FOURTH FIVE-YEAR REVIEW REPORT FOR BUNKER HILL SUPERFUND SITE SHOSHONE AND KOOTENAI COUNTIES, IDAHO

Prepared by

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Date

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Acronyms and Abbreviations

AMD	acid mine drainage
ARAR	applicable or relevant and appropriate requirement
ASARCO	American Smelting and Refining Company, LLC
AWQC	ambient water quality criteria
BAL	Borrow Area Landfill
Basin	Coeur d'Alene River Basin
BCR	Big Creek Repository
BCRA	Big Creek Repository Annex
BEIPC	Coeur d'Alene Basin Environmental Improvement Project Commission
BEMP	Basin Environmental Monitoring Plan
bgs	below ground surface
BLM	U.S. Bureau of Land Management
BMI	benthic macroinvertebrate
BMP	best management practice
BNSF	Burlington Northern Santa Fe
BPRP	Basin Property Remediation Program
Bunker Hill Box (the Box)	A 21-square mile area surrounding the historic smelter area that includes the cities of Kellogg, Wardner, Smelterville, and Pinehurst, Idaho
Bunker Hill Superfund Site	Bunker Hill Mining and Metallurgical Complex Superfund Facility
BURP	Beneficial Use Reconnaissance Program
$CaCO_3$	calcium carbonate
CCP	Comprehensive Cleanup Plan
CDC	Centers for Disease Control and Prevention
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CFP	Community Fill Policy
CFR	Code of Federal Regulations
cfs	cubic feet per second
CHDPE	corrugated high-density polyethylene
CIA	Central Impoundment Area
COC	chemical of concern
Coeur d'Alene	The drainage area of the Coeur d'Alene River in northern Idaho and River Basin northeastern Washington
CTP	Central Treatment Plant

CUA	common use area
CWA	Clean Water Act
cy	cubic yard
DDR	Design Definition Report
Ecology	Washington State Department of Ecology
ECSM	Enhanced Conceptual Site Model
EFNM	East Fork Ninemile
EMFR	East Mission Flats Repository
EMP	Environmental Monitoring Program
ESD	Explanation of Significant Difference
FFS	Focused Feasibility Study
FS	Feasibility Study
GIS	geographic information system
GWCS	groundwater collection system
H:V	horizontal to vertical
HDS	high-density sludge
HEPA	high-efficiency particulate air filter
HHRA	Human Health Risk Assessment
HHRE	Human Health Remedial Evaluation
HUC	Hydrological Unit Code
I-90	Interstate 90
IC	institutional control
ICA	Interagency Cooperative Agreement
ICP	Institutional Controls Program
IDAPA	Idaho Administrative Procedures Act
IDEQ	Idaho Department of Environmental Quality
IDFG	Idaho Department of Fish and Game
IDHW	Idaho Department of Health and Welfare
IDL	Idaho Department of Lands
IDPR	Idaho Department of Parks and Recreation
IDWR	Idaho Department of Water Resources
IEUBK	Integrated Exposure Uptake Biokinetic
IPS	interim performance standard
IVBA	*in vitro* lead bioavailability
JEG	Jacobs Engineering Group
LBCR	Lower Burke Canyon Repository
LDS	low-density sludge

LHIP	Lead Health Intervention Program
LMP	Lake Management Plan
Lower Basin	The area of the Coeur d'Alene River Basin in OU 3 west of Cataldo to the mouth of Coeur d'Alene Lake. Includes the lower Coeur d'Alene River and associated lateral lakes.
LUR	Limited Use Repository
µg/dL	microgram per deciliter
µg/L	microgram per liter
M&R	maintenance and repair
MAPS	Monitoring Avian Productivity and Survivorship
MCL	maximum contaminant level
MCLG	maximum contaminant level goal
MFA	Maul Foster & Alongi, Inc.
MFG	McCulley, Frick, and Gilman
mg/kg	milligram per kilogram
mg/L	milligram per liter
MOA	Mine Operations Area
NA	not applicable
NCP	National Oil and Hazardous Substances Contingency Plan
NFCDR	North Fork of the Coeur d'Alene River
North Wind Construction	North Wind Construction Services, LLC
North Wind	North Wind, Inc.
NPDES	National Pollutant Discharge Elimination System
NPL	National Priority List (list of Superfund sites)
O&M	operation and maintenance
ODBO	Operations/Design/Build/Operate
OU 1	Operable Unit 1, the populated areas within the Bunker Hill Box
OU 2	Operable Unit 2, the non-populated areas within the Bunker Hill Box
OU 3	Operable Unit 3, the mining-contaminated areas in the broader Coeur d'Alene River Basin outside of OU 1 and OU 2, from approximately Mullan, Idaho, west to Coeur d'Alene Lake and depositional areas of the Spokane River in Idaho and Washington State. For study purposes, OU 3 was divided into four areas: the Upper Basin (areas east of Cataldo, Idaho, outside the Box), the Lower Basin (west of Cataldo to the mouth of Coeur d'Alene Lake), Coeur d'Alene Lake, and depositional areas of the Spokane River.
OU	Operable Unit (used to define specific cleanup areas of Superfund sites)
PCS	petroleum-contaminated soil
PHD	Panhandle Health District

PPWTP	Page Pond Wastewater Treatment Plant
PRP	Potentially Responsible Party
PS	performance standard
PTM	Principal Threat Material
RAMP	Remedial Action Management Plan
RAO	remedial action objective
RD	remedial design
RDR	remedial design report
RfD	reference dose
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
ROW	right-of-way
RSA	reasonable segregable area
SACA	Support Agency Cooperative Agreement
SCA	Smelter Closure Area
SDR	Schematic Design Report
SDWA	Safe Drinking Water Act
SFCDR	South Fork of the Coeur d'Alene River
Site	Bunker Hill Mining and Metallurgical Complex Superfund Facility
SMC	Stauffer Management Company
SSC	State Superfund Contract
STI	Star Tailings Impoundment
Superfund	A common name for USEPA's CERCLA program
sy	square yard
TBC	to be considered
TerraGraphics	TerraGraphics Environmental Engineering
ton/yr	ton per year
TSS	total suspended solids
UMG	Upstream Mining Group
Upper Basin	The area of the Coeur d'Alene River Basin in OU 3 east of Cataldo, Idaho, and outside the Bunker Hill Box. Includes the South Fork of the Coeur d'Alene River and its tributaries outside of the Box.
UPRR	Union Pacific Railroad
USACE	U.S. Army Corps of Engineers
USBM	U.S. Bureau of Mines
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service

USGS	U.S. Geological Survey
WCA	Waste Consolidation Area
WENI	West End Natural Infiltration
WY	water year

Executive Summary

Introduction

The U.S. Environmental Protection Agency (USEPA) Region 10 has completed its fourth site-wide review of the Bunker Hill Mining and Metallurgical Complex Superfund Site (the "Bunker Hill Superfund Site" or "Site") located within northern Idaho, sections of the Coeur d'Alene Reservation, and northeastern Washington.

The Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Section 121(c) requires USEPA to perform a review of remedial actions that result in hazardous substances, pollutants, or contaminants remaining at the Site at least every 5 years. The purpose of the review is to determine whether the remedial actions are, or will be upon completion, protective of human health and the environment. Projects implemented with Clean Water Act (CWA) or other authorities are outside the scope of this review.

This Five-Year Review Report documents the methods, findings, and conclusions based on issues identified during the review and presents recommendations to address them. The text and summary tables in this Executive Summary provide an overview of this Five-Year Review Report.

Site Description

The Bunker Hill Superfund Site (the Site) was listed on the National Priorities List (NPL) in 1983. This NPL Site has been assigned Comprehensive Environmental Response, Compensation, and Liability Act Information System (CERCLIS) identification number IDD048340921. The Site includes mining-contaminated areas in the Coeur d'Alene River corridor, adjacent floodplains, downstream water bodies, tributaries, and fill areas, as well as the 21-square-mile Bunker Hill "Box" (referred to as the Box) located in the area surrounding the historic smelting operations. USEPA has the following designated three operable units (OUs) for the Site:

- The populated areas of the Bunker Hill Box (OU 1);
- The non-populated areas of the Box (OU 2); and
- Mining-related contamination in the broader Coeur d'Alene Basin (the "Basin" or OU 3).

Brief Site History

The Bunker Hill Superfund Site is within one of the largest historical mining districts in the world. Commercial mining for lead, zinc, silver, and other metals began in the Silver Valley in 1883. Heavy metals contamination in soil, sediment, surface water, and groundwater from over 100 years of commercial mining, milling, smelting, and associated modes of transportation has affected both human health and environmental resources in many areas throughout the Site.

The principal sources of metals contamination were tailings generated from the milling of ore discharged to the South Fork Coeur d'Alene River (SFCDR) and its tributaries or confined in large waste piles onsite, waste rock, and air emissions from smelter operations. Tailings were frequently used as fill for residential and commercial construction projects. Spillage from railroad operations also contributed to contamination across the Site.

Tailings were also transported downstream, particularly during high-flow events, and deposited as lenses of tailings or as tailings/sediment mixtures in the bed, banks, floodplains, and lateral lakes of the Coeur d'Alene River Basin and in Coeur d'Alene Lake. Some fine-grained material washed through the lake, which was deposited as sediment within the Spokane River flood channel. The estimated total mass and extent of impacted materials (primarily sediments) exceeds 100 million tons dispersed over thousands of acres (USEPA, 2001c). Over time, groundwater also became contaminated with metals.

Air emissions occurred from ore processing facilities in Kellogg and Smelterville. Although both the Lead Smelter and Zinc Plant had recycling processes designed to minimize airborne particulates, significant metals deposition still occurred together with deposition of sulfur dioxide emissions. In September 1973, a fire destroyed the baghouse and the primary emissions control for the Lead Smelter. The smelter continued production unabated and the emitted up to 160 tons per month of particulate emissions containing 50 to 70 percent lead compared to 10 to 20 tons per month prior to the fire (TerraGraphics, 1990). These emissions affected areas near the Smelter and Zinc Plant, poisoned local residents, and greatly contributed to the denuding of surrounding hillsides. Smelter operations ceased in 1981, but limited mining and milling operations continued onsite from 1988 to 1991, and small-scale mining operations continue today.

After site listing on the NPL in 1983, USEPA published the first Site Record of Decision (ROD) in August 1991 providing the Selected Remedy for OU 1 residential soils (USEPA, 1991). The second ROD for the Site was published by USEPA in September 1992 addressing contamination in the non-populated OU 2, as well those aspects of OU 1 that were not addressed in the 1991 OU 1 ROD (USEPA, 1992). Since publication of the 1992 OU 2 ROD, a number of remedy changes and clarifications have been documented in two OU 2 ROD Amendments (USEPA, 1996a, 2001b) and two Explanations of Significant Differences (ESDs; USEPA, 1996b, 1998a).

USEPA issued an interim ROD for OU 3 in 2002 (USEPA, 2002a) to clean up mining contamination consisting of an interim ecological remedy and a complete human health remedy in the communities and residential areas where actions were selected, including identified recreational areas.

In 2008, USEPA began a Focused Feasibility Study (FFS) to support additional remedy changes in the existing RODs for all three OUs (USEPA, 2010b). The FFS was completed in 2010 (2010 FFS). The focus of the 2010 Draft Final FFS was to identify additional remedial actions to protect the human health remedy throughout the Site and reduce metals contamination in surface water and groundwater in the Upper Basin portion of the Site, including the Bunker Hill Box.

The Upper Basin Proposed Plan (USEPA, 2010a) was published in summer 2010. After an extended public comment period in 2010, the Preferred Alternative identified in the Proposed Plan was revised. The revisions were documented in the final FFS Report, which was completed in late summer 2012 (the 2012 FFS; USEPA, 2012b). The 2012 Final FFS presents and evaluates alternatives for cleanup of the Upper Basin portion of the Site. Responses to all comments received during the extended public comment period were summarized in the Responsiveness Summary and published as part of the 2012 Upper Basin ROD Amendment (USEPA, 2012a).

The Selected Remedy in the 2012 Upper Basin ROD Amendment is an interim remedy. A final remedy will be selected in the future as additional knowledge is gained about conditions at specific locations within the Upper Basin and the effectiveness of remedial actions. The Selected Remedy for the Upper Basin builds upon the remedies identified in the previous RODs for OUs 1, 2, and 3 and incorporates additional information obtained since the ROD for OU 3 was issued in 2002.

In December 2009, as part of the American Smelting and Refining Company, LLC (ASARCO) bankruptcy settlement, funding was secured for Superfund response actions at the Site. However, due to a prior settlement with ASARCO for response actions in the Bunker Hill Box, most of the settlement monies, about $486 million, can only be used to perform USEPA-selected cleanup actions in mining-contaminated areas of OU 3, outside the Bunker Hill Box (OUs 1 and 2). These funds were placed in a trust, and a trustee was appointed to manage and invest the funds. The current balance of funds in the Trust is approximately $530 million. From the bankruptcy settlement, USEPA was reimbursed $8 million for human health protection actions that the agency had completed in the Bunker Hill Box from 2002 to 2005. The $8 million is available for additional cleanup work in the Box.

In June 2011, a settlement of $263.4 million plus interest was reached between Hecla Mining Company and the USEPA, the Coeur d'Alene Tribe, and the State of Idaho that resolved legal claims stemming from releases of wastes from Hecla's mining operations. Hecla settlement funds include funds for remediation and restoration of natural resources in the Coeur d'Alene Basin and can be spent anywhere within the Bunker Hill Superfund Site. Of the $263.4 million, approximately $180 million will fund response actions throughout the Site, $17 million was provided to the State of Idaho to fund the Institutional Controls Program (ICP) and the ICP soil repository (Page Repository) into perpetuity within OU 1, and $65.85 million was provided to the federal, Tribal, and state Natural Resource Trustees for use in restoration activities in coordination with cleanup actions.

Review of Selected Remedies

As stated above, this five-year review evaluates the protectiveness of the Selected Remedies that have been or will be implemented at the Site. This 2015 Site-wide Five-Year Review Report documents the results of the review, identifies issues found during the review, and presents recommendations to address them. USEPA will track the identified issues and recommendations to ensure that follow-up actions are completed.

The remainder of this section summarizes Site activities and remedial actions completed in the last five years by OU and identifies the issues and recommendations identified during this review.

Operable Unit 1

Introduction

Operable Unit 1 is located within the 21-square-mile area surrounding the former smelter complex commonly referred to as the Bunker Hill Box. The Box is located in a steep mountain valley in Shoshone County, Idaho, east of the city of Coeur d'Alene. Interstate 90 (I-90) bisects the Box and parallels the SFCDR.

OU 1 is often referred to as the populated areas of the Bunker Hill Box and is home to more than 7,000 people in the cities of Kellogg, Wardner, Smelterville, and Pinehurst, as well as the unincorporated communities of Page, Ross Ranch, Elizabeth Park, and Montgomery Gulch. Cleanup activities began first in OU 1 because this was the area of greatest concern for human health exposure from smelter emissions, fugitive dust, and mine waste.

OU 1 ROD Issuance

The OU 1 Selected Remedy and remedial action objectives (RAOs) are described in the 1991 OU 1 ROD (USEPA, 1991), the 1992 OU 2 ROD (USEPA, 1992), and the 2012 Upper Basin ROD Amendment (USEPA, 2012a). The primary goal of the OU 1 Selected Remedy is to reduce children's intake of lead from soil and dust sources to meet the following RAOs:

- Less than 5 percent of children with blood lead levels of 10 micrograms per deciliter (µg/dL) or greater; and
- Less than 1 percent of children with blood lead levels of 15 µg/dL or greater.

The 2012 Upper Basin ROD Amendment Selected Remedy supplements the existing Selected Remedy for OU 1 by including localized drainage improvement actions that will protect those portions of the existing remedy that are in areas at risk from localized tributary flooding and heavy precipitation.

Major Components of the Selected Remedy

To achieve RAO, the cleanup strategy includes the following:

- Implementing a lead health intervention program for local families
- Remediating all residential yards, commercial properties, and rights-of-way (ROWs) that have soil lead concentrations greater than 1,000 milligrams per kilogram (mg/kg)
- Achieving a geometric mean yard soil lead concentration of less than 350 mg/kg for each residential community in OU 1
- Controlling fugitive dust and stabilizing and capping contaminated soils throughout the Bunker Hill Box (OU 1/OU 2)
- Achieving a geometric mean of interior house dust lead levels of 500 mg/kg or less for each community, with no individual house dust level exceeding 1,000 mg/kg (1992 OU 2 ROD)
- Establishing an ICP to maintain protective barriers over time, and to ensure that future land use and development is compatible with the OU 1 Selected Remedy

- For all homes with house dust lead concentrations equal to or exceeding 1,000 mg/kg, implementing a one-time cleaning of residential interiors after completion of remedial actions that address fugitive dust. If subsequent interior house dust sampling indicates that house dust lead concentrations exceed a site-wide average of 500 mg/kg, the need for additional cleaning will be evaluated
- Implementing specific remedy protection actions, such as culvert replacements, channel improvements, small diversion structures, and asphalt ditches, identified in Pinehurst, Smelterville, Kellogg, and Wardner
- Identifying generalized remedy protection actions that are expected to be needed in Upper Basin side gulches

Operable Unit 2

Introduction

OU 2 consists of areas in the Bunker Hill Box that were non-populated, nonresidential areas at the time of the 1992 OU 2 ROD. OU 2 areas include the former industrial complex and Mine Operations Area (MOA) in Kellogg, Smelterville Flats (the floodplain of the SFCDR in the western half of OU 2), hillsides, various creeks and gulches, the Central Impoundment Area (CIA), and the Bunker Hill Mine and associated acid mine drainage (AMD). The SFCDR within OU 2 and the non-populated areas of the Pine Creek drainage area are both addressed as part of OU 3.

OU 2 ROD Issuance

A ROD for OU 2 was published by USEPA in 1992 (USEPA, 1992). Since then, three OU 2 ROD Amendments (USEPA, 1996a, 2001b, and 2012a) and two ESDs (USEPA, 1996b and 1998a) have been published. These ROD Amendments and ESDs changed the remedy in various ways.

Major Components of the Selected Remedy

The 1992 OU 2 ROD set forth priority cleanup actions to protect human health and the environment. Cleanup actions included a series of source removals, surface capping, reconstruction of surface water creeks, demolition of abandoned milling and processing facilities, engineered closures for waste consolidated onsite, revegetation efforts, and treatment of contaminated water collected from various site sources.

Phase I of remedy implementation includes extensive source removal and stabilization efforts, all demolition activities, all community development initiatives, development and initiation of an ICP, future land use development support, and public health response actions. Also included in Phase I are additional investigations to provide the necessary information to resolve long-term water quality issues, including technology assessments and pilot studies, evaluation of the success of source control efforts, development of Site-specific water quality and effluent-limiting performance standards, and development of a defined O&M plan and implementation schedule. Interim control and treatment of contaminated water and AMD is also included in Phase I of remedy implementation. Phase I remediation began in 1995, and source control and removal activities are nearly complete.

The 2012 Upper Basin ROD Amendment supplements the existing Selected Remedy for OU 2 by including localized drainage improvement actions that will protect those portions of the existing remedy that are in areas of risk from localized tributary flooding and heavy precipitation. The Selected Remedy defines Phase II cleanup actions to address ongoing water quality issues in OU 2. These actions include managing the contaminated discharge from the Reed and Russell Adits, reducing the flow of contaminated groundwater to the SFCDR, and collecting and treating contaminated groundwater.

The following are the major components of the Selected Remedy within the Bunker Hill Box (OU 1 and OU 2) identified in the 2012 ROD Amendment:

- Actions to reduce the flow of contaminated groundwater entering the SFCDR and Government Creek
- Conveyance of effluent from the CTP in Kellogg (i.e., clean, treated water) directly to the SFCDR in a pipeline to prevent recontamination through contact with contaminated subsurface Box soil
- Groundwater collection and treatment and water management actions to reduce the flow of contaminated discharges near the Reed and Russell Adits
- CTP expansion and upgrade to treat collected water from OU 2, consistently achieve discharge requirements, allow for operation in high-density sludge mode, and reduce the volume of waste sludge generated
- Continued implementation of the ICP to protect human health

Operable Unit 3

Introduction

OU 3 consists of the mining-contaminated areas in the Coeur d'Alene Basin outside of OU 1 and OU 2, primarily the following:

- The floodplain and river corridor of the Coeur d'Alene River (including Coeur d'Alene Lake) and the Spokane River; and
- Those areas where mine wastes have come to be located because of their use for road building or for fill and construction of residential or commercial properties.

Spillage from railroad operations also contributed to contamination across the Basin. OU 3 contaminants are primarily metals, and the metals of principal concern are lead and arsenic for protection of human health, and lead, cadmium, and zinc for protection of ecological receptors.

OU 3 ROD Issuance

On September 12, 2002, USEPA issued an interim ROD to address mining contamination in the broader Coeur d'Alene Basin (OU 3) (USEPA, 2002a).

The 2002 OU 3 ROD includes the following:

- The full remedy needed to protect human health in the community and residential areas, including identified recreational areas of the Upper Basin and Lower Basin, as well as Washington recreational areas along the Spokane River upstream from Upriver Dam.
- An interim remedy of prioritized actions for protection of the environment that focus on improving water quality, minimizing downstream migration of metal contaminants, and improving conditions for fish and wildlife populations.

In 2012, USEPA issued the Upper Basin ROD Amendment to include the eastern portion of OU 3. The Upper Basin Selected Remedy supplements the existing Selected Human Health Remedy for OU 3 by including actions that will protect the existing remedy. Relatively few elements of the existing Selected (interim) Ecological Remedy for OU 3 have been implemented. The 2012 Upper Basin Selected Remedy replaces the Upper Basin portion of the interim ecological actions selected in the 2002 ROD for OU 3 (USEPA, 2002a).

Major Components of the Interim Selected Remedy

For protection of human health in the community and residential areas of the Upper Basin and Lower Basin, the major remedial components include the following:

- Providing lead health information and intervention programs for residential and recreational users
- Partially excavating and replacing residential soils with lead concentrations above 1,000 mg/kg and/or arsenic concentrations above 100 mg/kg, implementing a barrier such as a vegetative barrier to control or limit migration of soils with lead concentrations between 700 and 1,000 mg/kg, and using a combination of removals, barriers, and access restrictions for street ROWs, commercial properties, and recreational areas
- Providing alternative drinking water sources for residences using contaminated private drinking water sources
- Evaluating lead in house dust, after residential soil remediation is completed, to determine if interior cleaning is needed
- Establishing an ICP to maintain protective barriers over time and guide land use and future development

For environmental protection in the Upper and Lower Basins, three environmental priorities were identified in the 2002 OU 3 ROD:

- Dissolved metals in surface water (particularly zinc and cadmium) have harmful effects on fish and other aquatic life.
- Lead in soil and sediment is present in the beds, banks, and floodplains of the river system and has harmful effects on waterfowl and other wildlife.
- Particulate lead in surface water is transported downstream and is a continuing source of contamination for the Coeur d'Alene River, Coeur d'Alene Lake, and the Spokane River. Lead transported in particulate form in the river has affected recreational areas in the Lower

Basin and the Spokane River, resulting in posted health advisory signs at beaches and swimming areas. During flood events, lead transported by the river also affects the wetlands and floodplains.

The Selected Remedy for the Washington recreational areas along the Spokane River identified in the 2002 OU 3 ROD is a combination of access controls, capping, and removals of metals-contaminated soil and sediment. The remedy includes water quality monitoring, aquatic life monitoring, remedial performance monitoring of sediments, and contingencies for additional or follow-up cleanups for the recreational areas.

As stated above, the 2012 Upper Basin ROD Amendment interim Selected Remedy replaces the Upper Basin portion of the Selected Remedy identified in the 2002 ROD for OU 3. The following are the major components of the Selected Remedy in the Upper Basin outside the Box (in the eastern portion of OU 3):

- Extensive excavation and consolidation of waste rock, tailings, and floodplain sediments
- Capping, regrading, and revegetation of tailings and waste rock areas
- Collection and treatment of contaminated adit discharges, seeps, and groundwater
- Stream and riparian stabilization actions in watersheds where sediment removal actions are implemented
- Additional CTP expansions and upgrades to treat collected water from OU 3, consistently achieve discharge requirements, allow for operation in high-density sludge mode, and reduce the volume of waste sludge generated
- Continued ICP implementation to protect human health
- Specific remedy protection actions, such as culvert replacements, channel improvements, small diversion structures, and asphalt ditches, identified in Osburn, Silverton, Wallace, and Mullan.
- Identification of generalized remedy protection actions that are expected to be needed in Upper Basin side gulches

EPA did not select a remedy for Coeur d'Alene Lake in the 2002 OU 3 ROD. USEPA deferred remedy selection in the Lake pending successful implementation of the Lake Management Plan by the State of Idaho, the Coeur d'Alene Tribe, and federal and local governments using separate regulatory authorities. The Coeur d'Alene LMP was finalized in March 2009 and is currently being implemented.

Next Five-Year Review

CERCLA Section 121(c) requires USEPA to perform a review of remedial actions that result in hazardous substances, pollutants, or contaminants remaining at the Bunker Hill Superfund Site at least every 5 years. The purpose of the review is to determine whether the remedial actions are protective of human health and the environment. The trigger date for completion of these reviews is 5 years after initiation of the first remedial action at the Site. The first remedial action at the Site started in 1995. Because onsite containment of hazardous substances is part of the

Site's Selected Remedy, the first Five-Year Review was completed on September 27, 2000. The second Five-Year Review was completed on October 24, 2005. The third Five-Year Review was completed on November 18, 2010.

The next review (the fifth Five-Year Review) of the Bunker Hill Superfund Site will be conducted within 5 years of the completion date of this fourth Five-Year Review Report. The fifth Five-Year Review Report will cover all remedial work, monitoring, operation, and maintenance activities conducted at the Site. In addition, as stated in the 2002 OU 3 ROD, USEPA will continue to evaluate Coeur d'Alene Lake conditions in the next and future Five-Year Reviews.

Five-Year Review Summary Form

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name: Bunker Hill Mining and Metallurgical Complex		
EPA ID: IDD048340921		
Region: 10	**State:** ID and WA	**City/County:** Shoshone, Kootenai, Benewah Counties in Idaho, and Spokane County in Washington

SITE STATUS	
NPL Status: Final	
Multiple OUs? Yes	**Has the site achieved construction completion?** No

REVIEW STATUS
Lead agency: EPA **If "Other Federal Agency" was selected above, enter Agency name:**
Author name (Federal or State Project Manager): Bill Adams, Bunker Hill Team Lead
Author affiliation: USEPA Region 10
Review period: May 1, 2010 – December 31, 2014
Date of site inspection: Various dates for individual remedial actions, from May 2010 through May 2015.
Type of review: Statutory
Review number: 4
Triggering action date: Previous Five-Year Review signed November 18, 2010
Due date *(five years after triggering action date)*: November 18, 2015

Five-Year Review Summary Form (Continued)

Issues/Recommendations

OU(s) without Issues/Recommendations Identified in the Five-Year Review: OU 2
Issues/recommendations identified for OU 1 and OU 3.

OU(s): OU 1	**Issue Category: House Dust**			
	Issue: Results of two pilot studies indicate that house dust lead concentrations return to pre-cleaning levels within one year of cleaning, regardless of the cleaning method. Recent data confirm that house dust lead concentrations have achieved the community mean of 500 mg/kg and the number of homes exceeding 1,000 mg/kg lead in house dust is declining.			
	Recommendation: Evaluate the need for implementation of the interior cleaning component of the remedy based in part on information on alternative dust lead sources. Determine additional data and monitoring needs to support one-time cleaning evaluation.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	IDEQ, USEPA	IDEQ, USEPA	December 31, 2017

OU(s): OU 1	**Issue Category: Drinking Water**			
	Issue: Owners of 13 wells that exceeded federal drinking water standards refused closure. At the time of refusal, all wells were dedicated to non-potable uses.			
	Recommendation: Review current use of the 13 wells whose owners refused closure to identify those being used for potable purposes, if any.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	IDEQ, USEPA	IDEQ, USEPA	December 31, 2016

Five-Year Review Summary Form (Continued)

OU(s): OU 3	**Issue Category: LHIP**			
	Issue: House dust monitoring currently only occurs every other year while remediation is ongoing. Therefore, other strategies are needed to help identify at-risk children annually.			
	Recommendation: Consider additional alternative approaches to the 2002 OU 3 ROD's dust intervention protocol to identify at-risk children.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	IDEQ, PHD, USEPA	IDEQ, USEPA	March 2016

OU(s): OU 3	**Issue Category: Basin Recreation Sites**			
	Issue: There are numerous contaminated sites used for recreation throughout the Basin that span the spectrum from informally used to fairly highly developed. These sites don't fit into established cleanup programs such as the BPRP. Many have recontamination potential from recurring flood deposition.			
	Recommendation: Identify and evaluate Basin recreational sites for possible exposure reduction or educational outreach measures. Identify and evaluate cost effective exposure reduction and educational outreach measures (where appropriate) geared towards various types of recreational sites.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
Yes	Yes	IDEQ, PHD, USEPA	IDEQ, USEPA	March 2019

Sitewide Protectiveness Statements for all OUs	
Protectiveness Determination: Will be protective	*Addendum Due Date:* Not applicable

Protectiveness Statements:

OU 1

The remedy at OU 1 is expected to be protective of human health and the environment upon completion. In the interim, where remedial activities have been completed to date, they have adequately addressed all exposure pathways that could result in unacceptable risks in these areas.

Although the selected remedy has not been fully implemented, it is nearly complete and data indicate that the remedy is functioning as intended by the 1991 OU 1 ROD (USEPA, 1991). As remediation nears completion, soil and house dust lead concentrations have declined, lead intake rates have been substantially reduced, blood lead levels have achieved their RAOs, and the ICP has been established and is operating. Continued operation of a robust ICP is

Sitewide Protectiveness Statements for all OUs
essential to the long-term performance of the installed human health barriers. House dust lead levels have declined to below the 500 mg/kg site-wide average RAO. However, further evaluation is necessary to inform ongoing implementation of the interior cleaning remedy. Private groundwater wells used for drinking were closed during the years that yard soil remedial actions were ongoing. Owners of 13 wells that exceeded federal drinking water standards refused closure. None of these 13 wells was used for drinking water purposes at the time; however, the current potable or nonpotable status of 13 wells whose owners refused closure is currently unknown. ***OU 2*** The remedy at OU 2 is expected to be protective of human health and the environment upon completion. In the interim, where remedial activities have been completed to date, they have adequately addressed all exposure pathways that could result in unacceptable risks in these areas. Implementation of Phase I of remedy as selected in the 1992 ROD, ROD Amendments (1996, 2001, and 2012), and ESDs (1996 and 1998) includes extensive source removal and stabilization efforts, demolition activities, development and implementation of the ICP, land use development support, and public health response actions. Phase I includes monitoring and evaluation of the success of source control efforts. Interim control and treatment of contaminated water and AMD were also included in Phase I of remedy implementation. Phase I remedies have removed and consolidated over 2.8 million cy of contaminated waste onsite in engineered closure areas (the Smelter and CIA closures; see Section 4, Table 4-1). The use of geomembrane cover systems on these closure areas effectively removes these contaminated wastes from direct contact by humans and biological receptors. Consolidating these wastes in engineered closures also substantially reduces the exposure pathway to the surface water and groundwater environment in comparison to pre-remediation Site conditions. Over 800 acres of property within OU 2 have been capped to eliminate direct contact with residual contamination that remains in place within some areas of OU 2. In addition, the revegetation work conducted as part of the Phase I remedial actions has substantially controlled erosion and has significantly improved the visual aesthetics of OU 2. The success of the Phase I revegetation efforts is providing improved habitat for wildlife that was largely absent for decades in many areas of the hillsides and Smelterville Flats. All of these efforts have reduced or eliminated the potential for humans to have direct contact with soil/source contaminants, have reduced opportunities for transport of contaminants by surface water and air, and are expected to provide surface and groundwater quality improvements over time throughout the Site. Responsibility for O&M of OU 2 Phase I remedial actions has been transferred to the State of Idaho upon completion of the remedies. ***OU 3*** The remedy at OU 3 is expected to be protective of human health and the environment upon completion. In the interim, where remedial activities have been completed to date, they have adequately addressed exposure pathways that could result in unacceptable risks in these areas. However, the ecological remedy included in the OU 3 ROD (USEPA, 2002a) and ROD Amendment (USEPA, 2012a) is an interim remedy and therefore a final remedy will need to be selected to fully address groundwater and surface water contamination. Implementation of cleanup activities is presented in the Superfund Cleanup Implementation Plan (USEPA, 2013).

Sitewide Protectiveness Statements for all OUs
Although the Implementation Plan focuses on cleanup actions selected in the ROD Amendment, it also identifies additional actions identified in other decision documents and additional studies that EPA plans to conduct at the site, including the Lower Basin. EPA continues to pursue data collection efforts in the Lower Basin to support the evaluation of remedial alternatives for subsequent decision documents. The Selected Remedy is designed to provide significant improvements to soil, sediments, surface water, and groundwater, and to greatly reduce the risks posed to human health and the environment within the Upper and Lower Basin. It is also expected to reduce the movement of contaminated sediments downstream in the Lower Basin. Although the remedial action in Basin residential and community areas has not been fully implemented, environmental data indicate that the remedy is, in general, functioning as intended by the 2002 OU 3 ROD. As property remediation progresses, soil and house dust lead concentrations are declining, lead intake rates have been substantially reduced, and blood lead levels have declined to levels that meet the RAOs. The low level of participation in the annual Basin blood lead monitoring program remains a concern because it limits the identification of children who might benefit from intervention. In addition to cleanup work in the residential and community areas of OU 3, remedial work has also been completed at a number of mine and mill sites in the Upper Basin as well as at recreational sites along the Coeur d'Alene and Spokane rivers. In addition to consolidating mine waste to reduce contaminant loading to surface water and groundwater, the remedial actions at the mine and mill sites have included barriers or deterrents to all-terrain vehicle and motorcycle use, which have reduced exposures and are functioning as designed. Remedial work at the recreational sites along the Coeur d'Alene River have largely involved grading and capping contaminated materials, installation of site access controls, and stabilization of adjacent eroded riverbank. Remedial actions at the Spokane River sites have involved a combination of removing contaminated materials, capping, and installing deterrents to recreational users. The remedies constructed at recreational sites along both the Coeur d'Alene and Spokane Rivers are, in general, functioning as designed. A number of additional privately owned recreational sites and informal, undeveloped sites have been identified that may present a heavy metal exposure risk to recreationalists. Three repositories have been designed, constructed, and operated pursuant to the 2002 OU 3 ROD to safely contain waste material and prevent the release of contaminants to surface water, groundwater, or air in concentrations that would exceed state and/or federal standards. Based on monitoring results in the last 5 years, the operation of these repositories has prevented the release of contaminants to surface water, groundwater, or air in concentrations that would exceed state and/or federal standards. In addition to the three repositories, the EFNM WCA, which is located in the upper reach of the EFNM Creek Watershed, was constructed approximately 250 feet above EFNM Creek outside of the alluvial valley and in an area that is relatively isolated from groundwater. The WCA was completed in 2014 and began receiving waste from the Interstate Callahan Rock Dump. It is expected to be operational for approximately 10 years and expanded to accommodate all the waste from cleanup in EFNM. USEPA, working with the USFWS and Ducks Unlimited, completed a cleanup and pilot study project establishing nearly 400 acres of clean feeding habitat for migratory and resident

Five-Year Review Summary Form (Continued)

Sitewide Protectiveness Statements for all OUs
swans, ducks, and other wetland bird species in the Lower Basin. The agriculture to wetland conversion project has demonstrated high water fowl usage on the East Field and an increasing activity in the West Field as a result of restoration activities conducted by the Natural Resource Trustees. The 2002 OU 3 ROD did not identify any remedial actions for Coeur d'Alene Lake, where large quantities of contaminated mining wastes have been deposited in lakebed sediments. The ROD indicated that a management plan for the lake would be developed by the State of Idaho and the Coeur d'Alene Tribe, with input from local, other state, and federal agencies to focus on controlling riverine inputs of metals and nutrients that continue to contribute to contamination of the Lake and Spokane River. An important milestone was achieved in March 2009 when the State of Idaho and the Coeur d'Alene Tribe completed a significant revision to the Lake Management Plan (LMP; IDEQ and Coeur d'Alene Tribe, 2009). Implementation of initial LMP actions has begun and lake monitoring efforts are underway.

1 Introduction

The U.S. Environmental Protection Agency (USEPA) Region 10 has completed its fourth Site-wide review of the Bunker Hill Mining and Metallurgical Complex Superfund Facility (the "Bunker Hill Superfund Site" or "Site") located within northern Idaho, sections of the Coeur d'Alene Reservation, and northeastern Washington. The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121(c) requires USEPA to review remedial actions that result in hazardous substances, pollutants, or contaminants remaining at the Site at least every 5 years. The purpose of a Five-Year Review is to evaluate the implementation and performance of a remedy to determine whether the remedy is and/or will continue to protect human health and the environment. Projects implemented with Clean Water Act (CWA) or other authorities are outside the scope of this review.

USEPA has prepared this Five-Year Review Report pursuant to CERCLA Section 121 and the National Oil and Hazardous Substances Contingency Plan (NCP). CERCLA Section 121 states:

> If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial actions no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.

USEPA interpreted this requirement further in the NCP (40 Code of Federal Regulations [CFR] Section 300.430(f)(4)(ii)), which states:

> If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.

Because some of the remedies selected at the Bunker Hill Superfund Site resulted in hazardous substances remaining onsite above levels that allow for unlimited use and unrestricted exposure, Five-Year Reviews of the Site must be completed to meet the above statutory requirements.

This Five-Year Review Report documents the methods, findings, and conclusions of the fourth (2015) Site-wide review of the Bunker Hill Superfund Site remedies and identifies issues found during the review and recommendations to address them. The text and Five-Year Review Summary Form in the Executive Summary provide an overview of the entire Five-Year Review Report. This section provides an overview of the Five-Year Review process and the relevant guidance and decision documents that were used in preparing this report.

The remainder of the report is organized as follows:

- Section 2: Site Background and Site-wide Considerations
- Section 3: Review of Selected Remedies for Operable Unit 1
- Section 4: Review of Selected Remedies for Operable Unit 2
- Section 5: Review of Selected Remedies for Operable Unit 3
- Section 6: Statement of Protectiveness
- Section 7: Next Five-Year Review
- Section 8: References
- Appendix A: Coeur d'Alene Lake Management Plan

1.1 Five-Year Review Process Overview

This 2015 Five-Year Review was conducted by the USEPA Region 10 Bunker Hill/Coeur d'Alene team and their contractor, CH2M HILL; the Idaho Department of Environmental Quality (IDEQ) and their contractor, TerraGraphics; and the Coeur d'Alene Work Trust and their contractor, Maul Foster Alongi. Sections of this report were contributed by the Panhandle Health District (PHD), Coeur d'Alene Tribe, U.S. Fish and Wildlife Service (USFWS), U.S. Geological Survey (USGS), and U.S. Bureau of Land Management (BLM). The review was conducted and the report prepared in accordance with USEPA *Comprehensive Five-Year Review Guidance* (USEPA Guidance; USEPA, 2001a) and Site-specific conditions at the Bunker Hill Superfund Site.

1.2 Community

During the Five-Year Review process, USEPA provided an opportunity for community members and other interested parties to offer their input. In November 2014, USEPA initially notified the public that we were performing a site-wide Five-Year Review, and invited people to share information and ideas about the site that might assist with the review. USEPA notified the public using local newspaper advertisements, the USEPA Region 10 website[1], and the Coeur d'Alene Basin Facebook page[2]. Additionally, USEPA sent direct notice by email to over 3,000 addresses. USEPA presented information on the review to a number of organizations, including the Coeur d'Alene Basin Environmental Improvement Project Commission (BEIPC), BEIPC's Technical Leadership Group, and BEIPC's Citizens Coordinating Council.

Under USEPA's Five-Year Review Guidance, a public review of the draft report is not required. USEPA requested public input on any issues that should be included in the 2015 Five-Year Review. We did not receive input.

[1] The USEPA Region 10 Website: http://go.usa.gov/39vTA

[2] The Coeur d'Alene Basin Facebook page: www.facebook.com/cdabasin

1.3 Relevant Guidance and Decision Documents

1.3.1 Guidance and Decision Documents

USEPA Guidance (USEPA, 2001a) was used to prepare this Five-Year Review Report. The key USEPA decision documents relevant to the Site's Selected Remedies include the three Site Records of Decision (RODs) and the remedy change documents that were prepared as remedy has been implemented. Under CERCLA, as amended, remedy changes are required to be formally documented either in an amendment to the ROD or in an Explanation of Significant Difference (ESD). USEPA decision documents that define the selected remedies for the Site are as follows:

- *Record of Decision, Bunker Hill Mining and Metallurgical Complex, Residential Soils (OU 1), Shoshone County, Idaho*, August 1991 (USEPA, 1991).
- *Record of Decision, Bunker Hill Mining and Metallurgical Complex, Non-Populated Areas, Shoshone County, Idaho*, September 1992. This document selected remedial actions for OU 2 (USEPA, 1992).
- *Amendment to the Record of Decision for the Bunker Hill Mining and Metallurgical Complex (Non-Populated Areas) Superfund Site*, September 3, 1996. This OU 2 document updates the remedy for Principal Threat Materials (PTMs) from stabilization to containment to promote remedy cost-effectiveness (USEPA, 1996a).
- *Explanation of Significant Differences for Revised Remedial Actions at the Bunker Hill Superfund Site, Shoshone County, Idaho*. There were two separate ESD documents, published in January 1996 and April 1998, which recorded the revisions to 19 separate remedial actions in OU 2. The revisions were implemented to ensure that the overall OU 2 remedy maximizes the benefit to the environment, is cost-effective, and responds to community concerns while maintaining or increasing the level of human health and environmental protection (USEPA, 1996b and 1998a).
- *Record of Decision Amendment: Bunker Hill Mining and Metallurgical Complex Acid Mine Drainage, Smelterville, Idaho*, December 2001 (USEPA, 2001b). This document selected remedial actions for OU 2.
- *Record of Decision, Bunker Hill Mining and Metallurgical Complex, Operable Unit 3 (Coeur d'Alene Basin), Shoshone County, Idaho*, September 2002 (USEPA, 2002a).
- *Interim Record of Decision Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Mining and Metallurgical Complex Superfund Site,* August 2012 (USEPA, 2012a). This document selected remedial actions for OU 1, OU 2, and OU 3.

1.3.2 Obtaining Decision Documents and Final Five-Year Review Report

The remedy decision documents listed in Section 1.3.1 and this final version of the 2015 Five-Year Review Report can be obtained via the following:

- Visiting the USEPA Region 10 website[3] for an electronic version of this final report
- Calling USEPA at 1-800-424-4372, extension 8561

[3] http://yosemite.epa.gov/r10/cleanup.nsf/bh/five+year+reviews

- Visiting one of the Site's seven information repositories:

USEPA Seattle Office
Superfund Records Center
1200 Sixth Avenue
Seattle, WA 98101
206-553-4494 or 800-424-4372

Kellogg Public Library
16 West Market Avenue
Kellogg, ID 83827
208-786-7231

St. Maries Library
822 W. College Avenue
St. Maries, Idaho 83861
208-245-3732

Coeur d'Alene Field Office, USEPA
1910 Northwest Boulevard, Suite 208
Coeur d'Alene, ID 83814
208-664-4588

Wallace Public Library
415 River Street
Wallace, ID 83873
208-752-4571

Molstead Library (North Idaho College) Library
1000 Garden Avenue
Coeur d'Alene, ID 83814
208-769-3355

Spokane Public Library
906 West Main Avenue
Spokane, WA 99201-0976
509-444-5336 (reference desk; ask for Dana Dalrymple)

2 Site Background

This section provides background information on the Bunker Hill Superfund Site, organized in the following subsections:

- 2.1, Site Location, Description, and Characteristics
- 2.2, Site History
- 2.3, Source and Nature of Contamination
- 2.4, Applicable or Relevant and Appropriate Requirements (ARARs)
- 2.5, Basin Environmental Monitoring Plan (BEMP)

2.1 Site Location, Description, and Characteristics

The Bunker Hill Superfund Site was listed on the National Priorities List (NPL) in 1983. This NPL Site has been assigned Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) identification number IDD048340921. The Site includes mining-contaminated areas in the Coeur d'Alene River corridor, adjacent floodplains, downstream water bodies, tributaries, and fill areas, as well as the 21-square-mile Bunker Hill "Box" located in the area surrounding the historic smelting operations.

The USEPA has designated three OUs for the Site:

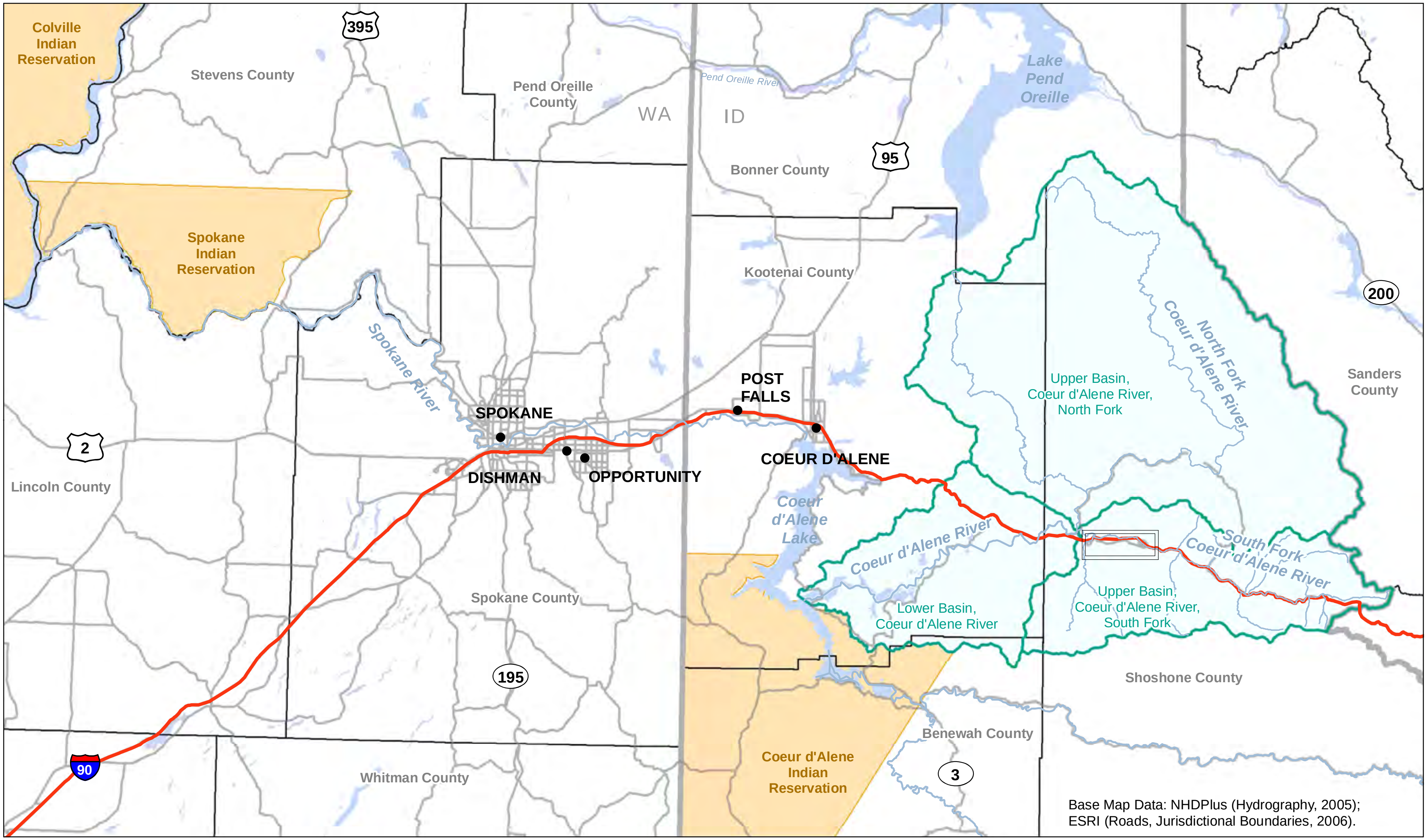
- The populated areas of the Bunker Hill Box (OU 1)
- The nonpopulated areas of the Box (OU 2)
- Mining-related contamination in the broader Coeur d'Alene Basin (the "Basin" or OU 3)

Figure 2-1 is a location map of the Bunker Hill Superfund Site. Detailed descriptions of the physical and cultural settings of the Site can be found in the Site RODs (USEPA, 1991, 1992, and 2002a). The general characteristics of each OU are summarized in the following subsections.

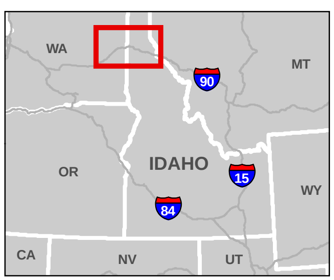
2.1.1 Operable Unit 1

OU 1 is located within the 21-square-mile area surrounding the former smelter complex, commonly referred to as the Bunker Hill Box. The Box is located in a steep mountain valley in Shoshone County, Idaho, east of the city of Coeur d'Alene. Interstate 90 (I-90) bisects the Box and parallels the South Fork of the Coeur d'Alene River (SFCDR).

OU 1 is often referred to as the populated areas of the Bunker Hill Box, and is home to more than 7,000 people in the Cities of Kellogg, Wardner, Smelterville, and Pinehurst, as well as the unincorporated communities of Page, Ross Ranch, Elizabeth Park, and Montgomery Gulch. The populated areas include residential and commercial properties, street rights-of-way (ROWs), and public use areas. Most of the residential neighborhoods and the former smelter complex are located on the valley floor, side gulches, or adjacent hillside areas. Cleanup activities first began in OU 1, because this area was of the greatest concern for human health exposure from mine waste. Current land use in OU 1 is primarily residential and commercial properties. Future land use is expected to be similar to the current land use.



Base Map Data: NHDPlus (Hydrography, 2005); ESRI (Roads, Jurisdictional Boundaries, 2006).



● City

The Bunker Hill Box: Operable Units 1 (Populated Areas) and 2 (Non-Populated Areas)

Coeur d'Alene River Subbasin Boundary

Tribal Land

Notes:
1. The geographic extent of the Bunker Hill Mining and Metallurgical Complex Superfund Site is defined by Operable Units 1, 2, and 3.
2. OU3 consists of mining-contaminated areas in the Coeur d'Alene River Corridor outside of OU1 and OU2, primarily adjacent floodplains, downstream water bodies, tributaries) including Coeur d'Alene Lake and the Spokane River), and fill areas.

N

0 3.75 7.5 15 Miles

Figure 2-1
Location Map: Bunker Hill Mining and Metallurgical Complex Superfund Site
2015 Five-Year Review
BUNKER HILL SUPERFUND SITE

2.1.2 Operable Unit 2

OU 2 includes areas of the Bunker Hill Box that were nonpopulated and nonresidential at the time the 1992 ROD was completed. These areas include the former industrial complex and Mine Operations Area (MOA) in Kellogg, Smelterville Flats (the floodplain of the SFCDR in the western half of OU 2), hillsides, various creeks and gulches, the Central Impoundment Area (CIA), and the Bunker Hill Mine and associated acid mine drainage (AMD). The SFCDR within OU 2 and the nonpopulated areas of the Pine Creek drainage are both addressed as part of OU 3.

Current land uses in OU 2 have changed over time and now include open space, recreational, residential (single and multi-family), and commercial uses. Future land uses may include light industrial.

2.1.3 Operable Unit 3

OU 3 consists of the mining-contaminated areas in the Coeur d'Alene Basin outside of OU 1 and OU 2, primarily the floodplain and river corridor of the Coeur d'Alene River (including Coeur d'Alene Lake) and the Spokane River, as well as areas where mine wastes have come to be located as a result of their use for road building or for fill and construction of residential or commercial properties. Spillage from railroad operations also contributed to contamination across the Basin.

Current land uses in OU 3 are a mix of residential, commercial, agricultural, and open space. Future land use is expected to be similar to the current land use.

2.2 Site History

More detailed information through 2010 for this section is in the third Five-Year Review[1] (USEPA, 2010c). The Bunker Hill Superfund Site is within one of the largest historical mining districts in the world. Commercial mining for lead, zinc, silver, and other metals began in the Silver Valley in 1883. Heavy metals contamination in soil, sediment, surface water, and groundwater from over 100 years of commercial mining, milling, smelting, and associated modes of transportation has impacted both human health and environmental resources in many areas throughout the Site. Smelter operations ceased in 1981, but limited mining and milling operations continued onsite from 1988 to 1991, and several mining operations continue today.

After listing on the NPL in 1983, USEPA published the first Site ROD in August 1991, providing the selected remedy for OU 1 residential soils (USEPA, 1991). The second Site ROD was published by USEPA in September 1992, addressing contamination in the nonpopulated OU 2, as well those aspects of OU 1 that were not addressed in the 1991 OU 1 ROD (USEPA, 1992). A number of remedy changes and clarifications have been documented in several OU 2 ROD amendments and two ESDs. USEPA issued an interim OU 3 ROD to clean up mining contamination in 2002 (USEPA, 2002a). USEPA issued an interim ROD Amendment for the Upper Basin including portions of OU 1, OU 2, and the eastern portion of OU 3 (USEPA, 2012).

[1] The third Five-Year review is available online at: http://go.usa.gov/39vTA.

Since the last Five-Year Review, the Upper Basin Proposed Plan (USEPA, 2010a) and Draft Final FFS Report (USEPA, 2010b) were published. After an extended public comment period in 2010, the Preferred Alternative identified in the Proposed Plan was revised. The revisions were documented in the Final FFS Report, which was completed in late summer 2012 (the 2012 FFS; USEPA, 2012b). The 2012 Final FFS presents and evaluates alternatives for cleanup of the Upper Basin portion of the Site. Responses to all comments received during the extended public comment period were summarized in the Responsiveness Summary and published as part of the 2012 Upper Basin ROD Amendment (USEPA, 2012a).

The Upper Basin is mostly located in Shoshone County, Idaho, and contains OUs 1 and 2 (the Bunker Hill Box) and the eastern portion of OU 3. The Selected Remedy in the 2012 Upper Basin ROD Amendment is an interim remedy. A final remedy will be selected in the future as additional knowledge is gained about conditions at specific locations within the Upper Basin and the effectiveness of remedial actions. The Selected Remedy for the Upper Basin builds upon the remedies identified in the previous RODs for OUs 1, 2, and 3 and incorporates additional information obtained since the ROD for OU 3 was issued in 2002. The Selected Remedy is designed to provide significant improvements to soil, sediments, surface water, and groundwater and to greatly reduce the risks posed to human health and the environment within the Upper Basin. Although the Lower Basin is not included in the Selected Remedy for the Upper Basin, actions in the Upper Basin are expected to improve water quality and reduce the movement of contaminated sediments downstream in the Lower Basin.

A diverse group of governments, Tribes, and agencies, including the State of Idaho, the Coeur d'Alene Tribe, the Spokane Tribe, the State of Washington, and federal Natural Resource Trustees, gave support for the 2012 Upper Basin ROD Amendment.

The technical scope of the Upper Basin Selected Remedy addresses contaminant sources (such as mine tailings, waste rock, adit drainage, and contaminated floodplain sediments), surface water quality in the SFCDR and its tributaries, and existing human health remedies that are potentially vulnerable to erosion and recontamination from stormwater runoff, tributary flooding, and high-precipitation events in the Upper Basin. Major components of the remedial actions within the Bunker Hill Box (OU 1 and OU 2) and OU 3 are presented in Sections 3, 4, and 5, respectively.

The significant differences for each OU between the existing selected remedies and the Upper Basin Selected Remedy are as follows:

- **OU 1—**The existing Selected Remedy for OU 1 (USEPA, 1991), which focused on protecting human health, was certified complete in 2008. The Upper Basin Selected Remedy supplements the existing Selected Remedy for OU 1 by including localized drainage improvement actions that will protect those portions of the existing remedy that are in areas at risk from localized tributary flooding and heavy precipitation.
- **OU 2—**The existing Selected Remedy for OU 2 (USEPA, 1992) identified OU 2 Phase I source control actions that have largely been completed. Implementation of the portions of the existing Selected Remedy for OU 2 focusing on protecting human health is also largely complete. The Upper Basin Selected Remedy supplements the existing Selected Remedy for OU 2 by including localized drainage improvement actions that will protect those portions of the existing remedy that are in areas of risk from localized tributary flooding and heavy

precipitation. The Upper Basin Selected Remedy defines Phase II cleanup actions originally identified in the 2002 ROD to address ongoing water quality issues in OU 2. These actions include managing the contaminated discharge from the Reed and Russell Adits, reducing the flow of contaminated groundwater to the SFCDR, and collecting and treating contaminated groundwater.

- **OU 3—**Implementation of the existing Selected Human Health Remedy for OU 3 is ongoing and will be completed in accordance with previous decision documents. The 2012 Upper Basin Selected Remedy supplements the 2002 Selected Human Health Remedy for OU 3 by including actions that will protect the existing remedy. Relatively few elements of the existing Selected (interim) Ecological Remedy for OU 3 have been implemented. The Upper Basin Selected Remedy replaces the Upper Basin portion of the interim ecological actions selected in the ROD for OU 3 (USEPA, 2002a).

The Selected (interim) Remedy will take significant steps towards achieving the remedial action objectives (RAOs) for the Upper Basin. The Upper Basin Selected Remedy RAOs for human health include the following:

- **Soil, sediments, and source materials—**Reduce human exposure to soil, sediments, and source materials, including residential yard soil, that have concentrations of chemicals of concern (COCs) greater than selected risk-based levels for soil.
- **Surface water—**Restore surface water designated as beneficial use for drinking water to meet drinking water and water quality standards; prevent ingestion of surface water used as drinking water and containing COCs exceeding drinking water standards and associated risk-based levels for drinking water; and prevent discharge of seeps, springs, and leachate that would cause surface water to exceed drinking water and water quality standards.
- **Aquatic food Sources—**Prevent human exposure to unacceptable levels of COCs via ingestion of aquatic food sources (e.g., fish and water potatoes).

The Upper Basin Selected Remedy RAOs for **ecological receptors** include the following:

- **Ecosystem physical structure and function—**Reduce COCs in soil, sediments, and surface water to support a functional ecosystem for aquatic and terrestrial plant and animal populations (including, but not limited to, waterfowl, riparian songbirds, and other species protected under the Endangered Species Act, the Fish and Wildlife Conservation Act, and the Migratory Bird Treaty Act) in the Upper Basin.
- **Soil, sediments, and source materials—**Reduce risks from COCs in soil, sediments, and source materials to acceptable exposure levels that protect ecological receptors and reduce transport and deposition into surface water and groundwater of COCs from soil, sediments, and source materials at concentrations above levels that protect ecological receptors.
- **Surface water—**Reduce risks from COCs in surface water in the Upper Basin to acceptable exposure levels that protect ecological receptors.
- **Mine water, including adits, seeps, springs, and leachate—**Reduce discharge to surface water of mine water, including adits, seeps, springs and leachate, containing COCs at concentrations that cause surface water to exceed levels that protect ecological receptors.

- **Groundwater:** Reduce discharge to surface water of groundwater containing COCs at concentrations that cause surface water to exceed levels that protect ecological receptors.

Following are some of the subtle differences between the RAOs developed for the Selected Remedy for the Upper Basin and the RAOs identified in the RODs for OUs 1, 2, and 3 and the ROD Amendments for OU 2:

- **Site-specific ambient water quality criteria (AWQC)—** Updated AWQC cleanup levels resulted from Site-specific research in the SFCDR conducted by the State of Idaho after the ROD for OU 3 was issued in 2002. This led to substantially higher AWQC for the SFCDR than are applied elsewhere in Idaho for lead and zinc. For each of these metals, AWQC are calculated as a function of hardness. The equations used to calculate the State of Idaho AWQC and the SFCDR-specific AWQC are different: the SFCDR-specific AWQC equation yields higher values for a given hardness.
- **Lead cleanup level for songbirds—**A lead cleanup level that specifically protects songbirds was not included in the 2002 ROD for OU 3 due to lack of Site-specific data. Since that time, additional data have been collected to support identifying a Site-specific lead cleanup level for songbirds of 530 milligrams per kilograms (mg/kg) in soil and sediments in the Upper Basin.

An adaptive management process and implementation approach will be used to implement the Selected Remedy. Through the adaptive management process, the remedial actions will be adjusted as needed to maintain efficient progress towards meeting RAOs.

In December 2009, as part of the American Smelting and Refining Company, LLC (ASARCO) bankruptcy settlement, funding was secured for Superfund response actions at the Site. However, due to a prior settlement with ASARCO for response actions in the Bunker Hill Box, most of the settlement monies, about $486 million, can only be used to perform USEPA-selected cleanup actions in mining-contaminated areas of OU 3, outside the Bunker Hill Box (OUs 1 and 2). These funds were placed in a trust, and a trustee was appointed to manage and invest the funds. The balance of funds in the Trust as of September 2015 is approximately $490 million. From the bankruptcy settlement, USEPA was reimbursed $8 million for human health protection actions that the agency had completed in the Bunker Hill Box from 2002 to 2005. The $8 million is available for additional cleanup work in the Box.

In June 2011, a settlement of $263.4 million plus interest was reached between Hecla Mining Company and the USEPA, the Coeur d'Alene Tribe, and the State of Idaho that resolved legal claims stemming from releases of wastes from Hecla's mining operations. Hecla settlement funds include funds for remediation and restoration of natural resources in the Coeur d'Alene Basin and can be spent anywhere within the Bunker Hill Superfund Site. Of the $263.4 million, approximately $180 million will fund response actions throughout the Site, $17 million was provided to the State of Idaho to fund the Institutional Controls Program (ICP) and the ICP soil repository (Page Repository) into perpetuity within OU 1, and $65.85 million was provided to the federal, Tribal, and state Natural Resource Trustees for use in restoration activities in coordination with cleanup actions.

2.2.1 Operable Unit 1 History

Information for this section is in the third Five-Year Review (USEPA, 2010c).

2.2.2 Operable Unit 2 History

Information for this section is in the third Five-Year Review (USEPA, 2010c).

2.2.3 Operable Unit 3 History

Information for this section is in the third Five-Year Review (USEPA, 2010c).

2.3 Source and Nature of Contamination

2.3.1 Source of Contamination

Metals related to mining, milling, and smelting activities are present throughout the Site in soil, sediment, surface water, and groundwater. The most significant contaminants are antimony, arsenic, cadmium, copper, lead, mercury, and zinc. The principal sources of metal contamination were tailings generated from the milling of ore and discharged to the SFCDR and its tributaries or confined in large waste piles onsite, waste rock, and air emissions from OU 2 smelter operations. Spillage from railroads and other modes of transportation also contributed to contamination across the Site.

Tailings were also transported downstream, particularly during high-flow events, and deposited as lenses of tailings or as tailings/sediment mixtures in the bed, banks, floodplains, and lateral lakes of the Coeur d'Alene River Basin and in Coeur d'Alene Lake. Some fine-grained material washed through the lake and was deposited as sediment within the Spokane River flood channel. The estimated total mass and extent of impacted materials (primarily sediments) exceeds 100 million tons dispersed over thousands of acres (USEPA, 2001d).

Section 2.3.2 describes the nature and extent of contamination in the three OUs. For additional quantitative data on levels of contamination found during the remedial investigations, see the applicable OU RODs and previous Five-Year Review Reports.

2.3.2 Nature and Extent of Contamination

2.3.2.1 Contamination Affecting Primarily Human Health

Following are the primary media of concern for human health in all three OUs:

- Contaminated soil where it occurs in residential yards, ROWs, commercial and undeveloped properties, and common areas, and airborne dust generated at these locations
- Contaminated house dust, originating primarily from contaminated soil (the OU 3 ROD also identified interior house paint as a potential source of lead)
- Drinking water from local wells or surface water
- Contaminated floodplain soil, sediments, and vegetation

People can be exposed to COCs by ingesting soil, breathing dust, drinking water, and eating contaminated fish or homegrown vegetables. The COCs for protecting human health are as follows:

- Lead and arsenic in soil and sediment
- Lead in house dust
- Arsenic, lead, and cadmium in drinking water from unregulated sources

Although fish and vegetables were not screened for COCs, indicator metals were selected for these based on toxicity and presence in the basin. The selected indicator metals for fish consumption were cadmium, lead, and mercury, and for vegetable consumption were arsenic, cadmium, and lead.

2.3.2.2 Contamination Affecting Primarily Ecological Receptors

Contaminated media that potentially affect ecological receptors are surface water, soil, and sediment. In addition, groundwater is important as a pathway for migration of metals to surface water. The ecological COCs for ecological protection are as follows:

- Cadmium, copper, lead, and zinc in surface water
- Arsenic, cadmium, copper, lead, and zinc in soil
- Arsenic, cadmium, copper, lead, mercury, silver, and zinc in sediment

Cadmium, lead, and zinc are pervasive in all environmental media and generally present higher risks to ecological receptors than arsenic, copper, mercury, and silver.

2.3.2.3 Contamination in Specific Areas of the Site

The following subsections describe the nature and extent of contamination for both human health and ecological receptors for specific areas of the Site.

The Box (Operable Units 1 and 2)

The main source of contamination in the Box includes jig tailings, flotation tailings, inflow of contaminants from upstream sources, air emissions from ore processing facilities, particulate dispersion from ore stockpiles, and residuals from the industrial complex. Spillage from railroads and other modes of transportation also contributed to contamination across the Site. Additional sources included gypsum generated from phosphoric acid production and zinc fuming, and AMD emanating from the Bunker Hill Mine.

Jig and flotation tailings were generated as waste products during concentration of mined ores. Jig tailings were generated by earlier mine concentrating techniques and were typically dumped on the valley floor. During flood events, these tailings were transported by the SFCDR, mixed with alluvium, and deposited on the flood plain. Over time, the valley floor throughout and downstream of OU 2 became mantled with a mixture of jig tailings, flotation tailings, and alluvium as floods occurred and as the SFCDR naturally meandered across the valley floor.

Flotation tailings, which were generated by an improvement to ore concentration methods that came into predominant use in 1930, were typically discharged to the CIA and Page Pond tailings impoundments. The flotation tailings were identified during the RI/FS as an important source of airborne contamination, as well as a source of contamination to groundwater and surface water.

Air emissions occurred from ore processing facilities. Although both the lead smelter and Zinc Plant in Kellogg had recycling processes designed to minimize airborne particulates, significant metals deposition still occurred together with deposition of sulfur dioxide emissions. In the 1960s, lead emissions from the two lead smelter stacks averaged from 10 to 15 tons per month. After a September 1973 fire in the baghouse of the main stack, particulate emissions containing 50 to 70 percent lead increased to about 25 tons to over 140 tons per month (USEPA, 1986). Emissions affected areas near the smelter and zinc plant as well as the surrounding hillsides.

Materials and residues from the smelter complex included ores, concentrates, sinter and calcine, copper dross flue dust, lead residues, slag, gypsum, and other materials and wastes. These materials were stored, transported, and occasionally spilled in various areas around the Box. Gypsum was generated during production of phosphoric acid, and slag was produced by fuming processes aimed at converting zinc sulfide to zinc oxide. For the most part, these materials were either concentrated in ponds or deposited in the CIA. AMD from the Bunker Hill Mine was impounded at the CIA without treatment until 1974, after which the CTP was constructed and became operational. From 1974 until 1996, AMD continued to be pumped to an unlined holding pond on top of the CIA prior to treatment.

Upper Coeur d'Alene Basin outside the Box (Operable Unit 3)

The Upper Basin encompasses the steep mountain canyons of the SFCDR and its tributaries. OU 3 encompasses those Upper Basin areas outside of the Box.

The Upper Coeur d'Alene Basin contains many primary sources for mining–related hazardous substances (metals), including mine workings, waste rock and other mining waste, mine tailings, concentrates and other process wastes, artificial fill (tailings and waste rock in roads, railroads, and building foundations), and other locations. Based on mapping conducted by the BLM (BLM, 1999), approximately 2,850 acres of land have been disturbed by mining-related activities or deposition of mining-related wastes in the Upper Basin (not including areas within OU 1 and OU 2). Approximately 295 acres of disturbed area were identified by the BLM as riparian. Approximately 1,200 acres of other impacted floodplain areas were identified by the BLM. As a consequence of the historical mining operations, heavy metals contamination is present in soils, sediment, surface water, and groundwater.

As discussed more fully in the OU 3 RI, the Upper Basin is a primary source of dissolved metals in the river system (USEPA, 2001d). Impacted sediments and associated groundwater in the valley fill aquifers of the Upper Basin are the largest sources of dissolved metals loading in the river and streams. An estimated 71 percent of the load is derived from impacted sediments and associated groundwater. Surface water and groundwater percolates through the tailings-impacted sediments and dissolves metals. The water discharges into the streams and rivers, carrying the dissolved metal load with it. Metal loading is enhanced by the relatively large degree of surface water/groundwater interaction that occurs in some parts of the Upper Basin. In areas where the valley floor widens, streams lose water to the valley fill aquifer. In areas where the valley floor constricts, groundwater discharges back into the streams, carrying additional metals load.

An estimated 7 million cubic yards (cy) of tailings-impacted sediments are present in the Upper Basin, including an estimated 3 million cy of sediments that potentially cannot be accessed for excavation because they are beneath the I-90 embankment, other roads, or residential or commercial structures. In addition to the estimated 7 million cy of sediments, analysis of deeper sediment samples indicates metals concentrations generally exceed background concentrations to depths of 10 to 30 feet. These deeper sediments are potentially an important secondary source of metals. Relatively little of the dissolved metals in the river system comes from discrete sources. Discrete sources include National Pollutant Discharge Elimination System (NPDES)-permitted discharges and unpermitted discrete discharges (adit and seep discharges). The estimated loads from the discrete discharges account for only about 8 percent of the estimated dissolved zinc load in the SFCDR at Pinehurst located at the western end of OU 2.

Lower Coeur d'Alene Basin (Operable Unit 3)

The Lower Basin extends along the 37 mile length of the mainstem Coeur d'Alene River, including the lateral lakes (or "chain lakes") area, and extensive surrounding floodplain wetlands. Flows in the river range from a few hundred cubic feet per second (cfs) in fall to flood stage flows of approximately 20,000 cfs and greater. Water surface elevations in the Lower Basin are often influenced by the level of Coeur d'Alene Lake. Backwater from the lake, during both summer months and during periodic flooding in winter and spring, extends nearly 30 miles up the river to the river grade break near Cataldo.

Large portions of the mine tailings released in the Upper Basin, into the South Fork and its tributaries, were transported to and deposited within the river channel and floodplains in the Lower Basin, especially during flood events. Erosion and resuspension of contaminated sediment from the river bed is the major current source of mobile metals, approximately 80 percent of the lead load at Harrison is mobilized from the river bed. Inflow from the Upper Basin and erosion of contaminated sediment deposits in river banks contribute relatively small portions of the total lead load at Harrison (about 10 percent each) (CH2M HILL, 2014b). Investigations conducted in the since 2008 have allowed USEPA to improve on previous estimates of the amount of contaminated sediment in the river bed, and are generally constrained to a range between about 6 and 11 million cy (CH2M HILL, 2014c). Surface concentrations of lead in the river bed average between about 1,500 and 3,000 mg/kg, while underlying layers contain concentrations more typically three to five times higher but have been measured as high as 70,000 mg/kg (CH2M HILL, 2014b). The depth of contaminated sediment is variable, ranging from zero (where native river bed is exposed) to more than 15 feet (CH2M HILL, 2014b). The average concentration of lead in over 2,000 nonrandom sediment samples within the floodplain collected in the Lower Basin is 3,100 mg/kg (USEPA, 2001d).

The Lower Basin is currently net erosional for both sediment and lead – that is, more sediment and lead leave the basin than enter it. On average, over the past 25 years, approximately two times as much sediment and seven times as much lead has discharged from the Coeur d'Alene River at its mouth (near Harrison) than entered it (at Cataldo); the Lower Basin has averaged about 34.2 metric tons per year of lead inflow, with approximately 250 metric tons per year of outflow.

Lower Basin wetlands and lateral lake sediments are significant points of exposure of waterfowl and other animals to contaminated sediment. An estimated 18,300 acres, or 95 percent, of floodplain surficial sediments contain more than 530 mg/kg of lead (the lowest observed adverse effects level for waterfowl), and 80 percent of floodplain sediments contain more than 1,800 mg/kg of lead (the mortality threshold concentration for waterfowl) (USEPA, 2001d).

Detailed discussion and information pertaining to the nature and extent of contamination and fate and transport of contaminants in the Lower Basin is documented in the Enhanced

Conceptual Site Model (CH2M HILL, 2010). As discussed in Section 2.5.1, surface water quality at 18 streamflow-gaging and water-quality sampling sites in the Coeur d'Alene and Spokane River Basins are monitored and evaluated by the USGS.

Coeur d'Alene Lake (Operable Unit 3)

Coeur d'Alene Lake is a natural lake, but Post Falls Dam controls its elevation. Coeur d'Alene Lake encompasses 49.8 square miles at its normal full-pool elevation (2,128 feet above mean sea level), with a maximum water depth of 209 feet. The 2,128-foot above elevation is the level defined by Avista's Federal Energy Regulatory Commission license as the maximum permitted lake level. The lake has a drainage area of 3,741 square miles. Its principal tributaries are the St. Joe and Coeur d'Alene Rivers. The discharge from the lake forms the Spokane River.

The beaches and wading areas adjacent to Coeur d'Alene Lake were sampled in 1998, and concentrations of metals did not exceed risk-based levels for recreation (USEPA, 2002a). The only exceptions are Harrison Beach, which was remediated as part of the UPRR ROW removal action, and Blackwell Island near the mouth of the Spokane River which only exceeded background values for arsenic. No mining contamination has been found in the residential and commercial areas in the cities of Coeur d'Alene, Post Falls, or Harrison.

According to the OU 3 ROD (USEPA, 2002a), the water in Coeur d'Alene Lake meets the safe drinking water standards for metals, except when discharge from the Coeur d'Alene River is high (e.g., during high spring runoff or during flood events), which causes short-term lead concentrations that exceed the drinking water standard. The water in the lake exceeds the water quality standards for protection of aquatic life for cadmium and zinc and intermittently for lead.

The 2001 Human Health Risk Assessment for the Coeur d'Alene Basin indicated that more information was needed about fish in Lake Coeur d'Alene (TerraGraphics, 2001); the Coeur d'Alene Tribe and a collaborative interagency team agreed. As a result, these groups cooperatively conducted a study to determine the contaminant levels in fish from Lake Coeur d'Alene. The Agency for Toxic Substances and Disease Registry (ATSDR) and the Idaho Department of Health and Welfare, Idaho Division of Health (IDOH) were asked to review the data from this study (USEPA, 2002b) and evaluate the potential health risks for tribal and recreational fishers that may result from consumption of three fish species found in Lake Coeur d'Alene.[2]

Based upon this evaluation, Idaho and the Coeur d'Alene Tribe jointly issued a fish consumption advisory in June 2003. The advisory was issued because study results detected lead, mercury, and arsenic at levels that may affect some people's health if they eat more fish than recommended. The advisory also noted that by following the consumption limits in the advisory, the public can continue to enjoy the health benefits from a diet that includes fish caught from Coeur d'Alene Lake. The advisory is posted at boat launches and other locations on Coeur d'Alene Lake. Information about the specifics of the fish advisory is available on the IDHW web page[3].

A large volume of metals-impacted sediment has been deposited in Coeur d'Alene Lake. There are an estimated 44 to 50 million cy of contaminated sediments at the bottom of the lake (USEPA, 2001d). Surface water and suspended sediment sampling indicate that trace metals

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[2] This study can be accessed at http://www.atsdr.cdc.gov/HAC/pha/pha.asp?docid=1045&pg=1#purp.

[3] The IDHW web page: http://healthandwelfare.idaho.gov

continue to be delivered to the lake. Studies by the USGS suggest that, under current lake conditions, there is some movement of the metals from the sediment into the water column; however, concurrent releases of dissolved iron facilitate formation of iron-metal complexes in the lake's lower water column. The rate of release of metals in the sediments into the water column could increase if nutrient enrichment causes decreases in near-bottom dissolved-oxygen and pH as a consequence of enhanced biological activity. The lake's geochemical and biological responses to future remediation activities will be influenced by reductions in zinc's suppressive effects on biological productivity. Concomitant reductions in nutrient inputs, particularly phosphorus, may be needed to counteract reductions in zinc concentrations. Limnological data collection and modeling are underway to provide lake managers with knowledge of the interaction of metal contamination and nutrient enrichment in the lake.

Spokane River (Operable Unit 3)

The Spokane River flows from Coeur d'Alene Lake and is dammed at six locations above its terminus at Lake Roosevelt. The riverbed primarily consists of coarse gravel and cobbles, and the floodplain and riparian areas are relatively narrow. Metals contamination is present in depositional areas within the river's floodway and behind the Upriver Dam.

The beaches and wading areas adjacent to the Idaho portion of the Spokane River were sampled in 1998 and were found to be safe for human health (i.e., concentrations of metals did not exceed risk-based levels for recreation). Sediment depositional areas in the state of Washington portion of the Spokane River were sampled in 1998, 1999, 2000, and 2004. Several depositional areas were found to contain lead at concentrations exceeding the risk-based levels. The water in the Spokane River meets the safe drinking water standards for metals.

In the Spokane River sediment samples, 82 percent of the samples contained lead above the upper background concentration. The average concentration of lead was 400 mg/kg in 265 sediment samples collected in the Spokane River floodway between Coeur d'Alene Lake and Long Lake. The sediment lead cleanup level for the Washington recreational areas along the Spokane River is 700 mg/kg for recreational use (USEPA, 2002a). The sediment arsenic cleanup level as selected by USEPA is 20 mg/kg for recreational use.

Because there are relatively few depositional areas along the Spokane River, the volume of contaminated sediments is small compared with the Upper and Lower Basins. An estimated volume of 260,000 cy of contaminated sediments are present upstream from Upriver Dam.

Additional contaminated sediments are present downstream from Upriver Dam but have not been quantified. Surface water in the Spokane River has been affected by metals including particulate lead transported into the Spokane River, particularly during winter storm events and spring runoff.

2.4 Applicable or Relevant and Appropriate Requirements

This section provides a review of the ARARs and presents the revised and new standards that have been evaluated since the last Five-Year Review.

2.4.1 Operable Unit 1

ARARs and to be considered (TBC) items from the 1991 OU 1 and the 1992 OU 2 RODs were reviewed as part of the 2000, 2005, and 2010 Five-Year Reviews. The 2000 Five-Year Review (USEPA, 2000a) identified changes or newly promulgated standards related to air and blood lead level goals. However, the modifications were found not to affect the protectiveness of the remedy selected in the 1991 and 1992 RODs. Since that time, promulgated standards affecting the protectiveness of the OU 1 human health remedy have remained unchanged.

2.4.2 Operable Unit 2

The remedies selected in RODs, ROD Amendments, and ESDs are intended to protect human health and the environment and to comply with federal and state standards that are ARARs.

As part of the 2000, 2005, and 2010 Five-Year Reviews, the ARARs and TBC guidance identified in the 1992 OU 2 ROD were reviewed, and any new or revised standards were identified and summarized within those OU 2 Five-Year Review Reports. Based upon these reviews, USEPA determined that the 1992 ARARs and TBCs still protected the remedies for OU 2 (USEPA, 2000b, 2005, 2010c).

With this 2015 Five-Year Review, the 1992 OU 2 ROD ARARs and TBCs were again reviewed, as well as those in the 2001 OU 2 ROD Amendment and the 2012 Upper Basin ROD Amendment. Standards were not revised or promulgated since the last Five-Year Review. As with the earlier reviews, USEPA has determined that the OU 2 ARARs and TBCs are still protective.

2.4.3 Operable Unit 3

The federal, state, and Tribal requirements that are applicable or relevant and appropriate to the scope of the remedial action selected in the 2002 OU 3 ROD are included in Section 13.2 (Compliance with Applicable or Relevant and Appropriate Requirements) of the 2002 OU 3 ROD. The ARARs, guidance, and other documents TBC were reviewed.

Additionally, USEPA reviewed the federal, state, and Tribal requirements that are applicable or relevant and appropriate to the scope of the remedial action selected in the 2012 Upper Basin ROD Amendment. These requirements are included in Section 13.2 (Compliance with Applicable or Relevant and Appropriate Requirements) of the 2012 Upper Basin ROD Amendment, which describes the federal and state ARARs and other available information that does not constitute an ARAR (e.g., advisories, criteria, guidance, and TBC criteria that are useful in selecting, designing, and implementing the remedy). Tables 13-1 through 13-3 in the 2012 Upper Basin ROD Amendment present the ARARs and TBCs for the Upper Basin OU 3 Selected Remedy along with summaries of each ARAR and an evaluation of how the ARAR applies to the Selected Remedy.

A lead cleanup level that specifically protects riparian songbirds was not included in the 2002 OU 3 ROD due to lack of Site-specific data. Since that time, a riparian songbird study was conducted by the USFWS (Hansen, 2007), and a Focused Ecological Risk Assessment was prepared (CH2M HILL, 2006). Given the absence of promulgated criteria for metals in soil and sediments, and using the results from these studies with other relevant information, USEPA has made a risk-management-based determination to use a Site-specific protective value of 530 mg/kg for lead in soil and sediments, to protect riparian songbirds in the Coeur d'Alene

Basin (see Attachment 4-1 in the 2012 FFS for details). This has resulted in an RAO and site-specific ecological risk lead cleanup level in the 2012 ROD Amendment of 530 mg/kg.

Standards were not revised or promulgated since the last Five-Year Review. As The ARARs identified in the 2002 OU 3 ROD and subsequent changes identified in the Five-Year Review Report (USEPA, 2010c), and the ARARs identified in the 2012 Upper Basin ROD Amendment continue to be protective.

2.5 Basin Environmental Monitoring Plan

In March 2004, USEPA released the Basin Environmental Monitoring Plan (BEMP), which implements the environmental monitoring program established as part of the ecological component of the OU 3 Selected Remedy. The BEMP established a monitoring plan for surface water, suspended and depositional sediment, and biological resources. Refer to the BEMP for further information on development, goals, and objectives (USEPA, 2004).

In 2006, the Environmental Monitoring Program (EMP) was developed to guide the collection, analysis, and interpretation of water quality and biological resources data to assess the effectiveness of the Phase I remedy for OU 2 based on the goals and objectives identified in the 1992 ROD (USEPA, 1992), ROD Amendments (USEPA, 1996a and 2001b), and explanations of significant differences (ESDs) (USEPA, 1996b and 1998a). The EMP established a monitoring plan for surface water, groundwater, suspended and depositional sediment, and biological resources. Refer to the EMP for further information on development, goals, and objectives (USEPA, 2006).

At the time of this Five-Year Review, USEPA is working to update and consolidate the BEMP and EMP to create one consolidated environmental monitoring program for OU 2 and OU 3 of the Bunker Hill Superfund Site.

2.5.1 Surface Water—Operable Unit 3

2.5.1.1 Monitoring Activities

The USGS has been collecting surface water data as part of the BEMP since 2004. In 2014, USGS published *Sources, Transport, and Trends for Selected Trace Metals and Nutrients in the Coeur d'Alene and Spokane River Basins, Northern Idaho, 1990-2013* (Clark and Mebane, 2014). This report contains an evaluation of the status and trends in surface water for the Five-Year Review. Information from the report is summarized as follows.

Data collected at 18 streamflow-gaging and water-quality sampling sites in the Coeur d'Alene and Spokane River Basins of northern Idaho (excluding Lake Coeur d'Alene) were used to estimate mean streamflow-weighted concentrations and annual loads of total and dissolved cadmium, lead, and zinc, and total phosphorus and nitrogen for water years (WYs) 2009–13. Chronic AWQC and AWQC ratios also were calculated to evaluate Idaho aquatic life criteria for chronic exposure to cadmium and zinc in streams. AWQC ratios for cadmium and zinc for WYs 2009-2013 are presented in Figure 2-2. At four sites with a longer period of record (Enaville, Pinehurst, Harrison, and Postfalls), a Seasonal Kendall trend test was used to assess historical trends in the concentrations of total cadmium, lead, and zinc, and chronic AWQC ratios for cadmium and zinc during WYs 1990–2013 and to understand the variability with time.

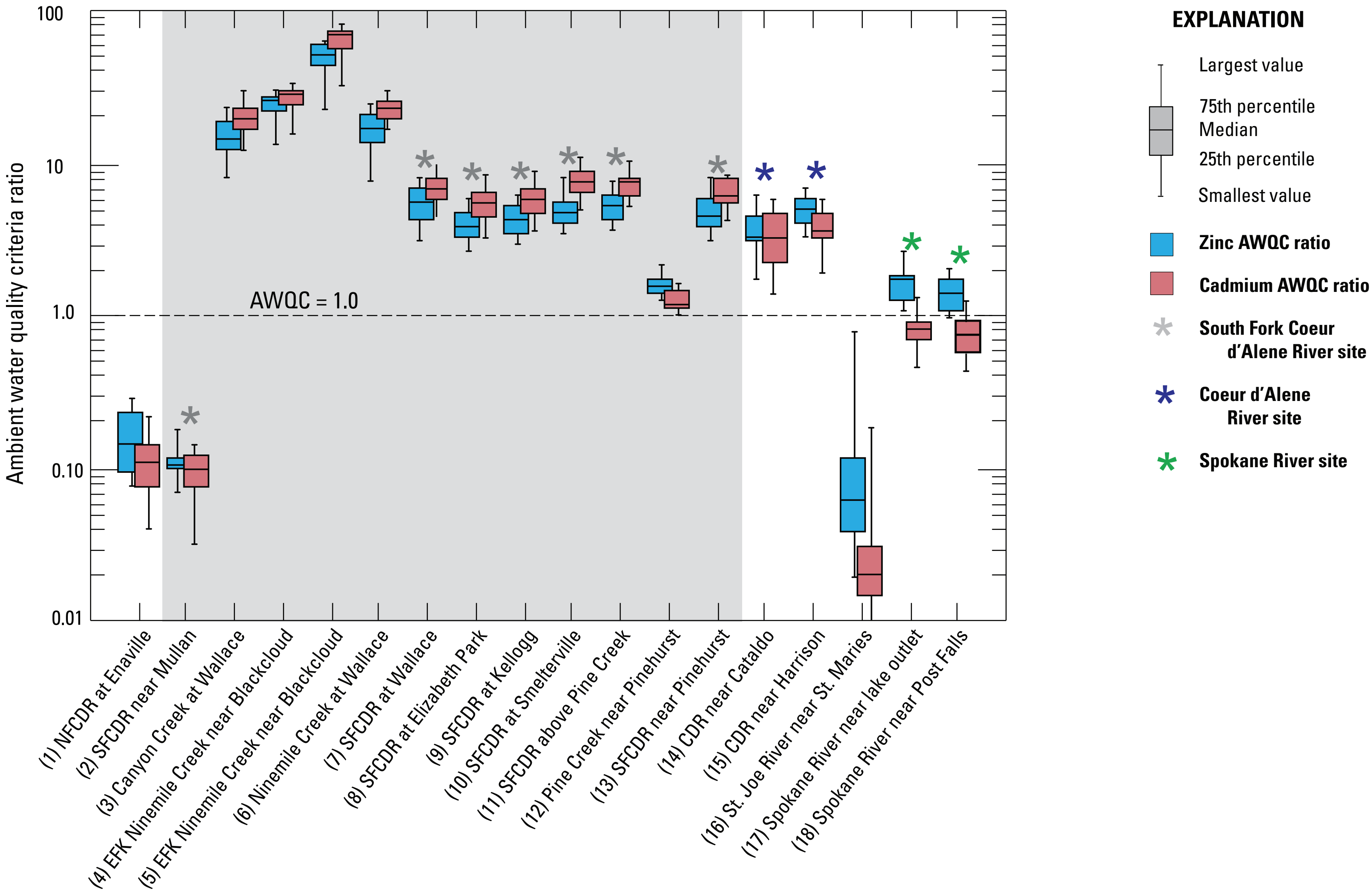

Figure 2-2
AWQC Ratios for Dissolved Zinc and Cadmium in Water Samples Collected at Sampling Sites (Clark and Mebane, 2014)
2015 Five-Year Review
BUNKER HILL SUPERFUND SITE

2.5.1.2 Key Findings

The results indicate that, during WYs 2009–13, cadmium and zinc entering Coeur d'Alene Lake and transported downstream in the Spokane River were derived primarily from mining-affected tributaries to the SFCDR and from groundwater discharge to the SFCDR near the CIA. Cadmium and zinc were transported in streams predominantly in the dissolved phase (less than 0.45 micrometer), and at most sites, concentrations were inversely correlated with streamflow and varied widely over the range of streamflows sampled. In contrast to cadmium and zinc, lead was transported in streams primarily in the particulate form, and total lead concentrations were positively correlated with streamflow. Transport of lead occurred primarily during high streamflow when lead-rich sediments stored in stream channels and the flood plain of the Coeur d'Alene River are eroded, transported, and redistributed downstream. Control of the transport of contaminated sediment as well as dissolved metals in surface water through the Coeur d'Alene and Spokane River Basins is a key factor for ensuring the long-term effectiveness of remedial activities in the SFCDR and Coeur d'Alene River.

Trace metal concentrations increased by 2 to 4 orders of magnitude along the SFCDR from near Mullan (upstream from historic mining) downstream to near Pinehurst. Mean streamflow-weighted concentrations of total cadmium, lead, and zinc in the SFCDR near Pinehurst for WYs 2009–13 were 3.71, 61.4, and 514 micrograms per liter (µg/L), respectively. Major tributary sources of trace metals to the SFCDR are Canyon Creek and Ninemile Creek. Combined, these two tributaries contributed estimated mean loads of about 0.575 tons per year (ton/yr) of total cadmium, 5.29 ton/yr of total lead, and 90.9 ton/yr of total zinc to the SFCDR during WYs 2009–13. Bunker Creek, Government Gulch, and groundwater discharge near the CIA between Kellogg and Smelterville were other major sources of cadmium and zinc to the SFCDR, contributing an estimated 1.39 and 143 ton/yr, respectively, during WYs 2009–13.

Although concentrations of cadmium, lead, and zinc in streams throughout the Coeur d'Alene and Spokane River Basins have shown significant decreases since the early 1990s in response to remedial activities, the rate of decrease has slowed since 2003, especially downstream of the CIA. Additionally, significant decreases in dissolved cadmium and zinc concentrations in the lower SFCDR and Coeur d'Alene River would require reducing the load of these trace metals being discharged to the SFCDR from groundwater near the CIA. The loading estimates from this study provide a valuable baseline for evaluating the efficacy of future remedial activities designed to reduce cadmium and zinc loading from groundwater to discrete reaches of the SFCDR. These loading estimates also provide a baseline for evaluating the efficacy of current and future remedial activities in the Canyon and Ninemile Creek tributaries to the SFCDR.

A large part of the trace-metal load entering Coeur d'Alene Lake from the Coeur d'Alene and St. Joe Rivers is retained in the lake, most likely in sediments on the lake bottom. On an annual mean basis, Coeur d'Alene Lake received nearly 1,100 tons of cadmium, lead, and zinc combined, about 99 percent of which was delivered from the Coeur d'Alene River. Of the total trace-metal load entering the lake, about one-third, or about 370 ton/yr, were transported from the lake and into the Spokane River. The mean streamflow-weighted concentrations of total cadmium, lead, and zinc in the Spokane River near Post Falls (site 18) were 0.231, 2.91, and 48.9 µg/L, respectively, substantially smaller than the concentrations entering the lake from the Coeur d'Alene River. About 1.48 tons of total cadmium, 18 tons of total lead, and 350 tons of total zinc exited Coeur d'Alene Lake and entered the Spokane River annually during WYs 2009-13.

2.5.1.3 Progress toward Remedial Action Objectives

Because they account for toxicity effects on aquatic organisms, AWQC ratios are important benchmarks for establishing the effectiveness of remedial activities in the Coeur d'Alene and Spokane River Basins. Although long-term monitoring sites in the sampling network have shown great improvement in the chronic AWQC for cadmium and zinc since the early 1990s, the chronic AWQC was achieved only at sites on the North Fork of the Coeur d'Alene River (NFCDR) at Enaville, the SFCDR near Mullan, and the St. Joe River near St. Maries. Chronic AWQC ratios at both sites on the Spokane River generally were close to achieving benchmark values. Sites the farthest from achieving the chronic AWQC criteria were located on Canyon Creek, the East Fork of Ninemile Creek, and Ninemile Creek. The downstream site on the East Fork of Ninemile Creek had mean streamflow-weighted AWQC ratios for cadmium and zinc of 64 and 51, respectively, more than twice the ratio of any other site in the sampling network.

Trend results indicate that remedial efforts in the SFCDR valley and its tributaries since the early 1990s have been successful in reducing concentrations of trace metals in the SFCDR, Coeur d'Alene River, and Spokane River. By significantly reducing sources of dissolved metals to the SFCDR river system, this will effectively reduce surface water concentrations in the lateral lakes due to the hydraulic connectivity between these systems. Statistically significant downward trends were noted during WYs 1990–2013 for all constituents evaluated in the SFCDR at Elizabeth Park and the SFCDR near Pinehurst, in the Coeur d'Alene River near Harrison, and for total lead and total zinc in the Spokane River near Post Falls. During WYs 2003–13, the SFCDR at Elizabeth Park continued to indicate significant downward trends in total cadmium and zinc concentrations and their AWQC ratios. Of the other three long-term sites, only the Spokane River near Post Falls showed significant trends during WYs 2003–13: a downward trend in total zinc concentration and an upward trend in the chronic AWQC ratio for dissolved cadmium. Further significant reductions in cadmium and zinc concentrations in the Spokane and Coeur d'Alene River Basins likely would necessitate reducing loads entering the SFCDR from cadmium- and zinc-enriched groundwater near the CIA.

Load models developed in this study are a valuable tool for estimating streamflow-weighted concentrations and loads of trace metals and nutrients in the Coeur d'Alene and Spokane River Basins. As additional data are collected, they can be integrated into the existing models to improve the understanding of how trace metals and nutrients are transported and deposited throughout the basins. Future data-collection activities should continue to target the hydrograph to incorporate data from a variety of streamflow conditions necessary for model development. Additionally, continued sampling at sites such as the SFCDR near Elizabeth Park, the SFCDR near Pinehurst, the Coeur d'Alene River near Harrison, and the Spokane River near Post Falls would provide data for evaluating trends and assessing the efficacy of remediation activities designed to reduce trace-metal loading to streams in the Coeur d'Alene and Spokane River Basins.

2.5.1.4 Program Updates

In 2014, changes were made to the surface water monitoring program (USEPA 2015a). This includes the addition of a surface water sampling location at Rose Lake. Surface water will be a key indicator of both short and long-term remedy effectiveness for current and future remedial actions including work in East Fork Ninemile (EFNM) Creek and the CIA GWCS. USEPA is preparing remedial action effectiveness plans for EFNM Creek and the GWCS. The plans will identify monitoring objectives for estimating dissolved metal loads to EFNM Creek and the SFCDR, respectively, determining remedy performance and effectiveness, and evaluating long-term response to the remedial actions.

At this time, USEPA is not proposing any additional changes to surface water sampling (location and frequency). USEPA will continue to work with USGS to determine the most representative locations for remedy short- and long-term effectiveness monitoring, define the surface water baseline dataset, and refine both remedy effectiveness and long-term monitoring objectives. In future publications, USEPA will be reporting progress achieved toward both acute and chronic metals AWQC.

2.5.2 Surface Water—Operable Unit 2

2.5.2.1 Monitoring Activities

Surface water quality monitoring activities within OU 2 apply to the tributaries of the SFCDR within the Box. The SFCDR as it passes through the Box is included in OU 3 and is discussed above. Until recently, OU 2 monitoring goals have focused on evaluating the tributaries with respect to compliance with AWQC, potential impacts to SFCDR from these tributaries, and evaluating the cumulative effect of Phase I remedial actions. A statistical summary of monitoring results for cadmium, lead and zinc collected from selected tributaries during the five-year period (2009 to 2013) is presented in Table 2-1.

2.5.2.2 Key Findings

During the period from 2009 to 2013, median dissolved cadmium and zinc concentrations continue to exceed the AWQC at all monitoring stations, with the exception of Grouse and Pine Creeks where zinc concentrations fall below the AWQC. Mean streamflow-weighted concentrations and load estimates require streamflow information that is not collected at these stations. However, Table 2-1 indicates that the largest source of cadmium and zinc to the SFCDR in the reach between Kellogg and Smelterville is represented by the seeps north of the CIA (BH-CS-0001). These seeps most likely reflect groundwater concentrations at the interface with the SFCDR. Of the remaining stations, Milo Creek, Bunker Creek, and Government Gulch contribute the most cadmium and zinc. Milo Creek is the largest source of lead. A Mann-Kendall trend test was performed on all stations with at least 15 data points between 2002 and 2014. All stations show a significant decreasing trend for cadmium, lead, and zinc with the notable exception that the seeps north of the CIA show an increasing trend for cadmium.

2.5.2.3 Progress Toward Remedial Action Objectives

Decreasing concentration trends at most OU 2 monitoring stations indicate that progress is being made toward RAOs. Increased concentrations at the seeps north of the CIA will be addressed by the groundwater collection and treatment system scheduled for construction in 2016.

TABLE 2-1
Statistical Summary for Selected Constituents in Water Samples Collected from 15 OU2 Surface Water Stations, 2009-13
2015 Five-Year Review, Bunker Hill Superfund Site

OU2 Station Name	OU2 Station Number	Statistic	Dissolved Cadmium (µg/L) AWQC* 0.62 (µg/L)	Total Cadmium (µg/L)	Dissolved Lead (µg/L) AWQC* 14.7 (µg/L)	Total Lead (µg/L)	Dissolved Zinc (µg/L) AWQC* 123 (µg/L)	Total Zinc (µg/L)
Milo Creek Outfall at SFCDR at Kellogg, ID	BH-MC-0002	Number	10	10	10	10	10	6
		Minimum	1.0	1.0	21	31	160	160
		Maximum	9.7	9.9	150	270	3,600	3,500
		Median	2.4	2.4	46	110	630	190
Bunker Hill Mine Yard Seep East Pipe at Kellogg, ID	BH-MY-0001	Number	10	10	10	10	10	10
		Minimum	1.0	1.1	1.9	5.1	140	150
		Maximum	4.3	4.2	12	26	730	720
		Median	2.1	2.2	3.8	12	340	340
Portal Gulch Drainage West Pipe at Kellogg, ID	BH-PG-0001	Number	6	6	6	6	6	6
		Minimum	1.9	2.0	9.8	7.1	140	140
		Maximum	51	51	42	51	3,900	3,500
		Median	2.6	2.7	19	23	180	190
Railroad Gulch above McKinley Avenue at Kellogg, ID	BH-RR-0001	Number	5	5	5	5	5	5
		Minimum	17	17	1.0	5.1	560	580
		Maximum	23	24	5.2	24	800	870
		Median	21	21	1.2	14	760	780

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Deadwood Gulch Creek at Kellogg, ID	BH-DW-0001	Number	10	10	10	10	10	10
		Minimum	1.1	1.3	1.5	1.7	180	180
		Maximum	2.9	2.9	23	56	390	400
		Median	1.7	1.8	3.4	8.6	270	270
Magnet Gulch Creek at Tailings Pond at Kellogg, ID	BH-MG-0001	Number	10	10	10	10	10	10
		Minimum	19	20	0.61	0.81	720	710
		Maximum	68	66	4.4	10	1,900	1,900
		Median	39	41	1.4	2.1	1,400	1,500
Bunker Creek at Mouth of Culvert at Kellogg, ID	BH-BC-0001	Number	10	10	10	10	10	10
		Minimum	8.6	9.0	0.20	0.69	600	600
		Maximum	30	28	4.4	6.6	2,400	2,400
		Median	17	17	1.0	2.2	1,300	1,300
Seeps North of Deadwood Gulch Tailings at Kellogg, ID	BH-CS-0001 and 0002	Number	10	10	10	10	10	10
		Minimum	69	73	0.23	0.27	11,000	9,800
		Maximum	230	250	1.0	5.9	25,000	27,000
		Median	130	160	1.0	1.0	17,000	17,000

TABLE 2-1
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2015 Five-Year Review, Bunker Hill Superfund Site

OU2 Station Name	OU2 Station Number	Statistic	Dissolved Cadmium (µg/L) AWQC* 0.62 (µg/L)	Total Cadmium (µg/L)	Dissolved Lead (µg/L) AWQC* 14.7 (µg/L)	Total Lead (µg/L)	Dissolved Zinc (µg/L) AWQC* 123 (µg/L)	Total Zinc (µg/L)
Government Gulch Creek below Plant near Smelterville, ID	BH-GG-0008	Number	10	10	10	10	10	10
		Minimum	9.9	11	1.3	2.7	450	470
		Maximum	79	76	6.0	13	3,000	2,600
		Median	47	46	2.7	5.8	1,700	1,800
Government Gulch Creek at SFCDR, ID	BH-GG-0004	Number	10	10	10	10	10	10
		Minimum	11	12	1.4	2.5	490	520
		Maximum	84	72	7.8	66	3,300	2,900
		Median	44	43	2.3	5.1	1,700	1,600
Government Gulch Creek near Mouth at Smelterville, ID	BH-GG-0001	Number	10	10	10	10	10	10
		Minimum	12	12	0.50	1.3	490	550
		Maximum	55	57	6.6	19	2,000	2,300
		Median	35	36	2	12	1,300	1,400
Grouse Creek at Smelterville, ID	BH-GC-0001	Number	2	2	2	2	2	2
		Minimum	0.21	0.32	0.07	4.4	30	53
		Maximum	0.50	0.53	5.0	5.8	89	95
		Median	0.36	0.42	2.5	5.1	60	74

TABLE 2-1
Statistical Summary for Selected Constituents in Water Samples Collected from 15 OU2 Surface Water Stations, 2009-13
2015 Five-Year Review, Bunker Hill Superfund Site

OU2 Station Name	OU2 Station Number	Statistic	Dissolved Cadmium (µg/L) AWQC* 0.62 (µg/L)	Total Cadmium (µg/L)	Dissolved Lead (µg/L) AWQC* 14.7 (µg/L)	Total Lead (µg/L)	Dissolved Zinc (µg/L) AWQC* 123 (µg/L)	Total Zinc (µg/L)
Humboldt Creek above Lagoon near Smelterville, ID	BH-HC-0001	Number	10	10	10	10	10	10
		Minimum	2.4	1.0	0.52	1.8	570	580
		Maximum	4.5	4.3	4.1	100	1,000	1,100
		Median	3.0	3.2	2.4	13	710	750
West Page Swamp Outfall at Pinehurst, ID	BH-WP-0001	Number	5	5	5	5	5	5
		Minimum	0.12	0.45	2.4	9.0	220	280
		Maximum	1.0	1.4	8.1	28	700	770
		Median	1.0	1.0	3.9	15	570	660
Pine Creek at SFCDR near Pinehurst, ID	BH-PC-0001	Number	10	10	10	10	10	10
		Minimum	0.09	0.09	0.17	0.46	48	53
		Maximum	1.0	1.0	6.1	20	130	160
		Median	1.0	1.0	1.0	1.0	56	57

* SFCDR-specific chronic AWQC, as specified in ADAPA 58.01.02.284, which is a function of hardness and calculated at a hardness of 50 mg/L as calcium carbonate ($CaCO_3$).

2.5.2.4 Program Updates

As part of the BEMP optimization, each OU 2 surface water station was evaluated. Starting in 2015, monitoring has been discontinued pending further data analysis at those Phase I remedy locations where the data indicate decreasing or no trend over time. The program was also streamlined to discontinue monitoring if a station was redundant with other monitoring programs (i.e., Page Repository and A-4 Gypsum Pond) or if there was insufficient flow during the base flow sampling event. Monitoring two times per year was retained at the north CIA seeps and at three stations (Milo Creek Outfall, Bunker Creek near the mouth, and Government Gulch near the mouth). These stations measure the more significant contributions of metals to the SFCDR and some will monitor Phase II remedy effectiveness of the groundwater collection and treatment system. The frequency and location of OU 2 surface water sampling will be adaptively managed throughout implementation of the Phase II remedy.

2.5.3 Sediment

2.5.3.1 Monitoring Activities

Focused sediment sampling under the BEMP began in 2008 for filling data gaps in the Lower Basin Enhanced Conceptual Site Model (ECSM). The ECSM provided the data needed for developing hydraulic and sediment transport models. Sampling has included high-volume suspended sediment sampling to allow measurement of particle size distribution and metals content by size fraction at 12 locations in the Upper and Lower Basins (including key tributaries). Sampling has also included collection of depositional sediment for similar data at 22 locations, including 16 locations within or near the river channel, and 6 locations in wetlands or lateral lakes.

It should be noted that the surface water sampling described in Section 2.5.1 included collection and analysis of suspended sediment, providing data on suspended sediment concentration and the concentration of metals in the sediment. The sampling and data described in this section also include suspended sediment concentration and bulk metals data from the high-volume sampling, and data from both BEMP efforts (water quality and sediment) are combined and used as an expanded dataset to support modeling efforts and the Lower Basin ECSM. However, for consistency and comparability, the findings summarized here specifically address data related to the high-volume suspended sampling.

Annual summary reports of the BEMP sediment data have been prepared for WYs 2011, 2012, 2013, and 2014; each is titled *Water Year 201X BEMP Sediment Sampling Data Summary.* These reports contain data summaries from each water year as well as cumulative data for some parameters (primarily lead concentrations). A more detailed summary of the sediment data obtained during this period is presented in, *Five-Year Data Summary, BEMP Sediment Monitoring Program, Water Years 2010-2014* (CH2M HILL, 2015).

Suspended Sediment

High-volume suspended sediment samples were collected at seven locations in the Upper Basin, including five locations on the SFCDR (Shoshone Park, Wallace, Elizabeth Park, Smelterville, and Pinehurst), and the mouths of Canyon and Ninemile Creeks. Samples were also collected at four locations in the Lower Basin, including the mouth of the Latour Creek, and three locations on the Coeur d’Alene River (Cataldo, Rose Lake, and Harrison), as well as the mouth of the NFCDR at Enaville. Samples were collected as close to peak flood flow conditions as possible, targeting large (bank full or greater) winter floods and spring runoff. Sampling was targeted to occur within 2 days, with more upstream sites generally conducted on the first day to account for the delay of peak flow conditions in the Lower Basin.

Samples were filtered in the laboratory to obtain suspended sediment concentration, and sieved to separate sediment into size classifications to obtain data on mass and metals by size class. Metals analyses included arsenic, cadmium, copper, lead, mercury, silver, and zinc. Data were reported for three size classes (bulk, fine sand, and silt/clay), with an additional size class break between fine sand and very fine sand added for WY 2014. Data on river flow and current velocity were obtained from USGS gages or, if none were present, velocity meters.

Data are used to assess temporal and spatial patterns of suspended sediment concentration and metals, including metals by particle size class. Data are also used to calculate the amount of lead and other metals being transported (known as flux, load, or discharge) and to assess data variability as a function of flood magnitude (flow rate), as well as flood type. Winter floods, flowing into relatively empty lakes, tend to have steeper gradient and higher velocities than longer-lasting spring floods, during which lake levels are typically higher.

Depositional Sediment

Depositional samples were collected at 22 locations, with 5 sites in the Upper Basin and 17 in the Lower Basin. Most samples were collected at locations in or near the channel banks, where stakes were used to measure depths of deposition (or erosion), allowing collection of material that had been deposited within that water year. All sampling locations in the Upper Basin, and 11 in the Lower Basin, were sampled in this manner. Samples were also collected at six off-channel areas from horizontal “tiles” on which sediment was deposited during overbank flooding.

All depositional samples were analyzed for particle grain size distribution, and metals (arsenic, cadmium, copper, lead, mercury, silver, and zinc) in each size class (bulk, fine sand, and silt/clay). An additional size class break between fine sand and very fine sand was added in analyses for WY 2014.

2.5.3.2 Key Findings

Suspended Sediment

Samples collected at Harrison, where the Coeur d’Alene River discharges to Coeur d’Alene Lake, showed the highest average suspended sediment concentration, lead concentrations (in the mainstem) and lead flux (all by significant margins). These parameters generally increased in the downstream direction below the confluence of the SFCDR and the NFCDR. Conditions at Cataldo reflect the dilution of sediment from the SFCDR (averaging 2,225 mg/kg lead at Pinehurst), with lower concentrations from the NFCDR (averaging 214 mg/kg at Enaville), though flood flows in the NFCDR averaging 4 to 5 times those of the SFCDR. Lead concentrations at Cataldo averaged 1,045 mg/kg, and increase downstream as more contaminated sediment is re-suspended from historical deposits in the riverbed (and to a lesser degree, river banks). As a result, the mean concentration of lead at Harrison (3,649 mg/kg) is significantly higher than the mean concentration at Cataldo. The finer fractions of sediment have higher concentrations of lead than bulk mixtures, with the fine-to-very-fine sand fraction showing the highest concentrations at Cataldo and Rose Lake, and the silt/clay fraction showing the highest concentrations at Harrison. The proportion of suspended sediment load represented by each size class is highly variable as a function of the variability of the flowrate and flow gradient.

Lead flux (also known as load or discharge) is the product of lead concentration, suspended sediment concentration, and flow, and provides an indication of the amount of lead being transported at a given location. This parameter is important because while high concentrations of lead or suspended sediment concentration in tributaries may be significant at specific locations, the higher river flow rates below the confluence are able to convey much larger masses of lead through and out of the Lower Basin. The highest average single-day flux during the reporting period was 35.5 tons/day at Harrison, compared with 3.25 tons/day at Cataldo, and 2.16 tons/day at Pinehurst.

A number of factors contribute to data variability in suspended sediment data, including the range of peak river flows, the location of sampling, the timing of sampling relative to peak flow, the gradient of the river (influenced by levels of the receiving water in Coeur d'Alene Lake), and inherent variability associated with sampling methods. Peak flows at Cataldo, for flood events sampled during water years 2011-2014, ranged from 12,800 to 33,000 cfs (1- to 6-year recurrence intervals, respectively). The correlation of suspended sediment concentration to flow was highest at Cataldo (R2 = 0.85, where the riverbed includes armoring gravels and cobbles) and lowest at Harrison (R2 = 0.0.54, in a sand bed section with variable flow gradients). No temporal trend was apparent during the reporting period, as the number and range of other variables affecting the dataset is large.

Depositional Sediment

Concentrations of lead in near-channel depositional samples generally follow a similar pattern to that observed with suspended sediment. However, although concentrations in suspended sediment generally increase in the downstream direction, lead concentrations in the depositional dataset decrease at Harrison rather than increase as they do with the suspended dataset. Average concentrations of lead in bulk depositional samples were 2,164 mg/kg near the Cataldo dredge site, increased to about 4,000 mg/kg near Dudley, but dropped to 2,399 mg/kg near Harrison. The ecological risk cleanup level for lead in soil and sediments is 530 mg/kg. The decrease in lead in the bulk samples between Dudley and Harrison reflects a higher proportion of sands (with lower concentrations of lead than the fine fraction) than samples further upstream. The silt/clay fraction of depositional samples at Harrison ranged between 4 and 17 percent of the sample mass, with lead concentrations averaging about 6,300 mg/kg, compared with 2,399 mg/kg for bulk samples; therefore, changes in particle size distribution of deposited material (controlled by flow rates and flood type) can significantly affect the bulk lead concentrations. Lead concentrations in depositional sediment at Harrison is generally less variable than in suspended sediment from the same location, with depositional sediment ranging between 2,030 and 3,650 mg/kg lead, compared with a range of 1,550 to 4,900 mg/kg for suspended sediment samples. The difference is assumed to reflect the higher proportion of fines comprising the suspended load, relative to coarser material deposited within the channel banks. The higher sand content deposited at Harrison may reflect the steeper flow gradients at the mouth of the river, though the reason for this pattern is not yet known.

Concentrations of lead in off-channel areas, measured on tiles, ranged between 1,664 mg/kg at Strobl Marsh to 4,614 mg/kg at Anderson Lake. Most of the sample material from off-channel samples consists of silt and clay size fractions. The variability of conditions at these sampling locations makes comparison among them difficult. A sediment transport model is being developed to assist in evaluating sediment deposition patterns in the floodplain.

The thickness of deposited sediment was measured at sampling sites. While the primary purpose of these measurements was to ensure that samples were collected from depth intervals reflecting sediment from that water year, they also provide indications of relative rates of deposition and erosion. The Harrison station had the highest rates of both deposition (30 centimeters) and erosion (-13.2 centimeters), significantly higher than the range of all other near-channel sites (18 to -10 centimeters). As noted previously, this may reflect higher current velocities near Harrison during certain flood conditions. The deposition rates on tiles averaged about 5 millimeters, ranging from 1 to 16.6 millimeters.

2.5.3.3 Progress toward Remedial Action Objectives

The number of variables affecting measurement of suspended and depositional sediment data, as noted above, make identifying and evaluating trends in sediment transport and metals concentrations difficult. Given the current understanding of the conceptual site model, approximately 80 percent of the lead loading in the Lower Basin originates from erosion of sediment from the riverbed; only 11 percent is attributed to inflow from the SFCDR. Remedial actions in the Lower Basin riverbed are likely necessary before significant and measureable reductions in lead concentrations and loading are observed in monitoring data.

2.5.3.4 Program Updates

Revisions were made to the BEMP sediment sampling program during the reporting period to improve the resolution of data and the efficiency of the data collection program, as the need for focused sediment sampling to address data gaps in the ECSM has decreased. Starting WY 2015, high volume sediment sampling has been reduced to hydrograph events with flows exceeding 25,000 cfs at Cataldo. The USGS water quality monitoring program will continue to include suspended sediment concentration and bulk metals sampling and will have an additional water quality station at Rose Lake. Currently, USEPA is working to define the sediment baseline dataset and monitoring objectives, and update data quality objectives.

2.5.4 Groundwater

The 1992 OU 2 ROD requires water quality monitoring to evaluate compliance with groundwater ARARs (maximum contaminant levels [MCLs]) as well as potential impacts to SFCDR water quality and to evaluate the performance of remedial actions. Since 2004, IDEQ has administered groundwater monitoring in accordance with the OU 2 EMP. In 2014, optimization of the groundwater monitoring program began in an effort to integrate groundwater monitoring into the BEMP.

2.5.4.1 Monitoring Activities

The groundwater monitoring network stretches from the eastern OU 2 boundary, near Elizabeth Park, to the western boundary near Pinehurst Narrows. Monitoring events take place during the spring and fall of each year to collect data during high and low flow conditions. During the spring of 2010 to 2014, samples were collected from 74 sites, which include a combination of wells and piezometers. During the fall of 2010 to 2013, samples were collected from 88 sites. Optimization efforts during the summer of 2014 reduced the fall 2014 sampling event to 71 sites. During all events, field parameters were collected and samples underwent laboratory analysis for a number of dissolved metals at all sites and total phosphorus at select sites.

2.5.4.2 Key Findings

The OU 2 groundwater network is subdivided into decision units based on transects and areas of past remedial actions. To assess groundwater conditions, statistical analysis was performed for 61 sites using groundwater data for dissolved cadmium and zinc collected between October 2002 and October 2014. Results are summarized in the *Operable Unit 2 Groundwater Annual Data Summary Report for Calendar Year 2014* (IDEQ, 2015). This timeframe represents the post-Phase I remedial action implementation period. For 36 of these 61 sites, previous statistical analysis of OU 2 groundwater data was completed for October 2002 to October 2009, as summarized in *Statistical Analysis of Groundwater Monitoring Data for Operable Unit 2* (CH2M HILL, 2012a). The purpose of this analysis is to establish baseline information for the optimization efforts and continue to maintain long-term groundwater quality information.

Analyses included trends over time, median MCL ratios (to compare the median concentration to the contaminant MCL), and interpretation of a current condition for each site based on the trend and ratio. Current conditions include the following: Not Improving (no statistically significant trend and ratio is greater than 1), Improving (decreasing trend and ratio is greater than 1), Caution (increasing trend and any ratio), and Stable (no statistically significant trend or decreasing trend and ratio less than or equal to 1). For sites with not improving or caution conditions, the short-term goal is transition to an improving condition (a decreasing trend). The target end goal for all sites is an improving or stable condition. The following discussion describes the results across OU 2; however, this interpretation is limited based on the location and number of sites included in this analysis.

2.5.4.3 Progress toward Remedial Action Objectives

Groundwater statistical results are summarized in Table 2-2. For comparison purposes, this table only shows percentages using the 36 sites analyzed during both periods (2002 to 2009 and 2002 to 2014). Overall, 27 of the sites showed no change in trend between the two periods. The percentage of sites showing improving conditions increased because trends in five sites for cadmium and three sites for zinc changed from no statistically significant trend to a decreasing trend. Decreasing or increasing trends are only included for sites with statistically significant trends. The percentage of caution sites increased because three sites for both cadmium and zinc changed from no trend to an increasing trend. Conditions across all of OU 2 are described as follows.

TABLE 2-2
Summary of Groundwater Statistical Results
2015 Five-Year Review, Bunker Hill Superfund Site

Current Condition		Not Improving	Improving	Caution	Stable
Cadmium	2002-2009	25%	28%	14%	33%
	2002-2014	14%	36%	22%	28%
Zinc	2002-2009	36%	19%	8%	36%
	2002-2014	31%	22%	14%	33%

For both periods, current conditions for both cadmium and zinc are stable in the one site analyzed upgradient of OU 2 (Transect 1). This site represents background conditions for groundwater flow entering OU 2. Within the easternmost portion of OU 2, a single unconfined aquifer is present. Transition to an upper and lower aquifer occurs to the west and upgradient of the CIA (upgradient of Transect 2). The upper, unconfined aquifer is associated with the mainstem SFCDR valley and defined by the presence of the underlying fine-grained confining unit. The lower, confined aquifer is associated with the mainstem SFCDR valley and defined by the presence of the overlying confining unit.

Most of the sites included in this analysis (39 of 61 sites) are located near the CIA (Transect 2 to 3), downgradient of the CIA (Transect 3 to 5), near the Smelter Closure Area (SCA), and near Transect 4. The highest median contaminant ratios compared to the MCL for cadmium in all of OU 2 are located within this area, including peak ratios of 99.8 between Transects 2 to 3, 85.2 between Transects 3 to 5, 192.0 for the SCA, 60.6 near Transect 4, and 896.0 in the upper part of Government Creek. Zinc within this area also had the highest ratios for OU 2, including peak ratios of 4.9 between Transects 2 to 3, 5.3 between Transects 3 to 5, 1.7 for the SCA, 3.7 near Transect 4 and 16.7 in the upper part of Government Creek. Over the last five years, most sites have shown no change in condition or have changed to improving. Exceptions include a change to caution for cadmium at three sites and zinc at two sites. In addition, one site changed to stable for zinc. Construction and operation of the GWCS will target improving groundwater conditions near and downgradient of the CIA. As for the vicinity of Transect 4, remedial actions for Government Creek were previously determined to be of lower priority because actions in this area would provide significantly less reduction in dissolved metals loading to surface water when compared to remedial efforts in other areas of OU 2 and OU 3 (USEPA, 2013).

Throughout OU 2, several upland tributary groundwater systems, located in the gulches and hillsides of the SFCDR valley floor, discharge directly to the single unconfined aquifer or upper aquifer. Conditions associated with two tributaries to Bunker Creek, located south of the CIA, show improving conditions for cadmium (Deadwood and Magnet Gulch), stable conditions for zinc (Deadwood Gulch), and not improving conditions for zinc (Magnet Gulch) from 2002 to 2014; however, interpretation of these conditions are limited by only one site analyzed within each of these gulches. Over the last 5 years, cadmium changed from not improving to improving at the one site in Deadwood Gulch. No comparisons were made for Magnet Gulch.

From Smelterville Flats to downgradient of the Page Repository (Transect 5 to 6), upper aquifer conditions were analyzed in seven sites from 2002 to 2014. Conditions for cadmium are not improving in three sites, improving in three sites, and stable in one site with ratios ranging from 0.6 to 16.2. Conditions for zinc are not improving in two sites, improving in one site, and stable in four sites with ratios ranging from 0.04 to 1.8. Over the last five years, cadmium changed from improving to not improving at one site and zinc changed from improving to stable at one site.

Confluence with the Pine Creek groundwater system is present in the westernmost section of OU 2. Conditions above the confluence (Transect 6) are monitored in one upper and one lower aquifer site. From 2002 to 2014, conditions are stable in both sites for cadmium and in the lower site for zinc (ratios ranging from 0.1 to 0.5); while improving for zinc in the upper site (a ratio of 1.1). Over the last five years, zinc at this upper site changed from not improving to improving.

Below the confluence, which represents groundwater flow exiting the OU 2 boundary (Transect 7), conditions are monitored at two upper and two lower aquifer sites. From 2002 to 2014, conditions are stable in three sites for cadmium (one upper and two lower) and two sites for zinc (one upper and one lower), with ratios ranging from 0.002 to 0.2. One upper site below the confluence is improving for cadmium (a ratio of 1.1); while one upper and one lower site are caution for zinc (ratios of 0.007). Over the last 5 years, one site changed from not improving to improving for cadmium and one site changed from stable to caution for zinc.

2.5.4.4 Program Updates

As part of ongoing optimization efforts in 2014, USEPA reduced groundwater monitoring frequencies to 27 sites during spring events, 59 sites during fall events, and 12 additional sites on a 5-year basis during the fall event. In addition, the analyte list was reduced to include only the contaminants identified in the 2012 ROD Amendment at all sites and total phosphorus at select sites. Mercury will be analyzed on a 5-year timeframe. Presently, an OU 2 groundwater quality assurance project plan is being prepared to integrate the optimized groundwater monitoring program into the BEMP. USEPA is also preparing a GWCS remedial action effectiveness plan, which will identify monitoring objectives for estimating dissolved metal loads to the SFCDR, determining remedy performance and effectiveness, and evaluating long-term response to the collection system operations. The GWCS remedial action effectiveness plan will include a statistical analysis of data collected to date to establish baseline groundwater concentrations. For sites where the baseline is established, monitoring will be discontinued until after construction of the GWCS remedy. Post construction monitoring frequencies will be determined based on the need for measuring remedial effectiveness and long-term monitoring objectives.

2.5.5 Biological Resources

2.5.5.1 Monitoring Activities

Biological monitoring is being conducted by USFWS. USFWS monitored the following during this Five-Year Review period:

- Lacustrine/Palustrine Habitat
  - 2010-2014: Waterfowl- Population/ Swan Mortality
  - 2013: Fish Exposure Bullhead- Liver Tissue Metals
  - 2013: Waterfowl- Blood Lead
- Riparian Habitat
  - 2010-2014: Songbirds
  - 2011: Songbirds- Blood Lead
  - Long-term and Pre-Remedial monitoring
- Upland Habitat
  - 2014: Small Mammals

2.5.5.2 Key Findings

Lacustrine/Palustrine Habitat

Waterfowl Surveys/Tundra swan mortality

Annual spring waterfowl surveys from 2010 to 2014 increased the understanding of how natural weather variability and associated hydrology affects waterfowl wetland use in the Basin.

Water levels throughout the Basin are important for waterfowl feeding and determine food accessibility during spring migration. During spring flooding events, waterfowl feeding habitat becomes inundated with water, limiting access to food sources. During these times, waterfowl are attracted to areas within the Basin where food is accessible and available. Understanding when and where waterfowl feed throughout the Basin is important for developing strategies for reducing waterfowl lead exposure and mortality during migration. High-waterfowl-use wetlands continue to include lead-contaminated Canyon Marsh, Cave Lake, Lane Marsh, and Harrison Slough; however, feeding areas shift within and among these wetlands depending on water levels and subsequent accessibility of preferred food types. Understanding the annual fluctuations among and within high-use feeding areas enables the USEPA and partners to develop strategies to assist with the overall goal of providing clean feeding waterfowl habitat and reducing exposure to lead.

Spring flood conditions in 2014 provided a clear example of how the Basin hydrology affects wetland use for feeding waterfowl. The agriculture-to-wetland conversion project easement has supported some of the highest overall waterfowl use and diversity from 2008-2013, although, swan use was limited until 2014 (see section 5.2.7). In 2014, early spring flooding coincided with an atypical shift in swan use from flooded Lane Marsh to clean feeding habitat provided at the Agriculture-to-Wetland Conversion Project (Schlepp remedial action pilot project). Control of water levels on the easement allow for creation of optimum feeding conditions in clean habitat. Results from weekly 2014 waterfowl surveys not only documented water level management and swan attraction techniques, but also captured how flooding is a useful strategy to deter waterfowl use of contaminated wetlands. Annual waterfowl surveys allow USEPA to monitor behavior and document shifts in use of specific wetlands and wetlands Basin-wide during spring migration.

Waterfowl exposure and mortality will continue as long as there is continued exposure to lead-contaminated sediment moving through the Basin and until sufficient clean feeding habitat is provided. Additional clean habitat providing ample preferred food types for waterfowl is essential to reducing lead exposure and mortality. Annual swan mortalities typically increase when high-water transport of contaminated sediments onto the floodplain is followed by high numbers of swans feeding in the Basin for an extended period. In further support of this trend, only one dead swan was observed in 2014 when relatively fewer swans stopped to feed in the Basin for only a few days. Feeding occurred in clean habitat provided by the Schlepp Project, reducing lead exposure and mortality before continuing migration north.

Annual waterfowl surveys continue to provide information on the relationship between water levels and preferred food sources for waterfowl throughout the Basin. Understanding the annual and seasonal fluctuation of waterfowl use within the Basin, and within wetlands, is imperative to successfully providing clean feeding habitat and reducing exposure. Additional strategies under development using waterfowl survey data will inform the formation of waterfowl attraction techniques (e.g., planting preferred food types) and areas where additional clean feeding habitat can be established through remediation/restoration, remediation/enhancement, or enhancement.

Fish Exposure

Biological resource monitoring within lacustrine and palustrine habitats in the Lower Basin has not included monitoring fish exposure to contaminated sediments. This lack of information on fish exposure was identified as a data gap for the BEMP and brown bullhead were sampled in 2013 by the USFWS to address this concern. Brown bullhead liver metals concentrations were elevated throughout much of the study area indicating they are sensitive bioindicators of widespread metals contamination within lacustrine and palustrine habitats. Bullhead liver lead concentrations generally followed sediment lead concentration gradients, with the highest lead concentrations found in livers from fish in the most contaminated lakes and wetlands (USFWS, 2015 in progress). Concentrations of arsenic, cadmium, and zinc co-varied with lead concentrations. Strong correlations were evident for cadmium, but sediment concentrations for these metals were lacking for a more complete analysis. The USFWS did not evaluate the contribution of metals (arsenic, cadmium, lead, and zinc) from water and dietary pathways as part of this study. It is unknown how much these pathways contributed to bioavailable metals concentrations reported within bullhead liver tissues. However, bullhead liver metals concentrations do reflect the integrated pathway exposure of bullhead to bioavailable metals within lake and wetland habitats. Therefore, bullhead liver metals concentrations may be used to determine if remedial actions are reducing bioavailable metals exposure to aquatic receptors.

Part of the selected remedy for OU 3 focuses on cleaning up sediments in the portions of the lateral lakes where the water depth is 6 feet or less. These water depths represent the high-use feeding areas for brown bullhead and other aquatic dependent species and, consequently, the areas of greatest exposure. The brown bullhead has been identified by the USFWS as the best aquatic indicator species for the ecological health of the lakes. Another interval of sampling is recommended to augment this dataset, which will provide more certainty in evaluating future reductions in metals exposure to aquatic receptors because of Basin-wide remedial activities.

Waterfowl Blood Lead

Blood lead concentrations in Basin waterfowl show continued exposure at concentrations that may result in injury, including mortality, but datasets are limited in size and geographic scope. Over the past two decades, blood lead concentrations have not declined within wetlands such as Thompson Marsh where long-term datasets exist. However, comparable long-term datasets are limited to Thompson Marsh, Campbell Marsh, and Schlepp's East Field. Based on these data, waterfowl blood lead concentrations continue to exceed toxicity thresholds, resulting in injury to migratory waterfowl at un-remediated sites. However, mean waterfowl blood lead concentrations have decreased by 30 percent within the remediated Schlepp's East Field and long-term data continue to demonstrate the efficacy of this pilot project in terms of reducing lead exposure in waterfowl by providing clean feeding habitat within the Lower Basin.

Riparian Habitat

2010-2014 Songbird Surveys- Monitoring Avian Productivity and Survivorship

The 2010-2014 Monitoring Avian Productivity and Survivorship (MAPS) study was developed to compare songbird use, productivity, and survivorship between Smelterville Flats in OU 2 and an uncontaminated reference site along NFCDR. This study was established to determine if songbird lead exposure manifests into discernible population-level effects and to evaluate the protectiveness of the selected remedy in OU 2. Adverse health effects are suspected to occur in ground-feeding songbirds (e.g., song sparrows) on Smelterville Flats, as soil lead concentrations remain above the cleanup level of 530 mg/kg level protective of ground-feeding species. A variety of songbirds breeds in the post-remedial habitat at Smelterville Flats. However, yearly songbird return rates, as well as song sparrow abundances, were lower at Smelterville Flats than those observed at the reference site (USFWS, 2015 in progress), suggesting decreased rates of survival and recruitment at Smelterville Flats. However, songbird return rates were relatively low at both sites, and even under favorable conditions, only 30 percent of birds can be expected to return and be recaptured using the MAPS protocol (Nur et al., 1999). Because estimates of year-to-year survival are based on relatively few mark-recaptures and affected by many other factors, the MAPS protocol does not appear to be the most efficient method of evaluating songbird lead exposure and protectiveness of selected remedies under the BEMP.

2011: Songbirds- Blood Lead

Results of the 2011 blood collection demonstrated that representative songbirds using contaminated riparian habitats in the Basin continue to be exposed to and accumulate lead at concentrations above toxicological thresholds (USFWS, 2014). Songbird blood lead concentrations in birds from the reference sites (North Fork and Little North Fork of the Coeur d'Alene River) were low with mean lead concentrations at background levels. Of the three songbird species targeted for blood collection (American robin, song sparrow, and Swainson's thrush), the American robin sample size was too small for comparison and Swainson's thrush had the lowest blood lead levels (background levels) across all sites, consistent with results obtained by Hansen (2007). Song sparrows collected from Springston showed 20 percent of the birds had blood lead levels in the sub-clinical range, as categorized by Fransen and Pain (2011). Forty percent of Osburn song sparrows showed sub-clinical blood lead levels, 40 percent clinical levels, and 20 percent severe clinical levels (USFWS, 2014). The three American Robins sampled from Osburn had blood lead concentrations in the clinical toxicity category. Mean blood lead concentrations of all songbirds were highest at Osburn, 3.3 mg/kg. Mean soil lead concentrations at contaminated sites ranged from 339 to 1,260 mg/kg with the highest mean concentrations at Osburn. Considerable variability in soil lead concentrations were observed among net locations, particularly at Osburn, as shown by high standard deviations associated with the means. Concentrations of songbird blood lead and corresponding soil lead concentrations from net locations at contaminated sites were not significantly correlated ($P = 0.44$) (USFWS, 2014).

Based on the results of the 2011 blood collection and those by Hansen (2007), Swainson's thrush may not be a suitable bioindicator for evaluating riparian exposure to metals of concern. This is due primarily to feeding behavior at greater heights than American robin and song sparrow, gleaning insects from foliage, capturing insects from the air, and foraging on berries (Mack and Young, 2000; Hansen, 2007). As remedial actions are implemented and other factors such as natural attenuation and habitat changes occur, songbird exposure to lead should be reduced.

Habitat Assessment

In 2014, the riparian vegetation monitoring study was incorporated into the aquatic habitat assessment designed to include additional habitat measurements enhancing stream habitat characterization. Riparian vegetation data was collected at locations where riverine habitat assessments were conducted. Riparian habitat assessment included horizontal pattern, vertical structure, and vegetation types within 30 meters of the water's edge. The assessment defined habitat conditions known to effect quality of water and aquatic resources.

Previously, in 2006, the USFWS monitored riparian vegetation at four locations (Ninemile Creek, Pine Creek, South Fork (Osburn), and Lower Basin [Springston]) to provide baseline information that could be used to evaluate progress towards meeting ecological benchmarks of the Selected Remedy. At that time, a larger-scale vegetation monitoring effort (e.g., using geographic information system [GIS]) was identified to more effectively assess the long-term status and trends of Basin-wide riparian health as it pertains to metals contamination. This approach would require substantive effort, and is not as practical as monitoring floodplain soil to evaluate reduced metals toxicity in riparian habitats. Therefore, in 2014, the decision was made to conduct only riparian vegetation monitoring at aquatic habitat assessment locations aiding in the evaluation of a more comprehensive riverine habitat assessment to determine its capability of supporting a functional ecosystem.

Long-Term Monitoring

Aquatic habitat data at long-term monitoring locations were collected in 2013. In addition to the SFCDR and tributary locations sampled in 2005 and 2006 a reference location was added on the Little NFCDR. In 2013, the aquatic habitat assessment included riparian vegetation data collection to enhance the evaluation of physical condition measures. Fish, benthic macroinvertebrate (BMI), and periphyton diversity and abundance surveys were conducted. BMI and periphyton samples were taxonomically sorted, identified, and metrics were calculated. Fish and BMI samples were collected for tissue concentrations of lead, arsenic, cadmium, and zinc. Aquatic habitat and indicator species data were collected in 2013 to meet IDEQ's Beneficial Use Reconnaissance Program (BURP) requirements (IDEQ, 2012a). All applicable data were entered into IDEQ's BURP database. The data are available for inclusion in the statewide water quality program. Long-term aquatic data collection is considered early pre-remedial data; it establishes baseline ecological conditions prior to future remedial actions in the Basin.

Remedial Effectiveness Monitoring

Pre-remedial ecological resource monitoring was conducted during 2012 to 2014 in East Fork Ninemile and Canyon Creeks. Monitoring locations are downstream of the primary loading sources. Riverine habitat and aquatic resource data was collected at locations upstream of identified clean-up sites to act as reference conditions for monitoring locations below areas targeted for remediation. Post-remedial monitoring will evaluate ecological changes in downstream monitoring locations of remedial activities as they compare to the reference location.

Aquatic habitat assessment included riparian vegetation data collection to measure the physical condition of designated reaches prior to remedial activities. Fish, BMI, and periphyton diversity and abundance surveys were conducted to establish pre-remedial aquatic resource conditions. Fish and BMI samples were collected and analyzed by USEPA's Manchester Environmental Laboratory for tissue concentrations of lead, arsenic, cadmium, and zinc. As with long-term monitoring, aquatic habitat and indicator species data were collected to meet IDEQ's BURP requirements (IDEQ, 2012a). All applicable data were entered into IDEQ's BURP database. The data are available for inclusion in the statewide water quality program.

Habitat and indicator species pre-remedial data for East Fork Ninemile and Canyon Creeks show decreasing ecological conditions at downstream locations as additional elevated concentrations of metals enter the systems. East Fork Ninemile Creek habitat conditions are good to fair at all monitoring locations. A total of 152 fish were sampled from the two upper most (Reach 4 [reference site], Reach 3 [below IC Rock Dumps]) monitoring locations in 2012 and 2013, no fish were present within the two lower monitoring locations (Reach 2 [below Success], Reach 1 [Ninemile Creek]). Two species of salmonids were identified consisting of 135 westslope cutthroat (88 percent), 17 brook trout (12 percent), and one unidentified salmonid. Sculpin were not present within East Fork Ninemile Creek. Of the three reaches in EFNM sampled for BMI tissue metals analysis, samples from Reach 2 contain the highest concentrations of lead and zinc.

Habitat conditions are good in the uppermost reach of Canyon Creek, while three lower sample reaches have poor habitat conditions. Of the 548 salmonids sampled in Canyon Creek during 2013 and 2014, no fish were captured in the lowest reach and 97 percent of the salmonids sampled were from Reaches 4 (reference site) and 3 (below Burke). All 320 sculpin species captured were in Reach 4. Only one brook trout was caught in Canyon Creek. BMI diversity and abundance data shows Reach 3 and 4 in better overall condition than the lower two reaches. The 2013 metals tissue data shows the highest concentrations of zinc and lead in BMI collected from Reach 2 (below Gem).

Upland/Terrestrial Habitat

Small Mammals

USFWS analyzed livers of deer mice, shrews, and voles from upland and riparian areas within Smelterville Flats to determine tissue concentrations of arsenic, cadmium, lead, and zinc. Mean liver metals concentrations were higher in shrew species than in deer mice or voles, reflecting their different life history and foraging strategies. Compared to 2001 and 2008 USFWS data, preliminary results show decreased mean arsenic and lead concentrations, similar mean zinc concentrations, and increased mean cadmium concentrations. Concentrations of cadmium and lead in small mammals inhabiting Smelterville Flats remain above levels previously shown to be associated with adverse effects in small mammals.

2.5.5.3 Progress toward Remedial Action Objectives

Smelterville Flats

As part of long-term and remedial effectiveness biological monitoring, habitat-specific indicator monitoring was conducted in the palustrine, riparian and upland habitats on remediated portions of Smelterville Flats. Elevated concentrations of metals in avian and fish tissue and soil/sediment are indicators of exposure to metals in the environment. Blood lead concentrations in waterfowl using wetland habitat is an indicator of waterfowl lead exposure through sediment and is used to compare the success of remedial activities conducted at Smelterville Flats with exposure at remediated and unremediated areas within OU 3 (Thompson Marsh, Campbell Marsh, and Schlepp Agriculture to Wetland Conversion Project). Soil and sediment clean-up goals for Smelterville Flats were set at 3,000 mg/kg for lead prior to the establishment of a cleanup standard of 530 mg/kg lead in sediments as protective of avian species. Remediation at sites such as Smelterville Flats improves riparian and wetland habitat, yet waterfowl could continue to be exposed to lead levels above established cleanup standards. Post-remedial biological monitoring is a valuable tool for assessing clean-up success and recovery of ecological s.

2.5.5.4 Program Updates

Fish Exposure

Based on the data collected as part of the BEMP monitoring effort, the USFWS (Service) recommends continued monitoring of brown bullhead liver metals concentrations within lacustrine and palustrine habitats.

Monitoring Avian Productivity and Survivorship

The Service recommends discontinuing Monitoring Avian Productivity (MAPS) as part of songbird monitoring under the BEMP. However, because remediation/restoration is not permitted for "take" under the Migratory Bird Treaty Act, cleanup needs to support the health, survival, and reproduction of individual migratory birds. A more cost-effective approach for evaluating clean-up protectiveness is to continue monitoring lead levels in songbird blood and the associated riparian soils, and begin monitoring songbird diversity and abundance using simple point counts before and after floodplain remediation.

Songbird Blood

Because established toxicity thresholds exist for lead in migratory bird blood, the USFWS recommends eliminating the North Fork and Little North Fork reference sites. Additionally, because future remedial actions are not likely to occur within Pine Creek, it is also recommended to eliminate these sites (Pine Creek/Highland Creek, Lower Pine Creek) for future sampling.

Small Mammals

Without any additional remedial activities conducted at Smelterville Flats, two small mammal tissue lead concentration datasets are sufficient to understand small mammal exposure through soil. Additional data may be collected after future significant remedial actions influencing lead in floodplain soils are implemented.

Periphyton

Periphyton can be a useful monitoring tool for riverine systems by contributing an additional sensitive trophic level, but obtaining reliable data is problematic and challenging. Accurate and meaningful assessments of periphytic resources require, at minimum, intensive and robust sampling efforts, development of region- or site-specific metrics, and costly specimen identification using contracted specialists. Fish and BMI diversity and abundance data will provide sufficient information to evaluate the effectiveness of remedial actions and the long-term status of aquatic resources throughout the Basin. These considerations, in addition to high costs, high seasonal variability, and the potential for confounding or uninformative data, lead the USEPA to recommend that periphyton monitoring be discontinued.

Currently, USEPA is working with USFWS to define the biological resources baseline dataset and monitoring objectives, and update data quality objectives.

2.5.6 Summary of BEMP Issues, Recommendations, and Follow-Up Actions

The 2010 Five-Year Review included the following recommendations.

- **Recommendation:** Continue to implement the BEMP (an ongoing 2005 Five-Year Review recommendation).

  Discussion: The BEMP provided monitoring data to evaluate the ecological remedy Bunker Hill Superfund Site cleanup and as such, these activities will continue as appropriate as an integral part of the various remedies. USEPA is currently evaluating BEMP data and will be updating the BEMP data quality objectives and monitoring parameters and frequency to more effectively implement to program. This recommendation is complete.

- **Recommendation:** Continue implementation of remedial action effectiveness monitoring at recreational areas and include remedial effectiveness monitoring in the designs and implementation plans for ecological-related remedial actions (an ongoing 2005 Five-Year Review recommendation).

  Discussion: USEPA is working to incorporate remedial action effectiveness monitoring plans in remedial action designs, including in the Interstate Callahan and GWCS remedial actions. USEPA is also developing a template for remedial action effectiveness monitoring that can be used for future remedial actions. This recommendation is complete.

3 Review of Selected Remedies for Operable Unit 1

This section documents the studies and remedial actions completed in OU 1. The information in this section is organized as follows:

- 3.1 Overview of the Selected Remedy
- 3.2 Review of Operable Unit Remedial Actions
- 3.3 Technical Assessment
- 3.4 Issues and Recommendations
- 3.5 Performance Evaluation of the OU 1 Remedy

A review of actions taken since the last Five-Year-Review and progress on Issues and Recommendations is included in the review of each remedial action in Section 3.2 as appropriate. A protectiveness statement for OU 1 is provided in Section 6 of this report. Figure 3-1 is a map of the communities in OU 1.

3.1 Overview of Selected Remedy

The OU 1 Selected Remedy and RAOs are described in the 1991 OU 1 ROD (USEPA, 1991) and the 1992 OU 2 ROD (USEPA, 1992). The primary goal of the OU 1 Selected Remedy is to reduce children's exposure to and intake of lead from soil and dust sources to meet the following RAOs:

- Less than 5 percent of children with blood lead levels of 10 micrograms per deciliter (μg/dL) or greater; and,
- Less than 1 percent of children exceeding a blood lead level of 15 μg/dL.

The long-term strategy to achieve the blood lead goals is to remediate surface soils through removal and replacement with clean soil or other barriers, manage those barriers into perpetuity, and stabilize other contaminated areas throughout the Site to effect reductions in house dust lead levels. The 1991 OU 1 ROD and previous investigations identified house dust as the primary source of lead intake and subsequent absorption among young children in OU 1 (PHD, 1986). This pattern has been widely observed and supported by many subsequent studies. One of the primary sources of house dust is soil around homes and throughout community areas. (Lanphear and Roghmann, 1997; Succop et al., 1998; Manton et al., 2000; Lanphear et al., 2002; Lanphear et al., 2003; Laidlaw et al. 2005, von Lindern et al., 2003a, von Lindern et al., 2003b, Zahran et al., 2013a, Zahran et al., 2013b).

To achieve the RAOs, the cleanup strategy includes the following:

- Implementing a Lead Health Intervention Program (LHIP) for local families;
- Remediating all residential yards, commercial properties, and ROWs that have soil lead concentrations greater than 1,000 mg/kg;

- Achieving a geometric mean yard soil lead concentration of less than 350 mg/kg for each residential community in OU 1;
- Controlling fugitive dust and stabilizing and capping contaminated soils throughout the Box;
- Achieving a geometric mean of interior house dust lead levels for each community of 500 mg/kg or less, with no individual house dust level exceeding 1,000 mg/kg; and,
- Establishing an ICP to maintain protective barriers over time and to ensure that future land use and development is compatible with the OU 1 Selected Remedy.

A more detailed overview of the OU 1 selected remedies can be found in the third Five-Year Review Report (USEPA, 2010c)[1].

The Interim ROD Amendment (USEPA, 2012b) identified remedy protection actions to protect existing human health remedies against stormwater runoff, tributary flooding, and heavy rain. The remedy protection actions are a modification to the OU 1 Selected Remedy (USEPA, 1991). Additional details on specific remedy protection projects are summarized in Appendix G (Human Health Remedy Protection) of the FFS Report (USEPA, 2012b). Stormwater drainage and localized flooding pose risks to the permanence of the existing human health remedies. In particular, risks to the barriers are associated with three discrete threats:

- Water containing contaminated sediment flooding remediated or "clean" areas;
- Stormwater causing scouring (erosion) of barriers; and
- Contaminated sediment being mobilized and carried into the communities by runoff and deposition.

Such risks are associated with failures of existing local drainage systems and flooding in areas with no existing water management systems. Major components of the remedy protection actions include the following:

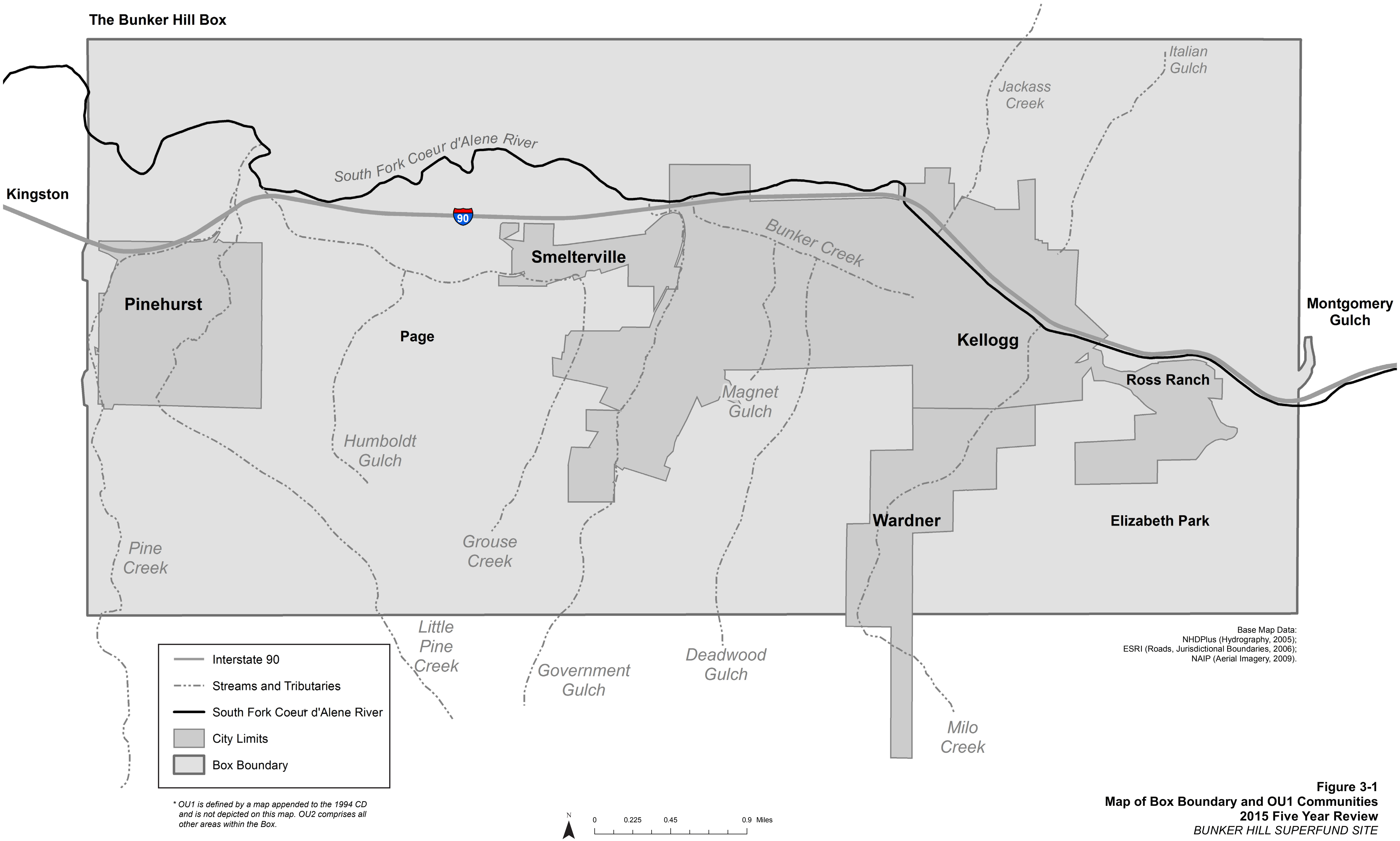
- Culvert replacements, drainage ditches, channel improvements, diversion structures, bypass systems, and subsurface road drainage systems identified in the eight primary Upper Basin communities (Pinehurst, Smelterville, Kellogg, Wardner, Osburn, Silverton, Wallace, and Mullan)
- Identification of generalized actions expected to be needed in Upper Basin side gulches.

3.2 Review of Operable Unit Remedial Actions

This section describes the progress to date in implementing the Selected Remedy and achieving the RAOs in OU 1. This information is presented in the following subsections: 3.2.1, Residential and Community Areas, and 3.2.2 Box Repository.

[1] The third Five-Year Review Report is available online at http://go.usa.gov/39vTA.

The Bunker Hill Box



* OU1 is defined by a map appended to the 1994 CD and is not depicted on this map. OU2 comprises all other areas within the Box.

Base Map Data:
NHDPlus (Hydrography, 2005);
ESRI (Roads, Jurisdictional Boundaries, 2006);
NAIP (Aerial Imagery, 2009).

Figure 3-1
Map of Box Boundary and OU1 Communities
2015 Five Year Review
BUNKER HILL SUPERFUND SITE

Path:

EPA

3.2.1 Residential and Community Areas

3.2.1.1 Human Health Barriers

Background and Description

The long-term strategy to achieve the OU 1 blood lead RAOs was to protect residents from exposure to lead and other metals in soil and dust by removing and replacing contaminated surface soils and wastes and establishing barriers in residential yards, commercial properties, and ROWs that contain contamination above levels determined to be protective. Implementing remedial activities began in 1989 with the objective of achieving a geometric mean yard soil lead concentration of less than 350 mg/kg for each residential community in OU 1.

Detailed discussions of the historical context of the remedy, including the soil lead concentration data, are provided in the 2010 Five-Year Review (USEPA, 2010c). Remediation of Box residential yards, commercial properties, and ROWs was largely complete by 2007, and certified complete by USEPA in 2008 (USEPA, 2008a). As part of the 2008 certification, the Potentially Responsible Parties (PRPs) provided a cash-out payment for the remaining properties whose owners had refused soil remediation. The payment is held in trust overseen by the State of Idaho for remediation of these properties if current or future owners agree to cleanup. At the time of the 2010 Five-Year Review, the 350 mg/kg soil RAO had been achieved in all communities.

The Paved Roads program began in 2013 to assist local communities to maintain paved roads that serve as protective barriers to underlying contaminants. The objective is to help maintain the long-term effectiveness of barriers installed in ROWs and to repair damage done to roads during the implementation of the soil remedy in OU 1. The program provides monetary assistance to local roadway jurisdictions with proposed road improvement projects covered by the approved roads strategy (IDEQ, 2012b). The local jurisdictions are responsible for project planning, design, construction, documentation, and long-term maintenance of the completed work.

Operations and Maintenance and Actions since the Last Five-Year Review

Residential Soil and Gravel

Four residential refusals were remediated since the last Five-Year Review (one in each year from 2010 through 2013). As of the end of 2014, with the exception of 14 properties that continue to refuse remediation, all remaining properties within OU 1 have been completed. These properties that continue to refuse remediation are located throughout the Box: six properties in Pinehurst, three in Kellogg, two each in Wardner and Elizabeth Park, and one in Page. The last Five-Year Review included the following recommendations. Discussions and any actions taken since 2010 follow each recommendation.

- **Recommendation**: Develop an approach (or program) that defines how barrier integrity for all remediated properties would be maintained and monitored over time.

  Discussion: The main purpose of the ICP is to have an approach or program to monitor and maintain barriers into perpetuity. USEPA has no reason to believe the ICP has not been effective in achieving this goal. However, a widespread evaluation of the status of property barriers has not been completed since the PRP certification of remedial activities.

This activity will not be retained in the table of issues and recommendations because it does not directly affect protectiveness. It will instead be included in the table of planned action items. This recommendation is repeated in OU 3.

- **Recommendation**: Conduct ROW sampling and analysis to determine whether lead concentrations have remained stable (an ongoing 2005 Five-Year Review recommendation).

  Discussion: The potential for ROW recontamination is increased by: vehicular traffic, road or shoulder grading, general tracking of materials from unremediated areas, and mixing of underlying soils during excavations. ROW monitoring from 1998 to 2008 indicated occurrences of lead levels in excess of 1,000 mg/kg, although geometric mean ROW results were generally less than 350 mg/kg (USEPA, 2010c). No additional ROW monitoring was conducted for this Five-Year Review. The Paved Roads program has addressed some of these recontaminated ROWs. The question of monitoring remediated ROWs will be addressed along with other human health barriers in the previous action item. This recommendation is complete.

- **Recommendation:** Evaluate unaddressed hillside sloughing areas adjacent to residential yards and determine whether control measures are needed (an ongoing 2005 Five-Year Review recommendation).

  Discussion: O&M inspections of the hillsides continued during the last five years and are summarized in Section 4.2.1. No activities associated with hillsides adjacent to residences occurred in the last five years because the hillsides were considered stable. However, in August 2011, a fire on the hillsides around Kellogg and Wardner burned more than 17 acres and compromised the vegetation controlling erosion (PHD, 2011a). In November 2013, representatives from USEPA, PHD, Idaho Department of Lands (IDL), and IDEQ met to discuss hillside erosion and control in the event of a disaster or clear cutting. The group concluded that PHD will continue to monitor hillsides, and IDL will ensure best forest management practices are followed. Currently, the ICP is the “control measure”’ to manage the several hundred acres of developable hillside areas that exceed the soil removal action level. Appropriate information must continue to be made available to interested developers to ensure adequate understanding of ICP permitting and barrier installation requirements. This recommendation is complete.

Paved Roads

Paved roads provide barriers to underlying contamination and are therefore a component of the human health barriers cleanup. The Paved Roads program was established in response to the communities’ recognition that damage to roads in community areas had occurred over a number of years from cleanup activities, and the 2010 Five-Year Review recommendation to develop an approach for addressing roads as long-term barriers in collaboration with state, county, and local entities.

Approximately 14 miles of Box roads underlain by contaminated soils were rebuilt, patched, or chip sealed in 2013 and 2014. While implementation of this program is expected to address a significant number of paved roadways, it is not intended to address all problems with all of the paved roads in the Box.

Remedy Status

The soil remedy is largely complete: all properties in OU 1 have been remediated, with the exception of 14 properties that refused remediation. These 14 properties can be remediated in the future through use of funds provided by Upstream Mining Group (UMG) held in trust by the State. New property development and future modifications to existing properties are required to establish barriers following the ICP guidance.

The community mean soil target of 350 mg/kg lead was achieved in all communities as of 2008 (USEPA, 2010c). PHD continues to manage soils through the ICP according to the Rules of the Panhandle Health District 1 (IDAPA 41.01.01) to reduce lead levels in community soils and to maintain the community mean target goal. The ICP is monitoring and permitting projects throughout the Box (discussed in Section 3.2.1.6), and directs disturbed soils with lead concentrations greater than 350 mg/kg to one of the designated repositories or to be placed under a cap. Clean soil criteria for backfill material cannot be greater than 100 mg/kg lead. Consequently, soil lead concentrations in community areas as of this Five-Year Review are assumed to be similar to the community soil means presented in the 2010 Five-Year Review (USEPA, 2010c), which were below 350 mg/kg.

Substantial subsurface and some surface contamination remains in the Box and poses a risk of recontamination. Catastrophic events pose potential challenges with maintaining a protective barrier. Hillsides (most of which are well vegetated) and unremediated mine dumps pose additional risk of exposure and soil recontamination. Since the last Five-Year Review, two programs have been implemented to ensure contaminated materials ≥1,000 mg/kg remain under a barrier: remedy protection projects and the human health barriers paved roads program. The 2012 ROD Amendment selected remedy protection projects intended to enhance the protection of human health remedies vulnerable to erosion, and recontamination from stormwater drainage and localized flooding, as discussed in Section 3.2.1.5.

Opportunistic soil and sediment sampling conducted as part of the ICP provides additional data to evaluate continued remedy performance. Results from three samples collected in 2011 from a pile of material generated during road sweeping stored at the State of Idaho's Department of Transportation site along the Interstate 90 (I-90) corridor were less than 350 mg/kg (Table 3-1). Snow pile debris samples collected in Kellogg in 2011, 2012, and 2014 had lead concentration averages of about 1,000 mg/kg. The snow pile storage areas should drain so excess sediment can be collected and disposed annually after the snow has melted. Regrinds and "other non-surface soil" samples collected since 2010 for ICP monitoring and permitting purposes show lead levels up to approximately 45,000 mg/kg , reinforcing the necessity for an ICP to protect public health by managing the human health barriers to contaminants left in place. One sample collected in 2014 indicated recontamination of a Kellogg ROW due to stormwater runoff from the Bunker Hill Mine. IDEQ subsequently cleaned a drainage ditch that directs stormwater from the Bunker Hill Mine Area to a storm drain off Mine Road (also see Section 3.2.1.6).

TABLE 3-1
Summary of ICP Samples Collected in the Box, 2010-2014
2015 Five-Year Review, Bunker Hill Superfund Site

Type	Year	Number of Samples	Minimum Lead Concentration (mg/kg)	Maximum Lead Concentration (mg/kg)	Average Lead Concentration (mg/kg)	Standard Deviation	Percentage of Samples ≥ 350 mg/kg Lead
Snow Pile	2010	0					
	2011	5	383	2,637	958	948	100%
	2012	4	555	2,130	1,161	731	100%
	2013	1		551			100%
	2014	3	645	2,650	1,367	1,114	100%
City Sweepings	2010						
	2011	3	149	204	168	31	0%
	2012						
	2013						
	2014						
Regrinds[a]	2010	5	887	8,532	[a]	[a]	100%
	2011	68	10.8	638	[a]	[a]	21%
	2012						
	2013						
	2014						
Other Soils[a]	2010	77	25	45,305	[a]	[a]	49%
	2011	12	12.3	2,518	[a]	[a]	42%
	2012	12	15.1	2,860	[a]	[a]	50%
	2013	25	4.21	3,680	[a]	[a]	32%
	2014	5	676	8,040	[a]	[a]	100%

Note:

[a] These samples were collected during ICP inspections of permitted projects, projects undertaken by the utilities or government, or to monitor erosion and/or tracking. Soils that tested greater than 100 mg/kg lead were directed to the repositories or capped under barriers. For this reason, averages and standard deviations were not calculated.

Maintenance of the community mean soil target of 350 mg/kg lead cannot be directly measured without a representative large-scale soil sampling program to monitor barrier integrity and potential recontamination. Rather, house dust and blood lead monitoring data (see Sections 3.2.1.2 and 3.2.1.4, respectively), achievement of the blood lead RAOs (Section 3.2.1.4), and continued ICP performance (Section 3.2.1.6) indicate success of the Selected Human Health Remedy in OU 1.

3.2.1.2 House Dust

Background and Description

Previous investigations identified house dust as the primary source of lead intake and subsequent absorption among young children in OU 1 (Yankel et al., 1977; TerraGraphics Environmental Engineering [TerraGraphics], 1990; PHD, 1986; von Lindern et al., 2003a and 2003b). The cleanup strategy outlined in USEPA remedy decision documents includes the objective of achieving a geometric mean lead level of 500 mg/kg or less for interior house dust in each community. One part of the Selected Remedy is a one-time interior cleaning for any home with house dust concentrations at or above 1,000 mg/kg, but this component has not been implemented to date. USEPA, IDEQ, and PHD decided not to clean home interiors until exterior contamination sources were controlled. The rationale for waiting until completion of soil remediation was based on an initial 1990 pilot cleaning study in which some homes in the Box received interior cleaning, yet within one year, lead concentrations in the home had returned to pre-cleaning levels (CH2M HILL, 1991).

In 2000, USEPA and IDEQ conducted a follow-up interior cleaning pilot project in Smelterville to determine whether reduced house dust lead levels would be better sustained following completion of yard soil remediation in that community. Yard remediation in Smelterville was complete by 1997. The second study confirmed conclusions of the initial study: sustained reductions in lead dust concentrations would require frequent and repeated interior cleanings following comprehensive commercial cleaning protocols and carpet replacement; without these significant and long-term efforts, dust lead levels would return to pre-cleaning levels within months to a year (TerraGraphics, 2002).

Completion of yard and community remediation controls a significant source of lead in house dust. However, the Selected Remedy does not address other anthropogenic house dust lead sources, such as residents' hobbies, habits, and activities, as well as dust generated from lead-based paint. Based on these factors, a one-time cleaning is not likely to achieve the house dust objectives.

IDEQ and PHD sampled house dust from vacuum bags and dust mats annually from 1988 through 2005, and periodically thereafter in 2008 and 2013 to evaluate lead concentrations within homes and to assess progress towards meeting the community geometric mean dust lead concentration target of 500 mg/kg. Detailed discussions of the historical context of the remedy, sampling methods, and the house dust lead concentration data are provided in the 2010 Five-Year Reviews (USEPA, 2010c). Data collected during the past five years are discussed below.

The success of the remedy depends on achieving target lead dust concentrations, and maintaining house dust lead levels at or below post-remedial soil levels. The risk management strategies expected to achieve and maintain the community house dust target include remedial actions to address community soils (Section 3.2.1.1) and fugitive dusts (Section 4.2), and the ICP high-efficiency particulate air filter (HEPA) vacuum loan program and ICP regulation of exterior soils and interior renovation projects (Section 3.2.1.5).

Operations and Maintenance and Actions since the Last Five-Year Review

The 2010 Five-Year Review (USEPA, 2010c) presented the following recommendations regarding the house dust remedy:

- **Recommendation:** Evaluate the need for implementation of the interior cleaning component of the remedy based in part on information on alternative dust lead sources. Determine additional data and monitoring needs to support one-time cleaning evaluation.

  Discussion: Based on the collective discussion below, this activity will be retained in the table of issues and recommendations because it directly affects protectiveness.

- **Recommendation:** Determine whether additional work is needed to identify alternative lead sources, such as lead-based point, that may be contributing to house dust lead levels.

Discussion: Based on the collective discussion below, this recommendation will be rolled into the above recommendation and not retained in the table of issues and recommendations separately.

- **Recommendation:** Evaluate need for implementation of the interior cleaning component of the remedy. Continue monitoring house dust concentrations annually as soil remediation is completed (an ongoing 2005 Five-Year Review recommendation).

  Discussion: Based on the collective discussion below, this activity will be rolled into the above recommendation and not retained in the table of issues and recommendations separately.

Collective Discussion: To begin addressing these three recommendations, vacuum and dust mat samples were collected from 270 homes in 2013. The sample data were assessed relative to a) past data and trends, b) the risk assessment completed for OU 1, and c) risk management strategies incorporated as part of the Selected Remedy (TerraGraphics, 2015a).

Potential sources and cofactors influencing house dust lead levels were evaluated using questionnaire data. Several analyses identified factors that appear to be associated with a higher likelihood of elevated dust lead levels (greater than or equal to 1,000 mg/kg; TerraGraphics, 2015a). The condition of exterior paint, the age of the house, remodeling activities, and the presence of interior lead-based paint were observed as possible reasons for elevated dust lead concentrations. However, these same co-factors were also common responses among homes with lead levels less than 1,000 mg/kg, and alone do not indicate that a home will have elevated dust lead concentrations. Exploratory statistical analysis identified potential risk co-factors such as, the total number of people living in the home, total number of recreational activities in which any members of the household partake, interior paint condition, forced air heating or cooling, whether the home was built prior to 1960, and whether the ground immediately surrounding the residence had been flooded. The conclusions from these analyses were that few variables appear to be risk co-factors at this time, and questionnaire responses alone cannot identify a home with elevated dust lead concentrations in the Box.

Remedy Status

Dust Lead Concentrations and Dust and Lead Loading Rates

Mean house dust lead concentrations decreased as exterior soil remediation progressed. As of 2002, all communities had geometric mean house dust levels below 500 mg/kg lead (USEPA, 2005), the established community-mean performance standard for house dust. Since the 2010 Five-Year Review, the one year of house dust lead monitoring indicates minimal change. Community geometric mean lead concentrations in 2013 continue to remain well below 500 mg/kg, ranging from 160 mg/kg to 288 mg/kg for vacuum samples, and from 151 mg/kg to 322 mg/kg for dust mat samples (Table 3-2). The remedy has reduced dust lead levels to geometric mean concentrations that are near post-remedial soil community average lead levels (i.e., <350 mg/kg). Mean house dust levels in the Box are also near or within three times background levels previously observed from similarly aged housing and socio-economically situated communities in northern Idaho outside the mining district. Geometric mean background vacuum sample lead levels were 120 mg/kg in 1999 and 129 mg/kg in 2004, and dust mat lead levels were 95 mg/kg in 1999 and 79 mg/kg in 2004 (Spalinger et al., 2000). The 2013 Box dust mat sampling results continue to indicate that remaining external sources of lead in the Silver Valley are likely causing mat lead levels to exceed background levels.

TABLE 3-2
Dust Summary Statistics by Community for OU 1, 2013
2015 Five-Year Review, Bunker Hill Superfund Site

Sample Type	City	Number of Samples	Sample Concentrations ≥ 1,000 mg/kg Lead		Lead Concentration Range (mg/kg)		Mean House Dust Lead Concentration (mg/kg)			
			Number	Percent	Minimum	Maximum	Arithmetic Mean	Arithmetic Standard Deviation	Geometric Mean	Geometric Standard Deviation
Vacuum	Kellogg	102	3	3%	17	1,520	369	257	288	2.20
	Page	9	0	0%	15	718	238	208	160	2.98
	Pinehurst	64	4	6%	21	2,200	319	421	195	2.61
	Smelterville	41	0	0%	17	859	243	146	202	1.96
	Wardner	8	0	0%	112	454	268	109	248	1.56
	Box Total	224	7	3%	15	2,200	323	297	235	2.32
Dust Mat	Kellogg	105	6	6%	20	91,200[a]	1,375	8,928	322	2.90
	Page	8	0	0%	91	665	321	229	245	2.30
	Pinehurst	72	4	6%	24	9,600	369	1,143	151	3.00
	Smelterville	46	1	2%	25	1,060	276	204	209	2.20
	Wardner	10	0	0%	52	605	285	173	231	2.10
	Box Total	241	11	5%	20	91,200	784	5,934	231	2.90

Note: Corresponding vacuum result was less than 1,000 mg/kg.

Statistical evaluation of paired vacuum and mat dust data from 2008 and 2013 indicates that site-wide lead concentrations do not differ significantly between the two sampling methodologies (TerraGraphics, 2015a). The fact that both methods produce similar results suggests that exterior soils and interior dusts in the Box are in equilibrium.

In general, geometric mean Box dust loading rates have remained similar over time, but the amount of lead tracked into homes has decreased because of reduced exterior lead concentrations in remediated soils. By 2002, geometric mean lead loading rates were at an all-time low for the larger communities, near 0.1 milligrams per square meter per day (TerraGraphics, 2015a). Since then, geometric mean lead loading rates have remained similar. For information that is more detailed about the 2013 house dust sampling results, see *OU 1 2013 House Dust and Blood Lead Data Evaluation and Risk Management Evaluation* (TerraGraphics, 2015a).

One-time Interior Cleaning Remedy

The Second and Third Five-Year Reviews recommended evaluating the one-time cleaning component of the Selected Remedy because some individual homes continue to demonstrate lead concentrations above 1,000 mg/kg. In 2013, 17 homes, or 6 percent of sampled OU 1 homes, had vacuum bag and/or dust mat lead concentrations ≥1,000 mg/kg (TerraGraphics, 2015a). Extrapolating to the entire estimated housing population of OU 1, this equates to an estimated 175 homes in the Box that may have elevated house dust lead concentrations, even after yard soil remediation has been completed (TerraGraphics, 2015a).

Review of house dust data indicates that measured house dust lead levels for an individual home can vary from year to year and may differ depending on sampling methodology. Houses with high concentrations in one year may show lower levels in following years, even without intervention. Few homes consistently show elevated lead levels over time (through 2013, 21 homes were identified based on multiple samples collected six or more years after the associated yard was remediated). Observed fluctuations in individual house dust lead concentrations suggest that residents' hobbies and activities may affect dust lead levels (TerraGraphics, 2005, 2008a, and 2015a).

IDEQ and USEPA have not yet implemented the interior cleaning component of the OU 1 Selected Remedy. The interior cleaning pilot studies conducted in 1990 and 2000 (CH2M HILL, 1991; TerraGraphics, 2002) suggest that one-time residential interior cleaning is not likely a sustainable remedy. In some cases, the elevated lead levels may be attributed to other sources of contamination, including the following:

- Soil and sediment from the hillsides, Coeur d'Alene River Basin, and Upper Basin mine and mill sites where many residents recreate;
- Erosion from hillsides surrounding OU 1, especially those that abut residential properties;
- Occupational sources;
- Lead-based paint;
- Interior legacy reservoirs such as attics, basements, and crawl spaces; and/or
- Personal activities, occupations, or hobbies.

The Selected Remedy does not address those anthropogenic lead sources that cannot be controlled by CERCLA cleanup activities, and no systematic effort has been made to reduce lead paint exposure in the Box. The cost-effectiveness and efficacy of a one-time interior cleaning of homes with dust lead concentrations ≥1,000 mg/kg versus other methods of reducing a typical child's risk of elevated blood lead levels in such homes has yet to be resolved, and additional work to determine a risk management strategy for these homes is ongoing (TerraGraphics, 2015a).

3.2.1.3 Drinking Water

Background and Description

Part of the Selected Human Health Remedy for OU 1 properties was to close domestic drinking water wells that exceeded the federal drinking water standards for total arsenic, cadmium, lead, or zinc, and attach the affected residences to a municipal water system (USEPA, 1992; USEPA and Idaho Department of Health and Welfare [IDHW], 1994). The PRPs, collectively referred to as the UMG, entered into a CD with USEPA and IDHW in 1994 to complete remediation in OU 1, including domestic water well closures (USEPA and IDHW, 1994).

Remedial action certification reports developed as part of USEPA certification process include the domestic well test results and whether a well was closed or left operational (MFG, 1997 and 1999; UMG, 1998; LFR, 2008a, 2008b, 2008c, 2008d, and 2008e). Table 3-3 summarizes the status of drinking water well closures in the reasonable segregable areas (RSAs). Owners of 13 wells that exceeded federal drinking water standards refused closure. None of these 13 wells was used for drinking water purposes at the time.

The Idaho Department of Water Resources (IDWR) continues to designate the upper and lower zones of the main valley groundwater system within OU 1 and OU 2 as an "area of drilling concern" to protect public health and prevent increased aquifer contamination.

Operations and Maintenance and Actions since the Last Five-Year Review

None.

Remedy Status

The metals concentrations and potable or nonpotable status of the 13 wells whose owners refused closure are currently unknown, although at the time of refusal these wells were not used for drinking water. The area of drilling concern, as designated by IDWR, continues to protect residents from developing new private drinking water wells in the main valley aquifer.

TABLE 3-3
Number of Drinking Water Wells Closed in OU 1
2015 Five-Year Review, Bunker Hill Superfund Site

RSA	Closed, Destroyed, No Longer Exists, Not Found, or Inaccessible	Did Not Require Testing or Closure	Refused Closure	Comments
Smelterville	17	1	9	One well was determined to be out of the influence from the main valley aquifer and therefore closure or hook-up following refusal was not necessary
Kellogg North of I-90	5	1	1	
Kellogg South of I-90	2	3	3	
Pinehurst	NA	41	NA	None of the wells sampled in the Pinehurst RSA exceeded primary or secondary drinking water standards for metals and the RSA wells were not collectively classified as requiring closure
Wardner	NA	0	NA	
Page	1	13	NA	With one exception, sampled wells in Humboldt Gulch were not considered affected by the Page Mine or waste rock dump and so wells in this RSA were not collectively classified as requiring closure
Elizabeth Park / Montgomery Gulch / Ross Ranch	NA	1	NA	
Total	25	60	13	

NA = not applicable

3.2.1.4 Lead Health Intervention Program

Background and Description

Since 1985, the LHIP, administered by PHD as a public health service, has served to minimize lead exposure through non-engineering means. The LHIP, as selected by the 1991 OU 1 ROD, offers activities designed to intervene in lead absorption pathways through biological monitoring, follow-up, parental awareness, counseling, and education. The basic elements of the LHIP effort are as follows:

- Biological (annual fixed-site child blood lead testing) and dust lead monitoring
- Follow-up for children with elevated blood lead levels
- Education and awareness for parents and children
- Vacuum loan program for cleaning residences

A detailed discussion of these elements and the historical context of the LHIP, including blood lead data and educational and awareness programs, can be found in the 2010 Five-Year Review as well as the *Overview of the Silver Valley Lead Health Intervention Program* (USEPA, 2010c; PHD, 1999).

The Human Health Remedial Evaluation (HHRE) provides a thorough discussion of blood lead levels from 1988 through 2002 (TerraGraphics, 2004). The blood lead monitoring data from 2003 through 2013 are evaluated in the *Bunker Hill Mining and Metallurgical Complex Superfund Site OU 1 House Dust Remedy and Risk Management Evaluation* (TerraGraphics, 2015a).

Operations and Maintenance and Actions since the Last Five-Year Review

Since the 2010 Five-Year review, the LHIP continued to offer the same services previously described in detail (USEPA, 2010c). From 2010 through 2012, the same services were offered. These were a fixed-site blood lead screening offered annually at no cost to and with no financial incentive for Box residents. Participation was low, with a total of 36 children participating over the three years (less than 20 children each year, Table 3-4). In 2013, PHD, IDEQ, and USEPA reinstated the door-to-door survey and incentive program for one year to increase participation and to help inform the regulatory agencies about the status of current exposures; 11 years after observed blood lead levels had dropped below the RAOs (USEPA, 2005) and five years after residential areas were certified complete (USEPA, 2008a).

The 2013 LHIP door-to-door survey identified an estimated total of 502 children residing in the Box based on consenting participants and information from neighbors or Site observations to determine if children lived at homes where no contact was made. The estimate is within 10 percent of the estimated number of children between 6 months and 9 years (555) based on school enrollment data. A total of 276 children, or 50 percent of the estimated eligible population based on school enrollment data, provided blood lead samples in 2013. This participation rate is similar to those from 1990 through 1998, which averaged 50 percent or more (TerraGraphics, 2004). In 2014, only four children participated in the fixed-site blood lead screening.

Beginning in 2012, the Centers for Disease Control and Prevention (CDC) recommended eliminating use of the term "blood lead level of concern" because evidence suggests that negative effects appear to be present at any blood lead level, and they urged primary prevention of lead exposure (CDC, 2012). The CDC recommends the use of a reference value (currently 5 μg/dL) to identify children with elevated blood lead levels. In 2013, 10 of the children tested (4 percent) had blood lead levels greater than or equal to 5 μg/dL, compared to 40 children (11 percent) in 2002 (Table 3-5).

In response to the CDC recommendations, PHD began offering follow-up services in 2012 to the parents of all children exhibiting a blood lead level of 5 μg/dL or greater (as opposed to 10 μg/dL, which had been previously used). Since the last Five-Year Review and for the years of 2010 through 2012 and 2014, one family was offered and accepted follow-up services (in 2010). Nine families were offered follow-up services in 2013, and two families (with a total of three children) accepted. In general, PHD determined that exposures were likely occurring from recreation activities in unremediated areas of the Coeur d'Alene Basin.

TABLE 3-4
Summary of Blood Lead Levels for OU 1 Children, 2010-2014
2015 Five-Year Review, Bunker Hill Superfund Site

Year	City	Number of Observations	Blood Lead Level Range (µg/dL)		Blood Lead Level (µg/dL)				Children with Blood Lead Levels ≥15 µg/dL		Children with Blood Lead Levels ≥10 µg/dL	
			Minimum	Maximum	Arithmetic Mean	Arithmetic Standard Deviation	Geometric Mean	Geometric Standard Deviation	Number	Percent	Number	Percent
2010	Site-wide	13	1.6	10	3.5	2.2	3.0	1.7	0	0%	1	8%
2011	Site-wide	15	1.4	5.0	2.3	1.3	2.0	1.6	0	0%	0	0%
2012	Site-wide	8	1.6	4.1	2.6	0.84	2.4	1.4	0	0%	0	0%
2013	Kellogg	147	1.0	20	2.6	2.1	2.3	1.6	1	1%	2	1%
	Page	6	1.4	4.4	2.6	1.1	2.4	1.6	0	0%	0	0%
	Pinehurst	68	1.4	6	2.1	1.0	1.9	1.5	0	0%	0	0%
	Smelterville	45	1.4	6	2.3	1.0	2.1	1.5	0	0%	0	0%
	Wardner	10	1.4	4.6	2.5	1.1	2.3	1.5	0	0%	0	0%
	Site-wide	276	1.0	20	2.4	1.7	2.2	1.6	1	0%	2	1%
2014	Site-wide	4	2.0	4	2.7	0.9	2.6	1.4	0	0%	0	0%

TABLE 3-5
OU 1 Children with Elevated Blood Lead Levels
2015 Five-Year Review, Bunker Hill Superfund Site

Year	City	Number	Number ≥ 5 µg/dL	% ≥ 5 µg/dL	Number ≥ 10 µg/dL	% ≥ 10 µg/dL	Number ≥ 15 µg/dL	% ≥ 15 µg/dL
2002	Kellogg	195	22	11%	4	2%	2	1%
	Page	8	2	25%	0	0%	0	0%
	Pinehurst	115	10	9%	3	3%	1	1%
	Smelterville	45	6	13%	0	0%	0	0%
	Wardner	5	0	0%	0	0%	0	0%
	Site-Wide	368	40	11%	7	2%	3	1%
2013	Kellogg	147	8	5%	2	1%	1	1%
	Page	6	0	0%	0	0%	0	0%
	Pinehurst	68	1	1%	0	0%	0	0%
	Smelterville	45	1	2%	0	0%	0	0%
	Wardner	10	0	0%	0	0%	0	0%
	Site-Wide	276	10	4%	2	1%	1	0%

The vacuum loan program continues to be a valuable part of the LHIP. From 2010 through 2014, there was an annual average of 127 vacuum checkouts for Box and Basin homes (there is no breakdown of activity by OU). An average of 105 people checked out the vacuums annually from an average of 103 addresses, indicating this resource is still being used by the community.

PHD's LHIP staff works in cooperation with IDEQ to provide outreach and education to raise awareness about the human health risks associated with lead exposure and recreating in the Coeur d'Alene River Basin. The goal is to inform residents and recreational users of exposure routes and protective measures that can be taken. Since 2010, this goal has been accomplished using various media types, including the following:

- Twelve human health signs posted at public recreation access sites;
- Brochures and posters;
- Audio public service announcements run throughout the summer during the peak of outdoor recreation;
- Children's activity books disseminated to more than 600 children in kindergarten through third grade; and
- Presentations to community groups and school-aged students.
- Classes for students in kindergarten through third grade were conducted at seven schools each year from 2010 through 2012 and at eight schools each year in 2013 and 2014.

Remedy Status

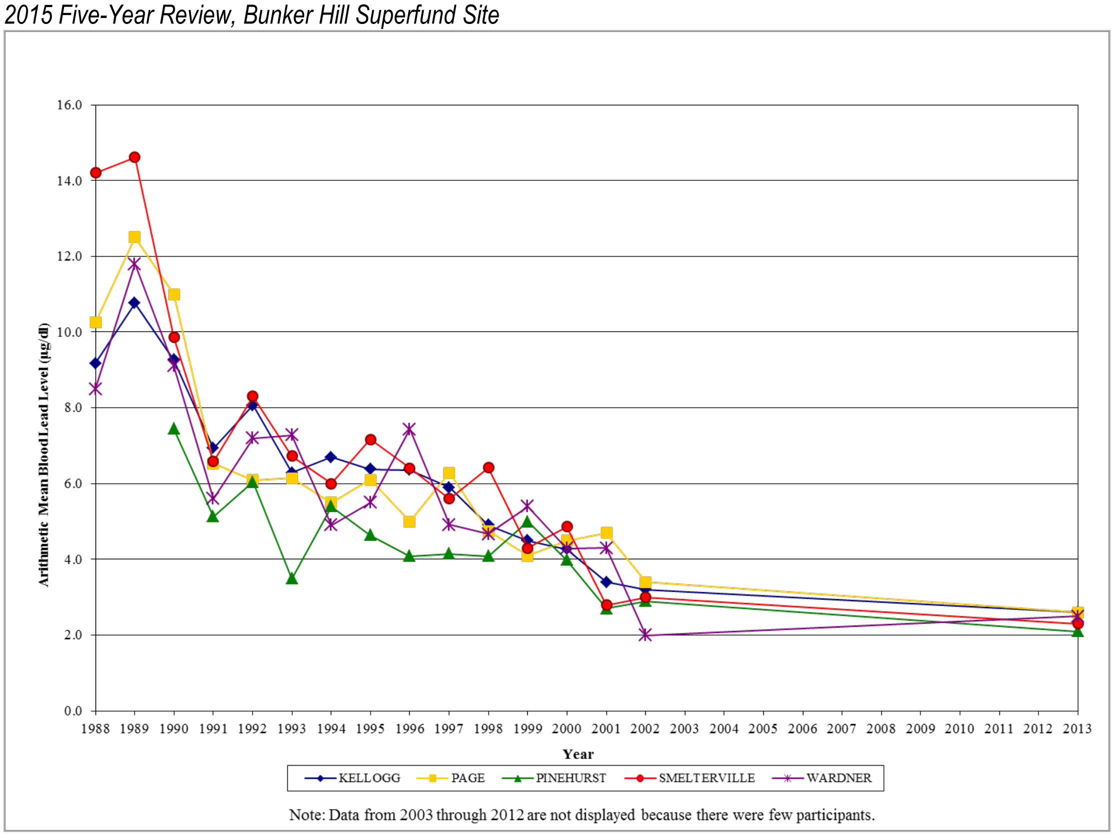
Blood lead sampling provides useful information to target families and children in need of intervention and to evaluate the performance of the human health Selected Remedy. Few families took advantage of the annual fixed-site screenings from 2003 through 2012, with only 130 children tested in those 10 years. Five of those children had blood lead levels exceeding 10 µg/dL, and none exceeded 15 µg/dL (TerraGraphics, 2015a).

In 2013 when an estimated 50 percent of children in the Box were tested, two children (1 percent) had blood lead levels ≥10 µg/dL, and one child had a blood lead level ≥15 µg/dL (Table 3-5). The 2013 arithmetic mean blood lead levels ranged from 2.1 µg/dL in Pinehurst to 2.6 µg/dL in Page and Kellogg and either continued to decline or remained similar to 2002 levels (Figure 3-2).

The LHIP continues to provide voluntary blood lead screening services, environmental health follow-up for children with blood lead levels ≥5 µg/dL, and education and awareness programs. Blood lead monitoring participation rates in the Box appear to be highly dependent on monetary incentives. Consequently, blood lead results from the low number of participants in 2010–2012 and 2014 do not represent the childhood population and limit the identification of children who require intervention.

Education and outreach continues to occur at the schools, and PHD's personnel have noted that children recall and reiterate what was taught from the previous year. The vacuum loan program continues to be used by local residents.

FIGURE 3-2
Blood Lead Levels for OU 1 Children by City and Year, 1988–2013
2015 Five-Year Review, Bunker Hill Superfund Site



USEPA recommends the use of its Integrated Exposure Uptake Biokinetic (IEUBK) Model, not actual blood lead levels, to evaluate lead health risk using environmental exposure data and to develop consequent cleanup criteria. The model is used to predict the risk of elevated blood lead levels in children under the age of seven. IEUBK Model analysis was conducted in 2014 to predict childhood residential lead health risk and assess if the most recent environmental exposures achieve the RAOs. The success of the risk management strategy was contingent upon post-remedial dust lead levels, in combination with soils, drinking water, and air, that predict blood lead levels below the RAOs.

The 2014 modeling used observed house dust lead concentrations from vacuum samples collected in the most recent year (either 2013 or 2008), in combination with current community geometric mean and yard soil lead concentrations (assuming a concentration of 100 mg/kg lead for soil at remediated properties). The IEUBK modeling results indicate that all Box communities achieve both community blood lead RAOs (i.e., <5 percent of children with blood lead levels ≥10 µg/dL, and <1 percent with blood lead levels ≥15 µg/dL).

3.2.1.5 Remedy Protection

Background and Description

The Interim ROD Amendment (USEPA, 2012b) selected remedy protection actions to protect existing human health remedies against stormwater runoff, tributary flooding, and heavy rain. The remedy protection actions are a modification to the OU 1 Selected Remedy (USEPA, 1991). Additional details on specific remedy protection projects are summarized in Appendix G (Human Health Remedy Protection) of the FFS Report (USEPA, 2012b).

Stormwater drainage and localized flooding pose risks to the permanence of the existing human health remedies. In particular, risks to the barriers are associated with two discrete threats:

- Water containing contaminated sediment flooding remediated or "clean" areas
- Stormwater causing scouring (erosion) of barriers

Such risks are associated with failures of existing local drainage systems and flooding in areas with no existing water management systems.

Major components of the remedy protection actions include the following:

- Culvert replacements, drainage ditches, channel improvements, diversion structures, bypass systems, and subsurface road drainage systems, identified in the eight primary Upper Basin communities, four of which are located with OU 1 (Pinehurst, Smelterville, Kellogg, and Wardner); and

- Identification of generalized actions that are expected to be needed in Upper Basin side gulches outside OU 1.

Key benefits of these remedy protection actions include the following:

- Greater long-term protection of human health and the environment in Upper Basin community areas, achieved through improvements to existing water conveyance systems (e.g., culvert replacements, drainage ditches) and installation of new drainage systems.

- A proactive approach to addressing recontamination issues associated with potential erosion or recontamination of existing barriers after a storm event. A proactive approach decreases the risk of human exposure to contaminated materials.

Prior to construction of remedy protection infrastructure projects, local residents and elected officials engage in a public information or participation process with the agencies. Local jurisdictions responsible for infrastructure, along with IDEQ, sign an Interagency Cooperative Agreement (ICA). The ICA requires local governmental entities holding jurisdiction or ownership of the project to assume responsibility for performing and funding ongoing O&M of the project.

Remedy protection actions in the Box do not include protection against flooding of the SFCDR and Pine Creek. Protection against flooding of the SFCDR and Pine Creek is a complex, system-wide problem that will require substantial involvement and investment on the part of numerous local, state, and federal entities. USEPA and IDEQ are committed to participating in efforts to understand more fully the SFCDR system, including Pine Creek, and ways in which various entities can contribute to the management of flooding problems.

Operations and Maintenance and Actions since the Last Five-Year Review

As described earlier, the remedy protection actions were selected in the 2012 Interim ROD amendment. Since then, four remedy protection projects (see Figure 3-3) have been constructed in OU 1 in 2013 and 2014 and are summarized in the following subsections. Construction of three additional remedy protection projects are planned in OU 1 in 2015 including Jackass Creek in Kellogg, Silver Creek in Page, and Slaughterhouse Gulch in Wardner.

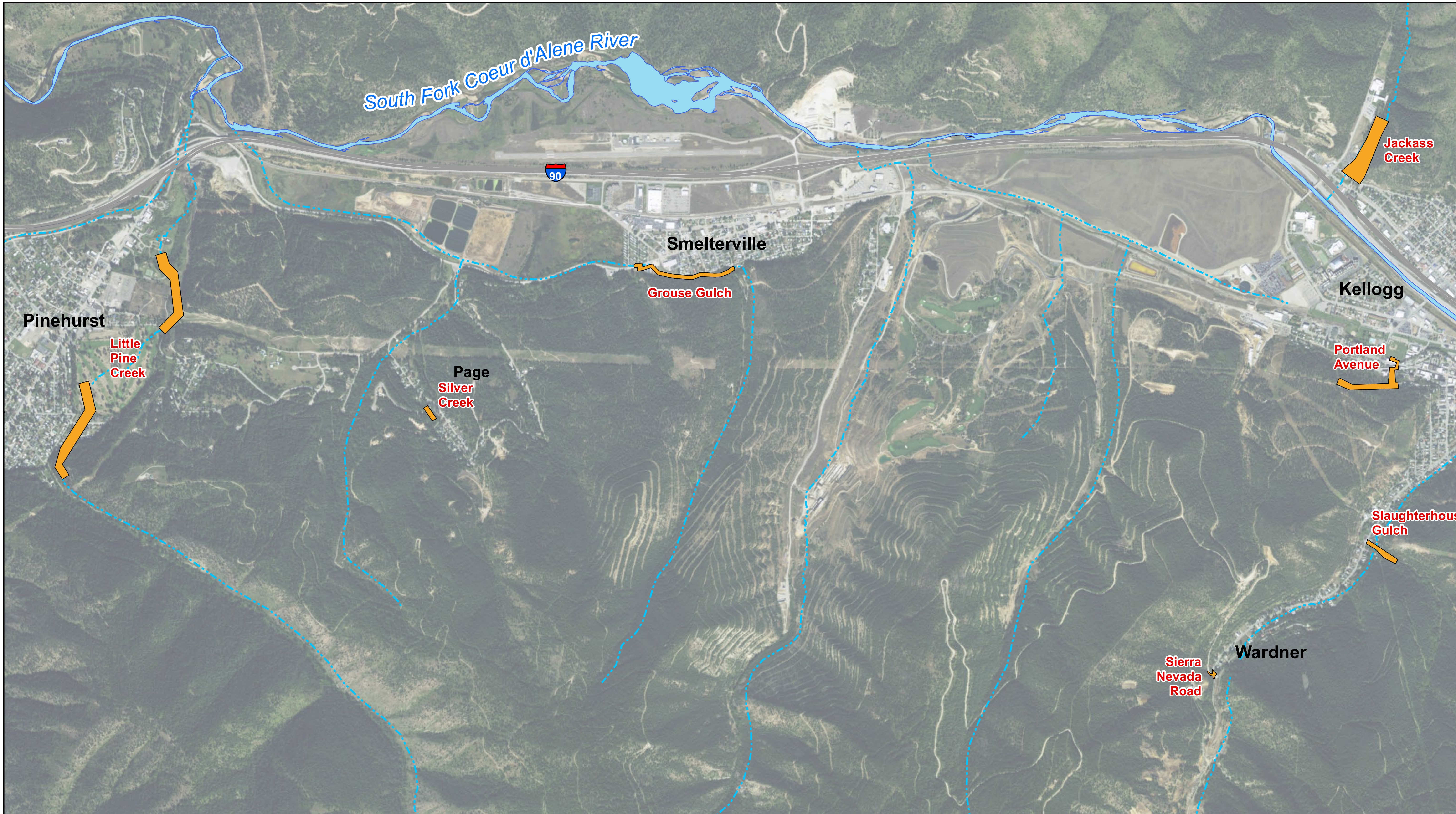
Wardner Projects

Sierra Nevada Road

The Sierra Nevada Road Remedy Protection Project was constructed in 2013. The major features of the installed remedy include the following:

- Enlarging approximately 300 feet of existing ditch and armoring with riprap.
- Installing catch basins and approximately 60 linear feet of 12-inch corrugated high-density polyethylene (CHDPE) storm drainpipe.
- Installing approximately 90 linear feet of 30-inch diameter CHDPE storm drainpipe tied into the west wall of the Milo Creek intake structure.
- Constructing 85 linear feet of curb and gutter and grading and resurfacing the road to promote drainage to the installed features.

O&M of the Sierra Nevada Road project is conducted in accordance with the *Sierra Nevada Road Operation and Maintenance Manual* (TerraGraphics, 2013a). Inspections and maintenance of the Sierra Nevada Road remedy protection remedial action are conducted by the City of Wardner in accordance with an ICA (IDEQ and City of Wardner, 2012). The Sierra Nevada Road project has required no maintenance during this review period.



Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

N

0 0.5 1 Miles

Interstate 90

Streams and Tributaries

South Fork Coeur d'Alene River

Remedy Protection Areas

South Fork Coeur d'Alene River

FIGURE 3-3
Box Remedy Protection Project Areas
2015 Five-Year Review
BUNKER HILL SUPERFUND SITE

TerraGraphics Environmental Engineering, Inc. 2010_5_Year / Figure1_2_box.mxd 2/25/2010

EPA

Slaughterhouse Gulch

Plans for the Slaughterhouse Gulch remedy protection project involve construction of two rolling dips and swale to direct overland drainage from Slaughterhouse Road to Slaughterhouse Creek. Construction is planned for 2015.

Smelterville Project

Grouse Creek

The Grouse Creek Remedy Protection Project was constructed in 2013. The major features of the installed remedy include:

- Excavating approximately 1,530 cy along 1,660 feet of the existing Grouse Creek stream channel to increase the channel capacity and constructed a typical two-stage trapezoidal channel with a low-flow section designed for the 2-year event.
- Replaced an existing jersey barrier wall with 153 linear feet of 7-foot-tall reinforced concrete cantilever retaining wall.
- Installed 137 linear feet of 7-foot-tall and 225 linear feet of 4-foot-tall reinforced concrete cantilever retaining wall along portions of the channel where a vertical channel wall was required to meet the design capacity.
- Replaced two culverts under Main Street and Breeden Street with a single 100-foot-long realigned 14-foot by 6-foot, 3-sided concrete bridge culvert.
- Installed a catch basin and 18-inch-diameter CHDPE pipe tied into the installed bridge culvert wingwall.
- Armored select stream banks with riprap and reinforced the constructed channel benches and stream banks with erosion mats and prescribed vegetation.

O&M of the Grouse Creek project is conducted in accordance with the *Grouse Creek Operation and Maintenance Manual* (TerraGraphics, 2013b). Inspections and maintenance of the Grouse Creek remedy protection remedial action are conducted by the City of Smelterville in accordance with an ICA (IDEQ and City of Smelterville, 2013). The city repaired the fence along one of the channel walls in February of 2015. No other maintenance has been required on the project.

Pinehurst Project

Little Pine Creek

The majority of the Little Pine Creek Remedy Protection Project was constructed in 2014. Final completion of the project occurred during the summer of 2015. The major features of the designed remedy include:

- Installation of four concrete bridge culverts, two in the north reach and two in the south reach.
- Four concrete box culverts were installed in the south reach along D Street, replacing existing bridges that provided access to the residences.

- Four existing metal or wood bridges were replaced with new timber bridges in the south reach.
- A large portion of the existing stream channel was dredged, widened, and cleared of debris. The new banks were reinforced with riprap or vegetation and the bottom remained natural stream substrate. Berms were constructed along some sections of the stream channel where it was more feasible than dredging.
- Installation of new concrete retaining walls at select reaches of the creek.

O&M of the Little Pine Creek project will be conducted by the City of Pinehurst and Shoshone County following construction closeout (IDEQ and Shoshone County, 2014; IDEQ and City of Pinehurst, 2014). A draft O&M manual was prepared during the design of the project, which will be revised once construction is complete to incorporate the final project as constructed.

Kellogg Projects

Portland Avenue

The Portland Avenue Remedy Protection Project was constructed in 2014. The major features of the installed remedy include:

- Approximately 1,150 linear feet of Portland Avenue gravel roadway was resurfaced and a riprap channel was constructed to convey stormwater to the riprap rundown.
- Installation of a culvert to convey stormwater from the roadside ditch to the riprap rundown. The riprap rundown will convey stormwater to the storm drain system.
- Installation of a storm drain catch basin and storm drain curb inlet that routes the stormwater on the project site to the storm drain system. Approximately 425 linear feet of subsurface storm drainpipe, including three manholes, were installed.
- Construction of a stilling basin that reduces the velocity of the stormwater runoff before entering the storm drainpipe system. Construction of approximately 50 linear feet of new curb and gutter to convey surface runoff water to curb inlets.

O&M of the Portland Avenue project will be conducted by the City of Kellogg in accordance with an Intergovernmental Cooperative Agreement (IDEQ and City of Kellogg, 2014). A draft O&M manual was prepared during the design of the project, and is currently being finalized.

Jackass Creek

Plans for the Jackass Creek remedy protection project involve installation of a subsurface bypass pipe and culvert upgrade along the Creek. Construction is planned for 2015.

Page Area Project

Silver Creek

Plans for the Silver Creek remedy protection project involve replacement of a damaged culvert. Construction is planned for 2015.

Remedy Status

The OU 1 remedy protection projects installed during this review period were constructed between 2013 and 2014. Maintenance personnel at the cities of Smelterville, Wardner, and Kellogg were contacted in March 2015 to provide feedback on the project performance and to summarize any maintenance activities. To date, minor storms have occurred, and the systems have performed as designed according to discussion with city maintenance staff.

In the relatively short time that these projects have been in place, they have required minimal O&M efforts. Channel side slopes and channel inverts have remained stable. Based on these observations, the remedy protection projects appear to be functioning as designed to protect existing human health remedies against stormwater runoff, tributary flooding, and heavy rain.

3.2.1.6 Institutional Controls Program

Background and Description

Institutional controls were identified as a key component to the Selected Remedy in order to manage contaminants left in place into perpetuity. The ICP was adopted for OU 1 and OU 2 as part of the PHD environmental health code in April 1995 and was expanded to include OU 3 in 2007. Implementation and execution of the ICP follows the requirements and standards described in the Code itself (IDAPA 41.01.01.500 through 41.01.01.543 and 41.01.01.900 through 41.01.01.902).

The ICP was established to 1) protect public health by controlling human exposure to metals, especially children's exposures; 2) ensure that barriers remain protective, are adequately maintained, and are appropriately installed in new developments and during redevelopment activities; and 3) ensure clean materials are used and provide appropriate disposal options for the local communities. The ICP regulates construction and land use changes on all properties within the ICP boundary; it is designed to facilitate community development and commerce.

The program provides a number of free services to local residents, including education, sampling assistance, clean soils for small projects (less than 1 cubic yard of material), collection of soil removed in small projects, and permanent disposal sites for contaminated soils generated within the ICP administrative area. The ICP also regulates and provides information for interior construction and renovation projects that involve ceiling or insulation removal, as well as dirt basements and crawl spaces. The ICP's permitting process is linked to existing local building departments and land use planning activities. Educational materials are made available primarily through permitting, contractor training, and property disclosures to owners, lenders, and realtors. Pamphlets and flyers with information about the ICP are available at the ICP office and online. The PHD records ICP activities and summarizes them in quarterly reports that are provided to IDEQ and USEPA.

The historical context of the ICP, including detailed ICP-related documents, is provided in the 2010 Five-Year Review (USEPA, 2010c). Information specific to OU 2 and OU 3 is discussed in Section 4.2.12 and Section 5.2.1.6 of this report, respectively.

Operations and Maintenance and Actions since the Last Five-Year Review

All permits and records of compliance are maintained in hard copy and electronic form. PHD also maintains contractor licenses, logs of samples collected and results, logs of disposal volumes and counts, and logs of clean soil and gravel provided to homeowners. Since the last Five-Year Review, PHD completed the following activities under the ICP:

- Issued 2,597 permits in OU 1, most of which were for large exterior excavation projects (>1 cubic yard) (Table 3-6). Photographs are taken for every permitted project.

- Issued 1,260 licenses to contracting companies and 152 licenses to government entities and utility companies for all OUs (licenses are not tracked by OU).
- Provided 918 property disclosures in OU 1 and OU 2.
- Recorded and followed-up with 3,096 One-Call system calls in OU 1 and OU 2.
- Scanned all current and historical permits and records of compliance into electronic files that are maintained on PHD's local server in Kellogg, Idaho and backed-up following PHD's information technology procedures.

TABLE 3-6
Number of ICP Permits Issued in OU 1, 2010-2014
2015 Five-Year Review, Bunker Hill Superfund Site

Permit Type	Calendar Year					Cumulative	Annual Average
	2010	2011	2012	2013	2014	5-Year Total	
Large Exterior Projects - Excavation[a]	1,035	241	273	286	378	2,213	443
Large Exterior Projects - Demolition	11	7	8	6	15	47	9
Interiors Total	18	24	15	23	33	113	23
Records of Compliance	33	36	54	48	53	224	45
Total	1,097	308	350	363	479	2,597	519

Notes:
[a] Includes subdivision/planned unit development totals.

An estimated total of 80,562 cubic yards of soil from permitted projects in OU 1 and OU 2 were directed to the Page Repository or community fill locations since the last Five-Year Review (Table 3-7). In addition, an estimated total of 642 cubic yards of building demolition debris (including insulation), 230 bags of insulation, and 34,430 square yards of carpets and padding were directed to the Page Repository. As part of the ICP permitting process, waste disposal volumes are reported by the permittee. For this reason, the reported waste volumes from ICP permitted projects are estimates and will not match those presented in Section 3.2.2, which are based on year-end engineering surveys for all remedial action and ICP waste volumes placed and compacted.

From 2010 through 2014, a total of 237 cubic yards of clean soil and gravel were delivered to Box properties and a total of 13 vouchers were issued for homeowners to pick up clean soil and gravel (Table 3-8).

TABLE 3-7
OU 1 and OU 2 ICP Waste Disposal Volumes
2015 Five-Year Review, Bunker Hill Superfund Site

Waste Category	Disposal Site	Materials Disposed or Source of Materials	Units	Calendar Year					Cumulative 5-yr Total	Annual Average
				2010	2011	2012	2013	2014		
Building Demolition	Page Repository	Demolition Debris	cy	8	350	60	41	10	469	94
		Insulation	Bags	9	0	3	20	198	230	46
		Insulation	cy	0	168	0	5	0	173	35
		Carpets and Pads	sy	479	1,068	1,016	19,162	12,705	34,430	6,886
Soil Disposal	Page Repository	Soil	cy	17,592	14,000	9,125	8,087	18,089	66,893	13,379
	Shoshone County Airport	Soil	cy	1,335[a]	4,744[a]	370[a]	0	0	6,449	1,290
	Transfer Station	Soil	cy	7,220	0	0	0	0	7,220	1,444

Notes:

Data provided by PHD based on permittee estimates.

sy = square yard

[a] Includes Basin soils disposed at Shoshone County Airport.

TABLE 3-8
OU 1 and OU 2 ICP Clean Material Volumes
2015 Five-Year Review, Bunker Hill Superfund Site

Delivery Method	Units	Calendar Year 2010	2011	2012	2013	2014	Cumulative 5-yr Total	Annual Average
Clean soil and gravel delivery	cy	39	53	41	41	63	237	47
Clean soil and gravel delivery	Buckets	0	0	0	0	0	0	0
Soil and gravel voucher issued (homeowner pickup)	No. of vouchers	1	1	0	6	5	13	3

The ICP rule gives PHD the authority to undertake enforcement action for noncompliance with ICP requirements. No enforcement proceedings have been initiated in the Box since the last Five-Year Review. Letters urging compliance with the ICP are required infrequently.

The 2010 Five-Year Review recommended the following specifically to OU 1, and discussions of each recommendation and actions taken since 2010 are presented in the following list.

- **Recommendation:** Secure permanent funding for the ICP, including consideration of adequate staff and information management support to manage the program, as required by the 1994 Consent Decree.

  Discussion: Funding for the OU 1 ICP has been secured through settlements with Hecla Mining Company and Asarco. The funds are in the State of Idaho's Bunker Hill Consent Decree Trust Fund and are invested in interest-bearing accounts of the State of Idaho Treasurer's Office. Based on cost estimates for the ICP administration and disposal management, these funds are expected to be able to provide secure funding for the near future (currently estimated for approximately 30 more years). PHD adopted the rule based on the premise of external funding and as such, IDEQ continues to monitor ICP costs and available funding, and make adjustments as necessary to meet long-term ICP funding obligations. Additionally, PHD evaluates staffing needs and adjusts when necessary. This recommendation is complete.

- **Recommendation:** Complete the Community Fill Policy (CFP) currently being developed by USEPA and IDEQ for all three OUs.

  Discussion: The CFP for using metals-impacted materials within the ICP administrative boundary was finalized by IDEQ and USEPA in December 2013 (USEPA and IDEQ, 2013). Subsequently, in 2014, IDEQ began evaluating possible CFP sites based on the established criteria. This recommendation is repeated for all three OUs and is complete for all three OUS.

- **Recommendation:** Continue offering ICP programs, including the vacuum loan program. Secure permanent funding the ICP as required by the 1994 Consent Decree (an ongoing 2005 Five-Year Review recommendation).

  Discussion: ICP funding is addressed above. PHD continues to offer the HEPA vacuum loan program as part of the LHIP and will continue to do so. This recommendation will not be retained in the table of issues and recommendations, because it is an ongoing element of the ICP. This recommendation is complete.

- **Recommendation:** Continue offering services, including blood lead screening services and follow-up nurse visits, to help identify and mitigate potential exposure pathways (an ongoing 2005 Five-Year Review recommendation).

  Discussion: Blood lead screening is an important component of the LHIP. PHD has maintained the blood lead screening program and follow-up consultations throughout the Site and will continue to do so. This recommendation will not be retained in the table of issues and recommendations, because it is an ongoing element of the Remedial Action LHIP component. This recommendation is complete.

- **Recommendation:** Address long-term disposal needs as part of the permanent funding for ICP, as required by the 1994 Consent Decree. Evaluate the need for snow disposal areas (an ongoing 2005 Five-Year Review recommendation).

  Discussion: Long-term waste estimates have been developed and planning for additional Box repository space is ongoing (TerraGraphics, 2014a). Expansion of the Page Repository is discussed in Section 3.2.2. The long-term disposal needs portion of the recommendation is complete because this task has been initiated and is underway. Snow disposal is still an issue of concern identified by ICP inspectors. As snow melts, sediment is left behind, and past samples for some years have averaged more than 1,000 mg/kg lead (see Section 3.2.1.1). If contaminated sediment left behind as snow piles melt is of a significant quantity and lead concentration, these sediments may contribute to recontamination because most of the snow piles are located on remediated properties with gravel/soil barriers. The snow disposal portion of the recommendation will not be retained in the table of issues and recommendations, because it does not directly affect protectiveness. It will instead be included in the table of planned action items.

- **Recommendation:** Continue working with the BEIPC and other stakeholders to evaluate and plan actions relative to addressing SFCDR and Pine Creek flooding that may affect cleanups.

  Discussion: IDEQ, USEPA, and the BEIPC have requested assistance from federal and state flood control agencies to address the threat of large-scale flooding to the remedy (such as flooding from the SFCDR and Pine Creek). The Silver Jackets, an interagency coordinating group, identified local actions that could be taken to help protect against flooding. However, funding has not yet been found to perform the required flooding study and subsequent flood control projects. The BEIPC Executive Director continues to work with local flood control entities to identify sources of assistance. This recommendation is complete. This recommendation is repeated for all three OUs.

- **Recommendation:** Continue working to develop an approach for addressing roads as long-term barriers in collaboration with state, county, and local entities.

  Discussion: Approximately 28 miles of Box and Basin roads that were underlain by contaminated soils were rebuilt, patched, or chip sealed in 2013 and 2014. The Paved Roads program is expected to last several more years in the Box and Basin. Local authorities are responsible for long-term maintenance and eventual replacement of roads within their jurisdictions. This recommendation is repeated for all three OUs and is complete for all three OUs.

- **Recommendation:** Develop appropriate institutions and funding mechanisms to finance and oversee stewardship activities.

  Discussion: In 2013 and 2014, USEPA and the Coeur d'Alene Trust have invested approximately $11.5M in paved road surface remediation and $6.4M in flood management infrastructure work throughout the Upper Basin. These "Paved Roads" and "Remedy Protection" projects are on-going. In addition to the Selected Remedy Protection projects identified in the 2012 ROD Amendment (USEPA, 2012b), IDEQ, USEPA, and the BEIPC have requested assistance from federal and state flood control agencies to address the threat of large-scale flooding to the remedy (such as flooding from the South Fork of the Coeur d'Alene River and Pine Creek). The Silver Jackets, an interagency coordinating group, identified local actions that could be taken to help protect against flooding. However, funding has not yet been found to perform the required flooding study and subsequent flood control projects. The BEIPC Executive Director continues to work with local flood control entities to identify sources of assistance. Since the last Five-Year Review, Remedy Protection projects have been constructed. In addition, associated environmental covenants and O&M agreements have been developed to ensure long-term maintenance of the constructed infrastructure. These assist in addressing the institutional elements of the recommendation. Additionally, IDEQ has developed an inventory of flood control structures in the communities, including those that were installed as part of the remedy. IDEQ plans to create a coordination cooperative that will work together to track maintenance and repair work for the structures. This effort is in the initial planning stage. This recommendation will not be retained in the table of issues and recommendations, because much work has been completed and additional actions are underway to oversee stewardship activities. It will instead be included in the table of planned action items. This recommendation is repeated for all three OUs.

- **Recommendation:** Repair and regularly maintain existing infrastructure (e.g. failing roads). Identify funding and other resources for infrastructure maintenance and improvement to protect the remedy, such as stormwater controls (an ongoing 2005 Five-Year Review recommendation).

  Discussion: In 2013 and 2014, USEPA and the Coeur d'Alene Trust have invested approximately $11.5M in paved roads surface remediation and $6.4M in flood management infrastructure work throughout the Upper Basin including OU1. These "Paved Roads" and "Remedy Protection" projects are ongoing. Local jurisdictions and IDEQ have entered into Interagency Cooperative Agreements in which the jurisdictions have accepted responsibility for O&M of Paved Roads and Remedy Protection structures. In addition, since the last Five-Year Review, IDEQ has developed an inventory of flood control structures in the communities, including those that were installed as part of the remedy. IDEQ plans to create a coordination cooperative consisting of local jurisdictions and IDEQ that will work together to track maintenance and repair work for the structures. This effort is in the initial planning stage. Because this effort will be pursued in response to the recommendation directly above, this recommendation is complete.

Remedy Status

As part of this Five-Year Review, ICP activity reports and special reports concerning recreation, storm, fire, and flood events were reviewed and discussions with PHD personnel were completed. Several issues were identified that pose challenges to the ICP.

In the last five years, localized flooding was previously noted to be an issue with destroying barriers, and was noted again in the winter of 2010-2011 and 2012 (PHD, 2011a and 2013a). Erosion from hillsides may potentially affect adjacent remediated properties. In August 2011, a fire on the hillsides around Kellogg and Wardner burned more than 17 acres. The area is steep and the vegetative barrier that was controlling erosion and soil movement was compromised (PHD, 2011b). Damaged barriers have the potential to release contaminants back into the public domain where children can again be exposed. To begin to address these issues, the 2012 ROD Amendment selected projects to assist with protecting the remedy (see Section 3.2.1.5). Additionally, USEPA and the State of Idaho requested assistance from federal and state flood control agencies to address the threat of large-scale flooding to the remedy. The Silver Jackets, an interagency coordinating group, identified local actions that could be taken to help protect against flooding.

Managing recontamination or release of contamination because of localized instances of runoff has been a challenge for the ICP. For example, contaminated runoff from the Bunker Hill Mine complex in Kellogg was identified after high precipitation in spring of 2014, and has not yet been comprehensively addressed. USEPA and IDEQ subsequently took actions to clean out a drainage ditch that was previously constructed to direct water to a storm drain off Mine Road from the Bunker Hill Mine.

PHD personnel indicate that adequate documentation is a key component for the ICP to issue permits and disclose appropriately. In the past and at times, the ICP has been unable to acquire or locate documentation from entities performing work that affects properties on the Site. As remediation continues, it is imperative that the Coeur d'Alene Trust, USEPA, IDEQ, U.S. Army Corps of Engineers (USACE), and any other entity conducting earthwork provide the ICP with documentation of completed work to ensure PHD's database remains up to date.

Community and contractor acceptance and compliance with the ICP remains high. PHD routinely requests feedback from those acquiring permits and licenses on the quality of ICP services. From 2010 to 2014, nearly 28 percent of questionnaires sent to Box and Basin contractors, utility companies, and government agencies were returned; very few questionnaires were returned by homeowners. A large majority of responses rated the ICP as good or excellent (≥ 96 percent). Based on community-wide acceptance, no enforcement actions have been required. ICP users indicated a very high level of satisfaction with the program. The main concerns voiced relate to increased costs incurred on large projects for labor, gravel, cleanup (dependent on weather and time of year), drainage issues, and access to disposal sites.

Based on record and report reviews and discussions with personnel, PHD continues to implement the ICP according to its rule (IDAPA 41.01.01). PHD continues to implement the ICP in a manner that maintains the 350 mg/kg residential community-wide lead average in soils by directing contaminated soils to a repository, enforcing the use of clean import soils, and permitting and inspecting new property development. Clean barriers that were disrupted through excavation have been repaired in response to ICP permitting and inspection activities. The ICP inspectors are continually in the field to ensure that barriers are installed consistent with the remedy defined in the ROD and in compliance with the ICP rule. PHD has also continued to evaluate and ensure the appropriate level of staffing for the ICP and maintain adequate information management support that is critical to ensure the long-term sustainability and protectiveness of installed remedies. Funding to implement the ICP into perpetuity is critical.

3.2.2 Box Repository

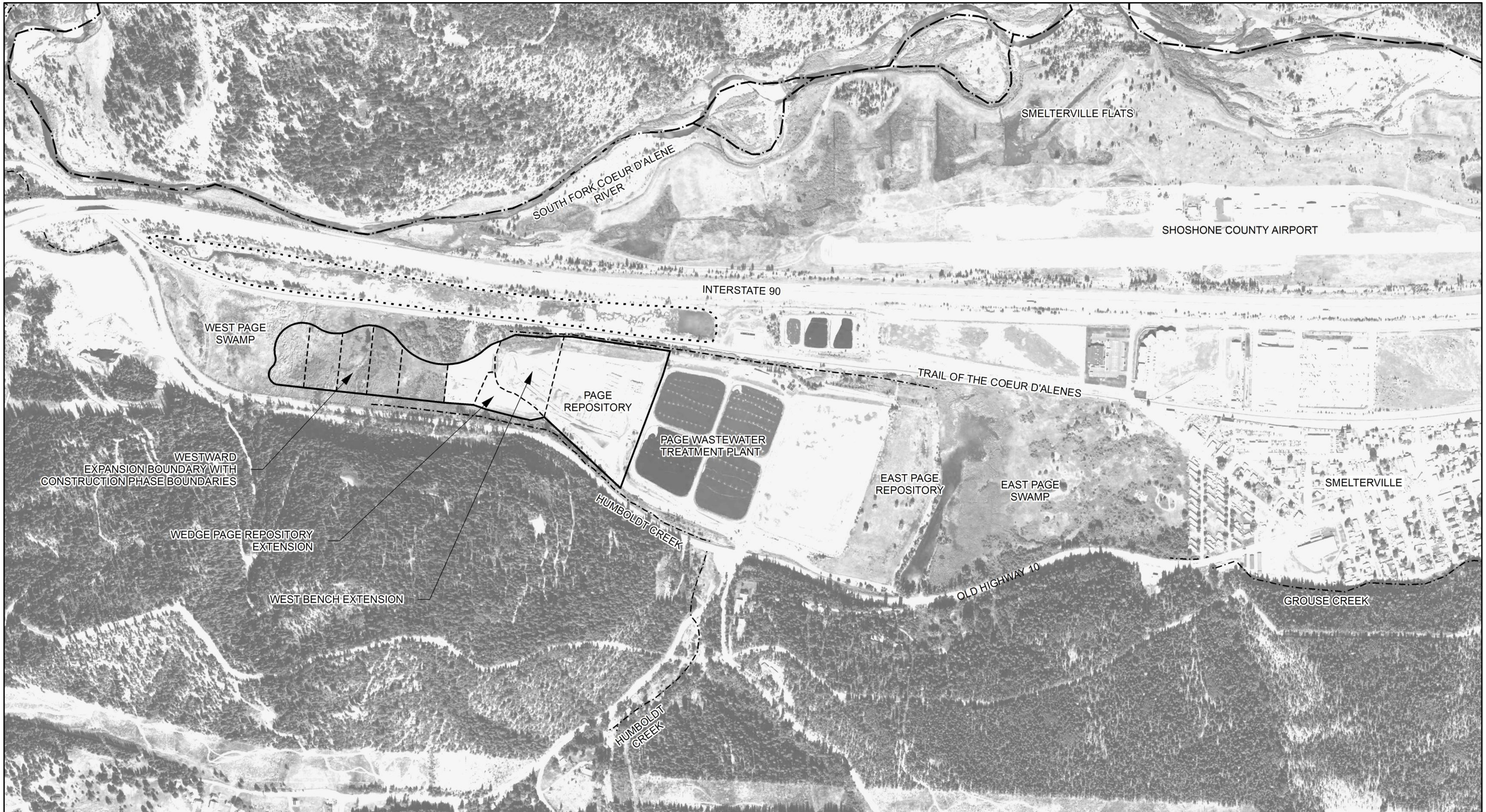
This section presents information for the Bunker Hill Box Repository Program with respect to disposal of waste from ICP-permitted activities and Remedial Actions. Background, remedial actions, and remedy evaluation of the Page Pond area in OU 2 are presented in Section 4.2.12.

3.2.2.1 Background and Description

Primary disposal operations for waste generated in the Bunker Hill Box occur at the Page Repository in the Page Pond area, located near the west end of OU 2 (Figure 3-4). The areas immediately to the east and west of the Page Ponds Wastewater Treatment Plant (PPWTP) were used as designated repository areas for contaminated soils removed during implementation of remedial actions within OU 1 and OU 2 and are identified as East Page Repository and Page Repository, respectively. The East Page Repository was filled and has been closed since the mid-1990s. In 2010, expansion of the Page Repository (the Wedge expansion) into West Page Swamp started to address the need for additional repository space within the Box. A much larger expansion, planned in phases or cells to the west of the Wedge, began in 2013 and is known as the Westward Expansion (TerraGraphics, 2013c).

A long-term repository system in the Box is necessary to meet the needs of local residents, contractors, utilities, and the government, while protecting the remedial actions implemented pursuant to the ROD. The Page Repository, currently managed by IDEQ, has been used as the primary repository for waste materials generated under ICP permits. In 2013 and 2014, it was also used to dispose of remedial action wastes from remedy protection and paved roadway remediation projects.

The historical context of the Page Repository, including disposal volumes, is provided in the 2010 Five-Year Review (USEPA, 2010c). Additionally, the *Page Repository Westward Expansion 2013 Annual Water Quality Report* (IDEQ and TerraGraphics, 2014) provides a comprehensive conceptual site model that includes a summary of the historical Site activities, past remedial actions, repository use and expansion, site-specific conditions, hydrogeology, and surface water–groundwater interactions.



Repository Boundary
Repository Extensions
Surface Water
WENI Wetland Area

N

0 375 750 1,500 Feet

FIGURE 3-4
Page Ponds Repository and Vicinity
2015 Five-Year Review
BUNKER HILL SUPERFUND SITE

EPA

3.2.2.2 Operations and Maintenance and Actions since the Last Five-Year Review

Several upgrades and operational changes have been completed to allow for greater efficiencies and expanded repository capacity since the last Five-Year Review.

Upgrades completed during the 2010 summer construction season included a woody debris stockpile area and associated composting bins for the use of compost as a soil amendment in revegetation efforts. The access routes and traffic patterns were also rearranged and a one-way loop was added to allow for continuous traffic flow, more efficient operations, and ease of use. Asphalt regrinds covered these new routes to provide a passive barrier against the spread of contamination from tracking and fugitive dust emissions. A newly established ICP stockpile area began providing a designated area for residents to dispose of their waste materials (generated from ICP-permitted projects) easily and safely outside the areas where heavy construction equipment is operated. The apron of asphalt regrinds that underlies the ICP stockpile area is routinely washed off to minimize 1) exposure of ICP customers to contaminants in the disposal area and 2) offsite tracking. The ICP area is continuously accessible through PHD-managed key-card access. The final upgrade completed in 2010 was the designation of an area to contain petroleum-contaminated soils (PCS) that may be generated from accidents or spills within the ICP administrative boundary. A berm constructed around this designated area allows it to be used for emergency disposal of PCS, if needed in the future. It is the only designated PCS disposal and treatment location within the Silver Valley.

Westward expansion of Page Repository was selected as the preferred alternative for additional repository space (TerraGraphics, 2011a). The Westward Expansion is expected to hold a total of 665,000 cubic yards of waste soil and is planned in phases. The foundation consists of coarse durable cobble-sized material, designed to segregate contaminated waste from West Page Swamp surface water, and riprap side-slope armoring to prevent scour.

Based on this design layout, construction of the foundation for Cell 1 of the expansion began in fall 2012. Foundation construction continued in May 2013 and waste placement commenced in Cell 1. The Final Design Report was completed in September 2013 (TerraGraphics, 2013c). In May 2014, foundation materials were stockpiled on the western edge of Cell 1 for Cell 2 site preparation and construction, which began shortly thereafter. The foundation for Cell 2 was completed in November 2014.

To mitigate for wetland losses associated with the Westward Expansion, a 14-acre wetland was constructed in 2012 in the 18-acre WENI area, located north of West Page Swamp. An additional 45-acre wetland mitigation project at Robinson Creek in the Lower Coeur d'Alene Basin began in 2014 to complete USEPA and IDEQ obligations for mitigating wetland losses due to the expansion. Construction of the Robinson Creek mitigation project is scheduled to be completed in 2015.

As part of the O&M of Page Repository, annual topographic surveys to estimate waste placement volume have been completed beginning in 2012. Table 3-9 presents estimated volumes for the years 2012-2014 based on in-place, compacted cubic yards of ICP and remedial action waste and Panhandle Health estimated ICP waste volumes for 2010 and 2011. Section 3.2.1.6 includes a description of estimated ICP waste volumes.

TABLE 3-9
Estimated Waste Volumes Placed at Page Repository 2010–2014
2015 Five-Year Review, Bunker Hill Superfund Site

Year	Foundation (cy)	Westward Expansion Waste Soils (cy)	Wedge Waste Soils (cy)	Total Waste Soil Volume Placed, Excluding Foundation (cy)	Total Volume Placed (cy)
2010	0	0	17,470	17,470	17,470
2011	0	0	11,500	11,500	11,500
2012	9,975	0	26,200	26,200	36,175
2013	4,400	11,525	7,500	19,025	23,425
2014	21,800	52,000	1,650	53,650	75,450
Totals	**36,175**	**63,525**	**46,850**	**110,375**	**146,550**

The Paved Road program implemented in the Box began generating significant waste volumes in 2014. The waste from this program is in the form of inert asphaltic concrete and generally low-level contaminated base materials excavated with the asphalt. To prioritize repository space for more contaminated ICP and remedial action wastes, a Limited Use Repository (LUR) was sited and developed in the Government Gulch area south of Smelterville, in accordance with the LUR policy memo, (IDEQ and USEPA, 2015). The Government Gulch LUR will operate for approximately 2 years to receive Box road waste. It will then be completed into an area ready for redevelopment, following the ICP capping requirements. It has a design capacity of 82,000 cy.

The 2010 Five-Year Review included the following recommendations. Any actions taken since 2010 follow each recommendation.

- **Recommendation**: Continue to develop a comprehensive O&M and Site Closure Plan for the Page Repository.

  Discussion: An interim O&M plan for the Page Repository was developed as part of the Repository expansion design. Although closure criteria for soils cap and cover, use of stormwater best management practices (BMPs), and Site access controls are stipulated in the final designs for the Westward Expansion, a final closure plan will not be completed until the final repository footprint has been developed. At that time, plans are to update the Page Repository O&M plan based on current operating practices and to incorporate Page Pond Area O&M requirements into a comprehensive plan. This activity will not be retained in the table of issues and recommendations, because it does not directly affect protectiveness. It will instead be included in the table of planned action items.

- **Recommendation:** Evaluate appropriate decontamination improvements and put measures in place to reduce the potential for recontamination (an ongoing recommendation from the 2005 Five-Year Review).

  Discussion: Construction of a water production well for a complete decontamination facility began in the spring of 2014. The facility was fully functional for the 2014 construction season. The facility is used for decontamination of all vehicles entering and leaving the Exclusion Zone of the repository, for filling water trucks used in fugitive dust abatement, to promote composting on wood chip piles, and to prevent spontaneous combustion of composting piles. This recommendation is complete.

- **Recommendation:** Evaluate biological monitoring results and impacts related to the Page Repository expansion (an ongoing recommendation from the 2005 Five-Year Review).

  Discussion: The WENI Wetland was constructed in 2012 as part of the wetland mitigation for the Westward Expansion of Page Repository. In keeping with the design goal to improve wetland habitat, approximately 14 acres of wetlands were constructed or improved within the 18-acre WENI area. Construction included removing more than 50,000 cubic yards of rock and soil material, which was taken to Page Repository where it was screened and sorted for re-use or disposal. As part of the mitigation process, the monitoring, evaluation, and maintenance of the constructed wetlands are vital to document the wetland condition, progress, and status over time. Specific post-construction requirements, a monitoring and evaluation plan, guidance for O&M, adaptive management of the WENI wetland, and a comprehensive method for determining wetland mitigation credits was developed in 2014 (TerraGraphics, 2014b). Mitigation credits for the expansion of West Page Swamp will be determined over a period of approximately five years and will be based on the *MDT Montana Wetland Assessment Method* (Bergland, 1999).

  IDEQ started a monitoring and maintenance program at the WENI wetland immediately following construction (TerraGraphics, 2013d and 2014b) and two monitoring events have been conducted at the Site in 2013 and 2014 (TerraGraphics, 2014b and 2015b). IDEQ has assessed the potential for mitigation credits and anticipates 14.3 acres of 1-to-1 credit from the WENI Wetland (TerraGraphics, 2014c). IDEQ anticipates that the mitigation credits derived from the Robinson Creek Project will exceed USEPA and IDEQ obligations for the Westward Expansion and will be banked to offset other site-wide remedial actions requiring mitigation under Section 404 of the CWA. Additionally, USFWS continues to conduct biological monitoring of the Page Pond area annually; the results are summarized in Section 2.5.3. This recommendation is complete.

3.2.2.3 Remedy Status

Reviews of existing documents, Site evaluations, and water quality data all indicate the Page Repository is currently functioning as designed. Repository expansion and associated actions are ongoing to provide continuous ICP and remedial action waste disposal capacity. IDEQ predicts a need for additional repository space (beyond the Westward Expansion) for future remedial actions and ICP projects in the Box, which may generate more than 2.4 million cubic yards of waste. IDEQ and USEPA continue to work on alternative waste reuse and disposal technologies to provide for this need. This includes recycling and reuse of asphalt and concrete, use of community fill sites, and the development of limited use repositories for specific purposes or projects.

Weekly, monthly, and annual reports for construction progress and remedy performance are developed and IDEQ applies corrective actions as needed. O&M activities at the Page Repository have occurred based on those outlined in the *Page Repository Westward Expansion Design Report* (TerraGraphics, 2013c) and a draft O&M Plan. Maintenance and modification of stormwater BMPs occur routinely. All BMPs are inspected weekly and after major stormwater events. The results of those inspections are documented in weekly reports. BMPs are maintained or modified based on the results of those inspections. There have been no unauthorized releases through the stormwater management system and no catastrophic failures observed.

The potential for tracking contaminated materials has been reduced with the addition of the permanent decontamination facility in full operation during daytime hours throughout the construction season. For ICP users, a road surfaced with gravel and asphalt regrind leads to the designated disposal area on top of the historical repository where they can dispose of soil and exit the repository while traveling on designated clean roads. Because the hardened roadways are easy to clean and have proven to be an asset in controlling contaminant tracking, all roadways, off-loading aprons, equipment, and materials stockpile areas that are underlain by asphalt regrinds are routinely inspected, washed clean of dirt and litter, and rebuilt to optimize their use as a clean barrier in the work area.

As Page Repository expansion continues, revegetation efforts keep pace with the earthwork to minimize the area exposed to erosion by wind and water, and to begin closure of those portions of the repository that have reached final grade. Repository side slopes are covered with a mixture of clean soil and composted woodchips, hydroseeded, and watered annually as the repository expands. Revegetation efforts have provided a robust vegetative community that also reduces fine sediment on the face of the repository where cap and cover activities are not yet completed. Minimizing exposed earthworks eliminates excessive fugitive dust, as observed and reported in the last Five-Year Review.

The primary goal of groundwater and surface water quality monitoring at and near the Page Repository is to monitor for potential impacts from the Westward Expansion. Monitoring began in 2009 for the Page Repository Westward Expansion, prior to waste placement in the expended repository footprint, and continues to-date. Dissolved metals are considered indicators of contamination under base-flow conditions for surface water and for all groundwater conditions. Total metals, especially lead, are indicators of contamination in surface water under high-flow conditions. Historical impacts on water quality at the Page Ponds area, prior to the Page Repository, resulted from the Page Pond Tailings Impoundment, which was used to contain flotation tailings and reprocessed jig tailings stored within this vicinity (IDEQ and TerraGraphics, 2014 and 2015). Prior to the Westward Expansion, historical exceedances of the regulatory thresholds include dissolved arsenic, cadmium, lead, and zinc in groundwater, and dissolved cadmium, mercury, and zinc and total arsenic, cadmium, and zinc in surface water. Six monitoring events have been conducted since the start of waste placement in May 2013, and results show exceedances for the same contaminants at similar levels. Although historical impacts to water quality are present, the 2013–2014 data collected after waste placement provide no immediate indications that placement of repository waste in the Westward Expansion is adversely affecting water quality. However, only limited data are available (six sampling events over 18 months) and insufficient data exist to conduct statistical trend analyses. Statistical analysis is planned following collection of the 2015 data.

3.3 Technical Assessment for Operable Unit 1

3.3.1 Is the Remedy Functioning as Intended by the Decision Documents?

The implemented risk management strategies outlined in the Selected Remedy have been successful in reducing OU 1 children's lead exposure and subsequent lead absorption. The Human Health Selected Remedy aimed to protect residents from exposure to lead and other metals by removing and replacing contaminated surface soil and waste as well as establishing barriers in residential yards, commercial properties, and ROWs that contain subsurface contamination.

The community mean soil lead target of 350 mg/kg was achieved in all communities by 2008 (USEPA, 2010c) and is assumed to remain similar today because ongoing ICP activities have been successful in maintaining barriers. In addition to the ongoing ICP, the Paved Roads program and Remedy Protection projects have been implemented since 2013 to ensure materials greater than or equal to 1,000 mg/kg lead remain below a barrier. Under the Paved Roads program, to date approximately 14 miles of Box roads have been rebuilt, patched, or chip sealed by the end of 2014 and now provide effective barriers to contaminants. Approximately 25 miles of Box roads remain to be addressed by the Paved Roads program. Four remedy protection projects have been completed by the end of 2014, all of which are performing as designed. Three more Remedy Protection projects remain to be constructed in OU 1.

Remedial actions at OU 2 areas that contributed to fugitive dusts in OU 1 were largely implemented prior to 2002. O&M activities continue to maintain the remedies (see Section 4.3).

Remedial action waste and contaminated materials generated from ICP-permitted projects continue to be disposed of at the Page Repository. Reviews of construction and on-going operations reports and water quality data indicate the Page Repository is functioning as designed. Repository expansion and associated actions are ongoing to provide capacity for ICP and remedial action waste in the Box into the future. IDEQ recognizes the perpetual need for additional repository space (beyond the expansions to the Page Repository) to support future ICP projects in the Box.

Interior mean dust lead concentrations in Box communities remain below the community-wide risk-based goal of 500 mg/kg, even though the one-time interior cleaning component of the Selected Remedy has not been implemented. Approximately 5 percent of homes still have house dust lead concentrations above 1,000 mg/kg, the criterion for the one-time cleaning remedy specified in the ROD. Elevated lead levels in some homes may be attributed to multiple potential sources of contamination such as the following:

- Soil and sediment from hillsides, the Coeur d'Alene River Basin, and Upper Basin mine and mill sites where many residents recreate;
- Erosion from hillsides surrounding OU 1, especially those abutting residential properties;
- Occupational sources;
- Lead-based paint;
- Interior legacy reservoirs such as attics, basements, and crawl spaces; and
- Personal activities, occupations, or hobbies.

The Selected Remedy only addresses mining- and smelter-related lead sources and cannot change personal choices and activities. The efficacy of a one-time interior cleaning of homes with dust lead concentrations greater than or equal to 1,000 mg/kg versus other methods of reducing a typical child's risk of elevated blood lead levels in those homes has yet to be resolved. Additional work to determine a risk management strategy for OU 1 homes with dust lead concentrations greater than or equal to 1,000 mg/kg is ongoing (TerraGraphics, 2015a).

The Selected Remedy also included the prevention of contaminated groundwater consumption. Private groundwater wells used for drinking were closed during the years that yard soil remedial actions were ongoing; however, the current potable or nonpotable status of 13 wells whose owners refused closure is currently unknown. The IDWR continues to designate the upper and lower zones of the main valley groundwater system within OU 1 and OU 2 as an "area of drilling concern" to protect public health and further minimize aquifer contamination.

The LHIP provides voluntary blood lead screening, environmental health follow-up for children with blood lead levels greater than or equal to 5 µg/dL, education and awareness programs, and the vacuum loan program. Participation rates for blood lead monitoring in the Box have been highly dependent on door-to-door recruitment and monetary incentives, resulting in low participation in years when they are not provided. The vacuum loan program continues to be utilized by area residents.

The success of the ICP has been demonstrated for almost 20 years in the Box, as it continues to accomplish the following:

- Ensure that barriers are installed and maintained to prevent recontamination and consequent exposure;
- Provide clean materials and appropriate disposal options for the local communities; and
- Minimize the impact of residual subsurface contamination on community development and the conduct of commerce.

PHD issued 2,597 ICP permits in OU 1 in the last 5 years, and observations by PHD personnel inspecting these ICP-permitted projects indicate that owners (or their representatives) are maintaining installed barriers. Soil and sediment samples collected since 2010 for ICP monitoring and permitting purposes show substantial subsurface contamination remains in OU 1, with lead levels greater than 40,000 mg/kg. These results reinforce the continued need for an ICP to protect public health. PHD personnel have indicated that tracking and permitting of interior projects, which are often not permitted through the local building authorities, is difficult because interior work is not seen as easily as exterior projects. While estimates indicate funding for the ICP is expected to cover the near future, long-term funding mechanisms will be necessary to ensure success of the Selected Remedy and ultimately maintain public health and the environment.

Approximately half of the estimated childhood population participated in the 2013 LHIP blood lead screening because of door-to-door recruitment and monetary incentives. The observed mean blood lead level was 2.2 µg/dL, ranging from 1 to 20 µg/dL, and 1 percent (2 of 276 tested children) exhibited blood lead levels greater than or equal to 10 µg/dL. Sustained blood lead reductions indicate that the risk management strategies outlined in the Selected Remedy are functioning as intended.

Successful implementation of the remedial strategy has required a comprehensive approach to reduce soil and dust lead exposures throughout the communities. Remedial actions simultaneously produced reductions in soil exposure and sources of lead in house dust, both of which are essential to meeting and maintaining achievement of the blood lead RAOs (discussed in Section 3.2.1.4). Observed blood lead levels and IEUBK Modeling results (discussed in Section 3.2.1.2) indicate that the remedial actions continue to operate and function as designed.

3.3.2 Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives Used at the Time of Remedy Selection Still Valid?

No changes or new applicable or relevant and appropriate requirements (ARARs) since the last Five-Year Review.

The Box RAOs were selected based on the residential scenario for risk assessment (i.e., chronic and sub-chronic residential exposure through the air, diet, drinking water, and soil/dust pathways). The following summarizes the OU 1 RAOs.

- No more than 5 percent of children in the community have a blood lead level of 10 µg/dL or greater.
- Less than 1 percent of children exceed 15 µg/dL.

The Box RAOs are community-based, which differs from current USEPA lead health risk policy (USEPA, 1994a and 1998b). The current guidance advises that the risk of a *typical child* exceeding 10 µg/dL be less than 5 percent (USEPA, 1994b and 1998b) and uses the *individual* residence as the primary exposure unit of concern, as opposed to the community. As noted in previous Five-Year Reviews, the original OU 1 RAOs are considered to be protective of children living in the Box (USEPA, 2000a, 2000b, 2005, and 2010c). There are likely individual homes in OU 1 where a child living at that residence would have more than a 5 percent chance of experiencing a blood lead level of 10 µg/dL or greater. These exceedances are often associated with high house dust lead levels in combination with residual soil concentrations exceeding 700 mg/kg (USEPA, 2010c) and recreation occurring in non-remediated areas. To address the subset of individual OU 1 homes with estimated exceedances, USEPA, PHD, and IDEQ will continue to assess the sources of lead in house dust and the need for implementing the interior cleaning remedy.

Since the last Five-Year Review, CDC has recognized that adverse health effects occur even with low lead levels in the blood, and in 2012 began utilizing a reference value of 5 µg/dL (CDC, 2012). In response to this recommendation, PHD lowered the LHIP follow-up criterion to 5 µg/dL in 2012. USEPA is currently considering this CDC recommendation and its implications for current lead health risk management policies at Superfund Sites at the national level.

The cleanup strategy developed for the Box was based on site-specific dose-response analyses of the blood to soil/dust relationship. The cleanup levels were developed using an early version of the model later released as the IEUBK Model for Lead in Children. The dose-response relationship at the Bunker Hill site was evaluated extensively using site-specific soil, dust, and blood lead data amassed through 1990. At that time, the default IEUBK model over-predicted observed blood lead levels, and quantitative analyses identified a number of Bunker Hill site-specific parameters that improved the IEUBK model's ability to predict blood lead levels in resident children. Previously, it was not possible to determine whether the reduced dose-response relationship was due to lower soil/dust ingestion rates, lower bioavailability, or a combination thereof. Consequently, the original risk analysis used a combination of reduced soil/dust ingestion rates (a nominal average of 70 mg/day) and reduced bioavailability (20 percent) (TerraGraphics, 1990). The dose-response relationship, particularly soil and dust lead uptake (ingestion rate × bioavailability), was monitored throughout the cleanup, and the uptake parameters were adjusted periodically to reflect the accumulating data. These adjustments, in addition to modifications in the IEUBK model, resulted in what is now referred to as the "Box Model," which used default IEUBK soil/dust ingestion rates (nominal average of 109 mg/day) and a reduced bioavailability of 18 percent. The other assumptions and parameters used for the lead risk modeling are described in the original documents (Jacobs Engineering Group [JEG] et al., 1989 and TerraGraphics, 1990).

New information related to the risk parameters used at the time of remedy selection is now available. In 2012, a USEPA-funded research project analyzed archived property soil and house dust samples for analysis of *in vitro* lead bioavailability (IVBA) (USEPA, 2007a and 2012c). Archived soil and house dust samples originally obtained, respectively, from the top 1 inch of 73 yards and from 193 homes in Box communities were sieved using a No. 80 mesh and analyzed for IVBA. The objective of the project was to estimate children's soil and dust ingestion rates through re-evaluation of the dose-response relationship using the new bioavailability data. Mean soil bioavailability ranged from 30 to 39 percent by community, averaging 33 percent (standard deviation ±4.0 percent), and dust bioavailability ranged from 27 to 30 percent, averaging 28 percent (standard deviation ±5.5 percent) (von Lindern et al., 2015). Use of the new bioavailability results provided age-specific soil/dust ingestion rate estimates ranging from 86 to 94 mg/day for 6-month to 2-year-old children and 51 to 67 mg/day for 2- to 6-year-old children.

This new information suggests that a nominal soil and dust and ingestion rate of 65 mg/day and 30 percent bioavailability (near the IEUBK default value) is a more appropriate combination than those used in the original risk assessment. While this differs from the combination of soil and dust ingestion rates and bioavailability parameters employed, use of the new values results in nearly the same post-remedial blood lead estimates and cleanup levels (using a blood lead criterion of 10 µg/dL) and ultimately has little effect on the validity of the OU 1 blood lead RAOs. EPA will continue to evaluate the protectiveness of the remedy in future Five Year Reviews taking into account any changes to the Superfund lead health risk management policies.

Toxicity data for a few nonlead chemicals of concern have changed since the time of remedy selection, including arsenic and cadmium cancer slope factors and arsenic, zinc, and copper reference doses (RfD) for noncarcinogenic effects. The arsenic and cadmium inhalation cancer slope factors are outdated because guidance for estimating risk from the inhalation pathway has changed since the time of the risk assessment (USEPA, 2009a). The impact of these changes on baseline risk is unknown without further calculations. Zinc's oral RfD has increased slightly since the time of the original risk assessment, resulting in a decreased risk. The RfD for copper used in the risk assessment is outdated and the consequential change in risk is unknown without further calculations. The noncancer baseline and incremental risk from both zinc and copper was negligible (TerraGraphics, 1990). The oral RfD for arsenic has decreased since the time of the risk assessment, resulting in an underestimation of risk for noncancer effects. However, noncarcinogenic risk from arsenic was already considered excessive. Although these changes in toxicity factors have been identified, the Selected Remedy remains valid because subchronic lead was the most significant health risk and was used to determine the cleanup strategies.

No major changes in OU 1 land use have occurred since the last Five-Year Review.

3.3.3 Has any Other Information Come to Light that Could Call into Question the Protectiveness of the Remedy?

The 2015 Five-Year Review did not find new information that calls into questions the protectiveness of the OU 1 remedies.

3.4 Summary of Operable Unit 1 Issues, Recommendations, and Follow-Up Actions

Issues, recommendations, and follow-up actions that were identified during this fourth, or previous, Five-Year Reviews and affect protectiveness are summarized in Table 3-10. Action items that were identified during this fourth Five-Year Review and *do not* affect protectiveness, but are expected to require future action, are summarized in Table 3-11. These recommendations are summarized herein to allow USEPA to track this information, as suggested by Five-Year Review guidance (USEPA, 2001a).

TABLE 3-10
OU 1 Summary of Issues and Recommendations
2015 Five-Year Review, Bunker Hill Superfund Site

Remedial Action (e.g., Human Health Barriers, ICP)	Issue	Recommendations	Party Responsible	Oversight Agency	Planned Completion Date	Affects Protectiveness? (Y/N)	
						Current	Future
House Dust	Results of two pilot studies indicate that house dust lead concentrations return to pre-cleaning levels within one year of cleaning, regardless of the cleaning method. Recent data confirm that house dust lead concentrations have achieved the community mean of 500 mg/kg and the number of homes exceeding 1,000 mg/kg lead in house dust is declining.	Evaluate the need for implementation of the interior cleaning component of the remedy based in part on information on alternative dust lead sources. Determine additional data and monitoring needs to support one-time cleaning evaluation.	IDEQ, USEPA	IDEQ, USEPA	December 31, 2017	N	Y
Drinking Water	Owners of 13 wells that exceeded federal drinking water standards refused closure. At the time of refusal, all wells were dedicated to non-potable uses.	Review current use of the 13 wells whose owners refused closure to identify those being used for potable purposes, if any.	IDEQ, USEPA	IDEQ, USEPA	December 31, 2016	N	Y

TABLE 3-11
OU 1 Action Items that Do Not Affect Remedy Protectiveness
2015 Five-Year Review, Bunker Hill Superfund Site

Remedial Action (e.g., Human Health Barriers, ICP)	Action Item	Responsible Party	Oversight Agency
Human Health Barriers	Develop an approach (or program) that defines how barrier integrity for all remediated properties would be monitored over time. Repeated in OU 3.	IDEQ, PHD, USEPA	IDEQ, USEPA
Page Repository	Continue to develop a comprehensive O&M and Site Closure Plan for the Page Repository. Repeated in OU 2.	IDEQ	USEPA
LHIP	Continue to evaluate options for increasing participation in the annual blood lead screening program. Repeated in OU 3.	IDEQ, PHD, USEPA	IDEQ
ICP	Infrastructure Maintenance Funding: Develop appropriate institutions and funding mechanisms to finance and oversee stewardship activities and support local governments in their efforts to identify funding for large-scale flood control. Establish infrastructure O&M cooperative involving local jurisdictions and IDEQ. This action item applies to all three OUs, but is listed only once, here in OU 1.	BEIPC	IDEQ, USEPA
ICP	Formalize a process to be implemented after catastrophic events occur for the purpose of evaluating barrier performance, barrier repairs, responsibility, and funding sources. This action item applies to all three OUs, but is listed only once, here in OU 1.	IDEQ, PHD, USEPA	IDEQ, USEPA
ICP	Evaluate the need for snow disposal areas.	ICP, IDEQ	IDEQ
ICP	As required by the ICP, ensure all entities conducting earthwork and remedial actions provide documentation of these activities to Panhandle Health for inclusion in the ICP property database. This action item applies to all three OUs, but is listed only once, here in OU 1.	PHD, IDEQ, USEPA	IDEQ, USEPA

3.5 Performance Evaluation of the Operable Unit 1 Remedy

The 2012 Upper Basin ROD Amendment (USEPA, 2012a) selected additional OU 1 actions to protect in place remedies from localized flooding. Four remedy protection actions have been implemented through the end of 2014, and all are projected to be completed by the end of 2015. Approximately 14 miles of Bunker Hill Box roads underlain by contaminated soils were rebuilt, patched, or chip-sealed in 2013 and 2014.

Although the selected remedy has not been fully implemented, it is nearly complete and data indicate that the remedy is functioning as intended by the 1991 OU 1 ROD (USEPA, 1991). As remediation nears completion, soil and house dust lead concentrations have declined, lead intake rates have been substantially reduced, blood lead levels have achieved their RAOs, and the ICP has been established and is operating. House dust lead levels have declined to well below the 500-mg/kg site-wide average RAO.

There are some homes where interior house dust lead concentrations remain high. Based, in part, on information related to alternative lead sources, a determination will be made regarding the advisability of implementing the interior cleaning component of the OU 1 remedy.

Continued maintenance of the clean barriers to underlying contamination is essential to ensure long-term protectiveness of the remedy. In addition, continued funding and state and local support of the ICP is necessary to ensure barrier maintenance occurs in the long-term.

See Section 6.1 for the OU 1 protectiveness statement.

4 Review of Selected Remedies for Operable Unit 2

This section summarizes the protectiveness evaluation of the OU 2 remedial actions conducted to date. The individual remedial actions presented and discussed are part of the overall OU 2 Selected Remedy as documented in the initial 1992 OU 2 ROD (USEPA, 1992) and its subsequent decision documents (ROD Amendments [USEPA, 1996a, 2001b, and 2012a] and ESD documents [USEPA, 1996b and 1998a]). The information in this section is organized as follows:

- 4.1 Overview of the Selected Remedy
- 4.2 Review of Operable Unit Remedial Actions
- 4.3 Technical Assessment
- 4.4 Issues and Recommendations
- 4.5 Performance Evaluation of the Selected Remedy

A review of actions taken since the last FYR and progress on Issues and Recommendations is included in the review of each remedial action in Section 4.2 as appropriate.

4.1 Overview of Selected Remedies

OU 2 comprises areas in the Bunker Hill Box that were nonpopulated, nonresidential areas at the time of the 1992 OU 2 ROD. These areas (shown on Figure 4-1) are the former Industrial Complex and Mine Operations Area (MOA), Smelterville Flats (floodplain of the SFCDR in the western half of OU 2), hillsides, various creeks and gulches, Central Impoundment Area (CIA), and Bunker Hill Mine and associated acid mine drainage (AMD). The SFCDR within OU 2 and the nonpopulated areas of the Pine Creek drainage are both addressed as part of Operable Unit 3 (OU 3).

Cleanup actions identified in the 1992 OU 2 ROD included a series of source removals, surface capping, reestablishment of stable creek channels, demolition of abandoned milling and processing facilities, engineered closures for waste consolidated onsite, revegetation efforts, and treatment of contaminated water collected from various Site sources. The specific ROD requirements and remediation goals and remedial action objectives for the OU 2 Selected Remedy are described later in this section as the individual remedial actions are discussed and evaluated.

The bankruptcy of the major PRP for the Site (i.e., Gulf Resources) resulted in shifting responsibility for OU 2 remedy implementation from a PRP to USEPA and the State of Idaho. Pursuant to CERCLA requirements for fund-led remedy implementation, USEPA and the IDEQ entered into a State Superfund Contract (SSC) to implement the OU 2 Selected Remedy (USEPA and IDHW, 1995). The SSC comprises various supporting documents, including the Support Agency Cooperative Agreement (SACA) for Cost-Share, the Comprehensive Cleanup Plan (CCP), and the Remedial Action Management Plan (RAMP).

After the PRP bankruptcy, the IDEQ determined that the PRP-proposed remedy implementation strategy for OU 2 was unacceptable under the statutory constraints of CERCLA because the State would be responsible for 100 percent of O&M costs after the remedy is complete. As a result, the State and USEPA negotiated an alternative approach to OU 2 ROD implementation that focused more on permanent remedial techniques such as source control and containment and less on long-term treatment remedial approaches originally developed by the PRP. This led to a two-phased remedy implementation approach presented in the CCP for OU 2.

Phase I of remedy implementation includes extensive source removal and stabilization efforts, all demolition activities, all community development initiatives, development and initiation of an ICP, future land use development support, and public health response actions. Also included in Phase I are additional investigations to provide the necessary information to resolve long-term water quality issues, including technology assessments and pilot studies, evaluation of the success of source control efforts, development of Site-specific water quality and effluent-limiting performance standards, and development of a defined O&M plan and implementation schedule. Interim control and treatment of contaminated water and AMD is also included in Phase I of remedy implementation. Phase I remediation began in 1995, and source control and removal activities are nearly complete.

Phase II of remedy implementation will address long-term water quality, ecological, and environmental management issues. Phase II remedial actions are identified in the 2001 OU 2 ROD Amendment and the 2012 Upper Basin ROD Amendment. Implementation of the Phase II remedy is estimated to begin in 2016. The initial Phase II actions will consist of upgrading and expanding the CTP and a GWCS located between the CIA and the SFCDR. A detailed discussion of these initial Phase II actions are presented in Sections 4.2.8 and 4.2.9.

There have been three ROD Amendments (USEPA, 1996a, 2001b, and 2012a) and two ESDs (USEPA, 1996b and 1998a) since the 1992 OU 2 ROD was issued. The ESDs clarified implementation aspects of portions of the Selected Remedy for OU 2 consistent with Phase I objectives and did not change the Selected Remedy. The ROD Amendments added additional requirements and actions to the overall OU 2 Selected Remedy and are discussed in more detail in Section 2.2.2.

4.2 Review of Operable Unit Remedial Actions

4.2.1 Hillsides

4.2.1.1 Background and Description

The hillsides include the steep portions of OU 2 that slope upward from the floor of the SFCDR valley and from the gulches (Figure 4-1). This section describes the remedial actions associated with the hillsides and the two industrial landfills located between Deadwood and Railroad Gulches.

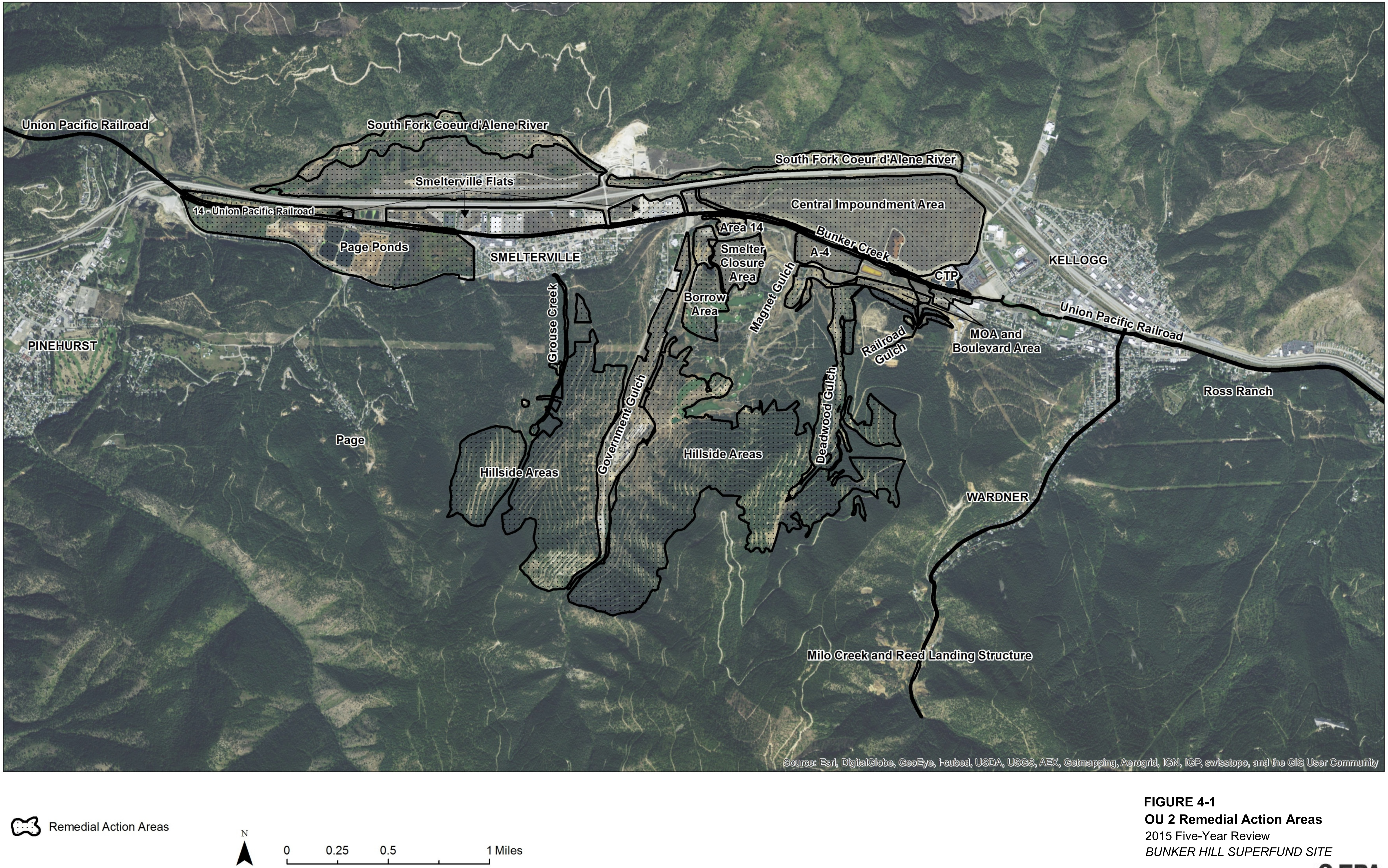


FIGURE 4-1
OU 2 Remedial Action Areas
2015 Five-Year Review
BUNKER HILL SUPERFUND SITE

EPA

The hillsides have been affected by 100 years of mining and metals-refining related activities, including logging and clearing, mine waste rock dumping, and emissions and fugitive dust from processing operations. Natural events such as forest fires, wind, and flooding have increased the impacts to the hillsides leading to severe erosion and reduced vegetation in many areas. The erosion of the contaminated soils from the hillsides has resulted in contaminants being conveyed to the streams, gulches, and other areas.

A review of hillsides remedial action requirements described in the 1992 OU 2 ROD and the 1998 OU 2 ESD is presented in the 2010 Five-Year Review Report (USEPA, 2010c). RAOs for the Hillsides consist of the following:

- Minimizing soil erosion
- Reducing suspended sediment and/or contaminant loading in surface runoff to SFCDR.

Information related to the interim and final performance standards (IPSs and PSs) used for monitoring hillside performance is also summarized in the 2010 Five-Year Review Report (USEPA, 2010c).

The hillsides remedial action was fully implemented by 2002. The general components of this action consist of the following:

- The hillsides were revegetated and reforested between 1975 and 2002 by the PRP, USEPA, and the IDEQ. Soil amendments were added prior to select plantings.
- The hillsides were stabilized with bench terraces for erosion control, and slopes were stabilized in Wardner and Smelterville.
- Check dams were installed to minimize erosion in gullied areas, and erosion control measures were implemented at select mine waste dumps.
- Solid waste from the lower industrial landfill located between Deadwood and Railroad Gulch was removed.

Additional detail, including a complete listing and description of remedial actions, is provided in the 2010 Five-Year Review Report (USEPA, 2010c).

In 2006, the IDEQ transferred a portion of the hillsides, located above the Smelter Closure Area (SCA) and Borrow Area Landfill (BAL), to a third party. Large-scale development of a golf course community has been ongoing in the lower hillsides, including residences, and associated infrastructure. As part of development, portions of the hillsides remedy were graded or altered to allow the golf course fairways to be placed. Along with the major undeveloped portions of the hillside areas, redeveloped portions are evaluated as part of regular O&M and ICP inspections. A long-term O&M manual was prepared for the hillsides remedial action in 2010 (TerraGraphics, 2010a), which describes the RAOs and O&M requirements in more detail. The Selected Remedial Action is intended to accomplish the following (TerraGraphics, 2010a):

- Minimize erosion
- Reduce suspended sediment and contaminant loading in surface runoff to the SFCDR

4.2.1.2 Operations and Maintenance and Actions since the Last Five-Year Review

Semiannual inspections of the hillsides remedial action are conducted by the IDEQ in accordance with the hillsides O&M manual (TerraGraphics, 2010a).

All IDEQ inspections, including the latest conducted in fall 2014, noted that hillsides areas appear to be functioning with adequate vegetation cover and no active erosion (IDEQ, 2014a). During this review period, the hillsides remedial action has required the following maintenance activities:

- Erosion and all-terrain vehicle damage was repaired at Silver King knob and included revegetation and placing rocks to restrict access in September 2012 (IDEQ, 2012c).
- Galena Ridge repaired and reseeded eroded areas on hillside slopes within the Galena Ridge Golf Course (IDEQ, 2011a, and IDEQ, 2013a).
- A fire occurred in August 2011 on the hillsides above Kellogg. The burned area was outside of the limits of the remedial action area depicted in Figure 4-1. IDEQ and PHD participated in discussions with Shoshone County Fire District 2 regarding mitigation following the fire with the understanding that increased stormwater runoff and erosion resulting from the vegetation loss in the area could potentially transport contaminated sediment from the burned area to the downgradient residential areas. The Fire District has implemented a mitigation plan in the area, and vegetation appears to be recovering. The Fire District has also conducted tree thinning and cutting as a fire mitigation measure in several other areas of the hillsides during this review period (IDEQ, 2011a and 2011b).

4.2.1.3 Remedy Performance

According to the O&M inspections of the hillsides conducted by IDEQ, check dam performance has been acceptable. Major findings include the following:

- Check dams are controlling gully erosion.
- Terraces are functioning as intended.
- Minimal slope erosion is occurring.

Although the hillsides remedy is functioning as intended and achieving the RAOs, the hillsides are accessible through the development of Upper Magnet Gulch and Deadwood Gulch, as well as through Grouse Gulch. IDEQ has observed some localized evidence of increased public access and recreational use on the hillsides during this review period. Significant increases in off-road vehicle use by the public could lead to additional adverse effects to re-established vegetation, as well as a potential human health risk in those areas of the hillsides where residual contamination is known to exist. At this time, most public use does not appear to be causing significant damage to vegetation, with the exception of all-terrain vehicle use at Silver King knob. IDEQ completed repair work in this area and placed a rock barricade to restrict access. Currently, IDEQ repair work is performing as intended. Logging can affect hillsides by causing erosion, if not done properly. Ongoing O&M inspections will continue to monitor this area.

4.2.2 Gulches

The gulches include the flat portions of the tributary gulches and not the sloping hillsides addressed in Section 4.2.1. The seven gulches of primary concern cited in the 1992 OU 2 ROD for remedial actions are, from west to east, Grouse, Government, Magnet, Deadwood, Railroad, Portal, and Milo (Figure 4-1). Milo Gulch is discussed in Section 4.2.8 because its remedial action is substantially different from the Phase I remedial actions conducted in the remainder of the gulches. The 1992 OU 2 ROD-required actions for Portal Gulch focus on mine water treatment from the Bunker Mine, whose portal (Kellogg Tunnel) is located in Portal Gulch. Mine water pumped from the Bunker Mine is conveyed to the CTP for treatment. See Section 4.2.9 for a discussion of the CTP and the treatment-related actions performed in the Portal Gulch area. Additional detail for these differences is described in the 2010 Five-Year Review Report (USEPA, 2010c). A review of remedial action requirements common to all gulches described in the 1992 OU 2 ROD and 2001 OU 2 ROD Amendment is presented in the 2010 Five-Year Review Report (USEPA, 2010c). The RAOs associated with the Gulches remedy are intended to accomplish the following:

- Minimize risk of direct contact with contaminants.
- Minimize soil erosion.
- Reduce suspended sediment and/or contaminant loading in surface runoff to the SFCDR.

For most OU 2 source removal actions, a chemical-specific soil excavation goal of 1,000 mg/kg lead was used. The exceptions included Government and Magnet Gulches, for which the 1998 OU 2 ESD (USEPA, 1998a) provided separate upland and stream bed excavation goals. Additional detail is provided in the 2010 Five-Year Review Report (USEPA, 2010c).

4.2.2.1 Grouse Gulch

Background

Grouse Gulch is a small watershed located west of Government Gulch with a perennial creek (Grouse Creek) that passes through the Smelterville city limits. Past smelting and mining activities resulted in surface contamination of the soils in the gulch area. Contamination sources and the unstable and eroding creek contributed to contaminated sediment being carried downstream, especially during high-flow runoff events.

The 1992 OU 2 ROD remedy for Grouse Gulch was not changed as a result of subsequent ROD Amendments or ESDs issued for OU 2. The 1992 OU 2 ROD remedial action is consistent with the goals and objectives of the Phase I remedy implementation.

The Grouse Gulch Phase I remedial action was fully implemented in 1997. The components of this action consist of the following:

- Approximately 1,200 cy of tailings above the uppermost of the three existing gabion structures were removed. Sediment accumulation was removed from other existing gabion dams.

- A new gabion dam was constructed in the lower reaches of the gulch.

- The Wyoming mine dump located near the creek was buttressed at its base. Approximately 2,000 cy of mine dump material was removed.

- Accumulated sediment and alluvium was removed from downstream portions of the creek within the Smelterville city limits.
- Access roads up through the gulch were improved to enable easier O&M of the gabion dams.

Additional detail, including a listing and description of remedial actions, is provided in the 2010 Five-Year Review Report (USEPA, 2010c).

Operations and Maintenance and Actions since the Last Five-Year Review

The Grouse Gulch Phase I remedial action was fully implemented in 1997, and no actions have been implemented since. Although a formal O&M plan for the Grouse Gulch gabion dams and Wyoming Mine dump does not exist, Shoshone County, City of Kellogg, and City of Smelterville are responsible for sediment removal from behind the three gabion dams to help control flooding in Smelterville associated with Grouse Creek. Sediment was removed from behind the three gabion dams in December of 2011 by the County and the City of Kellogg. Ninety-six loads of contaminated material were hauled to the Page Repository. A remedy protection project selected in the 2012 Upper Basin RODA was constructed downstream of Grouse Gulch in Grouse Creek through Smelterville in 2013 to reduce the risk of flooding. The remedy protection project is discussed in Section 3.2.1.5.

IDEQ conducts informal inspections of Grouse Creek semiannually along with the OU 2 O&M inspections. In 2014, IDEQ identified orange water overtopping the road along Grouse Creek in the upper portion of Grouse Gulch (IDEQ, 2014a and 2014b). The water is believed to come from a collapsed adit in the area, but the source has not been confirmed. The surface water in Grouse Creek remains orange for approximately 1,000 feet downstream of this source. Precipitates appear to settle out and accumulate behind the gabion dams.

Remedy Status

Surface water quality monitoring at the mouth of Grouse Creek (BH-GC-0001) indicates that no AWQC exceedances have occurred after Phase I remedial action. Concentrations of dissolved cadmium, lead and zinc showed a significant decrease in concentration during the period of 2002 through 2014. Concentrations and trend data are presented in Section 2.5.

4.2.2.2 Government Gulch

Background

Government Gulch is the historical location of several ore processing and acid/fertilizer producing facilities. Much of the subsurface soils were found to be highly contaminated to about 10 feet below ground surface (bgs), especially in the industrial parts of the gulch. Government Creek, which historically flowed down the center of the gulch in a meandering pattern, was modified during the time of active ore processing, and specifically in the area between the Zinc Plant and the Phosphoric Acid Plant.

A review of remedial action requirements specific to Government Gulch described in the 1992 OU 2 ROD, 1996 and 1998 OU 2 ESDs, and 2001 OU 2 ROD Amendment is presented in the 2010 Five-Year Review Report (USEPA, 2010c). The RAOs for the Government Gulch remedy consist of the RAOs listed in Section 4.2.2 and the following:

- Reduce contamination of surface water and groundwater.

The Government Gulch Phase I remedial action was fully implemented in 2001. The general components of this action consist of the following:

- Nearly 400,000 cy of contaminated materials (tailings, waste rock, and PTMs) were removed from the gulch extending from the upper reaches of Government Gulch down to McKinley Avenue.
- Specific segments of Government Creek were reconstructed.
- The aboveground structures associated with the Phosphoric Acid/Fertilizer Plant and Zinc Plant were demolished.
- Gulch areas received a 6-inch clean soil ICP barrier cap, including hydroseeding and riparian plantings.

Additional details, including a complete listing and description of remedial actions, are provided in the 2010 Five-Year Review Report (USEPA, 2010c).

In 2006 and 2010, the IDEQ transferred several parcels in Government Gulch to third parties, as described in the 2010 Five-Year Review Report (USEPA, 2010c).

A long-term O&M manual was finalized for the Government Gulch remedial action in 2010 (TerraGraphics, 2010b), which describes the RAOs and O&M requirements in more detail. The RAOs associated with the Government Gulch remedy include the following (TerraGraphics, 2010b):

- Minimize direct contact with contaminated material.
- Minimize erosion.
- Reduce suspended sediment/contaminant loading in surface runoff to the SFCDR.
- Reduce contamination of surface water and groundwater.

Operations and Maintenance and Actions since the Last Five-Year Review

Semiannual inspections of the Government Gulch remedial action are conducted by the IDEQ in accordance with the Government Gulch O&M Manual (TerraGraphics, 2010b). During this review period, the Government Gulch remedial action has required no maintenance to sustain the integrity of the action. The fall 2014 IDEQ inspection confirmed that the channel, gabion dam, and culverts are all functioning as designed (IDEQ, 2014a).

Remedy Status

Based on the above RAOs, the Site inspections conducted for the IDEQ O&M program focus on the stability of soil caps and constructed stream channel and condition of installed culverts. The inspections conducted during 2010-2015 indicated that the capped areas of Government Gulch are stable and provide effective barriers for underlying contaminated material. The stream channel and associated culverts are in good condition.

Surface water data collected from Government Gulch (BH-GG-0001, BH-GG-0004, and BH-GG-0008) continue to show significant decreasing trends for cadmium and zinc. However, median dissolved zinc and cadmium concentrations for the period from 2009 to 2013 continue to exceed AWQC. Concentrations and trend data are presented in Section 2.5.

4.2.2.3 Upper Magnet Gulch

Background

Magnet Gulch, located to the east of Government Gulch, was used for various material storage and handling processes. Much of Magnet Gulch was filled to construct the A-1 Gypsum Pond, a railroad embankment and materials storage area. The lower portion of Magnet Gulch was filled by the A-4 Gypsum Pond, discussed in Section 4.2.13. In the portion of Magnet Gulch immediately south of McKinley Avenue, approximately 20,000 tons of copper dross flue dust was stockpiled. This material contained significant amounts of lead, arsenic, zinc, and indium and was designated as a PTM during the OU 2 RI/FS phase. Magnet Creek stabilization work, primarily a sediment retention gabion dam, was constructed in 1992 as part of USEPA's 1990 Administrative Order on Consent with Gulf Resources and the Hecla Mining Company.

A review of remedial action requirements specific to Upper Magnet Gulch described in the 1992 OU 2 ROD, and 1996 and 1998 OU 2 ESDs is presented in the 2010 Five-Year Review Report (USEPA, 2010c). The Phase I remedial actions for Upper Magnet Gulch did not differ from the remedial actions identified in the 1992 OU 2 ROD.

The Upper Magnet Gulch Phase I remedial action was fully implemented in 1999. The general components of this action consist of the following:

- The copper dross flue dust pile was relocated from Magnet Gulch.
- The A-1 Gypsum Pond and mid-Gulch fill materials were removed.
- Magnet Creek was reconstructed and revegetated.

Additional details, including a complete listing and description of remedial actions, are provided in the 2010 Five-Year Review Report (USEPA, 2010c).

A long-term O&M manual was finalized for the Gulches, including Magnet Gulch remedial action in 2010 (TerraGraphics, 2010c), which describes the RAOs and O&M requirements in more detail. The RAOs associated with the Gulches include the following (TerraGraphics, 2010c):

- Minimize direct contact with contaminated material
- Minimize erosion
- Reduce suspended sediment/contaminant loading in surface runoff to the SFCDR
- Reduce contamination of surface water and groundwater

Operations and Maintenance and Actions since the Last Five-Year Review

O&M of Magnet Gulch is conducted in accordance with the gulches O&M manual (TerraGraphics, 2010c). Semiannual inspections of the Magnet Gulch remedial action are conducted by the IDEQ for features of the original action that remain intact. The property owner, Galena Ridge, is responsible for O&M of features that have been modified by construction of the Galena Ridge Golf Course. During this review period, the Magnet Gulch action has required no maintenance to sustain the integrity of the action.

IDEQ inspections, including the most recent fall 2014 inspection, confirmed that the lower sedimentation basin is functioning as designed. The Hilfiker retaining wall installed by Galena Ridge is sagging and has weeds growing in some areas. This has been under observation, but is not a structural concern and no further action is planned by Galena Ridge. The remedial action features on Galena Ridge property are in compliance with the performance standards of the O&M manual (IDEQ, 2014a).

Remedy Status

Based on the above RAOs, the Site inspections conducted by the IDEQ O&M program focus on the stability of soil caps and constructed stream channel, and condition of installed culverts. The inspections conducted during 2010-2015 indicated that the capped areas of Magnet Gulch are stable and provide effective barriers for underlying contaminated material. The stream channel and associated culverts are in good condition.

Surface water data collected from Magnet Gulch (BH-MG-0001)) continue to show decreasing trends for dissolved cadmium and zinc. Median dissolved zinc and cadmium concentrations for the period 2009 to 2013 continue to exceed AWQC.

4.2.2.4 Deadwood Gulch

Background

Deadwood Gulch is located immediately east of Magnet Gulch. The Arizona Mine Dump filled the narrow valley of Deadwood Gulch in its upper reaches. Various mine adits/portals were present in Deadwood Gulch, many of which occasionally discharged water from underground mine workings to the surface water in Deadwood Creek. Other than these point sources of contamination, Deadwood Gulch contamination was primarily from the erosion of adjacent hillside soils that had become contaminated with smelter emissions and the Sierra Nevada and Arizona Mine Dumps. In the early 1990s, two gabion dams were built across Deadwood Creek for sediment retention.

A review of remedial action requirements specific to Deadwood Gulch described in the 1992 OU 2 ROD is presented in the 2010 Five-Year Review Report (USEPA, 2010c).

The Deadwood Gulch Phase I remedial action was conducted beginning in 1995 and fully implemented in 2001. The general components of this action consist of the following:

- Sediment that had collected behind the gabion dams was removed.
- Creek stabilization work consisted of constructing small cobble and boulder grade check dams.
- The Arizona Mine Dump was removed and the streambed was reconstructed.
- Lower Deadwood Creek was reconstructed.
- Deadwood creek riparian corridor was planted.

Additional detail, including a complete listing and description of remedial actions, is provided in the 2010 Five-Year Review Report (USEPA, 2010c).

A long-term O&M manual was finalized for the Gulches, including Deadwood Gulch remedial action in 2010 (TerraGraphics, 2010c), which describes the RAOs and O&M requirements in more detail. The RAOs associated with the Deadwood Gulch are the same as those listed in Section 4.2.2.3 for Upper Magnet Gulch.

Operations and Maintenance and Actions since the Last Five-Year Review

O&M of Deadwood Gulch is conducted in accordance with the gulches O&M manual (TerraGraphics 2010c). Semiannual inspections of the Deadwood Gulch remedial action are conducted by the IDEQ for features of the original action that remain intact. Private property owner, Galena Ridge, is responsible for O&M of features that have been modified by development activities. Development work is coordinated with ICP. During this review period, the Deadwood Gulch action has required no maintenance to sustain the integrity of the action.

The fall 2014 IDEQ inspection noted the following (IDEQ, 2014a):

- Sediment basins, culverts, and the reconstructed channel are in good condition and function as designed.
- The lower gabion dam is in poor condition, but has served its purpose and no further action is necessary.

Remedy Status

The Deadwood Gulch Phase I remedial action has been in place for about 18 years. No O&M has been necessary for the Deadwood Gulch Phase I remedy during this Five-Year Review period.

The inspections conducted during 2010-2015 indicated that the remedial actions in Deadwood Gulch are stable and provide effective barriers for underlying contaminated material. All of the design features are meeting the performance standards listed in the gulches O&M manual (TerraGraphics, 2010c). Based on Site inspections and lack of O&M needed for this remedial action, this Five-Year Review documents that no issues currently exist with the performance of the Deadwood Gulch Phase I remedy (USEPA, 2010c).

Surface water data collected from Deadwood Gulch (BH-DW-0001) continue to show decreasing trends for the dissolved cadmium and zinc. Median dissolved zinc and cadmium concentrations for the period 2009 to 2013 continue to exceed AWQC.

4.2.2.5 Railroad Gulch

Background

Railroad Gulch is east of Deadwood Gulch and south of the Boulevard Area. The lower portion of the creek channel was undersized and routinely flooded during high flow spring runoff onto the Boulevard Area (a flat area that historically stored piles of highly concentrated ore material, “concentrates”). This localized flooding spread contamination that existed in the Boulevard Area. Erosion of the channel also occurred during high runoff owing to the steep channel gradient between McKinley Avenue and Bunker Creek.

The Railroad Gulch Phase I remedial action was fully implemented in 1997. The general components of this action consist of the following:

- A portion of the Railroad Gulch surface water channel was reconstructed.
- Culverts beneath McKinley Avenue were increased in size to handle the estimated spring runoff flows.
- Areas adjacent to the channel that were disturbed during construction capped with at least 6 inches of clean fill and were revegetated.

Additional detail, including a listing and description of remedial actions, is provided in the 2010 Five-Year Review Report (USEPA, 2010c).

A long-term O&M manual was finalized for the gulches, including Railroad Gulch remedial action in 2010 (TerraGraphics, 2010c), which describes the RAOs and O&M requirements in more detail. The RAOs associated with the Railroad Gulch are the same as those listed in Section 4.2.2.3 for Upper Magnet Gulch.

Operations and Maintenance and Actions Since the Last Five-Year Review
Semiannual inspections of the Railroad Gulch remedial action are conducted by the IDEQ in accordance with the gulches O&M manual (TerraGraphics 2010c). During the 2012 spring O&M inspection it was discovered that some of the western bank armor had sloughed into the channel, barrier fabric was exposed, and the bank was compromised. IDEQ completed repairs by replacing the channel armoring with large rip-rap rock in August of 2012 (IDEQ, 2012c).The Railroad Gulch remedy has required no other maintenance to sustain the integrity of the action.

The fall 2014 IDEQ inspection noted the sediment basin, culverts, and the reconstructed channel are in good condition and function as designed (IDEQ, 2014a).

Remedy Status
The Railroad Gulch remedial action has been in place for about 16 years. O&M inspections conducted during this review period indicated that the Railroad Gulch Creek channel is stable and revegetation in the gulch is established and minimizing erosion.

4.2.3 Smelterville Flats

4.2.3.1 Background and Description

The boundaries of the Smelterville Flats area are the northern bank of the SFCDR floodplain, Pinehurst Narrows to the west, the city of Smelterville to the south, and the I-90 West Kellogg interchange to the east (Figure 4-1). The Shoshone County Airport and runway are located in the Smelterville Flats area north of I-90.

In 1910, mining companies in the Silver Valley constructed a series of plank and pile dams on the SFCDR, including one in the Pinehurst Narrows area, to mitigate downstream transport of tailings. The Pinehurst Narrows plank and pile dam impounded tailings in the SFCDR floodplain in the Smelterville Flats area from OU 2 and upstream sources. Additional detail on chronological events is provided in the 2010 Five-Year Review Report (USEPA, 2010c).

A review of Smelterville Flats remedial action requirements described in the 1992 OU 2 ROD, the 1998 OU 2 ESD, and the 2001 OU 2 ROD Amendment is presented in the 2010 Five-Year Review Report (USEPA, 2010c). The 1992 OU 2 ROD requirements for the SFCDR removal and stabilization work are the same as those cited for Smelterville Flats. The 1992 OU 2 ROD and the 1998 OU 2 ESD requirements for the miscellaneous Box projects are the same as those cited for Smelterville Flats. The RAOs associated with the Smelterville Flats remedy are intended to accomplish the following:

- Minimize direct contact with contaminated material.
- Minimize surface water erosion and wind dispersion of contaminants.
- Minimize migration of contaminants to surface and groundwater.
- Minimize surface water infiltration into the underlying contaminants.

The Smelterville Flats Phase I remedial action was fully implemented in 2001. The general components of this action consist of the following:

- Tailings were extensively removed in Smelterville Flats north of I-90 to achieve Site-specific removal goals of 3,000 mg/kg lead and 3,000 mg/kg zinc, as well as south of I-90 and with a removal goal of 1,000 mg/kg lead. The tailings removed were transported to the CIA for disposal.
- The area was capped and revegetated, including riparian plantings of trees and shrubs, to prevent direct contact with underlying contaminants by humans and animals and to stabilize the floodplain and minimize erosion.
- Floodway work was conducted for the SFCDR to improve groundwater and surface water quality.
- Surface water runoff control was improved.

Additional detail, including a listing and description of remedial actions, is provided in the 2010 Five-Year Review Report (USEPA, 2010c).

A long-term O&M manual was prepared for the Smelterville Flats remedial action in 2010 (TerraGraphics, 2010d), which describes the RAOs and O&M requirements in more detail. Regular O&M inspections have been conducted by the IDEQ since the initial inspection of Smelterville Flats in September 2009.

Following the Phase I remedial action, SFCDR surface water quality appears to have improved with respect to dissolved zinc concentrations, AWQC ratios, and loading. The findings of the Phase I remedial action assessment, with respect to water quality and performance standards, are summarized in the 2010 Five-Year Review Report (USEPA, 2010c). The biological resource effectiveness monitoring conducted on Smelterville Flats by the USFWS for USEPA is discussed in Section 2.5.3 of this document and in monitoring reports prepared by USFWS.

4.2.3.2 Operations and Maintenance and Actions since the Last Five-Year Review

Semiannual inspections of the Smelterville Flats remedial action are conducted by the IDEQ in accordance with the Smelterville Flats O&M manual (TerraGraphics, 2010d). During this review period, the Smelterville Flats action has required no maintenance to sustain the integrity of the action.

The fall 2014 IDEQ inspection noted the following (IDEQ, 2014a):

- The wetlands are thriving.
- Floodplain features (e.g., spillways, berms) are functioning as designed with the exception of the three pairs of sills that failed twice to control the river channel route and were abandoned in 2000.
- Weeds are growing aggressively in the area.

The 2010 Five-Year Review included the following recommendations for Smelterville Flats:

- **Recommendation**: Complete the CFP currently being developed by USEPA and IDEQ for all three OUs.

Discussion: See Section 3.2.1.6 for discussion. This recommendation is complete. This recommendation is repeated for all three OUs and is complete for all three OUS.

- **Recommendation:** Continue informal observational monitoring of SFCDR removal and stabilization project sites, especially after flood events. Will also include as part of Smelterville Flats Phase I Remedial Effectiveness Monitoring (an ongoing recommendation from the 2005 Five-Year Review).

  Discussion: Informal observation of SFCDR removal and stabilization project areas and Phase I Remedial Effectiveness Monitoring near Smelterville Flats have been conducted as recommended. The 2012 ROD Amendment Selected Remedy does not include additional actions along the SFCDR in the Smelterville Flats area. This recommendation is complete.

4.2.3.3 Remedy Status

Remedy performance of the Smelterville Flats Phase I remedy was evaluated by reviewing IDEQ O&M inspections of the various remedial components completed to achieve the RAOs cited above. The Site inspections conducted by the IDEQ O&M program focus on the stability of soil caps and reconstructed stream banks and the health of the revegetation efforts. The inspections conducted during 2010-2015 indicated that the capped areas of Smelterville Flats are stable and provide effective barriers for underlying contaminated material. The vegetation at Smelterville Flats was healthy and has been regenerating yearly without maintenance efforts. Some noxious weed spraying has been conducted in the flats by Shoshone County on the airport property during this review period, but Site inspections continue to identify noxious weeds growing aggressively within the flats. Previous IDEQ O&M inspections have noted that stream bank erosion is occurring along sections that were not subject to remedial action (IDEQ, 2014b). Long-term surface water monitoring down gradient from Smelterville Flats at Pinehurst has displayed a decreasing trend in lead concentrations since the Phase I remedial actions were conducted and is an indicator that the area is acting as a lead sink and remains stable. The reconstructed stream banks of the SFCDR in the Flats area are stable and performing adequately to minimize sediment entering into the river.

As discussed in Section 2.5, the effectiveness of the Smelterville Flats Phase I remedy can be inferred by long-term decreasing trends in the SFCDR surface water station near Pinehurst. Concentrations of total lead and total zinc at this station showed a significant decrease over the period between 1990 and 2013, reflecting the remedial actions that occurred during Phase I. However, this decreasing trend levels off at SFCDR near Pinehurst after 2003.

4.2.4 Central Impoundment Area

4.2.4.1 Background and Description

The CIA was constructed in 1928 as a repository for flotation tailings from Bunker Hill ore concentration mills. Over time, the CIA developed into an impoundment for tailings, mine waste, gypsum, other process waste and water, and AMD from the Bunker Hill Mine. The current configuration of the CIA is shown in Figure 4-1 and covers approximately 260 acres with embankments ranging in height from 30 to 70 feet above the valley floor. The evolution of the CIA from its construction in 1928 through 1977, including detailed chronological events, is presented in the 2010 Five-Year Review Report (USEPA, 2010c). After 1977, no significant changes occurred to the CIA until its use as a waste repository during remedial actions in the mid to late 1990s and its eventual closure with an impermeable cap in 2000. Since 2000, the discharge rates measured at seepage locations on the southern bank of the SFCDR have been reduced an order of magnitude. Groundwater elevations in the shallow aquifer in the area suggest that the current discharge associated with the discrete seepage location are associated with the shallow groundwater in the area and not direct seepage from the CIA.

A review of the CIA remedial action requirements described in the 1992 OU 2 ROD, the 1998 OU 2 ESD, and the 2001 OU 2 ROD Amendment is presented in the 2010 Five-Year Review Report (USEPA, 2010c).

The CIA Phase I remedial action was fully implemented in 2000. The components of this action consist of the following:

- Mine wastes and materials within the CIA were consolidated between 1995 and 1999.
- A geomembrane cover system was installed on the surface of the CIA.

A long-term O&M manual was finalized for the CIA remedial action in 2009 (TerraGraphics, 2009a), which describes the RAOs and O&M requirements in more detail. The RAOs associated with the CIA remedy are intended to (TerraGraphics, 2009a):

- Minimize risk of direct contact with contaminated material.
- Minimize infiltration through contaminated media.
- Control erosion.
- Maximize efficient interception of contaminated groundwater from the CIA seeps.
- Provide location for CTP sludge disposal.

Additional detail, including a listing and description of remedial actions, is provided in the 2010 Five-Year Review Report (USEPA, 2010c).

4.2.4.2 Operations and Maintenance and Actions since the Last Five-Year Review

Semiannual inspections of the CIA remedial action are conducted by the IDEQ in accordance with the CIA O&M manual (TerraGraphics, 2009a).

The fall 2014 IDEQ inspection noted the following (IDEQ, 2014a):

- No major deficiencies were found in the CIA performance.
- The vegetation on the cover is flourishing.
- The weed population is under control.
- A section of the fence along the north side had been damaged by snow plowing of the adjacent parking lot.

During this review period, the CIA action has required the following maintenance activities:

- Weed spraying was conducted in October 2013 (IDEQ, 2013b).
- Disconnected drain system cleanout was repaired and area was reseeded in July 2012 (IDEQ, 2012c).
- Temporary fence was repaired in June 2014. Permanent repair of the access control in this area will be evaluated pending the installation of the groundwater cutoff wall along the north side of the CIA (IDEQ, 2014a).

4.2.4.3 Remedy Status

The Phase I CIA remedy is functioning as intended. To date, the first three objectives of the Phase I CIA remedy have been achieved. The interception of groundwater was deferred to the Phase II remedy, and the replacement of the unlined sludge pond will not be implemented until the existing pond reaches capacity. Therefore, this assessment focuses on the Phase I CIA remedies.

O&M inspections during this review period showed that the capped area of the CIA was stable and provided an effective barrier to the underlying consolidated waste materials. No evidence of adverse settlement was found. Vegetation on the capped area was healthy and regenerating yearly without maintenance efforts. Noxious weeds have been under control since spraying efforts took place in 2013. Weed control is not an element of the remedial action, but rather a property owner obligation.

The runoff control berms and swales were stable and provide effective means to channel runoff of the CIA and into rock-lined perimeter discharge points. The rock-lined surface water discharge channels were stable and showed no signs of rock displacement. No remedy issues were found in the CIA remedial action features.

The SFCDR reach adjacent to the CIA continues to be the highest source of dissolved metals loading from groundwater to the SFCDR in the Upper Basin. As discussed in Section 2.5, contaminant concentrations near the CIA, in both surface water and groundwater, continue to exceed AWQC at most sampling locations. To measure the effectiveness of the planned Phase II remedial action (groundwater collection and treatment adjacent to the CIA), USEPA will be monitoring selected groundwater and surface water locations in comparison to baseline conditions as part of a remedial action effectiveness monitoring program. The construction of this remedy is scheduled to begin implementation in 2016.

4.2.5 Bunker Creek

4.2.5.1 Background and Description

Bunker Creek is located at the southern toe of the CIA and north of the Trail of the Coeur d'Alenes. The combined flow of Bunker Creek is primarily made up of discharges from the CTP effluent, drainage from the SCA and BAL, and surface water flows from Portal Gulch, Railroad Gulch, the Boulevard Area, Deadwood Gulch, Magnet Gulch, and two CIA outfalls. Historical records show that uncontrolled dumping of coarse tailings, fine-grained tailings (slimes), mine waste rock, and granulated smelter slag occurred in the Bunker Creek corridor.

A review of Bunker Creek remedial action requirements described in the 1992 OU 2 ROD and the 2001 OU 2 ROD Amendment is presented in the 2010 Five-Year Review Report (USEPA, 2010c). The RAOs associated with the Bunker Creek remedy are intended to accomplish the following:

- Minimize the risk of direct contact with contaminants.
- Reduce suspended sediment and/or contaminant loading in surface runoff to the SFCDR.
- Minimize infiltration through contaminated material.

Bunker Creek Phase I remedial action was fully implemented by 2001. The general components of this action consist of the following:

- Approximately 7,600 linear feet of the creek channel was reconstructed, including a low flow channel and floodplain.
- Flotation slimes exposed at the surface of channel excavations were removed to a depth of 2 feet below the slimes and backfilled to stream grade with clean compacted backfill material.
- Culverts and riprap headwalls were installed for three road crossings to maintain Site access over Bunker Creek.
- Minimum 6-inch ICP barriers were placed at the surface of all disturbed areas in the Bunker Creek corridor and hydroseeded.
- Trees and shrubs were planted along the creek corridor in 2001.

Additional detail, including a listing and description of remedial actions, is provided in the 2010 Five-Year Review Report (USEPA, 2010c).

A long-term O&M manual was finalized for Bunker Creek remedial action in 2010 (TerraGraphics, 2010e), which describes the RAOs and O&M requirements in more detail.

4.2.5.2 Operations and Maintenance and Actions since the Last Five-Year Review

Semiannual inspections of the Bunker Creek remedial action are conducted by the IDEQ in accordance with the Bunker Creek O&M manual (TerraGraphics, 2010e). The fall 2014 IDEQ inspection confirmed that the channel and barriers are performing as designed.

Beaver activity was observed during the 2010, 2012, and 2014 O&M inspections. IDEQ has trapped six beavers and removed ten beaver dams and two beaver lodges since 2010. Beaver activity will continue to be monitored through the IDEQ O&M program for potential impacts on the remedy of Bunker Creek and adjacent areas.

During this review period, the Bunker Creek action has required the following maintenance activities:

- Weeds were sprayed regularly by hand, with commercial spraying conducted in 2013 (IDEQ, 2014b)
- Beaver trapping and dam removal in 2010, 2012, and 2014 (IDEQ, 2011a, 2012b, and 2014a)
- Fence repair in July 2011 and June 2013. (IDEQ, 2011b and 2013a)

The 2010 Five-Year Review included the following recommendations for Bunker Creek.

- **Recommendation:** Regarding the Bunker Creek Culverts, continue working with the BEIPC and other stakeholders to evaluate and plan actions relative to addressing SFCDR and Pine Creek flooding issues.

  Discussion: IDEQ, USEPA, and the BEIPC have requested assistance from federal and state flood control agencies to address the threat of large-scale flooding to the remedy (such as flooding from the SFCDR and Pine Creek). The Silver Jackets, an interagency coordinating group, identified local actions that could be taken to help protect against flooding. However, funding has not yet been found to perform the required flooding study and subsequent flood control projects. The BEIPC Executive Director continues to work with local flood control entities to identify sources of assistance. This recommendation is complete. This recommendation is repeated for all three OUs.

- **Recommendation**: SSC for 2001 OU 2 ROD Amendment to continue, with the assistance of the IDEQ, to pursue viable solutions to the SSC impasse. Once a solution is achieved, continue with implementation of the 2001 OU 2 ROD Amendment (an ongoing recommendation from the 2005 Five-Year Review).

  Discussion: Because of an inability to reach agreement on the State's obligations for the OU 2 Mine Water ROD amendment actions, phase II remedial actions have generally not been implemented to date. Due to the settlement with Hecla, non-federal funds are now available to implement some of the phase 2 actions, including the CTP and groundwater collection system. Long-term O&M obligations for these actions is addressed in a 2014 memorandum of agreement whereby the IDEQ agreed to conduct long-term O&M activities as long as the funds placed in the State Endowment Fund from the Hecla settlement last. This recommendation is complete.

4.2.5.3 Remedy Status

The Bunker Creek Phase I remedy is functioning as intended by the decision documents. Specific aspects of the Phase I remedy performance evaluation are described in the following paragraphs.

The 1992 ROD required Bunker Creek to be lined in order to meet the RAO described above. However, the 2012 ROD Amendment superseded this requirement with a selected remedy to divert CTP effluent away from Bunker Creek to minimize infiltration through contaminated materials. Planning for diversion of CTP flows away from Bunker Creek is underway. Site inspections indicate that the Bunker Creek channel is stable, with soil caps remaining intact and serving to prevent direct contact with underlying contaminated soils. The vegetation on both the channel and adjacent areas is well established and is regenerating yearly without any maintenance. Culverts are free of sediment and debris.

The 2005 Five-Year Review Report identified recontamination processes and contributing factors in certain segments of Bunker Creek. Samples collected from the Bunker Creek channel confirmed the presence of contaminated sediments. For this Five-Year Review, site inspections confirmed that fencing installed between the creek and the Trail of the Coeur d'Alenes is intact and functioning as intended, with the exception of occasional damage to the from wildlife crossing requiring repairs. Repairs are completed as needed.

Based on the Phase I remedy goal of preventing direct contact by humans with underlying contaminants, the Phase I remedy for Bunker Creek is performing adequately.

The water quality of Bunker Creek is significantly influenced by the water quality of tributary creeks and other discharges (Portal, Railroad, Deadwood, and Magnet Creeks; CTP discharge; stormwater runoff from the city of Kellogg, Bunker Hill Mine yard, and the SCA). As discussed in Section 2.5, base flows in Bunker Creek do not meet the AWQC. With the completion of the Phase II groundwater collection system, CTP effluent that is currently discharged to Bunker Creek will be diverted to a discharge location in the SFCDR.

4.2.6 Industrial Complex

As defined by the 1992 OU 2 ROD, the Industrial Complex consisted of three main areas: the Lead Smelter (now the Smelter Closure Area, SCA), the Zinc Plant (including the Phosphoric Acid Plant), and the Mine Operations Area (MOA) (Figure 4-1). The highest concentrations of contaminant metals within OU 2 were found in the Lead Smelter area. Risk assessments conducted during the remedial investigation resulted in a subset of Site process materials that were designated as Principle Threat Materials (PTMs) based on their higher level of contamination. This section focuses on the remedy implemented for the SCA and PTM Cell, the BAL, and Area 14. The MOA is discussed separately in Section 4.2.7.

A review of the Industrial Complex remedial action requirements described in the 1992 OU 2 ROD, the 1996 and 1998 OU 2 ESDs, and the 1996 and 2001 OU 2 ROD Amendments is presented in the 2010 Five-Year Review Report (USEPA, 2010c). Individual remedial actions and RAOs are discussed in the below sections.

The 2010 Five-Year Review included the following recommendation for the Industrial Complex.

- **Recommendation:** SSC for 2001 OU 2 ROD Amendment to continue, with the assistance of the IDEQ, to pursue viable solutions to the SSC impasse. Once a solution is achieved, continue with implementation of the 2001 OU 2 ROD Amendment (an ongoing recommendation from the 2005 Five-Year Review).

  Discussion: Because of an inability to reach agreement on the State's obligations for the OU 2 Mine Water ROD amendment actions, phase II remedial actions have generally not been implemented to date. Due to the settlement with Hecla, non-federal funds are now available to implement some of the phase 2 actions, including the CTP and groundwater collection system. Long-term O&M obligations for these actions is addressed in a 2014 memorandum of agreement whereby the IDEQ agreed to conduct long-term O&M activities as long as the funds placed in the State Endowment Fund from the Hecla settlement last. This recommendation is complete.

4.2.6.1 Smelter Closure Area and Principal Threat Material Cell

Background

The Industrial Complex remedial action consolidated highly contaminated soil and material accumulations from Site removal actions and debris resulting from demolition of the Industrial Complex structures into an engineered closure with a low-permeability geomembrane cap. This 30-acre SCA (Figure 4-1) was designed to accommodate up to 420,000 cy of material. The RAOs associated with the SCA remedy are intended to accomplish the following:

- Minimize risk of direct contact with contaminants.
- Minimize surface water infiltration through contaminants.
- Minimize soil erosion.
- Minimize the potential for contamination of surface water and groundwater.

The SCA Phase I remedial action was implemented between 1995 and 1998. The general components of this action consist of the following:

- Demolition debris from the Lead Smelter, Phosphoric Acid, and Zinc Plants, and boneyard soil, larger wood, and metal debris was consolidated in the SCA.

- Slag and contaminated soil from various Site removals was used as in-fill material to minimize void spaces and the potential for future settlement.
- The PTM Cell (geomembrane-lined mono-cell) was constructed within the boundary of the SCA. Approximately 80,000 to 100,000 cy of PTM, including copper dross flue dust, was placed in the cell.
- A seep collection system and toe drain was constructed that conveys water to the lined pond and to the CTP for treatment.
- The SCA was capped with a geomembrane liner, a drainage layer, growth media and revegetated with a native plant seed mix.
- A surface water management system prevents run-on onto the closure cap. A separate surface water system conveys precipitation off the closure cap using a series of berms and ditches. Collected surface water is conveyed to Magnet and Bunker Creeks.

Additional detail, including a complete listing and description of remedial actions, is provided in the 2010 Five-Year Review Report (USEPA, 2010c).

As described in previous sections, large-scale development of a golf course community has been occurring in the upper Magnet Gulch and lower hillsides area, including residences and associated infrastructure. As part of development, a portion of the SCA remedy was altered, consisting of the removal and replacement of a portion of the West Canyon surface water diversion and conversion of the unlined West Canyon sedimentation basins to a lined detention pond (lake). Additional detail related to the development activities, including groundwater quality and elevation monitoring at the SCA, is provided in the 2010 Five-Year Review (USEPA, 2010c).

A long-term O&M manual was finalized for the SCA Phase I remedial action in 2008 (TerraGraphics, 2008b), which describes the RAOs and O&M requirements in more detail. By mutual agreement, the third-party property owner agreed to perform maintenance of those features and areas that have been altered as part of development activities. IDEQ continues to be responsible for ensuring appropriate O&M of these features occurs and for O&M of unaltered features of the RA. The ICP oversees human health barriers installed outside the SCA fence.

Operations and Maintenance and Actions since the Last Five-Year Review

Semiannual inspections of the SCA remedial action are conducted by the IDEQ in accordance with the SCA Operation and Maintenance Manual (TerraGraphics, 2008b).

The fall 2014 IDEQ inspection noted the following (IDEQ, 2014a):

- The overall cover and drainage system is performing the intended function;
- Two strip-drain collection pipes, which had been repaired previously, have become disconnected again and are not conveying stormwater as designed.
- Seven conifers and five woody plants were beginning to establish on the cap;
- Cottonwood trees are growing in the North Perimeter ditch but do not appear to be obstructing flow in the ditch.

- Two isolated areas on the north and west ends were being invaded by spotted knapweed and hawkweed.
- The overall vegetation on the cover system is well established responding well to weed spraying.
- A section of the fence along the north side had been taken down and replaced by the third party with temporary fencing.

During this review period, the SCA has required the following maintenance activities:

- A large cottonwood tree was removed that was obstructing the intake to a culvert near McKinley Avenue in spring 2012.
- Woody vegetation found within the limits of the cover system was sprayed and removed routinely during semiannual inspections, including 38 deciduous trees and 40 conifers.
- Noxious weeds were sprayed by hand routinely during semiannual inspections.
- Temporary repair to disconnected surface water strip drain collection pipes in July 2012 (IDEQ, 2012c). This was found during the fall 2014 inspection to have disconnected again, and will require a permanent repair (IDEQ, 2014a).

Remedy Status

Inspections conducted through the IDEQ O&M program showed that the capped area of the SCA is stable and provides an effective barrier to the underlying consolidated waste materials. No evidence of settlement was found. Vegetation on the capped area is healthy and regenerating yearly. The closure runoff control berms and swales are stable and provide effective means to channel runoff off the closure area and into perimeter ditches. The rock-lined perimeter ditch systems are stable and show no signs of rock displacement. Permanent repair of the surface water strip drain collection pipes is planned for 2015.

As discussed in Section 2.5, the effectiveness of the SCA remedy can be inferred by long-term decreasing trends in the SFCDR surface water station near Pinehurst. Concentrations of total lead and total zinc at this station showed a significant decrease between 1990 and 2013, reflecting the remedial actions that occurred during Phase I. However, this decreasing trend is not observed in data collected at SFCDR near Pinehurst post 2003 and concentrations remain above AWQC for lead, cadmium, and zinc. Groundwater quality in near the SCA is discussed in Section 2.5.

4.2.6.2 Borrow Area Landfill

Background

The BAL (Figure 4-1) was developed in 1997 and 1998 to provide “clean” fill for several of the Site remediation projects (CH2M HILL, 2002a). A portion of the BAL was subsequently used to dispose of lower-level contaminated soil and solid waste from the upper industrial landfill located in Railroad Gulch. With the closure of the OU 2’s primary waste consolidation areas (the Smelter Closure in 1997 and the CIA in 2000), a disposal area within the borrow area, the BAL, was constructed in 2000 to accept contaminated soil and waste generated by the remaining remedial actions at the Site. The RAOs associated with the BAL remedy are provided in Section 4.2.6.1.

The following BAL activities were completed by 2002:

- Approximately 190,000 cy of waste materials were placed in the BAL in 2000 and 2001.
- The BAL was closed in 2002 and closure activities consisted of grading, surface water management, placement of a soil cover, hydroseeding, and establishing settlement monitoring points.

In 2006, the IDEQ transferred the BAL property to a third party. As described in previous sections, large-scale development activities have been occurring near the BAL that include construction of a golf course community and associated infrastructure. The BAL was converted to a golf course and an associated pond.

Additional detail, including a listing and description of remedial actions, is provided in the 2010 Five-Year Review Report (USEPA, 2010c). A long-term O&M manual was finalized for the BAL in 2007 (CH2M HILL, 2007b). By mutual agreement, the third-party property owner agreed to perform maintenance of those features and areas that have been altered as part of development activities. The ICP oversees the soil cover barrier at the BAL.

Operations and Maintenance and Actions since the Last Five-Year Review

O&M of the BAL during this review period has been conducted by property owner, Galena Ridge, LLC, as a component of the Galena Ridge Golf Course. IDEQ monitors the performance of the remedy at the BAL through coordination with ICP and notes potential issues in semiannual O&M reports. The fall 2014 O&M report concluded that all of the features of the BAL remedy are functioning as designed and in compliance with the ICP and performance standards of the O&M Manual.

Remedy Status

Observations of the BAL development by IDEQ and PHD personnel indicate that the barriers installed as part of the Galena Ridge Golf Course development are stable and well maintained. Based on these observations, the BAL remedy is performing as designed and in accordance with the decision documents.

4.2.6.3 Area 14

Background

Area 14 is approximately 8 acres located between McKinley Avenue and the SCA. Area 14 has been defined as the West Slag Dumps of the Smelter Complex due to blast furnace slag piles that were staged on the eastern portion of the subarea. The western portion of the area contains the former Sweeney Mill and an area currently leased to Avista Utilities and Williams Gas. Area 14 is currently designated for industrial use.

The following Area 14 activities were completed:

- Two former sedimentation ponds (Gilges Pond and Sweeney Pond) and known PTM were excavated and backfilled in 1997 and 1999.
- In 2006, the former Sweeney Mill area was graded to drain and a 6-inch ICP barrier placed. Approximately 120 cy of contaminated material was removed from the adjacent hillside and disposed in the Page Repository. The hillside was graded, capped, and revegetated.

In 2006, the IDEQ transferred Area 14 property to a third party, as described in the 2010 Five-Year Review Report (USEPA, 2010c). An ICP barrier has not yet been installed within the eastern portion of Area 14 pending development.

Operations and Maintenance and Actions since the Last Five-Year Review

No activity has occurred in Area 14 during this review period.

The 2010 Five-Year Review included the following recommendation.

- **Recommendation:** Initiate phased site characterization, remedial design, and remedial action at Area 14 (an ongoing recommendation from the 2005 Five-Year Review).

  Discussion: Area 14 is currently fenced and owned by Galena Ridge. Further cleanup of Area 14 will occur in accordance with the ICP during development of the property. This recommendation is complete.

Remedy Status

Other than an ICP cap over the Sweeney Mill portion and subsurface removal of contaminated material, the remedy for Area 14 has not yet been installed, pending development by the property owner.

4.2.7 Mine Operations and Boulevard Areas

4.2.7.1 Background and Description

Figure 4-1 shows the historical location of the MOA and Boulevard Area. Historically, the MOA consisted of land and ore processing structures consisting of the powerhouse, the concentrator silo and conveyor system, the concentrator building and trestle system to the CIA, the mill settling pond, and two small ancillary office buildings west of the concentrator building. When initial ore processing was conducted at the MOA facilities, the Boulevard Area was used as a staging area for concentrates prior to being loaded into rail cars and transported to the Lead Smelter. The MOA facilities operated until the early 1980s. The RI (McCulley, Frick, and Gilman [MFG], 1992) indicated that the Boulevard Area soils were contaminated to levels exceeding principal threat levels.

A review of the Mine Operations and Boulevard Areas remedial action requirements described in the 1992 OU 2 ROD and the 1996 OU 2 ROD Amendment, and a summary of performance standards for the remedies, are presented in the 2010 Five-Year Review Report (USEPA, 2010c). The RAOs associated with the MOA remedy are intended to accomplish the following:

- Minimize risk of direct contact with contaminants.
- Minimize surface water infiltration through contaminants.

The MOA remedial action was completed in 1995. The components of this action consist of the following:

- Hazardous materials located within buildings were characterized and removed.
- Contaminated soil, concentrates, and ores were removed for reprocessing.
- Buildings were demolished, and debris was disposed of on top of the CIA. Asbestos was abated and disposed offsite.

- The Site was graded and revegetated and ICP barriers were put into place.

The Boulevard Area remedial action was completed in 1997. The components of this action consist of the following:

- PTMs and contaminated soil were removed and transported to the SCA and disposed in the geomembrane-lined PTM Cell. Non-PTM-level (84,600 mg/kg) materials were disposed in the general SCA.
- Soil was replaced with clean soil and surface water control measures constructed.

Additional detail, including a complete listing and description of remedial actions, is provided in the 2010 Five-Year Review Report (USEPA, 2010c). Long-term O&M of the Boulevard Area is addressed in the Gulches O&M Manual (TerraGraphics, 2010c).

4.2.7.2 Operations and Maintenance and Actions since the Last Five-Year Review

Semiannual inspections of the MOA and Boulevard Area remedial action are conducted by the IDEQ in accordance with the Railroad Gulch/Boulevard Area portion of the Gulches Operations and Maintenance Manual (TerraGraphics, 2010c).

The fall 2014 IDEQ inspection (IDEQ, 2014a) confirmed that the remedy is functioning as intended. Soil barriers are intact, drainage ditches are functioning, and culverts are in good condition.

During this review period, the Boulevard Area action has required the following maintenance activities:

- A small cottonwood tree was obstructing the intake to one of the culverts along McKinley Avenue and was removed by IDEQ in fall 2011 (IDEQ, 2011b).
- A bare area was identified near the sediment basin during the fall 2010 O&M inspection (IDEQ, 2011a). Subsequent sampling indicated lead levels below 1,000 parts per million. No follow on action was necessary.

4.2.7.3 Remedy Status

The MOA remedy is functioning as intended by the decision documents.

O&M inspections conducted through the IDEQ O&M program indicated that the soil caps in the MOA and Boulevard Areas remain intact and prevent direct contact with underlying contaminated soils. The vegetation on both the MOA and Boulevard Areas is well established and is regenerating yearly without any maintenance. In addition, surface water runoff ditches and culverts are performing as necessary to channel flow to Bunker Creek.

4.2.8 Milo Gulch

4.2.8.1 Background and Description

Milo Creek drains an approximately 4-square-mile watershed located above and within Wardner and Kellogg and eventually discharges into the SFCDR (Figure 4-1). The Milo Creek watershed is discussed in this section in three segments: the upper Milo Creek watershed, the lower Milo Creek piping system, and Reed Landing. Additional detail for each segment is provided in the 2010 Five-Year Review Report (USEPA, 2010c).

The upper Milo Creek watershed has an area of about 2 square miles and consists of forested and clear-cut areas, the Silver Mountain Ski Resort, mine dumps, and some industrial mining areas (Reed Landing). Mine dumps, portals, access roads, hoists, and other industrial mining features are located throughout this area and have affected Milo Creek's water quality and discharge over the years.

The lower Milo Creek piping system consists of a concrete sediment basin upgradient of Wardner and an underground high-density polyethylene conveyance system.

Reed Landing consists of a mine tailings dump obstructing the Milo Creek flow path, located midway up the watershed, which was filled in the early days of the Bunker Hill Mine Complex operations. Prior to 1998, a 4 x 4 culvert conveyed Milo Creek through the dump or "landing."

A review of Milo Gulch remedial action requirements described in the 1992 OU 2 ROD, the 1998 OU 2 ESD, and the 2001 OU 2 ROD Amendment is presented in the 2010 Five-Year Review Report (USEPA, 2010c). The RAOs associated with the Milo Gulch remedy are intended to accomplish the following:

- Reduce suspended sediment and/or contaminant loading in surface runoff to SFCDR.
- Minimize surface water infiltration through contaminants.
- Minimize surface water infiltration into the underlying Bunker Hill Mine workings.
- Minimize the potential for recontamination of previously remediated residential yards.
- Reduce the quantity of AMD created in the Bunker Hill Mine.

Milo Gulch and Reed Landing remedial action was conducted between 1995 and 2000. The general components of this action consist of the following:

- About 30,000 cy of mine waste rock and tailings removed from creek banks above Reed Landing and placed in Guy Caves area by Bunker Hill Mine owner.
- Milo Creek and Reed Landing conveyance systems were installed to convey flow unimpeded and to minimize contact between Milo Creek and underlying tailings/mine waste and to protect downstream residences from recontamination during floods. The conveyance system was constructed with a capacity to convey a 100-year recurrence interval storm event.
- The failing timber crib retaining walls were removed and the nearly vertical face of the landing was regraded.

Additional detail, including a listing and description of remedial actions, is provided in the 2010 Five-Year Review Report (USEPA, 2010c).

There are additional remedial actions called for in the 2001 OU 2 ROD Amendment (USEPA, 2001b) to address the infiltration into the underground mine workings. Remedial design for the West Milo Diversion project was conducted by USACE for USEPA. The design was completed to the 95 percent level in 2008. Construction is pending remedial action funding. In addition to the West Milo Diversion project, other remedial actions called for in the 2001 OU 2 ROD Amendment that have not be implemented include rehabilitating the Phil Sheridan Raise and plugging in-mine drill holes to reduce the quantity of surface water entering the mine and AMD creation within the mine.

A watershed district was formally established in 1998 for maintaining the Milo structures. A long-term O&M manual was prepared for Milo Creek (TerraGraphics, 2001) and the Reed Landing structures (USACE, 2000) that describe the O&M requirements in more detail. USEPA remains responsible for Reed Landing elements of the Milo conveyance system until O&M responsibilities are formally transferred from USEPA to the IDEQ. The Milo Creek Watershed District has the responsibility of conducting regular O&M activities for the lower Milo Creek piping system.

4.2.8.2 Operations and Maintenance and Actions since the Last Five-Year Review

The Milo Watershed District Commissioner was consulted and confirmed that the District conducts regular inspections semiannually and inspects the intake structures daily during high flow events to prevent excessive sediment and debris buildup. Maintenance activity during this review period has been limited to regular sediment and debris removal and a concrete patch after a hole was found in the structure during the July 2015 inspection.

The Reed Landing flood control project is inspected semiannually by IDEQ (on behalf of USEPA) in accordance with the Reed Landing O&M manual (USACE, 2000). USEPA funded sediment and debris removal from the Reed Landing structure in October of 2011. IDEQ removed debris from the structure by hand during the fall 2014 O&M Inspection (IDEQ, 2014a). No other maintenance has been required during this review period to sustain the integrity of the remedial action.

The 2010 Five-Year Review introduced the following recommendations for Milo Gulch.

- **Recommendation:** Regarding AMD discharge at Reed and Russell adits, continue discussions and negotiations with the mine owner to redirect the adit flows in the Milo drainage to the CTP for treatment. Subsequent to redirection of the adit flows, evaluate stability of the 4-foot by 4-foot structure (the first portion of this recommendation is also an ongoing recommendation from the 2005 Five-Year Review).

  Discussion: USEPA continues to be eager to coordinate this issue with the mine owner and operator. USEPA selected a remedy in the Upper Basin ROD Amendment to address this issue. This recommendation is complete.

- **Recommendation:** Secure permanent access for system maintenance (an ongoing recommendation from the 2005 Five-Year Review).

  Discussion: USEPA continues to work with the mine owner and operator to secure permanent access to Reed Landing for long-term O&M. This recommendation will not be retained on the table of issues and recommendations, because it does not directly affect protectiveness. It will instead be included on the table of planned action items.

- **Recommendation:** SSC for 2001 OU 2 ROD Amendment to continue, with the assistance of the IDEQ, to pursue viable solutions to the SSC impasse. Once a solution is achieved, continue with implementation of the 2001 OU 2 ROD Amendment (an ongoing recommendation from the 2005 Five-Year Review).

Discussion: Because of an inability to reach agreement on the State's obligations for the OU 2 Mine Water ROD amendment actions, phase II remedial actions have generally not been implemented to date. Due to the settlement with Hecla, non-federal funds are now available to implement some of the phase 2 actions, including the CTP and groundwater collection system. Long-term O&M obligations for these actions is addressed in a 2014 memorandum of agreement whereby the IDEQ agreed to conduct long-term O&M activities as long as the funds placed in the State Endowment Fund from the Hecla settlement last. This recommendation is complete.

4.2.8.3 Remedy Status

The Milo Gulch remedies have been in place for 15 years. The drainage system continues to function as designed, providing protection to downstream residences from recontamination due to flooding. Based on IDEQ O&M inspections and discussion with the Milo Creek Watershed District Staff in March of 2015, the hydraulic systems, including pipes and open channels, have required regular O&M efforts to keep structures free from debris during high flow, but the system appears to be functioning as designed.

As discussed in Section 2.5, surface water quality monitoring at the mouth of Milo Creek since the last five-year review shows a significant decreasing trend in particulate and dissolved lead as well as dissolved cadmium and zinc. All metals continue to exceed AWQC.

4.2.9 Central Treatment Plant

4.2.9.1 Background

The CTP was constructed in 1974 to treat metals-laden AMD from the Bunker Hill Mine and process water from various Industrial Complex facilities using a lime precipitation process. The CTP is located at the base of the southeast corner of the CIA (Figure 4-1). Historically, mine water flowed by gravity to the top of the CIA into an unlined holding pond prior to being conveyed to the CTP for treatment. Additional metals-contaminated water from other Site sources (runoff from the Zinc Plant, Phosphoric Acid Plant, and the Lead Smelter) was pumped to the CTP for treatment beginning in the mid-1970s.

To continue treatment of the Bunker Hill mine water and other contaminated Site flows, operational efficiency of the CTP has been improved, and more routine maintenance and equipment upgrades have been conducted since 1995. In addition, the historical practice of placing acidic mine water in unlined ponds on top of the CIA was ceased after construction of a lined holding pond in 1995.

Currently, the overall Bunker Hill mine water collection and treatment system consists of the Kellogg Tunnel Portal system, the mine water pipelines, the Lined Mine Water Storage Pond (Lined Pond), the Sweeney Area pipeline, the CTP, and the unlined Sludge Disposal Cell on the CIA. AMD flows from the Kellogg Tunnel Portal into a concrete channel and passes through a Parshall flume where the flow is measured. AMD then enters a buried high-density polyethylene pipeline (Mine Water Pipelines - Main Line), which conveys it either directly to the CTP (via the Direct Feed Branch) or to the Lined Pond (via the Lined Pond Branch), depending on the pipeline valve settings.

The Bunker Hill CTP is a lime treatment system configured for the high-density sludge (HDS) process. The HDS process is a modification of conventional lime precipitation designed to densify the sludge, reduce the volume of sludge requiring management, and improve sludge dewatering and water filterability. The CTP is currently operated in low-density sludge (LDS) mode with insufficient sludge recycling and sludge inventory in the Thickener to produce a high degree of sludge densification. Operating in LDS mode results in lower effluent total suspended solids (TSS) and particulate metals concentrations, enabling compliance with current discharge requirements. However, the LDS process generates significantly more sludge volume (approximately three times) than the volume if the CTP were operated in HDS mode. Currently, treated effluent is discharged directly to Bunker Creek, and waste sludge is pumped to the unlined Sludge Disposal Cell on the CIA, for dewatering and disposal in-place. Additional detail, including CTP configuration and operation, is provided in the following documents:

- *Design Considerations for Phase 1 and 2 CTP Upgrades* (also known as the 2013 CTP Master Plan Update; CH2M HILL, 2013b);
- Phase 1 Central Treatment Plant Upgrades Project Design Definition Report (DDR; CH2M HILL, 2013a); and
- Revised Draft Phase 1 Central Treatment Plant Upgrades and Central Impoundment Area Groundwater Collection System Schematic Design Report (CH2M HILL, 2014a).

4.2.9.2 Review of Record of Decision and Record of Decision Amendment Requirements

A review of the CTP remedial action requirements described in the 1992 OU 2 ROD and the 2001 OU 2 ROD Amendment (also known as the 2001 Mine Water ROD Amendment) is presented in the 2010 Five-Year Review Report (USEPA, 2010c). The 1992 OU 2 ROD identified Phase I source control actions for OU 2, which have largely been completed. The 2001 Mine Water ROD Amendment (USEPA, 2001b) and the 2012 Upper Basin ROD Amendment (USEPA, 2012a) identified Phase II remedial actions for collecting and treating select metals-contaminated source waters within OU 2 and the Upper Basin portion of OU 3 of the Site. Some remedial actions included in previous decision documents for OU 2 have not yet been implemented and are not modified by the Selected Remedy in the 2012 Upper Basin ROD Amendment. The RAOs associated with the CTP remedy are intended to accomplish the following:

- Reduce metal concentration in AMD to levels treatable using constructed wetland.
- Reduce the flow of mine water from the Bunker Hill Mine.
- Prevent AMD from discharging at locations other than the Kellogg Tunnel.
- Provide a cost-effective way to convey mine water from the Kellogg Tunnel to the CTP and Lined Pond.
- Provide storage for AMD to prevent flows greater than treatment capacity under high flow conditions.
- Meet effluent requirements for the CTP and prevent CTP upsets.

- Provide a lined storage facility for CTP sludge.
- Provide an alternate location for treatment of contaminated water.

The 2001 Mine Water ROD Amendment added remedial actions to the Selected Remedy for OU 2 (USEPA, 1992) to address the management of AMD from the Bunker Hill Mine. This was necessary, in part, because the CTP, which had not been significantly upgraded since it was built in 1974, could not consistently meet current water quality standards, and the existing sludge disposal area was approaching capacity. The OU 2 Selected Remedy also includes source control actions to reduce the amount of surface water flow into, and AMD flowing out of, the mine. The 2000 CTP Master Plan (CH2M HILL, 2000a), included as an appendix in the 2001 Bunker Hill Mine Water RI/FS (USEPA, 2001c), provided technical guidance on the phased implementation of the actions included in the 2001 Mine Water ROD Amendment.

Time-critical components of the 2001 Mine Water ROD Amendment were implemented between 2002 and 2006 as emergency actions to avoid potential catastrophic failure of the aging CTP and to provide for emergency mine water storage (USEPA and IDEQ, 2003; CH2M HILL, 2013a).

As noted in Section 2.2.2 of this report, USEPA, the IDEQ, and the Coeur d'Alene Tribe signed a memorandum of agreement in 2014 to provide funds set aside in a Court Registry Fund from the Consent Decree with Hecla Limited (U.S. v. Hecla Ltd., 2014) with the State's Endowment fund Investment Board. The memorandum of agreement stipulates that the funds set aside for the IDEQ must be used for collection and treatment, including O&M of facilities, of OU 2 contaminated waters.

The 2012 Upper Basin ROD Amendment clarified and modified some of the OU 2 and OU 3 water collection and treatment actions that had previously been selected in prior RODs for OU 2 and OU 3 (USEPA, 1992 and 2002a). Overall, the water collection actions focus on intercepting metals-contaminated groundwater, and adit discharges emanating from abandoned mining-impacted Sites before the flows enter surface waters. Some adit discharges, primarily those in relatively remote locations, have been designated for onsite passive or semi-passive treatment. The collected groundwater and adit seeps not treated onsite have been designated for collection, conveyance to, and active treatment at the CTP. The current treatment capacity of the CTP is insufficient to accommodate those additional OU 2 and OU 3 flows designated for active treatment; therefore, actions to increase the capacity of the CTP were selected as part of the 2012 Upper Basin ROD Amendment. In addition to increasing the capacity, the CTP upgrades are needed to comply with NPDES requirements. Based on additional flows that were planned to be treated as part of implementing the Selected Remedy in the 2012 Upper Basin ROD Amendment, the CTP Master Plan was updated in the fall of 2013 (CH2M HILL, 2013b) to document the CTP upgrades that had been conducted since 2000 as well as to revise future upgrade approaches.

4.2.9.3 O&M and Actions since Last Five-Year Review (2010-2015)

Additional remedial actions at the CTP were not completed during this Five-Year Review period. Activities performed at the CTP consisted of routine O&M of the treatment plant.

USACE, under an Interagency Agreement with USEPA, currently administers an O&M contract for the CTP and associated mine water infrastructure components external to the mine. The

New Bunker Hill Mining Corporation has not actively mined for several years. USEPA does not have regular access to the interior of the mine to verify that the maintenance of internal infrastructure is being conducted by the mine owner regularly; however, observations by USEPA, its contractors, and the CTP O&M contractor indicate that at least some of the needed maintenance activities are occurring. Such indications include regular pumping from the mine and visible flows in the ditch leading to the mine water line intake flume.

A long-term O&M manual was prepared for the CTP remedial action in 2004 (CH2M HILL, 2004). Regular O&M activities are conducted by the USACE O&M contractor that operates and maintains the CTP.

The 2010 Five-Year Review included the following recommendations for the CTP.

- **Recommendation:** SSC for 2001 OU 2 ROD Amendment to continue, with the assistance of the IDEQ, to pursue viable solutions to the SSC impasse. Once a solution is achieved, continue with implementation of the 2001 OU 2 ROD Amendment (an ongoing recommendation from the 2005 Five-Year Review).

  Discussion: Because of an inability to reach agreement on the State's obligations for the OU 2 Mine Water ROD amendment actions, phase II remedial actions have generally not been implemented to date. Due to the settlement with Hecla, non-federal funds are now available to implement some of the phase 2 actions, including the CTP and groundwater collection system. Long-term O&M obligations for these actions is addressed in a 2014 memorandum of agreement whereby the IDEQ agreed to conduct long-term O&M activities as long as the funds placed in the State Endowment Fund from the Hecla settlement last. This recommendation is complete.

- **Recommendation:** Regarding the AMD discharge from Reed and Russell, work with mine owner to address AMD conveyance issues resulting in discharge of AMD at these locations (an ongoing recommendation from the 2005 Five-Year Review).

  Discussion: USEPA continues to be eager to coordinate this issue with the mine owner and operator. USEPA selected a remedy in the Upper Basin ROD Amendment to address this issue. This recommendation is complete.

4.2.9.4 Central Treatment Plant Upgrades/Groundwater Collection System Remedial Design (2013-2015)

As part of the Phase II remedial actions identified in the 2001 Mine Water ROD Amendment and the 2012 Upper Basin ROD Amendment for collecting and treating select metals-contaminated source water within OU 2 and the Upper Basin portion of OU 3, upgrade and expansion of the CTP is expected to occur in two phases. The first phase (Phase 1) would include upgrades to the existing systems to improve efficiency and effectiveness, and would provide expanded treatment capacity to accommodate contaminated groundwater collected in OU 2 prior to its discharge to the SFCDR, in addition to the Bunker Hill Mine water currently treated at the CTP. The second phase (Phase 2) of CTP upgrade and expansion would provide additional treatment capacity for waters collected in OU 3 and conveyed to the CTP.

As one of the first of several water collection and treatment actions included in the Selected Remedy in the 2012 Upper Basin ROD Amendment, a remedial design (RD) project was initiated in 2013. An SDR was prepared (through approximately 30 percent design completion) to document the RD basis for the Phase 1 CTP Upgrades and CIA GWCS Remedial Action (also known as the 2014 CTP Upgrades/GWCS SDR; CH2M HILL, 2014a). The RD was conducted in accordance with the 2001 Mine Water ROD Amendment, the 2012 Upper Basin Interim ROD Amendment, the 2013 CTP Master Plan Update, and Remedial Design/Remedial Action Handbook (USEPA, 1995). The RD, as documented in the 2014 CTP Upgrades/GWCS SDR, includes the following elements:

- A GWCS located primarily between the CIA and the SFCDR
- Phase 1 CTP upgrades and expansion
- An effluent discharge pipeline from the CTP to the SFCDR

Based on analysis produced by CH2M HILL (2014a) it was apparent that the remaining capacity of the existing sludge disposal facility would likely be exhausted during the design and construction of the upgrades to the CTP. Therefore, USEPA directed CH2M HILL to include the provisions for a new sludge disposal cell on top of the CIA for dewatering and disposal in-place of waste sludge from the CTP. The new disposal cell will be included in the Phase 1 CTP upgrades and expansion.

The upgraded and expanded CTP will include replacement of the existing facility components that have reached their useful life and the construction of new components to meet discharge water quality standards. The power supply for the CTP and GWCS will be from existing substations and power lines and will terminate at a new transformer near the CTP, and at service transformers at the extraction wells.

The CTP Upgrades/GWCS will be implemented under an Operations/Design/Build/Operate (ODBO) contract. Procurement will be administered by the USACE on behalf of USEPA. The construction is estimated to start mid-2016 and to be complete in 2020, which includes a one-year O&M period after the upgrades are completed.

4.2.9.5 Upgraded Central Treatment Plant Effluent Discharge Limits Evaluation (2014-2015)

The CTP currently operates under discharge limitations established by a NPDES permit that was issued in 1986 and expired in 1991. Expected future discharge limits were evaluated for USEPA in 2002, and the evaluation was revised in 2007 (CH2M HILL, 2002b and 2007b). These expected future limits, as evaluated in 2007, were lower than the current expired CTP effluent limits. However, these evaluations were never formalized into permit documentation. The evaluations are being superseded by the most recent evaluations, described as follows.

The 2012 Upper Basin ROD Amendment selected the discharge point of the upgraded CTP to be the SFCDR (whereas it previously discharged into Bunker Creek). In February 2015, USEPA established new surface water quality discharge requirements consistent with the substantive requirements of the NPDES permit program. The statutory and regulatory basis for the technology and water quality-based effluent limits and a list of the current and future CTP effluent discharge limits, are provided in the *CTP Discharge Requirements Technical Memorandum* (USEPA, 2015b). Based on these future limits, a filtration system will be a necessary component of the upgraded CTP to achieve the discharge limits.

4.2.9.6 Groundwater Collection System

The GWCS is part of the OU 2 groundwater collection remedial action and is intended to collect the metals-contaminated groundwater from the CIA (Section 4.2.4) and convey it to the CTP for treatment (Section 4.2.9) or the Lined Pond for temporary storage. The GWCS is currently in the early stages of remedial design. Once constructed, the GWCS will be located between the CIA and the SFCDR. The GWCS will primarily consist of a cutoff wall and 10 to 12 extraction wells

4.2.9.7 Review of Record of Decision, Record of Decision Amendment, and Explanation of Significant Differences Requirements

The 2001 Mine Water ROD Amendment and the 2012 Upper Basin ROD Amendment identified Phase II remedial actions for collecting and treating select metals-contaminated source waters within OU 2 and the Upper Basin portion of OU 3 of the Site. The 2012 Upper Basin ROD Amendment clarified and modified some of the OU 2 and OU 3 water collection and treatment actions that had previously been selected in prior RODs for OU 2 and OU 3 (USEPA, 1992 and 2002). Overall, the water collection actions focus on intercepting metals-contaminated groundwater, and adit discharges emanating from abandoned mining-impacted sites before the flows entering into surface water creek and river systems. The collected groundwater and adit seeps not treated onsite have been designated for active treatment at the CTP.

As part of USEPA's remedy implementation planning, the OU 2 groundwater collection and treatment remedial action was selected for design and construction in the first 10-year phase of cleanups in the Upper Basin (USEPA, 2013). Collecting and treating OU 3-contaminated groundwater and adit seepage was identified as a potential cleanup project in the latter part of the first 10-year implementation plan. The GWCS described in this section focuses solely on the OU 2 groundwater collection remedial action associated with the CIA. As described in Section 4.2.9, Phase 1 design of the CTP upgrades is currently ongoing to accommodate the OU 2 waters, in addition to the Bunker Hill Mine water that is currently treated at the CTP.

There has been a change in approach to collect the contaminated groundwater as described in the Final FFS (USEPA, 2012a) and the 2012 Upper Basin ROD Amendment. Initially, the GWCS within OU 2 was assumed to be a 4,225-foot-long drain constructed along the northern edge of the CIA with a single pump station and conveyance piping back to the CTP. The groundwater collector drain would be used to collect contaminated groundwater near the CIA before it enters the SFCDR. As part of the design definition phase of the GWCS, the groundwater collection approach was evaluated in greater detail from the perspective of groundwater and surface water interaction, geochemical and geotechnical conditions, constructability, and screening level costs. This optimization phase is documented in the *Central Impoundment Area Groundwater Collection System Design Definition Report* (2013 GWCS DDR; CH2M HILL, 2013c). The groundwater collection approach was modified to include a cutoff wall (likely a slurry wall) constructed north of the toe of the CIA to block groundwater flow and to minimize oxygenated river water from entering the collection system. A series of pumping wells behind (to the south) of the cutoff wall that would connect to a force main to convey collected groundwater back to the CTP for treatment or temporary storage in the Lined Pond. This change in approach constitutes a "significant change" to the Selected Remedy, as defined by CERCLA. USEPA plans to prepare and publish an ESD describing the reasons for the change while the project design and construction activities are underway.

4.2.9.8 Groundwater Collection System Design Activities (2013 – 2015)

A Design Definition Report (DDR) was prepared in 2013 (CH2M HILL, 2013c), which documented the design basis for the GWCS to collect the metals-contaminated groundwater from the CIA and convey it to the CTP. The design objectives included reducing contaminant loading to surface water (SFCDR; Bunker Creek), minimizing system maintenance and fouling to the extent practicable, preventing contaminated groundwater surface ponding, minimizing the flow to be treated at the CTP, and minimizing system capital and O&M costs.

The groundwater collection approach included a cutoff wall (likely a slurry wall) constructed north of the toe of the CIA to block groundwater flow and to minimize oxygenated river water from entering the collection system. A series of pumping wells behind (to the south) of the cutoff wall would connect to a force main to convey collected groundwater back to the CTP for treatment or temporary storage in the Lined Pond.

The CTP Upgrades/GWCS will be implemented under an ODBO contract. Procurement will be administered by the USACE on behalf of USEPA. The construction is estimated to start mid-2016 and to be complete in 2020, which includes a one-year O&M period after the upgrades are completed.

4.2.10 Union Pacific Railroad Right-of-Way Remedial Action in the Box

4.2.10.1 Background and Description

Two separate remedial actions have been implemented by Union Pacific Railroad (UPRR) in its ROW, which stretches more than 71.5 miles between Plummer and Mullan, Idaho. The initial action was conducted in the Box in 1997 and 1998 and is briefly described in this section. The second action was conducted between 2000 and 2004 and focused on the ROW portions outside the Box. Additional information can be found in Section 5.2.5, Trail of the Coeur d'Alenes Removal Action, on the latter.

The ROW in the Box runs east–west and is approximately 7.75 miles long and 60 to 200 feet wide (Figure 4-1). The rail line was originally constructed in the late 1800s and used to transport mining and milling products to and from the Silver Valley. In portions of the UPRR ROW, lead-bearing materials were used in the construction of the original rail bed. In 1991, UPRR commenced proceedings to abandon the Wallace and Mullan Branches; cessation of rail service was authorized in 1994 (USEPA, 1999a). The line is being maintained by UPRR as part of the larger Trail of the Coeur d'Alenes rails-to-trails recreational facility. Oversight and management of the ROW within the Box is under the State and USEPA and is subject to the ICP.

The Box UPRR ROW remedial action requirements are described in the 1991 OU 1 ROD and the 1992 OU 2 ROD. A review of these actions is presented in the 2010 Five-Year Review Report (USEPA, 2010c). The RAO associated with the UPRR ROW remedy is intended to minimize risk of direct contact with contaminants.

The UPRR-funded remediation of the UPRR ROW in the Box was conducted between 1997 and 1998. For additional details on these actions, refer to the 2010 Five-Year Review (USEPA, 2010c).[1] A long-term O&M manual prepared in 2001 for the UPRR ROW remedial action describes the post-closure O&M requirements in more detail (MFG, 2001).

[1] The 2010 Five-Year Review Report is available online at http://go.usa.gov/39vTA.

4.2.10.2 Operations and Maintenance and Actions since the Last Five-Year Review

The Idaho Department of Parks and Recreation (IDPR) manages the trail within the Box boundary. UPRR conducts O&M activities under the oversight of the IDEQ. Transect surveys were conducted every year (2010–2014) to determine if any barrier settlement or loss had occurred. No significant barrier loss problems were documented based on the transect surveys (ARCADIS, 2011a, 2012a, 2013a, 2014a, 2015a).

Routine monitoring, maintenance and repair (M&R) of the trail is documented in more detail in annual reports (ARCADIS, 2011a, 2012a, 2013a, 2014a, 2015a, Coeur d'Alene Tribe and IDEQ, 2010, 2011, 2012, 2013, 2014). The following summary of actions have occurred since the last Five-Year Review.

- Asphalt was repaired in 2011 and 2013 near the trail on the north side of the A-4 Gypsum Pond and the Magnet Gulch bridge, because of subgrade settlement.
- Fences damaged by humans and game animals were repaired in 2011 throughout Smelterville and the corridor between the A-4 Gypsum Pond and Kellogg.
- Asphalt damage, as a result of tree roots, was routinely repaired in areas where the asphalt cracked. Tree seedlings were also removed.
- In 2014, trail asphalt and gravel barriers were damaged due to bridge construction at the Pinehurst I-90 overpass. Final repairs will occur in 2015, when the project is complete.
- The steep gravel bank between the paved trail and the area below the Pine Creek bridge, located west of the Pinehurst trailhead, was temporarily repaired because of damage caused by human foot traffic. This area is used for access to a popular summer swimming location.
- The access control fence located in Smelterville between the trailer court and the Wal-Mart store was damaged by vandals and repaired several times.
- The access control fence between Smelterville and Kellogg was damaged by large game animals and subsequently repaired.
- Several sink holes appeared in the trail below the Smelter Complex and were repaired. The steep hillside slope in this same area was severely eroded and subsequently repaired.

The 2010 Five-Year Review included the following recommendation:

- **Recommendation:** Regarding UPRR barrier protectiveness, ensure that O&M obligations defined in the CD are met to protect the integrity of the installed barriers.

  Discussion: UPRR is meeting their O&M obligations under the oversight of IDEQ, USEPA, the Coeur d'Alene Tribe, and the ICP. This recommendation is complete.

4.2.10.3 Remedy Status

Continued M&R activities conducted is critical to the preservation of the barriers. Regularly scheduled M&R activities, conducted by UPRR, have address those issues identified as a result of inspection activities conducted by IDEQ, IDPR, and the ICP along with the UPRR's contractor. The integrity of the asphalt and gravel barriers is maintained by O&M activities conducted by UPRR. Such activities address damage to the barriers caused by flooding, tree root intrusion, and unauthorized use by motor vehicles. Transect surveys conducted as part of barrier monitoring showed no significant barrier loss.

4.2.11 Page Pond Area

4.2.11.1 Background and Description

The Page Pond area is located near the west end of OU 2 and is bounded on the east by the city of Smelterville, on the south and west by Highway 10, and on the north by the UPRR ROW (Figure 3-7). The area covers approximately 170 acres, including roughly 70 acres of tailings repository and 100 acres of wetlands and riparian habitat. The Page Pond Tailings Repository was used between 1926 and 1969 to contain flotation tailings produced at the Page Mill in Humboldt Gulch. Approximately 30 acres in the central portion of the inactive 70-acre tailings repository now serves as the Site of the Page Ponds Wastewater Treatment Plant. The areas immediately to the east and west of the Page Ponds Wastewater Treatment Plant were used as designated repository areas for contaminated soils and are identified as "East Page Repository" and "Page Repository," respectively. The East Page Repository has been closed since the mid-1990s.

The 2010 Five-Year Review Report (USEPA, 2010c) provides a review of the Page Pond area remedial action requirements described in the 1992 OU 2 ROD. The previous five-year report provided specific remedial actions outlined in the Bunker Hill Superfund Site, Page Pond Closure Final Remedial Design Report (RDR; MFG, 1995), and remedial actions completed by UMG during the 2000 construction season and between 2005 and 2010.

The RAO associated with the Page Pond remedy are intended to accomplish the following:

- Minimize risk of direct contact with contaminants.
- Minimize surface water infiltration through contaminants.
- Minimize habitat destruction.

The Page Pond area remedial action components completed through 2010 consist of the following:

- Tailings excavation and removal, and disposal in the Page Repository.
- Exposed tailings in the eastern portion of the North Channel were graded, capped, and vegetated.
- Outlet control weirs were installed at the East and West Swamp discharge locations.
- Isolation of Humboldt and Grouse Creeks.
- The surface of the original Page Repository was graded and vegetated.

A detailed discussion of the remedial actions listed above can be found in the 2010 Five-Year Review Report (USEPA, 2010c).

4.2.11.2 Operations and Maintenance and Actions since the Last Five-Year Review

UMG worked with USEPA and IDEQ to review and complete all work prescribed in the RDR (MFG, 1995) since the last Five-Year Review. UMG submitted its remedial action certification report on April 11, 2011 (Hydrometrics Inc., 2011). After consultation with IDEQ, USEPA certified completion of work on April 18, 2011.

The last Five-Year Review recommended the following items for the Page Pond area, and a discussion of the recommendation or actions taken since 2010 are presented as follows.

- **Recommendation:** Continue to work with the Site-wide water quality monitoring program (i.e., forthcoming revised BEMP) to integrate special considerations at the Page Pond.

  Discussion: Historically, water quality monitoring was conducted in the Page Ponds area as part of the BEMP (CH2M HILL, 2006). In preparation for the Page Repository Westward Expansion, a water quality program specific to the repository expansion was developed and implemented in July 2013. Beginning in the fall of 2014, select monitoring sites (that are included in the repository expansion monitoring program) were removed from the BEMP to eliminate redundancy. This recommendation is complete.

- **Recommendation:** Evaluate possible issues in existing Page Pond monitoring program. Review recommendations in 1999 monitoring program memorandum (CH2M HILL, 1999). Finalize monitoring program elements (ongoing recommendation from the 2005 Five-Year Review).

  Discussion: See discussion for 2010 recommendation, above. This recommendation is complete.

- **Recommendation:** Evaluate biological monitoring results and impacts related to Page Repository expansion (ongoing recommendation from the 2005 Five-Year Review).

  Discussion: Mitigation wetlands have been constructed in the WENI area and a design for further wetland mitigation at Robinson Creek is being developed. These projects are in response to the loss of existing wetlands in the West Page Swamp due to repository expansion. Refer to Section 3.2.2 for the complete discussion on mitigation wetlands. Additionally, USFWS continues to conduct biological monitoring of the Page Pond area annually; the results are summarized in Section 2.5.3. This recommendation is complete.

- **Recommendation:** Complete Page Pond remedial actions (ongoing recommendation from the 2005 Five-Year Review).

  Discussion: As discussed above, UMG worked with USEPA and IDEQ to review and complete all work prescribed in the RDR (MFG, 1995). After consultation with IDEQ, USEPA certified completion of work on April 18, 2011. This recommendation is complete.

- **Recommendation:** Mitigative measures should be considered for wetland loss at West Page Swamp due to expansion of Page Repository (an ongoing recommendation from the 2005 Five-Year Review).

  Discussion: The WENI Wetland was constructed in 2012 as part of the wetland mitigation for the Westward Expansion of Page Repository. In keeping with the design goal to improve wetland habitat, approximately 14 acres of wetlands were constructed or improved within the 18-acre WENI area. Specific post-construction requirements, a monitoring and evaluation plan, guidance for O&M, adaptive management of the WENI wetland, and a comprehensive method for determining wetland mitigation credits was developed in 2014

(TerraGraphics, 2014b). Mitigation credits for the expansion of West Page Swamp will be determined over a period of approximately five years and will be based on the *MDT Montana Wetland Assessment Method* (Bergland, 1999).

IDEQ has assessed the potential for mitigation credits and anticipates 14.3 acres of 1-to-1 credit from the WENI Wetland (TerraGraphics, 2014c). Additionally, IDEQ anticipates that the mitigation credits derived from the Robinson Creek Project will exceed USEPA and IDEQ obligations for the Westward Expansion and will be banked to offset other site-wide remedial actions requiring mitigation under Section 404 of the CWA. This recommendation is complete.

The status of other ongoing items is presented as follows.

- Routine O&M activities are being conducted as part of the Page Repository, such as maintenance of stormwater and dust controls (see Section 3.2.2 for more information on the Page Repository). UMG developed a draft O&M Plan that is not yet approved by the Agencies or finalized by UMG (Hydrometrics Inc., 2010). The Agencies plan to incorporate Page Pond Area O&M requirements into the Page Repository O&M Manual, as appropriate

- An upgraded broad-crest step weir was installed at the West Page Swamp outlet in December 2014. This structure replaced the existing flume to maintain swamp water levels and allow larger spring peak flow events to pass with less risk to the repository expansion side slopes.

4.2.11.3 Remedy Status

Completion and certification of the remedial actions associated with the Page Pond area indicate that releases of metals from tailings and the potential for direct contact has been reduced (see Section 3.2.2). The west outlet control weir has been replaced with an upgraded design that more effectively limits downgradient flooding and maintains minimum water levels over contaminated wetland sediments. Long-term O&M required to maintain the remedial action should be formalized in an overall manual for the Page Repository and Page Pond Area.

The graded and seeded surface of the original Page Repository has been maintained or is actively being used as part of the current repository operations, and the open footprint area has been kept to a minimum to aid in reduction of contaminated dust. Additionally, stormwater best management practices are employed at the Page Repository to limit releases to the Page Pond area. No unauthorized releases through the stormwater management system and no catastrophic failures have been observed at the Page Repository (see Section 3.2.2 for additional information).

A remedial effectiveness monitoring program now exists as part of the Page Repository Westward Expansion monitoring. Refer to Sections 3.2.2 and 2.5.2 of this report for additional information on water quality monitoring results.

4.2.12 A-4 Gypsum Pond Closure

4.2.12.1 Background and Description

The A-4 Gypsum Pond is located in the central region of OU 2 near the mouth of Magnet Gulch (Figure 4-1). The gypsum contained in the A-4 Gypsum Pond was produced between 1964 and

1970 as a waste byproduct during production of phosphoric acid at the Phosphoric Acid/Fertilizer Plant in Government Gulch. The material is predominantly calcium sulfate ($CaSO4$) with traces of impurities.

The 2010 Five-Year Review Report (USEPA, 2010c) provides a review of the A-4 Gypsum Pond remedial action requirements described in the 1992 OU 2 ROD, and specific remedial actions outlined in the RDR (MFG, 1996). The RAO associated with the A-4 Gypsum Pond remedy are intended to accomplish the following:

- Reduce or prevent direct contact with gypsum.
- Control migration of gypsum o surface water, groundwater, and air.
- Reduce surface water infiltration through the gypsum.

The Stauffer Management Company (SMC) initiated remedial actions in 1996. The general components of this remedial action consist of the following:

- Ditches were constructed to manage run on and runoff at the Site, and surface water management improvements for Magnet and Deadwood Creeks.
- Approximately 13 acres of the closure surface area were capped and vegetated.
- The upper portion of the existing north perimeter embankment was removed, and the downstream face of the embankment was regraded, to achieve a slope of 2 horizontal to 1 vertical and reduce erosion.
- A seepage barrier was installed along the north perimeter of McKinley Pond (south of McKinley Avenue), as was a new culvert under McKinley Avenue from McKinley Pond.
- A French drain was installed on the eastern side of the mouth of Magnet Gulch channel along the toe of the north dike to intercept groundwater seeps and supplement lowering of groundwater levels beneath the impounded gypsum.

Additional detail of remedial actions is provided in the 2010 Five-Year Review Report (USEPA, 2010c).

A long-term O&M manual was prepared for the A-4 Gypsum Pond remedial action in 2004 (MFG, 2004), which describes the post-closure O&M requirements in more detail. Semiannual O&M inspections and repair work have been conducted by SMC since the initial inspection of the A-4 Gypsum Pond in 2005.

4.2.12.2 Operations and Maintenance and Actions since the Last Five-Year Review

Inspection details, records of repair work, and water quality results from the semiannual inspections and water quality monitoring of the A-4 Gypsum Pond are documented in the O&M and annual water quality reports (ARCADIS 2011b, 2012b, 2012c, 2013b, and 2013c; LFR 2010 and 2011; Maul Foster & Alongi, Inc. [MFA] 2014, 2015a, and 2015b).

The following summarizes the 2010 through 2014 O&M inspections findings (ARCADIS, 2011a, 2012a, 2012b, 2013b, and 2013c; LFR, 2010 and 2011; MFA, 2014a and 2015b):

- Sink holes were observed during all inspections conducted for the last five years. Sink holes are associated with embankments, dikes, and drainage features along the north edge of the pond and Magnet Gulch channel, and eastern surface diversion ditch vicinities.
- In 2011, SMC conducted a geophysical survey using electrical resistivity to compare previous survey work and evaluate solution cavity activity (ARCADIS, 2011c). No conclusive evidence was found concerning solution cavity development.
- Sink holes and settlement impacted three monitoring wells (A4-4, A4-5, and A4-6). These wells were either repaired or abandoned and replaced.
- Several instances of riprap/channel failure were observed on the western side of the Magnet Gulch channel due to dissolution of underlying gypsum.
- Perimeter fence damage as a result of game animal activity was observed during all inspections. Repairs to the fence occurred.
- Other observations included areas of thinning vegetation, erosion rills, cracks, cap sloughing, brush growth in drainages, and the presence of noxious weeds.

The 2010 Five-Year Review included the following recommendation for the A-4 Gypsum Pond.

- **Recommendation:** Regarding A-4 contaminant release, determine whether additional measures should be undertaken to reduce the potential for contaminant migration from the gypsum to groundwater in accordance with the remedy objective as described in the RDR (MFG, 1995).

  Discussion: RDR performance standards include "reduction or prevention of contaminant migration from the gypsum to groundwater, surface water and air." Groundwater monitoring near the A-4 Gypsum Pond is ongoing and will continue at least through implementation of the CIA GWCS, which is expected to capture and treat significant volumes of groundwater near the CIA and adjacent areas, including the A-4 Gypsum Pond. IDEQ and USEPA will continue to evaluate SMC's groundwater monitoring results. Recommendation is complete.

4.2.12.3 Remedy Status

The O&M inspection findings and maintenance actions show that gypsum continues to dissolve. Maintenance of the pond cover and monitoring wells will always be necessary. Perimeter fencing repair will continue due to big game animal activity in the area. Vegetation and capping is sufficient to reduce wind-blown dust from the facility. Noxious weed control will continue to be necessary.

Water quality results indicate that elevated cadmium and zinc in groundwater is likely due to the underlying jig tailings beneath the pond, and surface water may be periodically impacted by the dissolution of gypsum. Water quality results documented in the latest annual report include the following (MFA, 2015a):

- Groundwater dissolved cadmium and zinc concentrations remain generally stable, except closure well A4-2 that shows appreciable concentration fluctuations in the past three to four years.

- Long-term trends of dissolved cadmium and zinc at the mouth of Magnet Gulch (BH-MG-0001) have shown a significant decrease since 2002. Concentrations of these metals continue to exceed AWQC and detections in both upstream and downstream surface water monitoring sites have fluctuated over the years.
- Lower concentrations of cadmium and zinc in Magnet Gulch surface water compared to higher concentrations of cadmium and zinc in closure wells A4-2 and A4-12 indicate that the aquifer is likely influenced by the underlying tailings.
- Concentration of fluoride, phosphate, and sulfate observed during October 2014, indicate possible gypsum dissolution. Fluctuation of fluoride and phosphate levels between closure wells and surface water sites indicate that surface water is not consistently impacted.
- Distinct rises in sulfate were observed in upgradient and closure wells, and upstream and downstream surface water Sites.

4.2.13 Institutional Controls Program

4.2.13.1 Background and Description

Institutional controls were identified as a key component to the Selected Remedy in order to protect public health by managing contaminants left in place into perpetuity (USEPA, 1992). The ICP in OU 2 is the same as the ICP implemented in OU 1, discussed in Section 3.2.1.6. The ICP in OU 2 focuses on future development. Development in OU 2 is managed by local jurisdictional planning and zoning ordinances requiring adherence to the ICP administrative rules. The IDEQ provides funding for the OU 2 ICP as part of its match and O&M obligations at the site, including costs for Page Repository operations associated with disposal from the non-populated areas of the Box, discussed in Section 3.2.2.

4.2.13.2 Operations and Maintenance and Actions since the Last Five-Year Review

Since the last Five-Year Review, the ICP has issued a total of 92 permits in OU 2, almost all of which were for large excavation projects (Table 4-1). Other ICP activities and functions, such as contractor licensing, disclosures, disposal, and clean fill material handling, are tracked with OU 1 activities and are presented in Section 3.2.1.6. Due to the economic downturn, no new subdivisions or planned unit developments were proposed in OU 2 since the last Five-Year Review.

TABLE 4-1
Number of ICP Permits Issued in OU 2, 2010-2014
2015 Five-Year Review, Bunker Hill Superfund Site

Permit Type	Calendar Year					Cumulative 5-Year Total	Annual Average
	2010	2011	2012	2013	2014		
Large Exterior Projects - Excavation Total[a]	10	8	18	26	28	90	18
Large Exterior Projects - Demolition Total	0	0	0	0	0	0	0
Interiors Total	0	0	0	0	1	1	0

TABLE 4-1
Number of ICP Permits Issued in OU 2, 2010-2014
2015 Five-Year Review, Bunker Hill Superfund Site

Permit Type	Calendar Year					Cumulative 5-Year Total	Annual Average
	2010	2011	2012	2013	2014		
Records of Compliance Total	0	0	1	0	0	1	0
Totals	10	8	19	26	29	92	18

Notes:

Data provided by PHD.

[a] Includes subdivision/planned unit development (PUD) totals.

The last Five-Year Review recommended the following, specifically to OU 2, and discussions of each recommendation and actions taken since 2010 are presented as follows.

- **Recommendation**: Secure permanent funding for the ICP, including consideration of adequate staff and information management support to ensure long-term effectiveness of the program.

  Discussion: Funding for the OU 2 ICP is held in the Box Bunker Hill Environmental Remediation Fund. Idaho Statute 39-3606c establishes the Environmental Remediation Fund for the purpose of meeting match and O&M requirements at environmental cleanup and remediation and restoration Sites. The Fund was established in the state treasury under 39-3605c and is interest-bearing. The Box Fund was established in 1995 to meet OU 2 match and O&M obligations. Based on cost estimates for the ICP administration and disposal management, these funds are expected to be able to provide secure funding for the foreseeable future (currently estimated for approximately 30 more years). PHD adopted the rule based on the premise of external funding and as such, IDEQ continues to monitor ICP costs and available funding, and make adjustments as necessary to meet long-term ICP funding obligations. Additionally, PHD evaluates staffing needs and adjusts when necessary. This recommendation is complete.

- **Recommendation**: Create irrevocable trust to provide consistent cash flow for the ICP operation into perpetuity (an ongoing 2005 Five-Year Review recommendation).

  Discussion: The State of Idaho has not established an irrevocable trust and will work with USEPA to determine if such a Trust is required beyond the commitment embodied in a SSC. This activity will not be retained in the table of issues and recommendations, because it does not directly affect protectiveness. It will instead be included in the table of planned action items.

- **Recommendation**: Establish a long-term disposal plan for ICP-generated wastes (an ongoing 2005 Five-Year Review recommendation).

  Discussion: Long-term waste estimates have been developed and planning for additional Box repository space is ongoing (TerraGraphics, 2014a). Expansion of the Page Repository is discussed in Section 3.2.2. This recommendation is complete.

- **Recommendation**: Collect information for an ICP property database (an ongoing 2005 Five-Year Review recommendation).

  Discussion: Documentation of some past remedial actions affecting property in the Box has not yet been located and creates challenges for PHD to issue ICP permits and provide disclosure. To date, IDEQ has provided PHD with documentation when information is located. As work continues, PHD needs the timely receipt of documentation from the Coeur d'Alene Trust, USEPA, and IDEQ and any other entities conducting remedial action work. This activity will not be retained in the table of issues and recommendations, because it does not directly affect protectiveness. It will instead be included in the table of planned action items. This is a site-wide task and as such has been listed only once in the OU 1 table of action items.

- **Recommendation:** Identify funding and other resources for infrastructure maintenance and improvements to protect the remedy, such as stormwater controls (an ongoing 2005 Five-Year Review recommendation).

  Discussion: In 2013 and 2014, USEPA and the Coeur d'Alene Trust have invested $6.4M in flood management infrastructure work throughout the Upper Basin including OU2. These "Remedy Protection" projects will continue until the ROD Amendment Selected Remedy is complete. In addition to the Selected Remedy Protection projects identified in the 2012 ROD Amendment (USEPA, 2012a), IDEQ, USEPA, and the BEIPC have requested assistance from federal and state flood control agencies to address the threat of large-scale flooding to the remedy (such as flooding from the SFCDR and Pine Creek). The Silver Jackets, an interagency coordinating group, identified local actions that could be taken to help protect against flooding. However, funding has not yet been found to perform the required flooding study and subsequent flood control projects. Since the last Five-Year Review, Environmental Covenants and Interagency Cooperative Agreements have been finalized for completed Remedy Protection projects to ensure long-term maintenance of the constructed infrastructure. These assist in addressing the institutional elements of the recommendation. Additionally, IDEQ has developed an inventory of flood control structures in the communities, including those that were installed as part of the remedy. IDEQ plans to create a coordination cooperative consisting of local jurisdictions and IDEQ that will work together to track O&M work for the structures. This effort is in the initial planning stage and is the same effort developed in response to issue and recommendation "Infrastructure Maintenance Funding: Develop appropriate institutions and funding mechanisms to finance and oversee stewardship activities". This recommendation is complete.

- **Recommendation:** State of Idaho should continue to work with the different entities to ensure the appropriate O&M is conducted. Investigate development and designation of a central O&M coordinating entity for all remedy-specific O&M. Develop dedicated funding sources to ensure responsible implementing of O&M.

  Discussion: Since the last Five-Year Review, IDEQ has developed an inventory of flood control structures in the communities, including those that were installed as part of the remedy. IDEQ plans to create a coordination cooperative consisting of local jurisdictions and IDEQ that will work together to track O&M work for the structures. This effort is in the initial planning stage. This activity will not be retained in the table of issues and recommendations, because it does not directly affect protectiveness. It will instead be included in the table of planned action items.

- **Recommendation:** Regarding flood control, continue working with the BEIPC and other stakeholders to evaluate and plan actions relative to addressing SFCDR and Pine Creek flooding that may affect cleanups.

  Discussion: This recommendation is repeated for all three OUs. See Section 3.2.1.6 for discussion. This recommendation is complete.

- **Recommendation:** Continue working to develop an approach for addressing roads as long-term barriers in collaboration with state, county, and local entities.

  Discussion: This recommendation is repeated for all three OUs. See Section 3.2.1.6 for discussion. This recommendation is complete.

- **Recommendation:** Develop appropriate institutions and funding mechanisms to finance and oversee infrastructure maintenance activities.

  Discussion: This recommendation is repeated for all three OUs. See Section 3.2.1.6 for discussion. This activity will not be retained in the table of issues and recommendations, because it does not directly affect protectiveness. It will instead be included in the table of planned action items. This is a site-wide task and as such has been listed only once in the OU 1 table of action items.

4.2.13.3 Remedy Status

Section 3.2.1.6 discusses the performance and status of the Box ICP in detail. The ICP in OU 2 faces challenges similar to those in OU 1. The ICP is being implemented according to its rule (IDAPA 41.01.01) and in a manner that maintains the 350 mg/kg residential community-wide lead average in soils. Funding to implement the ICP into perpetuity is critical to the success of the Selected Remedy.

4.3 Technical Assessment for OU 2

4.3.1 Is the Remedy Functioning as Intended by the Decision Documents?

To the extent remedial actions selected in decisions documents have been implemented, they are functioning as intended.

Construction of the remedial actions listed in the 1992 ROD (Phase I) are complete, except at Area 14, which was postponed pending development by the property owner.

Continued implementation of O&M, in accordance with O&M plans, is integral to the long-term effectiveness of completed remedial actions and the Selected Remedy. O&M of completed remedial actions is ongoing as scheduled, and potential repairs and maintenance are identified during inspections. The IDEQ and USEPA entered into a Memorandum of Agreement that designated settlement dollars to be invested by the State for purpose of operating the CTP until funds are exhausted (USEPA and IDEQ, 2014).

Inspection findings over the last five years show that capped areas, constructed stream channels, culverts, sedimentation basins, and gabion dams are generally in good condition and functioning as intended. If IDEQ finds any engineered feature not functioning properly, they either repair the feature (e.g., Railroad Gulch) or in coordination with USEPA decide it is no longer needed (e.g., the lower gabion dam in Deadwood Gulch). Hillsides are generally stable, vegetation is thriving in most areas, and check dam performance is acceptable. Beaver activity in Bunker Creek is recurring, and beaver removal is needed to prevent negative impacts to the reconstructed creek channel and culverts. The CIA cap shows no evidence of settlement, and vegetation is regenerating. The reconstructed stream banks of the SFCDR in the Smelterville Flats area are stable and performing adequately to minimize sediment entering the river. Many areas require noxious weed control. However, weed control is a property owner obligation and is not an O&M responsibility under Superfund.

Monitoring and Maintenance &Repair of the Trail has proven effective in the long-term protectiveness of the remedy. Based on the findings of the M&R reports and regular monitoring, the remedy is performing as intended and remains protective of human health and the environment.

IDPR is closely monitoring the adequacy of the settlement cash-out they received to manage the Trail of the Coeur d'Alenes. Incurred costs to date have exceeded the revenues generated from interest earned on the principal plus encroachment and other special use fees, resulting in the utilization of base funds.

Galena Ridge Golf Course, Milo Watershed District, and SMC are third-party entities also responsible for implementing O&M of OU 2 remedial actions. IDPR and UPRR are responsible for maintaining the remedy on the Trail of the Coeur d'Alenes.

Long-term ICP waste estimates for OU 2 have been developed. Although the current Page Repository offers sufficient capacity for years to come, planning for additional Box repository space is ongoing.

O&M costs for State maintained actions have been less than expected. However, there has not been a significant storm or flood event in OU 2 since IDEQ took over O&M responsibilities. Such an event would likely cause a large expenditure of O&M dollars, offsetting the low annual costs experienced so far.

The ICP is administered, implemented, and enforced by PHD according to the rule (IDAPA 41.01.01), with funding from the State. Funding to implement the ICP into perpetuity is critical to protect public health and maintain protectiveness of the Selected Remedy. Current estimates indicate funding for the ICP is expected to cover the foreseeable future, or approximately 30 more years. Longer-term funding mechanisms will be necessary.

The various remedial actions implemented at the CTP to date are functioning as designed and as intended by the decision documents. However, the overall CTP and mine water remedy is not yet complete. Therefore, only the completed portions of the remedy are addressed in this Five-Year Review Report. The CTP is currently required to meet the discharge requirements of its expired NPDES permit (USEPA, 1986). This permit expired on October 30, 1991; however, its discharge requirements have continued to be used by USEPA until the remaining CTP upgrades are implemented. This is because the existing CTP is not capable of consistently meeting modern Idaho water quality standards without the upgrades. The CTP consistently meets its current discharge requirements with only occasional minor deviations from the effluent requirements, which are primarily attributable to the lack of a filtration system and the condition of dilapidated equipment that are planned to be replaced as part of the plant upgrades. When deviations occur, standard procedures are to adjust the treatment plant operations as needed and re-sample and re-test effluent quality to ensure compliance. As previously discussed in Section 4.2.9.6, CTP upgrades and expansion are schedule to begin in 2016. Specific actions on the CTP and groundwater collection system are being implemented under a memorandum of agreement that provides for long-term O&M as long as the funds placed in the State Endowment Fund from the Hecla settlement last.

Both remedial action effectiveness and long-term water quality monitoring for OU 2 is ongoing (discussed in Section 2.5). Trend results indicate that remedial efforts in the SFCDR valley and its tributaries since the early 1990s have been successful in reducing concentrations of trace metals. Statistically significant downward trends were noted during water years 1990–2013 for all constituents evaluated in the SFCDR at Elizabeth Park and for zinc and lead in the SFCDR near Pinehurst, reflecting the effectiveness of Phase I remedial actions. During water years 2003–13, the SFCDR at Elizabeth Park continued to indicate significant downward trends in total cadmium and zinc concentrations, but no significant trends were observed for this period in the SFCDR near Pinehurst (USGS, 2015) However, significant decreasing trends in cadmium and zinc concentrations were observed in monitored tributaries that feed SFCDR between 2002 and 2014, with the exception of Bunker Creek for which no trend was observed.

Further significant reductions in cadmium and zinc concentrations in the SFCDR necessitates reducing loads entering the SFCDR from cadmium- and zinc-enriched groundwater near the CIA. The SFCDR reach adjacent to the CIA continues to be the highest source of dissolved metals loading from groundwater to the SFCDR in the Upper Basin (USGS, 2015). Contaminant concentrations near the CIA, in both surface water and groundwater, continue to exceed ARARs at most sampling locations. As discussed in Section 2.5, most groundwater monitoring sites (40 of 62 sites) are located near or downgradient of the CIA, near the SCA, and near Government Gulch. The highest MCL ratios for cadmium and zinc are also found in these areas. Across OU 2, 77 percent of the sites exceed the MCL for cadmium and 61 percent exceed the MCL for zinc. For the period between 2002 and 2014, results for zinc across OU 2 show 39 percent of sites as not improving, 21 percent improving, 8 percent caution (concentrations increasing), and 32 percent stable. Overall results for cadmium across all of OU 2 show 29 percent of sites as not improving, 37 percent improving, 13 percent caution, and 21 percent stable. The groundwater collection and treatment remedial action (Phase II) currently under design is expected to intercept metals-contaminated groundwater and reduce loading to the SFCDR from groundwater by over 60 percent, resulting in significantly decreasing trends in cadmium and zinc following installation of the remedy.

The effectiveness evaluation of Phase I source control and removal activities to meet water quality improvement objectives, including drinking water requirements, indicates that Safe Drinking Water Act (SDWA) groundwater MCLs identified as ARARs in the 1992 OU 2 ROD have not been met for areas within the Box. As the 2012 FFS for the Upper Basin explains, given the pervasive nature of the subsurface contamination under communities, roadways and infrastructure in the Box (and elsewhere in the Upper Basin), achieving the MCLs in the groundwater is expected to be challenging. The Selected Remedy in the 2012 Upper Basin ROD Amendment will address many significant sources of contamination in the Upper Basin and will protect human health and the environment commensurate with its scope. However, as an interim measure, achieving certain water quality criteria standards for all locations, are outside the scope of, and need not be attained by, the Selected Remedy. As determined to be appropriate, USEPA will evaluate future monitoring data and completed actions to determine whether a technical impracticability waiver may be warranted at locations where achievement of drinking water standards in groundwater cannot be achieved.

4.3.2 Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives Used at the Time of Remedy Selection Still Valid?

The ARARs identified in the 1992 OU 2 ROD, 2001 OU 2 ROD Amendment, subsequent changes identified in the 2010 Five-Year Review Report (USEPA, 2010c), and the ARARs identified in the 2012 Upper Basin ROD Amendment continue to be protective.

The RAOs outlined in the ROD, ROD Amendments, and O&M plans are generally intended to reduce human and ecological exposure to chemicals of concern and reduce impacts on surface water and groundwater quality.

The following RAOs were addressed:

- Minimize direct contact with contaminated material
- Minimize erosion and wind dispersion of contaminants
- Minimize migration of contaminants to surface water and groundwater
- Minimize water infiltration through underlying contaminated media

No major changes in land use have occurred since the last Five-Year Review. However, the Trail of the Coeur d'Alenes, the SFCDR, and hillsides are typically used by recreationalists in OU 2, and the frequency of access appears to be increasing in localized areas. New, informal pedestrian paths leading down the riverbank to the SFCDR have been observed by IDPR, IDEQ, and PHD in various places along the Trail of the Coeur d'Alenes and likely result in barrier erosion and increased risk of exposure to trail users. PHD has also observed several informal, undeveloped (or "impromptu") Sites where children created swimming holes on the banks of the SFCDR and its tributaries. As noted in the last Five-Year Review, development of Upper Magnet Gulch, Deadwood Gulch, and Grouse Gulch has made areas of the hillsides more readily accessible.

The recreational scenario evaluated in the original OU 2 risk assessment suggested that a soil concentration from about 1,200 to 3,500 mg/kg could be considered acceptable for short-term exposures involving children 6 years of age and older (SAIC, 1991). Consequently, a recreational cleanup number was not selected at the time of the 1992 ROD. New information about bioavailability and ingestion rates suggests that these levels may not be protective and consideration should be given to re-evaluation if a recreational cleanup standard is needed for future cleanup decisions in OU 2. Incremental risk for OU 2 areas was estimated by projecting post-remediation blood lead levels for children living in the residential areas of OU 1 and calculating potential incremental exposures (or increased blood lead levels) for children that might undertake recreational activities in OU 2. Post-remediation blood lead levels for children residing in OU 1 were estimated using Site-specific parameters in the USEPA IEUBK model, described in the original documents (SAIC, 1991, JEG et al., 1989). Incremental intake rates were calculated using a soil and dust ingestion rate of 100 mg/day for a typical 6-year-old child engaging in more dirt-intensive recreational activities, coupled with a 20 percent bioavailability estimate and a number of other Site-specific input parameters (SAIC, 1991; JEG et al., 1989).

As discussed in Section 3.3, a USEPA-funded research project analyzed archived yard soil and house dust samples for IVBA in 2012, which was not available at the time of the original risk assessment (USEPA, 2007a, 2012c). Results from that project suggest that a lower residential soil and dust ingestion rate and higher soil bioavailability are more appropriate than those used in the Site-specific model (von Lindern et al., 2015). The new bioavailability information indicates the risk assessment for child recreational scenarios should employ a higher value, closer to the IEUBK default value of 30 percent, or as high as the 39 percent observed in Smelterville, which may reflect smelter emissions deposited on nearby hillsides. Many factors are involved in calculating risk and it is unknown how this new information might impact the original recreational risk-based soil values (i.e., over or underestimated). Current information regarding recreational areas (PHD findings on high blood levels associated with recreational exposures) and risk assessment assumptions suggest recreational risk was likely underestimated, but may be somewhat offset by the better than anticipated post-remediation blood lead levels observed in the residential areas. The 2013 mean blood lead levels were slightly lower than those estimated in the risk assessment (2.2 μg/dL compared to 3.2 μg/dL), likely due to lower than anticipated diet and drinking water intakes and projected post-remediation soil/dust lead concentrations. There is no new information to suggest recreational soil and dust ingestion rates should be modified.

In addition to lead, incremental carcinogenic risks for arsenic and cadmium were estimated for the various OU 2 locations and the cancer slope factors used in the original risk assessment have changed. Risk was negligibly underestimated for arsenic ingestion because the slope factor used was slightly higher (1.75 $(mg/kg\text{-}day)^{-1}$) than the current slope factor in the Integrated Risk Information System (IRIS; 1.5 $(mg/kg\text{-}day)^{-1}$). The inhalation slope factors are outdated as newer guidance for estimating risk from the inhalation pathway has changed since the time of the risk assessment (USEPA, 2009a). The impact of these changes on incremental risk from the recreational and occupational scenarios is unknown without further calculations. However, the impacts are likely inconsequential because most of the remedial actions at the OU 2 locations have barriers and/or access controls, or the inhalation pathway was not applicable.

4.3.3 Has any Other Information Come to Light that Could Call into Question the Protectiveness of the Remedy?

The 2015 Five-Year Review did not find any other new information that calls into question the protectiveness of the OU 2 remedies.

4.4 Summary of OU 2 Issues, Recommendations, and Follow-Up Actions

No issues, recommendations, and follow-up actions that directly affect protectiveness were identified during this fourth Five-Year Review. Action items identified during this fourth Five-Year Review that are expected to require future action, but do not affect protectiveness are summarized in Table 4-2. These recommendations are summarized herein to allow USEPA to track this information, as suggested by Five-Year Review guidance (USEPA, 2001a).

TABLE 4-2
OU 2 Action Items that Do Not Affect Remedy Protectiveness
2015 Five-Year Review, Bunker Hill Superfund Site

Remedial Action	Action Item	Responsible Party	Oversight Agency
Page Pond Area	Continue to develop a comprehensive O&M and Site Closure Plan for the Page Repository. Repeated in OU 1.	IDEQ	USEPA
ICP	Create irrevocable trust to provide consistent cash flow for the ICP operation into perpetuity	IDEQ, PHD, USEPA	IDEQ, USEPA
ICP	IDEQ should continue to work with the different entities to ensure the appropriate O&M is conducted. Investigate development and designation of a central O&M coordinating entity for all remedy-specific O&M. Develop dedicated funding sources to ensure responsible implementing of O&M.	IDEQ, PHD	IDEQ, USEPA
Milo Gulch	Secure permanent access for system maintenance.	USEPA, IDEQ	USEPA

4.5 Performance Evaluation

In 1995, with the bankruptcy of the Site's major PRP, USEPA and the State of Idaho defined a path forward for phased remedy implementation in OU 2. Phase I of remedy implementation included extensive source removal and stabilization efforts, demolition activities, community development initiatives, ICP development and implementation, land use development support, and public health response actions. Phase I also included investigations to provide the necessary information to resolve long-term water quality issues, including technology assessments and pilot studies, and evaluation of the success of source control efforts. Interim control and treatment of contaminated water and AMD was also included in Phase I of remedy implementation.

Phase I remedies have removed and consolidated more than 2.8 million cy of contaminated waste onsite in engineered closure areas (the Smelter and CIA closures). Using geomembrane cover systems on these closure areas effectively removed these contaminated wastes from direct contact by humans and biological receptors. Consolidating these wastes in engineered closures also substantially reduced the exposure pathway to the surface water and groundwater environment in comparison with pre-remediation Site conditions.

In addition, more than 800 acres of property within OU 2 have been capped to eliminate direct contact with residual contamination that remains in place within some areas of OU 2. In addition, the revegetation work conducted as part of the Phase I remedial actions has substantially controlled erosion and significantly improved the visual aesthetics of OU 2. The success of the Phase I revegetation efforts involved providing improved habitat for wildlife that was largely absent for decades in many areas of the hillsides and Smelterville Flats.

All of these efforts have reduced or eliminated the potential for humans to have direct contact with soil and source contaminants, have reduced opportunities for contaminants to be transported by surface water and air, and are expected to provide surface and groundwater quality improvements over time throughout the Site. Responsibility for O&M of OU 2 Phase I remedial actions has been transferred to the IDEQ upon completion of the remedies and development of area-specific O&M manuals.

Phase II of remedy implementation will address long-term water quality, ecological, and environmental management issues. Phase II remedial actions are identified in the 2001 OU 2 ROD Amendment and the 2012 Upper Basin ROD Amendment. Implementation of the Phase II remedy is estimated to begin in 2016. Initial Phase II work will consist of upgrading and expanding the CTP and a GWCS located between the CIA and the SFCDR.

USEPA and the IDEQ signed a memorandum of agreement in June 2014 to provide long-term O&M of the CTP, the new sludge disposal cell, and the GWCS located primarily between the CIA and the SFCDR. IDEQ's obligation under this Agreement for O&M of the facilities used to collect and treat contaminated waters exists only as long as the Endowment Fund Account (from the Hecla settlement) contains sufficient funds to pay for those operations.

The OU 2 remedy currently protects human health and the environment where remedial actions have been taken. However, continued maintenance of the clean barriers to underlying contamination is essential to ensure long-term protectiveness of the remedy. In addition, continued funding and state and local support of the ICP is necessary to ensure barrier maintenance occurs in the long term.

5 Review of Selected Remedies for Operable Unit 3

This section documents the remedial actions completed in OU 3. The information in this section is organized as follows:

- 5.1 Overview of the Selected Remedies
- 5.2 Review of Operable Unit Remedial Actions
- 5.3 Technical Assessment
- 5.4 Issues and Recommendations
- 5.5 Performance Evaluation of the OU 3 Remedy

A review of actions taken since the last Five-Year-Review and progress on Issues and Recommendations is included in the review of each remedial action in Section 5.2 as appropriate. A protectiveness statement for OU 3 is provided in Section 6.1 of this report. Figure 5-1 is a site map for the Upper Basin of OU 3. Figure 5-2 is a site map for the Lower Basin of OU 3. A timeline of key events associated with OU 3 may be found in the 2010 Five-Year Review Report (USEPA, 2010c).

5.1 Overview of Selected Remedies

On September 12, 2002, USEPA issued an interim ROD (the 2002 OU 3 ROD) to address mining contamination in the broader Coeur d'Alene Basin (OU 3) (USEPA, 2002a). The 2002 OU 3 ROD describes the specific cleanup work, called the interim Selected Remedy (the remedy), that will occur in the Basin**.** Letters of support for the 2002 OU 3 ROD were signed by the State of Idaho, the Coeur d'Alene Tribe, the Spokane Tribe, the State of Washington, the BLM, the USFWS, and the U.S. Forest Service (USFS).

In 2012, USEPA issued a ROD Amendment for the Upper Basin, which included the eastern portion of OU 3 upgradient of the Bunker Hill Box (USEPA, 2012a). The Selected Remedy in the 2012 Upper Basin ROD Amendment is an interim remedy that will be finalized in the future as additional knowledge is gained about conditions at specific locations within the Upper Basin and the effectiveness of remedial actions. The Selected Remedy for the Upper Basin builds upon the remedies identified in the 2002 ROD and incorporates additional information obtained since the ROD for OU 3 was issued in 2002. Specific elements of the interim remedy for OU 3 are presented in Sections 2.2 and 2.2.3.

The 2010 Five-Year Review included the following recommendations.

- **Recommendation:** USEPA Region 10 has received funding for implementation of the OU 3 human health remedy. The Region will continue to work with USEPA Headquarters and other parties to secure funding for full implementation of the 2002 OU 3 ROD (an ongoing 2005 Five-Year Review recommendation).

Discussion: Because of the settlements with Hecla and ASARCO, USEPA Region 10 has received only limited amounts of pipeline funds from Headquarters. Most of the work under the OU 3 ROD is being conducted by the Coeur d'Alene Work Trust using funds from the Asarco settlement. The Trust cannot conduct work in the Box, as stipulated in the ASARCO settlement, so funds from the Hecla settlement are being used to conduct actions in OU 1 and OU 2. The Hecla funds have also been used for the Basin Property Remediation Program (BPRP), but this work is also being transitioned to the Trust in 2015. USEPA is continuing to seek funds from Headquarters in order to complete actions in OU 1 and OU 2, because the Hecla funds may not last beyond 2017. This recommendation does not impact protectiveness and will not be retained in the table of issues and recommendations.

- **Recommendation:** Continue successful implementation of safety programs as evidenced by no lost time or injuries reported (an ongoing 2005 Five-Year Review recommendation).

  Discussion: USEPA agrees continued safe implementation of remedial actions is very important. However, this recommendation does not impact protectiveness and will not be retained in the table of issues and recommendations.

Although the sediments at the bottom of Coeur d'Alene Lake contain mining contaminants, a remedy for Coeur d'Alene Lake was not selected in the 2002 OU 3 ROD. State, Tribal, federal, and local governments committed to developing a revised Lake Management Plan (LMP) outside of the Superfund process using separate regulatory authorities. Appendix A of this Five-Year Review Report provides additional details of the LMP.

The 2010 Five-Year Review included the following recommendations relative to Coeur D'Alene Lake.

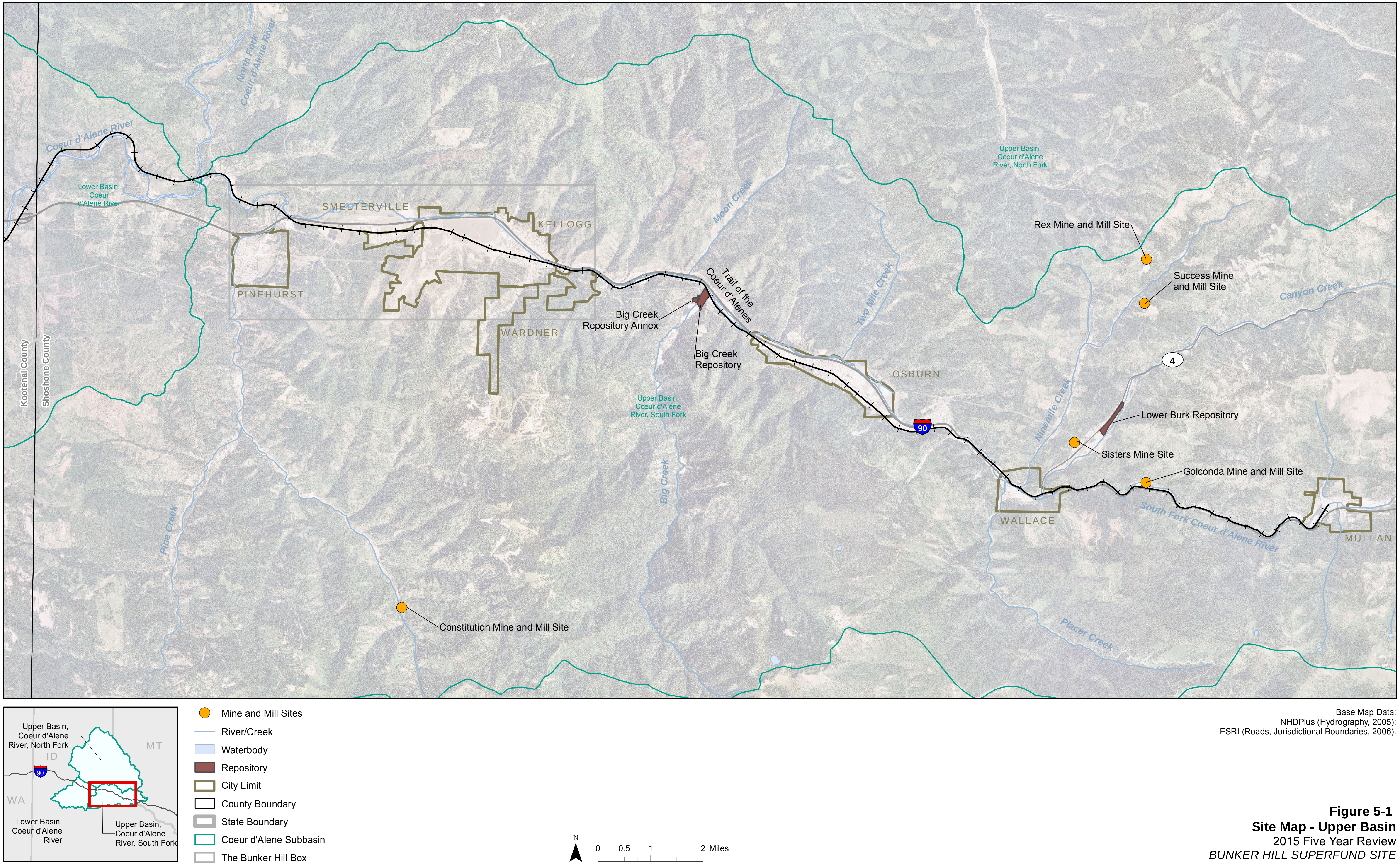
- **Recommendation:** Continue LMP implementation activities and lake monitoring efforts.

  Discussion: The 2002 OU 3 ROD did not select a remedy for the lake, but relies on the effective implementation of the LMP by IDEQ, the Coeur d'Alene Tribe, and other jurisdictions. This recommendation will not be retained in the table of issues and recommendations, because the LMP is not a CERCLA action.

- **Recommendation:** Evaluate the need for additional fish tissue sampling and testing in Coeur d'Alene Lake to assess the applicability of the current fish consumption advisory (an ongoing 2005 Five-Year Review recommendation).

  Discussion: Planning for collection of additional fish samples within the waterbodies of the Lower Basin is underway. The sampling program will follow the fish advisory guidelines from USEPA (USEPA, 1994b, 1995a, 1996c, and 1999b) as implemented by the Idaho Fish Consumption Advisory Project (IFCAP). The goal of the IFCAP is to protect the public from adverse health risks associated with consuming contaminated fish from Idaho and Tribal waters.

USEPA has identified the need to evaluate potential data gaps on fish tissue concentrations and consumption in the Lower Basin and in particular the chain of lakes. Further evaluation of this issue is identified as an action item as discussed in Section 5.1.1.1. This activity will not be retained in the table of issues and recommendations, but will instead be included in the table of planned action items.



Base Map Data:
NHDPlus (Hydrography, 2005);
ESRI (Roads, Jurisdictional Boundaries, 2006).

Figure 5-1
Site Map - Upper Basin
2015 Five Year Review
BUNKER HILL SUPERFUND SITE

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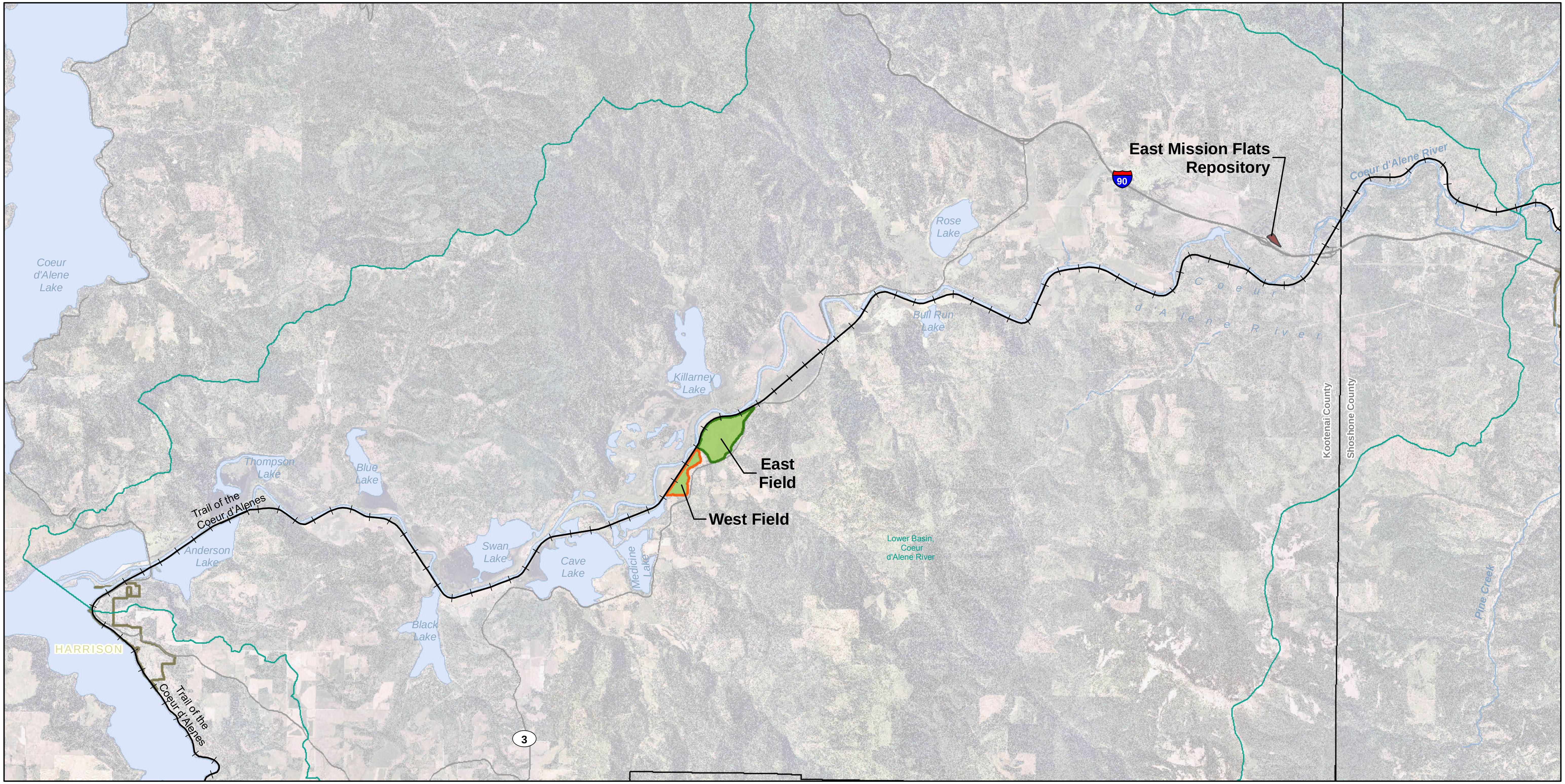

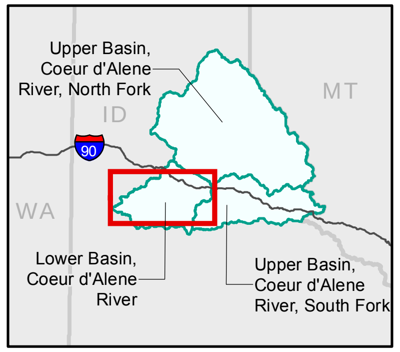

River/Creek
Waterbody
Coeur d'Alene Subbasin
City Limit
County Boundary
State Boundary

Repository
Agriculture to Wetland Conversion Site
East Field
West Field

N
0 0.5 1 2 Miles

Base Map Data:
NHDPlus (Hydrography, 2005);
ESRI (Roads, Jurisdictional Boundaries, 2006).

Figure 5-2
Site Map - Lower Basin
2015 Five Year Review
BUNKER HILL SUPERFUND SITE
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USEPA's highest priority for implementation of the 2002 OU 3 ROD has been and continues to be the remediation of residential and community areas and recreational areas that pose direct human health risks. Additional actions include cleanup of areas that pose ecological risks.

A more detailed overview of the OU 3 selected remedies can be found in the third Five-Year Review (USEPA, 2010c)[1].

5.1.1 Upper and Lower Basins

5.1.1.1 Human Health Actions

The primary goal of the human health cleanup is to prevent people (particularly young children and pregnant women) from coming into contact with unhealthy levels of metals. Children under 3 years of age and pregnant women are the most at risk from exposure to lead and other metals; however, the goal applies to all children under 7. The 2002 OU 3 ROD describes the actions needed to reduce children's exposure to lead through soil and dust exposure pathways. The lead health risk goal defined in the 2002 OU 3 ROD states that "the selected remedy will reduce exposure to lead in soil and house dust…such that there is a five percent or less probability of a typical child having a blood lead level greater than 10 µg/dL and a one percent or less probability of a typical child having a blood lead level greater than 15 µg/dL" (USEPA, 2002a). The 2002 OU 3 ROD also describes actions to reduce human exposure to other metals in soil and private drinking water sources.

Residential and Community Area Remedies

The OU 3 community and residential area cleanup program includes:

- Testing of residential soils and informing property owners of their sample results;
- Remediation of residential and commercial properties, common-use areas, and ROWs;
- Partial removal and replacement of surface soils that have metal levels greater than 1,000 mg/kg lead or 100 mg/kg arsenic, and enhancement of barriers, such as vegetation, for soils between 700 and 1,000 mg/kg lead. No cleanup is required for soils below 700 mg/kg lead and 100 mg/kg arsenic;
- Evaluation of the need for interior cleaning for homes after completion of exterior soil cleanup;
- Testing of private drinking water wells and provision of safe drinking water for homes with contamination above 2002 OU 3 ROD action levels; and
- Implementation of a lead health education and intervention program to provide health and hygiene information to families as well as a free HEPA vacuum cleaner loan program to limit exposure to household dust. In addition, an annual blood lead screening program is being implemented in the Basin.

Remedies in Recreational Areas on the Coeur d'Alene River

The 2002 OU 3 ROD identifies recreational areas near the Coeur d'Alene River (campgrounds, picnic areas, and boat ramps) that have been prioritized for cleanup. The contaminated soils at

[1] The third Five-Year Review is available online at http://go.usa.gov/39vTA.

these areas are to be either capped or removed, depending on the area. In addition, lead health information and signs are to be placed at several recreational use areas in the Basin.

Information for Anglers

The 2002 OU 3 ROD calls for education and information, including health advisories, to be provided to anglers to advise them of the potential risks associated with eating fish from areas of concern. The advisories will be provided in alternative language formats, as required. While there is currently a fish consumption advisory for Coeur d'Alene Lake, it does not apply to other portions of the Lower Basin including the lateral lakes. To address this potential gap, information being collected by other federal and state agencies has been reviewed to determine if fish advisories are necessary in the SFCDR, the chain lakes and Coeur d'Alene River. Based on this review, additional data will need to be collected on fish tissue concentrations and consumption rates in these areas in order to make this determination. This activity has been included in the table of action items (Table 5-17).

Institutional Controls Program

The 2003 OU 3 ROD indicates that Institutional Controls (ICs) are required to protect the remedy over time when contaminants are left in place. The ROD states that an ICP for the Basin is to be established, modeled on the existing ICP in OU 1 and OU 2. The Basin ICP, which is implemented by the PHD, was established and first implemented in 2007.

5.1.1.2 Ecological Actions

The remedial actions selected for environmental protection in the Upper and Lower Basins are described in the 2002 OU 3 ROD and 2012 Upper Basin Rod Amendment. For protection of the environment, USEPA, working with Basin stakeholders, identified three environmental priorities in the 2002 OU 3 ROD:

- **Dissolved metals in surface water (particularly zinc and cadmium):** High concentrations of these metals have harmful effects on fish and other aquatic life.
- **Lead in soil and sediment:** Existing elevated lead concentrations in the beds, banks, and floodplains of the river system have harmful effects on waterfowl and other wildlife.
- **Particulate lead in surface water:** Lead transported downstream is a continuing source of contamination for the Coeur d'Alene River, Coeur d'Alene Lake, and the Spokane River. Lead transported in particulate form in the river has contaminated recreational areas in the Lower Basin and the Spokane River. The Panhandle and Spokane Health Districts have posted health advisory signs at beaches and swimming areas. During flood events, lead transported by the river also affects wetlands, floodplains, waterfowl, and other wildlife.

The Selected Ecological Remedy for OU 3 is an interim remedy based upon a subset of the numerous actions included as part this remedy. For protection of ecological receptors, the Selected Remedy includes excavation and disposal, containment, bioengineering, and water treatment actions to reduce dissolved metals in rivers and streams. Waste dumps and stream banks that are major sources of particulate metals will be stabilized to reduce erosion.

Upper Basin

USEPA issued a ROD Amendment in 2012 updating the Upper Basin cleanup plan that builds upon the remedies identified in the previous ROD and incorporates additional information obtained since the ROD for OU 3 was issued in 2002. The Selected Remedy will be implemented through an adaptive management approach, which will involve prioritizing activities and identifying and evaluating remedy modifications where necessary based on information gained as this interim remedy is implemented. Remedial actions are currently underway in the Ninemile Creek Watershed discussed in Section 5.2.2.3.

Remedial actions completed prior to the 2010 Five-Year Review Report in the Upper Basin that are expected to result in some ecological benefit were primarily conducted at the mine and mill sites that posed the greatest human health risk. The 2002 OU 3 ROD identified specific actions for the mine and mills sites, which are further discussed in Section 5.2.2.

Lower Basin

The 2002 OU 3 ROD defines the Lower Basin as the Coeur d'Alene River west of Cataldo to Harrison at the mouth of the Coeur d'Alene River and identifies remedial actions such as pilot-scale dredging, bank stabilization, capping, remediation of select water fowl feeding habitat and increasing clean waterfowl feeding habitat through the conversion of agricultural lands, construction of contaminated sediment traps, and measures to prevent recontamination. While the ROD selected a broad range of actions to be taken in the Lower Basin it acknowledged that the data upon which they were based were limited. Should additional Lower Basin remedies beyond those selected become necessary, an additional decision document would be necessary in the future. This approach allowed critical source control measures to proceed in the Upper Basin, where contaminant sources and pathways are better defined, while allowing more time to refine the understanding of the complex Lower Basin system further and to develop specific details of remedial actions."

Remedial actions completed to date in the Lower Basin include a pilot-scale agriculture–to-wetlands conversion project that involved soil inversion and hydraulic controls to minimize recontamination and riverbank bio-stabilization demonstration project at a commercial campground in Cataldo. Early actions have also have included paving boat ramps and installing engineered bank isolation structures.

Detailed planning for future remedial action in the Lower Basin requires more comprehensive knowledge of the complex mechanisms by which lead and other metals in sediment is mobilized, transported, and deposited. As a first step in expanding the working hypothesis for the Lower Basin, the 2000 conceptual site model for the Coeur d'Alene Basin (CH2M HILL, 2000b) was updated for the Lower Basin in 2010. The ECSM summarized existing data and knowledge regarding river system dynamics, sediment characteristics, key data gaps, and related information (CH2M HILL, 2010).

USEPA will use this information to establish baseline data against which to evaluate the effectiveness of Lower Basin remedies previously selected in the 2002 OU 3 ROD and future actions that may be selected. USEPA will use available information coupled with computational hydraulic and sediment transport models to examine Lower Basin remedies previously selected in the OU 3 ROD and determine whether the selected actions should be modified or supplemented. The Lower Basin work may include reviews of select remedial actions identified in the 2001 FS Report (USEPA, 2001e), with recognition that a ROD Amendment or other decision document for the Lower Basin may be appropriate at a future date.

5.1.2 Spokane River

The 2002 OU 3 ROD did not identify any areas needing cleanup on the Idaho State portion of the Spokane River. The Washington State portion of the Spokane River, however, has a number of sediment and soil areas in and adjacent to the Spokane River that have been identified for further investigation and possible cleanup on the basis of potential human and ecological risks. These areas are located along a 16-mile reach of the river between the Idaho/Washington state line and Upriver Dam, upstream from Spokane. The identified areas include 10 shoreline areas and one subaqueous area where contaminated sediments have accumulated directly behind Upriver Dam.

5.2 Review of Operable Unit 3 Remedial Actions

5.2.1 Residential and Community Areas

5.2.1.1 Human Health Barriers

Background and Description

Remedial Action Objectives (RAOs) in the OU 3 ROD include the reduction of movement of soil and sediments containing unacceptable levels of contaminants into residential areas and structures, and the reduction of human exposure to soils (including residential garden soils) and sediments that have concentrations of contaminants of concern greater than selected risk-based levels (USEPA, 2002a). The long-term strategy to achieve these objectives is to clean up contaminated soils on residential and commercial properties, common use areas, and ROWs, and establish a network of barriers to contain subsurface contamination and protect residents from exposure to lead and other metals in soil and dust. Actions to address human exposure to metals contamination include the following:

- Testing of residential soils;
- Informing property owners of their sample results;
- Education;
- Access controls;
- Partial removal and replacement of surface soils that have metal concentrations greater than or equal to 1,000 mg/kg lead or 100 mg/kg arsenic; and
- Barrier enhancement (such as vegetation) of soils with lead concentrations between 700 and 999 mg/kg.

In 2013, IDEQ and USEPA clarified how specific remedial actions shall be applied on a property-specific basis in the Basin (IDEQ and USEPA, 2013). Clarifications included guidance on which areas of large rural Basin properties may need to be remediated and what can realistically be done to address a property that is flood-prone and subject to recontamination.

Detailed discussions of the historical context of the remedy, including the soil lead and arsenic concentration data, and property sampling and remediation progress are provided in the 2005 and 2010 Five-Year Reviews (USEPA, 2005 and 2010c).

As a component of the human health barriers Selected Remedy, the Paved Roadway Surface Remediation Program began in 2013 to address the need for paved roads to serve as protective barriers to underlying contaminants. The program is described in more detail in Section 5.2.1.1.

O&M and Actions since the Last Five-Year Review

Residential and Commercial Properties

Since the 2010 Five-Year Review (from 2010 through 2014), a total of 1,014 properties were remediated, 53 of which housed children younger than seven years of age or pregnant women at the time of remediation (Table 5-1). Refer to annual construction completion reports for a more detailed description of remediation efforts in the last 5 years (North Wind, Inc. [North Wind], 2011 and 2012; North Wind Construction Services, LLC [North Wind Construction], 2013, 2014, and 2015a). An estimated 260,195 cy of contaminated soil were removed and placed in designated repositories. Through 2014, up to 17 percent of sampled properties did not require remedial action and 83 percent require remedial action (Table 5-2).

TABLE 5-1
Summary of OU 3 Property Remediation
2015 Five-Year Review, Bunker Hill Superfund Site

Year[a]	**2010**	**2011**	**2012**	**2013**	**2014**
Number of Remediated Properties[b]	316	243	223	137	95
Remediated Properties with Resident Young Children (less than 7 years of age) or Pregnant Women	21	16	6	6	4
Cubic Yards of Contaminated Soil Removed	76,000	57,815	56,463	40,917	29,176

Notes:

[a] Remediation of schools, daycares, recreational, and common use areas have not been tracked separately from other properties since 2005.
[b] Data provided by IDEQ. A property may have discrete areas, such as a ROW, driveway, play area, etc. in addition to a yard. If discrete areas of a property were remediated (and not the yard), that property is included in this count. City or County ROWs and private gravel roads are also included in this count.

TABLE 5-2
OU 3 Properties by Remedial Action Category, through 2014
2015 Five-Year Review, Bunker Hill Superfund Site

Remedial Action Category[a]	Lower Basin		Kingston		Side Gulches		Osburn		Silverton		Wallace		Burke/Ninemile		Mullan		All Areas	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
No Action	392	66%	145	19%	59	13%	60	8%	8	3%	11	3%	4	1%	27	5%	706	17%
Barrier Enhancement Only, No Removal	15	3%	28	4%	14	3%	23	3%	4	2%	7	2%	3	1%	4	1%	98	2%
Combination, Removal and Barrier Enhancement	31	5%	129	17%	111	24%	154	20%	48	20%	96	23%	64	19%	119	21%	752	18%
Removal Only, No Barrier Enhancement	159	27%	460	60%	273	60%	551	70%	175	74%	306	73%	259	78%	423	74%	2606	63%
Total Number of Properties Sampled	597		762		457		788		235		420		330		573		4162	

Note:

[a] Remedial actions occur on at least one or more portions of a property due to exceedances of either the lead or arsenic criteria. No action means all sampled areas on a property tested below remedial action criteria for both lead and arsenic.

Of those properties that require remedial action, the majority only require action on a portion of the property (as opposed to all sampled areas of a property, Figure 5-3). The Lower Basin has a larger proportion of properties that require no remediation when compared to the Upper Basin. The Wallace, Burke/Ninemile, and Mullan geographic areas have a larger proportion of properties that require remedial action on all sampled areas of the property (Figure 5-3).

As the soil remedy has progressed, IDEQ and USEPA have continued to revise the total number of parcels requiring remediation in OU 3 (IDEQ and USEPA, 2013; IDEQ and TerraGraphics, 2012; TerraGraphics, 2008c). An estimated 5,200 parcels in OU 3 were eligible for sampling and potential remediation. To date, sampling of those eligible parcels is estimated at 91 percent complete, and remediation is 85 percent complete. Approximately 4 percent of the eligible parcels have owners that are unable to be contacted or have refused sampling or remediation.

In 2012, IDEQ and USEPA implemented an inventory to track completion of the Basin residential and commercial property sampling and remediation (IDEQ and TerraGraphics, 2012). A status summary is completed annually and contains additional details on property status counts (TerraGraphics, 2015c; IDEQ and TerraGraphics, 2012).

The 2010 Five-Year Review included the following recommendations.

- **Recommendation:** Develop an approach (or program) that defines how barrier integrity for all remediated properties would be maintained and monitored over time.

  Discussion: An O&M approach or program separate from the ICP has not been developed. However, the main purpose of the ICP is to have an approach or program to monitor and maintain barriers into perpetuity. Widespread evaluation of the property barriers has not been completed since the PRP certification of remedial activities in OU 1. This activity will not be retained in the table of issues and recommendations, because it does not directly affect protectiveness. It will instead be included in the table of planned action items. This recommendation is repeated for OU 1.

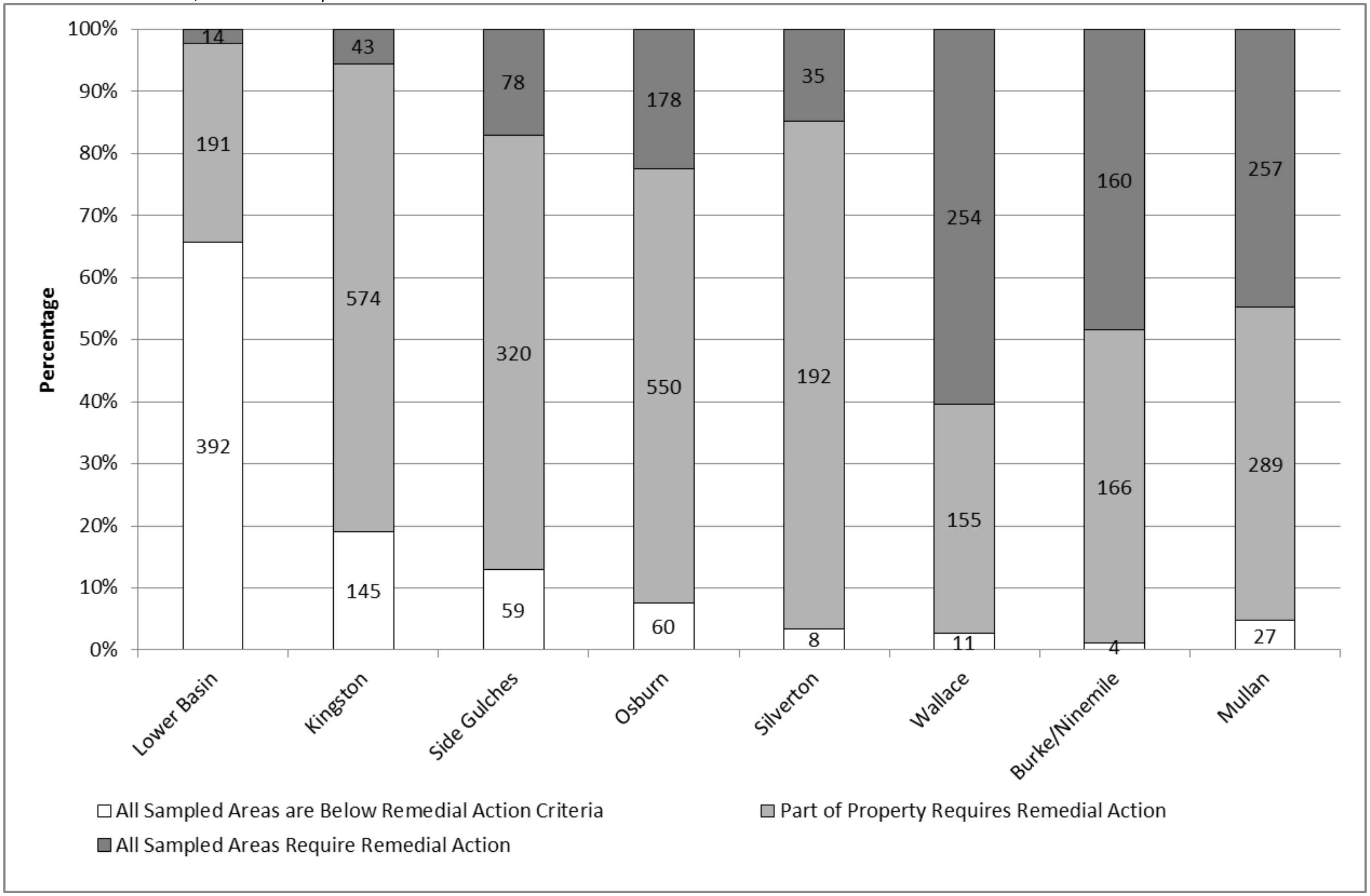
- **Recommendation:** Continue to implement residential and community area remedial actions.

  Discussion: This recommendation will not be retained in the table of issues and recommendations, because completion of the BPRP is the highest priority for USEPA and IDEQ at the Bunker Hill Site and will continue through completion.

- **Recommendation:** Evaluate findings of follow-up study and, as appropriate, conduct further evaluations of technical feasibility of soil amendments (an ongoing 2005 Five-Year Review recommendation).

  Discussion: IDEQ evaluated the feasibility of soil amendments and found that over time compaction rates for amended or unamended soils reached a nearly identical 83 percent, which is an acceptable density for soils that may be manually worked by property owners. In order to provide garden soils with workable densities in the short term, the BPRP determined that soils used to backfill garden areas will be amended with composted material. In addition, throughout areas to be backfilled, work practices such as soil delivery, spreading, and traffic patterns were to be modified when possible to reduce compaction rates. This recommendation is complete.

FIGURE 5-3
Summary of Remediation in OU 3 by Property Proportions and Geographic Area, through 2014
2015 Five-Year Review, Bunker Hill Superfund Site



Gravel Roads

The OU 3 ROD recognized that roads are barriers to underlying contamination, and the 2010 Five-Year Review recommended that a collaborative approach be developed to address roads as a long-term barrier. Beginning in 2011, sampling/remediating publicly owned unpaved gravel roads became a priority and unpaved gravel roads were categorized according to the entity that owned or maintained it (public or private) (TerraGraphics, 2011b, 2012, 2013e, and 2014d). Criteria for remediation of publicly owned gravel roads has a maximum removal depth of six inches and depends on proximity to residences and traffic use (IDEQ and USEPA, 2013). Alternatively, privately owned gravel roads are remediated using the same criteria as a residential property (IDEQ, 2014c).

Through 2014, a total of 64.3 miles of publicly owned (includes county and local jurisdictions) gravel roads have been sampled (Table 5-3). A total of 7.5 miles of those gravel roads required remediation according to criteria developed by the agencies (IDEQ and USEPA, 2013), and 7.25 miles have been remediated to date. Some public gravel roads are scheduled to be remediated under a different program, such as the Paved Roads Program.

A total of 27.8 miles of privately owned gravel roads have been sampled to date, and 6.7 miles of those exceed remedial action criteria (Table 5-3). Through 2014, approximately 2 miles of private gravel roadways have been remediated.

Paved Roads Program

Approximately 13.5 miles of Basin roads (6 percent) were rebuilt, overlaid, patched, or chip sealed in 2013 and 2014. Completion or remedial action reports are not yet available because many of these projects were completed in 2014. This is an ongoing program based on the paved roadway surface remediation strategy (IDEQ and USEPA, 2013). A joint IDEQ/USEPA Paved Roads Board was established which reviews and approves paved road remediation proposals from the local cities and counties in the Box and Basin. The local road jurisdictions are responsible for implementing the remediation according to approved plans and following board guidelines. The jurisdictions are also responsible for O&M of the remediated roads, which serve as barriers to contamination.

Remedy Status

To date, a total of 3,603 properties have been remediated, 734 of which were considered high risk (residences with young children or pregnant women) at the time of sampling or remediation, and nearly 820,000 cy of contaminated soil have been removed and placed in designated repositories. The OU 3 ROD underestimated the number of properties that would require cleanup because it was based on yard samples only (USEPA, 2002a). The 83 percent of properties in the Basin that require remedial action is based on samples collected from the entire property (e.g., a vegetable garden or gravel driveway).

Substantial reductions have occurred in community mean soil lead concentrations since the large-scale property remediation began in 2002 (Figure 5-4). The earliest community reductions for lead were observed in Upper Basin communities, corresponding to the prioritization of the remediation efforts. As of 2014, community mean soil lead concentrations were near or below 200 mg/kg for all geographic areas. Community mean soil arsenic concentrations have remained generally stable below the clean soil criteria of 35 mg/kg since the 2010 Five-Year Review because remedial actions on property soils are typically due to elevated lead concentrations (as opposed to elevated arsenic concentrations).

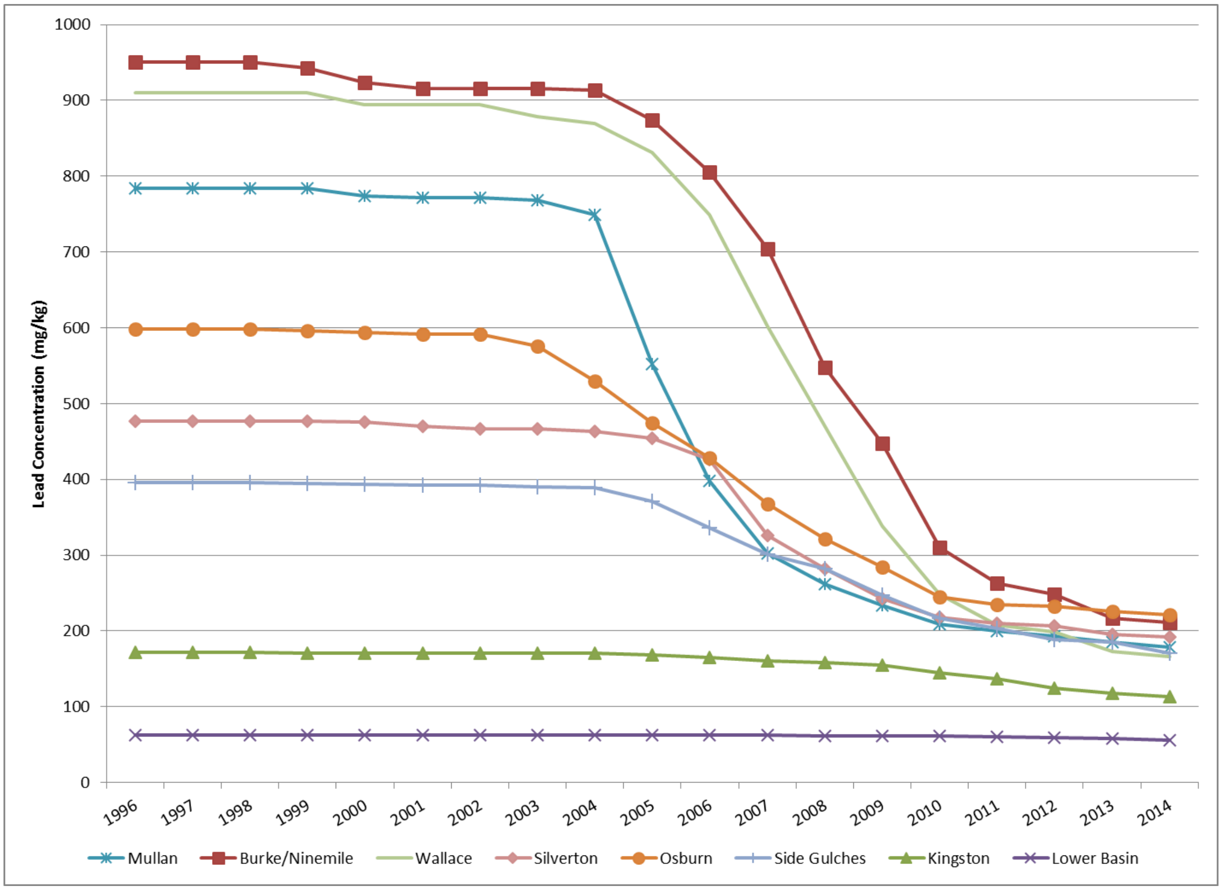
TABLE 5-3
Summary of Gravel Roads Sampled and Remediated in the Basin, through 2014
2015 Five-Year Review, Bunker Hill Superfund Site

	Publicly Owned/Maintained Roads			Privately Owned/Maintained Roads		
GeoArea	**Length of Sampled Road (miles)**	**Length Requiring Remediation (miles) [a]**	**Percent of Length Remediated that Required Remediation**	**Length of Sampled Road (miles)**	**Length Requiring Remediation (miles)**	**Percent of Length Remediated that Required Remediation [b]**
Lower Basin	46.7	2.0	100%	15.8	2.4	12%
Kingston	7.0	0.4	100%	8.0	2.1	32%
Side Gulches	3.7	1.2	100%	1.7	1.2	54%
Osburn	0.8	0.6	100%	0.2	0.2	0%
Silverton	0.3	0.1	100%	0.0	0.0	N/A
Wallace	0.2	0.1	100%	0.1	0.1	100%
Burke/Ninemile	1.9	1.6	100%	0.1	0.1	48%
Mullan	3.7	1.4	84%	1.8	0.6	26%
Total for All Geographic Areas	64.3	7.5	97%	27.8	6.7	29%

Notes:

[a] Based on criteria set forth in IDEQ and USEPA, 2013.
[b] Percent of remediated gravel roads is an estimate because not all 2014 remediation records were finalized at the time of drafting this report.

FIGURE 5-4
OU 3 Area-Weighted Geometric Mean Lead Concentration by Geographic Area and Year
2015 Five-Year Review, Bunker Hill Superfund Site



Through 2014, a total of 7.25 miles of gravel roads have been remediated. Operations and maintenance of remediated publicly owned gravel and paved roads are the responsibility of the governmental jurisdiction that maintains each road. Unpaved gravel road remediation was completed as designed in 2014. Performance of the unpaved gravel roads will be evaluated in future years and reported in the next Five-Year Review.

The performance of the soil barriers is dependent on long-term maintenance and the ICP. Barrier enhancement may have involved adding grass or other vegetation, or in some cases when vegetation was considered sufficient, no additional barrier was installed. Maintenance of these barrier enhancement areas relies on the residents and monitoring of these areas is not conducted by the agencies. Consequently, the performance of the barriers may be degraded if vegetation is not being maintained.

Additionally, flooding can affect the integrity of installed barriers. In January 2011, the Highway 3 culvert at Rose Creek failed and the Idaho Department of Transportation installed a new culvert and repaired the highway, but was unable to connect the old flood control gate to the new culvert. High water that spring resulted in the Coeur d'Alene River backwashing through the culvert and flooding the Rose Lake community. By fall of 2011, the BEIPC and IDEQ installed a new flood control gate using IDEQ funds. The Rose Lake Water Board is responsible for future O&M of the gate (BEIPC, 2012). It is unknown if this flood event recontaminated any of the previously remediated properties in the Rose Lake community.

As part of the ICP, opportunistic sampling is conducted on projects by PHD, offering additional data to evaluate remedy performance (Table 5-4). Snow pile sediment samples were collected from various areas previously remediated in Osburn and Wallace between 2011 and 2014. Snow sediment samples resulted in average lead concentrations of 300 to 500 mg/kg and average arsenic concentration of approximately 20 mg/kg (Table 5-4). Two samples were collected from basements in 2010: one with a lead concentration greater than 1,000 mg/kg and an arsenic concentration greater than 100 mg/kg and the other below 1,000 mg/kg and 100 mg/kg, respectively. Sediment samples from runoff and/or erosion depositional areas were collected in 2014 in Silverton and Kingston and averaged 113 mg/kg lead and 8 mg/kg arsenic. Regrinds and "other soil" samples were collected for ICP monitoring and permitting purposes, and results from these samples indicate the need for an ICP to protect public health and manage barriers into perpetuity.

Approximately 13.5 miles of Basin roads (6 percent) were rebuilt, overlaid, patched, or chip sealed in 2013 and 2014. Paved road maintenance and performance is the responsibility of each local jurisdiction. Therefore, funding for the Paved Roads Program does not include maintenance, future site inspections, or data collection and analysis to determine if the paved roads continue to function as a barrier. While implementation of this program is expected to address a significant number of paved roads in the Site, it is not intended to address all road problems and conditions. All roads within the ICP administrative boundary are subject to ICP rules.

TABLE 5-4
ICP Samples Collected in OU 3, 2010-2014
2015 Five-Year Review, Bunker Hill Superfund Site

		Lead[a]						Arsenic[a]					
Type	**Year**	**No. of Samples**	**Min Conc. (mg/kg)**	**Max Conc. (mg/kg)**	**Average Conc. (mg/kg)**	**Standard Deviation**	**% of Samples ≥ 350 mg/kg[b]**	**No. of Samples**	**Min Conc. (mg/kg)**	**Max Conc. (mg/kg)**	**Average Conc. (mg/kg)**	**Standard Deviation**	**% of Samples ≥ 100 mg/kg**
Snow Pile	2010	0						0					
	2011	3	88	1,145	487	574	33%	0					
	2012	7	317	939	448	219	86%	0					
	2013	6	109	1,080	381	351	17%	6	6.8	22.9	16	7	0%
	2014	3	174	382	282	104	33%	3	7.7	25.2	18	9	0%
Basement	2010	2	-	-	-	-	50%	2	-	-	-	-	50%
	2011	0						0					
	2012	0						0					
	2013	0						0					
	2014	0						0					
Runoff	2010	0						0					
	2011	0						0					
	2012	0						0					
	2013	0						0					
	2014	7	24.9	285	113	99	0%	7	4.7	10.1	8	2	14%

TABLE 5-4
ICP Samples Collected in OU 3, 2010-2014
2015 Five-Year Review, Bunker Hill Superfund Site

Type	Year	Lead[a]						Arsenic[a]					
		No. of Samples	Min Conc. (mg/kg)	Max Conc. (mg/kg)	Average Conc. (mg/kg)	Standard Deviation	% of Samples ≥ 350 mg/kg[b]	No. of Samples	Min Conc. (mg/kg)	Max Conc. (mg/kg)	Average Conc. (mg/kg)	Standard Deviation	% of Samples ≥ 100 mg/kg
Regrinds[c]	2010	12	545	4,866			100%	12	2.5	247			17%
	2011	3	895	2226			100%	2	-	-			0%
	2012	0						0					
	2013	2	-	-			100%	2	-	-			50%
	2014	6	11.1	342			0%	6	3.7	22.7			17%
Other Soils[c]	2010	94	16	8,879			41%	88	2.5	496			8%
	2011	19	25	13,300			68%	12	2.5	479			17%
	2012	50	20.7	68,200			78%	49	4.4	1,590			27%
	2013	17	7.24	8,620			29%	17	2.5	187			35%
	2014	17	24.9	4,090			18%	17	3.7	70			12%

Notes:

Data Provided by the Panhandle Health District.
- When the No. of Samples is less than three, data are not displayed in order to protect participant confidentiality.
Conc. = concentration.

[a] If a sample was below detection limits, the reported result was divided in half prior to data summary.
[b] ICP soil disposal lead level, discussed in Section 5.2.1.6.
[c] These samples were collected during ICP inspections of permitted projects, projects undertaken by the utilities or government, or to monitor erosion and/or tracking. Soils that test greater than ICP criteria are directed to the repositories or capped under barriers. For this reason, averages and standard deviations were not calculated.

5.2.1.2 House Dust

Background and Description

Similar to OU 1, the OU 3 long-term human health cleanup strategy includes remediation of contaminated soils and placement of clean soil barriers throughout the Site to reduce house dust lead levels. The house dust RAO is to "… reduce human exposure to lead in house dust via tracking from areas outside the home and air pathways, exceeding health risk goals" (USEPA, 2002a). Health risk goals, defined in USEPA's Office of Solid Waste and Emergency Response (OSWER) Directive, are intended "to reduce risk to a typical or individual child receiving exposures at the residence to meet Agency guidelines (i.e., no greater than a 5 percent chance of exceeding a 10 µg/dL blood-lead level for a full-time child resident)" (USEPA, 1998b). The Selected Remedy to achieve the dust RAO includes a vacuum loan program and information and intervention with the LHIP (discussed in Section 5.2.1.4), and monitoring to ensure that RAOs continue to be achieved after the Selected Remedy is implemented (USEPA, 2002a). In addition, a contingency of interior cleaning (including consideration of crawl spaces, attics, and basements) and paint abatement (via a state program) would address significant sources of recontamination within residences that require interior cleaning after yard cleanups are complete (USEPA, 2002a).

USEPA and the State of Idaho continue to monitor house dust concentrations as residential soil remediation is completed to assess progress towards meeting the house dust RAO. Two methods are used to track house dust lead concentration: vacuum bags and dust mats. Vacuum bag data have been used in dose-response analyses relating children's blood lead levels with environmental lead concentrations and are used in lead exposure modeling to assess achievement of the OU 3 house dust RAO. Dust mat data are used to assess remedy performance in reducing the tracking of soil lead into house dust.

Detailed discussions of the historical context of the remedy and evaluation of the house dust lead concentration data through 2009 are provided in the 2005 and 2010 Five-Year Reviews (USEPA, 2005 and 2010c).

O&M and Actions since the Last Five-Year Review

Basin house dust surveys were conducted in 2010, 2011, and 2013. In 2012, USEPA decided to monitor Basin house dust every other year instead of annually, because this was considered adequate for helping to assess the progress of the BPRP. Homes were targeted for sampling if they included children less than 7 years old and/or pregnant women based on prior house dust sampling efforts, through property remediation tracking, and/or through the annual LHIP blood lead screening. Vacuum and dust mat samples were collected from 368 homes in 2010, 356 homes in 2011, and 360 homes in 2013 during the house dust surveys. From 2010 through 2014, vacuum bag samples were also collected opportunistically from 166 properties that participated in the Basin residential property remediation program. Few vacuum samples were collected in 2014 and are not used to evaluate trends discussed in the subsequent section.

The dust mat used for monitoring from 2002 through 2011 was no longer available in 2012, and IDEQ selected a replacement dust mat based on similar dust and lead recovery results (TerraGraphics, 2013f).

Remedy Status

Dust Lead Concentration

Throughout the OU 3 communities, mean vacuum and dust mat lead concentrations have generally decreased since monitoring began (Figures 5-5 and 5-6, respectively; TerraGraphics, 2014e). Since the 2010 Five-Year Review, geometric mean vacuum concentrations decreased in all communities, with the largest decrease (67 percent) observed in Burke/Ninemile. Geometric mean dust mat lead concentrations fluctuated since 2010, with the largest decrease of 24 percent in Burke/Ninemile and the largest increase of 39 percent in the Side Gulches. In 2013, geometric mean lead concentrations in all Basin communities were below 500 mg/kg (Tables 5-5 and 5-6). Dust mat lead concentrations in the Lower Basin and Kingston geographic areas cannot be evaluated because of the limited data collected since 2007.

In addition to observed decreases in house dust lead concentrations, the number and percentage of homes that may be eligible for interior cleaning (i.e., greater than or equal to 1,000 mg/kg lead) have also generally declined since monitoring began in 1996 (Figures 5-7 and 5-8). However, the percentage of dust mat samples greater than or equal to 1,000 mg/kg lead has fluctuated at similar levels in each community since 2004 (Figure 5-8). The ROD cost estimates for house dust assumed up to 4 percent of Basin homes would require interior source removal or more extensive cleaning after yard remediation was complete, using a threshold of 1,000 mg/kg lead (USEPA, 2001b and 2002a). In 2013, 5 percent of vacuum dust samples and 9 percent of dust mat samples were equal to or greater than 1,000 mg/kg lead (Tables 5-5 and 5-6).

Historically, Wallace and Burke/Ninemile consistently had the highest house dust lead concentrations and greatest percentage of homes with lead levels above 1,000 mg/kg compared with other geographic areas (TerraGraphics, 2014e). Recent data indicated a substantial reduction in house dust concentrations in Burke/Ninemile since the last Five-Year Review. The community-mean vacuum and mat lead concentrations decreased by 67 and 24 percent, respectively, and no vacuum samples and only 3 percent of dust mat samples were ≥ 1,000 mg/kg lead (Tables 5-5 and 5-6).

Dust and Lead Loading Rates

Dust and lead loading rates provide data to evaluate tracking of exterior dust and lead into the home. For most OU 3 communities, geometric mean dust loading rates decreased substantially from 1996 when they were at their highest (Figure 5-9). Dust loading rates have generally fluctuated at similar levels in each community since 2004, although since 2007, not enough samples have been collected from the Lower Basin and Kingston areas to assess trends (Figure 5-9 and Table 5-7). Substantial decreases were also observed in dust lead content between 1996 and 2004, with generally constant lead loading rates since 2004 (Figure 5-10). Mullan and Wallace have continued to show higher lead loading rates than other geographic areas (Table 5-7).

It is not clear what caused the substantial reduction in dustiness and lead loading rates between 1996 and 2004 (USEPA, 2005). Most of the pre-ROD data was collected in the aftermath of the 1996 floods when dusty conditions were likely exacerbated, which may have contributed to higher lead loading rates.

FIGURE 5-5
Mean Vacuum Lead Concentrations by Year and Area for OU 3, 1996-2013
2015 Five-Year Review, Bunker Hill Superfund Site

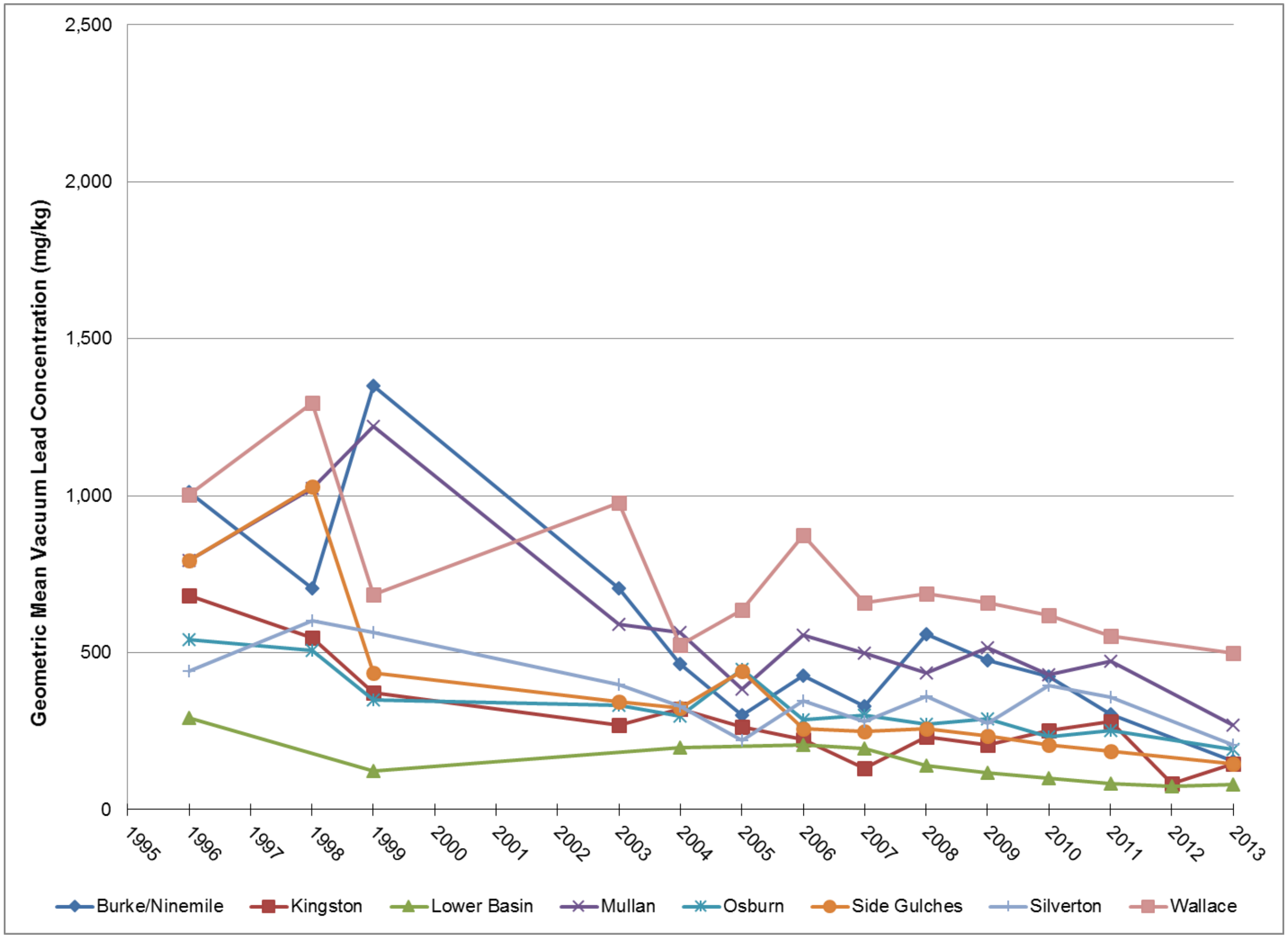


FIGURE 5-6
Mean Dust Mat Lead Concentrations by Year and Area for OU 3, 1996-2013
2015 Five-Year Review, Bunker Hill Superfund Site

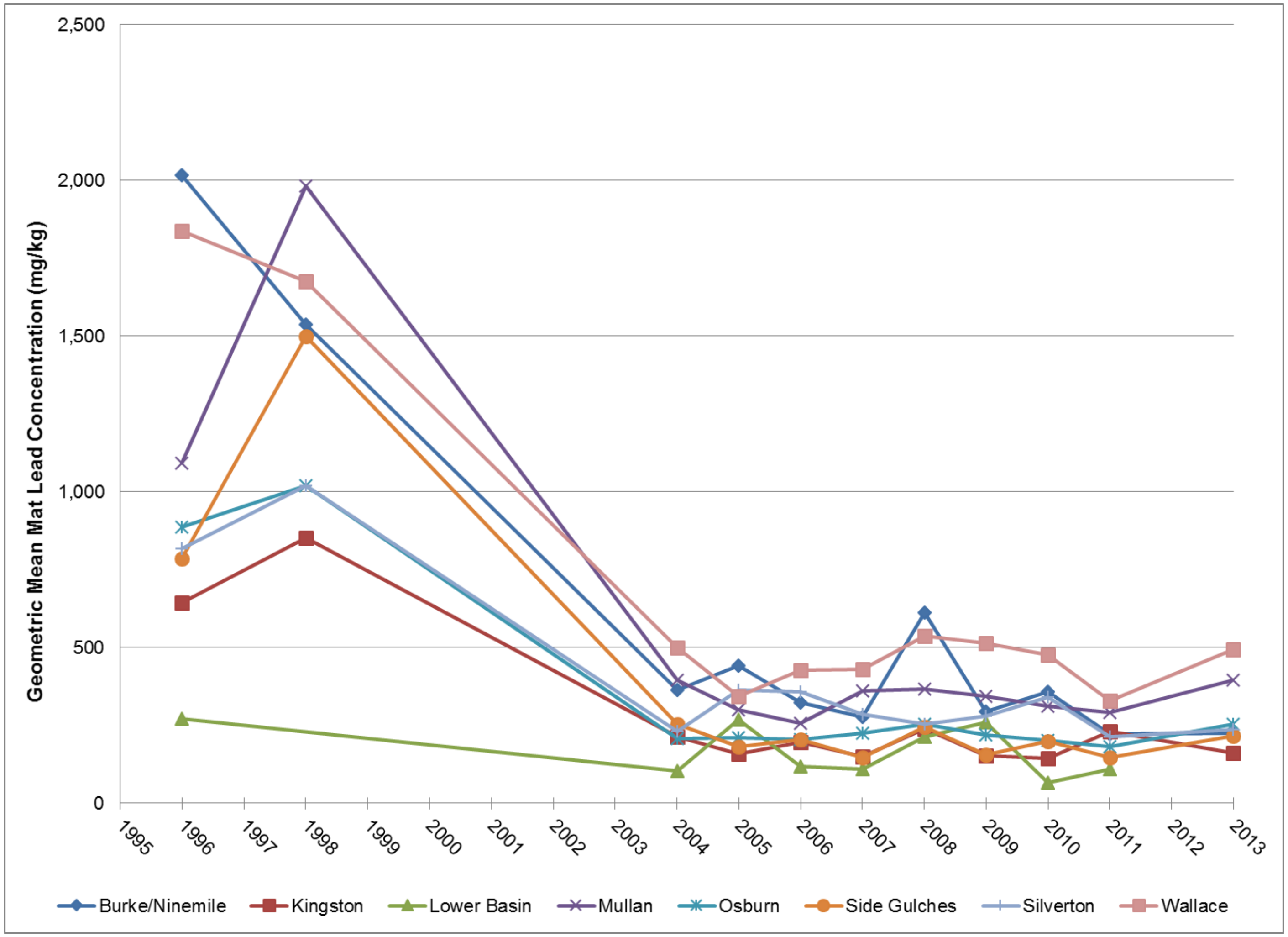


TABLE 5-5
Vacuum Dust Summary Statistics by Year and Area for OU 3, 2010-2014
2015 Five-Year Review, Bunker Hill Superfund Site

Year	Geographic Area	Number of Vacuum Samples[a]	Vacuum Samples ≥ 1,000 mg/kg Lead		Vacuum Samples ≥ 1,500 mg/kg Lead		Lead Concentration Range (mg/kg)		Mean Vacuum Dust Lead Concentration (mg/kg)			
			Number	Percent	Number	Percent	Minimum	Maximum	Arithmetic Mean	Arithmetic Standard Deviation	Geometric Mean	Geometric Standard Deviation
2010	Lower Basin	31	1	3%	1	3%	19	1,570	173	303	100	2.43
	Kingston	14	1	7%	1	7%	90	4,200	508	1,067	253	2.52
	Side Gulches	37	0	0%	0	0%	32	675	263	172	206	2.13
	Osburn	63	0	0%	0	0%	55	749	276	171	231	1.84
	Silverton	18	3	17%	1	6%	70	2,530	580	594	394	2.47
	Wallace	44	11	25%	7	16%	39	5,660	994	1,157	620	2.70
	Burke/Ninemile	23	3	13%	3	13%	88	4,700	701	996	425	2.54
	Mullan	43	4	9%	2	5%	37	8,670	698	1,321	429	2.33
	Basin-wide	273	23	8%	15	5%	19	8,670	513	860	293	2.68
2011	Lower Basin	47	1	2%	0	0%	22	1,040	125	164	83	2.29
	Kingston	5	1	20%	0	0%	69	1,040	401	377	280	2.69
	Side Gulches	32	0	0%	0	0%	44	952	262	237	186	2.33
	Osburn	59	2	3%	1	2%	46	1,640	326	282	251	2.02
	Silverton	10	1	10%	0	0%	145	1,230	422	305	358	1.76
	Wallace	19	5	26%	4	21%	9	46,200	3,640	10,716	552	5.95
	Burke/Ninemile	24	3	13%	3	13%	33	2,790	556	684	305	3.14
	Mullan	14	2	14%	1	7%	160	1,870	566	429	472	1.81
	Basin-wide	210	15	7%	9	4%	9	46,200	620	3,306	219	3.03

TABLE 5-5
Vacuum Dust Summary Statistics by Year and Area for OU 3, 2010-2014
2015 Five-Year Review, Bunker Hill Superfund Site

Year	Geographic Area	Number of Vacuum Samples[a]	Vacuum Samples ≥ 1,000 mg/kg Lead		Vacuum Samples ≥ 1,500 mg/kg Lead		Lead Concentration Range (mg/kg)		Mean Vacuum Dust Lead Concentration (mg/kg)			
			Number	Percent	Number	Percent	Minimum	Maximum	Arithmetic Mean	Arithmetic Standard Deviation	Geometric Mean	Geometric Standard Deviation
2012	Lower Basin	31	0	0%	0	0%	4	627	120	145	74	2.69
	Kingston	12	0	0%	0	0%	17	241	109	74	84	2.27
	Side Gulches	2	-	-	-	-	-	-	-	-	-	-
	Osburn	-	-	-	-	-	-	-	-	-	-	-
	Silverton	-	-	-	-	-	-	-	-	-	-	-
	Wallace	-	-	-	-	-	-	-	-	-	-	-
	Burke/Ninemile	-	-	-	-	-	-	-	-	-	-	-
	Mullan	-	-	-	-	-	-	-	-	-	-	-
	Basin-wide	45	0	0%	0	0%	4	627	125	141	80	2.62
2013	Lower Basin	11	0	0%	0	0%	32	187	89	42	80	1.62
	Kingston	6	0	0%	0	0%	49	310	181	111	147	2.12
	Side Gulches	30	0	0%	0	0%	17	748	201	179	145	2.30
	Osburn	42	0	0%	0	0%	37	820	233	157	191	1.93
	Silverton	22	1	5%	1	5%	66	4,540	421	937	207	2.59
	Wallace	27	6	22%	2	7%	29	7,140	904	1,384	499	3.01
	Burke/Ninemile	25	0	0%	0	0%	23	622	190	130	154	2.00
	Mullan	33	3	9%	1	3%	20	2,100	415	425	268	2.76
	Basin-wide	196	10	5%	4	2%	17	7,140	357	671	205	2.60

TABLE 5-5
Vacuum Dust Summary Statistics by Year and Area for OU 3, 2010-2014
2015 Five-Year Review, Bunker Hill Superfund Site

Year	Geographic Area	Number of Vacuum Samples[a]	Vacuum Samples ≥ 1,000 mg/kg Lead		Vacuum Samples ≥ 1,500 mg/kg Lead		Lead Concentration Range (mg/kg)		Mean Vacuum Dust Lead Concentration (mg/kg)			
			Number	Percent	Number	Percent	Minimum	Maximum	Arithmetic Mean	Arithmetic Standard Deviation	Geometric Mean	Geometric Standard Deviation
2014	Lower Basin	4	0	0%	0	0%	58	213	140	77	122	1.87
	Kingston	-	-	-	-	-	-	-	-	-	-	-
	Side Gulches	1	-	-	-	-	-	-	-	-	-	-
	Osburn	-	-	-	-	-	-	-	-	-	-	-
	Silverton	-	-	-	-	-	-	-	-	-	-	-
	Wallace	-	-	-	-	-	-	-	-	-	-	-
	Burke/ Ninemile	-	-	-	-	-	-	-	-	-	-	-
	Mullan	-	-	-	-	-	-	-	-	-	-	-
	Basin-wide	5	0	0%	0	0%	58	383	383	127	153	2.11

Notes:

Vacuum samples were collected through both the House Dust Survey and BPRP in 2010, 2011, and 2013 and the property remediation program in 2012 and 2014.

[a] When the number of samples is 2 or less, the results are not shown in order to maintain confidentiality.

TABLE 5-6
Dust Mat Summary Statistics by Year and Area for OU 3, 2010-2013
2015 Five-Year Review, Bunker Hill Superfund Site

Year	Geographic Area	Number of Dust Mat Samples[a]	Dust Mat Results ≥ 1,000 mg/kg Lead		Dust Mat Results ≥ 1,500 mg/kg Lead		Lead Concentration Range (mg/kg)		Dust Mat Lead Concentration (mg/kg)			
			Number	Percent	Number	Percent	Minimum	Maximum	Arithmetic Mean	Arithmetic Standard Deviation	Geometric Mean	Geometric Standard Deviation
2010	Lower Basin	5	0	0%	0	0%	28	148	81	50	68	2.0
	Kingston	5	0	0%	0	0%	74	315	162	91	144	1.7
	Side Gulches	58	2	3%	1	2%	22	18,900	587	2,458	199	3.0
	Osburn	92	3	3%	1	1%	25	2,850	298	358	203	2.3
	Silverton	29	3	10%	3	10%	47	5,040	696	1,248	342	2.8
	Wallace	72	15	21%	9	13%	39	20,800	1,207	2,984	477	3.1
	Burke/Ninemile	40	6	15%	4	10%	40	4,700	639	888	358	2.9
	Mullan	65	6	9%	2	3%	52	4,310	480	694	312	2.3
	Basin-wide	366	35	10%	20	5%	22	20,800	619	1761	281	2.8
2011	Lower Basin	5	0	0%	0	0%	59	292	137	103	111	2.1
	Kingston	6	1	17%	1	17%	24	13,600	2,386	5,494	231	9.0
	Side Gulches	51	1	2%	0	0%	34	1,010	210	205	146	2.3
	Osburn	90	3	3%	3	3%	16	2,050	274	322	182	2.4
	Silverton	27	1	4%	0	0%	24	1,380	283	260	213	2.2
	Wallace	72	9	13%	5	7%	38	4,640	527	678	328	2.6
	Burke/Ninemile	40	5	13%	3	8%	33	1,940	376	457	222	2.8
	Mullan	64	1	2%	0	0%	41	1,140	370	257	291	2.1
	Basin-Wide	355	21	6%	12	3%	16	13,600	379	819	223	2.6

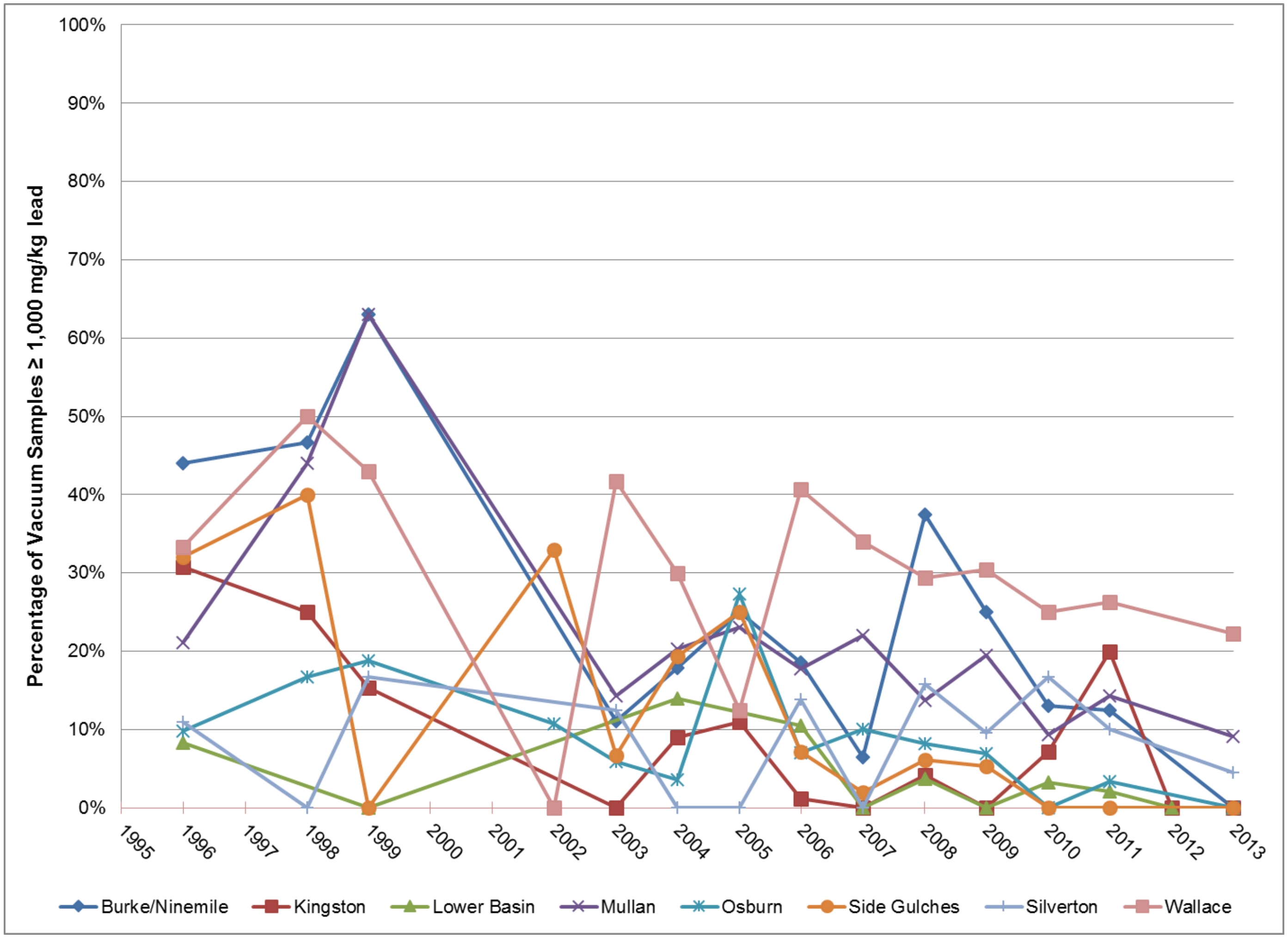
TABLE 5-6
Dust Mat Summary Statistics by Year and Area for OU 3, 2010-2013
2015 Five-Year Review, Bunker Hill Superfund Site

Year	Geographic Area	Number of Dust Mat Samples[a]	Dust Mat Results ≥ 1,000 mg/kg Lead		Dust Mat Results ≥ 1,500 mg/kg Lead		Lead Concentration Range (mg/kg)		Dust Mat Lead Concentration (mg/kg)			
			Number	Percent	Number	Percent	Minimum	Maximum	Arithmetic Mean	Arithmetic Standard Deviation	Geometric Mean	Geometric Standard Deviation
2013	Lower Basin	1	--	--	--	--	--	--	--	--	--	--
	Kingston	3	0	0%	0	0%	145	178	163	17	163	1.1
	Side Gulches	51	5	10%	3	6%	35	2,500	397	536	218	2.9
	Osburn	86	5	6%	2	2%	19	30,000	697	3,216	256	2.8
	Silverton	32	1	3%	1	3%	33	3,230	376	555	238	2.5
	Wallace	61	14	23%	7	11%	36	29,400	1,320	3,883	493	3.2
	Burke/Ninemile	34	1	3%	0	0%	53	1,260	305	268	226	2.2
	Mullan	65	4	6%	2	3%	74	2,560	503	405	396	2.0
	Basin-wide	333	30	9%	15	5%	19	30,000	650	2367	299	2.7

Note:

[a] Indicates the number of homes where a mat sample was collected; if both an original and split sample were collected, the higher result was used for data summary. When the number of samples is 2 or less, the results are not shown in order to maintain confidentiality.

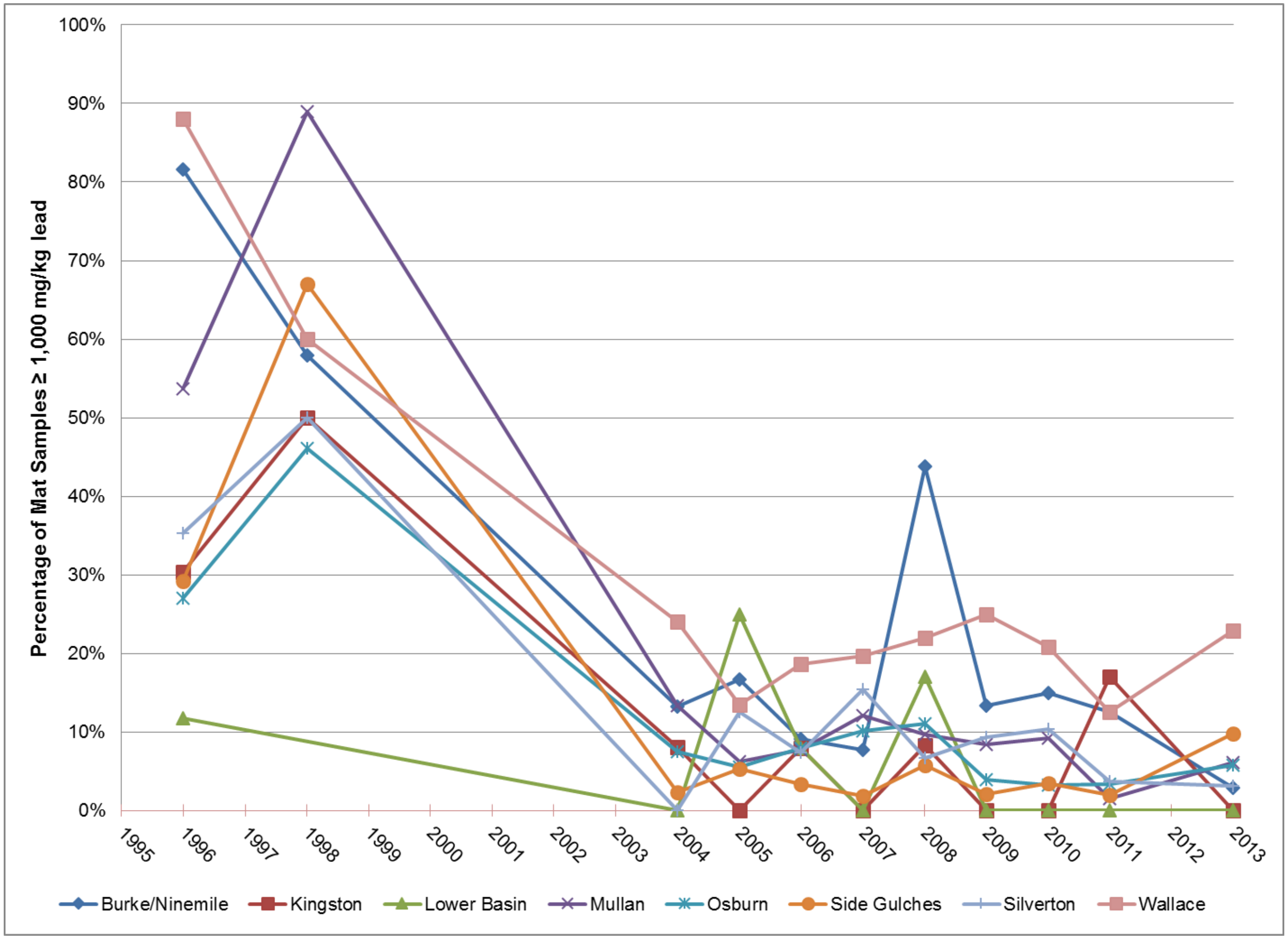
FIGURE 5-7
Percentage of OU 3 Vacuum Samples ≥ 1,000 mg/kg Lead, 1996-2013
2015 Five-Year Review, Bunker Hill Superfund Site



Note:

When the number of samples is 2 or less, the results are not shown in order to maintain confidentiality. Refer to USEPA, 2010c and Table 5-5 for the number of samples collected.

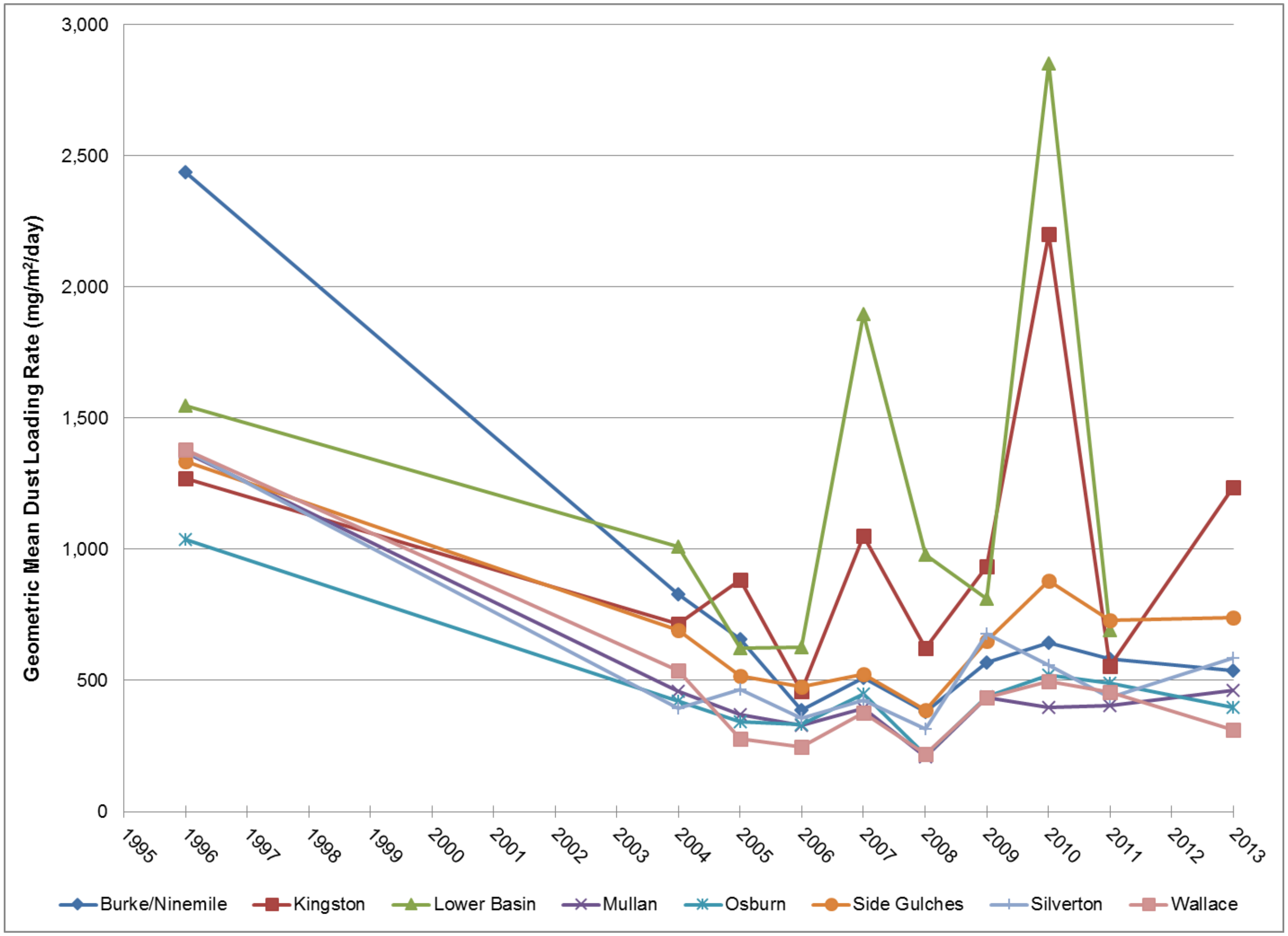
FIGURE 5-8
Percentage of OU 3 Mat Samples ≥ 1,000 mg/kg Lead, 1996-2013
2015 Five-Year Review, Bunker Hill Superfund Site



Note:

When the number of samples is 2 or less, the results are not shown in order to maintain confidentiality. Refer to USEPA, 2010c and Table 5-6 for the number of samples collected.

FIGURE 5-9
Mean Dust Loading Rates by Year and Area for OU 3, 1996-2013
2015 Five-Year Review, Bunker Hill Superfund Site



Note:

When the number of samples is 2 or less, the results are not shown in order to maintain confidentiality. Refer to USEPA, 2010c and Table 5-7 for the number of samples collected.

TABLE 5-7
Dust and Lead Loading Summary Statistics by Year and Area for OU 3, 2010-2013
2015 Five-Year Review, Bunker Hill Superfund Site

Year	Geographic Area	Number of Dust Mat Samples[a]	Dust Loading Rate ($mg/m^2/day$)				Lead Loading Rate ($mg/m^2/day$)			
			Arithmetic Mean	Arithmetic Standard Deviation	Geometric Mean	Geometric Standard Deviation	Arithmetic Mean	Arithmetic Standard Deviation	Geometric Mean	Geometric Standard Deviation
2010	Lower Basin	5	4,040	3,171	2,852	2.8	0.312	0.388	0.193	2.77
	Kingston	5	2,660	1,556	2,202	2.1	0.426	0.368	0.317	2.37
	Side Gulches	58	1,990	3,472	879	3.3	0.737	1.85	0.173	5.31
	Osburn	92	727	698	519	2.2	0.218	0.314	0.104	3.61
	Silverton	29	746	548	560	2.2	0.562	1.08	0.191	4.51
	Wallace	72	818	956	497	2.7	0.705	1.40	0.235	4.72
	Burke/Ninemile	40	959	859	643	2.7	0.564	0.778	0.209	5.00
	Mullan	65	569	546	397	2.4	0.286	0.469	0.119	3.87
	Basin-wide	366	1,015	1,690	573	2.7	0.477	1.09	0.157	4.43
2011	Lower Basin	5	746	270	693	1.6	0.100	0.098	0.077	2.05
	Kingston	6	952	1,055	555	3.2	0.713	1.18	0.128	12.2
	Side Gulches	51	1,411	2,456	730	2.9	0.242	0.399	0.107	3.74
	Osburn	90	702	755	491	2.3	0.189	0.312	0.089	3.60
	Silverton	27	602	537	434	2.3	0.185	0.230	0.092	3.93
	Wallace	72	667	712	454	2.3	0.355	0.531	0.148	3.91
	Burke/Ninemile	40	851	793	583	2.5	0.357	0.602	0.129	4.69
	Mullan	64	587	603	403	2.3	0.291	0.511	0.117	3.90
	Basin-wide	355	790	1,158	502	2.4	0.275	0.471	0.112	3.96

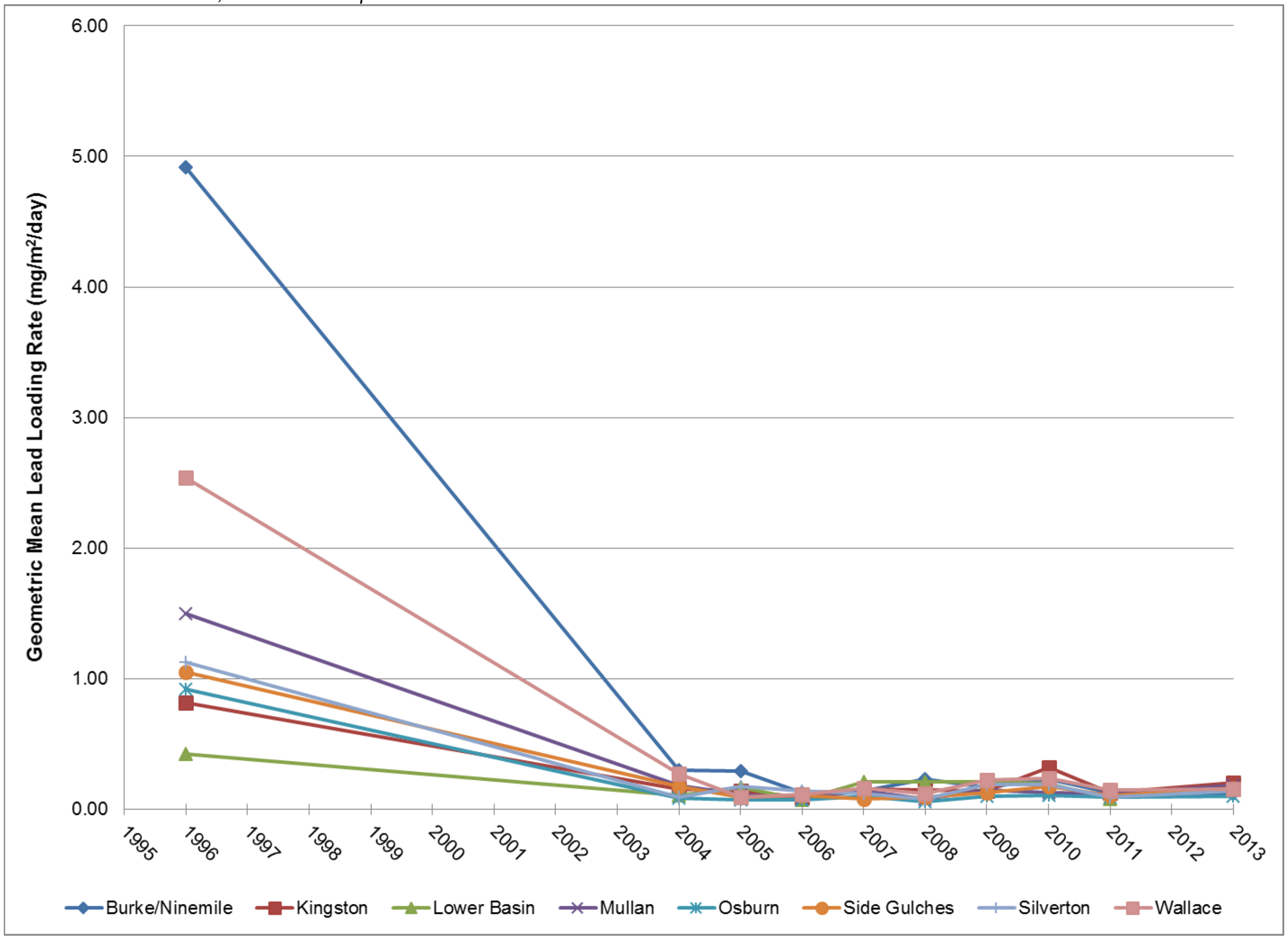
TABLE 5-7
Dust and Lead Loading Summary Statistics by Year and Area for OU 3, 2010-2013
2015 Five-Year Review, Bunker Hill Superfund Site

Year	Geographic Area	Number of Dust Mat Samples[a]	Dust Loading Rate ($mg/m^2/day$)				Lead Loading Rate ($mg/m^2/day$)			
			Arithmetic Mean	Arithmetic Standard Deviation	Geometric Mean	Geometric Standard Deviation	Arithmetic Mean	Arithmetic Standard Deviation	Geometric Mean	Geometric Standard Deviation
2013	Lower Basin	1	--	--	--	--	--	--	--	--
	Kingston	3	2,607	2,455	1,236	6.7	0.444	0.412	0.201	7.35
	Side Gulches	51	1,305	1,665	740	3.1	0.669	1.76	0.161	5.31
	Osburn	86	786	1,189	398	3.4	0.374	1.07	0.102	5.81
	Silverton	32	1,005	1,358	587	2.7	0.391	0.777	0.140	4.31
	Wallace	61	696	1,566	311	3.3	0.650	1.74	0.153	5.83
	Burke/Ninemile	34	980	1,309	537	3.1	0.265	0.377	0.121	3.86
	Mullan	65	789	1,061	464	2.7	0.501	1.13	0.183	3.97
	Basin-wide	333	910	1,374	468	3.2	0.485	1.28	0.140	5.01

Note:

[a] Indicates the number of homes where a mat sample was collected; if both an original and split sample were collected, the higher result was used for data summary. When the number of samples is 2 or less, the results are not shown in order to maintain confidentiality.

FIGURE 5-10
Mean Lead Loading Rates by Year and Area for OU 3, 1996-2013
2015 Five-Year Review, Bunker Hill Superfund Site



Note:

When the number of samples is 2 or less, the results are not shown in order to maintain confidentiality. Refer to USEPA, 2010c and Table 5-7 for the number of samples collected.

House Dust RAO and Lead Health Risk

In order to assess if the most current exposure data achieve the OU 3 house dust RAO, an analysis was conducted using the IEUBK Model (IEUBKwin version 1.1, build 11) to predict childhood residential lead health risk (USEPA, 1998b). The 2011 and 2013 house dust data and most recent property and community mean soil data were input into the IEUBK Model. The same assumptions and methods used in previous site-specific analyses were applied (TerraGraphics 2004, 2010f; TerraGraphics, et. al, 2001).

The probability that a hypothetical child exceeds a blood lead level of 10 µg/dL was estimated for each home and summarized by community. The results indicate that 13 percent of homes in the Basin do not currently meet lead health risk goals for a typical child between 6 months and 6 years of age (Table 5-8; USEPA, 1994a, 1998b, 2002a). Soil remediation is nearly complete in some residential areas of the Basin, particularly in the Upper Basin (TerraGraphics, 2015c). Although the overall trends show reductions in average dust lead concentrations, and dust and lead loading rates, the OU 3 dust RAO has not yet been achieved in all homes. Based on past projections and analyses, the remedy is expected to be protective and achieve the RAO only after dust lead concentrations in individual homes have been substantially reduced to final post-remedial community soil lead means.

Elevated dust lead concentrations in homes throughout the Basin could be related to the patchwork of remaining contaminated soils (i.e., un-remediated property soils, recreational areas, or mine dumps), or may be due to sources unrelated to the current remedies. The large number of discrete remediation activities in OU 3 leaves areas with soil lead levels less than 100 mg/kg among areas with soil lead concentrations ranging from 100 mg/kg to 999 mg/kg (USEPA, 2010c). This variation can exist both within individual properties and within communities due to the spatial distribution of contaminant concentrations. Other possible lead sources in Basin homes include lead-based paint and residual dusts in building structures.

Prior to 2012, PHD conducted follow-ups with participants in homes with dust lead concentrations exceeding 5,000 mg/kg, and they continue to offer follow-up services if a house dust lead concentration exceeds 1,500 mg/kg (see Section 5.2.1.4 for details). There has been some success in identifying lead sources in homes with dust lead concentrations above 5,000 mg/kg and providing guidance to the family to reduce exposures. However, there is less understanding of the specific sources of lead in homes with dust lead concentrations less than 5,000 mg/kg, likely resulting in less effective intervention efforts. Similar to OU 1, past analyses conducted to identify the sources and co-factors influencing persistent high dust lead levels in some OU 3 households concluded that in most cases, the cause of elevated lead levels could not be definitively determined (TerraGraphics, 2008d).

TABLE 5-8
OU 3 Dust RAO Summary, Probabilities to Exceed Lead Health Risk Criteria using Recent House Dust and Soil Data
2015 Five-Year Review, Bunker Hill Superfund Site

Geographic Area	No. of Homes with Recent Environment al Data[a]	No. of Homes With a Hypothetical Child[b] Predicted to Exceed Health Criteria[c]	% of Homes With a Hypothetical Child[b] Predicted to Exceed Health Criteria[c]	Minimum Soil Concentration (mg/kg)[d]	Maximum Soil Concentration (mg/kg)[d]	Minimum Dust Concentration (mg/kg)	Maximum Dust Concentration (mg/kg)
Lower Basin	56	1	2%	33	310	21.5	1,040
Kingston	11	1	9%	77	988	49.1	1,040
Side Gulches	48	5	10%	111	486	16.5	952
Osburn	86	8	9%	164	524	36.6	1,640
Silverton	27	3	11%	141	331	65.9	4,540
Wallace	38	16	42%	137	416	29.1	46,200
Burke/Ninemile	40	5	13%	158	821	32.5	2,790
Mullan	44	6	14%	123	540	19.9	2,100
Basin-wide	350	45	13%	33	988	16.5	46,200

Notes:

[a] Homes with house dust data from 2011 and 2013. If a home was sampled in both years, datum from 2013 was used.
[b] A child aged from six months through seven years old. An exceedance of risk criteria at an individual home may occur with one age group or multiple age groups.
[c] Greater than 5% chance of a blood lead level exceeding 10 µg/dL, using the Box Model
[d] The Box Model assumes 30% property soil and 30% community soils contribute to children's exposure. The values shown are the average of the area-weighted community mean and property soil concentration used as input to the IEUBK Model.

The cumulative nature of lead exposure and the lack of media-specific concentration RAOs in OU 3 require that risk analyses be conducted to measure the effectiveness of the cleanup strategy, which necessitates dust and soil exposure data. USEPA and IDEQ have continued to monitor OU 3 house dust biennial as remedial actions are completed, and this information is used by PHD to proactively identify and offer health intervention activities, in light of low participation in the annual LHIP blood-lead screening (discussed in Section 5.2.1.4). The vacuum loan program continues to be offered to residents through the LHIP. Evaluation of the implementation of the interior cleaning component of the OU 3 Selected Remedy has not been completed to date.

5.2.1.3 Drinking Water

Background and Description

The human health remedy in the 2002 OU 3 ROD includes testing private drinking water sources and providing safe drinking water for homes with contamination above action levels defined in the ROD (USEPA, 2002a). If a drinking water source exceeds a drinking water action level for arsenic, cadmium, or lead, filtration or an alternative drinking water source is provided, and the well is capped, if necessary. A detailed discussion of the historical context of the drinking water remedy is provided in the 2005 and 2010 Five-Year Reviews (USEPA, 2005 and 2010c). Drinking water data from 1996 through 1999 were discussed in the Human Health Risk Assessment (HHRA) (TerraGraphics et al., 2001). The 2010 Five-Year Review summarized data from 2000 through 2009 (USEPA, 2010c).

O&M and Actions since the Last Five-Year Review

Drinking water samples were collected from 257 homes from 2010 through 2014. Approximately 93 percent of those homes were in the Lower Basin and Kingston areas. Thirteen properties were identified between 2010 and 2014 that require alternative drinking water sources based on purged water sample results. No properties received municipal water hookup, water treatment, or bottled water services since the previous Five-Year Review.

In addition to drinking water sources, irrigation water samples from privately owned wells and surface water sources were collected from 22 properties that used the water sources to irrigate soil areas surrounding the homes from 2010 through 2014.

The 2002 OU 3 ROD estimated that 7 percent of properties in the Upper Basin and 10 percent of properties in the Lower Basin would exceed drinking water standards, for a total of 171 properties (USEPA, 2002a). Sampling results from 2000 through 2014 indicate that 5 percent of properties in the Basin exceed drinking water standards based on purged sample results. The current estimated number of homes eligible for the drinking water remedy is 65 (Table 5-9), which is less than that estimated in the ROD due to additional data collected regarding the number of residences that utilize private drinking water sources, as well as the slightly lower percentage of homes that exceed drinking water standards.

TABLE 5-9
Estimated Number of Residences with Drinking Water MCL Exceedances in the Upper Basin and Lower Basin
2015 Five-Year Review, Bunker Hill Superfund Site

	ROD Estimates[a]				Current Estimates			
Area	**No. of Residences[b]**	**Assumed Number of Private, Unregulated Sources[c]**	**Estimated Frequency of MCL Exceedances[d]**	**Estimated Number of Residences with MCL Exceedances**	**No. of Residences[e]**	**Assumed Number of Private, Unregulated Sources[c]**	**Estimated Frequency of MCL Exceedances[f]**	**Estimated Number of Residences with MCL Exceedances**
Upper Basin	4,633	1,216	7%	91	2,894	515	5%	26
Lower Basin[g]	1,642	800	10%	80	1,355	765	5%	39
Total	6,275	2,016	NA	171	4,249	1,280	NA	65

Notes:

[a] Source: USEPA, 2002a
[b] Based on site reconnaissance and demographic data from the human health risk assessment (TerraGraphics et al., 2001).
[c] Assumes 100 percent of residences outside water district service boundaries have private, unregulated sources.
[d] See Table 4-6 of the FS Report Part 2 (USEPA, 2001e) for actual observed MCL exceedances. Lower Basin value applied to Kingston area because of small Kingston dataset.
[e] Based on field observations and GIS analysis conducted in 2014.
[f] Based on purged drinking water results from sampling conducted between 2000 and 2014.
[g] Lower Basin Area includes Kingston geographic area.

Remedy Status

Private drinking water sources continue to be sampled to identify homes that require alternative drinking water supply or filtration. A total of 39 properties with high purged drinking water results have been identified since 2000. Approximately 35 properties may require an alternative drinking water supply or filtration system, which IDEQ and USEPA are planning to provide. As sampling continues in the Lower Basin, where many homes use private drinking water systems, additional homes may be identified that exceed drinking water standards and would require alternative drinking water sources or treatment.

5.2.1.4 Lead Health Intervention Program

Background and Description

The LHIP, described in Section 3.2.1.4, was extended to OU 3 in 1996. As in OU 1, PHD is the lead agency for implementing the LHIP in OU 3, with funding from IDEQ. Detailed discussions of the historical context of the LHIP, including blood lead data and educational and awareness programs, are provided in the 2005 and 2010 Five-Year Reviews (USEPA, 2005 and 2010c).

Annual voluntary blood lead screening of children between 6 months and 6 years of age and follow-up with those exhibiting high lead levels has been offered each year from 1996 to the present (prior to 2001, children through 9 years of age were included in the screening; USEPA 2005 and 2010c). The 1996 survey used the door-to-door solicitation method employed in the Box. All other years used fixed-site voluntary blood draws with monetary incentive offered to the family of each participating child, paid at the time of the blood draw. Participation rates have historically been much lower than those seen in OU 1, with between 2 and 29 percent of the estimated OU 3 child population tested each year from 1996 through 2009. Because of the low participation in the OU 3 annual blood lead screening, the OU 3 ROD identified an LHIP dust intervention protocol that used house dust monitoring techniques to identify families proactively that may need health intervention activities while remediation is ongoing (USEPA, 2002a). The protocol was not implemented due to logistical and resource challenges (USEPA, 2010c). Alternatively, PHD offered follow-up services to families residing in homes showing elevated dust lead concentrations when sampled during annual dust surveys.

The HHRA provides a thorough evaluation of blood lead levels from 1996 through 1999 (TerraGraphics et al., 2001). OU 3 blood lead levels from 1996 through 2005 are summarized in the 2005 Five-Year Review and the *Final Coeur d'Alene Basin Blood Lead Absorption and Exposure Report* (USEPA, 2005; TerraGraphics, 2006). The LHIP and blood lead levels through 2009 are discussed in the 2010 Five-Year Review (USEPA, 2010c).

O&M and Actions since the Last Five-Year Review

Since the 2010 Five-Year Review, the LHIP continued to offer the same services previously described in detail (USEPA, 2010c). Each year from 2010 through 2014, between 75 and 108 children participated in the blood lead screening (Table 5-10). The total number of children living in the Basin was estimated using 2014 school district enrollment data and verified with 2010 census data, using a similar methodology as previously employed (TerraGraphics et al., 2001). Basin-wide participation rates since the last Five-Year Review are estimated at 16 to 20 percent (Table 5-11).

TABLE 5-10
Summary of Blood Lead Levels for Children Participating in the LHIP by Geographic Area in OU 3, 2010-2014
2015 Five-Year Review, Bunker Hill Superfund Site

			No. (%) of Children With Blood Lead Levels				Blood Lead Level Range (µg/dL)		Mean Blood Lead Level (µg/dL)			
Year	Geographic Area	No. of Children	Below Detection Limits	≥ 5 µg/dL	≥ 10 µg/dL	≥ 15 µg/dL	Minimum	Maximum	Arithmetic Mean	Arithmetic Standard Deviation	Geometric Mean	Geometric Standard Deviation
2010	**Lower Basin**	**11**	1 (9%)	0 (0%)	0 (0%)	0 (0%)	1.4	4.2	2.0	0.9	1.9	1.4
	Kingston	**23**	4 (17%)	5 (21%)	2 (8%)	1 (4%)	1.4	20.0	3.7	4.5	2.6	2.1
	Side Gulches	**19**	4 (21%)	1 (5%)	0 (0%)	0 (0%)	1.4	6.9	2.8	1.5	2.5	1.7
	Osburn	**28**	6 (20%)	0 (0%)	0 (0%)	0 (0%)	1.4	4.1	2.0	0.7	1.9	1.4
	Silverton	**5**	3 (60%)	0 (0%)	0 (0%)	0 (0%)	1.4	2.0	1.5	0.3	1.5	1.2
	Wallace	**5**	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1.4	4.0	2.2	1.0	2.1	1.5
	Burke/Ninemile	**7**	2 (29%)	0 (0%)	0 (0%)	0 (0%)	1.4	2.8	1.8	0.5	1.8	1.3
	Mullan	**10**	4 (36%)	1 (9%)	0 (0%)	0 (0%)	1.4	5.6	2.2	1.2	2.0	1.5
	Basin-wide	***108***	*24 (22%)*	*7 (6%)*	*2 (2%)*	*1 (1%)*	*1.4*	*20.0*	*2.5*	*2.3*	*2.1*	*1.6*
2011	**Lower Basin**	**8**	1 (13%)	3 (38%)	0 (0%)	0 (0%)	1.4	7.0	3.8	2.3	3.2	2.0
	Kingston	**19**	7 (37%)	4 (21%)	1 (5%)	0 (0%)	1.4	12.0	3.4	2.9	2.7	2.0
	Side Gulches	**9**	0 (0%)	1 (11%)	0 (0%)	0 (0%)	2.5	6.5	3.8	1.2	3.7	1.4
	Osburn	**24**	4 (17%)	2 (8%)	0 (0%)	0 (0%)	1.4	5.8	2.6	1.3	2.4	1.6
	Silverton	**5**	1 (20%)	0 (0%)	0 (0%)	0 (0%)	1.4	2.9	2.2	0.6	2.2	1.3
	Wallace	**1**	-	-	-	-	-	-	-	-	-	-
	Burke/Ninemile	**5**	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1.4	4.4	3.4	1.3	3.2	1.6
	Mullan	**4**	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1.5	2.6	2.1	0.5	2.1	1.3
	Basin-wide	***75***	*14 (19%)*	*10 (13%)*	*1 (1%)*	*0 (0%)*	*1.4*	*12*	*3.1*	*1.9*	*2.6*	*1.7*

TABLE 5-10
Summary of Blood Lead Levels for Children Participating in the LHIP by Geographic Area in OU 3, 2010-2014
2015 Five-Year Review, Bunker Hill Superfund Site

			No. (%) of Children With Blood Lead Levels				Blood Lead Level Range (µg/dL)		Mean Blood Lead Level (µg/dL)			
Year	**Geographic Area**	**No. of Children**	**Below Detection Limits**	**≥ 5 µg/dL**	**≥ 10 µg/dL**	**≥ 15 µg/dL**	**Minimum**	**Maximum**	**Arithmetic Mean**	**Arithmetic Standard Deviation**	**Geometric Mean**	**Geometric Standard Deviation**
2012	**Lower Basin**	**3**	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1.7	2.3	2.1	0.3	2.0	1.2
	Kingston	**11**	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1.0	4.9	2.8	1.2	2.6	1.6
	Side Gulches	**9**	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2.1	4.6	3.5	0.9	3.4	1.3
	Osburn	**22**	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1.8	4.5	3.1	0.7	3.0	1.3
	Silverton	**5**	0 (0%)	0 (0%)	0 (0%)	0 (0%)	3.2	4.6	3.9	0.5	3.8	1.2
	Wallace	**19**	0 (0%)	4 (21%)	0 (0%)	0 (0%)	2.2	7.0	3.8	1.4	3.6	1.4
	Burke/Ninemile	**11**	1 (9%)	1 (9%)	0 (0%)	0 (0%)	1.0	8.0	3.4	1.8	3.0	1.7
	Mullan	**3**	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1.6	4.5	3.0	1.5	2.8	1.7
	Basin-wide	***83***	*1 (1%)*	*5 (6%)*	*0 (0%)*	*0 (0%)*	*1.0*	*8.0*	*3.3*	*1.2*	*3.1*	*1.4*
2013	**Lower Basin**	**2**	-	-	-	-	-	-	-	-	-	-
	Kingston	**21**	7 (33%)	4 (19%)	2 (10%)	1 (5%)	1.4	16.0	3.7	3.6	2.8	2.0
	Side Gulches	**17**	2 (12%)	0 (0%)	0 (0%)	0 (0%)	1.4	3.9	2.3	0.7	2.3	1.3
	Osburn	**29**	5 (17%)	0 (0%)	0 (0%)	0 (0%)	1.4	4.8	2.5	0.9	2.3	1.4
	Silverton	**12**	1 (8%)	0 (0%)	0 (0%)	0 (0%)	1.4	4.9	2.9	1.0	2.7	1.4
	Wallace	**2**	-	-	-	-	-	-	-	-	-	-
	Burke/Ninemile	**7**	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2.2	4.4	3.0	0.8	2.9	1.3
	Mullan	**2**	-	-	-	-	-	-	-	-	-	-
	Basin-wide	***92***	*15 (16%)*	*5 (5%)*	*2 (2%)*	*1 (1%)*	*1.4*	*16.0*	*2.8*	*1.9*	*2.5*	*1.6*

TABLE 5-10
Summary of Blood Lead Levels for Children Participating in the LHIP by Geographic Area in OU 3, 2010-2014
2015 Five-Year Review, Bunker Hill Superfund Site

			No. (%) of Children With Blood Lead Levels				Blood Lead Level Range (µg/dL)		Mean Blood Lead Level (µg/dL)			
Year	**Geographic Area**	**No. of Children**	**Below Detection Limits**	**≥ 5 µg/dL**	**≥ 10 µg/dL**	**≥ 15 µg/dL**	**Minimum**	**Maximum**	**Arithmetic Mean**	**Arithmetic Standard Deviation**	**Geometric Mean**	**Geometric Standard Deviation**
2014	**Lower Basin**	**3**	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2.1	4.1	3.2	1.0	3.1	1.4
	Kingston	**16**	1 (6%)	1 (6%)	0 (0%)	0 (0%)	1.0	5.0	2.7	0.9	2.5	1.4
	Side Gulches	**10**	1 (10%)	0 (0%)	0 (0%)	0 (0%)	1.4	4.4	2.6	0.8	2.5	1.4
	Osburn	**24**	0 (0%)	1 (4%)	0 (0%)	0 (0%)	1.6	5.0	3.0	0.9	2.8	1.3
	Silverton	**10**	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1.6	4.4	3.2	0.9	3.0	1.4
	Burke/Ninemile	**14**	0 (0%)	3 (21%)	1 (7%)	0 (0%)	2.3	11.0	4.1	2.3	3.7	1.5
	Mullan	**0**	-	-	-	-	-	-	-	-	-	-
	Basin-wide	***77***	*2 (3%)*	*5 (6%)*	*1 (1%)*	*0 (0%)*	*1.0*	*11.0*	*1.1*	*1.3*	*2.9*	*1.4*

TABLE 5-11
Summary of OU 3 Participation Rates in the LHIP, 2010-2014
2015 Five-Year Review, Bunker Hill Superfund Site

Year	Estimated Eligible Population[a]	Total No. of Eligible Population Providing Samples[a]	Percentage of Population Providing Samples
2010	555	108	19%
2011	517	75	15%
2012	455	83	18%
2013	469	92	20%
2014	483	77	16%

Notes:

Assumes 6% of children are not enrolled in school (2010 Census) and an even distribution in each age group.

[a] Eligible population is from 6 months through 6 years old and is based on annual enrollment data for School Districts 392, 393, and 274 and 2014 enrollment data for School District 391.

In response to CDC recommendations, discussed in Section 3.2.1.4, PHD began offering follow-up services in 2012 to the parents of all children exhibiting a blood lead level of 5 µg/dL or greater (as opposed to 10 µg/dL prior to 2012). Since the last Five-Year Review, PHD offered follow-up services to 18 families, and 7 families accepted these services. In addition to the LHIP services, PHD also responded to doctor's referrals and conducted follow-up education for additional children with elevated blood lead levels. In general, follow-up information indicated that children with elevated blood lead levels were likely exposed during recreational activities. In 2013, PHD documented a variety of recreational uses throughout the Basin, many of which occurred at undeveloped sites (e.g., privately owned property used for camping and fishing throughout the summer months and "impromptu" sites along the river and streams used for playing and swimming; PHD, 2013b). PHD and IDEQ are updating educational materials to increase public health education and awareness for recreational users (see Section 5.2.4). Additionally, IDEQ is now funding and PHD is offering free blood lead screening to children who recreate in the Basin but live outside the site.

The 2010 Five-Year Review recommended the following, and a discussion of actions taken since 2010 is presented after each recommendation.

- **Recommendation:** Determine whether an alternative approach to the 2002 OU 3 ROD's dust intervention protocol could be established and implemented.

  Discussion: In 2012, an alternative to the LHIP dust intervention protocol outlined in the ROD was formally adopted to proactively identify additional families that may benefit from lead health education and intervention while remediation is ongoing (IDEQ and USEPA, 2012). The alternative approach retains the intent outlined in the ROD, is simpler to apply, and would not significantly affect PHD's staffing levels.

  Each year, PHD offers follow-up services to families residing in homes with dust lead concentrations greater than or equal to 1,500 mg/kg that were sampled during annual dust surveys or as part of the BPRP (see Tables 5-5 and 5-6 of Section 5.2.1.2). The purpose of the follow-up phone call or home visit is to discuss sampling results, home hygiene, and general techniques to reduce dust lead concentrations in the home and to encourage parents to have their children's blood lead tested. From 2010 through 2014, 29 follow-ups were completed in response to elevated house dust lead concentrations at 71 homes. Twenty additional participants living at homes with dust lead concentrations less than 1,500 mg/kg called PHD to discuss their results from 2010 through 2014. This recommendation is retained on the table of issues and recommendations.

- **Recommendation:** Identify additional funding sources for the LHIP. Continue to evaluate options for increasing participation in the annual blood lead screening program (an ongoing recommendation from the 2005 Five-Year Review).

  Discussion: Additional funding sources for the LHIP have not yet been identified. However, State funding has not been a problem over the last 5 years. Participation in annual blood lead screenings seems to be associated with monetary incentives, and additional options to increase participation continue to be discussed among the agencies. This recommendation is not retained on the table of issues and recommendations, because it does not directly affect protectiveness. It will instead be included in the table of planned action items.

Details about the HEPA vacuum loan program and outreach and educational activities conducted from 2010 through 2014 are discussed in Sections 3.2.1.4 and 5.2.4.

Remedy Status

The LHIP supports public health through voluntary blood lead screening services, environmental health follow-up for children with blood lead levels ≥5 µg/dL, and education programs. Participation in the annual Basin blood lead monitoring continues to be less than a quarter of the estimated child population and could be improved to identify more children who require intervention.

To supplement the low participation rates, an intervention program using house dust sample results was adopted in 2012. This alternative approach has identified a number of households for follow-up lead health intervention services, but only a fraction of residents have returned PHD's contact attempts. If activities that contribute to increased house dust lead levels were identified at the time of follow-up, PHD staff provided specific instructions to help reduce the impacts of these activities on house dust lead levels. To date, the reasons for elevated house dust lead concentrations in most homes have not been definitively determined.

In general, mean blood lead levels in all geographic areas and age groups have declined both nationally and at Bunker Hill since the late 1990s (Figures 5-11 and 5-12). Due to the small sample size, particularly for some age groups and geographic areas, it is difficult to evaluate trends in observed blood lead levels. However, an assessment of lead health risk based on current soil and house dust exposures is described in Section 5.2.1.2.

Education and outreach continues to occur at the schools, and PHD personnel have noted that children recall and reiterate what was taught from the previous year. In addition, IDEQ's outreach and education efforts at community events have reached more than 2,500 people in attendance at these events and 600 children at schools per year.

The HEPA vacuum loan program continues to be used by local residents and is presented in Section 3.2.1.4.

FIGURE 5-11
OU 3 Geometric Mean Blood Lead Levels by Geographic Area, 1996-2014
2015 Five-Year Review, Bunker Hill Superfund Site

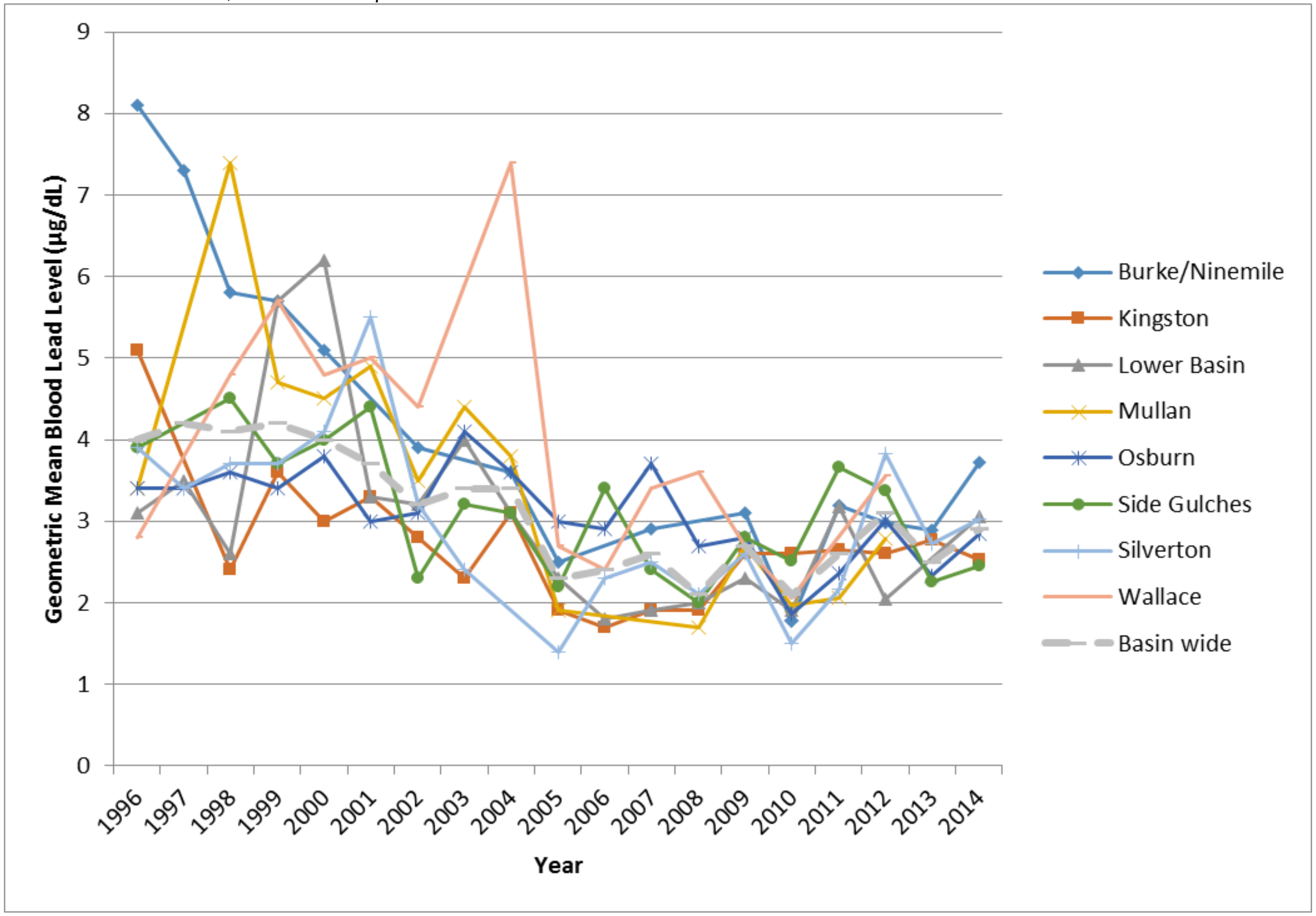
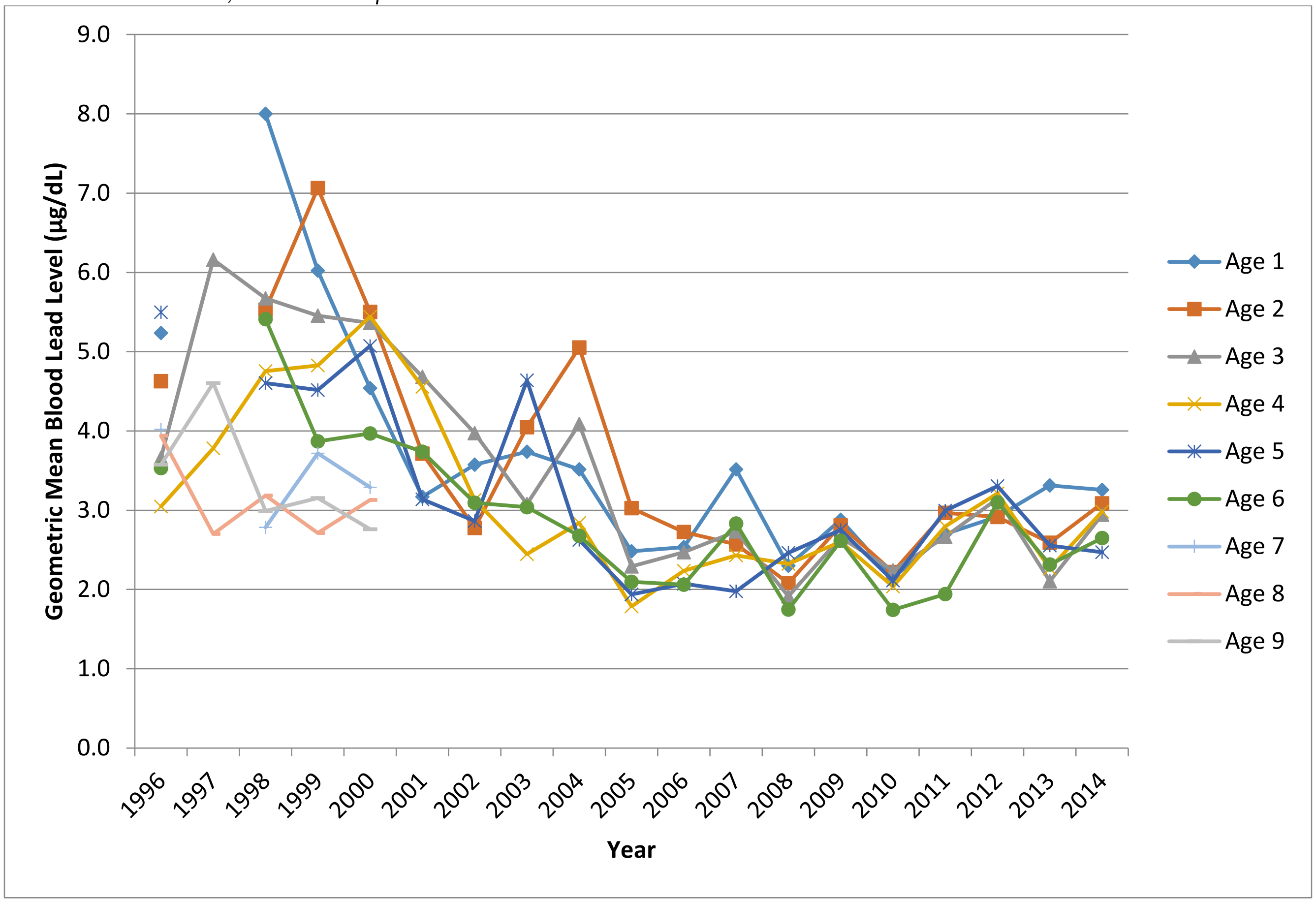


FIGURE 5-12
OU 3 Geometric Mean Blood Lead Levels by Age, 1996-2014
2015 Five-Year Review, Bunker Hill Superfund Site



5.2.1.5 Remedy Protection

Background and Description

See Section 3.2.1.4 for a discussion of Remedy Protection background description. Implementation of remedy protection, as selected in the 2012 Interim ROD amendment, began in 2013.

O&M and Actions since the Last Five-Year Review

In 2013 and 2014, five remedy protection projects were constructed in OU 3, as summarized in the following text. Construction of five remedy protection projects are planned for OU 3 in 2015: Mill Road, South 2nd Street, Revenue Gulch, Blackcloud Creek, and McCarthy Creek. The following projects have been completed or are planned to be constructed in 2015:

Mullan Projects (see Figure 5-13)

- Dewey Street—Construction of the Dewey Street remedy protection project was completed between July and October 2013. The project involved installation of a new stormwater system and reconstruction of a portion of Hunter Street. Additional information can be found in the memorandum of completion (MFA, 2014b).
- Third Street—Construction of the Third Street remedy protection project was completed between August and October 2013. The Third Street project involved replacement of existing culverts and roadside ditches with a corrugated, high-density polyethylene pipe network. It also included roadway reconstruction and curbing on Oregon, California, and Montana streets to direct stormwater toward Third Street. Additional information can be found in the memorandum of completion (MFA, 2014b).
- Mill Road—Construction of the Mill Road remedy protection project will begin in the summer of 2015 and will consist of the installation of a new stormwater system to convey water from various points along Mill Road and the upgradient catchment to the SFCDR. The project includes 20 catch basins and approximately 2,100 lineal feet of storm pipe. A perforated drainage pipe with fabric filter is included under both edges of Mill Road and along a portion of Daisy Loop to collect and drain subsurface flow beneath the roadway. The project also includes reconstruction of the roadway with curb and gutter and approximately 1,400 lineal feet of paving. Additional information about the project is available in the final design report (TerraGraphics, 2014f).
- South 2nd Street—Construction of the South 2nd Street remedy protection project is planned for the summer of 2015. The project will involve the installation of a new storm drain system to provide drainage to an area that experiences regular flooding and sediment buildup.

Silverton Projects (See Figure 5-13)

- Unnamed Gulch—Construction at the Unnamed Gulch remedy protection project was completed between October and November 2013. The project involved the removal of an existing culvert, installation of a pipe-arch culvert, channel modifications upstream and downstream from the new culvert, reshaping/restoration of Anderson Way and a private drive, and additional surface restoration. Additional information can be found in the memorandum of completion (MFA, 2014c).

- Revenue Gulch—Construction of the Revenue Gulch remedy protection project is scheduled for the summer of 2015. The project will involve the replacement of five existing culverts and one existing bridge with new concrete box culverts or equivalently sized aluminum plate culverts. The project includes installation of a high-flow diversion structure to divert a portion of large-volume storm flows from Revenue Gulch into a stormwater collection and conveyance system running parallel to the Revenue Gulch Channel. This will allow large storms to bypass the existing channel constrictions without going over the bank and damaging existing barriers. In addition, stormwater collection laterals will be installed along four side streets (Sixth through Ninth streets). The laterals will drain through the bypass system. The planned drainage area improvements will reduce the risk of flooding along the Revenue Gulch channel. Additional information can be found in the final design (TerraGraphics, 2015e).

Osburn Projects (see Figure 5-13)

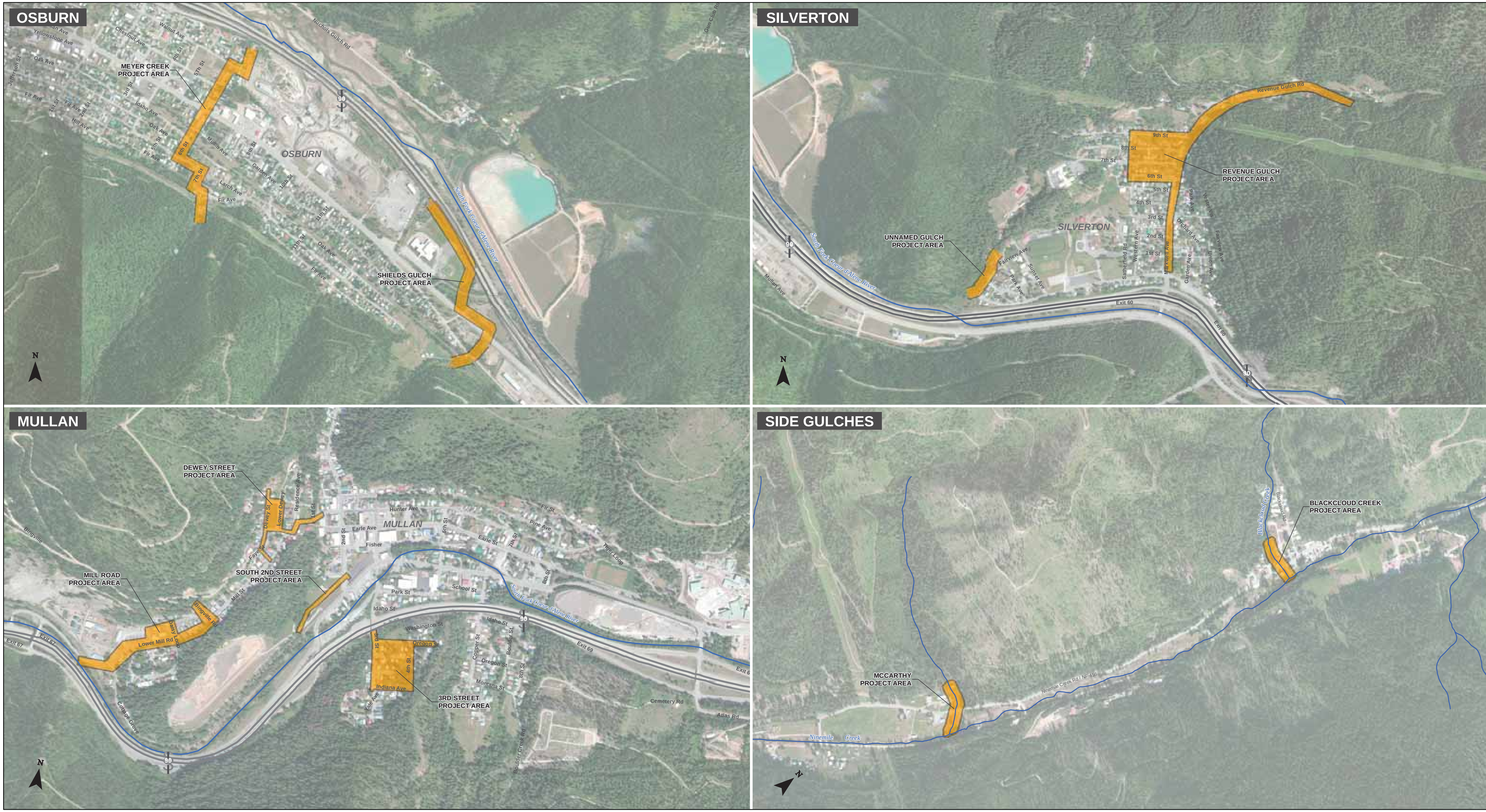
- Meyer Creek—Construction of the Meyer Creek remedy protection project was completed between May and October 2014. The project included the installation of a new stormwater drainage system that conveys Meyer Creek through the town of Osburn. The project provided increased flow capacity and located the piping system largely within the public ROW. The project included the installation of an inlet structure for the new storm drain, and modifications to the existing storm pipe inlet structure to restrict flow to the existing system. In addition, modifications were made to the water and sanitary sewer systems to mitigate conflicts with the new storm drain system. Additional information can be found in the construction summary memorandum (MFA, 2015c).

- Shields Gulch—The Shields Gulch remedy protection project was constructed over two construction seasons, starting in October 2013 and ending in August 2014. The project involved construction of a new stream channel designed to provide adequate flow capacity for the selected design storm and to reroute stormwater to bypass existing undersized ditches near the elementary school. The bypass will reduce flooding at the school entry area. In addition to construction of the new channel, four existing culverts were replaced by concrete box culverts in order to provide adequate channel flow capacity. Additional information can be found in the construction summary memorandum (MFA, 2015d).

Ninemile Watershed Projects (See Figure 5-13)

- Blackcloud Creek – Replacement of undersized drainage culverts and channel improvements to increase flow capacity are planned for 2015.

- McCarthy Creek – Replacement of undersized drainage culverts and channel improvements to increase flow capacity are planned for 2015.



Source: Aerial photograph obtained from Esri ArcGIS Onling; roads dataset obtained from Esri; river dataset obtained from Idaho Department of Water Resources.

River
Interstate
Remedy Protection Project Area

0 500 1,000 2,000 Feet

Figure 5-13
OU 3 Remedy Protection Project Areas
2015 Five Year Review
Bunker Hill Superfund Site

Path:

EPA

For each of the constructed remedy protection projects listed above, the Trust has prepared O&M plans that describe regular inspection and maintenance activities. O&M is the responsibility of the following local governments:

- Dewey Street: City of Mullan
- Third Street: City of Mullan
- Unnamed Gulch: Shoshone County
- Meyer Creek: City of Osburn
- Shields Gulch: City of Osburn

The Coeur d'Alene Trust completed a Five-Year Review inspection of the completed remedy protection projects on February 12, 2015. No deficiencies in the function of the constructed remedy protection projects were identified during the inspection.

Remedy Status

Based on the Five-Year Review visual inspections completed by the Coeur d'Alene Trust, the constructed remedy protection projects are functioning as intended and are protective of the previously completed remedies (i.e. yard remediation).

5.2.1.6 Institutional Controls Program

Background and Description

The purpose of the ICP established for the Basin is to protect public health by managing contaminated soil left in place into perpetuity. The Basin ICP rule, which is based on the Box ICP rule, was adopted by PHD in November 2006. The rule was accepted by the Idaho State Legislature in March 2007, and became effective in July 2007. Implementation of the Basin ICP commenced in September 2007. The ICP was adopted as part of the PHD environmental health code. Implementation and execution of the ICP follows the requirements and standards described in the Code itself (IDAPA 41.01.01.500 through 41.01.01.543 and 41.01.01.900 through 41.01.01.902).

The Basin ICP established a locally enforced set of rules and regulations to maintain the integrity of installed barriers and to ensure that new barriers are installed as part of excavation and grading. The ICP also regulates and provides information for interior construction and renovation projects within the administrative boundary of the ICP. The general features of the Basin ICP are the same as the Box ICP, which are described in Section 3.2.1.6 of this report and in the 2005 and 2010 Five-Year Reviews (USEPA, 2005 and 2010c).

O&M and Actions since the Last Five-Year Review

Since the last Five-Year Review, PHD completed the following activities under the ICP:

- Issued 3,122 permits in OU 3, most of which were for large exterior excavation projects (>1 cy) (Table 5-12).

- Issued 1,260 licenses to contracting companies and 152 licenses to government entities and utility companies for all OUs (licenses are not tracked by OU).

- Provided 1,014 property disclosures in OU 3.

- Recorded and followed-up on 3,904 One-Call system (intent to excavate – locate utilities) calls in OU 3.

- Scanned all hard copy permits and records of compliance into electronic files, maintained on PHD's local server in Kellogg, Idaho and backed-up following PHD's information technology procedures. The identification of parcels that will not be addressed under the BPRP, as determined by IDEQ and USEPA, began since the last Five-Year Review and will assist the ICP in issuing permits and directing installation of protective barriers.

TABLE 5-12
Number of ICP Permits Issued in OU 3, 2010-2014
2015 Five-Year Review, Bunker Hill Superfund Site

	Calendar Year						
Permit Type	**2010**	**2011**	**2012**	**2013**	**2014**	**Cumulative 5-Year Total**	**Annual Average**
Large Exterior Projects - Excavation[a]	715	339	446	598	548	2,646	529
Large Exterior Projects - Demolition	8	7	6	11	12	44	9
Interiors	25	11	13	11	16	76	15
Records of Compliance	67	77	68	73	71	356	71
Totals	815	434	533	693	647	3,122	624

Note:
Data provided by PHD.
[a] Includes subdivision/planned unit development totals.

The amount of waste managed through permitted projects is presented in Table 5-13 (refer to Section 3.2.1.6 for an explanation of waste estimations from ICP permits). An estimated 90,000 cubic yards of OU 3 waste soil were directed to Basin Repositories or other community fill locations since the last Five-Year Review. In addition, an estimated total of 1,100 cubic yards of building demolition debris, 120 bags of insulation and 10,000 square yards of carpets and padding were directed to the Big Creek Repository.

One hundred-twenty two (122) cubic yards and 5 buckets of clean soil/gravel were delivered to Basin properties, and a total of 21 vouchers were issued to homeowners for pick up clean/gravel since the last Five-Year Review (Table 5-14).

The ICP rule gives PHD the authority to undertake enforcement action for noncompliance with ICP requirements. No enforcement proceedings have been initiated in the Basin since the last Five-Year Review. Letters urging compliance with the ICP are required infrequently.

TABLE 5-13
OU 3 ICP Waste Disposal Volumes
2015 Five-Year Review, Bunker Hill Superfund Site

Waste Category	Disposal Site	Materials Disposed or Source of Materials	Units	Calendar Year					Cumulative 5-year Total	Annual Average
				2010	2011	2012	2013	2014		
Building Demolition	Big Creek Repository	Demolition Debris	cy	0	22	1,000	40	25	1,087	217
		Insulation	Bags	0	0	37	75	8	120	24
		Carpets and Pads	sy	1,856	3,760	3,425	351	318	9,710	1,942
Soil Disposal	Big Creek Repository	Soil	cy	3,255	3,940	2,914	10,360	21,966	42,435	8,487
	Mullan ICP Disposal Site	Soil	cy	22,515	582	2,735	931	1,057	27,820	5,564
	East Mission Flats	Soil	cy	2,686	1,387	1,439	6,566	1,337	13,415	2,683
	Shoshone County Airport	Soil	cy	722	369	370	0	0	1,461	292
	Other community fill sites[a]	Soil	cy	1,314	1,401	2,337	1,211	265	6,528	1,306

Note:

[a] Other areas include County landfill-Polaris Peak, Osburn Fire Hall, and Mullan Fire Hall.

TABLE 5-14
OU 3 ICP Clean Material Volumes
2015 Five-Year Review, Bunker Hill Superfund Site

Delivery Method	Units	Calendar Year					Cumulative 5-year Total	Annual Average
		2010	2011	2012	2013	2014		
Clean soil/gravel delivery	cy	22	25	33	18	24	122	24
Clean soil/gravel delivery	Buckets	0	5	0	0	0	5	1
Soil/gravel voucher issued (homeowner pickup)	No. of vouchers	2	0	2	10	7	21	4

The 2010 Five-Year Review recommended the following, specifically to OU 3, and a discussion of the recommendation or actions taken since 2010 are presented in the following list.

- **Recommendation:** Secure adequate funding of the ICP to ensure success of the remedy, including consideration of sufficient staff and information management support to ensure the long-term effectiveness of the program.

  Discussion: Funding for the OU 3 ICP is currently being provided by USEPA and IDEQ, and is based on an agreement among USEPA, IDEQ, and the PHD (2007). IDEQ is currently receiving $1.5 million per year from the Water Pollution Control Account (as established by the Idaho Statute) and placed in the Basin Bunker Hill Environmental Remediation Fund to create a principle balance amount that will cover future match and O&M costs for the State. Costs for the OU 3 ICP are considered to be match or O&M, depending on the activity. The Basin Environmental Remediation Fund was created under Idaho Statute 39-3606c that establishes the Environmental Remediation Fund for meeting match and O&M requirements at environmental cleanup and remediation and restoration sites. The Fund is held by the Treasurer's Office under 39-3605c and is interest-bearing. USEPA and IDEQ will continue to work together to ensure that adequate funding exists for the ICP. This recommendation is complete.

- **Recommendation:** Complete the CFP currently being developed by USEPA and IDEQ for all three OUs.

  Discussion: See Section 3.2.1.6 for discussion. This recommendation is complete. This recommendation is repeated for all three OUs and is complete for all three OUS.

- **Recommendation:** Regarding the long-term disposal need from ICP, establish a process with community planners to identify timing and quantity of waste soils to be hauled to repositories from ICP-regulated activities.

  Discussion: This activity should be undertaken for planning and repository capacity management. It is not retained in the table of issues and recommendations, because it does not directly affect protectiveness. It will instead be included in the table of planned action items (Table 5-17).

- **Recommendation:** Determine whether a community-wide soil lead level is needed for the Basin. If so, determine the appropriate level and how it would be used.

  Discussion: In 2012, IDEQ and USEPA agreed to an ICP soil disposal lead level of 350 mg/kg, for consistency with the Box (USEPA and IDEQ, 2012). This will assist PHD with disposal decisions that help achieve the objective of reducing exposures of young children and pregnant women to lead-contaminated soils.

  A Basin community-wide soil lead level has yet to be determined, because the only way to develop a health-protective community mean soil level in the Basin is to evaluate house dust lead levels and the distribution of soil lead levels at the completion of property remediation. This recommendation is not retained in the table of issues and recommendations, because while it does give the agencies a gauge of how protective the cleanup is, it does not directly affect protectiveness. It will instead be included in the table of planned action items (Table 5-17). The action item will be addressed once the BPRP is completed and a Basin community-wide soil lead level is determined.

- **Recommendation:** Flood Control: Continue working with the BEIPC and other stakeholders to evaluate and plan actions relative to addressing SFCDR and Pine Creek flooding that may affect cleanups.

  Discussion: This recommendation is repeated for all three OUs and is complete for all three OUs. See Section 3.2.1.6 for discussion.

- **Recommendation:** Continue working to develop an approach for addressing roads as long-term protective barriers in collaboration with state, county, and local entities.

  Discussion: This recommendation is repeated for all three OUs and is complete for all three OUs. See Section 3.2.1.6 for discussion.

- **Recommendation:** Develop appropriate institutions and funding mechanisms to finance and oversee infrastructure maintenance.

  Discussion: This recommendation is repeated for all three OUs. See Section 3.2.1.6 for discussion. This recommendation will not be retained in the table of issues and recommendations, because it does not directly affect protectiveness. It will instead be included in the table of planned action items. This is a site-wide task and, as such, has been listed only once in the OU 1 table of action items.

- **Recommendation:** Work with Basin communities and state and federal agencies on an infrastructure plan to ensure remedy success.

  Discussion: In 2013 and 2014, USEPA and the Coeur d'Alene Trust have invested $11.5M in paved road repairs and/or replacement and $6.4M in flood management infrastructure work throughout the Upper Basin. These "Paved Roads" and "Remedy Protection" projects will continue until the ROD Amendment Selected Remedy is complete. Since the last Five-Year Review, IDEQ has developed an inventory of flood control structures in the communities, including those that were installed as part of the remedy. IDEQ plans to create a coordination cooperative that will work together to track maintenance and repair work for the structures. This effort is in the initial planning stage. This recommendation will not be retained in the table of issues and recommendations, because it is similar to other ongoing recommendations that are included in the table of action items.

Remedy Status

As part of this Five-Year Review, the ICP activity reports and special reports concerning recreation, storm, fire, and flood events were reviewed, and discussions with PHD personnel were completed. PHD continues to implement the ICP according to its rule (IDAPA 41.01.01). Clean barriers that have been disrupted through excavation have been repaired in response to ICP permitting and inspection activities. The ICP inspectors are continuously in the field to ensure that barriers are installed consistent with the remedy defined in the ROD and in compliance with the ICP rule.

Similar to the Box, runoff, localized flooding, and documentation are challenges faced during everyday implementation of the ICP (refer to Section 3.2.1.6 for discussion of these topics). As identified in the feedback from contractors acquiring permits and licenses, acceptance and compliance with the program appears to be high. ICP users responding to the survey indicate a very high level of satisfaction with the program.

5.2.2 Mine and Mill Sites

The 2010 Five-Year Review recommended the following for OU 3 Mine and Mill Sites in general:

- **Recommendation:** Mine and Mill Site O&M: Coordinate with responsible entities to formally implement O&M at mine and mill site with completed remedial actions.
- **Discussion:** O&M of work completed on Mine and Mill sites is being conducted as follows: Constitution Site – BLM and Marmon Group, Golconda – Hecla, Rex – BLM and CDA Trust, Sisters – IDEQ, USBM – CDA Trust. This recommendation is complete. The need for further actions at previous Mine and Mill removal sites conducted by USEPA was considered during the ROD Amendment process and no additional actions were identified at that time. This recommendation for previous removal action follow-up is complete.
- **Recommendation:** Moon Creek, Silver Crescent, and Charles Dickens: Ongoing monitoring (an ongoing 2005 Five-Year Review recommendation).
- **Discussion:** A Removal Action was conducted by the USFS at the Silver Crescent and Charles Dickens Mines along Moon Creek in 1998-2000. Restoration was completed by the USFS in 2008. Monitoring by the USFS is ongoing. This recommendation is complete.
- **Recommendation:** Upper SFCDA Morning Mine No. 6: Routine monitoring (an ongoing 2005 Five-Year Review recommendation).

  Discussion: Hecla Mining Company conducted a Removal Action at the Morning Mine No 6 in 1989 and is responsible for on-going O&M of the site. This recommendation is complete.
- **Recommendation**: Upper Basin Mine and Mill Sites: Identify additional Mine and Mill sites to begin RD (an ongoing 2005 Five-Year Review recommendation).

  Discussion: Mine and Mill sites identified in the ROD Amendment are being prioritized by USEPA for action by the CDA Work Trust. For several years, this work is focused on Ninemile Creek and then moving over to Canyon Creek. In addition, IDEQ and USEPA are evaluating Mine and Mill sites that may pose a human health exposure and/or recontamination concern to aid in further prioritization for action. This recommendation is complete.

5.2.2.1 South Fork Coeur d'Alene River – Golconda

Background and Description

The Golconda Mine and Mill Site is located along the north banks of the Upper SFCDR below Trowbridge Gulch (Figure 5-1). This subarea included a small tailings impoundment as well as stream bank tailings and contaminated soils. The stream bank tailings were within and adjacent to the SFCDR and were subject to ongoing erosion. The site was easily accessed and was routinely used for recreational purposes.

The Golconda Mine and Mill Site remedial action was conducted in 2006 and 2007 to prevent direct human contact with metals from recreational exposure and to prevent further erosion of the source areas into the SFCDR. The components of these actions were as follows:

- Excavation and consolidation of mine wastes;
- Construction of riprap revetments along the SFCDR;
- Completion of final grading, construction of surface water control features, placement of soil cover systems, and hydro-seeding; and
- Conveyance of adit flow into a pipeline to bypass the waste rock pile.

Remedial action effectiveness monitoring at the Golconda Mine and Mill Site was conducted between 2007 and 2012 in accordance with the Golconda O&M Plan (USEPA, 2007b). Additional technical and background information for the site and groundwater and surface water monitoring data interpretation and evaluation through 2009 were presented in the 2010 Five-Year Review (USEPA, 2010c).

O&M and Actions since the Last Five-Year Review

The last Five-Year Review made a recommendation to coordinate with responsible entities to implement O&M formally at mine and mill sites with completed remedial actions. An Environmental Covenant was executed by Hecla Silver Valley, Inc ("Hecla SV"), USEPA, and IDEQ on February 19, 2013 to ensure that Hecla SV and subsequent property owners will carry out the O&M Plan (USEPA, 2009b) and that activities on the property will not interfere with the remedial actions.

A site inspection was performed by IDEQ in February 2015 for the purpose of this Five-Year Review. That inspection indicated the earthen cover, vegetation, and riprap revetments were functioning as intended. Culverts and drainage ditches were functional, and the barrier was intact. There was a healthy stand of grass and the site had signs of deer and elk. No anthropogenic activity or adverse impacts on the remedy were observed at the time of the site inspection. The site is accessible by foot from the east corner of the site after crossing the bike path bridge.

July 17, 2014, Hecla conducted an inspection of the Golconda site. Hecla verbally reported to USEPA that there were no indications of movement or delivery of new sediment, breaching of sediment ditches and overflows. No leached oxidized rock materials were noted in contact with surface waters, only the placed rip rap boulders from remediation. No areas of concern were observed.

In addition to the IDEQ site inspection, PHD indicated that no ICP permits have been issued for this section of Golconda, and ICP staff has not seen any evidence of change.

Remedy Status

The evaluation of monitoring data from 2007 through 2012 indicates that some ARARs have not been met, based on the median AWQC ratios (for additional detail see *Data Summary Report [2007-2012] and Adaptive Management Recommendations for the Upper Coeur d'Alene Basin Remedial Action Monitoring Program,* CH2M HILL, 2012b). However, surface water concentrations in the reach of the SFCDR adjacent to the site do not appear to be adversely affected by adit discharge, overland flow, or groundwater discharge from the site based on differences in the AWQC ratio calculated between upstream and downstream locations (CH2M HILL, 2012b). The groundwater and surface water monitoring was discontinued in July 2012. The Environmental Covenant signed by Hecla SV, USEPA, and IDEQ and recorded with the County in February 2013 ensures that O&M occurs and property use restrictions are applied at the site into the future.

5.2.2.2 Wallace Yard Removal

Background and Description

The Wallace Yard, Hercules Mill, and Spur Lines are located near Wallace, Idaho (Figure 5-14). In the early 1890s, railroad companies used the area known as the Wallace Yard for railcar storage, switching, and other operations. The Hercules Mill, located within Wallace Yard, processed ore from the nearby mines to produce concentrates for shipment to smelters. Over the past decades, several portions of the Wallace Yard and Hercules Mill were abandoned and/or removed (USEPA, 2008b). The two historical spur lines that ran along Canyon Creek and a single line along Ninemile Creek served the mines and communities in these side gulches for many years; the lines have been abandoned for decades.

Mine waste found at various locations within the Wallace Yard, Hercules Mill, and Spur Lines contained elevated concentrations of lead and other heavy metals above human health and environmental risk-based action levels (USEPA, 2008b, ARCADIS, 2009). Several documents provide additional background and technical information regarding the history and selected cleanup within the Wallace Yard (USEPA, 2001b, 2002a, and 2008b).

In 2009, USEPA and IDEQ entered into a Consent Decree with the UPRR and the Burlington Northern Santa Fe (BNSF) Railway Company to clean up the Wallace Yard, Hercules Mill, and Canyon and Ninemile Creek Spur Lines, which was approved in federal court in 2010 (USEPA and IDEQ, 2010). The following RAOs were identified:

- Reduce human exposure to soils, including residential garden soils, that have concentrations of lead greater than or equal to 700 mg/kg or arsenic greater than or equal to 100 mg/kg for portions of Wallace Yard or the Spur Lines that either are or may be reasonably anticipated to become residential use areas.
- Reduce human exposure to soils with lead concentrations at or above 700 mg/kg within readily accessible common use areas of Wallace Yard or the Spur Lines (USEPA, 2008b).

The RAOs were to be achieved through installation of protective asphalt, gravel, or vegetative barriers; removal and disposal of contaminated materials; and access controls (USEPA, 2008b).

O&M and Actions since the Last Five-Year Review

The remedial actions for Wallace Yard and the Ninemile and Canyon Creek spur lines were implemented in 2010 and 2011 (ARCADIS, 2013d, 2013e, and 2013f). Remedial actions at the

Hercules Mill were implemented in 2012 by UPRR and BNSF, and overseen by USEPA and IDEQ (ARCADIS, 2013g). The work was certified complete on January 21, 2014 (USEPA, 2014).

Remedial actions included:

- Removal and replacement or capping of contaminated soils greater than or equal to 700 mg/kg lead or 100 mg/kg arsenic that were within 1,000 feet of residences or accessed by the public;
- Installation of access controls to prevent barrier damage due to vehicle traffic;
- Asphalt capping of sections of the West Fork Ninemile Road, Yellow Dog Road, and some parking areas in the Wallace Yard;
- Placement of large riprap on embankments to prevent erosion; and
- Full soil removal to bedrock on the rock face at the Hercules Mill site.

The excavated soils were disposed of at the Big Creek Repository. Additional details are provided in the Completion of Element of Work reports (ARCADIS, 2013d, 2013e, 2013f, and 2013g).

The last Five-Year Review recommended that responsible entities should formally implement O&M at Mine and Mill Sites with completed remedial actions (USEPA, 2010c). A long-term Maintenance and Repair (M&R) Plan was finalized in 2013 for the Wallace Yard and the Hercules Mill remedial actions (ARCADIS, 2013h). The spur lines are not subject to the M&R Plan because the railroads had abandoned the spur lines and ownership is now subject to real estate ownership regulations. It is anticipated that the railroad ROW along the spur lines will or has been adopted by adjacent landowners and is therefore subject to the ICP which is administered by PHD.

UPRR and BNSF conducted quarterly inspections of the Wallace Yard and Hercules Mill sites and reported results to USEPA and IDEQ in accordance with the M&R Plan (ARCADIS, 2014b, 2014c, 2014d, and 2015b). During this review period, the Wallace Yard and Hercules Mill Site remedy required the following maintenance activities:

- Regrading of erosion rills and barriers that had been damaged due to snow plowing activities;
- Reorientation of traffic exclusion boulders that had been moved due to snowplowing activities;
- Grading out areas and adding gravel to small potholes due to traffic use; and
- Removal of sediment from culvert discharge.

In addition, barrier disturbance was observed in the lawn area at the Wallace Visitor Center due to the City of Wallace's construction activities (permitted by the ICP). The barrier will be repaired when the work is complete.

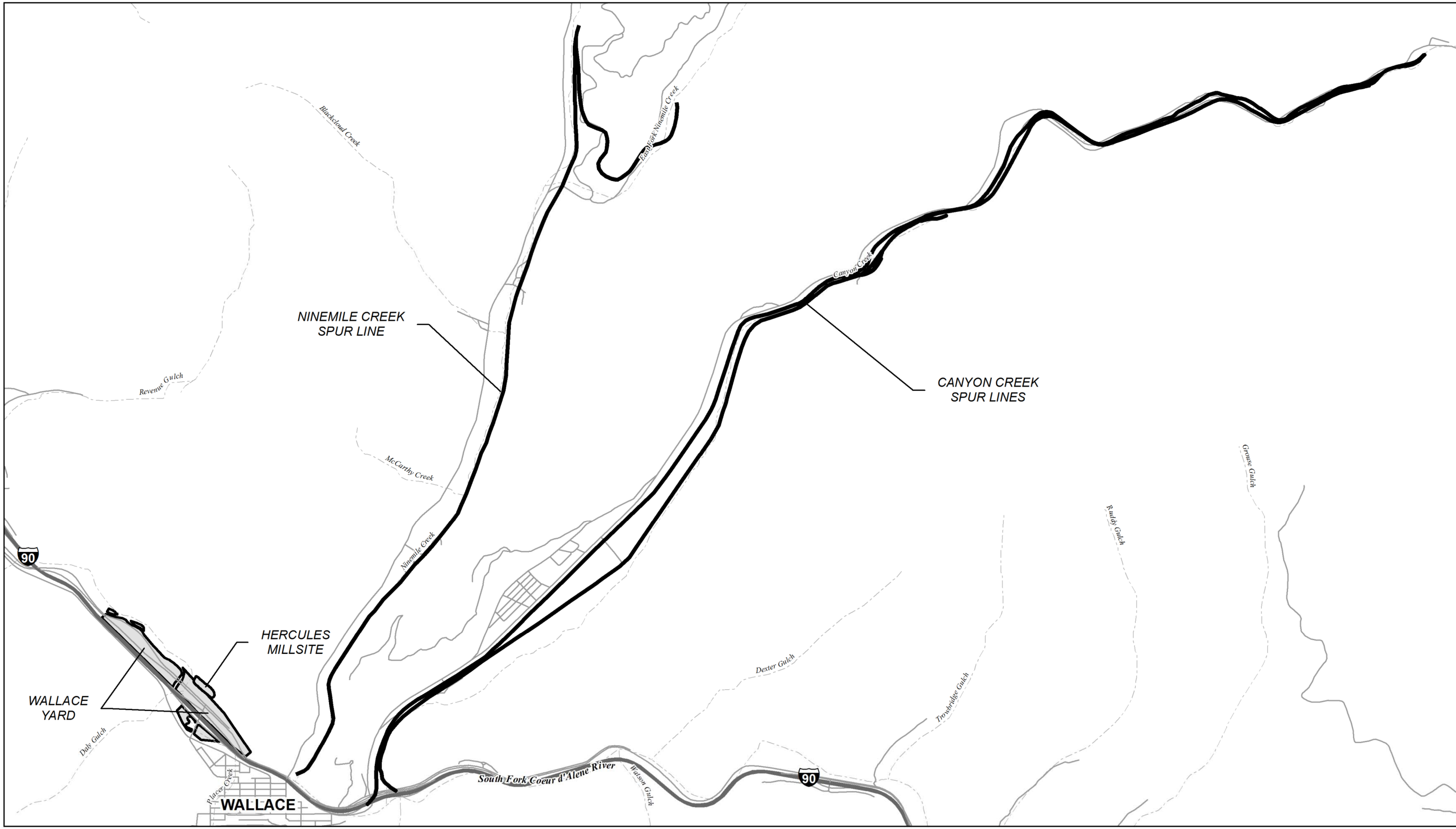


FIGURE 5-14

Wallace Yard Including Hercules Millsite and Spur Lines

2015 Five-Year Review

BUNKER HILL SUPERFUND SITE

TerraGraphics Environmental Engineering, Inc. 2010_5_Year / wallace_yard.mxd 3/23/2015

EPA

Remedy Status

The cleanup that occurred between 2010 and 2014 fulfilled the RAOs. An environmental covenant executed and recorded in November 2011 by USEPA, IDEQ, and UPRR set forth activity and land use limitations at the Wallace Yard property, including restrictions on residential use and use of groundwater as drinking water, as well as other protections for human health regardless of future ownership changes (USEPA et al., 2011).

The inspections conducted in 2013 and 2014 indicated several minor issues with barrier integrity. Repairs were completed or are pending, as discussed in the previous subsection. Snow removal and unauthorized vehicular access is expected to result in the continued need for regular M&R by UPRR. The capped areas continue to provide effective barriers to the underlying contaminated soils, access controls are still in place to prevent barrier disturbance, and continued M&R is required by the Consent Decree (USEPA and IDEQ, 2010), which is expected to continue to provide continued achievement of the RAOs. Clean barriers on the Spur Line are not subject to long-term UPRR and BNSF maintenance obligations. Similar to all human health barriers, continued performance of the barriers on the Spur Lines fall under the jurisdiction of the ICP.

5.2.2.3 Osburn U.S. Bureau of Mines Impoundment Site

Background and Description

The Osburn USBM Impoundment Site is located between the southern bank of the SFCDR and I-90 just west of Osburn, Idaho. The site is adjacent to North Frontage Road and Terror Gulch Road. Mine tailing impoundment cells were constructed on the site in the late 1970s and early 1980s to evaluate the use of mill tailings for filling and reclaiming areas in the river floodplain. Because of erosion and off-road vehicles activities, mill tailings with high concentrations of lead and arsenic are exposed.

The remedial action selected for the site by the USEPA involved capping an impoundment area of approximately 2.8 acres with 6 inches of 4-inch minus pit run material and quarry spall windrows to deter vehicular access to the site. Barrier boulders, a barrier fence, ecology blocks, and warning signs were placed around the perimeter of the site to limit access to the central portion of the impoundment area. A cap of pit run material was also placed along a roadway on the south side of the site to provide a designated route around the impoundment area to create a long-term barrier between contaminated solids and human receptors. The remedial action construction was completed in October 2011, as documented in the Remedial Action Completion Report (MFA, 2012a).

O&M and Actions since the Last Five-Year Review

The Coeur d'Alene Trust has assumed responsibility for O&M at the Osburn USBM Impoundment Site in accordance with site O&M plans (Parametrix, 2011; MFA, 2014d). Inspections were completed at least annually between 2012 and 2014, with results documented in annual reports (MFA, 2013, 2014e). Additional visual inspections are completed periodically throughout the year, and following high-flow events in the SFCDR. Periodic maintenance has involved replacing exterior barrier boulders that had been moved to allow recreational vehicular access to the site (MFA, 2013 and 2014d).

Remedy Status

The inspections indicate that the remedy is protective and functioning as intended. No evidence of cap erosion, quarry spall windrow deterioration, or flood damage has been observed. During the 2013 and 2014 inspections, barrier boulders had been moved to allow recreational vehicular access to the site. One-inch-deep tire ruts were observed in areas where barrier boulders had been moved, but the tire ruts were insignificant with respect to the integrity of the cap (MFA, 2013). The Coeur d'Alene Trust replaced the barrier boulders. If recreational vehicle users continue to move the boulders, then larger boulders will be installed.

5.2.2.4 Canyon Creek Watershed: Sisters

Background and Description

The Sisters Mine is a small site located within the Canyon Creek Watershed adjacent to the community of Woodland Park near Wallace, Idaho (Figure 5-1). Major features of the site include waste rock piles, an adit (overgrown with vegetation), a former access road, two unvegetated and slightly eroded escarpments, remnant mining track rails, and a refuse pile.

The remedial objective is to limit potential exposures of area residents and recreational users to arsenic and lead-contaminated soils (USEPA, 2002a). The remedial activities included a combination of site recontouring, installation of clean soil and native vegetative cover, and eliminating access points. The remedy was constructed by IDEQ in July/August 2005. Additional technical and background information for the Sisters Mine and Mill Site is provided in the 2010 Five-Year Review (USEPA, 2010c).

O&M and Actions since the Last Five-Year Review

The 2010 Five-Year Review recommended that responsible entities should coordinate to formally implement O&M at OU 3 mine and mill sites with completed remedial actions. No formal O&M plan exists for the Sisters Mine.

A site inspection was conducted by IDEQ on February 18, 2015 in support of this Five-Year Review. The terraces and vegetation were observed to be functioning as intended. Surface water was shedding off the site as intended in the drainage ditches. There was evidence of deer and elk crossing this site. Noxious weeds were present. No public use of this area was observed; however, the "Private Property" signs at the base of this site near Dairy Road have faded.

Remedy Status

Since completion of the remedy, IDEQ inspected the Sisters Mine site and it appears to remain stable. No maintenance has occurred since the last Five-Year Review, although updating signage and conducting future O&M is necessary.

5.2.2.5 Ninemile Watershed

Waste Consolidation Area

Background and Description

The EFNM Waste Consolidation Area (WCA) site (Figure 5-15) is located approximately 6 miles northeast of Wallace, Idaho in the upper reach of the EFNM Creek Watershed. It is located approximately 250 feet above EFNM Creek outside of the alluvial valley and in an area that is relatively isolated from groundwater. The site provides a location for long-term consolidation of mine waste materials, including waste rock and tailings, from sites located throughout the Ninemile Creek Watershed. Mine wastes will be consolidated into the EFNM WCA to reduce metals loading into the watershed. Additional information on the EFNM WCA can be found in the *Final Remedial Design Basis of Design Report* (CDM Smith, 2013).

The WCA was designed to be constructed in phases: construction of the initial 19 acres of the EFNM WCA was completed in 2014. Upon completion, the WCA will be approximately 33 acres, with a capacity of up to 1.9 million cy. It is anticipated that wastes will be placed in the WCA for at least 10 years, although the timeline is subject to change based on funding and work execution progress in the Ninemile Creek Watershed.

O&M and Actions since the Last Five-Year Review

Initial construction of the EFNM WCA began in July 2013 and was completed in August 2014. A winter shutdown of construction occurred from November 2013 through May 2014. A detailed description of construction activities is provided in the *Final Remedial Action Completion Report* (CDM Smith, 2014a). Construction activities associated with the EFNM WCA initial development included:

- Clearing and grubbing
- Soil salvaging (excavation, screening, hauling, and stockpiling of growth media [cover soil] and oversize material for future work)
- Developing and operating a rock quarry (excavation, crushing, screening, hauling and stockpiling of rock materials to meet the requirements of the project)
- Installing two buttresses constructed from quarry rock and installing a buttress drainage system consisting of drainage pipes and surface water drainage channels along the perimeter of the buttresses
- Installing stormwater channels
- Installing a base drainage system consisting of a drainage layer (2-foot-thick layer of drainage rock overlying a 16-ounce geotextile that separates the drainage rock from the underlying subsoil)
- Installing two permanent access gates

The Coeur d'Alene Trust began operating the EFNM WCA (i.e. placing waste rock) in July 2014, as the initial development of the WCA was being completed. The first waste materials placed at the EFNM WCA were generated from the remedial action completed at the Interstate-Callahan Rock Dumps. Placement of wastes from the Interstate-Callahan Rock Dumps site is scheduled to be complete during the 2015 construction season. An expansion of the WCA will also be designed in 2015 that will accommodate placement of waste materials from the Success

Complex site. Periodic site inspections are completed by the Coeur d'Alene Trust as part of operations.

A water monitoring program was initiated at the WCA in 2013 prior to waste placement. The objectives of the initial water monitoring at the EFNM WCA were to understand the hydrology of the area better and to evaluate surface water and groundwater baseline conditions prior to waste placement. Additional information on the monitoring points is summarized in the Coeur d'Alene Trust annual water monitoring reports (MFA, 2014f; 2015e). Monitoring will be completed throughout the operation of the WCA (i.e. during waste placement) to help understand effects of waste placement, if any, on surrounding surface water and groundwater.

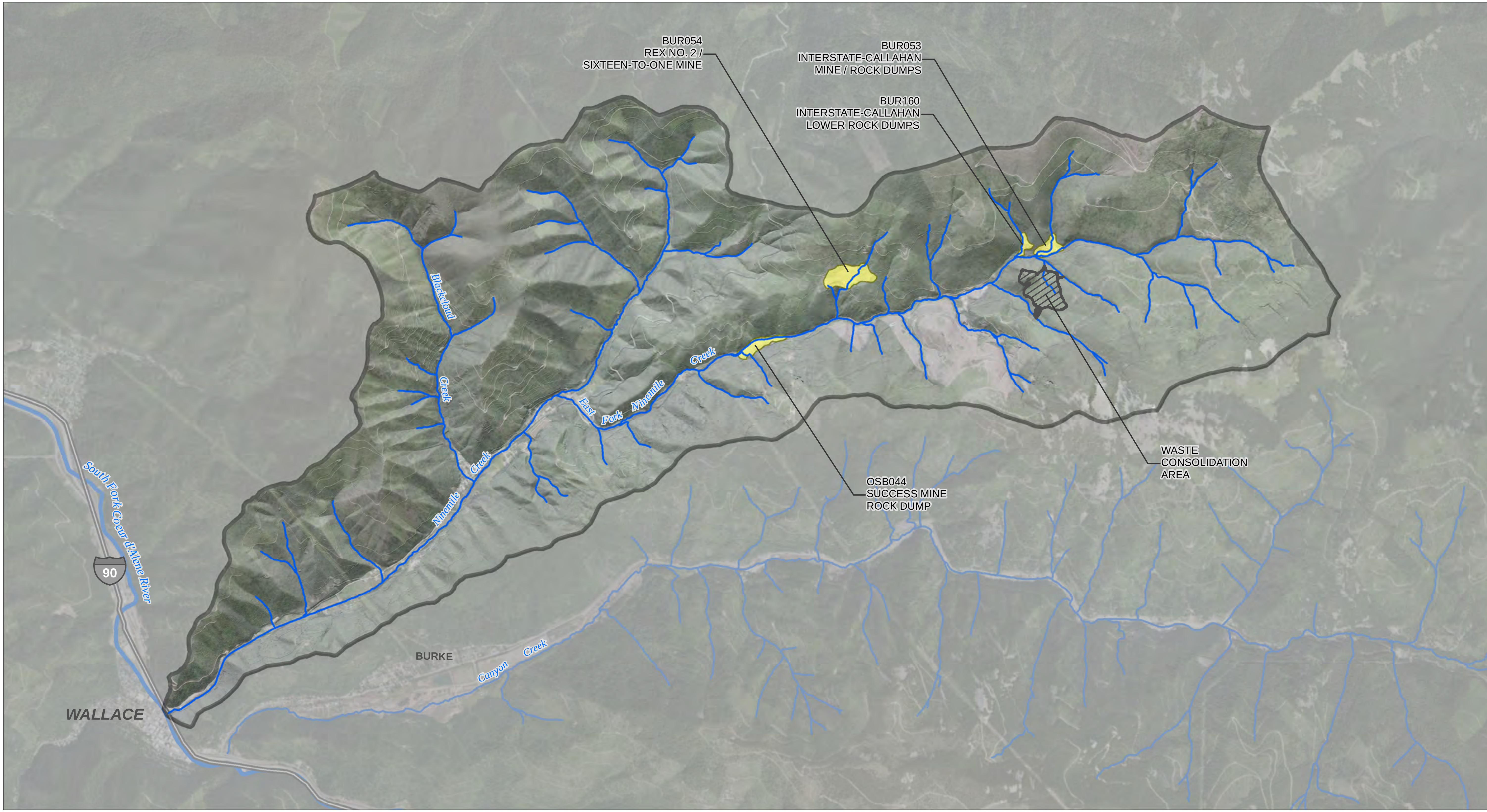
After initial waste placement in the WCA, two rounds of monitoring were completed in October and November of 2014. Dissolved metals concentrations in groundwater samples were generally consistent with background samples with two exceptions: cadmium and lead concentrations were somewhat elevated relative to background conditions in the October 2014 sampling event in one well, located southwest of the WCA. However, the November sample results for these metals were non-detect. As a result, it is inferred that the elevated cadmium and lead concentrations at this location may not be indicative of impacts associated with waste placement. As additional monitoring is completed, the trends and conclusions will be reevaluated.

Surface water samples collected after waste placement did not contain detectable dissolved metals concentrations above AWQC, except for dissolved mercury in EFNM 018 in the November 2014 event. EFNM-018 is upstream of all construction activities and mercury was detected only slightly above the method reporting limit (see MFA, 2015e for additional information).

During the monitoring of the drainage layer pipe outlets, flow was observed only in BRM-228 in the southwest corner of the EFNM WCA in July 2014. Metals were not detected above AWQC.

Remedy Status

The EFNM WCA has been operational since July 2014. Inspection and monitoring data collected through December 2014 indicate that the remedy is protective and functioning as intended.



Source: Aerial photograph obtained from Esri ArcGIS Online; rivers dataset obtained from Idaho Department of Water Resources; roads dataset obtained from Esri.

WCA Full Construction Boundary
Ninemile Creek Basin Boundary
Stream / River
Mine and Mill Source Site
Interstate

N

0 750 1,500 3,000 Feet

Figure 5-15
Ninemile Creek Watershed
Mine and Mill Sites
2015 Five-Year Review
BUNKER HILL SUPERFUND SITE

Path: X:\CdA\0442\07.01_2015 5 Five-Year Review\Projects\Figure_Ninemile Watershed Mine and Mill Sites.mxd Print Date: 3/11/2015

EPA

Interstate-Callahan Rock Dumps

Background and Description

The Interstate-Callahan Rock Dumps Site (Figure 5-15) is located in the upper reaches of the EFNM Creek Watershed approximately 6 miles northeast of Wallace, Idaho. Prior to implementation of the remedial action, the site consisted of two mine waste rock dumps, the Interstate-Callahan Mine/Rock Dumps (BUR053) and the Interstate-Callahan Lower Rock Dumps sites (BUR160), located within two steep unnamed tributaries to EFNM Creek.

The rock dumps impeded the flow of surface water and a significant portion of the tributaries flow infiltrated through the waste piles, contacting contaminated materials and resulting in transport of dissolved metals.

The remedial action for the Interstate-Callahan Rock Dumps site is described in detail in the 100 percent Basis of Design report (North Wind/Pioneer, 2014a). In general, the project includes the following components:

- Excavation of approximately 220,000 cubic yards of waste rock and placement in the EFNM WCA;
- Closure of up to three adits, if they are exposed during waste excavation;
- Placement of cover soil and revegetation of the excavated areas (approximately 17 acres);
- Reconstruction of approximately 1,700 linear feet of EFNM Creek and 1,320 linear feet of tributary channels, utilizing a temporary stream diversion for the EFNM Creek;
- Reconstruction of support roads and related culvert installation to provide continued access through the area once the waste rock is removed; and
- Construction of 5,050 linear feet of stormwater control channels and other erosion control BMPs

O&M and Actions since the Last Five-Year Review

Predesign investigation activities were completed at the Interstate Callahan Rock Dumps in 2011 and 2012. Results of the investigation are summarized in the 2012 EFNM Creek Predesign Investigation Results Report (MFA, 2012b).

The remedial action was initiated during 2014. Work completed included excavation of approximately 159,000 cy of mine waste and installation of cover soils over the corresponding excavation area. Excavated materials were placed in the EFNM WCA. In addition, the two tributary stream channels were reconstructed. An interim construction report provides additional details on the 2014 construction (Pioneer, 2015).

The remedial action will be completed in 2015. Additional anticipated work includes excavation and disposal of an additional 60,000 cy of mine waste and reconstruction of 1,700 linear feet of EFNM Creek.

Once the Interstate-Callahan Rock Dumps project is fully constructed in the fall of 2015, the Coeur d'Alene Trust will assume O&M responsibilities for the remedy. An O&M plan has been prepared to guide these activities (North Wind/Pioneer, 2014b). Inspections will occur at least annually beginning in 2016, and will evaluate vegetation, noxious weeds, cover soil and erosion, reconstructed stream and tributary channels, and stormwater controls.

In addition, the Coeur d'Alene Trust will implement remedial action effectiveness monitoring, including surface water monitoring in EFNM Creek above and below the completed remedy. The Coeur d'Alene Trust will work with USEPA to develop the monitoring plan for this work prior to completion of the project.

Remedy Status

Implementation of the Interstate-Callahan Rock Dumps remedy is on-going and will not be fully constructed until late summer or fall of 2015. It is anticipated that upon completion the remedy will be protective and will function as intended in the decision documents, because all mine waste is expected to be removed from the site.

Rex Mine and Mill Complex

Background and Description

The Rex Mine and Mill Complex (Figure 5-15) is located in the EFNM Creek Watershed approximately 5 miles northeast of Wallace, Idaho. The complex includes the Rex No. 2/Sixteen-to-One site (BUR054) and the Rex No. 1 site (BUR139), which is located approximately 500 feet upslope to the north of BUR054. The Rex No. 1 site includes the Rex No. 1 adit and a mine waste dump. The 2012 Upper Basin ROD Amendment (USEPA, 2012) specifies additional remedial action at Rex No. 1 (excavation and consolidation of waste rock).

The Rex No. 2/Sixteen-to-One site includes the Rex No. 2 adit and a consolidated mine waste pile covering approximately 4 acres. A remedial action was conducted at the Rex No. 2 site in 2007. Prior to the remedial action, the tailings completely filled the small drainage area with which it is associated, thus impounding the small creek that previously occupied the drainage area. The tailings dam at the downgradient end of the site was determined to be unstable because of the height and slope of the dam and the nature of the tailings. The remedial action components consisted of the following:

- Removal and offsite disposal of miscellaneous debris from the former mill building area;
- Excavation and consolidation of contaminated materials (mine tailings and waste rock) into the waste rock pile and the two tailings impoundments;
- Modifications to surface water management including routing the combined Rex No. 2 Adit discharge and the Rex Creek discharge through an unlined reconstructed channel to minimize contact of water with the tailings pile;
- Completion of final grading, placement of an earthen cover, and hydroseeding;
- Stabilization of the tailings dam; and
- Installation of a bat gate at the adit opening.

Additional detail is provided in the 2010 Five-Year Review (USEPA, 2010c) and in the Construction Completion Report (USACE, 2010).

O&M and Actions since the Last Five-Year Review

Remedial action effectiveness monitoring at the Rex Mine and Mill Site was initiated in fall 2007 and continued through 2012 at the following monitoring locations:

- One upgradient and one downgradient surface water monitoring location (REX-SWU and Rex-SWD-FLUME, respectively);

- Rex Adit (NM-361); and
- Two groundwater monitoring wells (one upgradient [REX-02] and two downgradient [REX-09 and REX-04]). Note that REX-04 was eliminated from the monitoring beginning in fall 2010.

Water monitoring data interpretation and evaluation are presented in the draft *Data Summary Report (2007-2012) and Adaptive Management Recommendations for the Upper Coeur d'Alene Basin Remedial Action Monitoring Program* (CH2M HILL, 2012b). Significant surface water loads and AWQC ratio differences were observed for arsenic and zinc between upgradient and downgradient stations (CH2M HILL, 2012b). The report concluded that trends are not changing because of the remedial actions completed in 2006 and 2007, further contaminant metal reduction from the completed RAs is expected to be relatively low, and additional RAs are needed to reduce the contaminant metal releases occurring from the residual tailings pile significantly (CH2M HILL, 2012b). Because of these findings, further action was conducted in 2014 to address continued infiltration into the tailings impoundment from the unlined portion of Rex Creek that crosses the site. Observational information during the spring indicates the Rex Creek lining has been effective and most water is bypassing the tailings impoundment. Additional monitoring will be conducted to evaluate the long-term effectiveness of this action in reducing surface water impacts downstream of the impoundment.

The Coeur d'Alene Trust completed water monitoring at Rex No. 2 at the following locations:

- Rex Adit (NM-361) (2013, 2014)
- REX-SWU (upstream location, 2014)
- NM-SWD-FLUME (flume located at the base of the dam, 2013)
- EFNM-020 and EFNM-021 (seeps identified downgradient of the waste pile during peak flow event in 2014)
- EFNM-015 (downstream location at base of Rex tributary, 2014)

Analytical results for dissolved surface water samples at the Rex Adit and REX-SWU locations generally exceed AWQC for cadmium, lead, and zinc. Dissolved cadmium and zinc exceed the AWQC at EFNM-015, located at the base of the Rex drainage (MFA, 2013; 2015e).

The Rex Mine and Mill remedial action has been periodically inspected by BLM and USEPA since completion of the remedy. The earthen cover and vegetation are functioning as intended. However, as discussed in the 2010 Five-Year Review (USEPA, 2010c), the Rex Creek and Rex Adit flows had been observed to completely infiltrate into the waste pile and then re-emerge at the toe of the waste pile. It was recommended that the infiltration be mitigated because the infiltrating water could be contacting contaminated materials and transporting dissolved metals into Rex Creek (USEPA, 2010c). Accordingly, the USEPA directed the Coeur d'Alene Trust to implement improvements to the existing remedial action that involved lining the existing surface water channels to reduce infiltration.

The Coeur d'Alene Trust reconstructed vegetated and riprap channels using a low-permeability geosynthetic liner between September and November 2014. Weir stations will be constructed above and below the tailings impoundment in 2015 to evaluate the effectiveness of the lined channels. The weirs will allow accurate flow measurements at the creek inlet/outlet; any difference in flow may be indicative of leaks within the channel lining system and potential stormwater infiltration into the consolidated mine waste. Additional details regarding the improvements constructed in 2014 are provided in the *Final Basis of Design Report* (CDM Smith, 2015a).

Beginning in 2015, the Coeur d'Alene Trust will complete remedial action effectiveness monitoring at the Rex No. 2 site, including flow measurement at the weirs.

The 2010 Five-Year Review recommended the following specifically to the Rex Site.

- **Recommendation:** Regarding Rex Site contaminant release, mitigate the infiltration of Rex Creek and the Rex Adit flow upgradient form the remedial action.

  Discussion: This recommendation is complete.

Remedy Status
The inspections at the Rex No. 2 site indicate that the 2007 remedial action has adequately protected against direct contact with contaminated tailings. However, the remedy was not functioning as intended with respect to maintaining separation between surface water and mine waste material. It is anticipated that the additional 2014 action to line the surface water channels will prevent surface water contact with the waste and that the remedy will function as intended in the future.

Success Mine and Mill Site
Background and Description
The Success Mine and Mill Site Complex (Figure 5-15) is located in the EFNM Creek Watershed approximately 4 miles northeast of Wallace, Idaho, directly adjacent to EFNM Creek. The Success Complex includes the following four sites that have been selected for remediation in the Upper Basin ROD Amendment (USEPA, 2012a): Success Mine Rock Dump (OSB044), the Success No. 3 adit (OSB089), the American Mine (OSB048), and the Alameda Mine adit (OSB088). Success No. 3 and the Alameda Mine adits are located east and upgradient of the Success Mine Rock Dump. A former mill was located within the Success Mine Rock Dump and a steep, unnamed tributary (informally referred to as the Alameda Tributary) flows into the rock dump.

The American Mine site is located across EFNM Creek from the Success Mine Rock Dump, but is included as part of the Success Complex remedial action due to its proximity.

Although the intent of the previous removal actions completed by USEPA and the Silver Valley Natural Resource Trustees at the Success Complex was to reduce metals loading in the SFCDR, the Success Complex continues to be a significant contributor of metals loading into the SFCDR from the Ninemile Creek Watershed (MFA, 2015g). Cleanup of the Success Complex is scheduled to begin in 2016.

O&M and Actions since the Last Five-Year Review
Monitoring was completed between 2007 and 2012, as part of the Remedial Action Monitoring Program, to assess the status and trends of mining-related contamination in surface water and shallow groundwater and to evaluate the effectiveness of interim remedial actions with respect to ecological conditions (CH2M HILL, 2012).

The Success Complex has been prioritized because it is a large source of metals to Ninemile Creek and the SFCDR. Predesign investigation activities were completed at the Success Complex in 2011, 2012, and 2014. Results of the investigation are summarized in the *Success Complex Remedial Design Investigation Report* (MFA, 2015f). Remedial action design was initiated by the Coeur d'Alene Trust in 2014. The design will be completed in 2015 and construction is scheduled to begin in 2016.

The remedial action will include excavation of mine waste materials in the Success Mine Rock Dump such that the remaining concentrations in the native soils are less than or equal to 530 mg/kg for lead. Based on the current understanding of site conditions, some excavation of saturated waste materials below the groundwater table is expected and dewatering efforts will be necessary. Native soils with elevated zinc concentrations within the floodplain that are hydraulically connected to groundwater will be excavated to the extent feasible.

The American Mine remediation will include excavation of mine waste to a slope of 2 horizontal to 1 vertical (2H:1V). There is a potential to expose four adits during the excavation of waste materials, in which case the adits will be closed using a bat-friendly closure structure that will restrict public access. Slopes that are 2.5H:1V or flatter following excavation will be covered using 12 inches of amended soil generated from the EFNM WCA. Slopes steeper than 2.5H:1V will be covered using 12 inches of a combination of amended cover soil and 12-inch minus riprap, to protect the slope from erosion and to ensure long-term stability. The reclaimed slopes will be revegetated using an upland seed mix and the steep slopes will be planted with conifer tubelings.

Excavated materials will be placed in the EFNM WCA. Haul roads will be developed to accommodate transfer of the waste to the EFNM WCA. As the waste materials are excavated, the existing Alameda Tributary, Success No. 3 adit discharge, Alameda adit discharge, and a section of the EFNM Creek adjacent to the Success Complex will be realigned and reconstructed. The access road that parallels the EFNM Creek will also be excavated and realigned as part of the reconstruction.

Remedy Status

The additional remedial actions selected in the 2012 ROD Amendment (USEPA, 2012a) are expected to significantly reduce future contaminant metal releases from the Success Complex, which will significantly reduce the metals load from the Ninemile Basin into the SFCDR.

5.2.2.6 Pine Creek Watershed – Constitution Mine and Mill Site

Background and Description

The Constitution Mine and Mill Site is on the East Fork of Pine Creek approximately 8 miles south of Pinehurst (Figure 5-1). The site is an abandoned lead, silver, and zinc mine and mill site with two large fine-grain tailings piles totaling approximately 36,000 cy. The tailings piles were uncontained and subject to extensive sediment loading into the East Fork of Pine Creek via direct stream channel erosion of the toe of the tailings piles, as well as overland runoff of sediment from the top of the piles into the stream.

Remedial actions were designed to prevent direct human contact with metals from recreational exposure and to prevent further erosion into Pine Creek. The remedial action was implemented in 2006 and consisted of the following:

- Excavation and consolidation of mine wastes to the Upper Constitution site;
- Completion of final grading, construction of surface water control features, placement of a soil/rock cap, and revegetation; and
- Conveying nearby adit flow into a pilot bioreactor project for treatment prior to discharging into the East Fork of Pine Creek.

Additional technical and background information for the Constitution Mine and Mill Site is provided in the 2010 Five-Year Review Report (USEPA, 2010c).

O&M and Actions since the Last Five-Year Review

The site has been inspected and the BLM performed O&M of the pilot bioreactor. Remedial action effectiveness monitoring at the Constitution Mine and Mill Site has been ongoing since the remedy was completed.

In 2013, the BLM decommissioned the pilot bioreactor. This involved removal of physical hazards, fencing and concrete, as well as site reclamation including grading and application of topsoil.

The 2010 Five-Year Review included the following recommendation for the Constitution Mine and Mill Site.

- **Recommendation:** Post-remedial action monitoring required as follow-up. Continue to monitor and operate the pilot water treatment unit (an on-going 2005 Five-Year Review recommendation).

  Discussion: With the decommissioning of the pilot reactor, no further monitoring is being conducted and this recommendation is complete.

Remedy Status

The integrity of the cap has been maintained and the repository is performing well. There are no signs of vandalism, surface erosion, or stream scour. Monitoring wells are intact. Weeds have been an issue and will continue to be treated and monitored by BLM.

5.2.3 Washington Recreation Areas along the Spokane River

5.2.3.1 Background and Description

In 1998, 1999, and 2000, Spokane River sediments were sampled to evaluate metals concentrations in the Spokane River recreational areas. Lead concentrations at these recreational areas exceeded the human health action level of 700 mg/kg. Arsenic, cadmium, and zinc were also detected.

The Selected Remedy for the Washington recreation areas along the Spokane River identified in the 2002 OU 3 ROD includes access controls, capping, and removal of metals-contaminated soil and sediment. The remedy monitors water quality, aquatic life, and sediments and includes contingencies for additional or follow-up cleanups for the recreational areas.

Ten shoreline recreation areas and one subaqueous area have been identified for investigation and remedial action. USEPA established a sediment lead cleanup level for the Washington recreation areas along the Spokane River as 700 mg/kg for recreational use (USEPA, 2002a). The 20 mg/kg arsenic cleanup level used by USEPA is based on Model Toxics Control Act method A. Implementation of the remedy, as defined by the 2002 OU 3 ROD, will reduce the potential for exposure to metals at the beaches and shoreline recreational areas and will enhance human uses of ecological resources.

The 2002 OU 3 ROD also states that additional cleanup of critical habitat areas identified by the Washington State Department of Ecology (Ecology) will reduce risks to waterfowl and other ecological receptors to generally safe levels. The critical habitat areas along the Spokane River in Washington have been identified by Ecology to include Starr Road, Island Complex, Murray Road, and Harvard Road.

A health advisory currently exists for ingestion of beach and shoreline sediment, and a fish consumption health advisory currently exists for the Spokane River from the state line to Ninemile Dam. These advisories include signs that have been posted along this portion of the river to alert the public to elevated levels of lead in the beach soils and describe ways the public can minimize the risk of lead exposure.

5.2.3.2 Description of Remedial Actions

Remedial actions have been implemented at eight of the ten Spokane River shoreline recreational areas. The following provides a brief summary of these actions.

Starr Road

Removal and replacement of impacted shoreline soils was completed in 2006. A cap was placed over upland areas. A pull-out parking area and footpath to the cleaned shoreline area was also created. In the summer of 2007, Ecology added additional materials to the cap to enhance identified trout spawning areas.

Island Complex

In 2007, a multi-layered soil cap was placed over contaminated sediments at the Island Complex area, and native trees and shrubs were planted to stabilize the eroding bank in the backwater area. River gravels were placed below the ordinary high water mark to enhance trout habitat and limit erosion. Irrigation lines were installed and operated for two seasons to help establish the plantings.

Murray Road

In 2007, an extensive sand and gravel cap was placed over impacted sediments at the Murray Road area. Public access trail improvements and signage were built at both locations to assist with foot traffic management and cap protection.

Harvard Road

In 2008, contaminated sediments along the upper portion of the riverbank were removed and sent to an appropriate landfill. The area was backfilled with clean sand and gravel. A protective cap of clean sand and gravel trout spawning mix was placed over the lower portion of the riverbank to enhance existing habitat. An adjacent graveled boat launch was also installed, in conjunction with fencing and boulder placement, to facilitate recreational river access while prohibiting vehicle access to the cap.

Flora Road
In 2012, contaminated sediments along the riverbank were removed and sent to an appropriate landfill. Filter rock and capping rock were placed over the excavated area.

Barker Road North Shore
In 2012, contaminated sediments along the riverbank were removed and sent to an appropriate landfill. Filter rock and capping rock were placed over the excavated area and native riparian vegetation was planted.

Barker Road South Shore
Remedial actions were not conducted at the Barker Road south shore area because metal concentrations were below cleanup levels, although signage was installed to limit recreational human exposure to sediments.

Myrtle Point
In 2012, contaminated sediments along the riverbank were removed and hauled to a landfill. Filter rock and capping rock were placed over the excavated area and native riparian vegetation was planted.

Islands Lagoon
In 2012, filter rock and capping rock were installed

Donkey Island
Remedial actions were not conducted at the Donkey Island area because metal concentrations are below cleanup levels.

Upriver Dam
Remedial actions to address metals contamination related to the Bunker Hill Superfund Site have not yet been conducted. However, Ecology implemented remedial actions to address polychlorinated biphenyls (PCBs). Co-located metal-contaminated sediments, related to Bunker Hill were likely also addressed. USEPA will investigate the remaining contamination at the Upriver Dam and determine whether further remedial action is warranted.

5.2.3.3 Remedy Status
Ecology monitors the Spokane River recreational areas to evaluate remedy performance and detect potential recontamination. Depositional sediment samples were collected in 2013 at Starr Road, Island Complex, Murray Road, and Harvard Road beach sites. Remedy inspections were conducted in 2014 at Flora Road, Barker Road North, Myrtle Point, and Islands Lagoon beach sites.

The results are provided in the *Spokane River Shoreline Sediment Sites Monitoring, Sampling and Analysis Report* (Ecology, 2015). Lead concentrations were below the 700 mg/kg cleanup level except for two samples collected at the Island Complex. These data suggest that recontamination may be occurring at the site.

The locations not sampled as a part of the 2013 sampling event (Barker Road North, Flora Road, Myrtle Point, and Islands Lagoon) were inspected for sediment accumulation and remedy performance. It was generally observed that, at each of the locations, the remedy was intact and little to no additional sediment accumulation had occurred (Ecology, 2015).

The remedies implemented at the Spokane River recreational areas are functioning as intended by the OU 3 ROD (USEPA, 2002a), based on follow-up inspections and sampling. Two exceedances above cleanup action levels (for lead) were found at Island Complex in 2013. Additional monitoring will be needed to measure accurately the impacts of the remedial actions with respect to sediment quality.

5.2.4 Lower Coeur d'Alene River Basin Recreation Sites (including Black Rock, Thompson, Anderson, Rose Lake, Medimont, and Rainy Hill)

Background and Description

The Selected Remedy in the OU 3 ROD includes remediation of recreational areas to reduce human exposure to lead and other metals. The ROD identified 31 recreational areas and recognized that other recreational sites may be evaluated for cleanup (USEPA, 2002a). Beaches along the Coeur d'Alene River pose special challenges for active remediation because of high recontamination potential due to flooding, private ownership, and access issues (USEPA, 2005). For these beach areas, an "information and education" program was implemented to inform recreational users of area risks and safe-use practices. In addition to remediation, information, and education, the Lower Basin Project Focus Team recommended the development of a Lower Basin recreational management plan/policy. This policy would be to establish a coordinated effort among the numerous agencies (i.e., BLM, IDFG, Coeur d'Alene Tribe, IDPR, USFS, and PHD) that own and/or manage recreational sites (BEIPC, 2003). This has not occurred to date.

Remedial actions occurred at six recreational areas, and health warning signs were installed at nine other locations. Detailed descriptions of the response actions accomplished through 2009 are provided in the 2005 and 2010 Five-Year Review Reports (USEPA, 2005 and 2010c).

Because of contaminated sediment deposition observed by PHD almost annually at public recreation sites along the Coeur d'Alene River, guidelines to address sediment deposition from high-water events were developed in 2008 by IDFG, IDPR, IDEQ, USEPA, Kootenai County, USFS, BLM, Coeur d'Alene Tribe, Spokane Tribe, and PHD. The guidelines address:

- When a recreation site should be closed due to sediment deposition;
- What sites/areas are to be cleaned or remediated;
- How sites are to be cleaned or remediated; and
- Coordination and communication among participating agencies.

Agencies that own and/or manage recreation sites are responsible to implement the guidelines.

O&M and Actions since the Last Five-Year Review

PHD inspects eight sites annually or after significant flood events, and makes recommendations to the responsible entities regarding cleanup or closure. The agencies usually respond to PHD's recommendations, and annual cleanup of recreational sites has occurred when necessary. The eight sites include the six previously remediated areas plus a few others more commonly accessed by the public: Medimont Boat Launch, Rainy Hill Boat Launch, Thompson Lake Boat Ramp, Anderson Lake Boat Ramp, Bull Run Boat Launch, Killarney Lake Boat Launch, Black Rock Slough Trailhead/ Highway 3 Crossing, and the Cataldo Mission and Boat Ramp (monitored as one site).

Active remediation at Lower Basin recreation sites has been limited because of high potential for flooding and recontamination. Three main actions have occurred since the last Five-Year Review:

- In 2013, USFS made improvements (USFS, 2015) to the Medimont Boat Launch to enhance site access, stabilize riverbanks, and mitigate health concerns associated with contaminants (see Table 5-15).
- In 2013, USEPA selected a river bank/recreation remediation pilot project based on community input provided at Pilot Project Idea Forums, with the objective to reduce human exposure to lead and other contaminated materials in banks and beaches where recreational use is common. The project at Kahnderosa Campground was completed in December 2014 in a manner that is intended to support recreational use and ecological habitat (MFA, 2014g) (see Table 5-15).
- IDEQ and PHD increased public outreach and education beginning in 2013 with two public service announcements that provide health tips to recreationists. These were aired on the radio during the summer months in 2013 and 2014 (BEIPC, 2014 and 2015). Additionally, in 2014, PHD and IDEQ inventoried many of the human health signs at recreation sites and made necessary improvements and repairs to the existing signs.

TABLE 5-15
Summary of Actions Completed Since the Last Five-Year Review at Identified Recreational Sites, 2010-2014
2015 Five-Year Review, Bunker Hill Superfund Site

Recreation Site (CUA No. when applicable)	Year(s) Remedial Actions Completed	Management Agency or Owner	Actions Since the 2010 Five-Year Review
Black Rock Slough Trailhead/Highway 3 Crossing	2001-2002, 2004, and 2005	IDPR	Routine monitoring and maintenance.
Medimont Boat Launch (CUA045)	1999 and 2013	USFS	In 2013, USFS reconstructed and paved the access road and parking area, reconstructed the existing ramp, installed a concrete vault toilet, placed boulders to control motorized vehicle use, and decommissioned unauthorized access routes. In January 2013, approximately 450 feet of riverbank was stabilized utilizing encapsulated soil lifts with coir fabric; no hard rock riprap was used. In February 2013, USFS staff along with other stakeholders installed vegetative plantings along the riverbank.
Rainy Hill Boat Launch (CUA046&47)	1999 and 2006	USFS	Routine monitoring and maintenance.
Thompson Lake Boat Ramp (CUA038)	1999-2000	IDFG	Routine monitoring and maintenance.
Anderson Lake Boat Ramp (CUA033)	1999 and 2008	IDFG	Routine monitoring and maintenance.
Bull Run Boat Launch (CUA059&60)	2004	USFS/IDPR	Routine monitoring and maintenance.

TABLE 5-15
Summary of Actions Completed Since the Last Five-Year Review at Identified Recreational Sites, 2010-2014
2015 Five-Year Review, Bunker Hill Superfund Site

Recreation Site (CUA No. when applicable)	Year(s) Remedial Actions Completed	Management Agency or Owner	Actions Since the 2010 Five-Year Review
Kahnderosa Campground Pilot Project	2014	Private	USEPA remediated/restored a 300-foot section of riverbank used as a beach. Work included the construction of fiber-encapsulated soil lifts laid on willow mattresses and affixed to the water's edge to help stabilize the bank. The work was coordinated with the BPRP that had selected this property to include hardening the camping pads and roads at this site so that they can be easily cleaned of sediments. The latter was conducted under the oversight of IDEQ and is scheduled to be completed in 2015.

CUA = common use area

The 2010 Five-Year Review included the following recommendations that were ongoing from the 2005 Five-Year Review. Discussions and any actions taken since 2010 follow each recommendation.

- **Recommendation:** Conduct post-flood monitoring at the Cataldo Mission.

  Discussion: PHD routinely inspects the Cataldo Mission recreational area after flood events. This recommendation is complete.

- **Recommendation:** Incorporate the Cataldo Boat Ramp into the remedial action program and ongoing monitoring.

  Discussion: PHD inspects the Cataldo Boat Ramp area, which consists of a hardened boat launch and parking lot, after flood events. In addition, a new human health sign was placed at this site in the fall of 2014. This recommendation is complete.

- **Recommendation:** Continue to monitor the stream bank at the Black Rock Slough Trailhead/Highway 3 Crossing.

  Discussion: PHD monitors this site periodically and after any substantial flooding. In spring 2015, PHD noted that the site was intact and clean. This recommendation will not be retained in the table of issues and recommendations, because it is an ongoing element of O&M. This recommendation is complete.

- **Recommendation:** Evaluate removal action in context of the 2002 OU 3 ROD and, if warranted, incorporate Dudley Bank Stabilization into the remedial action program.

  Discussion: In July 2015, IDEQ inspected the 1999 pilot bank stabilization work conducted by Silver Valley Natural Resource Trustees and determined it remains in good condition. No further action is necessary. This recommendation is complete.

- **Recommendation:** Evaluate removal action in context of the 2002 OU 3 ROD, and if warranted, incorporate Medimont Bank Stabilization into the remedial action program.

  Discussion: The banks at the boat launch were stabilized in 2014 by USFS. PHD monitors this site annually and has noted that the vegetation is growing well and the remedy is intact. This recommendation is complete.

- **Recommendation:** Recommend that USFS consider paving existing boat launch area at Medimont Boat Launch and establish a paved picnic site near the restrooms on the north side of the site. Continue day-use-only limitation. Address bank stabilization issues. Consider establishment of overnight recreational vehicle parking area.

  Discussion: USFS completed remediation and rehabilitation in 2013 (see Table 5-15). This recommendation is complete.

- **Recommendation:** Pending completion of designs for the Highway 97 bridge replacement, USEPA, IDFG, and the Recreational Area Project Focus Team will evaluate the potential need for additional cleanup work at the Anderson Lake Boat Launch.

  Discussion: The Highway 97 bridge replacement was completed by Idaho Transportation Department and the remedy at the boat launch was not compromised by the construction activities. PHD continues to monitor this site annually and after flooding events. This recommendation is complete.

- **Recommendation:** Informational Signage: Replace damaged as needed.

  Discussion: In 2014, IDEQ and PHD inventoried signage along the river between Bull Run and Cave Lake. Two signs were removed because they were on private land and were obstructed from view. One of the signs was installed at the Cataldo Boat Ramp in fall 2014. PHD is holding the other sign to place at another more visible location in 2015. This recommendation is complete.

- **Recommendation:** Additional Areas: Identify and evaluate additional Lower Basin recreational areas that may require cleanup.

  Discussion: During the past 5 years, a number of private or informal recreational sites have been identified that may present a heavy metal exposure risk to recreationalists. Although a comprehensive survey was not completed, PHD identified a number of privately owned recreational sites and informal, undeveloped sites in 2013 that may pose a risk to recreationalists (PHD, 2013b). Additional privately owned recreational sites along the floodplain and the banks of the Coeur d'Alene River have been identified through the Basin Property Sampling and Remediation Program in the last 5 years. Many of these sites are in the floodplain or adjacent to the riverbank. Many sites are contaminated with lead and other metals, and flood events likely deposit additional contaminated sediment.

  In 2015, IDEQ, PHD, and USEPA evaluated options for reducing exposure to lead and other heavy metals at a range of recreation sites in Upper and Lower Basin areas. This recommendation will be retained in the table of issues and recommendations (see Table 5-16) and expanded to include Upper Basin recreation sites and efforts to reduce exposure to lead and other heavy metals at those sites. Much of the work needed to complete the original recommendation has been performed and creating a new, broader action item is a more proactive way to address sites throughout the Basin.

Remedy Status

Sediment with lead concentrations ranging from approximately 1,000 to 5,000 mg/kg and arsenic concentrations ranging from 40 to 130 mg/kg is commonly observed at recreational sites along the lower Coeur d'Alene River after high-water events (personal communication, PHD to IDFG, July 16, 2008). From 2010 through 2014, PHD's annual monitoring and inspections of the eight recreation sites indicate that, in general, removal of contaminated sediment at the public recreation areas continues to help reduce the public's exposure to contaminated sediment. However, PHD has documented on multiple occasions that contaminants are often left at the eight monitored sites for prolonged periods throughout the spring before being cleaned up. The agencies that own and/or manage these sites state this is because of the risk of additional high-water events and lack of funding. Formal adoption of the guidelines developed in 2008 and additional criteria addressing barrier restoration after floods and other damage are necessary to ensure these sites remain protective of public health. Timely O&M (e.g., washing off contaminated sediment after flooding) carried out by the various agencies at these sites is important from a human health exposure and risk reduction standpoint.

Remedial actions at the Kahnderosa Campground were completed in fall 2014 (MFA, 2014g). No subsequent monitoring data are available, but USEPA plans to monitor the stability of the riverbank and metals concentrations on the beach at this site because of the potential for erosion or deposition from flooding.

Families recreate along the Coeur d'Alene River and are exposed to contaminated sediment (PHD, 2013b). A number of impromptu sites where children swim and play along the banks of the river were observed in 2013 (PHD, 2013b). Additionally, private property owners are establishing private campgrounds or other frequently used recreational areas, many of which are in the Coeur d'Alene River floodplain, are currently contaminated, and would become recontaminated with lead and other heavy metals during flood events. To better understand sediment transport and recontamination, USEPA has continued to develop a MIKE 21C (DHI) sediment transport model (CH2M HILL, 2010) to evaluate contaminated sediment transport and deposition in the river channel and across wetlands and floodplains. The model will assist with prioritizing and evaluating remedial options.

Although active remediation of the 31 recreational sites identified in the ROD and other private or impromptu sites is not complete or may not occur, signage, education, and outreach continue to inform river users about recreational risks and safer-use practices. Signage condition and visibility is being monitored, and the LHIP now offers free blood lead screening to recreational users (see Section 5.2.1.4). Some of the recreational sites identified in the 2002 ROD now have limited use or access and are lower priority for remediation. Meanwhile, use on other sites that have not been previously identified has evolved over time and are now being used more frequently. Those sites that fall into the latter may warrant further monitoring and evaluation.

In 2015, a recreation sites working group was established consisting of IDEQ, PHD, and USEPA staff to evaluate options for reducing exposure to lead and other heavy metals at a range of recreation sites in Upper and Lower Basin areas.

5.2.5 Trail of the Coeur d'Alenes Removal Action

Background and Description

UPRR performed the CERCLA removal action for its Wallace-Mullan Branch ROW located in OU 3 beginning in 2000 and ending in 2004. Similar work took place in OU 2 (see Section 4.2.10), but only the action conducted in OU 3 is presented in this section. The goal of the UPRR removal action was to contain mine-waste-related contamination within the ROW in a manner that was protective of human health and the environment (USEPA, 1999). The removal action addressed the main line and related sidings of the Wallace-Mullan Branch ROW.

A brief description of the work elements follows:

- Removal, decontamination, and salvage of useable railroad ties and rail. Non-salvageable material was decontaminated and disposed of at properly permitted offsite facilities.
- Repair of flood and scour damaged rail bed embankment, and removal of flood debris impinging on bridge structures. This work was completed to maintain the integrity of the railroad grade for use as a recreational trail and to mitigate the future migration of contaminants from the ROW.
- Removal and disposal of mine waste materials and placement of protective barriers.
- Conversion of the ROW to a recreational trail.
- Removal of and/or barrier installation over mine waste found within those ROW portions that were associated with a residential type of use.
- Installation of access controls to protect barriers and prevent access to areas of contamination such as tailings impoundments directly adjacent to the trail.

The remedial action was certified complete in 2005. UPRR retains responsibility for M&R of protective barriers (including the asphalt barrier and trail within the Coeur d'Alene Reservation), rail bed embankments that provide a foundation for the trail portion of the ROW, and certain aspects of the Chatcolet Bridge. The State of Idaho is the owner and primary manager of the Mullan through Harrison section of the ROW, which encompasses about 57.1 miles of asphalt trail. For this portion of the ROW, IDEQ is responsible for protecting human health and the environment, and IDPR is responsible for general management and operation. The Coeur d'Alene Tribe owns and is the primary manager of the Harrison through Plummer section of the ROW, which entails about 14.4 miles of asphalt trail. For this portion of the ROW, the Tribe Hazardous Waste Management Program is responsible for protecting human health and the environment, and the Tribe Recreation Management Program is responsible for general management and operation. The approximately 3-mile portion of ROW passing through Heyburn State Park is jointly owned and managed by the Tribe and the State.

As part of its obligations under the Consent Decree, UPRR has provided a lump-sum cash payment to support the trail maintenance activities conducted by the State and the Coeur d'Alene Tribe. ICs implemented include the installation and management of signage and the use of access controls as part of the removal action construction, as well as education and awareness for residents of both incorporated and unincorporated communities along the ROW and visitors to the area. UPRR is responsible for monitoring and repair of the barriers, including the trail surface, in accordance with the *Response Action Maintenance Plan* (Coeur d'Alene Tribe and State of Idaho, 2010; Coeur d'Alene Tribe et al., 2008) and Section VII of the Consent Decree

(U.S. District Court for the District of Idaho, 2000) Additional detail, including historical and removal action context, is provided in the 2010 Five-Year Review Report and the *Response Action Maintenance Plan*.

O&M and Actions since the Last Five-Year Review

Since the 2010 Five-Year Review, UPRR and IDPR conducted routine maintenance and repair activities, with oversight by IDEQ, IDPR, and the Coeur d'Alene Tribe as described by the *Response Action Maintenance Plan* (Coeur d'Alene Tribe et al., 2008). UPRR completed monthly trail inspections, and IDPR and Coeur d'Alene Tribe staff regularly patrolled the trail. Routine monitoring and maintenance of the trail is documented in detail in annual reports (ARCADIS, 2010, 2011d, 2012d, 2013i, and 2014e; Coeur d'Alene Tribe and State of Idaho, 2010, 2011, 2012, 2013, and 2014). The following summarizes the barrier and access maintenance actions undertaken in the last 5 years.

- Bollards at Springston Trailhead, Pine Creek Trailhead, Cataldo (near Kahnderosa), Big Creek near Shoshone Golf Course Road, Osburn, Enaville, and Wallace were replaced after being vandalized or damaged during separate incidents.
- The post and chains were replaced along the trail at CCC Road in Cataldo, K Street in Smelterville, and the Wallace Trailhead and repaired at Johnson Street in Osburn because of damage by motorists, snow removal equipment, and vandalism.
- A rock barrier between the grassy area and county road was extended near Leisure Acres, Osburn to stop unauthorized motorized vehicle access and preserve the protective barrier.
- Regular asphalt concrete pavement monitoring tests and assessments were conducted to determine the integrity of the asphalt.
- Fog Coat® was applied on the segment from Plummer to Harrison.
- IDPR and the Coeur d'Alene Tribe regularly conduct noxious weed control along the entire trail.
- Cracks, potholes, sinkholes, rills, and depressions were repaired to address roots, settling, and flooding damage. In some locations, tree roots were cut at the edge of asphalt and barricaded using steel flashing, after the application of herbicide.
- Damaged, disturbed, or eroded shoulder gravel was repaired along the length of the trail.
- Culverts and their grates were cleared to remove vegetation, rocks, and other debris.
- Eroded gravel barrier/rock armoring at the culvert at STA 50+00 was repaired.
- Damaged, stolen, or faded signs were replaced.
- PHD and IDEQ have increased their public outreach and education efforts (Section 5.2.4).
- Issuances of authorization to parties that intend to breach or cross the barriers and follow-up with parties that failed to obtain authorization.
- Annual sampling of sand at Harrison beach was below 100 mg/kg lead in all samples.

The 2010 Five-Year Review included the following recommendation.

- **Recommendation:** Continue monitoring the UPRR barrier protectiveness and conduct maintenance as needed.

Discussion: UPRR, IDPR, IDEQ, and Coeur d'Alene Tribe have been implementing the *Response Action Maintenance Plan* since 2008 and will continue to do so. This recommendation will not be retained in the table of issues and recommendations, because it is an ongoing element of the O&M program required by the Consent Decree. This recommendation is complete.

- **Recommendation:** Continue to monitor performance of Harrison Beach sand (an ongoing 2005 Five-Year Review recommendation).

  Discussion: Monitoring of the lead concentrations in the Harrison Beach Sand are part of the ongoing M&R obligations that UPRR conducts. This recommendation is complete.

- **Recommendation:** Continue monitoring Trail of the Coeur d'Alenes unauthorized use patterns (an ongoing 2005 Five-Year Review recommendation).

  Discussion: Monitoring of unauthorized access along the Trail of the Coeur d'Alenes corridor is part of the ongoing M&R obligations that UPRR conducts. This recommendation is complete.

Remedy Status

Monitoring, maintenance, and repair is essential to the long-term protectiveness of the remedy and is being conducted by the USEPA, State of Idaho, Coeur d'Alene Tribe, and UPRR, also discussed in Section 4.2.10. Regularly scheduled M&R activities conducted by UPRR address ongoing issues and those identified as a result of inspection activities conducted by IDEQ, IDPR, PHD, and the Coeur d'Alene Tribe along with the UPRR's contractor. The integrity of the asphalt and gravel barriers is maintained by M&R activities conducted by UPRR to repair damage to the barriers caused by flooding, tree roots intrusion, and unauthorized use by motor vehicles, snowmobiles, and all-terrain vehicles. Responsibility for control of unauthorized use and access of the trail system rests with the trail management entities.

Overall, the protective barriers and access controls are maintained and remain protective.

5.2.6 Repositories

Cleanup in the Basin will require construction of repositories for disposal of metals-contaminated soils, sediments, source materials, treatment residuals, and contaminated soils moved by residents or their contractors. The number and size of repositories to accommodate the estimated volumes will be determined as remedial actions proceed in OU 3.

Potential repository locations have been and will continue to be evaluated using criteria provided in the 2002 OU 3 ROD, which include proximity to cleanup areas, background environmental conditions, site conditions, impacts on groundwater, and other considerations. Repositories will require long-term ICs and monitoring. Public involvement processes are one of the primary components for the siting and design of all repositories.

Current and long-term disposal needs were estimated in the *Repository Waste Management and Planning Strategy 2014 Update* (TerraGraphics, 2014a). The OU 3 repositories currently operating or that are currently being constructed are discussed in the following subsections. Although the Osburn Tailings Impoundment Repository located east of Osburn is currently designed to 30 percent, additional work will be held until additional repository capacity is needed. The agencies continue to find additional or optimal repository capacity by waste segregation and re-use, identification and development of Limited Use Repositories, and minimizing ICP disposal at Repositories by promoting the use of Community Fill Projects. Appropriate disposal of remedial action wastes is an important factor in remedial action implementation.

The Paved Road program implemented in the Basin began generating significant waste volumes in 2014. The waste from this program is in the form of inert asphaltic concrete and generally low-level contaminant-containing base materials excavated with the asphalt. To prioritize repository space for more contaminated ICP and remedial action wastes, a Limited Use Repository (LUR) was sited and developed in Osburn in accordance with LUR policy memo, (IDEQ and USEPA, 2015). The East Osburn LUR will operate for 1 to 2 years to receive Basin road waste and then be completed following the ICP capping requirements into an area ready for redevelopment. It has a design capacity of approximately 32,000 cy.

The 2010 Five-Year Review recommended the following specific to OU 3 repositories.

- **Recommendation:** Regarding long-term disposal need from remedial actions, establish process with remedial design teams and long-term planners to identify waste quantities and timing associate with remedial actions.

  Discussion: This activity is a planning function that is ongoing but will be tracked as an action item because of the need to plan far enough in advance for waste streams and quantities. This recommendation will not be retained on the table of issues and recommendations, because it does not affect protectiveness. It will instead be included in the table of planned action items (Table 5-17).

- **Recommendation:** Continue search and evaluation of potential new repository sites (an ongoing 2005 Five-Year Review recommendation).

  Discussion: This activity is a planning function that is ongoing but will be tracked as an action item because of the need to plan far enough in advance for waste streams and quantities. This recommendation will not be retained on the table of issues and recommendations, because it does not affect protectiveness. It will instead be included in the table of planned action items (Table 5-17).

5.2.6.1 Lower Burke Canyon Repository

Background and Description

The Lower Burke Canyon Repository (LBCR) site is located approximately 2.25 miles northeast of Wallace and immediately to the northeast of the community of Woodland Park (Figure 5-1). The 40-acre LBCR site was formerly used for the impoundment of tailings, as part of the Star Tailings Impoundment (STI). A summary of the public involvement process for siting of the repository at the STI is provided in a response to comments document (BEIPC, 2010). The Coeur d’Alene Trust began design of the LBCR in 2012. Initial construction work at the repository, including necessary infrastructure and facilities, was initiated in 2014. The work will be completed in 2015. Additional information on the initial design of the repository is provided in the basis of design report (CDM Smith, 2014b).

The LBCR will provide a location for consolidating mine waste materials, including mine waste rock and tailings that are located at sites throughout the Canyon Creek Watershed and waste from Bunker Hill Superfund Site programs such as the BPRP and the ICP. These wastes will be consolidated in the LBCR to reduce metals loading into the watershed. Current design calculations indicate the LBCR will be capable of containing up to 1,150,000 cy of waste (CDM Smith, 2014b). Wastes could be placed in the LBCR as early as 2015 if necessary, based on the amount and location of wastes generated in the Upper Basin.

O&M and Actions since the Last Five-Year Review

No waste was placed at the LBCR through the end of 2014. As discussed above, waste could be accepted as soon as 2015. O&M will be completed by the Coeur d'Alene Trust's repository operations contractor for the LBCR. Prior to the placement of waste, the contractor will prepare an operations plan that will guide O&M activities throughout waste placement.

The Coeur d'Alene Trust completed water monitoring at the LBCR from 2012 through 2014 to support the repository design, to understand the hydrology of the area better, and to establish baseline conditions prior to waste placement. The monitoring included 21 locations, including 20 monitoring wells and one stilling well adjacent to Canyon Creek. Twelve of the monitoring wells were installed in 2012 by the Coeur d'Alene Trust. Additional information on the monitoring points is summarized in the Coeur d'Alene Trust annual water monitoring reports (MFA, 2014f and 2015e). Results indicate that a portion of the tailings in the northern STI ponds 3 and 4 are in contact with groundwater and that concentrations of metals are greatest upgradient (north) and crossgradient (east) of the ponds (MFA, 2015e). The design concluded that no additional groundwater monitoring is necessary for the LBCR (CDM Smith, 2014b).

Remedy Status

As of June 2015, the LBCR is now available to receive waste. Construction of the LBCR on top of the STI and ultimate capping will reduce infiltration.

5.2.6.2 Big Creek Repository

Background and Description

The Big Creek Repository (BCR) is located approximately 4 miles east of Kellogg adjacent to the Trail of the Coeur d'Alenes, near the confluence of Big Creek and the SFCDR (Figure 5-1). The repository was constructed on a former 22 acre tailings impoundment that was used from 1968 to 1979. It is rectangular in shape approximately 100 feet above the valley floor (North Wind Construction, 2015b). IDEQ has owned the BCR parcel since July 2003. Previous assessments of the site indicate that the historical tailings are likely in contact with groundwater during part or all of the year (TerraGraphics, 2015f). Additional information on the BCR site setting and history are provided in the 2010 Five-Year Review (USEPA, 2010c).

The repository has been open since 2002. The BCR accepts waste materials from the ICP, BPRP, Remedy Protection Program, and Paved Roads Program as well as wood waste material and oversize concrete debris. Waste acceptance criteria are specified in the *Final Bunker Hill Mining and Metallurgical Complex Waste Acceptance Criteria* (IDEQ and USEPA, 2011). Annual reports for the BCR document the source and volume of waste materials placed at the repository.

The original design capacity of the BCR was 250,000 cy. In 2007, the capacity was increased to 450,000 cy, and then in 2011 the capacity was again increased to 576,000 cy (TerraGraphics, 2015f). At the completion of the 2014 operating season, the remaining capacity of the BCR was approximately 24,000 cy, subject to change based on final repository closure and cover design (North Wind Construction, 2015b).

In 2015, the repository will be expanded again as the Big Creek Repository Annex (BCRA), located directly west of and across Big Creek from the BCR. Predesign investigation activities and design of the BCRA were completed in 2014. A new bridge across Big Creek was constructed in 2014 to connect BCR to BCRA. Necessary utility modifications were also initiated in 2014. The modifications will be completed during the first half of 2015 and construction of the BCRA repository completed in 2015. It is anticipated that the BCRA will be available for waste placement during late summer 2015. The design capacity of the BCRA is 190,000 cy, for a total projected remaining capacity of 214,000 cy between both the BCR and BCRA. Additional information on the BCRA is included in the Basis of Design Report (CDM Smith, 2015b).

O&M and Actions since the Last Five-Year Review

As described above, the BCR has operated since 2002. The repository was originally operated by IDEQ until May 2013 when operations were transferred to the Coeur d'Alene Trust. During waste placement, O&M are guided by an operations plan (North Wind Construction, 2015c). Operations include:

- Completing annual start-up activities each spring;
- Providing year-round access for users at the ICP transfer station;
- Inspecting and segregating incoming materials according to approved waste acceptance criteria to prevent unsuitable material from being placed in the repository;
- Placing and compacting waste materials;
- Removing wastes that do not meet the waste acceptance criteria;
- Operating the decontamination station;
- Final grading of external slopes in accordance with the design plans and in accordance with the requirements of the site stormwater plan;
- Managing stormwater BMPs including a stormwater retention pond at the top of the repository;
- Completing end of season shut-down activities in late fall or early winter; and
- Preparing annual surveys, as-builts, and operations reports.

The repository operations contractor prepares weekly, monthly, and annual reports. As part of operations, inspections are completed by the repository operations contractor and additional monthly inspections are completed by the Coeur d'Alene Trust. Long-term O&M activities will begin following the closure of the repository.

IDEQ contractors have completed monitoring of groundwater, porewater pressure in piezometers, settlement monuments, and surface water on a quarterly basis at the BCR since July 2004. Groundwater samples are currently collected from a network of five monitoring wells. Two monitoring wells are located within the footprint of the northern expansion cell. Groundwater monitoring results to date indicate that the tailings impoundment has contributed to groundwater metals loading. However, since placement of repository waste at the site, statistically significant decreasing concentrations of antimony and arsenic have occurred in the downgradient monitoring wells and no other trends have been identified (TerraGraphics, 2015h). Four piezometers within the BCR footprint appeared to be compromised and were decommissioned in 2014. Two piezometers remain. Surface water samples are collected at three locations in Big Creek and in two locations in the SFCDR. Surface water monitoring results through 2012 indicate no significant change in water quality in the previous 5 years (TerraGraphics, 2014g).

The Coeur d'Alene Trust monitored six groundwater and two surface water stations at the BCRA site from 2013 through 2014 prior to waste placement to establish baseline conditions and chemical trends. Water monitoring will continue in 2015 at three groundwater and the two surface water stations during operation of the BCRA to evaluate any effects from the BCRA on water quality.

The 2010 Five-Year Review included the following recommendation.

- **Recommendation:** Continue to implement remedial actions at Big Creek Repository (an ongoing 2005 Five-Year Review recommendations).

  Discussion: This activity continues to be performed as a matter of waste disposal in the Basin and will continue until closure (BCR anticipated after 2015 season and BCRA several years later depending on waste volumes) and commencement of long-term O&M. Therefore, this recommendation is complete.

Remedy Status

Based on the inspections and monitoring completed to date, the BCR is protective and functioning as intended. Construction of the BCRA is on-going and it is anticipated that it will also be protective.

5.2.6.3 East Mission Flats Repository

Background and Description

The East Mission Flats Repository (EMFR) is located on a 23-acre parcel of land owned by IDEQ. It is located north of the Coeur d'Alene River, north of I-90, across the freeway from the Old Mission State Park and Cataldo Mission (Figure 5-2). The site is within a floodplain in an area that has existing contamination from deposition of mining-impacted sediments. The EMFR was constructed and began receiving waste in 2009. Additional background details for the EMFR are provided in the 2010 Five-Year Review (USEPA, 2010c).

The EMFR accepts waste materials from the ICP, BPRP, Remedy Protection Program, and Paved Roads Program. Waste acceptance criteria are specified in the *Final Bunker Hill Mining and Metallurgical Complex Waste Acceptance Criteria* (IDEQ and USEPA, 2011). Annual operations reports for the EMFR are generated, which document the source and volume of waste materials placed at the repository.

The 14-acre repository footprint is roughly triangular, with a capacity of approximately 445,000 cy. Repository design details are available in the *East Mission Flats Repository 90% Design Report* (TerraGraphics, 2009b). As of the 2014, the remaining capacity of the EMFR was approximately 226,000 cy (North Wind Construction, 2015d).

O&M and Actions since the Last Five-Year Review

EMFR has operated since 2009. The repository was operated by IDEQ until May 2013 when operations were transferred to the Coeur d'Alene Trust. During waste placement, O&M are guided by the *East Mission Flats Repository Operations Plan* (North Wind Construction, 2015e).

Operations include:

- Completing annual start-up activities each spring
- Providing year-round access for users at the ICP transfer station
- Inspecting and segregating incoming materials according to approved waste acceptance criteria to prevent unsuitable material from being placed in the repository
- Placing and compacting waste materials
- Removing wastes that do not meet the waste acceptance criteria
- Operating the decontamination station
- Final grading of external slopes in accordance with the design plans and in accordance with the requirements of the site stormwater plan
- Managing stormwater BMPs including a stormwater retention pond at the top of the repository
- Completing end of season shut-down activities in late fall or early winter
- Preparing annual surveys, as-builts, and operations reports

The repository operations contractor prepares weekly, monthly, and annual reports. As part of operations, inspections are completed by the repository operations contractor and additional monthly inspections are completed by the Coeur d'Alene Trust. Long-term O&M activities will begin following the closure of the repository.

Groundwater monitoring has been conducted at the EMFR by IDEQ contractors since 2007. Groundwater monitoring at the EMFR site is conducted quarterly to evaluate groundwater quality and hydraulic conditions. Groundwater monitoring results indicate that arsenic, cadmium, lead, and zinc are below regulatory thresholds at five wells on and downgradient from the EMFR site. No trends indicating significant increasing or decreasing concentrations have been detected. Additional information and specific results of monitoring through 2012 can be found in the 2013 Annual Water Quality Report (IDEQ, 2014d). The report concludes that EMFR is not negatively affecting dissolved metals concentrations in groundwater and recommends continued monitoring.

Floodwater sampling was conducted during flooding that occurred in May 2011, April 2012, and March 2014 at the EMFR. The purpose of the sampling was to measure the quality of the floodwater entering and leaving the area surrounding the repository. In general, lower metals concentrations are measured as the floodwater recedes from the area surrounding the repository. No results conclusively confirm that the EMFR is adversely affecting surface water metals concentrations during flood events. Based on the many factors potentially contributing to metals concentration in the receding floodwater, such as the surrounding historical contamination, continued monitoring of floodwater metals concentrations is not recommended (IDEQ, 2014d). Continued visual inspection to identify surface erosion or deficiencies in sediment controls is recommended on a weekly basis.

Remedy Status

Based on the inspections and monitoring completed to date, the EMFR is protective and functioning as intended. The operation of the repository has prevented the release of contaminants to surface water, groundwater, or air in concentrations that would exceed state and/or federal standards.

5.2.7 Clean Waterfowl Habitat (Agriculture-to-Wetland Conversion Project)

5.2.7.1 Background and Description

A pilot project converted nearly 400 acres of farmland to clean wetland bird feeding habitat in the Lower Basin was established by USEPA in coordination with the Coeur d'Alene Basin Natural Resource Trustees led by USFWS and in coordination with Ducks Unlimited. Significant numbers of waterfowl deaths have been recorded in the Basin for decades due to the lead-contaminated sediment; this project will reduce waterfowl exposure to these contaminants by providing clean wetland feeding habitat for migratory and resident swans, ducks, and other wetland bird species.

USEPA used settlement monies to purchase a conservation easement from the property owner and converted farmland (USEPA, 2012d) to healthy wetland habitat following actions described in the 2002 OU 3 ROD (USEPA, 2002a). The conservation easement area, a 396-acre site located near Medimont, Idaho, is divided into two units: the East Field and the West Field (Figure 5-2). Approximately 295 acres are located in the East Field, and 100 acres are located in the West Field.

Cleanup and conversion of agricultural lands to clean wetlands was identified in the 2002 OU 3 ROD as a measure to provide clean feeding areas for waterfowl. The 2002 OU 3 Interim ROD identifies a soil cleanup level of 530 mg/kg lead in sediment for protection of waterfowl. A goal of this agriculture-to-wetland conversion project is that soils in the conservation easement be characterized with an overall average lead concentration less than 530 mg/kg lead.

Remedial activities were phased to allow for adaptive management of the remedial action. Remediation began in 2006 and was completed in 2011. The East Field remedial activities included:

- Remediation of a limited area with elevated soil lead concentrations;
- Abandonment of existing linear drainage ditches and creation of sinuous drainage swales;
- Rehabilitation of a portion of the levee between the East Field and both Robinson and Canary Creeks; and
- Construction of water control structures.

The West Field remedial activities included:

- Hydraulic control improvements consisting of installation of water control structures, abandonment of existing pump stations, and a new portable pump station; and
- Remediation of contaminated sediments using shallow soil removal and selective handling methodology.

Following implementation of remedial actions, the Coeur d'Alene Basin Natural Resource Trustees, led by USFWS in cooperation with Ducks Unlimited, began restoration activities including upland grass seeding, planting shrubs and trees along the riparian corridor, and restoration of the wetland vegetative community through control of reed canary grass, invasive species control, and water management.

5.2.7.2 O&M and Actions since the Last Five-Year Review

Remedial actions in the East Field were completed prior to this 2015 Five-Year Review period. Remedial actions in the West Field began prior to this 2015 Five-Year Review Period, but were completed during this review period in November 2011. Remedial actions completed at the West Field in 2010 and 2011 included:

- Soil remediation using the selective handling technique to address those limited areas with elevated soil lead values following the 2009 remedial work.
- Installation of the West Field portable pump and electrical improvements.
- Demolition of existing pump structure

The final remedy inspection was conducted in November 2011 following full implementation of the West Field remedy.

In 2006, the USEPA entered into a Memorandum of Agreement with the U.S. Department of Interior, the State of Idaho, and the Coeur d'Alene Tribe regarding the Schlepp conservation easement and wetland project. In the memorandum, the U.S. Department of Interior, on behalf of the Natural Resource Trustees agreed to perform restoration work on the easement property and provide for the long-term O&M of the easement interest consisting of maintenance of habitats and O&M of infrastructure, including water intake and outlet structures, pumps, levees, and the west field soil disposal area. USFWS and others are currently drafting a 10-Year Operation and Maintenance Plan that is intended to provide the necessary activities to be conducted at the easement. Recent O&M activities conducted at the easement are described in the following paragraphs.

East Field

Vegetation monitoring and maintenance to ensure habitat diversity and water management were the primary activities in the East Field. A new access ramp on the Canary Creek levee has been established to reach and manage a concentrated area of reed canary grass that was previously non-accessible. In 2013, Idaho Department of Transportation replaced two undersized culverts (Canary Creek and Robinson Creek) adjacent to the easement allowing for improved flow and reduced overflow of water onto the easement.

West Field

Poor establishment and growth of vegetation in the West Field following remediation and subsequent soil testing indicated an imbalance of nutrients in the soil. In 2013, a series of treatments were completed in the West Field to remedy nutrient, pH, and organic matter deficiencies identified.

During water drawdown of the West Field for soil amendment work, earthwork was conducted to create a new cross berm with a control structure to allow for improved water management. Additionally, three islands to increase habitat diversity and provide loafing areas for birds were constructed.

The 2010 Five-Year Review recommended the following specifically for the Clean Waterfowl Feeding Area/Agriculture-to-Wetland Conversion.

- **Recommendation:** Transfer the easement interest to the State of Idaho. The State will accept the transfer, without cost to Idaho, to a third-party conservation organization (Ducks Unlimited, Inc.).

  Discussion: This continues to be an open item but USEPA is meeting with USFWS and interested parties to seek agreement on final easement holder. This recommendation will not be retained on the table of issues and recommendations, because it does not directly affect protectiveness. It will instead be included on the table of planned action items.

- **Recommendation:** Identify landowners interested in agricultural to wetland conversion (an ongoing 2005 Five-Year Review recommendation).

  Discussion: Agricultural to wetland conversion is an important element of providing uncontaminated Lower Basin waterfowl habitat and as such, this activity will continue in support of new remedial actions. This recommendation is complete.

5.2.7.3 Remedy Status

The East Field agriculture-to-wetland conversion is functioning as intended by the ROD. The East Field remedy was fully implemented in 2008, and to date, has achieved the RAOs. In 2007, lead concentrations in confirmation samples from the East Field were below the 530 mg/kg cleanup goal (CH2M HILL, 2007c), which indicates the presence of clean feeding areas for waterfowl. Periodic site visits indicate that the wetland surface water elevation has been maintained as designed, and the source of the water, Robinson Creek, does not provide recontamination potential. Basin Environmental Monitoring Plan biological resource monitoring conducted in 2014 indicated significantly higher waterfowl use than in previous years. A 20-fold increase in tundra swan abundance was observed in 2014 compared to the 2008–2013 average. Additionally, there was a 99 percent reduction in tundra swan moralities. (USFWS, 2010)

The West Field remedy was completed in 2011; however, poor establishment and growth of vegetation required additional soil treatments. In 2014, there was high water fowl usage of both fields. Further monitoring will be required to determine whether the West Field will attract high waterfowl usage frequently or if additional restoration efforts may be necessary.

5.3 Technical Assessment for OU 3

5.3.1 Is the Remedy Functioning as Intended by the Decision Documents?

5.3.1.1 Selected Remedy for Protection of Human Health

The Human Health Selected Remedy in the community and residential areas of the Upper and Lower Basin is not yet complete. Sampling of eligible parcels is estimated at 91 percent complete, and remediation is up to 85 percent complete. Approximately 13.5 miles of paved roads in the Basin have been rebuilt, overlaid, patched, or chip sealed through the Paved Roads Program. Approximately 97 percent (or 7.25 miles) of publicly owned gravel roads that require remediation have been completed; the remainder are scheduled to be remediated under a different program, such as the Paved Roads Program.

Although the Selected Remedy is expected to result in significant improvements to groundwater quality, it is not intended to achieve groundwater MCL ARARs under the SDWA throughout the Upper Basin. Approximately 35 homes with private drinking water sources have been identified as having elevated lead, arsenic, or cadmium concentrations, and have not yet been provided an alternative drinking water supply or filtration system.

The Human Health Selected Remedy is functioning as intended by the OU 3 ROD and ROD Amendment, although it has not yet been fully implemented. Community mean soil lead concentrations are near or below 200 mg/kg lead for all geographic areas as of 2014. These community means have decreased by an average of 34 percent in the Upper Basin and 18 percent in the Lower Basin since the last Five-Year Review, and by an average of 69 percent and 23 percent, respectively, since the ROD. Community mean soil arsenic concentrations continue to remain below the clean soil criteria of 35 mg/kg. Geometric mean dust lead concentrations in all sampled Basin communities were below 500 mg/kg in 2013. The largest reductions in both vacuum and mat dust lead concentrations since the last Five-Year Review were observed in Burke/Ninemile. Since the last Five-Year Review, community mean vacuum dust lead concentrations have decreased by an average of 40 percent in Upper Basin communities and 30 percent in the Lower Basin communities. Upper Basin community mean mat lead concentrations have remained relatively similar to means presented in the 2010 Five-Year Review. Little to no dust mat data exist for the Lower Basin and Kingston geographic areas in recent years.

Based on recent soil and house dust data, approximately 13 percent of homes in the Basin currently do not meet childhood lead health risk goals, even though property remediation is nearing completion in some communities. These exceedances for a typical (or hypothetical) child between the ages of 6 months and 6 years are due to elevated soil or dust lead concentrations, or a combination thereof. The voluntary nature of the residential yards program may limit the protectiveness of the remedy when owners refuse to participate. An estimated 4 percent of eligible parcels refuse sampling and/or remediation (approximately 200 properties) increasing the potential of exposure to lead or arsenic in soil and increases the potential recontamination of adjacent properties. In recent years, elevated dust lead concentrations in homes throughout the Basin could be related to the patchwork of remaining contaminated soils (e.g., un-remediated property soils, recreational areas, or mine dumps). Additionally, the elevated dust lead concentrations may be due to sources unrelated to the current remedies that have not yet been addressed, including lead-based paint and residual dusts in building structures. Success depends on completing remediation of eligible properties and a better understanding of the spatial distribution of remaining soil concentrations, source sites, and elevated dust lead concentrations.

Interior house dust cleaning was a contingent remedial action identified in the ROD and has not yet been evaluated or implemented in OU 3. The need for interior cleaning will be evaluated after residential soil remediation is completed, taking into consideration ease of implementation, sustainability, ongoing OU 3 house dust monitoring results, and lessons learned in OU 1, which suggest that interior cleaning is not effective beyond the very short term.

The LHIP continues to provide a valuable public health service through voluntary blood lead screening to i) identify at-risk children, ii) provide environmental health follow-up for children with blood lead levels ≥ 5 μg/dL, and iii) implement education and awareness programs. The HEPA vacuum loan program continues to be used by local residents. The low level of participation in the annual Basin blood lead monitoring program remains a concern because it limits the identification of children who might benefit from intervention. An alternative approach using house dust data has identified a number of households for follow-up lead health intervention services; however, house dust monitoring does not occur every year, and only a fraction of residents take advantage of the follow-up services. For these reasons, the success of this alternative approach is limited and difficult to quantify with the amount of available blood and house dust data.

Remedial actions have been conducted at the Trail of the Coeur d'Alenes and seven recreational sites along the Coeur d'Alene River where action was warranted. In 2015, a recreation sites working group was established consisting of IDEQ, PHD, and USEPA staff to evaluate recreational uses and make recommendations on whether further actions are appropriate as recreational use evolves. Additional efforts to reach people through signage, education, and outreach provide trail and river users with information about recreational risks and safer-use practices. Semi-annual and post-flood monitoring of eight public recreational sites has indicated that, in general, removal of contaminated sediment at these areas continues to help reduce the public's exposure to sediments contaminated with mine wastes. Recreational boat launches are owned and maintained by state and federal agencies and they are responsible for removing contaminated sediments that are deposited on them. Resource constraints often result in optimizing removal efforts, which can result in sediments being left at the boat launches until the high runoff period has receded. Timely removal of contaminated sediments is critical to completely prevent potential exposure. As continued development of private recreational sites occurs along the SFCDR and mainstem of the Coeur d'Alene River, in addition to the public or developed recreational areas, several private or informal recreational sites have been identified in the last 5 years that may present a heavy metal exposure risk to recreationalists. These sites were not in use and therefore not identified for remediation as part of the OU 3 ROD. USEPA continues to develop a sediment transport model that, when complete, may be a useful tool for prioritizing and evaluating options to address contaminated sediment transport or deposition in the Lower Basin.

Based upon the trail inspections and transect measurements, the M&R activities performed on the Trail of the Coeur d'Alenes have been effective in preserving the integrity of the protective barriers, preserving the effectiveness of constructed access control measures, and maintaining controls that prevent erosion or slope destabilization in inspected work areas. Transect station measurements show that barrier losses are insignificant in relation to *Response Action Maintenance Plan* (Coeur d'Alene Tribe et al., 2008) specifications. In addition, the asphalt concrete pavement assessment inspection reports indicate the asphalt concrete pavement barrier was observed to be functioning as intended as both a barrier and recreational corridor. Monitoring, maintenance, and repair of the trail has proven effective in the long-term protectiveness of the remedy. Based on the findings of the M&R reports and monitoring, the remedy is performing as intended and remains protective of human health and the environment.

Similarly, continued implementation of the ICP is a key element to the long-term functionality and success of the human health selected remedy. PHD has implemented the ICP as described in IDAPA 41.01.01, issuing 3,122 permits in OU 3 since the last Five-Year Review, performing inspections, directing contaminated soils to designated repositories, receiving documentation of samples for clean fill, and visually observing barrier depth. Runoff, flooding, natural disasters, and documentation are challenges faced during everyday implementation of the ICP. Community acceptance and compliance with the ICP remains high.

The long-term performance of the soil remedy is dependent on both the ICP and maintenance by property owners, including free and convenient disposal locations for local users. Residents are responsible for the maintenance of barriers on their properties. The performance of barriers, especially barrier enhancements such as vegetation or gravel cover, may be compromised if they are not maintained. Maintenance of publicly owned gravel and paved roads is the responsibility of the governmental jurisdiction that maintains each road. Funding allotted for the Paved Roads Program assists local jurisdictions by funding one-time reconstruction of the paved roads as caps to underlying contamination. While implementation of this program is expected to address a significant number of paved roads in the Site, it is not intended to address all road problems and conditions and does not address privately owned paved roads. For this Five-Year Review there was no physical assessment conducted to evaluate the condition of remediated barriers on residential properties, publicly owned unpaved roads, and completed paved road projects.

Remedy protection actions are improvements to existing water conveyance systems that are being implemented to reduce the potential for erosion and recontamination of existing, clean barriers that have been installed. Remedy protection projects include specific actions such as culvert replacements, channel improvements, small diversion structures, and asphalt ditches. Five remedy protection projects identified in the ROD Amendment were completed in OU 3 by 2014. O&M is the responsibility of the local governments within which the projects are located. Based on the Five-Year Review inspections completed by the Coeur d'Alene Trust, the constructed remedy protection projects are protective of the previously established remedies. The projects are functioning as intended. The projects, along with future O&M, help alleviate threats of localized flooding and migration of contaminated media.

The Human Health Selected Remedy also called for education, intervention, and monitoring to reduce human exposure to contaminants in aquatic food sources. The IDHW has set forth fish consumption guidelines for Coeur d'Alene Lake, but does not include the Coeur d'Alene River or chain lakes, and are based on data collected in the mid-1990s. USEPA has identified fish tissue metals concentrations in the chain of lakes as a potential data gap. Further evaluation, through coordination with IFCAP, of fish consumption and concentrations has been identified as an action item along with coordination with IDHW and IDFG.

5.3.1.2 Environmental Protection

Completed remedies at mine and mill sites in the Upper Basin are generally functioning as intended and limit potential exposures of area residents and recreational users to contaminated soils. The remedies completed and in process at mine and mill sites are anticipated to provide ecological benefits, including protection of plants and animals from the effects of heavy metals and improvements to water quality in the SFCDR and its tributaries. However, it is too early to determine the full ecological improvements of completed remedies through monitoring activities.

O&M is an integral part of the remedy at these sites for long-term remedy protectiveness. O&M plans have been adopted for most sites, although there is no formal O&M plan for the Sisters Mine and Mill site. The Canyon Creek and Ninemile Spur lines were capped as part of the Wallace Yard and Spur Lines Response Action. Responsibility for long-term maintenance of the barrier on the Spur Lines rest to the landowner because the lines have been abandoned by the railroads as of 2014.

The Selected Remedy is expected to result in significant improvements to surface water quality in the Upper Basin and may achieve AWQC[2] ARARs under the Clean Water Act at many locations; however, the remedy may not achieve these ARARs at all locations.

Although the Selected Remedy is expected to provide additional safe habitat for special-status species and is intended to achieve ARARs under the Migratory Bird Treaty Act and the Endangered Species Act where remedial actions are taken, it will not achieve these ARARs at all locations.

5.3.1.3 Repositories

The repositories that are currently operational have been designed, constructed, and operated pursuant to the 2002 OU 3 ROD to safely contain waste material and prevent the release of contaminants to surface water, groundwater, or air in concentrations that would exceed state and/or federal standards. The Burke Canyon Repository (BCR) has been in operation since 2002. Groundwater and surface water monitoring at BCR indicate that metals concentrations are either stable or trending downward (TerraGraphics, 2014g and 2015f) and that the BCR design has reliably contained waste material from remedial actions, as well as wastes generated by citizens, communities, and development activities. EMFR has been in operation since 2009. No trends indicating significant increasing or decreasing concentrations of metals have been detected in groundwater at EMFR through the 2013 season (IDEQ, 2014d). Based on these monitoring results, the operation of BCR and EMFR has prevented the release of contaminants to surface water, groundwater, or air in concentrations that would exceed state and/or federal standards, and these repositories are functioning as intended. LBCR is operational, and continued monitoring will be conducted to ensure the protectiveness of the remedy.

In addition to the two repositories, the East Fork Ninemile (EFNM) Waste Consolidation Area (WCA), which is located in the upper reach of the EFNM Creek Watershed, was constructed approximately 250 feet above EFNM Creek outside of the alluvial valley and in an area that is relatively isolated from groundwater. The site provides a location for long-term consolidation of mine waste materials, including waste rock and tailings, from sites located throughout the Ninemile Creek Watershed. Mine wastes will be consolidated into the EFNM WCA to reduce metals loading into the watershed. Additional information on the EFNM WCA can be found in the Final Remedial Design Basis of Design Report (CDM Smith, 2013). The WCA was completed in 2014 and began receiving waste from the Interstate Callahan Rock Dump. It is expected to be operational for approximately 10 years and expanded to accommodate all the waste from cleanup in EFNM.

5.3.1.4 Spokane River

The remedies implemented at the Spokane River recreational areas were certified as complete in September 2013 for the 10 Spokane River shoreline areas and are functioning as intended by the OU 3 ROD (USEPA, 2002a). Follow-up inspections and sampling indicate that the remedies are functioning as intended. Two exceedances above cleanup action levels (for lead) were found at

[2] The AWQC that apply to the Selected Remedy are a combination of State of Idaho AWQC and Site-specific AWQC developed by the State of Idaho for the SFCDR Watershed. For a COC for which a Site-specific AWQC exists, the Site-specific AWQC is the ARAR. For some COCs, Site-specific AWQC were not developed and, in these cases, the AWQC used are the State of Idaho AWQC. The Site-specific AWQC were proposed by the State of Idaho and approved by USEPA as protective of ecological receptors in the SFCDR.

the Island Complex in 2013. Additional monitoring will be completed as part of O&M activities by Ecology before the next Five Year Review. Based on sampling results, Ecology in coordination with USEPA, will determine if additional cleanup is warranted.

5.3.1.5 Clean Waterfowl Habitat

The East Field agriculture-to-wetland conversion is functioning as intended by the decision documents. The East Field remedy was fully implemented in 2008, and to date, has achieved the RAOs. Basin Environmental Monitoring Plan biological resource monitoring conducted in 2014 indicated significantly higher waterfowl use than in previous years. A 20-fold increase in tundra swan abundance was observed in 2014 compared to the 2008–2013 average. Additionally, there was a 99 percent reduction in tundra swan moralities. (USFWS, 2010)

The West Field remedy was completed in 2011; however, poor establishment and growth of vegetation required additional soil treatments for site restoration. Further monitoring will be required to determine whether an increase in waterfowl abundance and frequency of the West Field occurs because of continued restoration activities and site operations by the Natural Resource Trustees.

5.3.2 Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and RAOs Used at the Time of Remedy Selection Still Valid?

The exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of remedy selection remain valid. Since the HHRA was completed, minor changes in the reference doses for several chemicals of potential concern have been adopted and no modifications to the cancer slope factors were found in USEPA's Integrated Risk Information System. The changes either decreased risk or would not effectively change risk and would not result in re-evaluation of the cleanup levels for the protection of human health. Promulgated standards affecting the protectiveness of the OU 3 Selected Remedy have remained unchanged.

As discussed in Section 3.3, new information is available on soil and house dust bioavailability and estimated baseline soil/dust ingestion rates. Findings from the recent Regional Applied Research Effort study affect the assumptions used at the time of remedy selection, but do not affect the protectiveness of the remedy based on 10 µg/dL as the blood lead reference value. Since the last Five-Year Review, CDC has recognized that adverse health effects occur even with low lead levels in the blood, and in 2012 began utilizing a reference value of 5 µg/dL (CDC, 2012). In response to this recommendation, PHD lowered the LHIP follow-up criterion to 5 µg/dL in 2012. USEPA is currently considering this CDC recommendation and its implications for current lead health risk management policies at Superfund sites at the national level. USEPA will continue to evaluate the protectiveness of the remedy in future Five-Year Reviews taking into account any changes to the Superfund lead health risk management policies.

5.3.3 Has Any Other Information Come to Light that could call into question the Protectiveness of the Remedy?

The Trail of the Coeur d'Alenes and the natural beauty of the river and mountains attract numerous outdoor enthusiasts to the Silver Valley and Coeur d'Alene River. Land use along the banks of the Coeur d'Alene River has continued to change in recent years. Property owners are establishing private campgrounds on which multiple users set up seasonal campsites.

Significant portions of these properties are in the floodplain, which is likely presently contaminated with lead and other metals and may be recontaminated during flood events. The HHRA identified certain exposures that cause potentially significant incremental risk to children and pregnant women, including recreational activities at upland parks, public beaches, and neighborhood streams and activities that cause contact with waste piles. Observations from blood lead monitoring follow-ups conducted as part of the LHIP have indicated that in some Basin children excess absorption is associated with recreational activities in the river or lateral lake areas. Many formal recreational areas with contaminated soils and sediment exist, although signage has been placed to alert recreationalists to the hazards associated with the Site, and surfaces have been hardened at boat launches along the river. Recreational exposures outside the Trail of the Coeur d'Alenes and its oases appear to be increasing as indicated by new, informal pedestrian paths leading down the riverbank to the SFCDR and Coeur d'Alene River in various locations. This unauthorized access may result in minor barrier erosion and increased risk of exposure to trail users; however, the *Response Action Maintenance Plan* (Coeur d'Alene Tribe et al., 2008) helps to ensure that such issues are addressed as part of regular maintenance activities conducted by UPRR, with oversight conducted by IDEQ and the Coeur d'Alene Tribe. PHD has also observed several informal, undeveloped (or impromptu) sites where children created access on the banks or swimming holes in the channel of the SFCDR and Coeur d'Alene River. In 2015, a recreation sites working group was established consisting of IDEQ, PHD, and USEPA staff to evaluated options for reducing exposure to lead and other heavy metals at a range of recreation sites in Upper and Lower Basin areas.

Potentially contaminated soils exist on properties where homeowners have refused sampling or remediation. In addition, discrete remediation has left large areas in OU 3 with soil lead concentrations ranging from 100 to 999 mg/kg. Soils with lead levels between 700 and 999 mg/kg receive a one-time surface enhancement (e.g., sod, stepping stones) that if not maintained also becomes a possible source of lead exposure. In combination with current interior dust lead concentrations, homes with soils in the 700 to 999 mg/kg range do not meet current USEPA risk goals. Protectiveness of the remedy relies on completing property remediation and long-term maintenance, as well as controlling tracking of contaminated soils and sediments from source sites into the home environment.

5.4 Summary of OU 3 Issues, Recommendations, and Follow-Up Actions

Issues, recommendations, and follow-up actions that were identified during this fourth, or previous, Five-Year Reviews and affect protectiveness are summarized in Table 5-16. Action items that were identified during this fourth Five-Year Review and *do not* affect protectiveness, but are expected to require future action, are summarized in Table 5-17. These recommendations are summarized herein to allow USEPA to track this information, as suggested by Five-Year Review guidance (USEPA, 2001)

TABLE 5-16
OU 3 Summary of Issues and Recommendations
2015 Five-Year Review, Bunker Hill Superfund Site

Remedial Action (e.g. Human Health Barriers, ICP)	Issue	Recommendations	Party Responsible	Oversight Agency	Planned Completion Date	Affects Protectiveness? (Y/N)	
						Current	Future
LHIP	House dust monitoring currently only occurs every other year while remediation is ongoing. Therefore, other strategies are needed to help identify at-risk children annually.	Consider additional alternative approaches to the 2002 OU 3 ROD's dust intervention protocol to identify at-risk children.	IDEQ, PHD, USEPA	IDEQ, USEPA	March 2016	N	Y
Basin Recreation Sites	There are numerous contaminated sites used for recreation throughout the Basin that span the spectrum from informally used to fairly highly developed. These sites don't fit into established cleanup programs such as the BPRP. Many have recontamination potential from recurring flood deposition.	Identify and evaluate Basin recreational sites for possible exposure reduction or educational outreach measures. Identify and evaluate cost effective exposure reduction and educational outreach measures (where appropriate) geared towards various types of recreational sites.	IDEQ, PHD, USEPA	IDEQ, USEPA	March 2019	Y	Y

TABLE 5-17
OU 3 Action Items that Do Not Affect Remedy Protectiveness
2015 Five-Year Review, Bunker Hill Superfund Site

Remedial Action (e.g., Human Health Barriers, ICP)	Action Item	Responsible Party	Oversight Agency
Human Health Barriers	Develop an approach (or program) that defines how barrier integrity for all remediated properties would be monitored over time. Repeated in OU 1.	IDEQ, PHD, USEPA	IDEQ, USEPA
Human Health	Determine whether a community-wide soil lead level is needed for the Basin. If so, determine what the appropriate level is and how it would be used. If deemed necessary, the level would be calculated once the BPRP is completed.	IDEQ, USEPA	IDEQ, USEPA
LHIP	Continue to evaluate options for increasing participation in the annual blood lead screening program. Repeated in OU 1.	IDEQ, PHD, USEPA	IDEQ
ICP and waste disposal	Regarding a long-term disposal need from ICP, establish process with community planners to identify timing and quantity of waste soils to be hauled to repositories from ICP-regulated activities.	IDEQ, PHD, USEPA	IDEQ, USEPA
Waste disposal from various remedial actions	Regarding long-term disposal need from remedial actions, establish process with remedial design teams and long-term planners to identify waste quantities and timing associated with remedial actions.	IDEQ, PHD, USEPA	IDEQ, USEPA
Waste disposal from various remedial actions	Continue search and evaluation of potential new repository sites, as needed.	IDEQ, PHD, USEPA	IDEQ, USEPA
Trail of the Coeur d'Alenes	Develop management and use strategies to prevent further unauthorized uses of the Trail of the Coeur d'Alenes, which increase the risk of exposure to trail users.	IDEQ, PHD, IDPR, Coeur d'Alene Tribe, UPRR	IDEQ, USEPA
Trail of the Coeur d'Alenes	Continue to monitor the slow moving slope next to the trail between Latour Creek and Cataldo and work with adjacent private landowners. The clay soil is moving at a slow rate, and trees located on private property continue to fall across the trail. Monitor trees near the trail as they help to stabilize the slope.	IDEQ, PHD, IDPR, Coeur d'Alene Tribe, UPRR	IDEQ, USEPA
Clean Waterfowl Habitat	Transfer the easement interest in the ag-to-wetland pilot project to the State of Idaho. The State will accept the transfer, without cost to Idaho, to a third-party conservation organization (Ducks Unlimited, Inc.)	IDEQ, USEPA	IDEQ, USEPA
Fish Consumption in Lower Basin (Chain of Lakes)	Planning for collection of additional fish samples within the waterbodies of the Lower Basin is underway. The sampling program will follow the fish advisory guidelines from USEPA (USEPA 1994b, 1995a, 1996c, and 1999b) as implemented by the Idaho Fish Consumption Advisory Project (IFCAP). The goal of the IFCAP is to protect the public from adverse health risks associated with consuming contaminated fish from Idaho and Tribal waters.	IDHW, IDFG, Coeur d'Alene Tribe	IDEQ, USEPA

5.5 Performance Evaluation of the OU 3 Remedy

The remedy included in the 2002 OU 3 ROD and subsequent 2012 Upper Basin ROD Amendment is an interim remedy. The interim remedy is not expected to be completely protective of the human health and the environment when fully implemented because additional actions will be needed to protect human and environmental resources fully.

In the interim, most exposure pathways that could result in unacceptable risks are being controlled or addressed in locations where remedial work has been completed. There are some locations where interior house dust lead concentrations remain high. Monitoring of these areas will continue in order to determine whether these levels decrease as anticipated as exterior cleanup actions progress toward completion.

Although the human health selected remedy has not been fully implemented, the remedy is functioning as intended by the OU 3 ROD and Upper Basin ROD Amendment where it has been implemented. Community mean soil lead concentrations are near or below 200 mg/kg lead for all geographic areas as of 2014. Geometric mean dust lead concentrations in all sampled Basin communities were below 500 mg/kg in 2013. To date, a total of 3,603 properties have been remediated, 734 of which were considered high risk at the time of sampling or remediation, and nearly 820,000 cy of contaminated soil have been removed and placed in designated repositories. Substantial reductions have occurred in community mean soil lead concentrations since the large-scale property remediation began in 2002. Overall trends show reductions in interior dust and lead concentrations and loading rates, but there are still residences where interior lead levels remain high (greater than 1,000 mg/kg). House dust sampling will continue in OU 3 to monitor dust trends in homes as remedial actions continue. This sampling effort will aid in determining whether overall interior dust trends continue to decline in Basin communities and whether the occurrences of residences with high lead levels decline in response to the remedial actions implemented. Blood-lead screening will continue to be offered annually to identify at-risk children and provide feedback on the effectiveness of cleanup efforts.

Sediment contaminated by mine waste continues to be transported throughout the SFCDR, including some of its tributaries, and the mainstem of the Coeur d'Alene River. Exposure to these contaminated sediments poses health risks to people recreating in the Lower Basin as well as waterfowl in the Lower Basin. Because of the significant recontamination potential in the Lower Basin due to flooding and other issues, USEPA is conducting studies to evaluate Lower Basin contaminated sediment transport issues prior to making or implementing additional remedy decisions in the Lower Basin. The focus of USEPA's ongoing work in the Lower Basin is to fill data gaps and to refine the ECSM (CH2M HILL, 2010), including sediment transport modeling that will help guide effective decision-making regarding future remedial actions in the Lower Basin.

In addition to cleanup work in the residential and community areas of OU 3, remedial work has also been completed at a number of mine and mill sites in the Upper Basin as well as at recreational sites along the Coeur d'Alene and Spokane Rivers. These remedial actions were undertaken primarily to reduce human exposures to site contaminants from people accessing mine and mill sites for recreational purposes (all-terrain-vehicle and motorcycle riding) and those camping or accessing the rivers on or through contaminated areas.

The remedial actions at the mine and mill sites have included barriers or deterrents to all-terrain vehicle and motorcycle use, which have reduced exposures and are functioning as designed. Although the remedial actions at the mine and mill sites were undertaken primarily to reduce human exposures, the work performed is also expected to provide some ecological benefits, though it is too early to determine such effects through monitoring activities. Remedies at mine and mill sites in the Upper Basin are functioning as intended.

Remedial work at the recreational sites along the Coeur d'Alene River have largely involved grading and capping contaminated materials, installation of site access controls, and stabilization of adjacent eroded riverbank. Remedial actions at the Spokane River sites have involved a combination of removing contaminated materials, capping, and installing deterrents to recreational users. In general, the remedies constructed at recreational sites along both the Coeur d'Alene and Spokane Rivers are functioning as designed.

Three repositories and a waste consolidation area in Ninemile Creek have been designed, constructed, and operated pursuant to the 2002 OU 3 ROD to safely contain waste material and prevent the release of contaminants to surface water, groundwater, or air in concentrations that would exceed state and/or federal standards. Based on monitoring results in the last 5 years, the operation of these repositories has prevented the release of contaminants to surface water, groundwater, or air in concentrations that would exceed state and/or federal standards, and these repositories are functioning as intended.

The clean waterfowl habitat pilot study project establishing nearly 400 acres of clean feeding habitat for migratory and resident swans, ducks, and other wetland bird species was completed in the Lower Basin. The overall intent of this action is to provide clean waterfowl feeding habitat to reduce their exposure to lead-contaminated sediment. The East Field was completed in 2007; it is functioning as intended by the ROD. The West Field was completed in 2011, but required additional work to establish vegetation suitable for waterfowl habitat. Sustained increased waterfowl usage in both fields remains an objective. Continued restoration activities coupled with water level management at the site may lead to the desired increase. Continued monitoring of waterfowl usage will be important in the determination of that success. The remedy provides clean waterfowl feeding habitat as intended but increased usage by swans and some other species is desired.

The Trail of the Coeur d'Alenes was created by a CERCLA-negotiated settlement with UPRR. The goals of this response action were to contain mine-waste-related contamination within the ROW in a manner that was protective of human health and the environment and in compliance with ARARs. Numerous entities routinely assess and inspect the functionality of the trail as both a recreational facility and a protective barrier. The installed barriers are being maintained by UPRR; they are functioning as designed. IDPR is closely monitoring the adequacy of the settlement cash-out they received to manage the Trail of the Coeur d'Alenes. Incurred costs to date have exceeded the revenues generated from interest earned on the principal plus encroachment and other special use fees, resulting in the utilization of base funds.

The OU 3 remedy is currently protective of human health and the environment in areas where remedial actions have been completed. However, continued maintenance of the clean barriers to underlying contamination is essential to ensure long-term protectiveness of the remedy. In addition, continued funding and state and local support of the ICP is necessary to ensure barrier maintenance occurs in the long term.

6 Statement of Protectiveness

6.1 Operable Unit 1

The remedy at OU 1 is expected to be protective of human health and the environment upon completion. In the interim, where remedial activities have been completed to date, they have adequately addressed all exposure pathways that could result in unacceptable risks in these areas.

Although the selected remedy has not been fully implemented, it is nearly complete and data indicate that the remedy is functioning as intended by the 1991 OU 1 ROD (USEPA, 1991). As remediation nears completion, soil and house dust lead concentrations have declined, lead intake rates have been substantially reduced, blood lead levels have achieved their RAOs, and the ICP has been established and is operating. Continued operation of a robust ICP is essential to the long-term performance of the installed human health barriers. House dust lead levels have declined to below the 500 mg/kg site-wide average RAO. However, further evaluation is necessary to inform ongoing implementation of the interior cleaning remedy.

Private groundwater wells used for drinking were closed during the years that yard soil remedial actions were ongoing. Owners of 13 wells that exceeded federal drinking water standards refused closure. None of these 13 wells was used for drinking water purposes at the time; however, the current potable or nonpotable status of 13 wells whose owners refused closure is currently unknown.

6.2 Operable Unit 2

The remedy at OU 2 is expected to be protective of human health and the environment upon completion. In the interim, where remedial activities have been completed to date, they have adequately addressed all exposure pathways that could result in unacceptable risks in these areas.

Implementation of Phase I of remedy as selected in the 1992 ROD, ROD Amendments (1996, 2001, and 2012), and ESDs (1996 and 1998) includes extensive source removal and stabilization efforts, demolition activities, development and implementation of the ICP, land use development support, and public health response actions. Phase I includes monitoring and evaluation of the success of source control efforts. Interim control and treatment of contaminated water and AMD were also included in Phase I of remedy implementation.

Phase I remedies have removed and consolidated over 2.8 million cy of contaminated waste onsite in engineered closure areas (the Smelter and CIA closures; see Section 4, Table 4-1). The use of geomembrane cover systems on these closure areas effectively removes these contaminated wastes from direct contact by humans and biological receptors. Consolidating these wastes in engineered closures also substantially reduces the exposure pathway to the surface water and groundwater environment in comparison to pre-remediation Site conditions.

Over 800 acres of property within OU 2 have been capped to eliminate direct contact with residual contamination that remains in place within some areas of OU 2. In addition, the revegetation work conducted as part of the Phase I remedial actions has substantially controlled erosion and has significantly improved the visual aesthetics of OU 2. The success of the Phase I revegetation efforts is providing improved habitat for wildlife that was largely absent for decades in many areas of the hillsides and Smelterville Flats.

All of these efforts have reduced or eliminated the potential for humans to have direct contact with soil/source contaminants, have reduced opportunities for transport of contaminants by surface water and air, and are expected to provide surface and groundwater quality improvements over time throughout the Site. Responsibility for O&M of OU 2 Phase I remedial actions has been transferred to the State of Idaho upon completion of the remedies.

6.3 Operable Unit 3

The remedy at OU 3 is expected to be protective of human health and the environment upon completion. In the interim, where remedial activities have been completed to date, they have adequately addressed exposure pathways that could result in unacceptable risks in these areas. However, the ecological remedy included in the OU 3 ROD (USEPA, 2002a) and ROD Amendment (USEPA, 2012a) is an interim remedy and therefore a final remedy will need to be selected to fully address groundwater and surface water contamination. Implementation of cleanup activities is presented in the Superfund Cleanup Implementation Plan (USEPA, 2013). Although the Implementation Plan focuses on cleanup actions selected in the ROD Amendment, it also identifies additional actions identified in other decision documents and additional studies that EPA plans to conduct at the site, including the Lower Basin. EPA continues to pursue data collection efforts in the Lower Basin to support the evaluation of remedial alternatives for subsequent decision documents.

The Selected Remedy is designed to provide significant improvements to soil, sediments, surface water, and groundwater, and to greatly reduce the risks posed to human health and the environment within the Upper and Lower Basin. It is also expected to reduce the movement of contaminated sediments downstream in the Lower Basin.

Although the remedial action in Basin residential and community areas has not been fully implemented, environmental data indicate that the remedy is, in general, functioning as intended by the 2002 OU 3 ROD. As property remediation progresses, soil and house dust lead concentrations are declining, lead intake rates have been substantially reduced, and blood lead levels have declined to levels that meet the RAOs. The low level of participation in the annual Basin blood lead monitoring program remains a concern because it limits the identification of children who might benefit from intervention.

In addition to cleanup work in the residential and community areas of OU 3, remedial work has also been completed at a number of mine and mill sites in the Upper Basin as well as at recreational sites along the Coeur d'Alene and Spokane rivers. In addition to consolidating mine waste to reduce contaminant loading to surface water and groundwater, the remedial actions at the mine and mill sites have included barriers or deterrents to all-terrain vehicle and motorcycle use, which have reduced exposures and are functioning as designed.

Remedial work at the recreational sites along the Coeur d'Alene River have largely involved grading and capping contaminated materials, installation of site access controls, and stabilization of adjacent eroded riverbank. Remedial actions at the Spokane River sites have involved a combination of removing contaminated materials, capping, and installing deterrents to recreational users. The remedies constructed at recreational sites along both the Coeur d'Alene and Spokane Rivers are, in general, functioning as designed. A number of additional privately owned recreational sites and informal, undeveloped sites have been identified that may present a heavy metal exposure risk to recreationalists.

Three repositories have been designed, constructed, and operated pursuant to the 2002 OU 3 ROD to safely contain waste material and prevent the release of contaminants to surface water, groundwater, or air in concentrations that would exceed state and/or federal standards. Based on monitoring results in the last 5 years, the operation of these repositories has prevented the release of contaminants to surface water, groundwater, or air in concentrations that would exceed state and/or federal standards.

In addition to the three repositories, the EFNM WCA, which is located in the upper reach of the EFNM Creek Watershed, was constructed approximately 250 feet above EFNM Creek outside of the alluvial valley and in an area that is relatively isolated from groundwater. The WCA was completed in 2014 and began receiving waste from the Interstate Callahan Rock Dump. It is expected to be operational for approximately 10 years and expanded to accommodate all the waste from cleanup in EFNM.

USEPA, working with the USFWS and Ducks Unlimited, completed a cleanup and pilot study project establishing nearly 400 acres of clean feeding habitat for migratory and resident swans, ducks, and other wetland bird species in the Lower Basin. The agriculture to wetland conversion project has demonstrated high water fowl usage on the East Field and an increasing activity in the West Field as a result of restoration activities conducted by the Natural Resource Trustees.

The 2002 OU 3 ROD did not identify any remedial actions for Coeur d'Alene Lake, where large quantities of contaminated mining wastes have been deposited in lakebed sediments. The ROD indicated that a management plan for the lake would be developed by the State of Idaho and the Coeur d'Alene Tribe, with input from local, other state, and federal agencies to focus on controlling riverine inputs of metals and nutrients that continue to contribute to contamination of the Lake and Spokane River. An important milestone was achieved in March 2009 when the State of Idaho and the Coeur d'Alene Tribe completed a significant revision to the Lake Management Plan (LMP; IDEQ and Coeur d'Alene Tribe, 2009). Implementation of initial LMP actions has begun and lake monitoring efforts are underway.

7 Next Five-Year Review

The CERCLA Section 121(c) requires the USEPA to perform a review of remedial actions that result in hazardous substances, pollutants, or contaminants remaining at the Bunker Hill Superfund Site at least every 5 years. The purpose of the review is to determine whether the remedial actions, upon implementation, are protective of human health and the environment. The trigger date for completion of these reviews is 5 years after initiation of the first remedial action at the Site. The first remedial action at the Site started in 1995. Because onsite containment of hazardous substances is part of the Site's Selected Remedy, the first Five-Year Review was completed on September 27, 2000. The second Five-Year Review was completed on October 24, 2005. The third Five-Year Review was completed on November 18, 2010.

The next review (the fifth Five-Year Review) of the Bunker Hill Superfund Site will be conducted within 5 years of the completion date of this fourth Five-Year Review Report. The fifth Five-Year Review Report will cover all remedial work, monitoring, and O&M activities conducted at the Site. In addition, as stated in the 2002 OU 3 ROD, USEPA will continue to evaluate implementation of the *Coeur d'Alene Lake Management Plan* (IDEQ and Coeur d'Alene Tribe, 2009) in the next and future Five-Year Reviews to help determine whether CERCLA remedial actions in the lake are necessary to protect human health and the environment.

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Appendix A
Coeur d'Alene Lake Management Plan

Introduction

Although Coeur d'Alene Lake is within the Bunker Hill Mining and Metallurgical Complex Superfund Site (Bunker Hill Superfund Site), remedial actions for the lake were not selected in the 2002 Interim Record of Decision (ROD). The U.S. Environmental Protection Agency (USEPA) deferred a decision on whether to select remedial actions for the lake pending the development and effective implementation of a revised Coeur d'Alene Lake Management Plan (LMP), which was to be a revision of the 1996 LMP. USEPA concluded that "…an effective LMP created outside of the CERCLA defined process, using separate regulatory authorities, would reduce riverine inputs of nutrients and metals that continue to contribute to contamination of the lake and the Spokane River" (Idaho Department of Environmental Quality [IDEQ] and Coeur d'Alene Tribe, 2009). The ROD also addressed the possibility of future actions. One effect of USEPA's decision was to limit its use of funds from the Superfund accounts created under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) to address mining related water quality conditions in the lake.

The Coeur d'Alene Tribe (Tribe) and the Idaho Department of Environmental Quality (IDEQ) share responsibility for water quality in Coeur d'Alene Lake under Clean Water Act (CWA) authority. The Tribe and IDEQ collaboratively developed the 2009 LMP with the goal "to protect and improve lake water quality by limiting Basin-wide nutrient inputs that impair lake water quality conditions, which in turn influence the solubility of mining-related metals contamination contained in lake sediments" (IDEQ and Coeur d'Alene Tribe, 2009) USEPA assisted the Tribe and IDEQ by convening and participating in an Alternative Dispute Resolution (ADR) process. USEPA includes lake management in its regular Five-Year Reviews of ROD implementation progress, most recently in 2010. However, the 2009 LMP was not far enough along to draw any conclusions at that time.

The LMP identifies objectives and strategies to accomplish the overall goal through ongoing science, coordination with Coeur d'Alene River Basin (Basin) stakeholders, public outreach and education, project implementation, and identification of potential funding sources. The status of each of the objectives outlined in the LMP is summarized in the following section.

Status of Lake Management Plan Objectives

LMP Objective 1 – Improve Scientific Understanding of Lake Conditions through Monitoring, Modeling, and Special Studies

The LMP highlights the need for an ongoing science program to understand water quality trends better and to ensure management actions are efficient and effective. Monitoring, modeling, and special studies are identified as strategies to achieve this objective. Progress in these arenas is summarized in the following sections.

Monitoring

The LMP calls for consistent descriptions of water quality conditions from various sources. This was identified during the ADR that IDEQ and the Tribe participated in to develop the LMP. This section provides an update of Section 2.2 of the LMP based on monitoring conducted by the Tribe and IDEQ (Lake Management Team or the Team).

Water quality data collected during 2008 to 2012 have been analyzed, with the following key findings. All of the following findings are based on annual averages. There can be significant seasonal deviations at specific locations throughout the lake. These variations will be addressed in the subsequent synthesis.

- The data show a trend of increasing concentrations in the northern lake of total phosphorus concentrations. Concentrations in the southern lake do not show a trend between the dataset from 2003 to 2007 and the current dataset, but levels are higher than those observed in 1991 to 1992 are.
- Microscopic algae (phytoplankton), as measured by chlorophyll *a*, has increased lake-wide since both the 1991 to 1992 dataset and the 2003 to 2007 dataset.
- Microscopic blue-green algae, as measured by the proportion of total bionumber, have increased since the 1991-1992 dataset. Small blooms of potentially toxin-producing blue-green algae have been observed at multiple locations within the lake during 2008 to 2012.
- Water clarity is greater now in the northern lake than it was in 1991 to 1992. There has been no significant change since 2003 to 2007.
- Dissolved oxygen approaches zero in deeper (hypolimnetic) waters in the southern lake in summer months. This is consistent with patterns observed in 1975, 1991 to 1992, and 2003 to 2007. Dissolved oxygen in deeper waters of the northern lake typically stays above 6 milligrams per liter (mg/L). However, the current dataset shows levels dropping below this level at times during summer months in the northern end of the lake.
- Dissolved zinc concentrations have steadily declined within upper waters of the lake, but continue to exceed water quality standards consistently.
- Dissolved lead concentrations are higher than was observed in 2003 to 2007. However, total (suspended) lead concentrations are lower than was observed in 1991 to 1992 at all locations except the University Point monitoring site. Dissolved lead concentrations exceed water quality standards during peak runoff months.
- Dissolved cadmium concentrations have not changed significantly since 2003 to 2007.
- Lakebed sediments remain contaminated with antimony, arsenic, cadmium, zinc, lead, copper, silver, and mercury in much of the lake.
- Eurasian watermilfoil is established in the southern portion of the lake and has been identified in shallow northern bays.

Based on current review of the available data, changes in a number of parameters have occurred over time. It appears that there is a measured increase in phosphorus and microscopic algae, which indicates a trend away from the state desired. This change warrants further investigation to identify causes and help identify possible management solutions.

Overall, the data show that total metals concentrations are either stable or have generally declined since the early 1990s. Except for total lead, the trends are continual. Trends in total metals (based on annual averages) are summarized in the following list.

1. Total zinc levels have declined by approximately 40 percent since the early 1990s across all sections of the lake. Relative to 1991 to 1992, these declines are significant to within 95 percent confidence.
2. Total cadmium levels are generally unchanged. However, in the northern pelagic zone, total cadmium may have declined by around 5 percent since 2003 to 2007. This apparent decline in the northern pelagic zone is significant to within 90 percent confidence.
3. Total lead levels in the northern and southern pelagic zones are variable, but have declined by approximately 30 to 40 percent since the 1990s. Total lead levels in the central pelagic are equivalent to their 1990s level. All observed declines relative to 1991 to 1992 are significant to within 95 percent confidence.

Long-term Trends for Dissolved Metals

The dissolved metals dataset is less complete than that for total metals. However, the trends are comparable for the period for which data are available. Overall, these data show that dissolved zinc levels declined since 2003 to 2007 and that dissolved cadmium levels have remained unchanged. Dissolved lead levels are higher than in 2003 to 2007 at all sampling locations. Idaho Water Quality Standards are based upon dissolved fraction of metals and the state has adopted site-specific criteria for certain dissolved metals on portions of the SFCDA River. The Lake Management Plan developed "Triggers" for a variety of chemical and biological criteria, which is referenced below. Trends in dissolved metals (based on annual averages) are summarized in the following list.

1. Dissolved zinc levels have declined by 5 to 10 percent since the mid-2000s across all regions of the lake. These declines are significant to within 95 percent confidence in the main lake (pelagic) and to within 80 percent confidence within the northern bays (littoral).
2. Dissolved cadmium levels are unchanged across all regions of the lake.
3. Dissolved lead levels have increased in the northern lake between 2003 to 2007 and 2008 to 2012. These increases are significant to within 95 percent confidence in the northern bays (littoral) and to within 85 percent confidence within the main lake (pelagic). Note that this increase has only had a minimal impact on the frequency of trigger exceedance.
4. The dissolved lead trigger is intermittently exceeded in the southern pelagic region of the lake.
5. Dissolved zinc trigger criteria are continuously exceeded in the northern and central regions of the lake, but intermittently exceeded in the southern lake.

6. Dissolved cadmium and lead triggers are intermittently exceeded in the northern and central regions of the lake, but not exceeded in the southern lake.

7. Trigger exceedances are most common in the central lake, closest to the Coeur d'Alene River.

Long-term Trends for Dissolved Oxygen

Long-term trends in hypolimnetic dissolved oxygen vary according to water depth and location within the lake. Dissolved oxygen levels are lowest in the southern lake with anoxic conditions at the most southern site during summer months. However, annual minimum values do not show a clear long-term trend since the early 1990s. Summer dissolved oxygen levels are higher in the northern lake, but have declined since the early 1990s. These trends (based on annual averages) are summarized in the following list.

1. Minimum summer oxygen levels are lower than they were in the early 1990s in the northern and central pelagic zones, but are stable in the shallower regions of the southern pelagic zone. Minimum oxygen levels are unchanged in the northern bays and southern littoral zone.

2. Average summer oxygen levels in the overall hypolimnion are unchanged since the 1990s.

3. Average summer oxygen levels in the deepest portions of the hypolimnion that are more sensitive to the lake's internal oxygen dynamics are lower than in the early 1990s in the northern and central pelagic zones. This trend is larger and more continuous in the northern pelagic zone than in the central pelagic zone.

4. Trigger exceedances are most common in the southern lake, where minimum summer oxygen levels are consistently less than 4.0 mg/L and drop to 0 mg/L in the southern littoral zone.

Long-term Trends for Trophic State Indicators

Phosphorus and chlorophyll *a* levels in the lake are increasing at all sampling locations. Water clarity is generally greater than was observed in the early 1990s. Though the northern portion of the lake is generally within the parameters of the preferred oligotrophic state (i.e., reduced productivity, higher oxygen, clearer waters), these data suggest the lake is trending away from this state. The southern portion of the lake has been mesotrophic since monitoring in 2003 began. These trends (based on annual averages) are summarized in the following list.

1. Total phosphorus levels have increased by about 1.5 to 2.5 times since the early 1990s across all lake regions. This trend is consistent across the entire lake.

2. Maximum chlorophyll *a* values have increased by approximately 3 to 5 times since the early 1990s across all lake regions. This trend is consistent across the entire lake.

3. Geomean chlorophyll *a* values have increased by around 1.5 to 2.5 times since the early 1990s across all lake regions. This trend is consistent across the entire lake.

4. Water clarity has improved by approximately 15 percent since the early 1990s in the northern lake.

Note that water clarity measures do stand in contrast to the other trophic state indicators, and indicate that the lake's aesthetics have improved since the early 1990s. However, this observation should be tempered by two factors:

- Water clarity is impacted by both sediment loading and phytoplankton productivity.
- This parameter is limited to the summer months when nutrient and chlorophyll *a* levels in the lake are at their lowest.

Consequently, this clarity measure may reflect changes in sediment loading rather than lake productivity and oxygen dynamics.

Long-term Trends for Biologic Indicators

Cyanobacteria are becoming more prevalent and Eurasian watermilfoil appears to be spreading northward. Nitrogen to phosphorus ratio (TN:TP) data indicate that the lake is becoming more nitrogen limited which could favor higher production of nitrogen-fixing cyanobacteria. The technical literature suggests that the lake can be considered nitrogen-limiting if the TN/TP ratio drops below 10. Such a condition would significantly increase the risk of blue-green algae blooms. The bioindicator data indicate that cyanobacteria are becoming more prevalent and that Eurasian watermilfoil appears to be spreading northward. Blooms of potentially toxin-producing cyanobacteria have also been observed, though they appear to be sporadic. Blooms that are more regular may occur in isolated bays, but current data are insufficient to assess this possibility. These trends in biologic indicators and their relation to the TN/TP ratio are summarized in the following list.

1. Since the early 1990s, cyanobacteria prevalence has increased to the point where total cyanobacteria now consistently comprise around 35 to 40 percent of the phytoplankton population throughout the lake. They now appear to be co-dominant with diatoms and microflagellates.
2. Blooms of potentially toxin-producing cyanobacteria are common. These blooms were thought to be absent or rare in the early 1990s.
3. Nitrogen to phosphorus ratios are steadily decreasing in a manner that is consistent with the cyanobacteria trends. Total nitrogen to total phosphorus ratios at C5 (Blue Point) and C6 (Chatcolet) have dropped below 10 every year since 2004.

Modeling

The Estuary, Lake and Coastal Ocean Model - Computational Aquatic Ecosystem Dynamics Model (ELCOM-CAEDYM) was identified as a model that would be used by the LMP team to simulate Coeur d'Alene Lake system process, such as the following:

- Inflow loading of metals and nutrients and river plume flow through the lake;
- Sediment-water interactions;
- Primary production; and
- Organic matter cycling within the water column.

The model will enhance understanding of the complex dynamics of the lake system, and may produce predictive results based on future land use changes within the Basin.

ELCOM-CAEDYM has been consistently improved since the initial model validation by Dallimore et al. 2007 and Hipsey et al. 2007. The initial model validation relied on only one meteorological station mounted on a buoy at mid-lake. Since 2011, the Tribe and IDEQ have maintained four meteorological stations spanning the north/south axis of Coeur d'Alene Lake. Each station measures all meteorological variables in high temporal resolution required by ELCOM-CAEDYM. The initial model validation did not use any zooplankton, so five zooplankton groups were added, representing several trophic levels from predatory copepods and herbivorous cladocerans, to early life stages of copepods and rotifers that are important grazers on the microbial loop component of the lake's food web. A critical component of modeling Coeur d'Alene Lake is the inflow and outflow of water temperature and chemical constituents. The Tribe and IDEQ use the Basin Environmental Monitoring Plan (BEMP) water quality data and U.S. Geological Survey (USGS) discharge data to estimate daily loading and export of nutrients and metals in Coeur d'Alene Lake. The estimated daily loading and export time series are input into ELCOM-CAEDYM as boundary conditions.

Current emphasis on model calibration includes the following:

- Temperature sensitivity analysis and tuning the model to optimize model accuracy to predict the thermal structure of Coeur d'Alene Lake
- Calibrating the sediment diagenesis sub model in CAEDYM using parameters from past sediment geochemistry studies of Coeur d'Alene Lake and the lower Coeur d'Alene River

Very limited phytoplankton data were available to the University of Western Australia Center for Water Research team during the initial validation of ELCOM-CAEDYM to Coeur d'Alene Lake. The next step in model refinement will be using the large phytoplankton database that has been collected consistently from sites C1, C3, C4, C5, and C6 since 2007 to adjust phytoplankton parameters in CAEDYM.

Special Studies

The LMP identified a need to improve knowledge and understanding of internal nutrient cycling, metals release from sediments, food web toxicity, subsurface sewage systems impacts, and other factors. Since 2009, the Team has collected data on aquatic macrophytes, benthic macroinvertebrates, adjacent lakebed sediments, phytoplankton, picoplankton in bays, and metals concentrations in size classes of zooplankton. Collection of data for these special studies is a multi-year process. Analyses and reporting will be forthcoming once data collection is complete in 2015. The LMP also began collecting data on the impact of anoxia on metals, nutrients, and bioindicators at one site in the northern portion of the lake in 2013. Monitoring is ongoing.

LMP Objective 2 – Establish and Strengthen Partnerships to Maximize Benefits of Actions under Existing Regulatory Frameworks

The LMP relies on stakeholders to use existing tools and management actions to address sediment and nutrient inputs to Coeur d'Alene Lake. The Management Action Tables (MATs) included in the LMP document the jurisdictions of agencies, existing programs, best management practices, and regulations that influence water quality. These MATs have been used to coordinate partnerships in implementing the LMP. The MATs are currently undergoing an audit process to determine the extent to which actions identified in them are being implemented, evaluate the effectiveness of actions, identify items not being fully implemented, evaluate resources needed to accomplish actions, and assess the commitment to continuing actions identified (or develop new actions and strategies). The audit process is scheduled for completion in 2015.

The audit has preliminarily identified the following completed actions:

- Kootenai County Parks and Waterways – upgrades of waterfront restroom facilities at 14 sites around Coeur d'Alene Lake, replacement of six antiquated sewage pump-out stations on Coeur d'Alene Lake, and stormwater/erosion management improvements at two boat launch ramps
- Kootenai County Community Development – Kootenai County adopted an updated Comprehensive Plan since 2009. Subsequent efforts to revise land use code have resulted in an amended site disturbance ordinance. Efforts to establish a land use code that aligns with the comprehensive plan have been slowed by staff changes and changes in direction as new county commissioners determine how to move forward. There is ongoing debate around the protection of private property rights versus protection of shared public resources. Waterfront protection has been especially contentious.
- Coeur d'Alene Tribe – The Tribe received approval in 2014 from USEPA for its water quality standards.

The Team has been successful in utilizing partnerships to develop collaborative projects. An example includes partnerships with the City of Coeur d'Alene, the University of Idaho (UI), and the Panhandle Stormwater and Erosion Education Program (SEEP), to identify potential waterfront and stormwater demonstration projects that will serve to both improve water quality and provide community outreach opportunities to increase awareness of water quality impacts. The Team has developed a partnership with the Watershed Advisory Group (WAG) in tributaries to Coeur d'Alene Lake to work together on planning and implementation activities. The Team has also been successful in collaborating with stakeholders in Washington to address regional stormwater issues and further develop education and outreach opportunities. The Team works with county natural resource advisory groups and county commissioners to coordinate and exchange feedback on activities each entity is undertaking. This enhances efficiency in connecting potential related efforts.

LMP Objective 3 – Develop and Implement a Nutrient Reduction Action Plan

In order to identify the magnitude and locations of nutrient sources, and in order to develop priorities for addressing these sources in the Coeur d'Alene Lake Basin, the LMP identified development of a nutrient reduction action plan as a major objective. The strategy identified to develop the action plan included the following:

- Conducting a Basin-wide nutrient source inventory;
- Using the inventory to identify specific projects for implementation with management agencies and other partners; and

- Incorporating the total maximum daily load (TMDL) process under the CWA, as well as mitigation measures required by the Federal Energy Regulatory Commission (FERC) for relicensing of the Avista hydroelectric project into the plan.
- Progress has been made in each of these components towards compiling the action plan.

Nutrient Inventory Status

The LMP identified a 3-year Basin-wide nutrient source inventory as a major action item. Since adoption of the LMP, the Team identified existing nutrient source data (TMDLs and USGS BEMP data) in the Basin and identified major data gaps. The largest data gap included the St. Maries/St. Joe River Watershed. Subsequently, the Team conducted a 3-year nutrient source inventory in this watershed, which focused on identifying the largest sources of nutrients within its sub-watersheds. The resulting information is currently being used to help calibrate GIS-based calculations. These calculations will help estimate nutrient loading from areas where monitoring data are unavailable or incomplete, in order to help guide nutrient reduction implementation. The Team will also use this information to determine whether additional inventory work is needed in these other watersheds.

Nutrient Reduction Projects

The Team has worked with partners in the Basin to identify, plan, and fund on-the-ground nutrient and sediment reduction projects. In the Wolf Lodge Creek Watershed at the northeast end of the lake, the Team participated in the Coeur d'Alene Lake Tributaries WAG to plan watershed assessment activities, applied for funding to implement watershed assessment activities, and ultimately provided matching funds to implement bank stabilization activities on Wolf Lodge Creek. The Team has also collaborated with the WAG and IDEQ TMDL staff to apply for funding to develop a watershed-scale conceptual restoration plan. The Team recently learned that funding for this effort has been approved by USEPA.

The Team has worked with Avista Corporation to help focus wetland enhancement and bank stabilization mitigation efforts in the Basin. To date, approximately a mile of St. Joe River bank erosion has been stabilized, and approximately 5,000 linear feet of the Coeur d'Alene River has been stabilized using Avista funding. In addition, 124 acres of wetland enhancement along the St. Joe River has been implemented using Avista mitigation funding provided under their FERC license.

Other nutrient reduction activities include:

- Riverbank stabilization totaling 12.7 river miles in Kootenai and Shoshone Counties and 11.4 miles in Benewah County completed through partnerships between conservation districts, the Natural Resource Conservation Service, and private landowners
- Upgrades to, or replacement of, four wastewater treatment systems throughout the Basin
- Meetings with the St. Joe/St. Maries River WAG to discuss nutrient inventory results and potential future implementation projects

- Identification of erosion control and stormwater treatment project potentials with partners, including the City of Coeur d'Alene, UI, Worley Highway District, Kootenai-Shoshone Soil and Water Conservation District, and others
- Participation in the Panhandle SEEP

Nutrient Reduction Action Planning Timeline

Work on developing the action plan has been ongoing. The Team plans to finalize an approach for filling data gaps, through either GIS-based modeling and/or tributary monitoring, by the end of 2015. Coordination with USEPA on BEMP nutrient monitoring in the Coeur d'Alene Basin will have an influence on completion of the inventory effort. The Team has relied on BEMP data to characterize nutrients in the Coeur d'Alene River Watershed as well as loading from the mouths of the Coeur d'Alene and St. Joe Rivers and nutrient concentrations at the outflow to the Spokane River. Next steps will be completing the modeling, planning monitoring, compiling existing monitoring data, and placing this all in an action plan that can be shared with land management entities throughout the Basin and other stakeholders. The final plan is expected to be completed by the end of 2017, with project implementation activities ongoing.

LMP Objective 4 – Increase Public Awareness of Lake Conditions and Influences on Water Quality

The establishment of an education and outreach program to achieve Objective 4 has been one of the most successful components of the Team's work. Through informal presentations at community groups, working with K12 educators, development of educational materials and tools, and partnership with UI and regional nonprofits, the Team has increased awareness of the LMP's objectives. This has resulted in opportunities for community stewardship and protection of water quality. Progress on strategies outlined in the LMP, as well as additional outreach and education, is summarized in the following text.

Conduct a Public Education and Outreach Needs Assessment

As a first step towards building an education and outreach program, the State and Tribe contracted Robinson Research to conduct a needs assessment, which included a telephone survey, web survey, and focus groups. Three hundred telephone surveys were conducted. Of the survey participants, 87 percent were year-round residents, and average age was 61 years old. Respondents were surveyed about their opinions regarding Coeur d'Alene Lake water quality, what they regarded as the biggest threat to water quality, which agencies they saw as both trustworthy and having jurisdiction over water quality, and their agreement/disagreement with statements regarding various aspects of cleanup. Most respondents felt that Coeur d'Alene Lake water quality was above average. Only one in four respondents saw metals as the biggest threat to water quality. Conversely, most respondents saw invasive plants as the most serious threat. Respondents saw local and state entities as more trustworthy than federal agencies.

One weakness of the survey was the reliance on landlines, which may have skewed results towards an older audience, as a majority of young adults now uses only cell phones. Nevertheless, the needs assessment results helped identify gaps in information and understanding of Coeur d'Alene Lake water quality issues that have informed the development of the Team's educational and outreach strategy. The full report is available through the IDEQ Coeur d'Alene Regional Office or the Tribe's Lake Management Department – Hazardous Waste Management Program Office.

Lake Stewardship Center

The 2010 Needs Assessment found that there was little public support for the use of LMP funds to establish an independent water resource educational center. However, at the same time, UI–Coeur d'Alene (UI-CDA) invited the Team and other stakeholders to explore the possibility of a joint water center to be housed at their facility on the Spokane River. Since 2010, both the State and Tribe have worked with UI-CDA to establish educational priorities for the Community Water Resource Center (Center). The Center houses a new water quality extension program that provides training and volunteer opportunities for citizen water quality monitoring, laboratory facilities, and a resource library. The Idaho Water Resource Research Institute has also established a staff position at the center to work with the Team and other stakeholders to identify and procure resources for both research and education. Most recently, a National Science Foundation (NSF) Experimental Program to Stimulate Competitive Research (EPSCoR) grant has provided funding for a UI-CDA-based coordinator as part of their "Managing Idaho Landscapes for Ecosystem Services" program. The 5-year program is providing faculty resources for teacher workshops, public outreach, and research related to Basin water quality issues. The program has greatly strengthened the capacity of UI faculty to work in partnership with the Team. The compilation of a science and resource library at the Center has begun, but the bulk of work still needs to be completed.

Coordination with Schools and Youth Organizations

The Team has established partnerships with both formal and informal educators to provide water quality education around the Basin. For 4 years, the Team has been providing training and equipment to camp counselors at Camp Cross, a summer camp located on Loff's Bay, and the Girl Scout facility, Camp Four Echoes, on Windy Bay. The counselors are then able to integrate the material into their summer camp programming.

The Team leads classroom activities, such as the Enviroscape™ and zooplankton/foodweb activities, at a number of venues, including science education days at Ramsey and Fernan Elementary schools in Coeur d'Alene, the North Idaho GEAR-UP STEM (science, technology, engineering, and math) Expo, and the UI-coordinated Women in Science event. The Team has also collaborated with UI-CDA to host water quality field days for Hayden Meadows Elementary. Most recently, the Team has teamed up with UI and the Lands Council on the "Confluence Project," a unique project that provides graduate students who teach and coordinate field experiences for three local high schools, Post Falls, St. Maries and Lake City. The Team has presented an environmental history of the Basin to each of the schools for the last 2 years. In addition, the Team has coordinated and assisted on various field trips.

Tribal LMP staff is also in partnership with the UI College of Education NSF-funded, "Back to the Earth" project, a 4-year informal indigenous STEM project that engages Coeur d'Alene and Spokane Tribal youth ages 9 to 16 in exploring water quality in their homelands. The project has allowed LMP staff to participate in extensive professional development opportunities related to STEM and experiential learning.

Education and Outreach Services Plan including a Lake*A*Syst Program

In 2013, the Team completed the Coeur d'Alene Basin Lake*A*Syst (Lakeshore Assessment System) manual, a 12-chapter manual for Basin landowners that provides information on land management strategies that can reduce negative impacts on water quality. Each chapter provides risk assessment worksheets that can be used by the landowner to identify areas or practices of concern, as well as resource directories for local technical assistance providers. The manual is available in print, as well as on the LMP website, www.ourgem.org. The Team has conducted pilot workshops with homeowners in the Fernan Lake Watershed, a tributary of Coeur d'Alene Lake. Based on public feedback, the Team is making small revisions to the manual. The Team will begin more targeted outreach in 2015.

Additional Outreach

The Team revised and reprinted the "Our Gem" map in 2010 and 2014. This map, initially created with CWA funds through the Basin Environmental Improvement Project Commission (BEIPC), provides information on recreational access to Coeur d'Alene Lake, as well as specific best management practices related to the recreation community, such as aquatic invasive species management, wake erosion prevention, and boater regulations. The map has been a successful tool for outreach and is in wide demand at commercial and tourist venues around the region.

In 2014, the Team established the "Our Gem" website (www.ourgem.org), as a means to provide general background and information on the LMP. The website provides links to partners, maps, the LMP itself, as well as the Lake*A*Syst materials. The Team also maintains an active Facebook page (www.facebook.com/CdA.LMP) as an avenue for providing updates and information to the public.

The LMP staff have presented to numerous community groups, including, but not limited to the following:

- Coeur d'Alene and Hayden Rotary
- Kiwanis
- Coeur d'Alene Chamber of Commerce
- Coeur d'Alene Lakeshore Property Owners Association
- Leadership Coeur d'Alene
- Kootenai Environmental Alliance's "Lunch and Learn"
- Annual Osprey Cruise (a U.S. Bureau of Land Management and Coeur d'Alene Chamber of Commerce event)
- Kootenai County Planning and Zoning Technical Advisory Group
- Various bay homeowners' associations

LMP coordinators actively participate in, and are instructors for, the Panhandle SEEP, a certification course on best management practices for regional contractors, developers, and planners. The SEEP committee recently helped initiate the formation of a stormwater working group, currently identifying and developing broader outreach and demonstration projects in the Coeur d'Alene-Spokane region. This effort led to a partnership with the Spokane River Forum in hosting a "Stormwater Breakfast" in Spokane that engaged public policy makers and agency representatives in discussions about innovative approaches to regional stormwater management.

As a result of the stormwater partnership, LMP coordinators were able to collaborate again with the Spokane River Forum in planning and hosting a one-day, "Our Gem" Coeur d'Alene Lake Symposium for the Basin public, held in November 2014. The symposium included presentations on the value of Coeur d'Alene Lake, in both economic and social/cultural terms, by local and Tribal elected officials, USEPA and BEIPC staff, representatives of the business community, and homeowners. LMP staff provided updates on monitoring and overall LMP implementation. About 200 community members participated in both the presentations and afternoon "Community Café" sessions. LMP staff received enthusiastic feedback on the symposium, which also saw new partnerships with the Coeur d'Alene Chamber of Commerce; local engineering firms; and CDA Vision 2030, a new community organization that encompasses multiple stakeholders in a visioning project that includes goals of lake and river enhancement and protection. LMP staff plan to work with these partners to host a 2016 symposium.

LMP Objective 5 – Establish Funding Mechanisms to Support the LMP Goals, Objectives, and Strategies

Core program activities and related budget needs were identified in the LMP. Since its adoption, funding commitments were made by IDEQ and the Tribe to fund a limited level of staffing and operating expenses. However, neither government has been able to fund the LMP at the level identified in the plan. The State of Idaho has funded the State's side of LMP implementation at approximately $300,000 to $400,000 per year since adoption of the LMP. The Tribe has funded their side of LMP implementation at similar levels. Other funding sources include, or have included, the following:

- Laboratory support from USEPA's Manchester Lab for metals analyses in water samples from Coeur d'Alene Lake
- Avista mitigation funding for water quality monitoring (not to include any metals analyses)
- Avista mitigation funding for erosion control (administered by Avista with input from IDEQ and the Tribe)
- Avista mitigation funding for wetlands enhancement (administered by Avista with input from IDEQ and the Tribe, among others)
- CWA Section 319 funding for TMDL-related implementation projects

Securing funding for LMP implementation has proved to be challenging, which affects the ability of the Team to perform action items identified under Objectives 1 to 4. Challenges include the following:

- USEPA has asked that the Team reduce the support in the number of samples sent to the Manchester Lab due to funding constraints. They have also indicated they would eventually like to discontinue any lab support soon. This puts an additional $30,000 to $50,000 burden on the State of Idaho, and $20,000 for the Tribe to pick up analysis of the metals and hardness samples (in 2013 dollars). It will be critical to maintain support for lab analyses, at a minimum.

- The source the State of Idaho has utilized to fund the LMP is finite. The latest projections indicate this funding source is likely adequate to provide the current level of support through State Fiscal Year 2019 or 2020. Securing alternative, supplemental and, ultimately, permanent funding sources is a priority.
- The Tribe also relies on a finite source of funding from mining settlements to fund the LMP, and anticipates this funding being significantly drained over the next 3 to 5 years.
- The Tribe applied for funding from USEPA Environmental Justice grants, but was unsuccessful in its application (2013). Additionally, the Tribe has twice been invited to collaborate with UI for USEPA Environmental Education grants, but due to restrictions within USEPA's request for proposal that explicitly excluded tribal environmental agencies or governments from applying, was unable to apply for funding to support its outreach and education efforts (2014 and 2015).

Conclusions

Lake Management Plan Effectiveness

The LMP is functioning as intended, albeit at a lower level of intensity than originally intended due to funding constraints and other factors. This has resulted in a slower rate of progress. The science program has continued to gather data that are useful in identifying trends in water quality. These data have also been utilized to calibrate the ELCOM-CAEDYM, which will eventually be used for predictive purposes and to reduce the level of staff hours necessary for monitoring activities.

Partnerships with Basin stakeholders have been maintained, and, in some cases, improved through collaboration and outreach. The first "Our Gem" Coeur d'Alene Lake Symposium brought nearly 200 participants from throughout the Basin to learn about Coeur d'Alene Lake and the challenges faced as a community in protecting it. The Team received feedback that the LMP implementation needs to continue in order to protect Coeur d'Alene Lake and local communities that rely upon it. The community was particularly emphatic about the need for the following:

- Overall funding of the LMP
- Increased outreach and marketing
- Continued monitoring and research
- Increased integration with K-12 education

A more comprehensive summary is included in the *Summary Report: Our Gem Symposium Community Café*, compiled by IDEQ and the Tribe (2015).

The nutrient reduction action plan is well under way in its development. In the meantime, information gathered through monitoring and coordination with other efforts is being used to prioritize nutrient reduction efforts. Nutrient reduction projects have been implemented and future projects are being identified and planned. This effort has been slow moving due to the critical need to work closely with stakeholders through outreach and their direct project participation. Working with stakeholders also requires identifying and pursuing project funds through resources such as CWA Section 319 funds. This process can take over a year, and necessitates substantial staff time and investment.

Recommendations

Although it is too early to determine the effectiveness of the LMP in protecting Lake Coeur d'Alene from nutrient loading, analysis of data collected from 2008-2012 by the LMP team does point to some potential trends that need further tracking over time. While the data show total and dissolved zinc levels are declining, dissolved cadmium and lead levels are not. This may be expected because remediation in the Upper Basin is primarily focused on removal of zinc from surface water while specific actions and timing for cleanup in the lower basin have yet to be identified. However, a trend in increased productivity is beginning to emerge from the analysis of the data collected over the past 5 years. More information needs to be gathered to verify this trend and identify the primary causes for this increase (e.g., increased population, temperature, or other sources of eutrophication pressure). This information then needs to be communicated to Basin stakeholders to identify actions that may reverse any adverse trends. Finally, USEPA's Superfund Program, along with USEPA's Water Program, will continue to evaluate available data. USEPA is committed to working with the State and Tribe to develop evaluation criteria for determining effectiveness of the LMP as well as benefits to the Lake from upgradient cleanup actions. In combination, this information will be used to determine if CERCLA response actions or other administrative controls will be necessary for the Lake in the long-term. Establishment of these evaluation criteria will be partially dependent on the progress of the upgradient cleanup actions and realized effects on Lake water quality.

Future funding of LMP implementation is a serious challenge. Sources of funding that have been used to date for basic operating costs are limited. Alternative sources for implementation, with the exception of Avista mitigation funding, are intermittent and require staff to seek them out and secure them. Commitments for funding the LMP into the future will be critical to future success.

References

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