2.0 Site Operations and Maintenance

2.1 Annual Site Inspection

Evidence of significant erosion and IC violations must be inspected for annually, in accordance with RFLMA Attachment 2, Sections 5.3.4 and 5.3.6. The 2012 inspection was conducted on March 12, 2012, and reported in the *Rocky Flats Site Quarterly Report of Site Surveillance and Maintenance Activities, First Quarter Calendar Year 2012* (DOE 2012b).

The following categories were monitored during the inspection:

- Evidence of significant erosion in the COU and evaluation of the proximity of significant erosion to subsurface features in RFLMA Attachment 2, Figures 3 and 4. This monitoring included visual observation for precursor evidence of significant erosion (e.g., cracks, rills, slumping, subsidence, sediment deposition);
- The effectiveness of ICs, as determined by any evidence of their being violated; and
- Evidence of adverse biological conditions, such as unexpected morbidity or mortality, observed during the inspection and monitoring activities.

As part of the IC inspection, the Environmental Covenant's presence in the Administrative Record and in Jefferson County records was verified. This verification is required annually. In addition, physical controls (signs placed along the COU fence) were also inspected.

Marker flags were placed where conditions showed evidence of the three condition categories listed above, to track their location for follow-up by Site subject matter experts. Several areas were noted as having evidence of erosion and possible depressions, which were minor and very limited in area. The inspection forms and maps are included in Appendix A of the *Rocky Flats Site Quarterly Report of Site Surveillance and Maintenance Activities First Quarter Calendar Year 2012* (DOE 2012b).

Most inspection observations were related to metal debris on the surface or trash that was either picked up or marked for subsequent removal and pickup. Rocky Flats field operations subject matter experts will subsequently visit the areas to determine if any observations appear to be significant or require repairs and to collect debris to close out all items in the Site Observation Log.

Note that the 2012 inspection also included the SW027 drainage area, to look for signs of significant erosion or precursors of significant erosion, such as cracks, rills, slumping, subsidence, and sediment deposition. This area was included pursuant to the revegetation seeding and erosion controls installed as follow-up actions for elevated levels of plutonium at SW027 (DOE 2010g). See Contact Record 2010-06 and the 2010 Annual Report (DOE 2011d) for a discussion of the SW027 monitoring data and mitigation actions. There were no signs of significant erosion or precursors to erosion. The compost/wood-chip-filled wattles that were placed on the hillside in 2010 are holding up well and working effectively.

No evidence of violations of ICs or physical controls was observed.

On March 13, 2012, a team member verified that the Environmental Covenant for the COU remains in the administrative record (AR #PD-A-000445) and on file with the Jefferson County land records, which are used by the Planning and Zoning Department.

No adverse biological conditions were noted during the inspection.

2.2 Pond Operations

Three constructed ponds collect and manage surface-water runoff at the Site.[1] The ponds are the A-4 in North Walnut Creek, B-5 in South Walnut Creek, and C-2 near and alongside of Woman Creek. Ponds A-4, B-5, and C-2 are referred to as "terminal ponds" because they are the farthest downstream ponds in their respective drainages. Discharges of water from the Walnut Creek terminal ponds were performed using a batch-release method through September 11, 2011. On September 12, 2011, outlets at both Ponds A-4 and B-5 were opened to initiate flow-through operations. Similarly, flow-through operations for Pond C-2 began on November 7, 2011.

Routine dam inspections, pond-level measurements, and piezometer measurements were performed as scheduled during the year. Annual dam mowing and vegetation removal was completed in September. Semiannual or quarterly (as applicable to specific dams) monument-movement surveys and inclinometer readings were also performed approximately as scheduled.

In compliance with the State of Colorado *Rules and Regulations for Dam Safety and Dam Construction,* a registered professional engineer conducted a formal dam safety inspection for Dams A-4, B-5, and C-2 in October 2012.[2] All inspected dams received a "satisfactory" condition rating and a recommended safe storage level of "full." Recommendations to enhance dam safety included the following:

- Monument and inclinometer data for Dam B-5 continue to suggest that apparent small movement and settling of the dam is occurring. Monument and inclinometer monitoring should continue.
- A shallow crack was observed in the crest of A-4 that is believed to be a shrinkage crack. All cracks should be monitored for any increase in size and vertical displacement.
- Visual inspection of the downstream slopes at A-4, B-5, and C-2 should be made regularly to look for slumping or bulging.

2.3 Landfills

The annual report of the results of inspections, monitoring data, and maintenance activities for the PLF and OLF is provided below.

2.3.1 Present Landfill

The PLF consists of an approximately 22-acre engineered RCRA Subtitle C–compliant cover over a former sanitary and construction debris landfill. A diversion channel surrounds the landfill

[1] The dams for Pond A-3 and the PLF were breached during 2012.
[2] The PLF and A-3 Dams were not inspected in 2011; both dams were breached in 2012. See Contact Record 2011-07, included in the 2011 Annual Report, for more detail regarding the breaching of these dams.

and diverts storm-water runoff away from the landfill to No Name Gulch. The landfill has a passive seep interception and treatment system (the Present Landfill Treatment System [PLFTS]) installed to treat landfill seep water and Groundwater Intercept System (GWIS) water that discharges into the Landfill Pond. A gas extraction system is also built into the landfill to let subsurface gas vent to the atmosphere.

Subsidence and consolidation at the PLF is monitored by visually inspecting the surface of the landfill cover for cracks, depressions, heaving, and sinkholes. The landfill final construction site conditions are used as a baseline for comparisons made during Site inspections. In addition to the visual inspection, settlement monuments are used to evaluate the actual settlement at these specific locations compared to the expected settlement calculated in the final design. Nine settlement monuments were installed across the top of the landfill cap, and an additional six monuments are located on the east face of the landfill. The monuments were monitored quarterly for the first year and annually thereafter.

Inspections and monitoring tasks follow the format and protocol established in the PLF M&M Plan and include groundwater and surface-water monitoring, as well as monitoring subsidence and consolidation, slope stability, soil cover, vegetation, storm-water management structures, and erosion in surrounding features. This monitoring is conducted so that corrective actions can be taken in a timely manner. Monthly inspections were initiated in October 2005. Quarterly inspections were initiated in the fourth quarter of CY 2007 as described in RFLMA Contact Record 2007-08.

2.3.1.1 Inspection Results

Four inspections were performed at the PLF in CY 2012. The inspection process followed the format and protocol established in the PLF M&M Plan. No significant problems were observed during these inspections. Appendix C contains the landfill inspection forms for the fourth quarter of CY 2012; earlier 2012 inspection forms are included in the applicable quarterly reports.

PLF area surface-water and groundwater monitoring, and operation of the PLFTS, is covered in those respective sections of this report.

2.3.1.2 Slumps

On February 13, 2007, a slump was discovered on the south-facing hillside just east of the PLF. The slump is not on the PLF, and engineering review determined that it does not impact the PLF cover. The slump was likely caused by heavy snow conditions and influenced by the post-closure lower water levels in the Landfill Pond. Therefore, regrading the slump is not necessary; however, deep-rooted plants were planted in the slump area to promote stabilization. There were no significant changes to the slumping area in CY 2012.

2.3.1.3 Settlement Monuments

The annual survey was completed in December 2012. Results of the settlement monument survey indicate that settling at each monument does not exceed expected settlement calculated in the final design and therefore does not trigger any maintenance activity under the PLF M&M Plan.

2.3.2 Original Landfill

The OLF consists of an approximately 20-acre soil cover over a former solid sanitary and construction debris landfill. The final cover consists of a 2-foot-thick Rocky Flats Alluvium soil cover that was constructed over both a regraded surface and a buttress fill and then revegetated. 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 carry storm-water runoff away from the cover to channels on the east and west perimeter of the cover.

The OLF is inspected monthly in accordance with the OLF M&M Plan (DOE 2009a).

2.3.2.1 Inspection Results

Twelve inspections were performed at the OLF in CY 2012. The inspection process followed the format and protocol established in the OLF M&M Plan. Appendix C contains the landfill inspection forms for the fourth quarter of CY 2012; earlier 2012 inspections forms are included in the applicable quarterly reports.

OLF area surface-water and groundwater monitoring is covered in those respective sections of this report.

2.3.2.2 Settlement Monuments

The settlement monuments were surveyed in March, June, September, and December 2012. Survey data indicate that settling at each monument does not exceed expected settling calculated in the final design and therefore does not trigger any maintenance activity under the OLF M&M Plan.

2.3.2.3 Geotechnical Investigation and Repairs

Conditions that warranted further repair and that triggered further investigation were found at the OLF beginning in 2007. This resulted in a geotechnical investigation of the conditions and repairs and maintenance actions to address conditions. This work is summarized in the RFLMA annual report for 2009 and quarterly reports for 2010 (DOE 2010d, 2010c, 2010e, 2011b). In 2010 additional maintenance was completed that addressed cracking in the vicinity of Berm 1 and recontoured the eastern end of Berm 7 where the berm was slumping into the eastern perimeter channel. This work is fully described in the quarterly reports for the second and third quarters of CY 2010 (DOE 2010e, 2011b). Locations are shown on Figure 1.

In 2012 no additional maintenance or repairs related to conditions addressed in the geotechnical investigation were needed.

2.3.2.4 Inclinometers

Seven inclinometers were installed in boreholes at the OLF in 2008 as part of the geotechnical investigation (Figure 1).

Figure 1. Original Landfill Previously Observed Surface Cracking Location and Inclinometer Locations

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Movement of the inclinometers has been monitored approximately monthly since installation. During the fourth quarter CY 2012, the inclinometers were monitored on October 24, November 27 (November 29 for inclinometer Tt-7), and December 31. No noticeable deflection was indicated during the quarter.

Inclinometers deflect based on lateral movement of the ground in which the inclinometer is located and can deflect enough to cause the inclinometer tube to break. Once an inclinometer tube breaks, it will no longer be monitored. Inclinometer monitoring data provide information on localized soil movement and serve to focus periodic inspections of the soil cover surface on signs of potential instability, such as cracking, vertical displacement, and slumping. A deflection of more than 1 inch is used as a trigger for evaluation of the data by a qualified geotechnical engineer. The engineer determines the significance of the deflection in relation to recommendations for maintenance or repairs to address potential instability in accordance with the OLF M&M Plan (DOE 2009a).

During 2012, deflection was minor. Although it did not trigger a formal geotechnical evaluation, a qualified geotechnical engineer has reviewed the inclinometer data. The *Technical Memorandum Regarding Instrumentation and Monitoring at the Rocky Flats OLF* that discusses the evaluation is included as Appendix E.

The conclusion of the data review is that recommendations made in the 2008 geotechnical investigation remain valid. The instrumentation indicates that instability is caused by one or more weak layers in the shallow subsurface, and movement is exacerbated by precipitation events and elevated water levels. Slope stability modeling indicates that, on a large scale, the overall slope is stable. Localized failures have occurred on the OLF under elevated water level conditions, but continued monitoring and maintenance provide an effective course of action.

2.4 Groundwater Plume Treatment Systems Maintenance

Rocky Flats utilizes four groundwater treatment systems to reduce contaminant load before the water is discharged. The four systems are the Mound Site Plume Treatment System (MSPTS), the East Trenches Plume Treatment System (ETPTS), the Solar Ponds Plume Treatment System (SPPTS), and the PLFTS. Each of these was designed and installed to passively collect and treat groundwater. Before the Site closed, only the SPPTS had been modified to include an active—i.e., powered—component. However, since Site closure, additional active components have been required in order to meet the more stringent post-closure system objectives. Active components were initially added to the SPPTS, were added to the MSPTS in 2011, and by early 2013 will be added to the ETPTS. Only the PLFTS remains fully passive.

This section focuses on the maintenance and operation of the MSPTS, the ETPTS, and the SPPTS during CY 2012. Refer also to previous quarterly reports from 2012 (DOE 2012d, 2012e, 2013a).

Details of the monitoring of the treatment systems, including the PLFTS, are presented in Section 3.1.2.9, and interpretations related to system operation and the corresponding contaminant plumes are provided in Section 3.1.5.

2.4.1 Mound Site Plume Treatment System

Routine maintenance activities continued at the MSPTS through CY 2012. The system operated throughout 2012 in parallel upflow configuration. A complete zero-valent iron (ZVI) media replacement for both treatment cells was completed in 2011 (DOE 2012c), and at the same time additional maintenance was performed at the subsurface effluent discharge gallery, and the prototype air stripper was installed. In addition to routine maintenance in 2012, the air stripper continued to be a focal point of operation and performance optimization efforts. The system operated smoothly throughout the year.

The pilot-scale air stripper drove several activities, some of which became routine and others not. A one-time activity was to install additional safety-related equipment; another one-time activity was to insulate the manhole lid to provide an element of freeze protection for the air stripper. (No signs of freezing in the air stripper manhole have been observed.) Other infrequent activities included removal and cleaning or maintenance/repair/manufacturer rebuild of the test pumps used to evaluate the air stripping option of polishing the MSPTS effluent. For a short time, two of these pumps were operating simultaneously, but for most of the year a single pump was operating. These pumps were selected because they are inexpensive and would perform adequately for testing purposes; in contrast, the full-scale air stripper scheduled to be completed in 2013 will incorporate a more powerful and sturdy pump designed for continuous operation over many years. This air stripper will be discussed in detail in the annual report for 2013.

Routine weekly activities included measuring water levels, inspecting the influent and effluent flow conditions, checking air stripper pump status and operating pressures, checking and cleaning air stripper spray nozzles, and checking the solar/battery power supply for the air stripper. Accumulations of biomass in the effluent manhole (which serves as the air stripper housing) required frequent attention and biomass removal, which ended up constituting the primary maintenance activity; according to the manufacturer, this biological material was also the cause of the pump failures. The bacteria comprising these accumulations appeared to be present as a result of the elevated iron concentrations in the water, which occurred because that water first passed through ZVI media in the treatment cells. The pump installed to support the full-time air stripper in 2013 should be able to accommodate this material without difficulty.

Refer to the annual report for 2011 (DOE 2012c) for additional detail and discussion of air stripper operation and maintenance.

2.4.2 East Trenches Plume Treatment System

Routine maintenance activities continued at the ETPTS through CY 2012. The flow configuration at this system is series, upflow through Cell 1 and then downflow through Cell 2, as discussed in the 2011 Annual Report (DOE 2012c).

Routine weekly maintenance activities included inspection of influent and effluent flow conditions. In addition, when necessary, any accumulations of biological growth were (1) skimmed from the surface of the standing water above the media in each cell, (2) brushed from the plumbing drain that routes the standing water out of each treatment cell, and (3) purged from the lines from the tops of each cell. A more intensive effort to remove these accumulations

was undertaken in September 2012; the influent valve was closed to allow this work to proceed and then reopened upon its completion.

In the fall of 2012, planning began to install a full-time air stripper at the ETPTS similar to the one planned for the MSPTS. In contrast to the unit to be installed at the MSPTS, the ETPTS air stripper would be installed on the influent manhole. Contact Record 2012-02 provides additional details about the planning for this ETPTS air stripper. (The ETPTS air stripper will treat raw influent water before it is routed to the ZVI-filled treatment cells, while the MSPTS air stripper will treat residual volatile organic compound (VOCs) in effluent from its ZVI-filled cells. There will be differences in treatment effectiveness as a result. Given that the water processed by the ETPTS air stripper will not be pre-treated with ZVI, there should be no issues related to accumulations of iron-loving bacteria.) The ETPTS air stripper will be discussed in detail in the annual report for 2013.

2.4.3 Solar Ponds Plume Treatment System

This section addresses the operation, maintenance, and optimization of the SPPTS. Routine inspections included monitoring water levels, line pressures, power consumption, and flow rates, and cleaning flow meters and lines. For a discussion of treatment system monitoring and performance, refer to Sections 3.1.2.9 and 3.1.5. A summary of the SPPTS upgrades is also included in the latter section.

During CY 2012, no maintenance issues arose within the original concrete structure (which contains the original treatment cells Cell 1 and Cell 2, as well as the overburden covering the media in these treatment cells). The puddle that had formed over the surface of the overburden within that structure was absent for most of the year. This is likely due to the reduced flow rates under which the system operated for most of the year, which were a result of the dry conditions prevailing in 2012.

The additional infrastructure installed as part of the Phase I upgrades continued to operate throughout CY 2011. (These components primarily include the additional groundwater collection sump referred to as the Intercept Trench System Sump [ITSS], a new effluent line and effluent monitoring location, a new vault housing at this effluent monitoring location, and additional plumbing and power equipment to serve these additions.) Routine inspections of these components include monitoring water levels, power usage, effluent flow totals, and details of pump operation. Electrical upgrades were installed at this component on May 1, 2012, including a separate battery box for the solar power component.

The influent collection well (location SPIN) was redeveloped in November 2012. There were no observed conditions that drove this activity; rather, it was performed as a prudent best-management practice, and will likely become a routine activity performed every few years. (Prior to closure, the well had to be redeveloped twice to address reduced flow conditions caused by fines clogging the screened interval.) Measurements were collected as a part of this work in order to generate drawings more clearly defining the design of this well. A downhole camera was also used to inspect the well casing, which was found to be in excellent condition.

Routine activities focusing on the Phase II and Phase III components included monitoring water levels, power usage, flow totals, and pumping operations. For most of 2012, Phase III Cell A was

in continuous operation, and it performed better following the media removal and cleaning efforts in 2011 (see the corresponding annual report, DOE 2012c). This cell was repeatedly visited to inspect the media and break up any accumulations of biomass. Conversely, because microcell testing utilized Cell B infrastructure, that cell remained offline. The microcell testing is focused on using a much smaller treatment cell (hence the term) to remove uranium. In contrast to the 2,000-gallon Phase II Cell, the microcells had a volume closer to 1 gallon. Throughout 2012, new microcells were assembled and put online to evaluate their effectiveness in removing uranium. Most used varying grain-size mixes of ZVI as a treatment media, but several incorporated different ion-exchange resins specifically designed to remove uranium. Refer to Section 3.1.5 for additional discussion and results of these efforts.

As confirmed in 2011, the effort required to keep Phase III Cell A or a full-scale version of this component operating smoothly over the long term was not sustainable. Therefore, the two Phase III pilot-scale nitrate treatment cells were emptied in September 2012 to prepare them for new tests. The inert plastic media was removed from Cell A, and the corn stover and gravel bedding were removed from Cell B. (These materials were packaged and will be dispositioned following an appropriate determination.) The cells were then cleaned out with a power washer and modified to support testing of lagoon-style nitrate treatment. Cell A retains its carbon dosing and recirculation pump, and Cell B gained carbon dosing for its influent stream. Both cells were slowly filled with carbon-dosed, high-nitrate influent beginning in late September 2012. This process allowed the denitrifying bacteria in the cells to multiply and develop healthy, robust colonies in each of the cells. On October 31, both cells were filled to effluent pipe levels and these pilot-scale lagoon tests began. Refer to Section 3.1.5 for additional discussion.

2.5 Sign Inspection

"U.S. Department of Energy - No Trespassing" signs are required to be posted at intervals around the perimeter of the COU to notify persons that they are at the boundary of the COU. Signs listing the use restrictions (ICs) and providing contact information are also required to be posted at access points to the COU. The signs are required as physical controls of the remedy, are inspected quarterly, and are maintained by repairing or replacing signs as needed. Physical controls protect the engineered components of the remedy, including landfill covers, groundwater treatment systems, and monitoring equipment, which are also inspected routinely during monitoring and maintenance activities.

The signs were inspected on March 20, June 5, September 5, and November 27, 2012, and they met the requirements.

2.6 Erosion Control and Revegetation

The existing erosion controls are maintained and repaired to protect the bare soil areas until the vegetation can stabilize the soil. Areas lacking sufficient vegetation cover are assessed and typically reseeded; however, in some cases, soil amendments are added to help establish the native vegetation. Additional information on the revegetation activities conducted at the Site during 2012 is provided in Section 3.2.2.3.

2.6.1 Erosion Control

Maintenance, repair, replacement, and monitoring of the Site erosion control features continued as needed through 2012. Assessing the erosion control is especially important following the high-wind events that are common at the Site and after significant precipitation events. Typical repairs included re-staking (or weighting with rocks) wattles or erosion blankets that had loosened. The *Erosion Control Plan for the Rocky Flats Property Central Operable Unit* (DOE 2007b) was followed for various projects conducted in 2012. The plan addresses the regulatory approach, monitoring inspections, and the applicability and scope of erosion control activities at the Site. It outlines the responsibilities, BMPs, and implementation aspects for erosion control activities before, during, and after projects.

2.7 General Site Maintenance and Operations

The Site is managed and maintained, and activities are conducted, pursuant to DOE's jurisdiction and control responsibilities. These activities help maintain the general condition of the Site through BMPs. Highlights of the routine and nonroutine maintenance and operations are described below.

2.7.1 Site Road Upgrades

2.7.1.1 Site Road Upgrades 2012

The Site Road Upgrades 2012 Project was completed in June 2012. Heavy equipment was used to regrade and compact sections of the existing road surfaces. Additional 3/4-inch rock was added to help strengthen the road surface. Contact Record 2012-01 provides additional details regarding this project.

2.7.2 Site Security

A USFWS officer was assigned to the Rocky Flats National Wildlife Refuge to perform nonroutine security evaluations as well as to respond to any security events on the refuge. LM can utilize the services of the USFWS enforcement officer, when available. In addition, LM has a Memorandum of Understanding with the Jefferson County Sheriff to pursue law enforcement on the COU.

No security infractions were noted on the COU during CY 2012.

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