good working order shall be locked out/tagged out and removed.

# Sample Preservation

Sample containers used for organic and inorganic analysis shall be pre-cleaned to the U.S. Environmental Protection Agency level 1 standard and have a Certificate of Analysis with an associated lot number. Sample containers shall be preserved before sampling in accordance with Table 3−2 of LMS/PLN/S04351, *Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites,* specific directed laboratory requests, or specific project direction. Preserved sample containers shall be securely placed in an appropriate U.S. Department of Transportation (DOT) conveyance in an upright position for transport.

# Sample Management and Shipping

Samples will be collected, processed, decontaminated, and transported to the sample preparation room in accordance with the *Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites.*

## Physical Security of Samples

The sampler shall maintain physical security of the samples in accordance with LMS/POL/S04325, *Environmental Procedures Catalog,* GT-3. Custody shall be maintained either by having custody seals on each sample or storing the samples in a locked area.

Individual custody seals will be placed on each sample if they are to be shipped via a carrier.

The sampler shall complete the chain-of-custody record in accordance with the *Environmental Procedures Catalog,* GT-3, and the chain-of-custody shall accompany the samples until they are received by the laboratory.

## Sample Packaging

Soil and water samples from sites at Rocky Flats with historical or processed knowledge have been determined not to be “hazardous materials” as defined in DOT Regulations, 49 CFR 171.8 and the International Air Transport Association (IATA) Dangerous Goods Regulations (DGRs).

Sampling and analysis procedures require the addition of certain chemicals to water samples for preservation. Based on process knowledge, water samples preserved in accordance with these procedures are also not DOT or IATA regulated hazardous materials. However, certain volumes of some of these chemicals may be DOT or IATA regulated hazardous materials in reagent form prior to mixing with water samples. Thus, when transported as reagents, limitations may apply to ensure they are not DOT or IATA regulated hazardous materials.

Samples from new sites must be evaluated to determine if there is a hazardous material Hazard Class association to the shipment as required by the 49 CFR, Title 172.101 table and any applicable IATA DGRs.

If radiological and industrial hygiene monitoring that may be required by the JSA or observation by persons performing sampling or preparation activities indicates that a sample or samples may

contain analyte concentrations significantly above process knowledge characterization data, the samples shall not be shipped until an evaluation by Health and Safety and/or Environmental Compliance staff confirms the status of the sample(s) as non-DOT hazardous materials and/or not posing a health and safety concern. If the evaluation concludes that the sample(s) are hazardous materials, a certified shipper will be engaged to perform the shipping in accordance with the DOT and IATA DRG requirements.

Coolers will be used to package the samples but other packaging that meets the DOT conveyance specifications can be used if necessary.

Sample containers will be individually bagged and sealed in ziploc bags. Glass containers will be bubble wrapped to prevent breakage during transport. The samples will then be placed in an internal large plastic bag to provide secondary containment. Sample containers will be placed in the package in an upright position except vials for volatile organic compound analysis. These vials will be placed in an inverted position.

If 4 °C ± 2 °C preservation is required, then a sufficient amount of Blue Ice packs, or equivalent is added to the package to maintain preservation temperature through laboratory receipt. An adequate amount of absorbent is also added to the package to ensure that the contents will not leak through the outer packaging.

A minimum amount of compatible cushioning is added to the package to minimize the potential for shifting and damage to the samples during transport.

The signed and dated chain-of-custody and any other documents is placed in separate ziploc bag and placed in the top of the package. The package is then sealed with strapping tape.

The package is then labeled in accordance with any applicable 49 CFR, Titles 171 through 178 with a minimum labeling of:

- “This Side Up” with arrows and “Fragile” labels on all four sides.
- “This Side Up” without arrows on the top.
- “Contractor for the United States Department of Energy” and “Environmental Samples” labels are also placed on the top.
- “Heavy Weight” placed on two opposite sides of the package if it is over 65 pounds.

Signed and dated custody seals are then placed on the package lid at two locations.

# Excess Sample Disposal

Disposal of excess samples will be in accordance with the *Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites*, Rocky Flats Program Directive RF-2006-03.

Excess samples that have been preserved with chemicals will be neutralized before disposal.

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# Appendix H

# Site-Specific Checklist

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**LMS Project/Activity Evaluation - Rocky Flats Site Supplement (Attach to Form DOE-LM 1005e)**
**This Supplement may be prepared at any time during planning process to document Action/Status for Manager's Approval, but Action Items must be completed before activity will be authorized to proceed on Plan of the Week/Day (POW/POD)**

Project/Activity Description: _____

Project/Activity Leader: _____ Designated Reviewers: _____
(Each Designated Reviewer must initial above their name after input given)

| Review Item | Yes | No | N/A | Action/Status | Date item Completed/Review Initials |
|---|---|---|---|---|---|
| Is the activity prohibited by one or more ICs? | | | | (ICs listed in RFLMA Attachment 2, Table 4). If yes, work is not authorized until Contact Record approved. | |
| Is JSA required by H&S evaluation? | | | | If yes, work is not authorized until JSA approved. | |
| Will the work involve Soil Disturbance > 6" and/or > 1 acre? | | | | If yes, work is not authorized until the Soil Disturbance evaluation (RFSOG Appendix F) completed. Includes IC, hazard and ecology review. | |
| Soil disturbance Erosion Control Plan review? | | | | Is item relevant? | |
| Soil disturbance Contaminant Migration? | | | | Is item relevant? | |
| Soil disturbance Dust Suppression? | | | | Is item relevant? | |
| Soil Disturbance Other item(s)? | | | | Note relevant item here – | |
| Will the work compromise any physical access controls? | | | | If yes, work is not authorized until mitigation plan completed. | |
| Will work be subject to wetland or surface water discharge permit requirements? | | | | If yes, work is not authorized until Permit Requirements established. | |
| Will the work be performed in PMJM habitat areas? | | | | If yes, work is not authorized until USFWS notification/approval. | |

## LMS Project/Activity Evaluation - Rocky Flats Site Supplement (Attach to Form DOE-LM 1005e)

| Review Item | Yes | No | N/A | Action/Status | Date item Completed/Review Initials |
|---|---|---|---|---|---|
| Will the work potentially impact migratory birds? | | | | If yes, work is not authorized until MBTA policy review completed. | |
| Will the work potentially mobilize contaminants or change flow paths of groundwater or surface water? | | | | If yes, work is not authorized until impacts evaluation completed. | |
| Does the work have the potential to impact USFWS Refuge Lands? | | | | If yes, work is not authorized until impacts evaluation completed, and any required consultation with USFWS completed. | |
| Are other project-specific work control documents or notifications required? | | | | If yes, work is not authorized until the documents or notification items (e.g., drawings, SOW, public notification) in the next blocks are completed. | |
| Item: | | | | . | |
| Item: | | | | | |
| Item: | | | | | |
| Item: | | | | | |

| Approval to Complete Planning: | Site Manager | Signature | Date: |
|---|---|---|---|
| | | | |

Other comments:

**RFSOG Final Planning Checklist**
**(attach PA/E and RF Site Supplement)**

| Item | Date Complete | Initials | Comments |
|---|---|---|---|
| JSA | | | |
| PA/E checklist (form DOE-LM 1005e) | | | |
| Utility locates | | | |
| Soil disturbance evaluation per RFSOG Appendix F | | | |
| Wetlands notifications | | | |
| PMJM notifications | | | |
| MBTA evaluation per RFSOG (Appendix L) | | | |
| Surface water discharge permits | | | |
| Contact Records (list each one) | | | |
| Make/buy analysis complete if subcontract | | | |
| Procurement documents complete if subcontract | | | |
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Note: add project-specific requirements from PA/E and Site Supplement forms to assemble a final project-specific checklist.

LMS Site Manager approval to add to POW/POD_____
Date:
Comments:

Page 1 of 1

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# Appendix I

# Rocky Flats Health and Safety Addendum

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# Rocky Flats Health and Safety Addendum

Health and safety information, policies, and procedures for work at the Rocky Flats Site and office are provided in LMS manuals including, but not limited to:

| Reference Procedure or Program | Applicable Section(s) |
|---|---|
| LMS/POL/S04321, *Health and Safety Manual* | Entire Manual |
| LMS/POL/S04325, *Comprehensive Emergency Management System* | Entire Manual |
| LMS/POL/S04324-0.0, *Construction Procedures Manual* | Entire Manual |
| LMS/POL/S04322-0.0, *Radiological Control Manual* | Entire Manual |
| LMS/PRO/S04337-0.0, *Health and Safety Procedures Manual* | Entire Manual |

Additional Site-specific information is included in the RFSOG and in Site-specific procedures. This addendum provides Site-specific policies and information for use in preparing JSAs, procedures, and other work control documents.

## Rocky Flats Adverse Weather Policy

In the event of adverse weather, the H&S representative will determine whether work can continue without compromising the health and safety of Site personnel. Adverse weather conditions that may affect safe performance of work tasks include:

- High winds,
- Heavy rainfall or hail,
- Tornadoes,
- Electrical storms and lightning,
- Snow and ice,
- Cold weather,
- Hot, dry weather,

### High Winds

Rocky Flats monitors wind speeds and issues wind advisories and warnings directly to cell phones via text messaging. Sustained (minimum 10 minutes) winds of 30 mph will require an H&S representative (or Field Operations Lead or Manager) to determine if work can continue safely. Sustained winds of 35 mph will require termination of work.

- Strong Wind Warning: Winds in excess of 30 mph but less than 45 mph, with wind gusts up to 65 mph. Loose materials should be secured. Work on elevated surfaces must be reviewed and authorized by a Health and Safety representative before continuing. Employees should use extreme caution when traveling around the Site.

- Gale Wind Warning: Sustained (minimum 10 minutes) winds in excess of 45 mph but less than 55 mph, with wind gusts up to 75 mph. Employees should remain in vehicles if possible or use extreme caution in choosing to walk outdoors. Outdoor work activities are limited to those reviewed and approved by a Health and Safety representative and all outside construction activities are curtailed.
- Whole Gale Wind Warning: Sustained (minimum 10 minutes) winds in excess of 55 mph but less than 65 mph, with wind gusts up to 85 mph. All outdoor work is curtailed. Personnel located in temporary building (east shed) shall leave Site.
- Severe Force Wind Warning: Sustained (minimum 10 minutes) winds in excess of 65 mph, with wind gusts in excess of 85 mph. All outdoor work is curtailed.

**Heavy Rainfall or Hail**

In case of hail, move to a sheltered area or vehicle until the hail passes. Heavy rainfall may cause slippery conditions or flash floods. Use extra caution when walking during or after heavy rainfall. If working in an area with suspected radioactive contamination, work should be suspended during wet conditions because radiation and contamination monitoring may not be effective in wet conditions.

**Tornadoes**

Meteorological conditions will be closely watched, especially in the spring, when severe thunderstorms and tornadoes are most likely to occur. Tornadoes are usually preceded by severe thunderstorms with frequent lightning, heavy rains and strong winds. Tornadoes are very unlikely at the Rocky Flats Site because of the proximity to the mountains. A tornado is destructive when it descends to earth, where its path may vary from 50 yards to one mile in width. Wind speed inside a tornado can reach up to 300 mph. Its forward speed will average 25 to 40 miles per hour.

- **Stay Tuned for Storm Warnings**
  - Listen to commercial radio station emergency broadcasts for updated storm information
  - Know what a tornado WATCH and WARNING means
    - A tornado WATCH means a tornado is possible in your area
    - A tornado WARNING means a tornado has been sighted and may be headed for your area. Go to safety immediately.
  - Work may continue during severe thunderstorm watches or tornado watches unless wind exceeds standards or lightning has been identified in the area
  - Check cellular phone for weather emergency text messages
- **When a Tornado WATCH is issued…..**
  - Be alert to changing weather conditions. Blowing debris or the sound of an approaching tornado may alert you. Many people say it sounds like a freight train.

- **When a Tornado WARNING is issued….**
  - — If outside, lie flat in a ditch or low-lying area
  - — If in a car, get out immediately and head for safety (as above)
- **If you are in the open….**
  - — Move at right angles to the tornado
  - — Lie flat in a ditch or depression, avoiding areas subject to rapid water accumulation or flooding in heavy rains
  - — Do not try to outrun a tornado
- **After the tornado passes…..**
  - — Stay out of the damaged area
  - — Report to the assembly area (east shed parking lot)
  - — Do not use candles at any time. Do not use matches or lighters, in case of leaking natural gas pipes or fuel tanks nearby.

## Electrical Storms and Lightning

Electrical storms commonly occur in the Denver region during spring, summer, and fall. The resulting lightning poses a safety hazard to field personnel or to office personnel in some instances. During lightning warnings, H&S will require the curtailment of work on elevated surfaces, open fields or next to water.

The distance to an electrical storm can be estimated by observing the interval between the lightning flash and the sound of thunder. Because sound travels approximately 1.100 feet per second, the interval of five seconds corresponds to a storm distance of approximately 1 mile. By counting the seconds between the flash and the thunder and dividing by 5, you can estimate your distance from the strike (in miles). If an electrical storm is observed within 3 miles of the Site (15 seconds between lightning strike and thunder clap), all activities are to be ceased. Personnel working near water should suspend activities immediately and move away from the water at the first sight of lightning. If caught in the open by an electrical storm and vehicles are inaccessible, personnel shall move to a topographically low area away from tall objects and conductors (e.g., power lines, metal sheds) and wait for the storm to leave the area. Work shall be suspended a minimum of thirty minutes after the last lightning strike.

## Snow and Ice

Snow and ice are a leading cause of injuries and car accidents in winter months. Employees are strongly encouraged to stay informed of changing weather conditions and assess the weather outside before beginning outdoor work.

Boots or shoes with good tread are essential for walking on snow or ice. Be aware that warm shoes can melt the snow beneath them and cause a slick surface to form. When first exiting a vehicle or building, rub your shoes on the snow to acclimate them to the outside conditions. Take your time, take small steps, and walk slowly with a “closed gait”. By wearing gloves you will be able to keep your hands out of your pockets, which enables you to use your arms and hands to

maintain and adjust your balance when walking on slick surfaces. Do not carry bulky or heavy loads that do not allow you to maintain at least one free hand. Snow and ice increase the hazards from walking on uneven terrain or near ponds and streams. Personnel shall wear boots with good soles, move cautiously, and use the buddy system.

Driving on roads covered with snow and ice requires extra caution. Clear the snow and ice off all windows, the front hood of the vehicle, and mirrors before driving. Clear ice from windshield wiper blades. Check windshield cleaner fluid to ensure an adequate supply.

Give yourself extra distance behind vehicles in snow and ice conditions. Allow extra stopping time at intersections and traffic signals and watch for other vehicles that may not be able to stop at the intersection. Wear your seat belt. Know whether your vehicle has anti-lock brakes and the best technique for stopping your vehicle on a slippery surface.

## Cold Weather

Cold weather, especially when accompanied by wind or wet weather, can lead to frostbite or hypothermia. During cold weather, personnel are strongly encouraged to follow recommendations for personal protective equipment (PPE) and winter weather gear. The buddy system should always be used when working outdoors for prolonged periods in cold weather.

## Hot, Dry Weather

Heat stress and dehydration can result when working for prolonged periods outdoors in hot weather, especially when wearing certain PPE. Employees are strongly encouraged to drink plenty of fluids when working outdoors in hot weather. Avoid caffeinated drinks. Sunblock or sunscreen is recommended for preventing sunburn.

## Personal Protective Equipment

The following PPE will be used for the identified work activities. Other activities and PPE will be described in task-specific JSAs.

| Activity | Head/Face | Foot | Hands | Respiratory | Clothing |
|---|---|---|---|---|---|
| General Site activities, tours | None required | Closed toe sturdy shoes/boots | None required | None required | Long pants, weather appropriate gear |
| Sampling | Safety glasses as necessary | Closed toe sturdy boots | Work gloves as necessary | N 95 dust mask, if desired | Long pants, weather appropriate gear |
| Revegetation activities | Safety glasses as necessary, Helmet when on ATV | Closed toe sturdy boots, safety toe boots if mowing | Work gloves as necessary | N 95 dust mask, if desired | Long pants, weather appropriate gear |
| Mowing activities | Safety glasses as necessary, Helmet when on ATV | Safety toe boots | Work gloves as necessary | N 95 dust mask, if desired | Long pants, weather appropriate gear |
| Chainsaw activities | Safety glasses, chainsaw full face helmet | Safety toe boots | Leather work gloves | None required | Chainsaw chaps, long sleeved shirt |
| Cleaning of east shed | Safety glasses, as desired | Closed toe sturdy shoes | Work gloves as necessary | N 95 dust mask, if desired – when sweeping, cleaning off dusty shelves | Long pants, weather appropriate gear |

The following competent person certifies that a hazard assessment for the identified activities has been performed and the selection of personal protective equipment is based on best available information.

| *Printed name* | *Signature* | *Date* |
|---|---|---|
| Stephanie E. Harris | Stephanie E. Harris | 7/29/2008 |

## Training Requirements

The following minimum training is required for LMS personnel:

| | |
|---|---|
| **All LMS personnel:**<br>EC 100, Environmental Management System Awareness,<br><br>IT 100, Computer Security Awareness,<br><br>SC 100LM, Security Education & Awareness Briefing,<br><br>SC 101, UCNI Awareness,<br><br>HS 100, Integrated Safety Management System Awareness,<br><br>HS 101, Hazcom Awareness,<br><br>SC 102, Counterintelligence Awareness Briefing,<br><br>RM 100, Hummingbird Training for Contractor Employees,<br><br>HS 103, 10 CFR 851 training,<br><br>EP 100, Environmentally Preferable Purchasing,<br><br>EA 100, Enterprise Architecture training<br><br>Rocky Flats Office Access and Health and Safety Read and Sign Agreement<br><br>Other training as identified by the LMS Training Department, including position-specific training as identified on each employee's Individual Training Plan | **Additional Training for Field Personnel:**<br>Rocky Flats Site Access and Health and Safety Read and Sign Agreement<br><br>RF01, Rocky Flats Orientation<br><br>Defensive Driver Training<br><br>Snake Bite Training<br><br>First Aid/CPR (for required employees)<br><br>**Required Training for Field Subcontractors**<br><br>Rocky Flats Site Access and Health and Safety Read and Sign Agreement<br><br>RF01, Rocky Flats Orientation,<br><br>RF03, Hazcom Awareness,<br><br>RF05, Security Awareness Briefing,<br><br>RF07, Thermal Stress<br><br>**Required Training for Visitors:**<br>Office: Rocky Flats Office Access and Health and Safety Read and Sign Agreement<br><br>Site: Rocky Flats Site Access and Health and Safety Read and Sign Agreement |

# Appendix J

# Program Manager Directive PM-08-02

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Stoller
Morgantown Office

*established 1959*

**PM–08–02**

Issued: 03/11/08
Expires: 03/11/09

# Program Manager Directive

**Subject: LMS Contractor Workflow** **Distribution: LMS All**

**Approved:** 2008.03.11 17:53:54 -04'00' **Date:**

**Jeff Neff, Program Manager**

Effective upon receipt, all planned work shall follow the "LMS Contractor Workflow" diagram (attached) and forms referenced in this Program Manager Directive. To date, the actual workflow for either self-performed or subcontracted services has been difficult to identify or follow. The "LMS Contractor Workflow" diagram and referenced forms give each task manager/subtask manager or site manager/site lead the exact information required to make their project successful from **safety and work authorization perspectives**. Remember, the objective and result of our work shall be zero accidents!

This directive is not fundamentally different from the way we currently do business. However, it does identify that task mangers/subtask managers are required to use the "Project/Activity Evaluation" form (LMS 1005e) to plan work and that site managers/site leads are required for some work that we do (refer to attachment "Graded Approach to Implementing PM-08-02") to hold Plan of the Day (POD)/Plan of the Week (POW) meetings and authorize work on their site through this process. More definition on PODs/POWs is provided in subsequent paragraphs.

There are three sections outlined in the attached "LMS Contractor Workflow" diagram. Each section is identified as a core function of our Integrated Safety Management System and is outlined in the *Integrated Safety Management System with Embedded Worker Safety and Health Programs*, Manual STO 10.

The first section of the workflow diagram, "Define the Scope of Work," refers to form LMS 2129e, "Make-Buy Analysis Checklist" and Manual STO 5, Section 3.0, "Subcontracting." These are not new concepts and are included to show how integrated safety management is incorporated into our day-to-day operations.

The second section of the workflow diagram shows how to identify and eliminate/mitigate hazards. This section requires the task/subtask managers to complete the "Project/Activity Evaluation" form, which has been modified slightly to include information about the work schedule, personnel who will be performing the work, subcontractors required to perform the work, and equipment deliveries that are expected while performing work. The task/subtask manager will submit this form to the site manager/site lead for authorization to perform the work at the site. This is different from how we are currently doing business and it was added to ensure

The S.M. Stoller Corporation 3596 Collins Ferry Road Morgantown, WV 26505 (304) 225-8300 Fax: (304) 225-8345

that work is clearly defined, authorized, and that the site manager/site lead is informed about all project activities and is enabled to coordinate between multiple activities on a site.

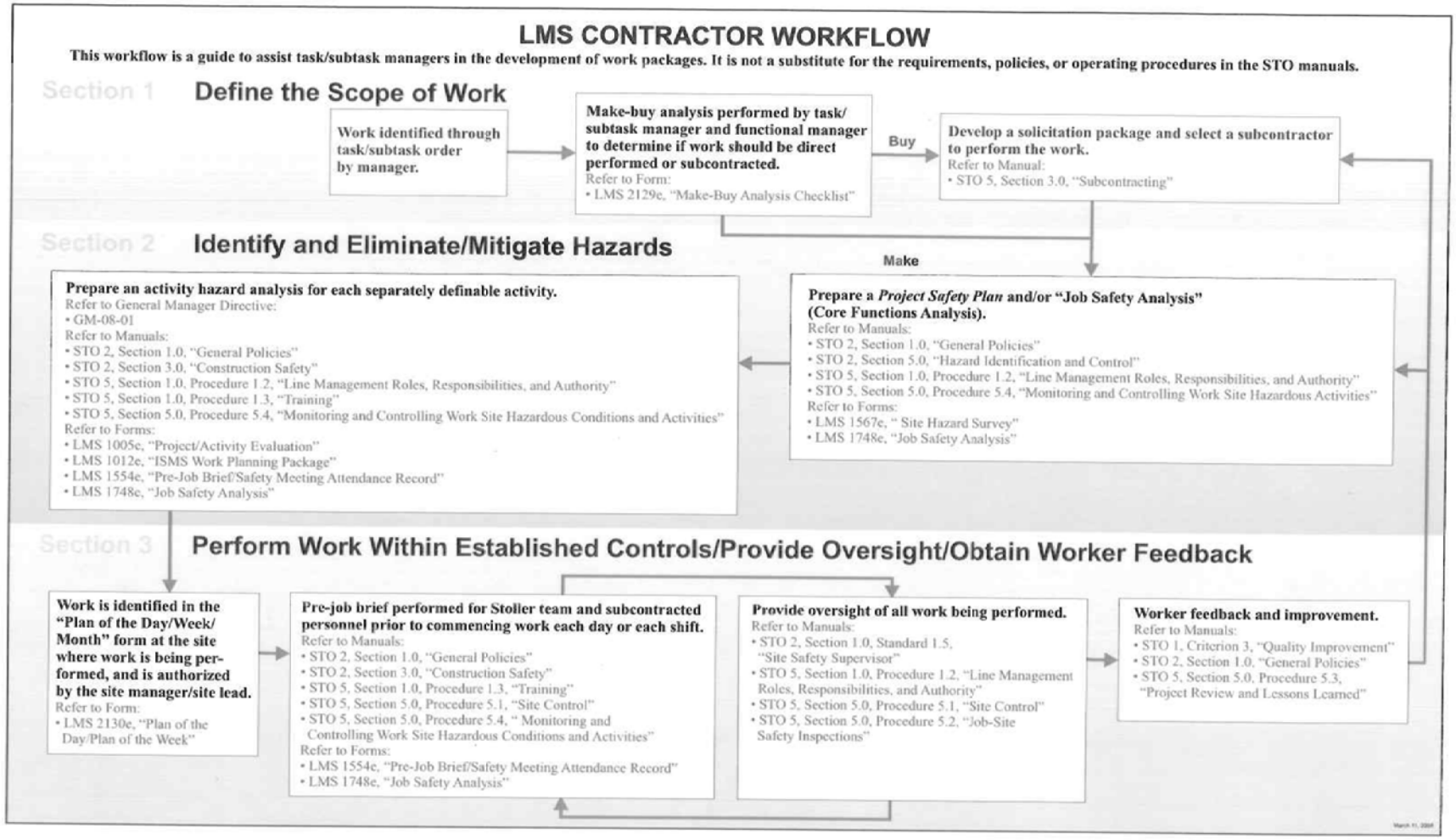
The third section of the workflow diagram shows the steps in performing the work. After reviewing the "Project/Activity Evaluation" form with the task/subtask manager, if applicable, the site manager/site lead is required to hold POD/POW meetings and complete the POD/POW form (LMS 2130e) that authorized the work. All applicable work activities must be on the POD/POW form.

The attachment "Graded Approach to Implementing PM-08-02," guides the task/subtask manager or site manager/site lead toward determining if a POD/POW is applicable to the specific work activity. After work is authorized through the POD/POW process, the projects then can hold their specific "Pre-Job Brief/Safety Meeting Attendance Record" (LMS 1554e). If during the course of business an activity that is not on the POD/POW becomes necessary, the task/subtask manager shall cease operations to allow the task/subtask manager, the site manager/site lead, and other applicable organizations to analyze the impacts of these emerging activities.

This directive has been rolled out to all LMS contractor employees, and training will be held for all employees at their regular staff meetings, or if necessary at a separate scheduled training session.

Review the requirements in Manual STO 2, STO 5, and STO 10 if this process does not closely match your current process. For additional information, questions, or comments, contact

- Doug Gail, technical services manager, at (970) 248-6536 or (208) 589-4779
- Joe Legare, programs and projects manager, at (970) 248-6502
- Jim Siler, safety and health manager, at (937) 847-8350 ext. 329


LMS CONTRACTOR WORKFLOW
This workflow is a guide to assist task/subtask managers in the development of work packages. It is not a substitute for the requirements, policies, or operating procedures in the STO manuals.
Section 1
Define the Scope of Work
Work identified through task/subtask order by manager.
Make-buy analysis performed by task/subtask manager and functional manager to determine if work should be direct performed or subcontracted.
Refer to Form:
• LMS 2129e, "Make-Buy Analysis Checklist"
Buy
Develop a solicitation package and select a subcontractor to perform the work.
Refer to Manual:
• STO 5, Section 3.0, "Subcontracting"
Make
Section 2
Identify and Eliminate/Mitigate Hazards
Prepare an activity hazard analysis for each separately definable activity.
Refer to General Manager Directive:
• GM-08-01
Refer to Manuals:
• STO 2, Section 1.0, "General Policies"
• STO 2, Section 3.0, "Construction Safety"
• STO 5, Section 1.0, Procedure 1.2, "Line Management Roles, Responsibilities, and Authority"
• STO 5, Section 1.0, Procedure 1.3, "Training"
• STO 5, Section 5.0, Procedure 5.4, "Monitoring and Controlling Work Site Hazardous Conditions and Activities"
Refer to Forms:
• LMS 1005e, "Project/Activity Evaluation"
• LMS 1012e, "ISMS Work Planning Package"
• LMS 1554e, "Pre-Job Brief/Safety Meeting Attendance Record"
• LMS 1748e, "Job Safety Analysis"
Prepare a Project Safety Plan and/or "Job Safety Analysis" (Core Functions Analysis).
Refer to Manuals:
• STO 2, Section 1.0, "General Policies"
• STO 2, Section 5.0, "Hazard Identification and Control"
• STO 5, Section 1.0, Procedure 1.2, "Line Management Roles, Responsibilities, and Authority"
• STO 5, Section 5.0, Procedure 5.4, "Monitoring and Controlling Work Site Hazardous Activities"
Refer to Forms:
• LMS 1567e, " Site Hazard Survey"
• LMS 1748e, "Job Safety Analysis"
Section 3
Perform Work Within Established Controls/Provide Oversight/Obtain Worker Feedback
Work is identified in the "Plan of the Day/Week/Month" form at the site where work is being performed, and is authorized by the site manager/site lead.
Refer to Form:
• LMS 2130e, "Plan of the Day/Plan of the Week"
Pre-job brief performed for Stoller team and subcontracted personnel prior to commencing work each day or each shift.
Refer to Manuals:
• STO 2, Section 1.0, "General Policies"
• STO 2, Section 3.0, "Construction Safety"
• STO 5, Section 1.0, Procedure 1.3, "Training"
• STO 5, Section 5.0, Procedure 5.1, "Site Control"
• STO 5, Section 5.0, Procedure 5.4, " Monitoring and Controlling Work Site Hazardous Conditions and Activities"
Refer to Forms:
• LMS 1554e, "Pre-Job Brief/Safety Meeting Attendance Record"
• LMS 1748e, "Job Safety Analysis"
Provide oversight of all work being performed.
Refer to Manuals:
• STO 2, Section 1.0, Standard 1.5, "Site Safety Supervisor"
• STO 5, Section 1.0, Procedure 1.2, "Line Management Roles, Responsibilities, and Authority"
• STO 5, Section 5.0, Procedure 5.1, "Site Control"
• STO 5, Section 5.0, Procedure 5.2, "Job-Site Safety Inspections"
Worker feedback and improvement.
Refer to Manuals:
• STO 1, Criterion 3, "Quality Improvement"
• STO 2, Section 1.0, "General Policies"
• STO 5, Section 5.0, Procedure 5.3, "Project Review and Lessons Learned"

## GRADED APPROACH TO IMPLEMENTING PROGRAM MANAGER DIRECTIVE (PM–08–02)

| FACTORS FOR DETERMINING IMPLEMENTATION OF PM–08–02 | | |
|---|---|---|
| **LOW HAZARD/ LOW ACTIVITY** | **MEDIUM HAZARD/ MEDIUM ACTIVITY** | **HIGH HAZARD/ HIGH ACTIVITY** |
| • Office work<br>• Landscaping<br>• No powered tools<br>• Single activity<br>• Minor fence replacement<br>• Sign replacement<br>• Step ladders–working height less than 8 feet<br>• Crew size: 1–2 members<br><br>**NO POD OR POW REQUIRED** | • Lifting<br>• Maintenance<br>• Revegetation<br>• Office move/office build-out<br>• Powered hand tools<br>• Performed at an in-service facility<br>• Ladders–working height over 8 feet<br>• Subcontracted activity<br>• Multiple concurrent activities<br>• Crew size: 3–7 members<br><br>**POD OR POW REQUIRED** | • Operating heavy equipment<br>• Excavating/drilling/trenching<br>• Energized electrical maintenance<br>• Pump repair/replacement<br>• System/facility initial start-up or restart<br>• Working with chemicals or other hazardous substances<br>• Hoisting and rigging<br>• Working with pressurized systems<br>• Performed in a radiological or nuclear facility<br>• Working in confined spaces<br>• Subcontracted activity<br>• Multiple concurrent activities<br>• Crew size: more than 7 members<br><br>**POD REQUIRED** |

# Appendix K

# Rocky Flats, Colorado, Site
# Erosion Control Monitoring and Maintenance
# Inspection Procedure

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LMS/RFS/S04532

# Rocky Flats, Colorado, Site Erosion Control Monitoring and Maintenance Inspection Procedure

**September 2008**

U.S. Department of Energy

**Office of Legacy Management**

*Work Performed Under DOE Contract No. DE–AM01–07LM00060*
*for the U.S. Department of Energy Office of Legacy Management.*
*Approved for public release; distribution is unlimited.*

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LMS/RFS/S04532

# Rocky Flats, Colorado, Site

# Erosion Control Monitoring and Maintenance Inspection Procedure

**September 2008**

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# 1.0 Introduction

The *Erosion Control Plan for Rocky Flats Property Central Operable Unit* (DOE 2007) addresses the best management practices (BMPs) to adequately control storm water runoff of soils that could ultimately discharge into surface water. Under the Erosion Control Plan, inspections of the implemented BMP erosion control measures must be conducted on a regular basis. The Erosion Control Monitoring and Maintenance Procedure outlines the procedures used for inspections, documentation, and maintenance of the current BMPs.

The BMPs typically used at the Rocky Flats Site include erosion bales, erosion logs, Georidge sediment control berms, erosion control blankets, turf reinforcement mats, tackifiers, and mulching. These BMPs are installed according to manufacturers' recommendations, and they require maintenance. Inspections are conducted regularly to keep the BMPs in effective operating conditions at all times.

# 2.0 Erosion Control Coordinator

The Rocky Flats site manager shall designate a staff member as the Rocky Flats erosion controls coordinator (ECC) responsible for carrying out the Erosion Control Plan. The site manager shall ensure that the ECC has an appropriate level of knowledge, skills, and abilities through work experience, formal or on-the-job training, and education to properly perform the ECC duties in relation to the Erosion Control Plan requirements. The site manager, in consultation with the ECC, shall identify additional training the ECC may need and the reasonable time for completion of the training. The ECC shall provide on-the-job training for field personnel as necessary to assist in implementing the Erosion Control Plan and the maintenance and inspection activities in this procedure.

The ECC is responsible for maintaining maps or having access to construction drawings for each active construction project that includes erosion control BMPs, for each location where current erosion control BMPs must be inspected. Final erosion control BMPs for any completed construction project will be added to the maps maintained by the ECC.

The maps are maintained in the site Geographical Information System (GIS), and the construction project lead maintains the construction drawings for active construction projects. The GIS will be updated to reflect new BMP installations and to reflect removals that result when success criteria have been met (according to the Erosion Control Plan).

# 3.0 Inspections

Currently two types of erosion control inspections are conducted at the Rocky Flats Site: the Preble's meadow jumping mouse (PMJM) erosion control survey and the erosion control survey for the Central Operable Unit. Erosion controls are inspected for placement, need for maintenance, potential need for additional measures, and effectiveness. The erosion control BMP maps or construction drawings will be used as a guide for the inspections.

Inspections are conducted by the ECC or a worker who has been trained in erosion and sediment controls and is designated by the ECC or the site manager to conduct inspections. A subcontractor worker involved in a construction project may be designated to conduct required inspections for the construction project. The inspector is responsible for visiting each location identified in the inspection forms and on the maps. The visits are documented on the Weekly Erosion Control Survey forms, Erosion Control Survey forms, in the Site Observation Log, and on the maps. Documentation includes the location, date, inspector's name, and any comments about the erosion controls in that location.

The PMJM erosion control surveys are required by the Programmatic Biological Assessment for the site. The PMJM inspections are conducted weekly at various mitigation locations around the site. This inspection is a spot inspection that evaluates BMPs in sensitive PMJM habitat to ensure that no sedimentation or erosion problems are damaging the habitat. Surveys are documented on the Weekly Erosion Control Survey forms.

The erosion control survey for the Central Operable Unit is conducted monthly at locations throughout the Central Operable Unit; the survey locations are identified on the maps maintained by the ECC. This inspection is performed monthly, or after a significant weather event that could damage the controls, or daily for controls related to active construction work.

Each area with erosion controls to be inspected will be traversed to visually inspect the conditions of the erosion controls that are implemented. In particular, the inspector should focus on locations with steep slopes, poor drainage, or bare soils and on locations near the roads. The evaluation looks at:

- Placement of BMPs—are they appropriately located?
- Installation of BMPs—were they installed correctly?
- Effectiveness of BMPs—are they providing effective control?
- Corrective action—does anything need repair, maintenance, or replacement?
- Documentation—record evaluation results on the survey forms and maps.

# 4.0 Maintenance

Maintenance should be performed as soon as site conditions allow. Maintenance needs that are not corrected within 24 hours should be recorded in the Site Observation Log to ensure proper follow-up and closeout. Maintenance will vary for specific site locations and conditions. The maintenance for each erosion control implemented will follow the manufacturers' recommendations (as feasible). The Colorado Department of Transportation *Erosion Control and Stormwater Quality Guide* (CDOT 2002) is a useful guide to installation and maintenance tips.

# 5.0 References

DOE (U.S. Department of Energy), 2007. *Erosion Control Plan for Rocky Flats Property Central Operable Unit,* DOE-LM/1497-2007, Office of Legacy Management, Rocky Flats Environmental Technology Site, July.

CDOT (Colorado Department of Transportation), 2002. *Erosion Control and Stormwater Quality Field Guide*, Denver, Colorado.

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# Appendix L

# Migratory Bird Treaty Act Issues, Natural Resource Management Activities, and Maintenance and Project Activities at the Rocky Flats Site

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LMS/RFS/S04511

# Migratory Bird Treaty Act Issues, Natural Resource Management Activities, and Maintenance and Project Activities at the Rocky Flats Site

September 2008

U.S. Department of Energy

Office of Legacy Management

*Work Performed Under DOE Contract No. DE–AM01–07LM00060*
*for the U.S. Department of Energy Office of Legacy Management.*
*Approved for public release; distribution is unlimited.*

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LMS/RFS/S04511

# Migratory Bird Treaty Act Issues, Natural Resource Management Activities, and Maintenance and Project Activities at the Rocky Flats Site

**Predecisional Draft**

**September 2008**

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# Contents


1.0 Background ..... 1
2.0 Migratory Birds and Raptors ..... 2
  2.1 Rocky Flats Activities That Have the Potential to Impact Migratory Birds ..... 2
3.0 Recommended Avoidance and Minimization Procedures for Different Types of Activities ..... 3
  3.1 Construction Projects ..... 3
  3.2 Vegetation Management Activities ..... 3
  3.3 Building and Equipment Maintenance Activities ..... 4
  3.4 Off-Road Monitoring Activities ..... 5
4.0 Training ..... 5
5.0 Reporting and Record Keeping ..... 5
6.0 Who to Contact Regarding MBTA Issues at RFS ..... 6
7.0 References ..... 6

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# 1.0 Background

The Rocky Flats Site (Rocky Flats) is under the jurisdiction of the U.S. Department of Energy (DOE) Office of Legacy Management (LM). S.M. Stoller Corporation conducts long-term surveillance and maintenance activities at Rocky Flats under the Legacy Management Support contract. Natural resource management activities and maintenance/project activities at Rocky Flats have the potential to impact migratory birds. These activities are conducted as part of the Rocky Flats surveillance and maintenance activities, which include activities conducted pursuant to the Rocky Flats Legacy Management Agreement (RFLMA). RFLMA established the regulatory framework to implement the final response action selected and approved in the Rocky Flats Corrective Action Decision/Record of Decision (CAD/ROD) under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), the Resource Conservation and recovery Act, and the Colorado Hazardous Waste Act to ensure that the response action remains protective of human health and the environment.

Migratory birds, as well as their eggs and nests, are protected under the Migratory Bird Treaty Act (MBTA). DOE signed a Memorandum of Understanding with the U.S. Fish and Wildlife Service (USFWS) on August 6, 2006, to strengthen migratory bird conservation through enhanced collaboration between the two agencies. The Memorandum of Understanding meets the requirements under Section 3 of Executive Order 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds*.

Unpermitted "take" of migratory birds or their eggs, which also may result from nest destruction, is prohibited under the MBTA (Migratory Bird Permit Memorandum, USFWS, April 15, 2003, Appendix A). The regulatory definition of "take" is to pursue, hunt, shoot, wound, kill, trap, capture, or collect; or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect. Under the regulations of the MBTA, depredation permits are required for the destruction of any active migratory bird nests. "Active" nests are defined as those with eggs or birds in them. Nests that are in the process of being constructed or nests that have been abandoned after a breeding season are not active nests (they are inactive). The MBTA does not prohibit the destruction of a bird nest alone (an inactive nest), provided that no possession occurs during the destruction. No permit is needed for this activity. Preventing the birds from nesting by knocking down unfinished nests is acceptable to the USFWS, which considers this to be nonlethal harassment. Continuing to knock down nests that are in the process of being built (prior to occupancy) will eventually persuade the birds to nest elsewhere. No permits are required for this activity (MNDOT 2008).

The MBTA is an applicable or relevant and appropriate requirement (ARAR) identified in the CAD/ROD in accordance with CERCLA requirements. For CERCLA response actions conducted on site, the substantive requirements of ARARs must be met, but administrative requirements, including any administrative requirement to obtain permits, are not required to be met. Thus, while activities to implement the CERCLA response action at Rocky Flats do not require specific permits, the following procedure will facilitate consultation with the USFWS and the RFLMA parties to determine appropriate actions if destruction of active nests is required to properly implement the remedy.

Under the MBTA, the USFWS may issue nest depredation permits, which allow a permittee to remove an active nest. The USFWS, however, issues few permits and only under specific

circumstances, usually related to human health and safety. Obtaining a nest depredation permit is unlikely and can be a time-consuming process that may take days to weeks. The best way to implement the MBTA is to remove vegetation outside of the active breeding season, which typically falls between April and August, depending on the species. Public awareness of the MBTA has grown in recent years, and most MBTA enforcement actions are the result of a concerned member of the community reporting a violation.

# 2.0 Migratory Birds and Raptors

The active breeding season for most migratory bird species in Colorado is between April 1 and August 15, which coincides with the peak construction season. It is recommended that vegetation removal for projects be conducted during the non-breeding season (August 16–March 31) to avoid the loss of any potentially active nests. If nests are active, activities that would directly impact the nest, or that would encroach close enough to cause adult birds to abandon the nest during the breeding season, is restricted in accordance with this procedure. A nest survey will be conducted to determine the activity status and what species use the nests if an activity is conducted during the breeding season.

If an active raptor nest is identified within the project area, buffer zones and seasonal restrictions surrounding raptor nests (Appendix B) developed by the Colorado Division of Wildlife (Craig 2002) will be followed. The Colorado Division of Wildlife has not established recommended buffer zones for great horned owls, a species that readily adapts to urban activities. Buffers and seasonal restrictions have been established for red-tailed and Swainson's hawks and many other species of raptors. If followed, the buffer zones and seasonal restrictions should curtail disturbance to nesting raptors and preclude nest abandonment by the raptors. Although the buffers are not required, project activities within the buffers could cause the abandonment of a nest, which may be considered a take. Thus, buffers should be planned and used to avoid nest abandonment. Depending on the species and the amount of existing human activity around the nest, the Colorado Division of Wildlife may reduce the buffer width on a case-by-case basis. As a precaution, vegetation should be removed outside of the breeding season to ensure that raptors, their eggs, or young would not be harmed.

## 2.1 Rocky Flats Activities That Have the Potential to Impact Migratory Birds

- Herbicide applications,
- Mowing and weed-whacking operations,
- Construction activities such as road regrading and excavations,
- Activities that involve driving vehicles or equipment off-road in grassy or forested areas,
- Tree cutting, trimming, and thinning; underbrush clearing operations, willow stake cutting,
- Maintenance activities on structures and buildings, monitoring equipment,
- General ongoing operations around garages, storage sheds, and other buildings where doors are kept open for lengths of time and birds are able to enter and exit freely.

# 3.0 Recommended Avoidance and Minimization Procedures for Different Types of Activities

The active nesting season for most migratory bird species in Colorado is between April 1 and August 15, which coincides with the peak season for natural resource management actions and construction projects. Several state and federal agencies have adopted avoidance strategies to preclude a violation of the MBTA. The following strategies shall be used at Rocky Flats for activities that have potential impact.

## 3.1 Construction Projects

Construction project activities would include excavation and earthmoving, off-road work (potentially something as simple as driving a vehicle off the roads during the breeding season), building projects, maintenance activities, or other similar activities.

The following step-down approach is recommended and is consistent with state and federal recommendations to avoid disturbing active bird nests during construction projects:

1. Conduct habitat-disturbing activities (tree removal, grading, scraping, grubbing, etc.) in the non-breeding season (August 16 to March 31) to the extent practicable.
2. If work activities are planned to occur between April 1 and August 15, remove or alter vegetation within construction footprints prior to April 1 to discourage nesting within areas scheduled for summer construction. Removal or alteration of vegetation will also discourage nesting in areas adjacent to the construction footprints and encourage birds to nest in more suitable habitat. Vegetation-altering activities can include mowing or and trimming to a height of 6 inches or less, grazing vegetation to a height of 6 inches or less, disking, herbicide applications, or other similar activities.
3. Once vegetation has been removed or trimmed, appropriate measures, such as repeated mowing and trimming, should be implemented to ensure that vegetation does not grow more than 6 inches in height.
4. If activities 1–3 cannot be completed, preconstruction clearance surveys must be conducted during the nesting season to identify any active nests and implement avoidance measures for those nests. **Note**: If active nests are found during these surveys, those nests cannot be removed without a DOE-LM decision regarding obtaining a depredation permit from the USFWS. Work could be delayed until a permit is obtained, a CERCLA permit waiver is determined to be appropriate, or the fledglings leave the nest.

## 3.2 Vegetation Management Activities

The types of activities in this category include mowing, herbicide applications, brush clearing, grubbing of vegetation, tree trimming, forest thinning, and similar types of vegetation management activities. The following recommendations will help avoid disturbing active bird nests during vegetation management activities:

1. Conduct habitat-disturbing activities (mowing, herbicide applications, noxious weed control, brush clearing, tree trimming and thinning, etc.) in the non-breeding season (August 16 to March 31) to the extent practicable.
2. Because some of these vegetation management activities (mowing, herbicide applications, noxious weed control) are not effective unless conducted during the active growing season for some plants or projects, the following alternative is proposed:
   - If these activities cannot be completed during the non-breeding season, conduct pre-job briefings to educate personnel on the MBTA issues.
   - If ATVs or other vehicles are being used off-road in potential ground-nesting areas, inform the vehicle drivers of the potential for nesting birds in the area.
   - If birds flush in front of the vehicle as the work is being conducted, instruct workers to stop and investigate the location from which the bird flushed to determine if an active nest is present. If an active nest is present, workers will go around the nest and avoid disturbing it. If the nest is not active, they can proceed as normal.

   Because these activities generally access an area only once annually, there is minimal potential for take using this precautionary approach. Given the size of the areas where this type of work is being conducted (greater than 100 acres in some cases), it is impractical to do a pre-job walk-down survey of the areas. **Note**: An employee of the USFWS Rocky Mountain Arsenal National Wildlife Refuge has stated that they do not conduct pre-job walk-down surveys of their mowing or herbicide application areas (Nelson 2008).
3. For tree trimming and thinning or brush removal activities that must be conducted during the active breeding season, pre-job clearance surveys must be conducted to identify any active nests and implement avoidance measures for those particular nests. **Note**: If active nests are found during these surveys, those nests cannot be removed without a DOE-LM decision regarding obtaining a depredation permit from the USFWS. Work could be delayed until a permit is obtained, a CERCLA permit waiver is determined to be appropriate, or the fledglings leave the nest.

## 3.3 Building and Equipment Maintenance Activities

Many maintenance activities on buildings and equipment are conducted during the breeding season. Several species of protected birds may be found nesting on buildings, equipment, and other structures. No active nests are allowed to be disturbed or removed without a DOE-LM decision regarding obtaining a depredation permit from the USFWS. Work could be delayed until a permit is obtained, a CERCLA permit waiver is determined to be appropriate, or the fledglings leave the nest. The following recommendations will help to avoid disturbing active bird nests during building and equipment maintenance activities:

1. Try to conduct these activities during the non-breeding season.
2. Remove inactive nests from structures and equipment during the non-breeding season so that no nests are present for birds to move into.
3. If projects are going to be conducted during the breeding season, and nesting birds have previously been found in the work area and will likely be problematic, one option is to prevent the birds from nesting in those locations through various means. Contact the Stoller Rocky Flats ecologist for potential options.

## 3.4 Off-Road Monitoring Activities

Many of the well and surface water monitoring locations are in grassland areas and are accessed using ATVs. Because these "two tracks" are driven so infrequently, the vegetation often grows tall and could provide good nesting habitat for ground-nesting birds. If these activities cannot be completed during the non-breeding season (due to monitoring schedules and regulatory requirements), the following approach is recommended:

- Conduct pre-job briefings and annual training to educate personnel on the MBTA issues.
- If ATVs or other vehicles are being used off-road in potential ground-nesting areas, inform the vehicle drivers of the potential for nesting birds in these areas.
- If birds flush in front of the vehicle as the work is being conducted, instruct workers to stop and investigate the location from which the bird flushed to determine if an active nest is present. If an active nest is present, workers will go around the nest and avoid disturbing it. If the nest is not active, they can proceed as normal.

Because these activities generally access an area infrequently during the breeding season, there is minimal potential for take using this precautionary approach.

**Note**: Implementing these activities demonstrates a good-faith effort to avoid incidental violation of the MBTA but does not guarantee that migratory birds will not still nest in some areas despite these efforts. Additionally, depending on the elevation, weather, and species, the active nesting season may be earlier for species such as owls and raptors.

# 4.0 Training

Training of personnel regarding MBTA issues and this guidance will be conducted in two ways for projects at Rocky Flats.

- For one-time and short-term projects that have potential MBTA issues, pre-job briefings will include information on migratory bird issues and information from this guidance specific to that project. The pre-job briefing will include the information in this guidance, what to look for, what to do, and who to contact if any questions or issues arise.
- Field personnel who work at Rocky Flats on an ongoing basis will be required to complete an annual training on MBTA issues at the site. The training will include the information in this guidance, what to look for, what to do, and who to contact if any questions or issues arise.

# 5.0 Reporting and Record Keeping

Record keeping will be conducted through the use of the Project/Activity Evaluation form and the DOE-LM Rocky Flats Site Non-Routine Activity Evaluation form. Additionally, project-specific MBTA nesting bird surveys (clearance surveys) will be documented in writing and as applicable on maps. Results of nesting surveys and any requirements resulting from those

surveys will be provided in writing to project management prior to initiation of the project. According to the RFLMA, if any evidence of adverse biological conditions is observed, notification to RFLMA parties will be made in accordance with the RFLMA.

# 6.0 Who to Contact Regarding MBTA Issues at RFS

Jody Nelson
Senior Ecologist
(720) 377-9677 or (303) 994-2464

# 7.0 References

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MNDOT (Minnesota Department of Transportation), 2008. *HPDP* [Highway Project Development Process] *Handbook,* Part II, Section D, "Fish and Wildlife," Appendix 5, "Swallow Procedure, Including Depredation Permit Guidance," available online at http://www.dot.state.mn.us/tecsup/xyz/plu/hpdp/book2sg/fish/fisha5.html, accessed March 17, 2008.

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# Appendix A

# USFWS Migratory Bird Permit Memorandum

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
Washington, Washington, D.C. 20240

MBPM-2
Date: APR 15, 2003

MIGRATORY BIRD PERMIT MEMORANDUM

SUBJECT: Nest Destruction

PURPOSE: The purpose of the memorandum is to clarify the application of the Migratory Bird Treaty Act (MBTA) to migratory bird nest destruction, and to provide guidance for advising the public regarding this issue.

POLICY: The MBTA does not contain any prohibition that applies to the destruction of a migratory bird nest alone (without birds or eggs), provided that no possession occurs during the destruction. To minimize MBTA violations, Service employees should make every effort to inform the public of how to minimize the risk of taking migratory bird species whose nesting behaviors make it difficult to determine occupancy status or continuing nest dependency.

The MBTA specifically protects migratory bird nests from *possession, sale, purchase, barter, transport, import,* and *export,* and *take.* The other prohibitions of the MBTA – *capture, pursue, hunt,* and *kill* – are inapplicable to nests. The regulatory definition of *take,* as defined by 50 CFR 10.12, *means to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue hunt, shoot, wound, kill, trap, capture, or collect.* Only *collect* applies to nests.

While it is illegal to collect, possess, and by any means transfer possession of any migratory bird nest, the MBTA does not contain any prohibition that applies to the destruction of a bird nest alone (without birds or eggs), provided that no possession occurs during the destruction. The MBTA does not authorize the Service to issue permits in situations in which the prohibitions of the Act do not apply, such as the destruction of unoccupied nests. (Some unoccupied nests are legally protected by statutes other than the MBTA, including nests of threatened and endangered migratory bird species and bald and golden eagles, within certain parameters.)

However, the public should be made aware that, while destruction of a nest by itself is not prohibited under the MBTA, nest destruction that results in the unpermitted take of migratory birds or their eggs, is illegal and fully prosecutable under the MBTA.

Due to the biological and behavioral characteristics of some migratory bird species, destruction of their nests entails an elevated degree of risk of violating the MBTA. For example, colonial nesting birds are highly vulnerable to disturbance; the destruction of unoccupied nests during or near the nesting season could result in a significant level of take. Another example involves

ground nesting species such as burrowing owls and bank swallows, which nest in cavities in the ground, making it difficult to detect whether or not their nests are occupied by eggs or nestlings or are otherwise still essential to the survival of the juvenile birds. The Service should make every effort to raise public awareness regarding the possible presence of birds and the risk of violating the MBTA, the Endangered Species Act (ESA), and the Bald and Golden Eagle Protection Act (BGEPA), and should inform the public of factors that will help minimize the likelihood that take would occur should nests be destroyed (i.e., when active nesting season normally occurs).

The Service should also take care to discern that persons who request MBTA permits for nest destruction are not targeting nests of endangered or threatened species or bald or golden eagles, so that the public can be made aware of the prohibitions of the ESA and the BGEPA against nest destruction.

In situations where it is necessary (i.e., for public safety) to remove (destroy) a nest that is occupied by eggs or nestlings or is otherwise still essential to the survival of a juvenile bird, and a permit is available pursuant to 50 CFR parts 13 and 21, the Service may issue a permit to take individual birds.

Steve Williams

Director

# Appendix B

# Colorado Division of Wildlife Migratory Bird Permit Memorandum

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# APPENDIX B
# RECOMMENDED BUFFER ZONES AND SEASONAL RESTRICTIONS FOR COLORADO RAPTOR NESTS

*These zones and seasonal restrictions are recommended as guidance and may be subject to change. They do not represent official Division policy

Prepared By
Gerald R. Craig
Colorado Division of Wildlife
Updated 1/18/02

Tolerance limits to disturbance varies among as well as within raptor species. As a rule, ferruginous hawks and golden eagles respond at greater distances to human activities than do ospreys and kestrels. Some individuals within a species also habituate and tolerate human activity at a proximity that would cause the majority of the species to abandon their nests. Other individuals become sensitized to repeated encroachment and react at greater distances. The tolerance of a particular pair may change when a mate is replaced with a less tolerant individual and may cause the pair to react to activities that were previously ignored. Responses will also vary depending upon the reproductive stage. Although the level of stress is the same, the pair may be more sensitive during egg laying and incubation and more demonstrative when the chicks hatch.

The term "disturbance" is also ambiguous and experts disagree on what actually constitutes a disturbance. Reactions may be as subtle as elevated pulse rate and as extreme as vigorous defense or abandonment. Impacts of disturbance may not be immediately evident. A pair of raptors may respond to human intrusion by defending the nest, but well after the disturbance has passed, the male may remain in the vicinity for protection rather than forage to feed the nestlings. Golden Eagles rarely defend their nests, but merely fly a half mile or more away and perch and watch. Chilling and over heating of eggs or chicks and starvation of nestlings can result from human activities that appeared not to have caused an immediate response.

A 'holistic' approach is recommended when protecting raptor habitat. While it is important for land managers to focus on protecting nest sites, equal attention should focus on defining important foraging areas that support the pairs' nesting effort. Hunting habitat of many raptor species are extensive and may necessitate interagency cooperation to assure the continued nest occupancy. Unfortunately, basic knowledge of habitat use is lacking and may require documentation through telemetry investigations or intensive observation. Telemetry is expensive and may be disruptive so a more practical approach is to assume that current open space is important and should be protected.

Although there are exceptions, the buffer areas and seasonal restrictions suggested here reflect an informed opinion that if implemented, should assure that the majority of individuals within a species will continue to occupy the area. Measurements are somewhat imprecise (fractions of a mile) and reflect the need to maintain some flexibility to adjust buffer zones depending upon intervening terrain and vegetation screens that obscure the activity. This document is intended to be modified and refined as additional information becomes available, hence the need for a revision date.

ERO Project #4091

## BALD EAGLE

**Nest Site:**

Year-round closure to surface occupancy * (beyond that which historically occurred in the area) within 1/4-mile radius of nest. No human encroachment from November 15 through July 31 within 1/2-mile radius of the nest. This closure is more extensive than the Northern States Bald Eagle Recovery Plan due to the generally open habitat used by Colorado's nesting bald eagles. Aside from four Colorado sites in coniferous forests, all others are in cottonwood riparian zones that don't have the vegetational density, and therefore obscurity offered by the habitats in the lake states. Recent evidence suggests that pairs nesting at lower elevations frequent and maintain their nests throughout the year. If it is necessary to work within the 1/2-mile buffer, the intrusion should be restricted to August 15 through October 15.

**Winter Night Roost:**

Activity should be eliminated within 1/4-mile radius of winter roosts between November 15 and March 15. If periodic visits (such as oil well maintenance work) are required within the buffer zone after development, activity should be restricted to the period between 1000 and 1400 hours from November 15 to March 15. Limited restrictions may be necessary out to 1/2 mile if there is a direct line of sight from the roost to the activities.

**Hunting Perch:**

Diurnal Perches associated with important foraging areas should also be protected from human encroachment. Preferred perches may be at varying distances from human encroachment and buffer areas will vary. However, at least two management plans recommend zones that range from 1/8 mile (200 meters) to 1/4 mile (400 meters) depending upon topographic or vegetational screening.

## GOLDEN EAGLE

**Nest Site:**

No surface occupancy * (beyond that which historically occurred in the area) within 1/4-mile radius of the nest site and associated alternate nests. Seasonal restriction to human encroachment within 1/4 mile of the nest and any alternate nests from February 1 to July 15.

## OSPREY

**Nest Site:**

No surface occupancy * (beyond that which historically occurred in the area) within 1/4 mile of the nest site. Seasonal restriction to human encroachment within 1/4 mile of the nest from April 1 to August 31. Some osprey populations have habituated and are tolerant to human activity in the immediate vicinity of their nests.

## FERRUGINOUS HAWK

**Nest Site:**

No surface occupancy * (beyond that which historically occurred in the area) within 1/2-mile radius of the nest site, and associated alternate nests. Seasonal restriction to human encroachment within 1/4 mile of the nest and any alternate nests from February 1 to July 15. This species is especially prone to nest abandonment during incubation if disturbed.

ERO Project #4091

**RED-TAILED HAWK**

**Nest Site:**

No surface occupancy * (beyond that which historically occurred in the area) within 1/3-mile radius of the nest site, and associated alternate nests. Some members of this species have adapted to urbanization and may tolerate human habitation to within 200 yards of their nest. Development that encroaches on rural sites is likely to cause abandonment. Seasonal restriction to human encroachment should be in effect from March 1 to July 15.

**SWAINSON'S HAWK**

**Nest Site:**

No surface occupancy * (beyond that which historically occurred in the area) within 1/4-mile radius of the nest site, and associated alternate nests. Some members of this species have adapted to urbanization and may tolerate human habitation to within 100 yards of their nest. Seasonal restriction to human encroachment within 1/4 mile of the nest from April 1 to July 15.

**PEREGRINE FALCON**

**Nest Site:**

No surface occupancy * (beyond that which historically occurred in the area) within 1/2 mile of the nest site. Seasonal restriction to human encroachment within 1/2 mile of the nest cliff(s) from March 15 to July 31. A 1-mile buffer with a closure from February 1 to August 31 was originally stipulated in the approved Recovery Plan, but recent field evidence suggests that the zone can be reduced to 1/2 mile. Due to propensity to relocate nest sites, sometimes up to 1/2 mile along cliff faces, it is more appropriate to designate 'Nesting Areas' that encompass the cliff system and a 1/2-mile buffer around the cliff complex.

**PRAIRIE FALCON**

**Nest Site:**

No surface occupancy * (beyond that which historically occurred in the area) within 1/2-mile radius of the nest site.

**NORTHERN GOSHAWK**

Reynolds et al. (1993) proposed 30 acres for the nest, a post-fledging family area of 420 acres, and a foraging area of 5,400 acres in size that encompasses habitat for squirrels, rabbits, jays, woodpeckers, and grouse. For purposes here, it seems that a buffer of 1/2 mile around the nest should protect the integrity of the nesting and post-fledging area. Occupancy of the nesting and brood-rearing area takes place from early March through late September.

**BURROWING OWL**

**Nest Site:**

No human encroachment or disturbance within 75 yards of the nest site from April 1 through July 31. This period is necessary to avoid disturbing nesting owls. However, owls may be present at burrows up to a month before egg laying and several months after young have fledged. Therefore, it is recommended that efforts to eradicate prairie dogs or destroy abandoned towns not occur between March 1 and October 31 when owls may be present. Although owls may occur throughout a prairie dog colony, there is a propensity for them to frequent the colony margins, and buffer zones should be applied to

ERO Project #4091

the colony perimeter. Measures that protect and enhance prairie dog colonies will benefit this species.

*Buffers Documented in the Literature*

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*Perch Buffers*

The following buffers for perches were recommended by T. Holmes (1994) to prevent flushing of 90% of raptors wintering in rangeland and agricultural habitats.

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* Surface occupancy means non-human habitation, examples would be oil and gas wells, roads, tracks, trails, etc.

ERO Project #4091

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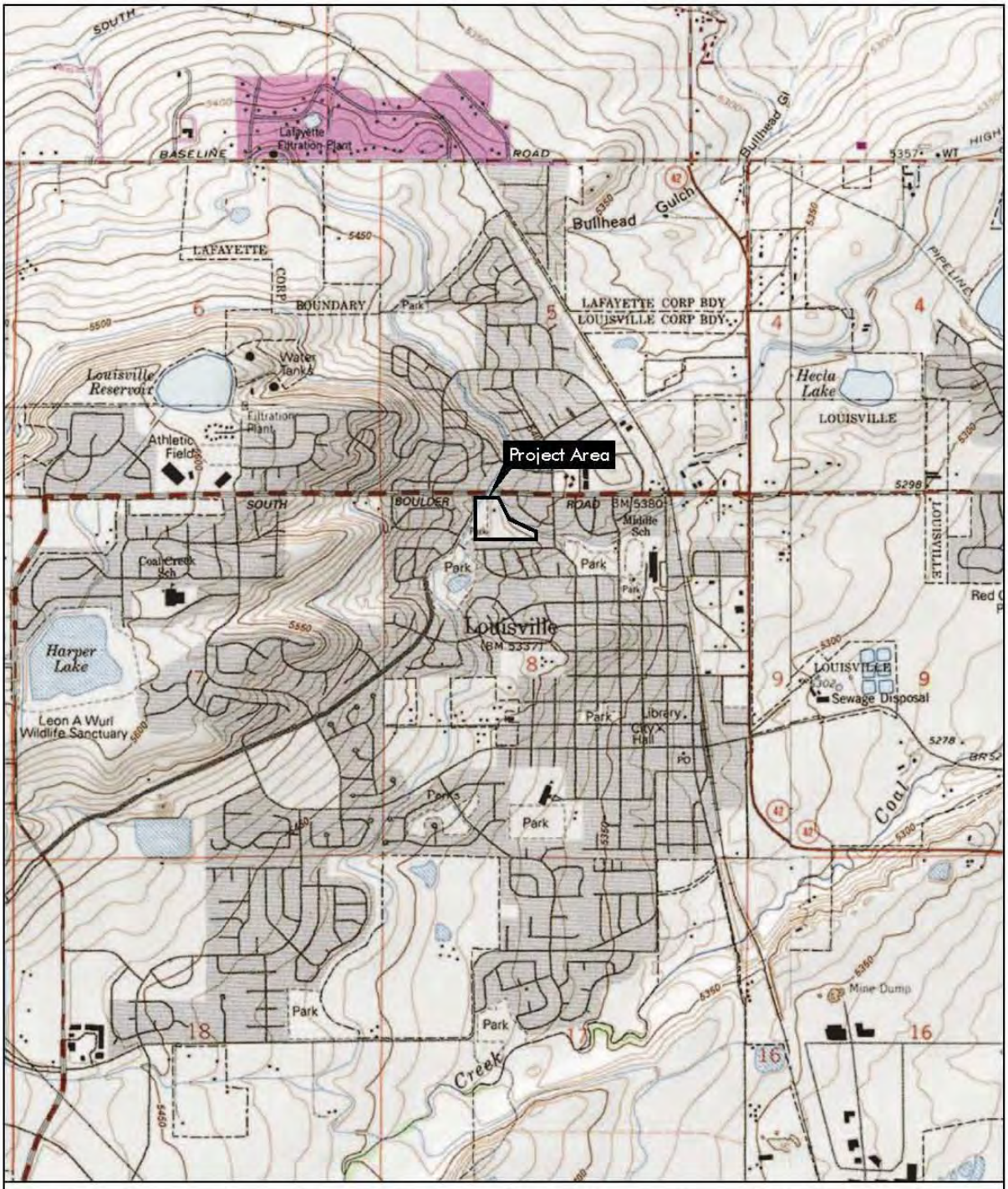
ERO Project #4091




ERO

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## Goodhue Ditch at 200 W. South Boulder Road

NW ¼ of Section 8, T1S, R69W
UTM Coordinates: Zone 13; 487995mE, 4426189mN
USGS Louisville, CO Quadrangle
Boulder County, Colorado

0 2000 4000 feet

1 Inch = 2,000 Feet

N

## Figure 1
## Site Location

Prepared for: RE Development
File: 4091 Figure 1.pdf
January 2008

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**Goodhue Ditch at 200 W. South Boulder Road**

Aerial Photograph: USGS 2005

0 300 600 feet

1 Inch = 300 Feet

N

**Figure 2**
**Site Plan**

Prepared for: RE Development
File: 4091 Figure 2.pdf
January 2008

**Goodhue Ditch at 200 W. South Boulder Road**
**Photo Log**
**January 2, 2008**

**Photo 1 -** View of the grassy field with the riparian habitat along the Goodhue Ditch in the background. View is to the west.

**Photo 2 -** View of the Goodhue Ditch, looking to the north.

**Goodhue Ditch at 200 W. South Boulder Road**
**Photo Log**
**January 2, 2008**

**Photo 3 -** View of the Goodhue Ditch, looking to the south.

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