Five-Year Review Report

2010 Five-Year Review
for the
Bunker Hill Mining and Metallurgical Complex Superfund Site
Operable Units 1, 2, and 3
Idaho and Washington

November 2010

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Acronyms and Abbreviations

µg/dL	microgram per deciliter
µg/L	microgram per liter
ACGIH	American Conference of Governmental Industrial Hygienists
ACM	asbestos-containing material
ADR	Alternative Dispute Resolution
AMD	acid mine drainage
AOC	Administrative Order on Consent; Area of Contamination
ARAR	applicable or relevant and appropriate requirement
ASARCO	American Smelting and Refining Company, LLC
ATSDR	Agency for Toxic Substances and Disease Registry
AWQC	ambient water quality criteria
BAL	Borrow Area Landfill
Basin	Coeur d'Alene River Basin
Basin Commission	Coeur d'Alene Basin Environmental Improvement Project Commission
BCR	Big Creek Repository
BDAT	Best Demonstrated Available Technology
BEMP	Basin Environmental Monitoring Plan
bgs	below ground surface
BHS	Bureau of Homeland Security
BLM	U.S. Bureau of Land Management
BLP	Bunker Limited Partnership
BMP	best management practice
BNSF	Burlington Northern Santa Fe Railroad
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
CCC	Citizens Coordinating Council
CCP	Comprehensive Cleanup Plan
CD	consent decree
CDC	Centers for Disease Control
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

CIA	Central Impoundment Area
CITU	Certificate of Interim Trail Use
cm/sec	centimeters per second
COC	chemical of concern
Coeur d'Alene River Basin	The drainage area of the Coeur d'Alene River in northern Idaho and northeastern Washington
COR	completion of obligation report
CPT	cone penetrometer testing
CTP	Central Treatment Plant
CUA	common use areas
CWA	Clean Water Act
cy	cubic yard
DAR	Design Analysis Report
DCIRP	Drainage Control Infrastructure Revitalization Plan
Ecology	Washington State Department of Ecology
ECR	Environmental Conflict Resolution
ECSM	Enhanced Conceptual Site Model
EE/CA	engineering evaluation/cost analysis
EFNMC	East Fork Ninemile Creek
EMF	East Mission Flats
EMFR	East Mission Flats Repository
EMP	Environmental Monitoring Plan
ESA	Endangered Species Act
ESD	Explanation of Significant Difference
EMP	Environmental Monitoring Program
EQIP	Environmental Quality Incentives Program
FEMA	Federal Emergency Management Administration
FERC	Federal Energy Regulatory Commission
FFS	Focused Feasibility Study
FIRM	Federal Insurance Rate Map
FPS	final performance standards
FS	Feasibility Study
FTE	full-time equivalent
GCL	geosynthetic clay liner
H&S	health and safety
H:V	horizontal to vertical
HAZWOPER	Hazardous Waste Operations and Emergency Response
HDPE	high-density polyethylene
HDS	high-density sludge
HEPA	high-efficiency particulate air filter

HHRA	Human Health Risk Assessment
HHRE	Human Health Remedial Evaluation
HUD	Housing and Urban Development
I-90	Interstate 90
IBDS	Idaho Bureau of Disaster Services
ICP	Institutional Controls Program
IC	institutional control
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
IDPR	Idaho Department of Parks and Recreation
IDWR	Idaho Department of Water Resources
IEUBK	Integrated Exposure Uptake Biokinetic Model for Lead in Children
IPS	interim performance standard
ITD	Idaho Transportation Department
kW	kilowatt
LHTAC	Local Highway Technical Assistance Council
LHIP	Lead Health Intervention Program
LMP	Lake Management Plan
LOAEL	lowest observed adverse effects level
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.
m^2	square meter
M&R	maintenance and repair
MAPS	Monitoring Avian Productivity and Survivorship
MBTA	Migratory Bird Treaty Act
MCC	motor control center
MCL	maximum contaminant level
MCLG	maximum contaminant level goal
MFG	McCulley, Frick, and Gilman
mg/kg	milligram per kilogram
mg/L	milligram per liter
MIDS	Mullan ICP Disposal Site
MOA	Memorandum of Agreement; Mine Operations Area
MP	milepost
msl	mean sea level
NCP	National Oil and Hazardous Substances Contingency Plan
NFCDR	North Fork Coeur d'Alene River

NPDES	National Pollutant Discharge Elimination System
NPL	National Priority List (list of Superfund sites)
NRD	natural resource damages
NTR	National Toxics Rule
NRC	National Research Council of the National Academies
NRCS	Natural Resources Conservation Service
NTU	nephelometric turbidity unit
O&F	operational and functional
O&M	operation and maintenance
OHW	ordinary high water
OIG	Office of Inspector General (USEPA)
OSHA	Occupational Safety and Health Administration
OSWER	Office of Solid Waste and Emergency Response (USEPA)
OTI	Osburn Tailings Impoundment
OU	Operable Unit (used to define specific cleanup areas of Superfund sites)
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.
PCB	polychlorinated biphenyl
PHD	Panhandle Health District
PPE	personal protective equipment
PPWTP	Page Pond Wastewater Treatment Plant
PRP	Potentially Responsible Party
PTM	Principal Threat Material
PUD	planned unit development
QA/QC	quality assurance and quality control
QAPP	Quality Assurance Project Plan
RA	remedial action
RAD	Response Action Design
RAMP	Remedial Action Management Plan
RAO	remedial action objective
RAWP	Remedial Action Work Plan
RCRA	Resource Conservation and Recovery Act
RDR	remedial design report

RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
RMB	reactive media bed
ROC	Record of Compliance
ROD	Record of Decision
ROW	right-of-way
RV	recreational vehicle
SACA	Support Agency Cooperative Agreement
SCA	Smelter Closure Area
SDWA	Safe Drinking Water Act
SFCDR	South Fork of the Coeur d'Alene River
SMC	Stauffer Management Company
SMCRA	Surface Mining Control and Reclamation Act
SOW	statement of work
SPLP	synthetic precipitation leaching procedure
SRB	sulfate-reducing bioreactor
SSC	State Superfund Contract
STB	Surface Transportation Board
STI	Star Tailings Impoundment
Superfund	A common name for USEPA's CERCLA program
SVNRT	Silver Valley Natural Resources Trust
TBC	to be considered
TCLP	toxicity characteristic leaching procedure
TerraGraphics	TerraGraphics Environmental Engineering
TI	Technical Impracticability
TLG	Technical Leadership Group
TLOP	Trail Long-Term Oversight Program
TLV	threshold limit value
TM	technical memorandum
TMDL	total maximum daily load
TSCA	Toxic Substances Control Act
TSS	total suspended solids
TT	treatment technique
UAO	Unilateral Administrative Order
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	United States Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WGI	Washington Group International
WHIP	Wildlife Habitat Incentives Program
WIC	Woman Infant and Children (Clinics)
WMS	*Coeur d'Alene Basin Waste Management Strategy*
WQX	Water Quality Exchange
WWTP	wastewater treatment plant
WY	water year

Executive Summary

Introduction

The U.S. Environmental Protection Agency (USEPA) Region 10 has completed its third 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 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 protective of human health and the environment. Projects implemented with Clean Water Act (CWA) funds 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 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 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, 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, Remedial Investigations (RIs) and Feasibility Studies (FSs) initially focused on the 21-square-mile Bunker Hill Box (McCulley, Frick, and Gilman [MFG], 1992a and 1992b). 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). These two OUs then proceeded into remedial design and remedial action phases of work. 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, 2001a) and two Explanations of Significant Differences (ESDs; USEPA, 1996b, 1998b).

USEPA began the Remedial Investigation and Feasibility Study (RI/FS) for OU 3 in 1998 (USEPA, 2001b, 2001c) and issued an interim ROD in 2002 (USEPA, 2002) 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. The 2002 OU 3 ROD consists of a complete human health remedy in the communities and residential areas, including identified recreational areas, and an interim ecological remedy. A number of removal actions to address immediate threats to human health and/or obvious sources of contamination in or along streams were initiated prior to the 2002 OU 3 ROD. Remedial design, remedial action, and studies to support future OU 3 remedial actions were initiated in 2003 and are ongoing.

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 FFS is to identify additional remedial actions to protect the human health remedy and reduce metals contamination in surface water and groundwater in the Upper Basin portion of the Site, including the Bunker Hill Box. These remedy changes are documented in a Proposed Plan (USEPA, 2010a), which is available for public review and comment until November 23, 2010. Following the public comment period, a responsive summary will be prepared that will provide a response to all comments received during the comment period. This document will be part of a ROD Amendment that is expected to be completed in late Spring 2011. This Five-Year Review Report does not include an assessment of the upcoming Upper Basin ROD Amendment actions because these remedies have not yet been selected or implemented.

In December 2009, as part of the largest settlement in Superfund history, the Bunker Hill Superfund Site received approximately $494 million from a bankruptcy reorganization of American Smelting and Refining Company, LLC (ASARCO). The majority of bankruptcy settlement funds are allocated for USEPA-selected response actions in mining-contaminated areas of the Coeur d'Alene Basin outside of the Bunker Hill Box. A much smaller portion, approximately $8 million, of the settlement funds is available for response actions within the Bunker Hill Box. Although very significant, the ASARCO settlement funds only represent a portion of USEPA's estimated site cleanup needs for the Bunker Hill Superfund Site. Therefore, USEPA wants to balance how quickly the bankruptcy settlement funds are expended with ensuring that there is enough funding for the remaining cleanup work. The settlement does, however, allow USEPA to do more long-term planning and provide greater certainty about how the cleanup will be implemented over the next several years. This, in turn, will provide more information to the community and ongoing local job opportunities generated by the cleanup.

The first (2000) Five-Year Review of the Bunker Hill Superfund Site remedies resulted in two separate Five-Year Review Reports: one for OU 1 (USEPA, 2000c), and the other for OU 2 (USEPA, 2000b). USEPA published these reports in September 2000, approximately 5 years after initiation of the first remedial action at the Site. The second (2005) Five-Year Review evaluated the remedy performance of OUs 1 and 2 and provided the first evaluation for OU 3 (USEPA, 2005). This third (2010) Five-Year Review evaluates the remedy performance for all three OUs.

Review of Selected Remedies

As stated above, the purpose of this review is to evaluate the selected remedies that have been or will be implemented at the Site. This 2010 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 following subsections provide a summary of:

- The site activities and remedial actions completed in the last five years by OU; and
- 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. The populated areas include residential and commercial properties, 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 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.

ROD Issuance

The OU 1 Selected Remedy and remedial action objectives (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 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.

Major Components of the Selected Remedy

To achieve these objectives, the cleanup strategy includes:

- Implementation of a lead health intervention program for local families;
- Remediation of all residential yards, commercial properties, and 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); and
- Establishing an Institutional Controls Program (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, implementation of 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.

Remedial Actions

Section 3 of this report describes activities and remedial actions conducted since the last Five-Year Review for OU 1 (USEPA, 2005) and presents a detailed description of the various remedial actions and the specific ROD requirements that apply to each action.

Issues, Recommendations, and Follow-up Actions

As part of this Five-Year Review, issues, recommendations, and follow-up actions have been identified to improve remedy performance or protectiveness to meet the RAOs and performance standards. Tables ES-1 and ES-2 summarize these issues, recommendations, and follow-up actions for OU 1. Also identified in these tables are parties responsible for implementation and oversight of these actions, proposed completion milestone dates, and the potential to affect the protectiveness of the remedy. This information is also summarized in Section 6.1. It is important to note that there are a number of ongoing issues, recommendations, and follow-up actions in OU 1 that were identified in the 2005 Five-Year Review. Section 1.4 of this report provides a summary of the previously identified recommendations/follow-up actions and indicates their completion status.

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 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, two OU 2 ROD Amendments (USEPA, 1996a and 2001a) and two ESDs (USEPA, 1996b and 1998b) have been published.

The 1996 Amendment to the 1992 OU 2 ROD (1996 OU 2 ROD Amendment) changed the remedy for Principal Threat Materials (PTMs) from chemical stabilization to containment. The 2001 Amendment to the 1992 OU 2 ROD (2001 OU 2 ROD Amendment) addressed AMD issues within the OU 2 boundaries. To date, USEPA and the State of Idaho have not concluded negotiations on a State Superfund Contract (SSC) Amendment that allows for full implementation of the 2001 OU 2 ROD Amendment. Time-critical components of this ROD Amendment were implemented, however, to avoid potential catastrophic failure of the aging Central Treatment Plant (CTP) and to provide for emergency mine water storage

(USEPA and Idaho Department of Environmental Quality [IDEQ], 2003d). These time-critical activities focused on preventing discharges of AMD to Bunker Creek and the SFCDR. Until an SSC Amendment is signed allowing for full implementation of the 2001 OU 2 ROD Amendment, control and treatment of AMD and its impact on water quality will continue to be an issue. USEPA and the State of Idaho continue to discuss the SSC Amendment and the long-term obligations associated with the full mine water remedy.

The two ESDs did not change the OU 2 Selected Remedy; rather, they clarified portions of the remedy. The 1996 OU 2 ESD addressed differences associated with placement of waste and demolition materials in the Smelter Closure Area (SCA). The 1998 OU 2 ESD addressed differences associated with the stabilization and removal of contaminated materials located in the tributary gulches within OU 2, the USEPA financial contribution to the lower Milo Creek/Wardner/Kellogg pipeline system, placement of mine wastes from outside of OU 2 into the CIA, and other clarifications on the OU 2 Selected Remedy (see Section 4.1).

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.

In 1995, with the bankruptcy of the Site's major Potentially Responsible Party (PRP), USEPA and the State of Idaho defined a path forward for phased remedy implementation in 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 Institutional Controls Program (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 operation and maintenance (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 largely complete.

The effectiveness evaluation of the Phase I source control and removal activities to meet the water quality improvement objectives of the 1992 OU 2 ROD was completed, as described in Section 4.5, and has been used to determine appropriate Phase II implementation strategies and actions, and are further discussed in Section 2.6.

Remedial Actions

Section 4 of this report describes activities and remedial actions conducted since the last Five-Year Review for OU 2 (USEPA, 2005) and presents a detailed description of the various remedial actions and the specific ROD requirements that apply to each action.

Issues, Recommendations, and Follow-up Actions

As part of this Five-Year Review, issues, recommendations, and follow-up actions have been identified to improve remedy performance or protectiveness to meet the RAOs and performance standards. Tables ES-3 and ES-4 summarize these for OU 2. Also identified in these tables are parties responsible for implementation and oversight of these actions, proposed completion milestone dates, and the potential to affect the protectiveness of the remedy. More detailed information is also summarized in Section 6.2 of this report. It is important to note that there are a number of ongoing issues, recommendations, and follow-up actions in OU 2 that were identified in the 2005 Five-Year Review. Section 1.4 of this report provides a summary of the previously identified recommendations/follow-up actions and indicates their completion status.

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 floodplain and river corridor of the Coeur d'Alene River (including Coeur d'Alene Lake) and the Spokane River, as well as those 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. 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.

Removal Actions

The 2005 Five-Year Review Report included a summary of removal actions that were implemented under CERCLA, primarily from 1997-2002. In the 2005 report, three general categories of removal actions were reviewed: Upper Basin mine and mill sites, Lower Basin recreational areas, and the Trail of the Coeur d'Alenes. Except for the Trail of the Coeur d'Alenes, the assessment of these removal actions has been integrated into the assessment of remedial action work that has been conducted in OU 3. Due to the large geographic scope of the Trail of the Coeur d'Alenes, it is assessed separately in this review.

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, 2002). The cleanup plan resulted from several years of intensive studies to determine the extent of contamination and the associated risks to people and the environment. The 2002 OU 3 interim ROD (2002 OU 3 ROD) describes the specific cleanup work, called the interim Selected Remedy (the remedy) that will occur in the Basin**.** The following governments and agencies in the areas targeted for cleanup gave their support for conducting the cleanup selected in the 2002 OU 3 ROD: the State of Idaho, the Coeur d'Alene Tribe, the Spokane Tribe, the State of Washington, the U.S. Bureau of Land Management (BLM), the U.S. Fish and Wildlife Service (USFWS), and the U.S. Forest Service (USFS).

The 2002 OU 3 ROD includes:

- 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; and
- 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.

Certain potential exposures to human health outside of the communities and residential areas of the Upper Basin and Lower Basin were not addressed by the 2002 OU 3 ROD. These potential exposures affecting human health include:

- Recreational use at areas in the Upper Basin and Lower Basin where cleanup actions are not implemented pursuant to the 2002 OU 3 ROD;
- Subsistence lifestyles, such as those traditional to the Coeur d'Alene and Spokane Tribes; and
- Potential future use of groundwater that is currently contaminated with metals.

In addition, a remedy for Coeur d'Alene Lake is not included in the 2002 OU 3 ROD. State, tribal, federal, and local governments are in the process of developing a revised lake management plan outside of the Superfund process using separate regulatory authorities.

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:

- Lead health information and intervention programs for residential and recreational users;
- Partial excavation and replacement of residential soils with lead concentrations above 1,000 mg/kg and/or arsenic concentrations above 100 mg/kg, 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 a combination of removals, barriers, and access restrictions for street ROWs, commercial properties, and recreational areas;
- Alternative drinking water sources for residences using contaminated private drinking water sources;
- Evaluation of lead in house dust, after residential soil remediation is completed, to determine if interior cleaning is needed; and
- Establishment of 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; and
- 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 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.

A remedy for Coeur D'Alene Lake is not included in the 2002 OU 3 ROD, but the OU 3 ROD did indicate that the State of Idaho, the Coeur d'Alene Tribe, and federal and local governments would implement a Lake Management Plan (LMP) outside of the Superfund process using separate regulatory authorities. The Coeur d'Alene LMP was finalized in March 2009 and is currently being implemented.

Review of the Interim Selected Remedy by the National Academies' National Research Council

In 2005, the National Academies' National Research Council (NRC) completed an independent evaluation of the Coeur d'Alene Basin interim Selected Remedy to examine USEPA's scientific and technical practices in Superfund site characterization, human and ecological risk assessment, remedial planning, and decision making (NRC, 2005). As part of its review, the Committee considered peer-reviewed scientific literature; government agency reports; information submitted to the Committee by citizens, advocacy groups, and industry; and unpublished database information as well as related statistics and data directly obtained from USEPA and the States of Idaho and Washington.

The NRC review generally supported USEPA's scientific and technical practices conducted at the Bunker Hill site, particularly related to human health risks. The NRC review also raised concerns about how the USEPA Superfund Program would be able to address the massive amounts of mining contamination that have resulted in significant risks to public health and the environment.

Since completion of the NRC review, USEPA has been evaluating the NRC recommendations and incorporating changes in remedy planning and implementation as appropriate. USEPA is moving forward with additional data collection and site characterization to address the NRC recommendations. In addition, NRC recommendations related to analysis and prioritization of sources contributing metals to Site waters will be addressed in the upcoming Upper Basin ROD Amendment (see Section 2.7). USEPA also is evaluating potential modifications to the current Lower Basin cleanup plan that would further address the NRC recommendations, particularly those related to potential recontamination in floodplain areas.

Implementing the Selected Remedy

USEPA's first priority for implementation of the 2002 OU 3 ROD is to remediate residential and recreational areas that pose direct human health risks. This includes actions to establish onsite repositories to safely store cleanup waste. Some actions also have been taken to clean up areas that pose ecological and human health risks. From 2004 to 2009, the primary source of project funding came from USEPA's national Superfund Program, which prioritized funding for implementation of the OU 3 human health remedy.

Idaho state legislation under the Basin Environmental Improvement Act (Title 39, Chapter 810) established the Coeur d'Alene Basin Environmental Improvement Project Commission (Basin Commission). This commission includes federal, state, tribal, and local governmental involvement. USEPA serves as the federal government representative to the Basin Commission and will continue to work closely with the governments and communities, including the Commission's Technical Leadership Group (TLG) and Citizens' Coordinating Council (CCC), in implementing the OU 3 cleanup. USEPA also will continue to be responsible for ensuring that the cleanup work meets the requirements of site cleanup plans as well as CERCLA laws and regulations.

Remedial Actions

Section 5 of this report describes activities and remedial actions conducted since the last Five-Year Review for OU 3 (USEPA, 2005) and presents a detailed description of the various remedial actions and the specific ROD requirements that apply to each action.

Issues, Recommendations, and Follow-up Actions

As part of this Five-Year Review, issues, recommendations, and follow-up actions have been identified to improve remedy performance or protectiveness to meet the RAOs and performance standards. Tables ES-5 and ES-6 summarize these for the 2002 OU 3 ROD remedial actions. Also identified in these tables are parties responsible for implementation and oversight of these actions, proposed completion milestone dates, and the potential to affect protectiveness of the remedy. This information is also summarized in Section 6.3. It is important to note that there are a number of ongoing issues, recommendations, and follow-up actions in OU 3 that were identified in the 2005 Five-Year Review. Section 1.4 of this report provides a summary of the previously identified recommendations/follow-up actions and indicates their completion status.

Protectiveness of the Remedy

Operable Unit 1

The remedy currently being implemented in OU 1 is expected to be protective of human health and the environment where response actions have already been taken, provided that follow-up actions identified in Table ES-2 are implemented. Exposure pathways that could result in unacceptable risks are being controlled or addressed in locations where remedial work has been completed. There are some homes where interior house dust lead concentrations remain high. The need to identify alternative lead sources, such as lead-based paint, will be evaluated. Based, in part, on information related to alternative lead sources, a determination will be made related to the need to implement the interior cleaning component of the OU 1 remedy.

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 below the 500-mg/kg site-wide average RAO. However, in 2008, 5 percent of sampled homes in OU 1 exhibited interior dust lead concentrations greater than 1,000 mg/kg. The 1991 OU 1 ROD contemplates a one-time cleaning of homes exhibiting lead dust concentration above 1000 mg/kg. The 1990 and 2000 interior cleaning pilot studies concluded that one-time residential interior cleaning is likely not a sustainable remedy for homes with house dust equal to or greater than 1,000 mg/kg lead.

Although the OU 1 remedy is currently protective of human health and the environment where remedial actions have been taken, it is possible that flooding and infrastructure issues may affect remedy protectiveness. In addition, the ability of the local communities to improve and maintain infrastructure to protect the remedy is a concern. Provision of a long-term ICP repository is essential to the continued performance of the installed human health barriers.

In 2008, USEPA initiated efforts to identify actions needed to augment the remedial actions taken in OU 1 residential and community areas to improve their long-term sustainability. At the time of the release of this review, a Proposed Plan outlining the elements of a ROD Amendment for the Upper Basin portion of the Site, which includes actions to augment the OU 1 remedy, has been released for public review and comment (USEPA, 2010a). Upon the completion of the comment period, USEPA will evaluate the comments received and subsequently issue a ROD Amendment for the Upper Basin portion of the Site.

Operable Unit 2

The remedy currently being implemented in OU 2 is expected to be protective of human health and the environment where response actions have already been taken, provided that follow-up actions identified in Table ES-4 are implemented. In the interim, exposure pathways that could result in unacceptable risks are being controlled or addressed in locations where remedial work has been completed.

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 includes extensive source removal and stabilization efforts, demolition activities, community development initiatives, development and implementation of the ICP, land use development support, and public health response actions. Phase I also includes 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 is also included in Phase I of remedy implementation.

Phase I remedies have removed and consolidated over 2.8 million cubic yards (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.

Also, as summarized in Table 4-1, 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 and development of area-specific O&M manuals.

In 2008, USEPA initiated efforts to identify actions needed to augment the remedial actions taken in OU 2, building on information produced during evaluations of Phase I remedial actions. Results of the evaluation of Phase I source control and removal activities to meet human health and ecological water quality goals have been incorporated into the 2010 FFS (see Section 2.7 for more information on the FFS).

An SSC Amendment that allows for the full implementation of the 2001 OU 2 ROD Amendment needs to be negotiated and signed. Time-critical components of this ROD Amendment were implemented to prevent catastrophic failure of the CTP and discharges of AMD to Bunker Creek and the SFCDR. Until an SSC Amendment is signed, however, control and treatment of AMD and its impact on water quality will continue to be an issue.

The OU 2 remedy is currently protective of human health and the environment where remedial actions have been taken. However, flooding and infrastructure issues may affect remedy protectiveness. In addition, the ability of the local communities to improve and maintain infrastructure to protect the remedy is a concern. Provision of a long-term ICP repository is essential to the continued performance of the installed human health barriers.

Operable Unit 3

The remedy currently being implemented in OU 3 is expected to be protective of human health and the environment where response actions have already been taken, provided that follow-up actions identified in Table ES-6 are implemented. 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.

The remedy included in the 2002 OU 3 ROD 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 fully protect human and environmental resources. In 2008, USEPA initiated efforts to amend the RODs for the Upper Basin portion of the Site in order to better define actions needed to protect water quality and human and ecological receptors in the Upper Basin. The Upper Basin refers to areas of mining related contamination along the SFCDR, its tributaries, and the Bunker Hill Box. This effort also included efforts to identify actions needed to augment the remedial actions taken in Basin residential and community areas to improve their long-term sustainability. At the time of the release of this review, a Proposed Plan outlining the elements of the ROD Amendment has been released for public review and comment (USEPA, 2010a). Upon the completion of the comment period, USEPA will evaluate the comments received and subsequently issue a ROD Amendment for the Upper Basin portion of the Site.

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 Enhanced Conceptual Site Model (ESCM; CH2M HILL, 2010), including sediment transport modeling that will help guide effective decision-making regarding future remedial actions in the Lower Basin. The ECSM currently shows that the largest portion of contaminated sediments being transported in the Coeur d'Alene River are re-entrained sediments from the banks and bed of the river in the Lower Basin that are mobilized, transported, and deposited during flood events. USEPA, through a collaborative process, is embarking on the planning process to address these issues in the Lower Basin. The Lower Basin evaluations will likely result in the issuance of a Lower Basin ROD Amendment at a future date.

Significant progress has been made in cleaning up properties and ROWs in Basin residential and community areas, with nearly 2,600 properties and ROWs having been remediated by the end of 2009 (roughly 2,900 properties and ROWs are projected to be completed by the end of the 2010 construction season). The ICP was established and became operational in the Basin in 2007. 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. 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). Annual 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 also decline in response to the remedial actions implemented. Blood-lead screening will also continue to be offered annually to identify at-risk children and provide feedback on the effectiveness of cleanup efforts.

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. The remedies constructed at recreational sites along both the Coeur d'Alene and Spokane Rivers are, in general, functioning as designed.

Two 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. The Big Creek Repository (BCR) has been in operation since 2002. The East Mission Flats Repository (EMFR) began operation in 2009. Data indicate that the BCR has been constructed in accordance with the 2002 OU 3 ROD and the BCR design and has reliably contained waste material from remedial actions, as well as wastes generated by citizens, communities, and development activities complying with the ICP. Although the EMFR has been in operation for only a short period, periodic monitoring has found no increases in contaminants of concern in the monitoring well network. Given the short operational time frame, monitoring will continue at the EMFR. 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.

USEPA is working with USFWS and Ducks Unlimited to complete a 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 overall intent of this action is to provide clean waterfowl feeding habitat to reduce their exposure to lead-contaminated sediment. A portion of an agriculture-to-wetland conversion project was completed in 2007 and is functioning as intended by the ROD.

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 did indicate that a management plan for the lake would be developed to focus on 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 revision to the LMP (Idaho Department of Environmental Quality [IDEQ] and Coeur d'Alene Tribe, 2009). Initial LMP implementation actions have been taken and lake monitoring efforts are underway. The effectiveness of LMP implementation will be reported in the next Five-Year Review Report.

The Trail of the Coeur d'Alenes was created by a CERCLA removal action under the National Rails-to-Trails Act. The goals of the removal 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 applicable or relevant and appropriate requirements (ARARs). There are numerous entities that routinely assess and inspect the functionality of the trail as both a recreational facility and a protective barrier. The installed barriers are being maintained and are functioning as designed.

The OU 3 remedy is currently protective of human health and the environment where remedial actions have been taken. However, flooding and infrastructure issues may affect remedy protectiveness. In addition, the ability of the local communities to improve and maintain infrastructure to protect the remedy is a concern.

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. The 2000 Five-Year Review was completed on September 27, 2000. The 2005 Five-Year Review was completed on October 24, 2005.

The next review (the fourth Five-Year Review) of the Bunker Hill Superfund Site will be conducted within 5 years of the completion date of this 2010 Five-Year Review Report. Consistent with previous Five Year Reviews, the next 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, 2002), USEPA will continue to evaluate Coeur d'Alene Lake conditions in the next and future Five-Year Reviews.

TABLE ES-1
Summary of Issues – OU 1
2010 Five-Year Review, Bunker Hill Superfund Site

Issues	Affects Protectiveness (Y/N)	
	Current (now to 1 year)	**Future (>1 year)**
Operation and Maintenance		
O&M Needs: It is not clear whether all protective barriers are being adequately maintained by property owners or whether the barriers are able to withstand everyday use in certain locations.	N	Y
House Dust Lead Concentrations		
Alternative House Dust Lead Source(s): Alternative source(s) may contribute to high dust lead concentrations that persist in some homes following completion of residential soil remediation. In many cases, it is likely that the elevated levels can be attributed to other sources of contamination including soils/sediments from the Coeur d'Alene River Basin where many residents recreate, hillsides within OU 1, occupational sources, lead-based paint, and/or personal activities, occupations, or hobbies.	Y	Y
One-Time Interior Cleaning: 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 led 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.	N	Y
Institutional Controls Program		
ICP Funding and Resources: Permanent funding of the ICP is needed to ensure success of the remedy, including consideration of adequate staff and information management support to ensure the long-term effectiveness of the program.	N	Y
Disposal of ICP Waste		
Community-Fill Policy: ICP waste is being disposed of in locations outside of approved repositories.	N	Y
Infrastructure		
Flood Control: Flooding in the SFCDR and Pine Creek poses a threat to portions of the installed remedy. Comprehensive flood control on the SFCDR and Pine Creek is a complex, multi-jurisdictional issue that exceeds the expertise and regulatory authority of USEPA and IDEQ cleanup programs, and that of the local communities.	N	Y
Roads as Protective Barriers: A number of paved roads throughout all OUs are deteriorating, compromising their ability to function as protective barriers.	Y	Y
Infrastructure Maintenance Funding: Infrastructure maintenance and improvements remain an issue. The remedy relies on functioning infrastructure to be sustainable. Resources to repair and install infrastructure have been difficult to secure by local governments.	N	Y

TABLE ES-2
Summary of Recommendations and Follow-Up Actions – OU 1
2010 Five-Year Review, Bunker Hill Superfund Site

Recommendations/Follow-up Actions	Responsible Entity	Oversight Agency	Proposed Milestone Date	Follow-up Actions: Affects Protectiveness (Y/N)	
				Current (now to 1 year)	**Future (>1 year)**
Operation and Maintenance					
O&M Needs: Develop an approach (or program) that defines how barrier integrity for all remediated properties would be maintained and monitored over time.	Upstream Mining Group (UMG), Panhandle Health District (PHD), IDEQ, USEPA	IDEQ, USEPA	12/2012	N	Y
House Dust Lead Concentrations					
Alternative House Dust Lead Sources: Determine whether additional work is needed to identify alternative lead sources, such as lead-based paint, that may be contributing to house dust lead levels.	PHD, IDEQ	IDEQ, USEPA	12/2012	Y	Y
One-time Interior Cleaning: Evaluate need for implementation of the interior cleaning component of the remedy based in part on information on alternative dust lead sources. Determine additional data/monitoring needs to support one-time interior cleaning evaluation.	IDEQ, USEPA	USEPA	6/2013	N	Y
Institutional Controls Program					
ICP Funding and Resources: 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 (CD).	UMG, IDEQ, USEPA, PHD	IDEQ, USEPA	12/2012	N	Y

TABLE ES-2
Summary of Recommendations and Follow-Up Actions – OU 1
2010 Five-Year Review, Bunker Hill Superfund Site

Recommendations/Follow-up Actions	Responsible Entity	Oversight Agency	Proposed Milestone Date	Follow-up Actions: Affects Protectiveness (Y/N)	
				Current (now to 1 year)	Future (>1 year)
Disposal of ICP Waste					
Community-Fill Policy: Complete the Community Fill Policy (CFP) currently being developed by USEPA and IDEQ for all three OUs.	IDEQ, USEPA	IDEQ, USEPA	12/2011	N	Y
Infrastructure					
Flood Control: Continue working with the Basin Commission and other stakeholders to evaluate and plan actions relative to addressing SFCDR and Pine Creek flooding that may affect cleanups.	Local Governments, IDEQ, USEPA, PHD	IDEQ, USEPA	12/2012	N	Y
Roads as Protective Barriers: Continue working to develop an approach for addressing roads as long-term barriers in collaboration with state, county, and local entities.	Local Governments, IDEQ, USEPA, PHD	IDEQ, USEPA	12/2012	Y	Y
Infrastructure Maintenance Funding: Develop appropriate institutions and funding mechanisms to finance and oversee stewardship activities.	Local Governments, IDEQ, PHD	IDEQ, USEPA	12/2012	N	Y

TABLE ES-3
Summary of Issues – OU 2
2010 Five-Year Review, Bunker Hill Superfund Site

Issues	Affects Protectiveness (Y/N)	
	Current (now to 1 year)	**Future (>1 year)**
Operation and Maintenance		
O&M Needs: Funding and coordination among the State of Idaho O&M program, ICP, local governments and utility districts, and property owners is critical to ensuring that sufficient O&M occurs to preserve the remedy.	N	Y
Smelterville Flats		
Community-Fill Policy: ICP waste is being disposed of in locations outside of approved repositories.	N	Y
Page Pond		
Environmental Monitoring: Although a Page area sampling and analysis plan is under development, a long-term environmental monitoring program has not yet been established.	N	Y
O&M: O&M manuals are under development but not yet completed for the closed portion of Page Repository, the operating portion of Page Repository, or the completed remedial actions.	Y	Y
Bunker Creek		
Bunker Creek Culverts: The lower Bunker Creek culverts, including the I-90 box culvert, were determined to be undersized for accommodating a 100-year flood event.	N	Y
UPRR ROW Remedial Action in the Box		
Portions of the barrier along the trail have degraded or been compromised.	Y	Y
Milo Gulch		
AMD Discharge at Reed and Russell Adits: Near Reed Landing, adit drainage flows into an old surface water channel and into the buried historical 4-foot x 4-foot structure, and eventually daylights onto a soil/tailings slope. Slope instability or erosion may occur as a result of this flow.	Y	Y
A-4 Gypsum Pond		
A-4 Contaminant Release: Groundwater level measurements indicate that groundwater periodically rises to above the bottom of the Gypsum Pond, in direct contact with tailings.	Y	Y

TABLE ES-3
Summary of Issues – OU 2
2010 Five-Year Review, Bunker Hill Superfund Site

Issues	Affects Protectiveness (Y/N)	
	Current (now to 1 year)	**Future (>1 year)**
Institutional Controls Program		
ICP Funding and Resources: Permanent funding of the ICP is needed to ensure success of the remedy, including consideration of adequate staff and information management support.. At this time, permanent funding for the OU 2 ICP has not been secured.	N	Y
Infrastructure		
Flood Control: Flooding in the SFCDR and Pine Creek poses a threat to portions of the installed remedy. Comprehensive flood control on the SFCDR and Pine Creek is a complex, multi-jurisdictional issue that exceeds the expertise and regulatory authority of the USEPA and IDEQ cleanup programs, and that of the local communities.	N	Y
Roads as Protective Barriers: A number of paved roads throughout all OUs are deteriorating, compromising their ability to function as protective barriers.	Y	Y
Infrastructure Maintenance Funding: Infrastructure maintenance and improvements remain an issue. The remedy relies on functioning infrastructure to be sustainable. Resources to repair and install infrastructure have been difficult to secure by local governments.	N	Y

TABLE ES-4
Summary of Recommendations and Follow-Up Actions – OU 2
2010 Five-Year Review, Bunker Hill Superfund Site

Recommendations/Follow-up Actions	Responsible Entity	Oversight Agency	Proposed Milestone Date	Follow-up Actions: Affects Protectiveness (Y/N)	
				Current (now to 1 year)	Future (>1 year)
Operation and Maintenance					
O&M Needs: The 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 implementation of O&M.	IDEQ, USEPA	IDEQ, USEPA	12/2011	N	Y
Smelterville Flats					
*Community-Fill Polic*y: Complete the CFP currently being developed by USEPA and IDEQ for all three OUs.	IDEQ, USEPA	IDEQ, USEPA	12/2012	N	Y
Page Pond					
Environmental Monitoring: Continue to work with the site-wide water quality monitoring program (i.e., forthcoming revised Basin Environmental Monitoring Plan) to integrate special considerations at the Page Pond.	UMG, IDEQ, USEPA	IDEQ, USEPA	6/2011	N	Y
O&M: Continue to develop a comprehensive O&M and Site Closure Plan for the Page Repository.	IDEQ, PHD, UMG	IDEQ, USEPA	4/2011	N	Y
Bunker Creek					
Bunker Creek Culverts: Continue working with the Basin Commission and other stakeholders to evaluate and plan actions relative to addressing SFCDR and Pine Creek flooding issues.	Local Governments	IDEQ, USEPA	12/2012	N	Y
UPRR ROW Remedial Action in the Box					
USEPA will work with UPRR so that O&M obligations defined in the CD are met to ensure the integrity and protectiveness of the installed barriers. USEPA will rely on oversight assistance from PHD and IDEQ to ensure that appropriate O&M actions are taken.	UPRR	IDEQ, PHD, USEPA	12/2010	Y	Y

TABLE ES-4
Summary of Recommendations and Follow-Up Actions – OU 2
2010 Five-Year Review, Bunker Hill Superfund Site

Recommendations/Follow-up Actions	Responsible Entity	Oversight Agency	Proposed Milestone Date	Follow-up Actions: Affects Protectiveness (Y/N)	
				Current (now to 1 year)	**Future (>1 year)**
Milo Gulch					
AMD Discharge at Reed and Russell Adits: Continue discussions/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 x 4-foot structure.	USEPA	USEPA	12/2010	Y	Y
A-4 Gypsum Pond					
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 remedial design report (RDR).	SMC	IDEQ, USEPA	12/2011	N	Y
Institutional Controls Program					
ICP Funding and Resources: Secure permanent funding for the ICP, including consideration of adequate staff and information management support to ensure the long-term effectiveness of the program.	IDEQ, USEPA, PHD	IDEQ, USEPA	12/2012	N	Y
Infrastructure					
Flood Control: Continue working with the Basin Commission and other stakeholders to evaluate and plan actions relative to addressing SFCDR and Pine Creek flooding that may affect cleanups.	Local Governments, IDEQ, USEPA, PHD	IDEQ, USEPA	12/2012	N	Y
Roads as Protective Barriers: Continue working to develop an approach for addressing roads as long-term barriers in collaboration with state, county, and local entities.	Local Governments, IDEQ, USEPA, PHD	IDEQ, USEPA	12/2012	Y	Y
Infrastructure Maintenance Funding: Develop appropriate institutions and funding mechanisms to finance and oversee stewardship activities.	Local Governments, IDEQ, PHD	IDEQ, USEPA	12/2012	N	Y

TABLE ES-5
Summary of Issues – OU 3
2010 Five-Year Review, Bunker Hill Superfund Site

Issues	Affects Protectiveness (Y/N)	
	Current (now to 1 year)	**Future (>1 year)**
Operation and Maintenance		
O&M Needs: It is not clear whether all protective barriers are being adequately maintained by property owners or whether the barriers are able to withstand everyday use in certain locations.	N	Y
Lead Health Intervention Program		
Dust Intervention Protocol: The dust intervention protocol in the 2002 OU 3 ROD is not being implemented	N	Y
Institutional Controls Program		
ICP Funding and Resources: Adequate funding of the ICP is needed to ensure success of the remedy, including consideration of sufficient staff and information management.	N	Y
Community-Wide Lead Remedial Action Objective (RAO): The lack of a community-wide lead RAO poses disposal challenges for ICP implementation in the Basin.	N	Y
Disposal of Wastes from Human Health Remedial Actions		
Community-Fill Policy: ICP waste is being disposed of in locations outside of approved repositories.	N	Y
Infrastructure		
Flood Control: Flooding on the SFCDR and Pine Creek poses a threat to portions of the installed remedy. Comprehensive flood control on the SFCDR and Pine Creek is a complex, multi-jurisdictional issue that exceeds the expertise and regulatory authority of USEPA and IDEQ cleanup programs, and that of the local communities.	N	Y
Roads as Protective Barriers: A number of paved roads throughout all OUs are deteriorating, compromising their ability to function as protective barriers.	Y	Y
Infrastructure Maintenance Funding: Infrastructure maintenance and improvements remain an issue. The remedy relies on functioning infrastructure to be sustainable. Resources to repair and install infrastructure have been difficult to secure by local governments.	N	Y

TABLE ES-5
Summary of Issues – OU 3
2010 Five-Year Review, Bunker Hill Superfund Site

Issues	Affects Protectiveness (Y/N)	
	Current (now to 1 year)	**Future (>1 year)**
Upper Basin Mine and Mill Sites		
Mine and Mill Site O&M: O&M of the mine and mill sites where remedial actions have been completed is not formally conducted.	Y	Y
Rex Site Contaminant Release: Rex Creek upstream from the remedial action and the Rex Adit flow infiltrate into the subsurface prior to entering the diversion channel. Infiltrating water could be contacting contaminated materials and transporting dissolved metals into Rex Creek. Significant differences in dissolved metal concentrations have been observed as part of the remedial action effectiveness monitoring. Possible solutions could be lining portions of the diversion channel.	Y	Y
Repositories		
Long-Term Disposal Need from ICP: The timing and waste volumes from ICP-regulated activities needing to be placed in repositories should be better quantified.	N	Y
Long-Term Disposal Need from Remedial Actions : The timing and waste volumes from remedial actions needing to be placed in repositories should be better quantified.	N	Y
Coeur d'Alene Lake		
Lake Management Plan Implementation: Management of land-use activities to prevent the acceleration of eutrophication under the LMP is necessary to minimize the potential release of metals from contaminated sediments.	N	Y
UPRR ROW Removal Action		
UPRR Barrier Protectiveness: Asphalt buckling will need continued monitoring.	N	Y

TABLE ES-6
Summary of Recommendations and Follow-Up Actions – OU 3
2010 Five-Year Review, Bunker Hill Superfund Site

Recommendations/Follow-up Actions	Responsible Entity	Oversight Agency	Proposed Milestone Date	Follow-up Actions: Affects Protectiveness (Y/N)	
				Current (now to 1 year)	Future (>1 year)
Operation and Maintenance					
O&M Needs: Develop an approach (or program) that defines how barrier integrity for all remediated properties would be maintained and monitored over time.	IDEQ, PHD, USEPA	IDEQ, USEPA	12/2012	N	Y
Lead Health Intervention Program					
Program Implementation: Determine whether an alternative approach to the 2002 OU 3 ROD's dust intervention protocol can be established and implemented.	IDEQ, PHD, USEPA	IDEQ, USEPA	12/2012	N	Y
Institutional Controls Program					
ICP Funding and Resources: 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.	IDEQ, PHD, USEPA	IDEQ, USEPA	12/2012	N	Y
Community-Wide Lead RAO: Determine whether a community-wide lead level is needed for the Basin. If so, determine the appropriate level and how it would be used.	IDEQ, PHD, USEPA	IDEQ, USEPA	12/2012	N	Y
Disposal of Wastes from Human Health Remedial Actions					
Community-Fill Policy: Complete CFP currently being developed by USEPA and IDEQ.	IDEQ, USEPA	IDEQ, USEPA	12/2012	N	Y

TABLE ES-6
Summary of Recommendations and Follow-Up Actions – OU 3
2010 Five-Year Review, Bunker Hill Superfund Site

Recommendations/Follow-up Actions	Responsible Entity	Oversight Agency	Proposed Milestone Date	Follow-up Actions: Affects Protectiveness (Y/N)	
				Current (now to 1 year)	Future (>1 year)
Infrastructure					
Flood Control: Continue working with the Basin Commission and other stakeholders to evaluate and plan actions relative to addressing SFCDR and Pine Creek flooding that may affect cleanups.	Local Governments, IDEQ, USEPA, PHD	IDEQ, USEPA	12/2012	N	Y
Roads as Protective Barriers: Continue working to develop an approach for addressing roads as long-term barriers in collaboration with state, county, and local entities.	Local Governments, IDEQ, USEPA, PHD	IDEQ, USEPA	12/2012	Y	Y
Infrastructure Maintenance Funding: Develop appropriate institutions and funding mechanisms to finance and oversee stewardship activities.	Local Governments, IDEQ, USEPA, PHD	IDEQ, USEPA	12/2012	N	Y
Upper Basin Mine and Mill Sites					
Mine and Mill Site O&M: Coordinate with responsible entities to formally implement O&M at mine and mill sites with completed remedial actions.	BLM, IDEQ, USEPA	BLM, IDEQ, USEPA	10/2011	Y	Y
Rex Site Contaminant Release: Mitigate the infiltration of Rex Creek and the Rex Adit flow upgradient from the remedial action.	BLM, IDEQ, USEPA	BLM, IDEQ, USEPA	10/2011	Y	Y
Repositories					
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	PHD, IDEQ	IDEQ, USEPA	12/2011	N	Y
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, USEPA	IDEQ, USEPA	12/2011	N	Y

TABLE ES-6
Summary of Recommendations and Follow-Up Actions – OU 3
2010 Five-Year Review, Bunker Hill Superfund Site

Recommendations/Follow-up Actions	Responsible Entity	Oversight Agency	Proposed Milestone Date	Follow-up Actions: Affects Protectiveness (Y/N)	
				Current (now to 1 year)	Future (>1 year)
Clean Waterfowl Feeding Area/Agriculture-to-Wetland Conversion *Easement Transfer*: 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.)	USEPA	--	6/2011	N	N
Coeur d'Alene Lake *LMP Implementation*: Continue LMP implementation activities and lake monitoring efforts.	Tribe, State	USEPA	11/2015	N	Y
UPRR ROW Removal Action *UPRR Barrier Protectiveness*: Continue monitoring the barrier and conduct maintenance as needed.	UPRR	Coeur d'Alene Tribe, State of Idaho	Ongoing	N	Y

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site name *(from WasteLAN)*: Bunker Hill Mining and Metallurgical Complex		
USEPA ID *(from WasteLAN)*: IDD048340921		
Region: 10	**States: Idaho & Washington:**	**Counties: Shoshone, Kootenai, Benewah Counties in Idaho, and Spokane County in Washington**
SITE STATUS		
NPL status: ■ Final ☐ Deleted ☐ Other (specify)		
Remediation status (choose all that apply): ■ Under Construction ■ Operating ☐ Complete		
Multiple OUs?* ■ YES ☐ NO	**Construction completion date:** ___/___/_____	
Has site been put into reuse? ☐ YES ☐ NO + **Portions of the site have been put into reuse.**		
REVIEW STATUS		
Lead agency: ■ USEPA ☐ State ☐ Tribe ☐ Other Federal Agency		
Author name: USEPA Region 10		
Author title:	**Author affiliation:**	
Review period:** 5/1/2005 to 4/1/2010		
Date(s) of site inspection: OU 3 - 3/22/2010, 5/14/2010; OU 2 - 9/2009, 2/25/2010		
Type of review: ■ Post-SARA ☐ Pre-SARA ☐ NPL-Removal only ☐ Non-NPL Remedial Action Site ☐ NPL State/Tribe-lead ☐ Regional Discretion		
Review number: ☐ 1 (first) ☐ 2 (second) ■ 3 (third) ☐ Other (specify) _________		
Triggering action: ☐ Actual RA Onsite Construction at OU #___ ☐ Actual RA Start at OU# ___ ☐ Construction Completion ■ Previous Five-Year Review Report ☐ Other (specify)		
Triggering action date *(from WasteLAN)*: 09/27/2000		
Due date *(five years after triggering action date)*: 10/24/2010		

* ["OU" refers to operable unit.]
** [Review period should correspond to the actual start and end dates of the Five-Year Review in WasteLAN.]

Issues:

See Executive Summary Tables ES-1, ES-3, and ES-5.

Recommendations and Follow-up Actions:

See Executive Summary Tables ES-2, ES-4, and ES-6.

Protectiveness Statements:

Operable Unit 1

The remedy currently being implemented in OU 1 is expected to be protective of human health and the environment where response actions have already been taken, provided that follow-up action identified in Table ES-2 are implemented. Exposure pathways that could result in unacceptable risks are being controlled or addressed in locations where remedial work has been completed. There are some homes where interior house dust lead concentrations remain high. The need to identify alternative lead sources, such as lead-based paint, will be evaluated. Based, in part, on information related to alternative lead sources, a determination will be made related to the need to implement the interior cleaning component of the OU 1 remedy.

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 below the 500-mg/kg site-wide average RAO. However, in 2008, 5 percent of sampled homes in OU 1 exhibited interior dust lead concentrations greater than 1,000 mg/kg. The 1991 OU 1 ROD contemplates a one-time cleaning of homes exhibiting lead dust concentration above 1000 mg/kg. The 1990 and 2000 interior cleaning pilot studies concluded that one-time residential interior cleaning is likely not a sustainable remedy for homes with house dust equal to or greater than 1,000 mg/kg lead.

Although the OU 1 remedy is currently protective of human health and the environment where remedial actions have been taken, it is possible that flooding and infrastructure issues may affect remedy protectiveness. In addition, the ability of the local communities to improve and maintain infrastructure to protect the remedy is a concern. Provision of a long-term ICP repository is essential to the continued performance of the installed human health barriers.

In 2008, USEPA initiated efforts to identify actions needed to augment the remedial actions taken in OU 1 residential and community areas to improve their long-term sustainability. At the time of the release of this review, a Proposed Plan outlining the elements of a ROD Amendment for the Upper Basin portion of the Site, which includes actions to augment the OU 1 remedy, has been released for public review and comment (USEPA, 2010a). Upon the completion of the comment period, USEPA will evaluate the comments received and subsequently issue a ROD Amendment for the Upper Basin portion of the Site.

Operable Unit 2

The remedy currently being implemented in OU 2 is expected to be protective of human health and the environment where response actions have already been taken, provided that follow-up actions identified in Table ES-4 are implemented. In the interim, exposure pathways that could result in unacceptable risks are being controlled or addressed in locations where remedial work has been completed.

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 includes extensive source removal and stabilization efforts, demolition activities, community development initiatives, development and implementation of the ICP, land use development support, and public health response actions. Phase I also includes 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 is also included in Phase I of remedy implementation.

Phase I remedies have removed and consolidated over 2.8 million cubic yards (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.

Also, as summarized in Table 4-1, 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 and development of area-specific O&M manuals.

In 2008, USEPA initiated efforts to identify actions needed to augment the remedial actions taken in OU 2, building on information produced during evaluations of Phase I remedial actions. Results of the evaluation of Phase I source control and removal activities to meet human health and ecological water quality goals have been incorporated into the 2010 FFS (see Section 2.7 for more information on the FFS).

An SSC Amendment that allows for the full implementation of the 2001 OU 2 ROD Amendment needs to be negotiated and signed. Time-critical components of this ROD amendment were implemented to prevent catastrophic failure of the CTP and discharges of AMD to Bunker Creek and the SFCDR. Until an SSC amendment is signed, however, control and treatment of AMD and its impact on water quality will continue to be an issue.

The OU 2 remedy is currently protective of human health and the environment where remedial actions have been taken. However, flooding and infrastructure issues may affect remedy protectiveness. In addition, the ability of the local communities to improve and maintain infrastructure to protect the remedy is a concern. Provision of a long-term ICP repository is essential to the continued performance of the installed human health barriers.

Operable Unit 3

The remedy currently being implemented in OU 3 is expected to be protective of human health and the environment where response actions have already been taken, provided that follow-up actions identified in Table ES-6 are implemented. 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.

The remedy included in the 2002 OU 3 ROD 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 fully protect human and environmental resources. In 2008, USEPA initiated efforts to amend the RODs for the Upper Basin portion of the Site in order to better define actions needed to protect water quality and human and ecological receptors in the Upper Basin. The Upper Basin refers to areas of mining related contamination along the SFCDR, its tributaries, and the Bunker Hill Box. This effort also included efforts to identify actions needed to augment the remedial actions taken in Basin residential and community areas to improve their long-term sustainability. At the time of the release of this review, a Proposed Plan outlining the elements of the ROD Amendment has been released for public review and comment (USEPA, 2010a). Upon the completion of the comment period, USEPA will evaluate the comments received and subsequently issue a ROD Amendment for the Upper Basin portion of the Site.

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 Enhanced Conceptual Site Model (ESCM; CH2M HILL, 2010), including sediment transport modeling that will help guide effective decision-making regarding future remedial actions in the Lower Basin. The ECSM currently shows that the largest portion of contaminated sediments being transported in the Coeur d'Alene River are re-entrained sediments from the banks and bed of the river in the Lower Basin that are mobilized, transported, and deposited during flood events. USEPA, through a collaborative process, is embarking on the planning process to address these issues in the Lower Basin. The Lower Basin evaluations will likely result in the issuance of a Lower Basin ROD Amendment at a future date.

Significant progress has been made in cleaning up properties and ROWs in Basin residential and community areas, with nearly 2,600 properties and ROWs having been remediated by the end of 2009 (roughly 2,900 properties and ROWs are projected to be completed by the end of the 2010 construction season). The ICP was established and became operational in the Basin in 2007. 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. 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). Annual 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 also decline in response to the remedial actions implemented.

Blood-lead screening will also continue to be offered annually to identify at-risk children and provide feedback on the effectiveness of cleanup efforts.

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. The remedies constructed at recreational sites along both the Coeur d'Alene and Spokane Rivers are, in general, functioning as designed.

Two 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. The Big Creek Repository (BCR) has been in operation since 2002. The East Mission Flats Repository (EMFR) began operation in 2009. Data indicate that the BCR has been constructed in accordance with the 2002 OU 3 ROD and the BCR design and has reliably contained waste material from remedial actions, as well as wastes generated by citizens, communities, and development activities complying with the ICP. Although the EMFR has been in operation for only a short period, periodic monitoring has found no increases in contaminants of concern in the monitoring well network. Given the short operational time frame, monitoring will continue at the EMFR. 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.

USEPA is working with USFWS and Ducks Unlimited to complete a 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 overall intent of this action is to provide clean waterfowl feeding habitat to reduce their exposure to lead-contaminated sediment. A portion of an agriculture-to-wetland conversion project was completed in 2007 and is functioning as intended by the ROD.

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 did indicate that a management plan for the lake would be developed to focus on 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 revision to the LMP (Idaho Department of Environmental Quality [IDEQ] and Coeur d'Alene Tribe, 2009). Initial LMP implementation actions have been taken and lake monitoring efforts are underway. The effectiveness of LMP implementation will be reported in the next Five-Year Review Report.

The Trail of the Coeur d'Alenes was created by a CERCLA removal action under the National Rails-to-Trails Act. The goals of the removal 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 applicable or relevant and appropriate requirements (ARARs). There are numerous entities that routinely assess and inspect the functionality of the trail as both a recreational facility and a protective barrier. The installed barriers are being maintained and are functioning as designed.

The OU 3 remedy is currently protective of human health and the environment where remedial actions have been taken. However, flooding and infrastructure issues may affect remedy protectiveness. In addition, the ability of the local communities to improve and maintain infrastructure to protect the remedy is a concern.

1 Introduction

The U.S. Environmental Protection Agency (USEPA) Region 10 has completed its third 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 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 protective of human health and the environment. Projects implemented with Clean Water Act (CWA) funds are outside the scope of this review.

This Five-Year Review Report documents the methods, findings, and conclusions of the third (2010) 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 summary tables in this Executive Summary provide an overview of the entire Five-Year Review Report. This section provides an overview of the Five-Year Review statutory requirements, the process for conducting this review, 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
- 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: Actions, Issues, and Recommendations
- Section 7: Statement of Protectiveness
- Section 8: Next Five-Year Review
- Section 9: References

1.1 Statutory Requirements

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

The first (2000) Five-Year Review of the Bunker Hill Superfund Site remedies resulted in two separate Five-Year Review Reports: one for Operable Unit (OU) 1 (USEPA, 2000c) and the other for OU 2 (USEPA, 2000b). USEPA published these reports in September 2000, approximately 5 years after initiation of the first remedial action at the Site. The second (2005) Five-Year Review evaluated the remedy performance of OUs 1 and 2 and provided the first evaluation for OU 3 (USEPA, 2005). This third (2010) Five-Year Review evaluates the remedy performance for implemented remedial actions in all three OUs.

1.2 Five-Year Review Process

This 2010 Five-Year Review was conducted by the USEPA Region 10 Bunker Hill/Coeur d'Alene team and their contractor CH2M HILL, and the Idaho Department of Environmental Quality (IDEQ) and their contractor TerraGraphics. Sections of this report were contributed by the Panhandle Health District (PHD), the Coeur d'Alene Tribe, the U.S. Fish and Wildlife Service (USFWS), the U.S. Forest Service (USFS), the Idaho Department of Fish and Game (IDFG), the U.S. Army Corps of Engineers (USACE), and the U.S. Bureau of Land Management (BLM).

The review was conducted and the report prepared in accordance with USEPA guidance (USEPA, 2001d) and site-specific conditions at the Bunker Hill Superfund Site. The review process and preparation of this report included a number of steps, as described in following subsections.

1.2.1 Information Gathering

The first step included gathering site-related information from the following sources:

- Review of the three reports for the first two Five-Year Reviews (USEPA, 2000b, 2000c, 2005);
- Review of remedies selected in the Site Records of Decision (RODs), as amended or modified (see Section 1.3.1);
- Review and assessment of relevant monitoring data and remedy completion reports, including Potentially Responsible Party (PRP) reports;

- Review of operation and maintenance (O&M) records;
- Onsite inspections;
- Interviews with various individuals familiar with specific remedial activities; and
- Public notification and request for input for this 2010 Five-Year Review.

1.2.2 Technical Assessment

The second step was to use the information gathered from the first step and conduct a technical assessment of remedy performance and conformance with ROD requirements, performance standards, and cleanup goals.

The technical assessment included evaluating the following three key questions for each remedial action or activity that is under construction, operating, completed, or in the case of many OU3 remedial actions or activities, to be completed in the future:

- **Question A**: Is the remedy functioning as intended by the decision documents (e.g., RODs and Explanation of Significant Differences [ESD] documents)?
- **Question B**: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of remedy selection still valid?
- **Question C:** Has any other information come to light that could call into question the protectiveness of the remedy?

After evaluation of the above three questions, answers were documented in the Five-Year Review Report.

1.2.3 Issues and Recommended Follow-up Actions

The third step was to identify and document any issues and/or recommended follow-up actions required for each remedial action or activity. This included determining whether the issue or follow-up action would affect the protectiveness of the remedy within the next year (current) or in the future (more than one year). In certain cases, a determination was made that an issue or follow-up action was not currently affecting the remedy, but, if not dealt with in the future, it could affect long-term remedy protectiveness.

For example, the OU 2 hillsides remedy is currently performing as expected consistent with the decision documents, but if adverse impacts from off-road vehicle use are not controlled, protectiveness of the hillsides remedy in the future could be compromised.

Another example is the OU 2 biomonitoring program. Because the 1992 OU 2 ROD goals (USEPA, 1992) did not include protectiveness of ecological receptors, the OU 2 biological monitoring issues and follow-up actions indicate that monitoring results do not affect current remedy protectiveness. However, because additional OU 2 remedial actions may be considered within the context of site-wide ecological goals, the biological monitoring results may affect the protectiveness of the remedy in the future.

This step also included identifying the entities responsible for conducting and overseeing each follow-up action, and when these actions are to be completed.

1.2.4 Determining Remedy Protectiveness for Each Operable Unit

The next step was to determine the remedy protectiveness of each operable unit at the Site. In general, if the answers to the above Questions A, B, and C were *yes, yes,* and *no*, respectively, then the remedy was considered protective. However, if the answers to the three questions were other than *yes, yes,* and *no*, depending on the elements that affect each question, the remedy may be one of the following:

- Protective;
- Protective once the remedy is completed;
- Protective in the short term (current to 1 year); however, in order for the remedy to be protective in the long term (greater than 1 year), follow-up actions need to be taken;
- Not protective, unless the following action(s) are taken in order to ensure protectiveness; or
- Of undetermined protectiveness until further information is obtained.

Even if there is a need to conduct further actions, it does not mean that the remedy is not protective. Normally, the remedy is considered not protective if:

- An immediate threat is present (e.g., exposure pathways that could result in unacceptable risks are not being controlled);
- Migration of contaminants is uncontrolled and poses an unacceptable risk to human health or the environment;
- Potential or actual exposure is clearly present or there is evidence of exposure (e.g., institutional controls are not in place or not enforced and exposure is occurring); or
- The remedy cannot meet a new cleanup level and the previous cleanup level is outside the risk range.

1.2.5 Community Involvement

An iterative step in the Five-Year Review process was to involve community members and other interested parties in the process and provide an opportunity to receive their input. The public was initially notified that USEPA was conducting a site-wide Five-Year Review began in February 2010. General public notification was accomplished through fact sheets, the Coeur d'Alene Basin Bulletin, the USEPA Region 10 website (http://yosemite.epa.gov/R10/CLEANUP.NSF/sites/bh), and local newspaper advertisements. Direct notification was accomplished via e-mails and presentations to a number of organizations including the Coeur d'Alene Basin Environmental Improvement Project Commission (Basin Commission), the Commission's Technical Leadership Group (TLG), and the Commission's Citizens Coordinating Council (CCC).

Under USEPA's Five-Year Review Guidance, a public review of the draft report is not required, and USEPA opted not to provide a public comment period for the draft 2010 Five-Year Review Report. However, USEPA requested public input on any issues that should be included in the 2010 Five-Year Review. In response, USEPA received one written public comment regarding the Central Treatment Plant's sludge pond located on the Central Impoundment Area, which is addressed in Sections 4.3.6 and 4.3.10 of this document.

The conclusions of this Five-Year Review process are summarized in this final report along with issues and recommendations for future actions to be taken at the Site, a statement of the level of protectiveness of Site remedies, and a schedule for the next Five-Year Review.

1.3 Relevant Guidance and Decision Documents

1.3.1 Guidance and Decision Documents

The USEPA guidance document titled *Comprehensive Five-Year Review Guidance* (USEPA, 2001d) was used for the preparation of this Five-Year Review Report. The key USEPA decision documents relevant to the Site's Selected Remedies include the three Site RODs and the remedy change documents that were prepared as the OU 2 remedy was being implemented. Under CERCLA, as amended, remedy changes are required to be formally documented either in an amendment to the ROD or in an ESD. The 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 is 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 document 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 is responsive to the community concerns while maintaining or increasing the level of human health and environmental protection (USEPA, 1996b and 1998b).
- Amendment to the 1992 OU 2 ROD to address acid mine water drainage (AMD) from the Bunker Hill Mine, December 2001 (USEPA, 2001a).
- *Record of Decision, Bunker Hill Mining and Metallurgical Complex, Operable Unit 3 (Coeur d'Alene Basin), Shoshone County, Idaho*, September 2002 (USEPA, 2002).

1.3.2 Obtaining Decision Documents, the Final Report, and the Responsiveness Summary

The remedy decision documents listed in Section 1.3.1 and this final version of the 2010 Five-Year Review Report can be obtained via the following:

- Visiting the USEPA Region 10 website for an electronic version of this final report and the complete Responsiveness Summary at http://yosemite.epa.gov/r10/cleanup.nsf/bh/five+year+reviews
- Calling USEPA at 1-800-424-4372 Ext. 8561
- Visiting one of the Site's eight information repositories listed below:

Box Information Repositories:

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

Pinehurst Kingston Library
107 Main Avenue
Pinehurst, ID 83850
208-682-3483

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

Basin Information Repositories:

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

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

Harrison City Hall
100 Frederick Avenue
Harrison, ID 83833
208-689-3212

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 for reference desk – ask for Dana Dalrymple

1.4 Status of 2005 Five-Year Review Recommendations and Follow-up Actions

A Five-Year Review Report for OU 1, OU 2, and OU 3 of the Bunker Hill Mining and Metallurgical Complex Superfund Site was completed and signed on October 24, 2005. In that report, USEPA evaluated the remedial work performed in each OU from 2000 to 2005 using the process and guidance outlined in the preceding sections.

The 2005 report recommended a number of follow-up actions for each OU. A number of recommendations and follow-up actions from the 2005 review have been initiated and completed, but many involve activities that are ongoing in nature. These ongoing recommended actions are still relevant and applicable to the current 2010 review findings. The status of the 2005 Five-Year Review recommendations and follow-up actions is presented in the following subsections.

1.4.1 Completed 2005 Five Year Review Recommendations/Follow-up Actions

Table 1-1 presents recommendations and follow-up actions from the 2005 Five-Year Review that have been completed for each OU.

TABLE 1-1
Summary of Completed 2005 Five-Year Review Recommendations and Follow-up Actions
2010 Five-Year Review, Bunker Hill Superfund Site

Location/Topic	Completed Recommendation/Follow-up Action
Operable Unit 1	
Mine Dumps	Assess new information regarding erosion or access concerns for mine dumps on hillsides adjacent to residential yards.
Operable Unit 2	
Gulches	**Biological Monitoring:** Conduct additional soil sampling for metals concentrations in areas where biomonitoring is occurring. **Phase I Remedial Action Effectiveness Monitoring:** Complete evaluation of the Phase I remedial actions effectiveness monitoring data and revise the remedial action effectiveness monitoring plan as appropriate.
Smelterville Flats	**Biological Monitoring:** Conduct additional soil sampling for metals concentrations in north of I-90 areas where biomonitoring is occurring. **Phase I Remedial Action Effectiveness Monitoring:** Complete evaluation of the Phase I remedial actions effectiveness monitoring data and revise the remedial action effectiveness monitoring plan as appropriate.
Central Impoundment Area	**Phase I Remedial Action Effectiveness Monitoring:** Complete evaluation of the Phase I remedial action effectiveness monitoring data and revise the remedial action effectiveness monitoring plan as appropriate.
Page Pond North Channel	Evaluate area that did not survive initial hydroseeding. Take action to reestablish vegetation and/or place a soil barrier over exposed tailings. Ensure access is limited to trail users, if appropriate.
Bunker Creek Beaver Dam	Coordinate with Idaho Department of Fish and Game (IDFG) on appropriate measures to address beaver presence.

TABLE 1-1
Summary of Completed 2005 Five-Year Review Recommendations and Follow-up Actions
2010 Five-Year Review, Bunker Hill Superfund Site

Location/Topic	Completed Recommendation/Follow-up Action
OU 2 Environmental Monitoring Plan	Incorporate biological monitoring components into revised OU 2 Environmental Monitoring Plan.
Bunker Creek Phase I Remedial Action Effectiveness Monitoring	Complete evaluation of the Phase I remedial action effectiveness monitoring data and revise the remedial action effectiveness monitoring plan as appropriate.
Box UPRR ROW Barrier Erosion	Continue oversight monitoring of UPRR's operation and maintenance (O&M) program.
A-4 Gypsum Pond Vegetative Standard	Review performance of vegetative standard at the next Five-Year Review. It is currently estimated that this standard will be met in 2008 or 2009.
OU 2 Phase I	**Water Quality Monitoring/Environmental Monitoring:** Complete revision of OU 2 Environmental Monitoring Plan and implement. **Conceptual Site Model:** Complete revised OU 2 Conceptual Site Model. **Trend Analysis:** Complete statistical trend analysis of OU 2 Phase I water quality monitoring data. **Phase I Water Quality Assessment:** Complete assessment of OU 2 Phase I remedial actions with respect to water quality.
Operable Unit 3	
Institutional Controls Program	Establish an OU 3 ICP as soon as possible to protect barriers from disturbance and minimize recontamination.
Human Health Exposure Profile	Complete and updated exposure profile for OU 3.
Coeur d'Alene Lake Fish Investigation Future Sampling	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.
Lower Basin Recreational Areas Remedial Action Effectiveness Monitoring	Implement remedial action effectiveness monitoring programs at the East of Rose Lake Boat Launch and the Highway 3/Trail of the Coeur d'Alenes crossing site.
Canyon Creek	**Water Treatment Pilot Study:** Complete pilot studies to evaluate active and passive technologies to achieve the goals of the 2002 OU 3 ROD (USEPA, 2002). **Evaluate Removal Actions:** Evaluate removal actions at the following locations in context of the 2002 OU 3 ROD and, if warranted, incorporate into remedial action program: • Standard Mammoth Facility • Canyon Creek from Tamarack to below Gem • Lower Canyon Creek Floodplain • Woodland Park Repository. This also includes collection and evaluation of groundwater monitoring data.

TABLE 1-1
Summary of Completed 2005 Five-Year Review Recommendations and Follow-up Actions
2010 Five-Year Review, Bunker Hill Superfund Site

Location/Topic	Completed Recommendation/Follow-up Action
	• Gem Portal Pilot. Continue to evaluate pilot treatment system in context of Canyon Creek remedy.
Silver Dollar Growth Media Pilot	Continue annual monitoring and use results to help develop vegetative cover for future remedial actions.
Upper Basin Mine and Mill Sites	**Remedial Designs:** Complete remedial designs at Rex and Golconda sites. Initiate construction of the remedy at Constitution, Rex, and Golconda.
Ninemile Creek	**Interstate Tailings Removal:** Routine monitoring **Evaluate Removal Actions:** Evaluate removal actions at the following locations in context of the 2002 OU 3 ROD and, if warranted, incorporate into remedial action program: • Interstate Mill Site • Success Mine/Mill Tailings and Waste Rock • Success Mine Site Passive Treatment • East Fork Ninemile Creek Floodplain: • Ninemile Creek Floodplain near Blackcloud • Day Rock Repository
Pine Creek	**Constitution Mine and Mill Site:** Remedial action scheduled for summer 2006. **Denver Creek (Includes Little Pittsburg, Hilarity, Denver Mine, and Mascot Mine):** Tailings near the confluence with Pine Creek on private land remain and need to be evaluated in context of the 2002 OU 3 ROD and, if warranted, incorporate into remedial action program. Continue efforts to stabilize and revegetate mouth of Denver Creek. At the Little Pittsburg Mine, surface structures are within the active channel of Denver Creek and one adit is flooded and filled with stream sediment. Hilarity Mine needs revegetation and stream work, and Denver Mine has open tunnels and collapsed stopes. All previous work needs to be evaluated in context of ROD and, if warranted, incorporate into remedial action program. **Douglas Mine and Mill Site:** The mine discharge, old mill foundation area, and rock dump areas will be evaluated in context of the 2002 OU 3 ROD and, if warranted, incorporate into remedial action program. Several homes have been constructed near floodplain containing tailings. This area needs to be evaluated for human exposure and exposure to grazing animals. **Highland Creek Floodplain:** Ongoing revegetation and monitoring. Evaluate removal action in context of the 2002 OU 3 ROD and, if warranted, incorporate into remedial action program.
	Highland-Surprise (Includes Nevada Stewart Mine): High flows in Highland Creek have eroded the base of a Highland Surprise mine dump. Ongoing effort to revegetate the lower Highland Surprise rock dump. Mine adit discharge needs to be evaluated. Nevada Stewart rock dump needs further revegetation and site needs long term management of mine water discharge. Evaluate removal action in context of the 2002 OU 3 ROD and, if warranted, incorporate into remedial action program. **Sidney (Red Cloud):** Continue to monitor and operate the pilot water treatment unit. Evaluate waste rock pile and adit discharge in context of the 2002 OU 3 ROD and, if warranted, incorporate into remedial action program.

TABLE 1-1
Summary of Completed 2005 Five-Year Review Recommendations and Follow-up Actions
2010 Five-Year Review, Bunker Hill Superfund Site

Location/Topic	Completed Recommendation/Follow-up Action
	Amy-Matchless Mill Site: Limited revegetation and stream stabilization at the Amy site. Matchless has waste rock dumps, collapsed tunnels, and discharges that need to be evaluated in context of the 2002 OU 3 ROD and, if warranted, incorporate into remedial action program.
	Liberal King Mine and Mill Site: Continue efforts to further revegetate and stabilize the stream reach with plantings of shrubs and trees. Evaluate mine opening, waste rock dump, and mill site foundation area in context of the 2002 OU 3 ROD and, if warranted, incorporate into remedial action program.
	Nabob Mine and Mill Site: Tailings remain near the Nabob Mill that need to be addressed. BLM is continuing the site investigation and is planning to install a cover over the tailings pile in the near future. Evaluate upper and mid rock dump, mine tunnel discharge, and other actions taken in context of the 2002 OU 3 ROD and, if warranted, incorporate into remedial action program.
Moon Creek	**Elk Creek Pond at Mouth of Moon Creek:** Evaluate removal action in context of the 2002 OU 3 ROD and, if warranted, incorporate into remedial action program.
Upper South Fork Coeur d'Alene River	**Osburn Flats:** Evaluate removal action in context of the 2002 OU 3 ROD and, if warranted, incorporate into remedial action program.
Grouse Creek	**We Like Mine and Star Rock Dump:** Continue to evaluate and monitor the pilot bioreactor water treatment system. Rock dump needs stabilization and revegetation. Star Rock dump needs to be evaluated in context of the 2002 OU 3 ROD and, if warranted, incorporate into remedial action program.
South Fork Coeur d'Alene River	**Evaluate Removal Actions:** Evaluate removal actions at the following locations in context of the 2002 OU 3 ROD and, if warranted, incorporate into remedial action program: • South Fork Floodplain Removals • Elizabeth Park Bank Stabilization **Rainy Hill Boat Launch**: Due to gradual recontamination from flooding and high spring flows, USFS plans to cap with asphalt. **Anderson Lake Boat Launch:** USEPA will continue to stay abreast of plans for Highway 97 bridge replacement to the extent that this activity may influence the Superfund actions at the IDFG Anderson Lake Facility.
Lake Coeur d'Alene	**Eutrophication:** Complete lake model. **Lake Management Plan:** Complete and implement the Lake Management Plan.
Trail of the Coeur d'Alenes	**Trail Long-Term Oversight Program (TLOP):** Finalize TLOP and begin implementation. **Management Agreement:** Finalize and Implement State-Tribe Management Agreement.
Lower Basin Recreational Areas	**Remedial Action Effectiveness Monitoring**: Implement remedial action effectiveness monitoring programs at the East of Rose Lake Boat Launch and the Highway 3/Trail of the Coeur d'Alenes crossing sites.
Migratory Songbird Study	**Risk Analysis:** Conduct a risk analysis with data generated from the migratory songbird study, and assess any data gaps identified.

TABLE 1-1
Summary of Completed 2005 Five-Year Review Recommendations and Follow-up Actions
2010 Five-Year Review, Bunker Hill Superfund Site

Location/Topic	Completed Recommendation/Follow-up Action
Silver Dollar Growth Media Pilot	**Further Monitoring:** Continue annual monitoring and use results to help develop vegetative covers for future remedial actions.

1.4.2 Ongoing 2005 Five Year Review Recommendations/Follow-up Actions

Table 1-2 presents recommendations and follow-up actions from the 2005 Five-Year Review for each OU that are currently in progress.

TABLE 1-2
Summary of Ongoing 2005 Five-Year Review Recommendations and Follow-up Actions
2010 Five-Year Review, Bunker Hill Superfund Site

Location/Topic	Recommendation/Follow-Up Action In Progress
Operable Unit 1	
Right-of-Way (ROW) Recontamination	Conduct ROW sampling and analysis to determine whether lead concentrations have remained stable.
Hillside Sloughing	Evaluate unaddressed hillside sloughing areas adjacent to residential yards and determine whether control measures are needed.
One-Time Interior Cleaning	Evaluate need for implementation of the interior cleaning component of the remedy. Continue monitoring house dust concentrations annually as soil remediation is completed.
Lead Health Intervention Program	Continue offering services, including blood lead screening services and follow-up nurse visits, to help identify and mitigate potential exposure pathways.
Institutional Controls Program	Continue offering ICP programs, including the vacuum loan program. Secure permanent funding for the ICP as required by the 1994 Consent Decree.
Disposal/ICP Repository	Address long-term disposal needs as part of permanent funding for ICP, as required by the 1994 Consent Decree. Evaluate need for snow disposal area.
Infrastructure	Repair and regularly maintain existing infrastructure (e.g., failing roads). Identify funding and other resources for infrastructure maintenance and improvements to protect the remedy, such as stormwater controls.
Operable Unit 2	
Institutional Controls Program	**Funding:** Create irrevocable trust to provide consistent cash flow for ICP operation into perpetuity. **Disposal/ICP Repository:** Establish long-term disposal plan for ICP-generated wastes. **Database:** Collect information for ICP property database. **Barrier Maintenance:** Identify funding and other resources for infrastructure maintenance and improvements to protect the remedy, such as stormwater controls.

TABLE 1-2
Summary of Ongoing 2005 Five-Year Review Recommendations and Follow-up Actions
2010 Five-Year Review, Bunker Hill Superfund Site

Location/Topic	Recommendation/Follow-Up Action In Progress
Hillsides Access Controls	Assess the need for additional access control to hillsides and gulches. Inform the public of the adverse impacts resulting from off-road use.
State Superfund Contract for 2001 OU 2 ROD Amendment	Continue, with the assistance of the State of Idaho, to pursue viable solutions to the SSC impasse. Once a solution is achieved, continue with implementation of the 2001 OU 2 ROD Amendment (USEPA, 2001a).
Remedial Effectiveness Monitoring Program	Evaluate possible issues in existing Page Pond monitoring program. Review recommendations in 1999 monitoring program memorandum (CH2M HILL, 1999). Finalize monitoring program elements.
Page Repository Vehicle Decontamination	Evaluate appropriate decontamination improvements and put measures in place to reduce the potential for recontamination.
Page Pond Area	**Biological Monitoring:** Evaluate biological monitoring results and impacts related to Page Repository expansion. **Remedy Implementation:** Complete Page Pond remedial actions.
Industrial Complex	**Area 14 Remediation**: Initiate phased site characterization, remedial design and remedial action at Area 14. **State Superfund Contract (SSC) for 2001 OU 2 ROD Amendment:** Continue, with the assistance of the State of Idaho, to pursue viable solutions to the SSC impasse. Once a solution is achieved, continue with implementation of the 2001 OU 2 ROD Amendment.
Central Treatment Plant	**State Superfund Contract (SSC) for 2001 OU 2 ROD Amendment:** Continue, with the assistance of the State of Idaho, to pursue viable solutions to the SSC impasse. Once a solution is achieved, continue with implementation of the 2001 OU 2 ROD Amendment. **AMD Discharge from Reed and Russell:** Work with mine owner to address AMD conveyance issues resulting in discharge of AMD at these locations.
Bunker Creek	**State Superfund Contract (SSC) for 2001 OU 2 ROD Amendment:** Continue, with the assistance of the State of Idaho, to pursue viable solutions to the SSC impasse. Once a solution is achieved, continue with implementation of the 2001 OU 2 ROD Amendment.
Milo Gulch	**State Superfund Contract (SSC) for 2001 OU 2 ROD Amendment:** Continue, with the assistance of the State of Idaho, to pursue viable solutions to the SSC impasse. Once a solution is achieved, continue with implementation of the 2001 OU 2 ROD Amendment. **Reed Landing Adit Flows:** Continue discussions/negotiations with the mine owner to redirect the adit flows in the Milo drainage to the CTP for treatment. **Permanent Access:** Secure permanent access for system maintenance.
SFCDR Removal and Stabilization Project	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.
OU 2 Potential Wetland Loss	Mitigative measures should be considered for wetland loss at West Page Swamp due to expansion of Page Repository.

TABLE 1-2
Summary of Ongoing 2005 Five-Year Review Recommendations and Follow-up Actions
2010 Five-Year Review, Bunker Hill Superfund Site

Location/Topic	Recommendation/Follow-Up Action In Progress
Operable Unit 3	
Pine Creek, Constitution Mine and Mill Site	Post-remedial-action monitoring required as follow-up. Continue to monitor and operate the pilot water treatment unit.
Moon Creek, Silver Crescent and Charles Dickens	Ongoing monitoring.
Upper SFCDR Morning Mine No. 6	Routine monitoring.
Lower Coeur d'Alene River	**Cataldo Mission:** Post-flood monitoring. **Cataldo Boat Ramp:** Incorporate into remedial action program and ongoing monitoring. **Black Rock Slough Trailhead/Highway 3 Crossing:** Remedy is functioning as intended; continue to monitor stream bank. **Dudley Bank Stabilization:** Evaluate removal action in context of the 2002 OU 3 ROD and, if warranted, incorporate into remedial action program. **Medimont Bank Stabilization:** Evaluate removal action in context of the 2002 OU 3 ROD and, if warranted, incorporate into remedial action program. **Medimont Boat Launch:** Recommend that the U.S. Forest Service (USFS) consider paving existing boat launch area and establish paved picnic site near restrooms on north side of site. Continue day use only limitation. Address bank stabilization issues. Consider establishment of overnight RV parking area. **Anderson Lake Boat Launch:** Pending completion of designs for the Highway 97 bridge replacement, USEPA, IDFG, and the Recreational Area Project Focus Team (PFT) will evaluate the potential need for additional cleanup work at this site.
Trail of the Coeur d'Alenes	**Harrison Beach Sand:** Continue to monitor performance. **Unauthorized Use Patterns:** Continue monitoring.
Secure Funding for Full Implementation of Interim OU 3 Remedy	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.
Health and Safety During Remediations	Continue successful implementation of safety programs as evidenced by no lost time or injuries reported.
Residential and Community Area Remediation	**Implement Actions:** Continue to implement remedial actions. **Lead Health Intervention Program (LHIP):** Identify additional funding sources for the LHIP. Continue to evaluate options for increasing participation in annual blood lead screening program. **Infrastructure:** Work with Basin communities and state and federal agencies on an infrastructure plan to ensure remedy success.

TABLE 1-2
Summary of Ongoing 2005 Five-Year Review Recommendations and Follow-up Actions
2010 Five-Year Review, Bunker Hill Superfund Site

Location/Topic	Recommendation/Follow-Up Action In Progress
Coeur d'Alene Lake Fish Investigation Future Sampling	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.
Lower Basin Recreational Areas	**Informational Signage:** Replace damaged signs as needed. **Additional Areas:** Identify and evaluate additional Lower Basin recreational areas that may require cleanup.
Agriculture-to-Wetland Conversions	Identify landowners interested in agricultural to wetland conversion.
Soil Amendment Study	Evaluate findings of follow-up study and, as appropriate, conduct further evaluations of technical feasibility of soil amendments.
Upper Basin Mine and Mill Sites	Identify additional Mine and Mill sites to begin RD.
Repositories	**Big Creek:** Continue to implement remedial actions at Big Creek Repository. **New Sites**: Continue search and evaluation of potential repository sites.
OU 3 Basin Environmental Monitoring Plan	Continue to implement the BEMP.
Remedial Action Effectiveness Monitoring	Continue implementation of remedial action effectiveness monitoring at recreational areas and include remedial action effectiveness monitoring in the designs and implementation plans for ecological-related remedial actions.

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 State Superfund Contracts and Cost-Share Agreements
- 2.5 Basin Environmental Improvement Project Commission
- 2.6 Review of the Interim Selected Remedy by the National Academies' National Research Council
- 2.7 Upcoming Upper Basin ROD Amendment

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 U.S. Environmental Protection Agency (USEPA) has designated three Operable Units (OUs) for the Site:

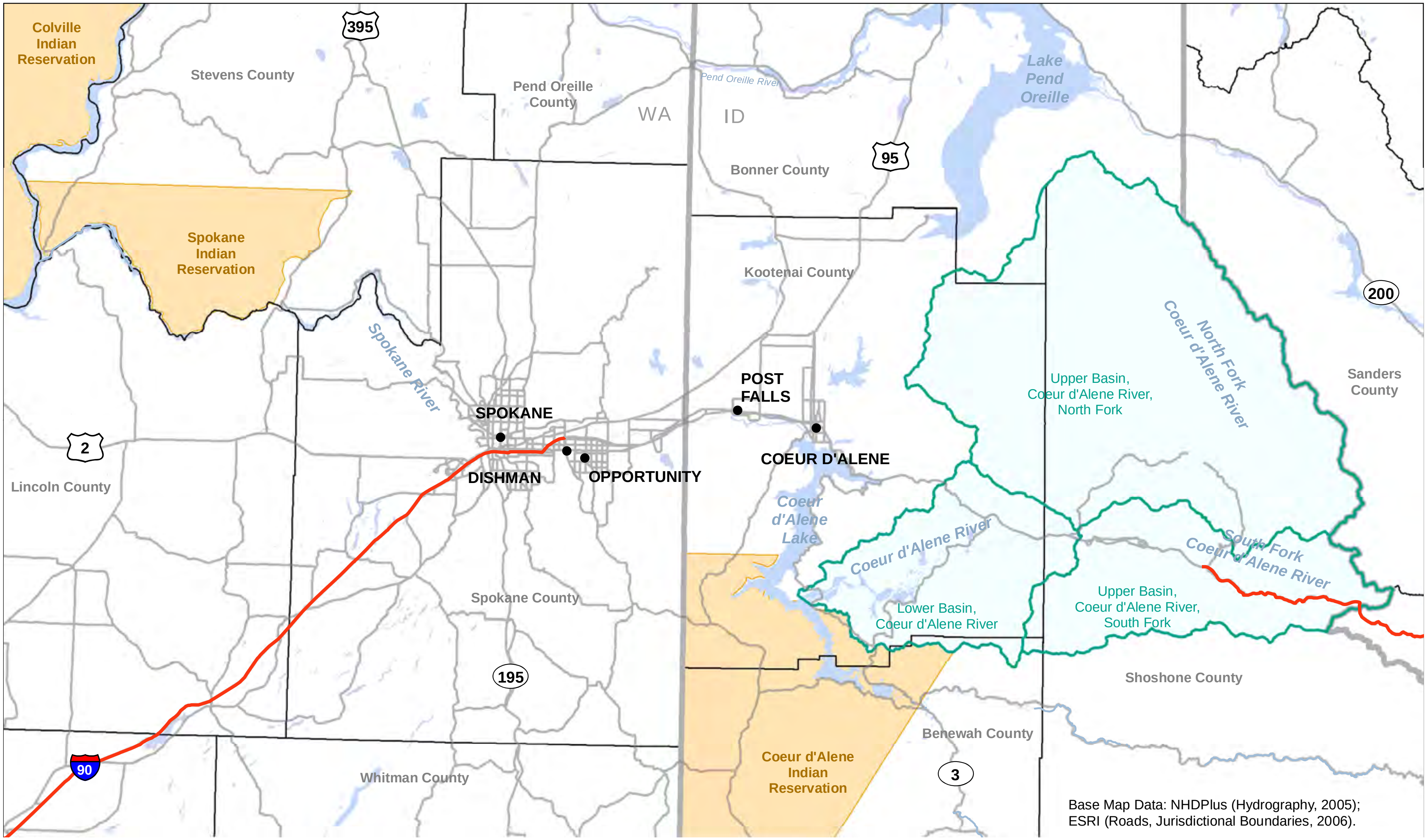
- The populated areas of the Bunker Hill Box (OU 1);
- The non-populated areas of the Box (OU 2); and
- Mining-related contamination in the broader Coeur d'Alene Basin (the "Basin", or OU 3).

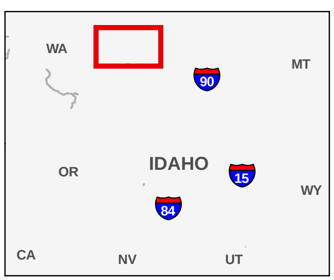
Figure 2-1 is a location map of the Bunker Hill Superfund Site. Detailed descriptions of the physical and cultural settings of the Site can be found in the Site Records of Decision (RODs) (USEPA, 1991, 1992, and 2002). The general characteristics of each OU are summarized in the following subsections.

2.1.1 Operable Unit 1

2.1.1.1 Physical Characteristics

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).





● 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
2010 Five-Year Review
BUNKER HILL SUPERFUND SITE

EPA

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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 was the area of greatest concern for human health exposure from mine waste.

2.1.1.2 Land and Resource Use

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.

2.1.2 Operable Unit 2

2.1.2.1 Physical Characteristics

OU 2 includes areas of the Bunker Hill Box that were non-populated and non-residential 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 non-populated areas of the Pine Creek drainage are both addressed as part of OU 3.

2.1.2.2 Land and Resource Use

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

2.1.3.1 Physical Characteristics

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.

2.1.3.2 Land and Resource Use

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

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, remedial investigations (RIs) and feasibility studies (FSs) initially focused on the 21-square-mile Bunker Hill Box (McCulley, Frick, and Gilman [MFG], 1992a, 1992b). USEPA published the first Site 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). These two OUs then proceeded into remedial design and remedial action phases of work. 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 and 2001a) and two Explanations of Significant Differences (ESDs) (USEPA, 1996b and 1998b).

USEPA began the Remedial Investigation/Feasibility Study (RI/FS) for OU 3 in 1998 (USEPA, 2001b and 2001c) and issued its interim ROD to clean up mining contamination in 2002 (USEPA, 2002). A number of removal actions to address immediate threats and/or obvious sources of contamination in or along streams were completed prior to the 2002 OU 3 ROD. Remedial design, remedial action, and studies to support future OU 3 remedial actions were initiated in 2003.

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 FFS is to identify additional remedial actions to protect the human health remedy and reduce metals contamination in surface water and groundwater in the Upper Basin portion of the Site, including the Bunker Hill Box. These remedy changes are documented in a Proposed Plan (USEPA, 2010a), which is available for public review and comment until November 23, 2010. Following the public comment period, a responsive summary will be prepared that will provide a response to all comments received during the comment period. This document will be part of a ROD Amendment that is expected to be complete in late Spring 2011. This Five-Year Review Report does not include an assessment of the upcoming Upper Basin ROD Amendment actions because these remedies have not yet been selected or implemented.

In December 2009, as part of the largest settlement in Superfund history, the Bunker Hill Superfund Site received approximately $494 million from a bankruptcy reorganization of American Smelting and Refining Company, LLC (ASARCO). The majority of bankruptcy settlement funds are allocated for USEPA-selected response actions in mining-contaminated areas of the Coeur d’Alene Basin outside of the Bunker Hill Box. A much smaller portion, approximately $8 million, of the settlement funds is available for response actions within the

Bunker Hill Box. Although very significant, the ASARCO settlement funds only represent a portion of USEPA's estimated site cleanup needs for the Bunker Hill Superfund Site. Therefore, USEPA wants to balance how quickly the bankruptcy settlement funds are expended with ensuring that there is enough funding for the remaining cleanup work. The settlement does, however, allow USEPA to do more long-term planning and provide greater certainty about how the cleanup will be implemented over the next several years. This, in turn, will provide more information to the community and ongoing local job opportunities generated by the cleanup.

The first (2000) Five-Year Review of the Bunker Hill Superfund Site remedies resulted in two separate Five-Year Review Reports: one for OU 1 (USEPA, 2000c), and the other for OU 2 (USEPA, 2000a). USEPA published these reports in September 2000, approximately 5 years after initiation of the first remedial action at the Site. The second (2005) Five-Year Review evaluated the remedy performance of OUs 1 and 2 and also evaluated the remedy performance for OU 3 (USEPA, 2005). This third (2010) Five-Year Review evaluates the remedy performance for all three OUs.

A narrative of the major events that have occurred at each of the OUs is provided in the following subsections. Table 2-1 provides a chronological list of major events that have occurred at the Site from 1883 to 2003. Sections 3, 4, and 5 provide timelines of major events that have occurred at each of the OUs.

TABLE 2-1
Summary of Major Events at the Bunker Hill Superfund Site from 1983 to 2010
2010 Five-Year Review, Bunker Hill Superfund Site

Event	Date
Mining operations begin at Bunker Hill	1883
First ore mill constructed	1886
Lead smelter begins operation in Kellogg (OU 2)	1917
Zinc plant begins operation (OU 2)	1928
Central Impoundment Area (CIA) is created (OU 2)	1928
Gulf purchases Bunker Hill Company (OU 2)	1968
Tailing disposal practices changed from direct river/stream discharge to settling ponds	1968
Revegetation begins with hillside tree planting by Bunker Hill Mining Company	1970s
Passage of the Clean Air Act	1970
Smelter baghouse fire destroys major air emission control equipment, lead emissions increase dramatically (OU 1 and 2)	1973
Central Treatment Plant (CTP) constructed primarily to treat acid mine drainage (AMD) (OU 2)	1974
The Centers for Disease Control (CDC) emergency response to epidemic lead poisoning, including a lead health study conducted by CDC and Idaho Department of Health and Welfare (OU 1)	1974-1975
Residents file suit against Bunker Hill Company for lead poisoning and related injuries.	1977
Smelting activities end (OU 2)	1981
Bunker Limited Partnership (BLP) purchases the Bunker Hill mine, mill, and smelter (OU 2)	1982
Bunker Hill Site listed on the National Priority List (NPL); USEPA begins Site studies and identifies liable parties (OU 1 and 2)	1983

TABLE 2-1
Summary of Major Events at the Bunker Hill Superfund Site from 1983 to 2010
2010 Five-Year Review, Bunker Hill Superfund Site

Event	Date
Kellogg revisits Childhood Blood Lead and Environmental Survey (OU 1)	1983
Blood lead screening and intervention funded by CDC (OU 1)	1985 -1989
Removal actions: common use areas (OU 1)	1986
Idaho settles natural resource damages (NRD) claim against mining companies	1986
Blood lead screening and intervention funded by the Agency for Toxic Substances and Disease Registry (ATSDR) (OU 1)	1989-2001
Bunker Hill Mining Company reopens Bunker Hill Mine. Attempts to raise capital for expansion of Mine.	1989
Removal actions: residential yards start (OU 1)	1989
Administrative Order on Consent with Gulf Resources and Hecla Mining Company for Hillsides Revegetation/Stabilization Removal Action, hillsides planting begins (OU 2)	1990
Bunker Hill Mining Company files for Chapter 11 bankruptcy. USEPA subsequently resolves its claims against this company as part of bankruptcy proceedings.	1991
Large-scale mining operations end; several operations still continue today	1991
Coeur d'Alene Tribe files a Natural Resource Damages (NRD) lawsuit against mining companies	1991
Initial Potentially Responsible Party (PRP) investigations and cleanups conducted (OU 1 and 2)	1982-1994
Remedial Investigation/Feasibility Study (RI/FS) for OU 1 completed	1991
ROD for populated areas (OU 1) signed	1991
BLP files for bankruptcy. USEPA subsequently resolves its claims against this company as part of bankruptcy proceedings.	1992
USEPA and the State of Idaho assume remediation and operation and maintenance (O&M) responsibilities (OU 2)	1992 and 1994
RI/FS for OU 2 completed	1992
ROD for non-populated areas (OU 2) signed	1992
Remedial design for OU 1 and OU 2 begins	1993-1994
Gulf Resources file for Chapter 11 bankruptcy. USEPA subsequently resolves its claims against this company as part of bankruptcy proceedings.	1994
USEPA and the State of Idaho enter into a Consent Decree (CD) in 1994 with the Upstream Mining Group for remedial work inside the Bunker Hill Box.[1]	1994
1995 CD with the Stauffer Management Company and the Union Pacific Railroad (UPRR) to begin work on the A-4 Gypsum Pond and the UPRR ROW in OU 2, respectively.[2]	1995
Institutional Control Program (ICP) adopted for the Box communities	1995
First State Superfund Contract (SSC) for the Box OU 2	1995
PRP Residential Remedial Action begins (OU 1)	1995
Phase I Remedial Action construction begins (OU 2)	1995
Basin exposure study conducted (OU 3)	1996

[1] Consent Decree; Bunker Hill; United States of America and State of Idaho v. ASARCO Incorporated, Coeur d'Alene Mines Corporation, Callahan Mining Corporation, Hecla Mining Company, Sunshine Precious Metals, Sunshine Mining Company; Civil Action No. 94-0206-N-HLR; May 10, 1994.

[2] Consent Decree; Bunker Hill; United States of America and State of Idaho v. Union Pacific Railroad Company; Stauffer Management Company; Rhone-Poulenc; Civil Action No. 95-0152-N-HLR; March 24, 1995.

TABLE 2-1
Summary of Major Events at the Bunker Hill Superfund Site from 1983 to 2010
2010 Five-Year Review, Bunker Hill Superfund Site

Event	Date
Department of Justice, on behalf of USEPA, U.S. Department of Agriculture, and Department of Interior, files complaint against Asarco, Hecla, Sunshine Mining Company, and Coeur d'Alene Mines Corporation. This case is consolidated with a pending claim by the Coeur d'Alene Tribe.	1996
Explanation of Significant Differences (ESDs) for non-populated areas (OU 2) issued	1996 and 1998
ROD Amendment for containment of Principal Threat Materials (PTMs) issued (OU 2)	1996
Removal actions: residential yards and common use areas start (OU 3)	1997
Administrative Order on Consent with ASARCO for Gem Portal Pilot Project in Canyon Creek.	1997
RI/FS for Coeur d'Alene River Basin area (OU 3) begins	1998
USEPA issues a Unilateral Administrative Order (UAO) for a removal action to address spillage of metal concentrates along the UPRR ROW	1999
2000 Five-Year Review Reports for OU 1 and OU 2 published	2000
9th Circuit Court of Appeals confirms that the NPL facility includes all areas of the Coeur d'Alene Basin where mining contamination has come to be located.	2000
U.S. District Court approves the 2000 CD between UPRR, the State of Idaho, the Coeur d'Alene Tribe, and the United States for the railroad ROW.[3] Construction of the Trail of the Coeur d'Alene begins.	2000
U.S. District Court approves the 2001 Partial CD between Sunshine Mining Company, the United States, and the Coeur d'Alene Tribe.[4]	2001
U.S. District Court approves the 2001 Partial CD between the United States and defendants Coeur and Callahan.[5]	2001
First phase of trial regarding liability was conducted in district court in Boise, Idaho with Asarco and Hecla as principal defendants.	2001
ROD Amendment for Bunker Hill Mining and Metallurgical Complex Acid Mine Drainage issued (OU 2)	2001
Basin Environmental Improvement Act of 2001 enacted by Idaho State Legislature; establishes Basin Environmental Improvement Project Commission (Basin Commission)	2001
Box SSC amended to include OU 1 property remedial actions	2002 - 2004
ROD for OU 3 signed	2002
Basin Commission begins operation	2002
Hillsides revegetation planting completed (OU 2)	2002
SSC for the Basin (OU 3)	2003
Remedial Actions begin in the Basin (OU 3) pursuant to the OU 3 ROD	2003
Box residential yards, commercial properties, and ROW cleanup by the Upstream Mining Group (UMG) under 1994 CD certified complete by USEPA (OU 1)	2008
Bunker Hill Superfund Site receives about $494 million for Superfund response actions from the ASARCO bankruptcy settlement	2009

[3] Consent Decree; Bunker Hill; United States of America, State of Idaho and the Coeur d'Alene Tribe v. Union Pacific Railroad Company; Civil Action No. 91-0342-N-EJL; February 2000.

[4] Partial Consent Decree; Bunker Hill; United States of America v.
Sunshine Mining and Refining Company and Sunshine Precious Metals, Inc.; Civil Action Nos. 96-0122-N-EJL and 91-0342-N-EJL; January 2001.

[5] Partial Consent Decree: Bunker Hill; United States of America v. Coeur d'Alene Mines Corporation and Callahan Mining Corporation; Civil Action Nos. 96-0122-N-EJL and 91-0342-N-EJL; May 2001.

2.2.1 Operable Unit 1 History

CDC, USEPA, and ATSDR have studied human health associated with exposure to heavy metals at the Bunker Hill Superfund Site (Landrigan, et al., 1976; ATSDR, 1997a and 1997b; Stokes, et al., 1998; Rao, et al., 1999). The smelter caused epidemic lead poisoning in the 1970s following gross emissions caused by bypassing the bag house, with greater than 75 percent of children exceeding 40 micrograms per deciliter (µg/dL) blood lead (von Lindern, Spalinger, Petroysan, et al., 2003). Health response activities have been ongoing for three decades.

During 1973-1974, Gulf Resources operated the lead smelter without controls following a fire in the main baghouse. Excessive smelter emissions and deposition of fine, high-lead particulates in air, soil, and dusts were the principal exposure routes to children. Dozens of children were diagnosed with clinical lead poisoning and several were hospitalized and chelated. Emergency response actions were initiated in 1974; however, mean blood lead levels in preschool children remained near 40 µg/dL until smelter closure in 1981 (Chisolm, et al., 1976; von Lindern, Spalinger, Bero, et al., 2003; von Lindern, Spalinger, Petroysan, et al., 2003). An early health study was performed cooperatively by the State of Idaho and the Bunker Hill Company (Chisolm, et al., 1976).

In 1983, a subsequent Lead Health Study was jointly conducted by state, federal, and local health agencies to identify blood lead levels and exposure pathways in the community (Panhandle Health District [PHD], 1986). In 1985, a Lead Health Intervention Program (LHIP) was initiated by the State of Idaho with funding provided by CDC and ATSDR. The LHIP was developed to minimize blood lead levels in children through health education, parental awareness, and biological monitoring. This ongoing program is administered by PHD in conjunction with the Idaho Department of Environmental Quality (IDEQ).

In 1986, 16 public properties (including city parks and school playgrounds) were remediated as part of a Comprehensive Environmental, Response, Compensation and Liability Act (CERCLA) time-critical removal action. In 1989, additional CERCLA time-critical removal actions were implemented to replace contaminated soils in yards of young children at highest risk of lead poisoning.

The OU 1 Residential Soils ROD was published in 1991 (USEPA, 1991). Additional remedial actions in the residential areas (e.g., remediation of house dust, commercial properties, and ROWs) were identified in the 1992 OU 2 ROD for the non-populated areas (USEPA, 1992).

In 1994, USEPA and the State of Idaho entered into a consent decree (CD) with the PRPs for remedial work inside the Box.[6] As part of the CD work obligations, the PRPs were required to remediate at least 200 residential yards each year until all contaminated yards, commercial properties, and ROWs have been remediated. Between 1998 and 2008, residential, commercial, and ROW cleanup work required by the CD in Box communities was certified complete by USEPA.

[6] Consent Decree; Bunker Hill; United States of America and State of Idaho v. ASARCO Incorporated, Coeur d'Alene Mines Corporation, Callahan Mining Corporation, Hecla Mining Company, Sunshine Precious Metals, Sunshine Mining Company; Civil Action No. 94-0206-N-HLR; May 10, 1994.

In 1995, the ICP was adopted by the PHD to address the Box communities. The ICP is a rule adopted by the State of Idaho legislature (Idaho Administrative Procedures Act [IDAPA] 41.01.01) designed to ensure the integrity of protective barriers throughout the Site.

The first and second Five-Year Review Reports for OU 1 were published in 2000 and 2005 (USEPA, 2000c, 2005).

In 2002, USEPA and the State of Idaho assumed responsibility over a portion of the residential property remediation due to the PRPs not fulfilling their 1994 CD work obligations. USEPA and the state continued this partial "takeover" during the 2002, 2003, and 2004 construction seasons.

In 2008, USEPA certified completion of the residential property remediation program performed under the 1994 CD.

2.2.2 Operable Unit 2 History

In 1989, USEPA presented various orders to the PRPs to begin remediation of environmental problems within OU 2. A ROD for OU 2 was published in 1992 (USEPA, 1992). Two OU 2 ROD amendments (1996a, 2001a) and two ESDs (1996b, 1998b) have been issued.

PRP-supported cleanup efforts ensued for about 10 years, including the funding of numerous studies, the initial cleanup of the smelter complex, the terracing of the denuded hillsides, and some revegetation work. However, with the 1991 bankruptcy of one of the Site's PRPs (BLP) and the subsequent bankruptcy of the Site's major PRP (Gulf Resources) in 1994, USEPA and the State of Idaho assumed responsibility for the 1992 OU 2 ROD-specific remedial actions that were previously BLP and Gulf responsibilities in 1995. These included remedial actions at the following areas:

- Hillsides;
- Gulches (Grouse, Government, Magnet and Deadwood);
- Smelterville Flats, north and south of I-90;
- Central Impoundment Area (CIA);
- Industrial Complex (Lead Smelter, Zinc Plant, Phosphoric Acid Plant);
- Boulevard Area and Railroad Gulch;
- Mine Operations Area (MOA);
- Central Treatment Plant (CTP);
- Bunker Creek; and
- Milo Creek and Reed Landing.

Remaining PRPs signed CDs with USEPA and committed to implementing the following OU 2 remedial actions:

- Page Pond remediation (ASARCO, Hecla, and Sunshine).[7]

[7] Consent Decree; Bunker Hill; United States of America and State of Idaho v. ASARCO Incorporated, Coeur d'Alene Mines Corporation, Callahan Mining Corporation, Hecla Mining Company, Sunshine Precious Metals, Sunshine Mining Company; Civil Action No. 94-0206-N-HLR; May 10, 1994.

- Remediation of the Union Pacific Railroad (UPRR) ROW through OU 2;[8] and
- Closure of the A-4 Gypsum Pond (Stauffer Management Company).[9]

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, 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 were 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 operation and maintenance (O&M) plan and implementation schedule. Interim control and treatment of contaminated water and AMD was also included in Phase I of remedy implementation. Phase I remediation activities began in 1995 and are nearly complete.

The Phase I remedy has been largely implemented within the Box. The effectiveness evaluation of the Phase I source control and removal activities to meet the water quality improvement objectives of the 1992 OU 2 ROD has been completed, and additional data collection activities and studies have been conducted to assist in evaluating the appropriate Phase II implementation strategies and actions.

OU 2 also includes the Bunker Hill Mine and associated AMD. The 1992 OU 2 ROD did not select response actions for the mine water and therefore did not address control of AMD from the Bunker Hill Mine or operation of the CTP where the AMD is treated, in any significant way. It also did not identify any plans for the long-term management of the mine water flows or address the long-term management of sludge from the CTP. Additional remedies addressing these AMD issues were selected in the 2001 OU 2 ROD Amendment (USEPA, 2001a).

To date, USEPA and the State of Idaho have not concluded negotiations on an SSC Amendment that allows for full implementation of this ROD Amendment. Time-critical components of the 2001 OU 2 ROD Amendment were implemented beginning in 2004, however, to avoid potential catastrophic failure of the aging CTP and to provide for emergency mine water storage (USEPA and IDEQ, 2003d). These time-critical activities focused on preventing discharges of AMD to Bunker Creek and the SFCDR. Until an SSC Amendment is signed allowing for full implementation of the 2001 OU 2 ROD Amendment, control and treatment of AMD and its impact on water quality will continue to be an issue. USEPA and the State of Idaho continue to discuss the SSC amendment and the long-term obligations associated with the full mine water remedy.

The first and second Five-Year Review Reports for OU 2 were published in 2000 and 2005 and summarized both PRP- and government-led activities (USEPA, 2000b, 2005).

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8 Consent Decree; Bunker Hill; United States of America and State of Idaho v. Union Pacific Railroad Company; Stauffer Management Company; Rhone-Poulenc; Civil Action No. 95-0152-N-HLR; March 24, 1995.

9 Ibid.

2.2.3 Operable Unit 3 History

Prior to the OU 1 and OU 2 RODs, it was recognized that mining-related contamination in the Coeur d'Alene Basin was not limited to the areas within OU 1 and OU 2. Starting in 1989, removal actions were initiated in OU 3 to address immediate threats and/or obvious sources of contamination in or along streams.

The first comprehensive study of human health effects outside of OU 1 and OU 2 was conducted in 1996 by IDHW, PHD, and ATSDR (IDHW, 2000). The study indicated excessive levels of lead absorption by children.

In September 1996, the United States District Court for the Western District of Washington ordered USEPA and the State of Idaho to develop a schedule for completion of total maximum daily loads (TMDLs) for all water-quality impaired streams identified by the state, including the Coeur d'Alene River Basin. In August 2000, a TMDL for dissolved cadmium, lead, and zinc in surface waters of the Basin was jointly issued by USEPA and the State of Idaho (USEPA and IDEQ, 2000). In 2001, a district court judge for the State of Idaho invalidated the TMDL on the procedural grounds that the State of Idaho had not engaged in formal rulemaking when adopting the Basin TMDL. The invalidation of the TMDL was appealed to the Idaho Supreme Court and the decision was upheld. Any new Basin TMDL developed by the State of Idaho would be required to go through a formal rulemaking under state law before being sent to USEPA for approval.

Because of the presence of environmental and human health impacts in areas outside of OU 1 and OU 2 and the limitations of the existing authorities to deal with these impacts, USEPA initiated an RI/FS for the Coeur d'Alene Basin in 1998. The Final RI/FS (USEPA, 2001b and 2001c), Ecological Risk Assessment (USEPA, 2001e), and Human Health Risk Assessment (Terragraphics et al., 2001) were released in 2001.

On September 12, 2002, USEPA issued an interim ROD to address mining contamination in the broader Coeur d'Alene Basin (OU 3) (USEPA, 2002). The cleanup plan resulted from several years of intensive studies to determine the extent of contamination and the associated risks to people and the environment. The 2002 OU 3 interim ROD (2002 OU 3 ROD) describes the specific cleanup work, called the interim Selected Remedy (the remedy) that will occur in the Basin at a cost of about $360 million over approximately 30 years. Support for the 2002 OU 3 ROD was given by 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, the U.S. Bureau of Land Management (BLM), the U.S. Fish and Wildlife Service (USFWS), and the U.S. Forest Service (USFS).

The 2002 OU 3 ROD includes:

- 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; and
- 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.

Certain potential exposures to human health outside of the communities and residential areas of the Upper Basin and Lower Basin were not addressed by the 2002 OU 3 ROD. These potential exposures affecting human health include:

- Recreational use at areas in the Upper Basin and Lower Basin where cleanup actions are not implemented pursuant to the 2002 OU 3 ROD;
- Subsistence lifestyles, such as those traditional to the Coeur d'Alene and Spokane Tribes; and
- Potential future use of groundwater that is currently contaminated with metals.

In addition, a remedy for Coeur d'Alene Lake is not included in the 2002 OU 3 ROD. State, tribal, federal, and local governments revised a Lake Management Plan (LMP) outside of the Superfund process using separate regulatory authorities. The OU 3 ROD does state, however, that USEPA will evaluate lake conditions in future Five-Year Reviews.

USEPA's first priority for implementation of the 2002 OU 3 ROD is to remediate residential and recreational areas subject to direct human health risks. Subsequent actions will include cleanup of areas that pose ecological and human health risks.

Idaho state legislation under the Basin Environmental Improvement Act (Title 39, Chapter 810) established the Coeur d'Alene Basin Environmental Improvement Project Commission (Basin Commission). This commission includes federal, state, tribal, and local governmental involvement. USEPA serves as the federal government representative to the Basin Commission and will continue to work closely with the governments and communities as they implement the cleanup plan. USEPA will continue to be responsible for ensuring that the cleanup work meets the requirements of the 2002 OU 3 ROD as well as CERCLA laws and regulations.

The 2002 OU 3 ROD has been reviewed by the National Research Council (NRC) of the National Academies and is documented in *Superfund and Mining Megasites: Lessons from the Coeur d'Alene River Basin* (NRC, 2005) (see Section 2.6, below). Since the ROD for OU 3 was issued in 2002, USEPA has continued to support data collection efforts throughout the Coeur d'Alene Basin, particularly in the Upper Basin. The additional data have served to improve USEPA's understanding of the Upper Basin, and enabled USEPA to address key NRC recommendations with respect to the fate and transport of dissolved metals in the subsurface and the role that groundwater plays in contaminant loading to surface water. USEPA also remains committed to work closely with Basin Commission as well as the TLG and CCC in implementing the 2002 OU 3 ROD.

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.

In the RI conducted in OU 2 (MFG, 1992b), typical lead concentrations found in wastes and soils within the OU 2 smelter complex ranged to 100,000 milligrams per kilogram (mg/kg) or more. Tailings in the river's flood plain averaged greater than 20,000 mg/kg lead. Soils in residential yards in the smelter communities averaged 2,500 mg/kg to 5,000 mg/kg in the early 1980s, and house dust lead concentrations averaged 2,000 mg/kg to 4,000 mg/kg at that time. For additional quantitative data on levels of contamination found during the RI, see the ecological and human health risk assessments for OU 3 referenced in Section 2.2.3.

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, 2001c).

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.

2.3.2 Nature and Extent of Contamination

2.3.2.1 Contamination Affecting Primarily Human Health

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

- 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 aquatic food sources (e.g., fish);
- Contaminated homegrown vegetables; and
- Contaminated floodplain soil, sediments, and vegetation.

People can be exposed to chemicals of concern (COCs) by ingesting soil, breathing dust, drinking water, and eating contaminated fish or homegrown vegetables. The COCs for protection of human health are:

- Lead and arsenic in soil and sediment;
- Lead in house dust; and
- 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.

Exposures to lead in soil and dust from the home and surrounding communities are the primary human health concerns. Exposure to contaminated soil and sediment at recreational areas also are a concern. Drinking water obtained from private, unregulated sources is another potential exposure route.

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 chemicals of ecological concern for ecological protection are:

- Cadmium, copper, lead, and zinc in surface water;
- Arsenic, cadmium, copper, lead, and zinc in soil; and
- 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.

The Site's first mill for processing lead and silver ore was constructed in 1886 and had a capacity of 100 tons of raw ore per day. Subsequent mills built at the Site contributed to a total of 2,500 tons of processed ore per day (USEPA, 1992). 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, 1986b). 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 put online. 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 (OU 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 historic 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, 2001c). Based on the estimated historic average values, about 1,550 pounds per day of dissolved zinc (53 percent of the total Upper Basin load) came from sources inside OU 1 and OU 2 and about 1,370 pounds per day of dissolved zinc (47 percent of the total Upper Basin load) came from sources in the Upper Basin outside of OU 1 and OU 2. 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 sediments 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 (OU 3)

The Lower Basin includes the mainstem Coeur d'Alene River, the lateral lakes area, and extensive floodplain wetlands. Below Cataldo, the river flows into a broad, flat valley and takes on a meandering, depositional valley and takes on a meandering, depositional character with a fine sediment bottom. From Rose Lake downstream, the river surface elevation is controlled by Post Falls Dam on the Spokane River near the outlet from the Coeur d'Alene Lake. Much of the tailings released to streams in the Upper Basin were transported to and deposited within the river channel and floodplains in the Lower Basin, largely transported during flood events.

In the Lower Basin, erosion of river banks and beds is a major secondary source of metals, particularly lead, entering the Coeur d'Alene River. There are an estimated 1.8 million cy of impacted bank materials and an estimated 20.6 million cy of impacted bed sediments subject to erosion. The average concentration of lead in over 2,000 non-random sediment samples within the floodplain collected in the Lower Basin is 3,100 mg/kg (USEPA, 2001c).

The increase in total lead load below the confluence of the North Fork of the Coeur d'Alene River (NFCDR) and the SFCDR is about 1,040 pounds per day, or about 69 percent of the load that discharges to the lake. Lead tends to bind more strongly to soil particles than does zinc, and the lead load is largely due to erosion of soil and sediment, particularly during high-flow periods. As a result, the total lead loads display a large variability with time. During the 100-year flood event in February 1996, an estimated 1,400,000 pounds of lead were discharged to Coeur d'Alene Lake in a single day. Lower Basin wetlands, 100-year floodplains, and lateral lake sediments are the major sources of metals ingested by waterfowl and other animals. Based on geostatistical analysis, there are about 18,300 acres of floodplain sediments that contain more than 530 mg/kg of lead in the surficial sediments, the lowest observed adverse effects level (LOAEL) for waterfowl. The area containing more than 530 mg/kg of lead represents an estimated 95 percent of the 19,200 acres of floodplain habitat present in the Lower Basin. There are about 15,400 acres of floodplain sediments that contain more than 1,800 mg/kg of lead, the mortality threshold concentration for waterfowl. The area containing more than 1,800 mg/kg of lead represents an estimated 80 percent of the 19,200 acres of floodplain habitat present in the Lower Basin.

The Lower Basin includes the Cataldo/Mission Flats area, where tailings were dredged from the river and placed within the 100-year floodplain from 1932 to 1967. An estimated

13 million cubic yard of tailings-impacted dredge spoils cover about 680 acres at this location.

Detailed planning for future remedial action in the Lower Basin requires more comprehensive knowledge of the complex mechanisms by which lead 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 (CH2M HILL, 2000) for the Coeur d'Alene Basin was updated for the Lower Basin in 2010 and captured in the Enhanced Conceptual Site Model (ECSM; CH2M HILL, 2010). Existing data, river system knowledge, information learned from pilot projects, and identification of key data gaps have been compiled in the disciplinary technical memoranda that comprise the ECSM. The ECSM synthesizes results from previous studies, reports, modeling, and existing data to enhance understanding of environmental processes in the Lower Basin.

Development of the ECSM has helped determine the type and amount of data necessary to measure and model sediment transport and river system dynamics in the Lower Basin. These data will be used to document current trends, define contaminant source areas, refine the sediment budget, calibrate and validate simulation model(s), and quantitatively describe baseline conditions against which to predict the effects of potential remedies, document success of remedial actions, and select future remedial actions. Collection of additional data to address key data gaps is being integrated into the ongoing Basin Environmental Monitoring Plan (BEMP). USEPA will use this information to examine Lower Basin remedies previously selected in the 2002 OU 3 ROD and determine whether the selected actions should be modified or supplemented. The Lower Basin work will likely include review of select remedial actions identified in the 2001 FS Report (USEPA, 2001b), with a view to USEPA's anticipated issuance of a ROD Amendment for the Lower Basin at a future date.

Coeur d'Alene Lake (OU 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 (FERC) 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. Coeur d'Alene Lake is the homeland of the Coeur d'Alene Tribe.

The beaches and wading areas adjacent to Coeur d'Alene Lake were sampled in 1998 and were found to be safe; i.e., concentrations of metals did not exceed risk-based levels for recreation (USEPA, 2002). 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.

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.

A fish consumption study was conducted in 2002 in Coeur d'Alene Lake. 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 (http://healthandwelfare.idaho.gov).

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, 2001c). Studies by the U.S. Geological Survey (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 (OU 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, 2002). 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 to the Upper Basin and Lower Basin. 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 State Superfund Contracts and Cost-Share Agreements

An SSC is required prior to initiation of a federal-lead response action at a Superfund site.[10] The purpose of the SSC is two-fold. First, it obtains the necessary CERCLA assurances from the state such as cost-sharing and O&M responsibilities. Second, it documents the responsibilities of USEPA and the state during remedial action and includes clauses that outline the basic purpose, scope, and administration of the SSC, as well as the remedial actions to be conducted under the SSC.

In addition to the SSC, a state may be required to enter into a cost-share Support Agency Cooperative Agreement (SACA) with USEPA if it intends to meet any or all of its response action cost-share obligations via in-kind services.[11] The cost-share SACA identifies the approvable categories of activities the state will perform with in-kind services, and in the case of the Bunker Hill Superfund Site, with nonfederal funds (credits) to meets its cost-share obligations.

2.4.1 SSC and SACA for the Box

In 1995, with the bankruptcy of the Site's major PRP, USEPA and the State of Idaho entered into an SSC specific to OU 2 remedial actions (USEPA and IDHW, 1995). This SSC incorporated several additional documents that provided a framework for decisionmaking and conducting OU 2 remedial actions. These documents included:

- Cost-share SACA: Documents the types of activities the State of Idaho will perform with in-kind services and nonfederal funds (credits) to satisfy its cost-share obligations for OU 2. The state's cost-share is 10 percent of the federally financed response action expenditures.[12]
- Memorandum of Agreement (MOA): Defines the working relationship between the State of Idaho and USEPA for the OU 2 (and later OU 1) cleanups.
- Remedial Action Master Plan (RAMP): Outlines the process by which an individual response action can be selected, refined, designed and constructed.

[10] CERCLA Section 104(a)(1), (c)(2), and (c)(3) and Section 121; 40 CFR 300.515(a) & 300.180(d); 40 CFR 35.6800(a) & 35.6805(a).

[11] 40 CFR S§§ 31.24 and 35.6815.

[12] 40 CFR Parts 35.6105(b)(2), 35.6120(2) & 35.6805(i)(5); 40 CFR 300.510(b); Section 104(c)(3) of CERCLA, as amended.

- Comprehensive Cleanup Plan (CCP) and Two-Phase Strategy: Outlines the conceptual two-phased approach to implement the remedy in OU 2.
- Cost Memorandum: Summarizes the 1995 cleanup cost estimate that was developed by USEPA and the State of Idaho based on the implementation approaches summarized in the CCP.

In 2001, the PRPs responsible for OU 1 remedial actions indicated they would not fully comply with their CD obligations.[13] In June 2002, USEPA and the State of Idaho amended the OU 2 SSC and cost-share SACA to include the scope and costs associated with a partial USEPA takeover of OU 1 residential and common-use area response actions (USEPA and IDEQ, 2002). While negotiations with the PRPs continued, the SSC was again amended in 2003 and 2004 to ensure that priority actions to protect human health continued in OU 1 (USEPA and IDEQ, 2003c and 2004). This combined OU 1 and OU 2 SSC is referred to as the Box SSC.

In December 2001, a comprehensive remedy for AMD was approved in an OU 2 ROD Amendment (USEPA, 2001a). To date, USEPA and the State of Idaho have not concluded negotiations on an SSC amendment that allows for full implementation of this ROD amendment. In March 2003, however, the Box SSC was amended to allow implementation of time-critical components of the 2001 OU 2 ROD Amendment to avoid potential catastrophic failure of the aging CTP and to provide for emergency mine water storage (USEPA and IDEQ, 2003d). These time-critical activities focused on preventing discharges of AMD to Bunker Creek and the SFCDR. Until an SSC amendment is signed allowing for full implementation of the 2001 OU 2 ROD Amendment, control and treatment of AMD and its impact on water quality will continue to be an issue. USEPA and the State of Idaho continue to discuss the SSC amendment and the long-term obligations associated with the full mine water remedy.

The Box SSC was again amended in September 2003 to revise and clarify the CERCLA assurance language regarding real property acquisition (USEPA and IDEQ, 2003a). Specifically, the language was revised to reflect disposition of the approximately 1,900 acres USEPA acquired in 1995 as part of the Gulf bankruptcy settlement. According to the terms of the 1995 SSC, the state will eventually accept transfer of all 1,900 acres (USEPA and IDEQ, 1995). To date, 1,799 acres have already been conveyed to the state for future beneficial use by the communities of the Silver Valley.

2.4.2 SSC and SACA for the Basin

In August 2003, USEPA and the State of Idaho signed a separate SSC and cost-share SACA regarding response activities to be conducted in OU 3 (USEPA and IDEQ, 2003b) in accordance with the 2002 OU 3 ROD. This SSC includes language regarding the role of the Basin Commission in overseeing implementation of the 2002 OU 3 ROD. The Basin Commission will prepare and approve annual and five-year work plans. USEPA and the State of Idaho will use these work plans to generate an annual list of projects to be performed.

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[13] Consent Decree; Bunker Hill; United States of America and State of Idaho v. ASARCO Incorporated, Coeur d'Alene Mines Corporation, Callahan Mining Corporation, Hecla Mining Company, Sunshine Precious Metals, Sunshine Mining Company; Civil Action No. 94-0206-N-HLR; May 10, 1994.

2.5 Basin Environmental Improvement Project Commission

The Basin Environmental Improvement Project Commission (Basin Commission) was created by the Idaho legislature under the Basin Environmental Improvement Act of 2001 (Idaho Code Title 39, Chapter 81). The Basin Commission conducts its work in the Coeur d'Alene Basin of Idaho, which is defined as the watershed of Coeur d'Alene Lake within the counties of Shoshone, Kootenai, and Benewah as well as the Coeur d'Alene Reservation located within the state of Idaho (Basin Commission, 2004).

The Basin Commission became operational in March of 2002 and includes one representative each from the State of Idaho, the Coeur d'Alene Tribe, and Shoshone, Benewah, and Kootenai Counties. The State of Washington and the Federal Government joined the Basin Commission through the execution of an MOA signed by the USEPA Administrator in Coeur d'Alene (Basin Commission, 2002). Each of the representatives noted above are signatories to the MOA. In addition, USFS, the U.S. Department of the Interior and the Spokane Tribe signed on to the MOA in the same period. The MOA affirmed the dual roles of the Basin Commission to exercise certain state authorities to address heavy metal contamination in Idaho's Coeur d'Alene Basin as set forth in the enabling legislation, and to oversee and coordinate the implementation of the 2002 OU 3 ROD in coordination with other authorities and entities involved in OU 3 cleanup activities. In addition, consistent with the MOA, the Basin Commission may address:

- Implementation of Phase II of the OU 2 CCP consistent with the 1992 OU 2 ROD;
- Adoption and implementation/coordination of the Coeur d'Alene LMP to manage, enhance, preserve, and protect lake water quality; and,
- Remediation of heavy metal contamination at specific mining sites in the NFCDR.

The Basin Commission created the TLG and the CCC to advise the Commissioners on planning and implementation of remedial actions and environmental projects. The TLG "advises and provides recommendations on and plans for all duties related to implementation of Records of Decision and other technical or regulatory issues put forward to the Commission" (Basin Commission, 2002). The TLG consists of federal, state, local, and tribal representatives serving the governmental entities with regulatory or land management responsibilities in the Basin that may be affected by remedial actions. The CCC is intended to serve as "the primary information conduit to and from the Basin Commission on citizen/community issues, concerns, and opportunities for input related to Commission activities" (Basin Commission, 2002).

Additional information about the Basin Commission can be found on the Commission's website: www.basincommission.com.

2.6 Review of the Interim Selected Remedy for OU 3 by the National Academies' National Research Council

In 2005, the National Academies' NRC completed an independent evaluation of the Coeur d'Alene Basin interim Selected Remedy for OU 3 to examine USEPA's scientific and technical practices in Superfund site characterization, human and ecological risk assessment, remedial planning, and decision making (NRC, 2005). The NRC is an independent, nongovernmental institution that advises the nation on scientific, technical, and medical issues. The NRC convened the Committee on Superfund Site Assessment and Remediation in the Coeur d'Alene Basin, composed of members with a wide range of expertise and backgrounds. As part of its review, the Committee considered peer-reviewed scientific literature; government agency reports; information submitted to the Committee by citizens, advocacy groups, and industry; and unpublished database information as well as related statistics and data directly obtained from USEPA and the States of Idaho and Washington.

The NRC review generally supported USEPA's scientific and technical practices conducted at the Bunker Hill Site, particularly related to human health risks. The NRC review also raised concerns about how the USEPA Superfund Program would be able to address the massive amounts of mining contamination that have resulted in significant risks to public health and the environment.

Since completion of the NRC review, USEPA has been evaluating the NRC recommendations and incorporating changes in remedy planning and implementation as appropriate. For example, the NRC recommended USEPA further evaluate the potential for recontamination in floodplain areas and perform additional characterization of groundwater and surface water contamination. USEPA is moving forward with additional data collection and site characterization to address the NRC recommendations. Additionally, NRC recommendations related to analysis and prioritization of sources contributing metals to Site waters will be addressed in the upcoming Upper Basin ROD Amendment (see Section 2.7). USEPA also will likely complete a Lower Basin ROD Amendment in the next few years that will further address the NRC recommendations, particularly those related to potential recontamination in floodplain areas.

Since the ROD for OU 3 was issued in 2002, USEPA has continued to support data collection efforts throughout the Coeur d'Alene Basin, particularly in the Upper Basin. The additional data have served to improve USEPA's understanding of the Upper Basin and enabled USEPA to address key NRC recommendations with respect to the fate and transport of dissolved metals in the subsurface and the role that groundwater plays in contaminant loading to surface water.

2.7 Upcoming Upper Basin ROD Amendment

As discussed in Section 2.2, USEPA has completed an FFS and a Proposed Plan for the Upper Basin to support additional remedy changes to the existing RODs for all three OUs (USEPA, 2010b). For purposes of the FFS and the Proposed Plan, the Upper Basin includes areas of mining-related contamination along the SFCDR and its tributaries downstream to one mile west of the confluence of the South and North Forks of the river and the Bunker Hill Box.

The 2010 FFS summarizes USEPA's evaluation of additional remedial actions to protect the human health remedy and reduce metals contamination in surface water and groundwater in the Upper Basin portion of the Site, including the Bunker Hill Box. The 2010 FFS builds upon Alternatives 3 and 4 of the 2001 FS Report (USEPA, 2001b) for the Upper Basin of OU 3, taking into consideration the NRC recommendations and current Site environmental conditions. OU 2 Phase II remedial actions also are evaluated as part of the 2010 FFS. The focus of the Phase II remedial actions is improving water quality in the SFCDR.

The proposed cleanup approach for the Upper Basin, including the Box, would provide a final remedy for:

- Human health protection for surface waters used for drinking purposes;
- Ecological protection for surface waters; and
- Human health and ecological protection for soil, sediment, and source material in locations where remedial actions are taken.

The proposed cleanup approach for the Upper Basin also would enhance the protectiveness of previously selected human health remedies in areas that are vulnerable to erosion and degradation of clean barriers. Further, the proposed cleanup approach is expected to significantly reduce groundwater contamination levels and the contribution of contaminated groundwater to surface water.

USEPA has documented its preferred cleanup approach for the Upper Basin in a Proposed Plan (USEPA, 2010a), which was issued for public comment on July 12, 2010. USEPA initially offered a 45-day public comment period, which exceeds the 30-day minimum requirement. After receiving requests for additional review time from external stakeholders, USEPA provided an additional 90 days for public comment. The Proposed Plan public comment period will close on November 23, 2010. Following the public comment period, USEPA will prepare a summary of responses to all comments received during the comment period. The responsiveness summary will be part of an Upper Basin ROD Amendment that is expected to be completed in late Spring 2011.

This Five-Year Review Report does not include an assessment of the upcoming Upper Basin ROD Amendment actions because these remedies have not yet been selected or implemented.

3 Review of Selected Remedies for Operable Unit 1

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

- 3.1 Overview of the Selected Remedy
- 3.2 Review of Applicable or Relevant and Appropriate Requirements (ARARS)
- 3.3 Review of Operable Unit Work and Remedial Actions
- 3.4 Performance Evaluation of the OU 1 Remedy

A protectiveness statement for OU 1 is provided in Section 7 of this report. Figure 3-1 is a map of the communities in OU 1, and Figure 3-2 is a timeline of key events.

3.1 Overview of Selected Remedy

The OU 1 Selected Remedy and remedial action objectives (RAOs) are described in the 1991 OU 1 Record of Decision (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 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 removals 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 (Panhandle Health District [PHD], 1986). This pattern has been widely observed and supported by many subsequent studies (Lanphear and Roghmann, 1997; Succop et al., 1998; Manton et al., 2000; Lanphear et al., 2002; Lanphear et al., 2003; von Lindern, Spalinger, Petroysan, et al., 2003; von Lindern, Spalinger, Bero, et al., 2003; Laidlaw, Mielke, et al., 2005).

To achieve the RAOs, the cleanup strategy includes:

- Implementation of a Lead Health Intervention Program (LHIP) for local families;

- Remediation of all residential yards, commercial properties, and rights-of-way (ROWs) that have soil lead concentrations greater than 1,000 milligrams per kilogram (mg/kg);

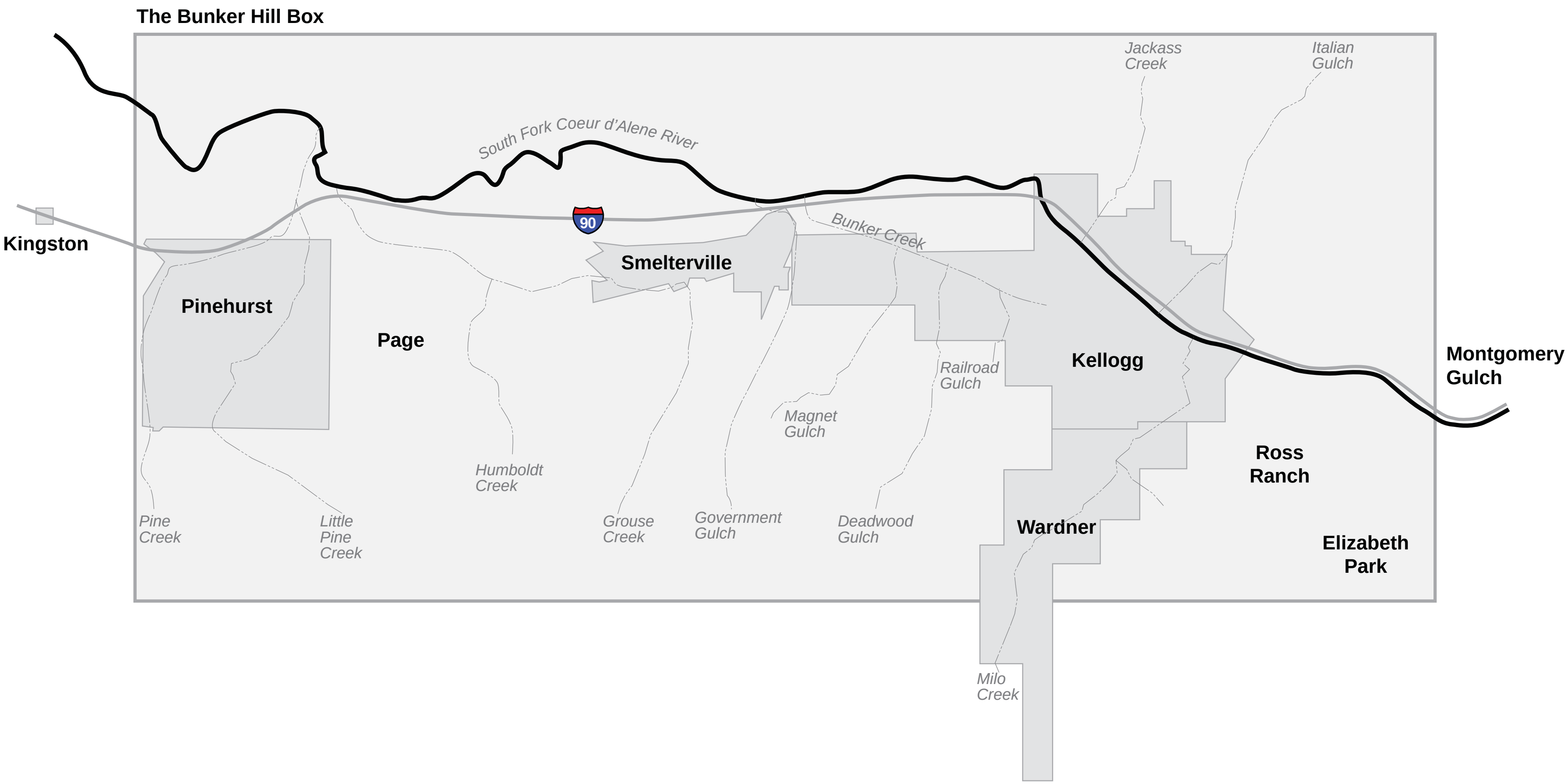


Figure 3-1
Map of Communities in OU 1
2010 Five-Year Review
BUNKER HILL SUPERFUND SITE

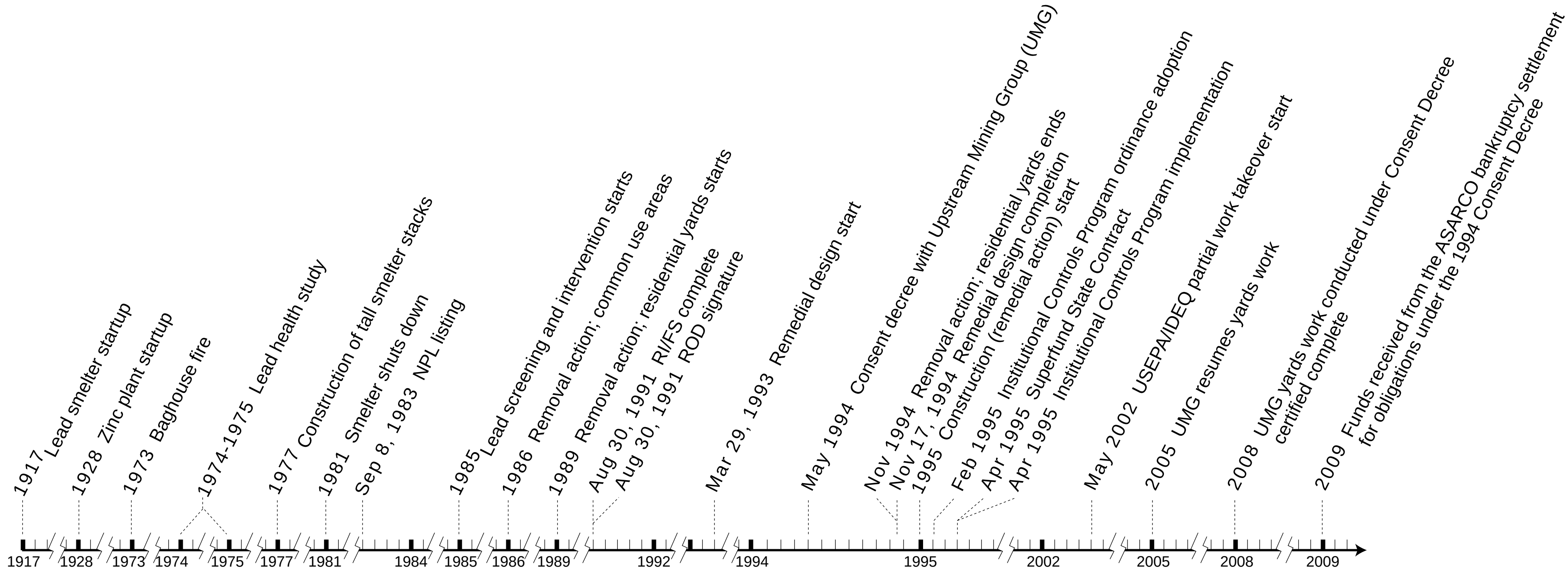


Figure 3-2
OU 1 Removal and Remedial Action Timeline
2010 Five-Year Review
BUNKER HILL SUPERFUND SITE

- 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 for each community of 500 mg/kg or less, with no individual house dust level exceeding 1,000 mg/kg; and,
- Establishing an Institutional Controls Program (ICP) to maintain protective barriers over time and to ensure that future land use and development is compatible with the OU 1 Selected Remedy.

In 1994, the U.S. Environmental Protection Agency (USEPA) and the State of Idaho entered into a consent decree (CD) with the Potentially Responsible Parties (PRPs) to conduct remedial actions in OU 1.[1] The OU 1 PRPs also are referred to as the Upstream Mining Group (UMG). Hecla Mining Company is the only remaining member of UMG. Among other things, the CD requires the PRPs to remediate at least 200 residential yards and associated ROWs and commercial properties each year until all residential areas are remediated.

3.2 Review of Applicable or Relevant and Appropriate Requirements

Applicable or relevant and appropriate requirements (ARARs) and to be considered (TBC) items from the 1991 OU 1 ROD and the 1992 OU 2 ROD were reviewed as part of the 2000 and 2005 Five-Year Reviews. The 2000 Five-Year Review (USEPA, 2000) 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. Section 4.2 of this 2010 Five-Year Review Report provides a brief discussion of the revised and new standards that have been evaluated since the last Five-Year Review.

3.3 Review of Operable Unit Work and 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:

- 3.3.1 Health and Safety
- 3.3.2 Operation and Maintenance
- 3.3.3 Residential Area Soil Remediation
- 3.3.4 House Dust Remediation
- 3.3.5 Blood Lead Level Reduction
- 3.3.6 Lead Health Intervention Program

[1] Consent Decree; Bunker Hill; United States of America and State of Idaho v. ASARCO Incorporated, Coeur d'Alene Mines Corporation, Callahan Mining Corporation, Hecla Mining Company, Sunshine Precious Metals, Sunshine Mining Company; Civil Action No. 94-0206-N-HLR; May 10, 1994.

- 3.3.7 Institutional Controls Program
- 3.3.8 Disposal of ICP Waste
- 3.3.9 Infrastructure

3.3.1 Health and Safety

Health and safety (H&S) is an important component of implementation of the remedy. Protection of the H&S of workers and the public is planned and managed during remedial activities. H&S plans are required for all construction work funded by USEPA and the State of Idaho, consistent with requirements of the Occupation Safety and Health Administration (OSHA) Hazardous Waste Site Regulations.[2] H&S plans are prepared by the contractor(s) hired to perform the work and then submitted to the agency overseeing the work effort. Contractors are responsible for H&S for their projects, including the work of their subcontractors. Components of a typical H&S plan may include:

- Site description and contaminant characterization;
- Safety and hazard assessment and risk analysis;
- Accident prevention;
- H&S training;
- Medical surveillance;
- Personal protective equipment;
- Monitoring, including air, noise, heat stress, and confined space;
- Safety and work practices;
- Site control measures;
- Personnel and equipment decontamination;
- Logs, reports, and recordkeeping;
- Emergency response plan and contingency procedures; and
- Spill containment plan.

Each contract employee is required to be familiar with the H&S plan and is required to have the necessary OSHA Hazardous Waste Operations and Emergency Response (HAZWOPER) 40-hour training and 8-hour annual refresher training. Daily tailgate meetings to plan the day and discuss activity-specific H&S issues are held with work crews.

Between 2005 and 2010, limited field work took place in OU 1. Lost time was not tracked for the limited work in OU 1, but no obvious safety issues have been noted.

3.3.2 Operation and Maintenance

3.3.2.1 Background and Status Update

Because the Site is subject to potential recontamination due to erosion or neglect of the installed barriers, there is a need to continually maintain and protect the barriers placed over the contaminated soil. Each property owner is responsible for maintaining barriers on their property. Upon completion of remediation of each property, the owner was provided with instructions and information on how to care for their newly installed barrier (i.e., sod, gardens, and trees and shrubs.) These instructions describe upkeep and maintenance

[2] 29 CFR 1910.129 and 29 CFR 1926.65.

practices that should be followed to ensure that the clean barriers installed as part of the cleanup remain in good condition so that they retain their protective function.

Property owner activities that have the potential to breach barriers, from homeowner improvements to large construction projects, are regulated by the ICP. The ICP is in place to assure the proper handling and management of contaminated materials and long-term implementation of Superfund remedies. This program regulates construction projects and, in so doing, provides for long-term operation and maintenance (O&M) of established remedial actions within the Site (including OU 1, OU 2, and OU 3). The program does not regulate active mining operations or agricultural activities.

The success of the ICP in ensuring that barriers are maintained has been demonstrated for over 15 years in the Box. Observations by field-based personnel and inspections of ICP-permitted projects by PHD indicate that maintenance of remediated properties by owners (or their representatives) generally appears effective in maintaining installed barriers. However, it is not clear whether all protective barriers are being adequately maintained by property owners or whether the barriers are able to withstand everyday use in certain locations.

3.3.2.2 Technical Assessment of Operation and Maintenance

Consistent with USEPA guidance (USEPA, 2001d), technical assessment was conducted by evaluating the following three questions related to protectiveness of the implemented remedial actions.

Question A: Is the remedy functioning as intended by the decision documents?

The review of documents, ARARs, and risk assumptions indicates that the OU 1 remedy is functioning as intended by the RODs. Observations by field-based personnel indicate that maintenance by owners (or their representatives) of remediated properties and those cleaned up as time critical removal actions generally appears effective. There is, however, no established approach being used to inspect these properties to determine whether the remedies are retaining their functionality as protective barriers after their warranty periods have ended.

Question B: 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.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

All properties located within the ICP boundary must comply with the ICP (see Section 3.3.7.1 for a description of the ICP). While the ICP provides an effective system for ensuring that barriers are maintained on ICP-permitted properties, it does not ensure that all barriers are properly maintained and functional. For example, some clean sod or gravel barriers may erode and expose underlying contamination as part of everyday uses in certain locations, such as areas used for parking cars or other vehicles on a regular basis. In general, these types of activities are not subject to ICP permitting and oversight and are not monitored by IDEQ or USEPA once the warranty periods have ended. A systematic approach is needed to ensure that properties not obtaining an ICP permit retain functional and protective barriers.

Remedy Issues

A summary of issues identified with respect to O&M in OU 1 is provided in Table 3-1.

TABLE 3-1
Summary of OU 1 O&M Remedy Issues
2010 Five-Year Review, Bunker Hill Superfund Site

Issues	Affects Protectiveness (Y/N)	
	Current (now to 1 year)	**Future (>1 year)**
O&M Needs: It is not clear whether all protective barriers are being adequately maintained by property owners or whether the barriers are able to withstand everyday use in certain locations.	N	Y

Recommendations

A summary of recommendations and follow-up actions for O&M in OU 1 is provided in Table 3-2.

TABLE 3-2
Summary of OU 1 O&M Recommendations and Follow-Up Actions
2010 Five-Year Review, Bunker Hill Superfund Site

Recommendations/Follow-up Actions	Responsible Entity	Oversight Agency	Proposed Milestone Date	Follow-up Actions: Affects Protectiveness (Y/N)	
				Current (now to 1 year)	**Future (>1 year)**
O&M Needs: Develop an approach (or program) that defines how barrier integrity for all remediated properties would be maintained and monitored over time.	UMG, PHD, IDEQ, USEPA	IDEQ, USEPA	12/2012	N	Y

IDEQ = Idaho Department of Environmental Quality

3.3.3 Residential Area Soil Remediation

The 2005 Five-Year Review evaluated the human health remedy for the Box and estimated that, as of 2004, 95 percent of all residential yards requiring remediation were completed, with approximately 90 yards remaining to be remediated (USEPA, 2005). At the time of the 2005 Five-Year Review, the 350 mg/kg soil RAO had been achieved in all communities except Wardner, where remediation was ongoing.

Between 2002 and 2008, the PRPs and the U.S. Army Corps of Engineers (USACE), on behalf of IDEQ and USEPA, continued remediation activities in south Kellogg, Pinehurst, Wardner, Elizabeth Park, Montgomery Gulch, and portions of Ross Ranch and Alhambra. In 2008, USEPA, with the involvement of IDEQ, certified as complete the PRPs' CD work in Kellogg South of Interstate 90 (I-90), Pinehurst, Page, Wardner, and Elizabeth Park-

Montgomery Gulch-Ross Ranch (USEPA, 2008). As part of the 2008 certification of completion, the PRPs provided a cash-out payment of $534,464.23 for 15 properties and 2 wells to the State of Idaho for "remediation refusals". Remediation refusals refer to properties where the owner has refused soil remediation or well closures. The cash payment to the State of Idaho was based on the estimated cost of remediating the property. The payment was deposited in a trust fund held by the State for property remediation if the property owner changes their mind or a new owner acquires the property and agrees to clean up.

A total of 194 properties and ROWs were remediated in 2005, 37 in 2006, and 2 in 2007. One residential property that was previously a refusal was remediated in 2008. As of 2010, all properties requiring remediation within OU 1 have been remediated, with the exception of some remediation refusals. Eighteen properties containing soil lead concentrations in excess of 1,000 mg/kg and three wells requiring closure have refused remediation in the Box. These properties are located throughout OU 1: six parcels each in Pinehurst and Kellogg, two in Wardner and Elizabeth Park, and one each in Montgomery Gulch and Page. Disclosures provided by PHD at the time of sale alert prospective purchasers and loan providers whether remediation has or has not occurred. Sellers are required by law to disclose this fact as well. Prospective purchasers can then arrange for the State of Idaho's "remediation refusals" trust fund to complete remediation.

3.3.3.1 Yard Soil Lead Concentrations

Surface soil is most available for exposure to young children. For this reason, surface yard soil lead concentrations are used in site-specific risk assessment evaluations and to ensure attainment of the RAOs. The remedy requires the installation of protective barriers 6 to 12 inches thick (depending on depth of contamination) to reduce direct exposure to contaminated soil and migration of contaminated soil to dust in homes.

Table 3-3 summarizes surface (top inch) soil lead concentration data for each Box community by two methodologies. The first method presents the community mean soil concentrations estimated in the certification reports (McCulley, Frick, and Gilman [MFG], 1997, 1999; LFR, 2008a, 2008b, 2008c, 2008d, 2008e). These mean soil concentrations were estimated for each residential community following the procedures outlined in the *Final Residential Yards Remedial Design Report* (MFG, 1994) and include results for residential and commercial properties and ROWs. The second method shows the residential yard soil community means as they have been presented in past Five-Year Reviews. These means are reflective of residential property data through 2004 and were not updated using data through 2009 for this Five-Year Review because the community means were calculated in the 2008 certification reports after remediation was complete.

As shown in Table 3-3, the average lead concentrations reported in the certification reports are all below the community mean soil RAO of 350 mg/kg and are comparable to the residential yard soil means estimated in the 2005 Five-Year Review. Between 1989 and 2008, lead concentrations in the top inch of yard soils was significantly reduced in all Box communities. Generally, community mean yard soil concentrations decreased by about 100 to 300 mg/kg annually in the earlier years of remediation and by about 30 to 50 mg/kg annually in more recent years. As of 2008, the community mean soil RAO of 350 mg/kg was achieved.

TABLE 3-3
Community Mean Soil Lead Concentrations for OU 1
2010 Five-Year Review, Bunker Hill Superfund Site

Community Area	Average Lead Concentration from Certification Reports (mg/kg)	Residential Yard Soil Geometric Mean Lead Concentrations (mg/kg)[b]
Kellogg North of I-90	114	131
Kellogg South of I-90	132	131
Elizabeth Park, Montgomery Gulch, and Ross Ranch[a]	258	N/A
Page	168	184
Pinehurst	262	270
Smelterville	70.9	129
Wardner	126	144[c]

[a]Elizabeth Park, Montgomery Gulch, and Ross Ranch were included in the geometric mean for Kellogg in the Human Health Remedial Evaluation (HHRE) (TerraGraphics Environmental Engineering [TerraGraphics], 2004).

[b]Mean soil concentrations reflect data through 2004 and were taken from Table 3-1 of the *Addendum to the Final Human Health Remedial Evaluation Report for the Bunker Hill Superfund Site Box* (TerraGraphics, 2005b).

[c]Additional properties were remediated in 2004-2008 since the HHRE. The community mean for Wardner was recalculated as of 2009.

N/A = not applicable

3.3.3.2 Visual Assessment of Residential Barriers

Twenty-one remediated properties in Smelterville and north Kellogg were selected to determine the condition of installed barriers through visual assessment. Selected properties were remediated between 1989 and 1998, 11 to 20 years prior to the visual assessment, which was accomplished in winter of 2009-2010. Most of the visually inspected properties were remediated prior to the adoption of the ICP in 1995, which requires property owners to obtain an ICP permit for any excavation work involving one cubic yard or more of material.

Properties were visually inspected with the owner (when available) and compared to the remediation as-built documentation. The property was examined for evidence of barrier degradation, imported material, soil disturbances, and other differences from the as-built map. Obvious signs of barrier disturbance were not commonly observed. One common observation was noted on the majority of properties: the planting of trees, shrubs, or flowers. Table 3-4 summarizes the observations made and the number of ICP permits on record for imported material on previously remediated properties.

The visual assessment identified several activities that could potentially compromise barriers or the protectiveness of the remedy, as follows:

1. The degradation of gravel barriers to the point of possible exposure to underlying materials;
2. The import of new material from unidentified, potentially contaminated sources;

TABLE 3-4
Visual Assessment: Evidence of Wear and Imported New Material in Previously Remediated Areas
2010 Five-Year Review, Bunker Hill Superfund Site

Material Type	Visible Signs of Wear in Previously Remediated Areas			Visible Signs of New Material on or in Previously Remediated Areas			
	Total Number of Properties with Evidence of Wear	**Apparent Cause and Extent of Wear**	**Extent of Wear**	**Number of Properties that Obtained an ICP Permit**	**Number of Properties with no ICP Permit: Homeowner Indicated Material Came from a Clean Source**	**Number of Properties with no ICP Permit: Material Source Unknown**	**Total Number of Properties with Evidence of New Material**
Gravel Area	6	Vehicle traffic	Shallow ruts and bare soil were observed. Wear does not appear to extend below the installed barrier.	6	7	2	15
Soil	2	Vehicle traffic, children playing	Shallow ruts and bare soil were observed. Wear does not appear to extend below the installed barrier.	5	2	1	8
Cement	N/A	N/A	N/A	3	N/A	N/A	5[a]

[a]These cement areas were not shown on the as-built maps. The two homeowners who did not obtain a permit from ICP indicated the work was completed at the time of remediation.

3. The recontamination of barriers due to vehicle traffic;
4. The possible mixing due to tilling of clean soils with contaminated soils below the barrier; and

The disturbance of soils involving less than one cubic yard of material do not require ICP permits.

Only two areas showed obvious signs of disturbance below the remediation barrier. In one case, a homeowner completed an emergency sewer repair on the weekend and obtained a permit from the ICP the following business day. In the other instance, a homeowner excavated a trench to install water, sewer, and electrical lines. There was no ICP permit on record for this work, and it was difficult to identify through visual observation whether or not the excavation involved more than one cubic yard of material. ICP personnel are currently working with this owner to ensure the barrier is appropriate.

Seventeen of the 21 assessed properties had a permit or multiple permits from the ICP. The scope of work covered by the permits varied widely. All information from these visual assessments has been provided to PHD.

3.3.3.3 Right-of-Way Soil Concentrations

ROWs, as discussed in this section and sampled to support the Five-Year Review, consist of roads and road shoulders, city streets and alleys, utility substations, and corridors. In general, ROWs were remediated to the same criteria as adjacent residential or commercial properties, and in many cases were remediated with the adjacent property.

Beginning in 1997, post-remediation ROW sampling was carried out to characterize lead levels, and to assess barrier integrity and the potential for recontamination of remediated or previously uncontaminated ROWs over time. Post-remediation ROW sampling was conducted by IDEQ beginning in 1997 and continued on an annual basis through 2004.

The outcome of this sampling indicated that ROW recontamination was occurring, and the 2005 Five-Year Review recommended that additional ROW sampling and analysis be conducted to determine whether ROW concentrations have remained stable. USEPA sampled ROWs in 2008 for evaluation in this Five-Year Review, as discussed in the following subsections.

Summary of Right-of-Way Investigations (1997 to 2008)

Results from all ROW investigations have been previously summarized in numerous reports (TerraGraphics, 1999a, 1999b, 2000b, 2001b, 2002b, 2003b, 2005a, and 2009g). ROWs were sampled in Smelterville, Kellogg, and Pinehurst in 1997, 1998, 1999-2004, and 2008. Other community areas were also sampled in 2008 that had not been previously sampled (Page, Wardner, Elizabeth Park, Ross Ranch and Montgomery Gulch.)

In 2008, ROWs in Smelterville, Kellogg, and Pinehurst were sampled near previously sampled test pits (i.e., generally within 6 feet to 8 feet north or west of the former test pit). In the event that sampling crews could not dig 6 feet to 8 feet north or west of the original location, samples were collected 6 feet to 8 feet south or east of the original location. A total of 91 samples were collected from 32 locations in Smelterville, 92 samples were collected from 33 locations in Kellogg, and 131 samples were collected from 48 locations in Pinehurst.

Table 3-5 summarizes sample results and geometric means for 2008 from the OU 1 ROWs, and the following subsections discuss the results shown in the table.

Smelterville Rights-of-Way Sampling Results (1997 to 2008)

The geometric mean of ROW samples in Smelterville has remained below 350 mg/kg, and the majority of samples have concentrations less than 350 mg/kg across years. Between 1997 and 2007, 5 percent to 24 percent of all samples from Smelterville ROWs had lead concentrations greater than 1,000 mg/kg. In general, the number of samples greater than 1,000 mg/kg remained fairly stable across years, with smaller percentages in 2003 and 2008. In 2008, between 6 and 9 percent of samples were greater than 1,000 mg/kg across depth intervals (see Table 3-5), compared to 15 to 24 percent observed in 1997. This may partially be due to the City of Smelterville's sewer project that occurred in 2008, in which many of the streets and gravel ROWs had been removed and replaced.

Kellogg Rights-of-Way Sampling Results (1998 to 2008)

The geometric mean of ROW samples in Kellogg has remained below 350 mg/kg since 1999 (with one exception at the 6- to 12-inch depth interval in 2000), and the majority of samples have concentrations less than 1,000 mg/kg across years. From 1998 to 2007, between 7 and 38 percent of samples from Kellogg ROWs were greater than 1,000 mg/kg. However, in the early years of sampling, some samples collected were from areas that had not yet been remediated. In general, the number of samples greater than 1,000 mg/kg remained fairly stable or decreased across years, with the lowest percentages in 2004 and 2008. In 2008, between 0 and 7 percent of samples were greater than 1,000 mg/kg, across depth intervals (see Table 3-5). Maximum concentrations in the 0- to 1-inch and 6- to 12-inch depth intervals have generally decreased over time.

Pinehurst Rights-of-Way Sampling Results (1999 to 2008)

The geometric mean of ROW samples in Pinehurst has remained below 350 mg/kg since 2000, and the majority of samples have concentrations less than 350 mg/kg. In 1999, depending on sample depth, between 36 and 46 percent of samples had concentrations greater than 1,000 mg/kg. As remediation continued in Pinehurst, that percentage dropped to a range of 0 to 12 percent from 2000 through 2004, with the highest percentage noted in 2004. In 2008, the percent of samples exceeding 1,000 mg/kg (between 3 and 9 percent) has remained similar to or slightly higher than 2004 levels.

Page, Wardner, Elizabeth Park, Ross Ranch and Montgomery Gulch Right-of-Way Sampling Results (2008)

Similar to other ROW sampling, samples in these areas were collected from three depth intervals (0-1 inch, 1-6 inch, and 6-12 inch) or until a fabric barrier or visible color change was observed.

In Page, Wardner, and Ross Ranch, the geometric mean lead concentration across all depth intervals was less than 350 mg/kg, and no sample exceeded 350 mg/kg. In Elizabeth Park, of seven samples collected, one exceeded 1,000 mg/kg in the 0- to 1-inch depth interval, while the geometric mean concentration remained below 350 mg/kg. In Montgomery Gulch, the 1-to 6-inch depth interval exceeded 1,000 mg/kg in the one location that was sampled.

TABLE 3-5
Right-of-Way Lead Concentration Summary for Box Communities, 2008
2010 Five-Year Review, Bunker Hill Superfund Site

	Depth Interval:			
	0 to 1 inch	**1 to 6 inch**	**6 to 12 inch**	**All Depth Intervals**
Elizabeth Park[b]				
Total number of samples[a]	3	3	1	7
Number of samples from 0-100 mg/kg	1	1	1	2
Number of samples from 101-350 mg/kg	1	1	0	2
Number of samples from 351-999 mg/kg	0	1	0	1
Number of samples ≥ 1,000 mg/kg	1	0	0	1
Minimum (mg/kg)	33.3	99.5	65.9	33.3
Maximum (mg/kg)	1,040	941	65.9	1,040
Geometric mean (mg/kg)	164	248	N/AN/A	172
Kellogg				
Total number of samples[a]	33	31	28	92
Number of samples from 0-100 mg/kg	10 (30%)	16 (52%)	14 (50%)	40
Number of samples from 101-350 mg/kg	13 (39%)	10 (32%)	9 (32%)	32
Number of samples from 351-999 mg/kg	10 (30%)	3 (10%)	3 (11%)	16
Number of samples ≥ 1,000 mg/kg	0 (0%)	2 (6%)	2 (7%)	4
Minimum (mg/kg)	37.8	12.7	14.2	12.7
Maximum (mg/kg)	962	4,840	2,490	4,840
Geometric mean (mg/kg)	187	110	106	
Montgomery Gulch[b]				
Total Number of samples[a]	1	1	N/A	2
Number of samples from 0-100 mg/kg	1	0	N/A	1

TABLE 3-5
Right-of-Way Lead Concentration Summary for Box Communities, 2008
2010 Five-Year Review, Bunker Hill Superfund Site

	Depth Interval:			
	0 to 1 inch	**1 to 6 inch**	**6 to 12 inch**	**All Depth Intervals**
Number of samples from 101-350 mg/kg	0	0	N/A	0
Number of samples from 351-999 mg/kg	0	0	N/A	0
Number of samples ≥ 1,000 mg/kg	0	1	N/A	1
Minimum (mg/kg)	67.4	1340	N/A	67.4
Maximum (mg/kg)	67.4	1,340	N/A	1,340
Geometric mean (mg/kg)	N/A	N/A	N/A	N/A
Page[b]				
Total number of samples[a]	4	4	4	12
Number of samples from 0-100 mg/kg	3	2	3	8
Number of samples from 101-350 mg/kg	1	2	1	4
Number of samples from 351-999 mg/kg	0	0	0	0
Number of samples ≥ 1,000 mg/kg	0	0	0	0
Minimum (mg/kg)	26.7	16	16.2	16
Maximum (mg/kg)	143	214	112	214
Geometric mean (mg/kg)	49	63	42	50
Pinehurst				
Total number of samples[a]	48	48	35	131
Number of samples from 0-100 mg/kg	19 (40%)	32 (66%)	27 (78%)	78
Number of samples from 101-350 mg/kg	19 (40%)	10 (21%)	3 (8%)	32
Number of samples from 351-999 mg/kg	7 (15%)	2 (4%)	4 (11%)	13
Number of samples ≥ 1,000 mg/kg	3 (6%)	4 (9%)	1 (3%)	8

TABLE 3-5
Right-of-Way Lead Concentration Summary for Box Communities, 2008
2010 Five-Year Review, Bunker Hill Superfund Site

	Depth Interval:			All Depth Intervals
	0 to 1 inch	**1 to 6 inch**	**6 to 12 inch**	
Minimum (mg/kg)	35.1	21.5	12.4	12.4
Maximum (mg/kg)	1,430	3,580	2,630	3,580
Geometric mean (mg/kg)	149	81	68	
Ross Ranch[b]				
Total Number of samples[a]	2	2	1	5
Number of samples from 0-100 mg/kg	2	2	0	4
Number of samples from 101-350 mg/kg	0	0	1	1
Number of samples from 351-999 mg/kg	0	0	0	0
Number of samples ≥ 1,000 mg/kg	0	0	0	0
Minimum (mg/kg)	17.9	16.2	110	16.2
Maximum (mg/kg)	95	69	110	110
Geometric mean (mg/kg)	41	33	N/A	46
Smelterville				
Total number of samples[a]	32	32	27	91
Number of samples from 0-100 mg/kg	7 (22%)	17 (53%)	18 (67%)	42
Number of samples from 101-350 mg/kg	16 (50%)	10 (31%)	5 (19%)	31
Number of samples from 351-999 mg/kg	6 (19%)	3 (9%)	2 (7%)	11
Number of samples ≥ 1,000 mg/kg	3 (9%)	2 (6%)	2 (7%)	7
Minimum (mg/kg)	32.5	28.2	24.3	24.3
Maximum (mg/kg)	4,020	7,610	5,430	7,610
Geometric mean (mg/kg)	227	139	107	

TABLE 3-5
Right-of-Way Lead Concentration Summary for Box Communities, 2008
2010 Five-Year Review, Bunker Hill Superfund Site

	Depth Interval:			
	0 to 1 inch	**1 to 6 inch**	**6 to 12 inch**	**All Depth Intervals**
Wardner[b]				
Total number of samples[a]	3	3	3	9
Number of samples from 0-100 mg/kg	2	2	2	6
Number of samples from 101-350 mg/kg	1	1	1	3
Number of samples from 351-999 mg/kg	0	0	0	0
Number of samples ≥ 1,000 mg/kg	0	0	0	0
Minimum (mg/kg)	41.7	25.7	25.1	25.1
Maximum (mg/kg)	102	124	293	293
Geometric mean (mg/kg)	64	47	62	57

[a] This count does not include quality assurance/quality control (QA/QC) samples. The higher concentration from a split or duplicate pair is used in this summary.

[b] Percentage of samples within concentration intervals are not presented for Page, Elizabeth Park, Montgomery Gulch, Wardner, and Ross Ranch because the number of samples collected in these communities is relatively small.

Interpretation of recontamination in ROWs is complicated due to spatial variability in sampling methodology and uncertainty regarding the remediation year of some sample locations. Random variability may be due to the nature of ROW sampling methods, in which the sample location varied between 2 and 8 feet from the original test pit location, depending on the year. However, small areas of elevated concentrations, or "hot spots", could exist throughout the Box.

Visual Assessment of Rights-of-Way (2008)

After the 2008 sampling event, IDEQ conducted visual assessments at the 15 ROW sample locations where 2008 results were near or above 1,000 mg/kg. IDEQ personnel noted if the area had recently been disturbed and recorded information about the installed remedy, the remediation year, and prior ROW sample results. IDEQ's findings indicated that increased soil lead levels may be due to:

- Construction, road maintenance, and/or utility work (six locations);
- Barrier compaction and dislocation and mixing of contaminated underlying soils (two locations);
- Use patterns and other impacts at the sampling location (one location was used as a parking area, one was a high-traffic area where the presence of street sweepings was thought to affect ROW concentrations, one was an access route to a back yard, and one IDEQ noted as being in a heavy traffic area that appeared to have had a new rock garden and power pole placed in the vicinity); and
- The possibility that some locations may have never been remediated (two locations; Olsen, 2010). The reason for increased concentrations at one other location could not be determined.

Summary of Right-of-Way Results

The 2005 Five-Year Review concluded that ROW recontamination appears to be increasing, although not to widespread levels of human health concern, and recommended that ROW recontamination be evaluated in the 2010 Five-Year Review. In 2008, historical ROW sampling locations were resampled in preparation for the 2010 Five-Year Review, as discussed above.

Geometric mean ROW results from 1997 to 2008 are all less than 350 mg/kg, with the exception of earlier sampling years in some communities when a large percent of sampled pits had not yet been remediated (e.g., 1998, 1999, and 2000 geometric mean concentrations for Kellogg and 1999 geometric mean concentrations for Pinehurst), and from some areas where less than five samples were collected in 2008 (e.g., Elizabeth Park and Montgomery Gulch). By 2008, a small number of ROW sample locations (up to 9 percent) show lead levels in excess of 1,000 mg/kg.

Although it is clear that ROW recontamination has occurred, widespread recontamination of ROWs to levels of human health concern has not been observed to date. However, surface and subsurface contamination remaining in the Box poses a risk of recontamination. In general, the remediation has been effective in capping contamination but may not be sustainable in areas such as road shoulders and alleys, where heavy use may cause dislocation and compaction. Areas in which ROWs are subject to sustained saturation conditions also may be particularly susceptible to recontamination as a result of erosion caused by vehicle use during saturated conditions.

3.3.3.4 Other Sampling

Sampling protocols were developed for the ICP in 1997 and have been updated through the years (see Section 3.3.7 for a list of ICP protocols.) In general, ICP sampling is opportunistic and sample locations are based on professional judgment. Table 3-6 summarizes samples collected by the ICP from 2005 through 2009.

TABLE 3-6
Summary of ICP Samples Collected in the Box, 2005-2009
2010 Five-Year Review, Bunker Hill Superfund Site

Sample Type	Calendar Year				
	2005	2006	2007	2008	2009
Snow Pile Sediment					
Number of samples	4	4	3	6	25
Minimum Pb Conc. (mg/kg)	658	200	185	456	81
Maximum Pb Conc. (mg/kg)	1,936	967	282	1,010	2,732
Average Pb Conc. (mg/kg)	1,050	401	248	791	913
Standard Deviation	595	378	54	206	724
Percentage of Samples ≥1000 mg/kg	25%	0%	0%	17%	36%
Potholes					
Number of samples	0	0	0	0	17
Minimum Pb Conc. (mg/kg)					720
Maximum Pb Conc. (mg/kg)					41,521
Average Pb Conc. (mg/kg)					9,884
Standard Deviation					11,180
Percentage of Samples ≥1000 mg/kg					88%
City Sweepings					
Number of samples	5	2	0	0	2
Minimum Pb Conc. (mg/kg)	160	256			197
Maximum Pb Conc. (mg/kg)	220	266			1,109
Average Pb Conc. (mg/kg)	190	261			653
Standard Deviation	30	7			645
Percentage of Samples ≥1000 mg/kg	0%	0%			50%
Sand					
Number of samples	0	4	4	0	0
Minimum Pb Conc. (mg/kg)		90	92		
Maximum Pb Conc. (mg/kg)		149	404		
Average Pb Conc. (mg/kg)		128	235		
Standard Deviation		27	136		
Percentage of Samples ≥1000 mg/kg		0%	0%		
Other Soils					

TABLE 3-6
Summary of ICP Samples Collected in the Box, 2005-2009
2010 Five-Year Review, Bunker Hill Superfund Site

Sample Type	Calendar Year				
	2005	2006	2007	2008	2009
Number of samples	108	45	86	59	76
Minimum Pb Conc. (mg/kg)	8	72	75	62	5
Maximum Pb Conc. (mg/kg)	13,101	4,821	8,991	14,164	27,738
Percentage of Samples ≥1000 mg/kg	23%	11%	26%	37%	41%

Note: Data Provided by the Panhandle Health District.
Pb Conc. = lead concentration

Most of the samples collected and categorized as "Other Soils" in this table were from permitted projects or projects undertaken by the utilities or government. These samples were collected on projects for various reasons and at varying depths. All soils on these projects that tested greater than 1,000 mg/kg lead or 100 mg/kg arsenic were directed to the repositories or capped under permanent barriers (such as roads and parking lots). For this reason, averages and standard deviations were not calculated.

Between 2005 and 2007, almost all snow pile sediment, city sweepings, and sand samples had lead concentrations less than 1,000 mg/kg in the Box communities, with the exception of one snow pile sediment sample collected in Kellogg (Table 3-6). All four snow pile sediment samples collected in 2005 were from one snow pile in Kellogg.

Snow pile sediment samples collected in 2008 and 2009 resulted in lead concentration averages above 350 mg/kg, and a total of 10 samples (17 percent in 2008 and 36 percent in 2009) were greater than 1,000 mg/kg lead (Table 3-6). These high samples were all observed in Kellogg. All snow pile sediment samples collected from Smelterville, Pinehurst, and Wardner were below 600 mg/kg lead. Pothole samples collected in the Box (from Smelterville, Kellogg, and Pinehurst) averaged 9,884 mg/kg, and 88 percent of the 17 samples were 1,000 mg/kg or greater (Table 3-6). Two city sweeping samples were collected in Kellogg in 2009 and ranged from about 200 mg/kg to 1,100 mg/kg lead. These results are typical, because most roads in the Silver Valley were built on mine tailings, but indicate the need for ongoing road maintenance and the importance of roads as a barrier.

3.3.3.5 Hillsides

Revegetation of approximately 3,200 acres and new development in hillside areas as part of remedial actions (see Section 4.3.3) in recent years has increased hillside stability. Contamination from hillsides is primarily an issue for OU 1 communities that are located within the historical zone of influence of the Bunker Hill Smelter emissions (USEPA, 2005). The volume of contaminated soil remaining on the hillsides has been estimated to be approximately 1,000,000 cubic yards, based on an average contaminated depth of 1 foot (TerraGraphics, 2006b). The assumption of 1 foot was made based on the sampling data collected for future hillsides development (TerraGraphics, 1996, 1997b, 1999c). There are currently no plans to remove contaminated soils from these very steep hillsides, with the possible exception of private development. Several hundred acres of developable hillside areas exceed the soil removal action level for commercial and residential properties (1,000 mg/kg lead). In the event these areas are developed in the future, ICP requirements include installation of appropriate human health barriers by the developer.

3.3.3.6 Mine Dumps

The RODs call for stabilization of mine dumps as they relate to erosion from hillsides. As Phase II remedial actions are prioritized for implementation, consideration will be given to potential exposures to recreational uses and recontamination of adjacent residences as well as ecological impacts from mine dumps.

3.3.3.7 Technical Assessment of Residential Area Soil Remediation

Consistent with USEPA guidance (USEPA, 2001d), technical assessment was conducted by evaluating the following three questions related to protectiveness of the implemented remedial actions.

Question A: Is the remedy functioning as intended by the decision documents?
The review of documents, ARARs, and risk assumptions indicates that the OU 1 remedy is functioning as intended by the RODs. The soil remedial strategy has been successful in decreasing soil and house dust concentrations and the health RAOs have been achieved. The blood lead RAO was achieved by reducing soil and dust lead concentrations to levels that limited estimated mean soil and dust lead intakes for children.

Successfully implementing the remedial strategy required a comprehensive approach to reducing soil lead exposures throughout the community. The primary soil and fugitive dust sources included residential home yards, common use areas, ROWs, commercial properties, hillsides, river floodplain, and industrial complex and waste material piles and impoundments. These remedial actions simultaneously produced reductions in soil exposure and sources of lead in house dust; both reductions are essential to meeting the blood lead RAOs.

A number of activities could potentially compromise barriers and the protectiveness of the remedy including, as listed in Section 3.3.3.2. During visual assessments of installed clean barriers, there were discrepancies noted between the current situation and information documented on the as-built maps, all of which have been recorded in the assessment notes and copies provided to the ICP. Although visual assessments provide a limited ability to confirm that remedies have not been compromised, observations of clean barriers indicate that the remedy remains intact. However, in a number of cases, it was not possible to confirm whether the remedy was compromised without taking samples or moving material to check the barrier's integrity.

Recontamination of ROWs is a potential issue due to the impact of vehicular traffic, road and/or shoulder grading, general tracking of materials from unremediated areas, and mixing of underlying soils during excavations. In addition, areas in which ROWs are subject to sustained saturation conditions may be particularly susceptible to recontamination caused by erosion from vehicle use during saturated conditions. From 1998 to 2008, the thickness and depth of the ROW barriers have been measured, observed, and reported in field notes to evaluate whether these barriers are deteriorating and/or compacting over time. In 2008, a total of 126 ROW pits were sampled in Kellogg, Smelterville, Pinehurst, and other residential areas. Of the 126 ROW pits sampled, 44 visible transitions were observed. Fabric barriers were found at depths ranging from 1 inch to 12 inches, with an average depth of 9 inches. Visible color changes were noted at depths ranging from 3 inches to 10 inches, with an average depth of 7 inches. Sampling of roadway potholes in Smelterville, Kellogg, and Pinehurst demonstrated that 88 percent of pothole samples were greater than 1,000 mg/kg and averaged more than 1 percent lead. Samples from snow piles/storage areas indicated lead contaminant concentrations near or below 1,000 mg/kg.

Widespread recontamination of ROWs to levels of human health concern has not been observed to date, and ROW lead concentrations appear to have remained stable based on limited sampling conducted since the last Five-Year Review. USEPA and IDEQ are developing an approach under the existing RODs to address this issue collaboratively with local, county, and state entities responsible for providing and maintaining roadways in their communities. The objective of this effort is to develop and implement a strategy that ensures the long-term effectiveness of barriers installed in ROWs and also aligns with the transportation and maintenance needs of the Box and Upper Basin communities.

Several hundred acres of developable hillside areas exceed the soil removal action level for commercial and residential properties (1,000 mg/kg lead). Appropriate information must continue to be made available to interested developers to ensure adequate understanding of ICP permitting and barrier installation requirements.

Question B: 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. The Selected Remedy has reduced soil and dust lead concentrations and children's lead intake from these sources to sufficiently low levels to meet the blood lead RAOs. Dust lead concentrations indicate minimal changes in contributions from soil sources since the 2005 Five-Year Review.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

Since the last Five-Year Review, no new information other than that discussed in response to Questions A and B has come to light that could call into question the protectiveness of the remedy.

Remedy Issues and Recommendations

No issues or recommendations were identified for the residential area soil remediation remedy.

3.3.4 House Dust Remediation

Following completion of soil remediation in a community, the remedy includes a one-time interior cleaning for any home with house dust concentrations at or above 1,000 mg/kg. The rationale for not performing interior cleaning at the time of soil remediation is derived from the 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). USEPA, IDEQ, the Agency for Toxic Substances and Disease Registry (ATSDR), and PHD decided not to clean home interiors until exterior contamination sources were controlled.

In 2000, USEPA and the State of Idaho conducted a second, follow-up interior cleaning project to determine whether house dust levels would be better sustained following completion of substantial soil remediation. The second study confirmed conclusions of the initial study: sustained reductions in lead dust concentrations would require frequent and repeated interior cleanings by either Housing and Urban Development (HUD) carpet replacement and/or comprehensive commercial cleaning protocols, otherwise dust lead levels would return to pre-cleaning levels within months (TerraGraphics, 2002a). The remedy does not address anthropogenic lead sources that cannot be controlled by Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) cleanup activities (i.e., residents' hobbies, habits, and activities, as well as dust generated by lead-based paint).

3.3.4.1 Status Update

USEPA and the State of Idaho are continuing to monitor house dust concentrations as residential soil remediation is completed. House dust has long been recognized as the predominant source of exposure for young children within the Box. House dust concentrations are being measured to assess progress towards meeting the remedial action objective of a 500 mg/kg lead dust community average and an individual goal for each home of 1,000 mg/kg lead or less.

Complementary methods are being used to track the concentration of dust in the home: vacuum bags and dust mats (TerraGraphics, 2000a). In addition to measuring lead concentration in dust, dust mats collect dust for a known number of days, so that they also measure dust and lead loading rates. Dust and lead loading rates were the strongest predictors of blood lead levels in the OU 3 Human Health Risk Assessment (Terragraphics et al., 2001). Loading rates are informative because dust lead concentrations do not measure mass of dust or its rate of movement in and out of a house. Dust loading represents the mass of dust per unit area. In the absence of a strong interior lead source, most of the lead in interior house dust originates from exterior soils (TerraGraphics, 2005a; National Research Council [NRC], 2005).

In the 2000 Five-Year Review, decreasing house dust lead concentrations were observed; however, OU 1 community means were not below 500 mg/kg. The 2005 Five-Year Review Report for OU 1 recommended the following: (1) evaluate the need for a one-time cleaning of house dust prior to moving forward with the interior cleaning remedial action, and (2) continue to monitor house-dust levels every year as soil cleanup of residential and community areas is completed. Since the 2005 review, dust mat and vacuum bag samples were collected from approximately 200 homes in 2005 and 280 homes in 2008. In addition, USEPA and IDEQ are evaluating modification of the house dust RAO that specifies interior remediation for OU 1 homes with concentrations equal to or greater than 1,000 mg/kg lead (USEPA, 1992).

Figures 3-3, 3-4, and 3-5 show histograms of house vacuum dust lead concentrations throughout OU 1 from 1988 to 2008. In 1988, nearly 70 percent of vacuum bag samples collected from Box homes had lead concentration exceeding 1,000 mg/kg. With the addition of Pinehurst in 1990, more than 50 percent of samples remained above that level. Through the years, the percentage of vacuum bag samples that exceed 1,000 mg/kg lead has steadily

FIGURE 3-3
House Dust Vacuum Bag Concentration Histograms for OU 1, 1988-1994
2010 Five-Year Review, Bunker Hill Superfund Site

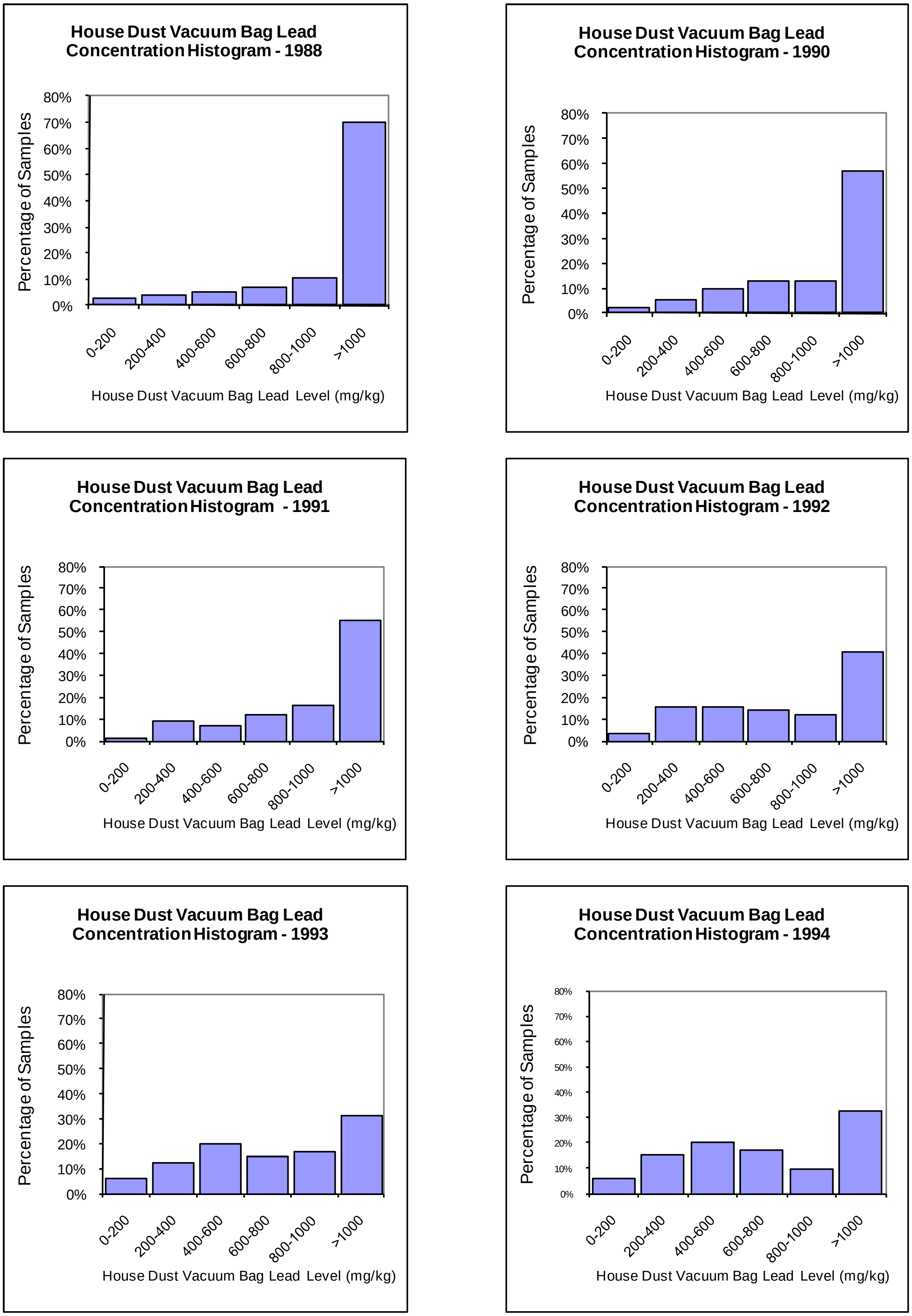


FIGURE 3-4
House Dust Vacuum Bag Concentration Histograms for OU 1, 1995-2000
2010 Five-Year Review, Bunker Hill Superfund Site

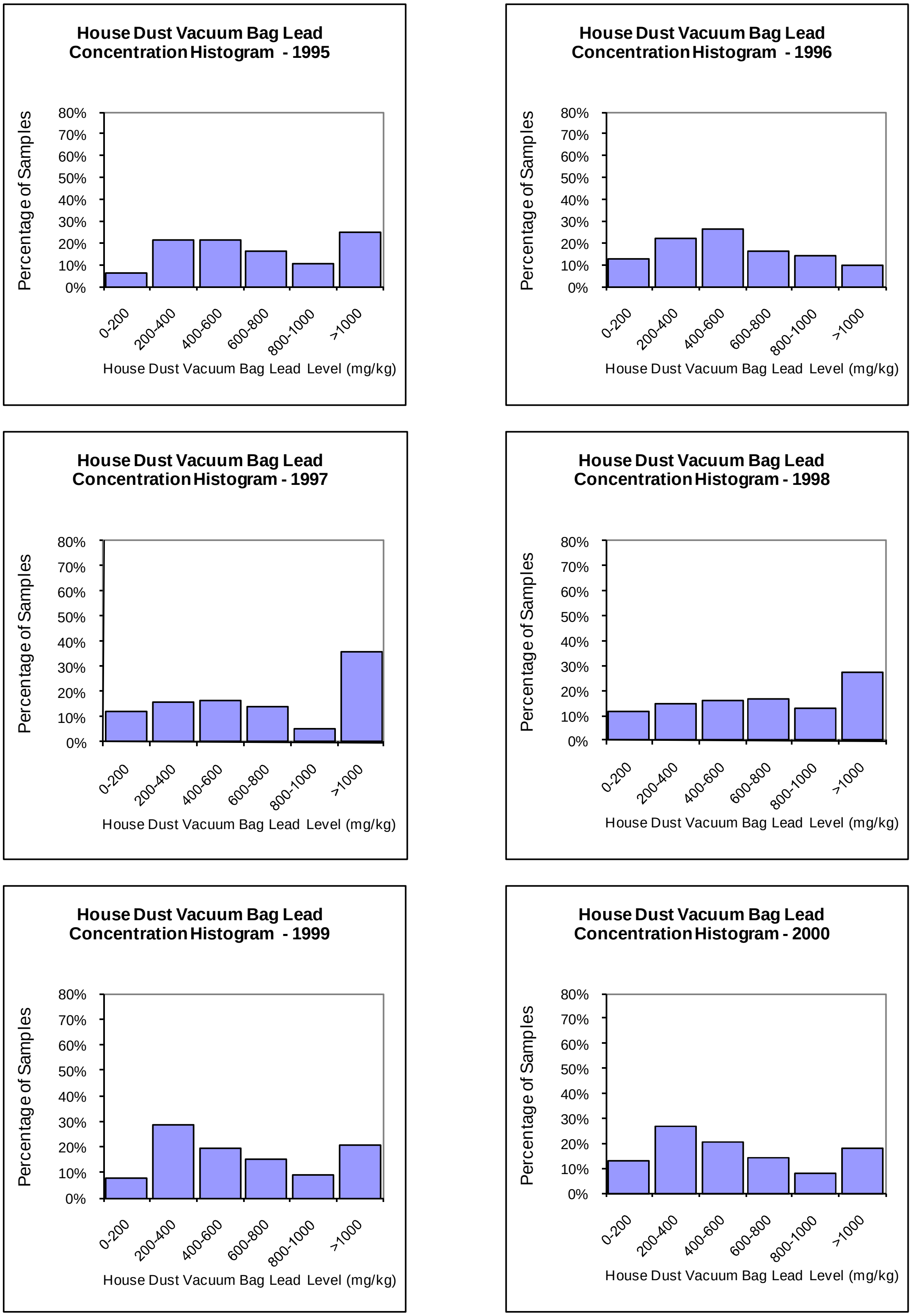


FIGURE 3-5
House Dust Vacuum Bag Concentration Histograms for OU 1, 2001-2008
2010 Five-Year Review, Bunker Hill Superfund Site

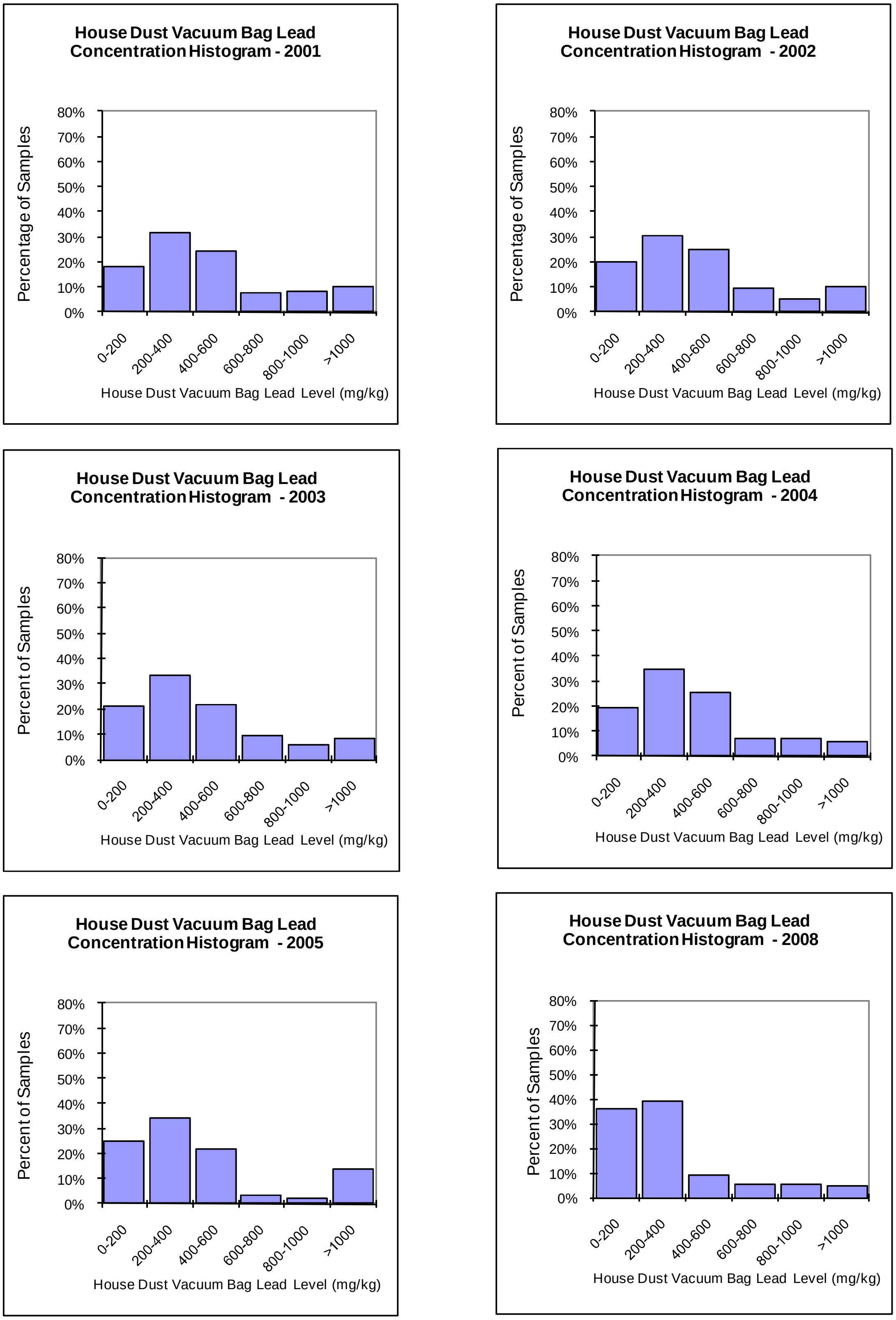
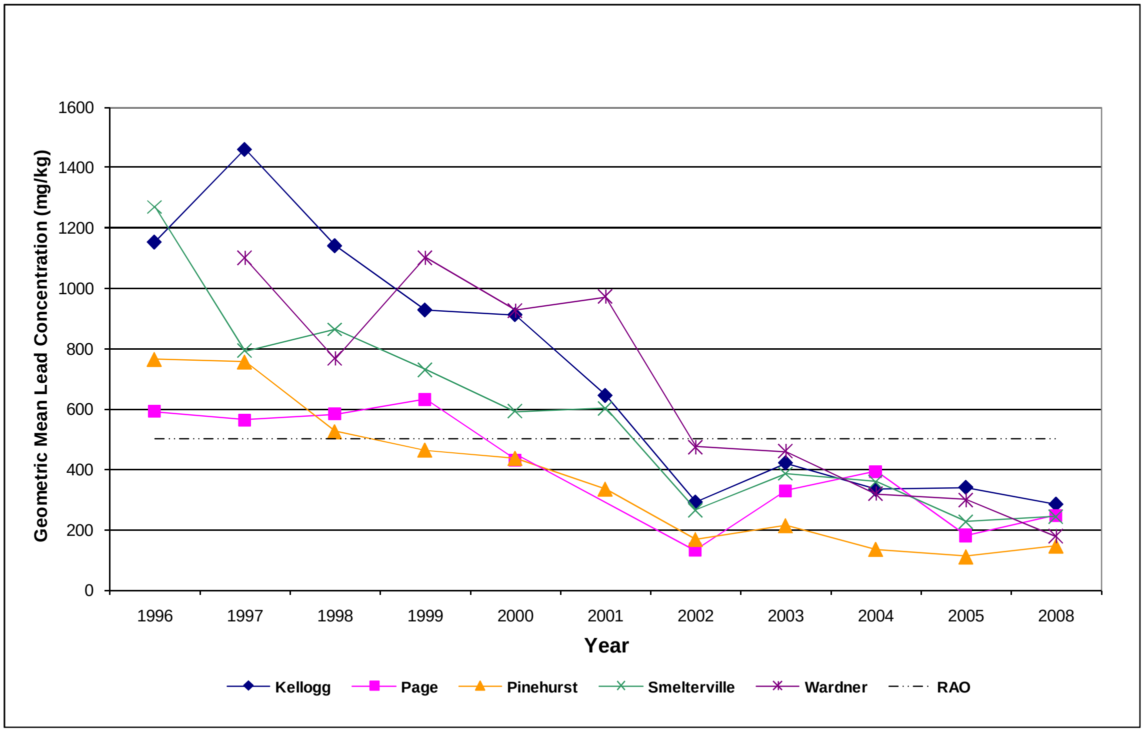


FIGURE 3-6
Mean Dust Mat Lead Concentrations by Year and Area for OU 1, 1996-2008
2010 Five-Year Review, Bunker Hill Superfund Site



decreased. From 2001 to 2005, around 10 percent of all vacuum bag samples collected in the Box have been above 1,000 mg/kg. In 2008, this number dropped to 5 percent.

Table 3-7 presents dust mat lead concentrations from 1996 to 2008. As observed in Figure 3-6, the trend in geometric mean mat concentrations throughout the sampling years has gradually decreased, and, from 2002 to 2008, geometric means were below the established RAO for house dust. In 2002, a significant decrease was observed in OU 1 dust mat concentrations (Figure 3-6). However, some of the decrease was attributed to a change in sampling equipment when the manufacturer discontinued the model of mat used from 1996 to 2001. A replacement mat was selected, and a number of the discontinued mats were retained to determine a calibration to estimate the effect of replacing the dust mats (TerraGraphics, 2005a).

Table 3-8 presents dust and lead loading rates for years 1996 to 2008. Dust and lead loading rates provide information on the amount of dust and lead from soils that are tracked into homes during a specified time period. Lead loading rates are indicators of remedial effectiveness in reducing house dust lead levels by removing contaminated soils. In general, geometric mean dust loading rates have remained similar, but a reduction in lead concentration in outdoor soils has resulted in a reduction in the amount of lead being tracked into homes.

Although the community-wide house dust RAO was achieved in all communities by 2002, some homes continue to show lead levels equal to or greater than 1,000 mg/kg lead. Over the years as remediation continued throughout the Site, the number and percentage of

TABLE 3-7
Dust Mat Summary Statistics by Community and Year for OU 1, 1996-2008
2010 Five-Year Review, Bunker Hill Superfund Site

Year	City	Number of Samples	Dust Mat 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
1996	Box Total	75	37	49%	180.2	7,019	1,329	1,124	1,013	2.08
1997	Box Total	301	129	43%	11	8,200	1,240	1,088	926	2.17
1998	Box Total	489	233	48%	43	35,600	1,444	2,647	968	2.16
1999	Box Total	356	126	35%	90	57,600	1,367	3,845	796	2.29
2000	Box Total	330	101	31%	70	15,500	1,022	1,373	705	2.20
2001	Box Total	223	45	20%	7	15,100	849	1,314	569	2.34
2002[a]	Box Total	343	19	6%	15	79,700	602	4,313	257	2.34
2003[a]	Box Total	362	30	8%	47	51,200	626	2,723	359	2.19
2004[a]	Box Total	338	20	6%	32	57,700	671	3,535	270	2.59
2005[a]	Kellogg	75	12	16%	30	25,400	1,109	3,315	340	3.70
	Page	15	0	0%	41	562	225	153	181	2.04
	Pinehurst	48	1	2%	6	1,100	170	184	112	2.58
	Smelterville	48	2	4%	25	10,500	520	1,492	227	3.02
	Wardner	10	1	10%	35	3,420	624	1,001	300	3.56
	Box Total	196	16	8%	6	25,400	642	2,218	222	3.36
2008[a]	Kellogg	133	6	5%	27	6,380	426	617	285	2.36
	Page	6	0	0%	93	520	287	154	247	1.88
	Pinehurst	78	1	1%	13	1,830	205	225	148	2.23
	Smelterville	38	0	0%	60	976	300	197	244	1.96
	Wardner	15	1	7%	31	1,480	293	364	178	2.78
	Box Total	270	8	3%	13	6,380	334	473	224	2.38

Note: When the number of observation is $\leq$ 2, data are not shown for confidentiality purposes.

[a] Mat multiplier was not applied to these concentrations.

TABLE 3-8
Dust and Lead Loading Summary Statistics by Community and Year for OU 1, 1996-2008
2010 Five-Year Review, Bunker Hill Superfund Site

			Dust Loading Rate (mg/m2/day)					Lead Loading Rate (mg/m2/day)			
Year	City	Number of Samples	Arithmetic Mean	Arithmetic Standard Deviation	Geometric Mean	Geometric Standard Deviation	Number of Samples	Arithmetic Mean	Arithmetic Standard Deviation	Geometric Mean	Geometric Standard Deviation
1996	Box Total	107	1,063	1,167	630	3.06	75	1.68	1.74	1.12	2.55
1997	Box Total	295	836	1,365	492	2.61	295	1.05	2.20	0.46	3.57
1998	Box Total	485	609	858	355	2.78	485	0.94	3.45	0.34	3.42
1999	Box Total	354	808	1,287	395	3.46	353	1.33	7.96	0.32	4.32
2000	Box Total	332	672	885	419	2.65	330	0.57	0.93	0.30	3.21
2001	Box Total	250	697	1,140	352	3.16	223	0.59	1.21	0.25	3.71
2002[a]	Box Total	343	703	902	477	2.27	343	0.34	1.01	0.12	3.66
2003[a]	Box Total	364	576	877	335	2.78	362	0.36	1.24	0.12	3.78
2004[a]	Box Total	339	708	1,152	402	2.62	338	0.57	3.22	0.11	4.44
2005[a]	Kellogg	74	998	4,228	339	3.03	74	13.22	107.61	0.11	7.63
	Page	15	692	538	511	2.26	15	0.18	0.23	0.09	3.59
	Pinehurst	48	575	1,076	279	2.98	48	0.11	0.21	0.03	5.65
	Smelterville	48	704	694	439	2.86	48	0.78	3.95	0.10	6.16
	Wardner	10	557	779	288	3.07	10	0.99	2.65	0.09	9.26
	Box Total	195	775	2,684	352	2.94	195	5.30	66.33	0.08	6.86
2008[a]	Kellogg	133	440	373	308	2.52	133	0.23	0.42	0.09	4.51
	Page	6	316	205	231	2.83	6	0.10	0.09	0.06	4.72
	Pinehurst	78	745	1,804	394	2.69	78	0.22	0.86	0.06	4.72
	Smelterville	38	955	990	548	3.36	38	0.29	0.33	0.13	4.79
	Wardner	15	441	536	257	2.90	15	0.17	0.33	0.05	6.61
	Box Total	270	595	1,087	353	2.76	270	0.23	0.57	0.08	4.79

Note: When the number of observation is ≦ 2, data are not shown for confidentiality purposes.

[a] Mat multiplier was not applied to these concentrations.

homes with dust lead levels equal to or greater than 1,000 mg/kg substantially decreased (Table 3-9). In 2008, 15 homes, or 5 percent of OU 1 homes sampled site-wide, had vacuum bag or dust mat concentrations (or both) equal to or greater than 1,000 mg/kg (Table 3-7). Six Kellogg homes (5 percent), one Pinehurst home (1 percent), and one Wardner home (7 percent) had dust mat results with lead concentrations equal to or greater than 1,000 mg/kg. Five Kellogg homes (6 percent), two Pinehurst homes (4 percent), and two Smelterville homes (7 percent) had vacuum bag results with lead concentrations equal to or greater than 1,000 mg/kg. Two homes had both high dust mat and vacuum bag results. Three homes were referred to PHD for follow-up and intervention due to house a dust result exceeding 5,000 mg/kg lead. To date, the reason for these higher levels of house dust lead concentrations has not been determined.

TABLE 3-9
Number of OU 1 Homes with Elevated House Dust Lead Concentrations
2010 Five-Year Review, Bunker Hill Superfund Site

Year	Number of Homes Sampled	Homes with Dust Lead Concentrations ≥ 1,000 mg/kg	
		Number	Percent
1988	74	52	70%
1990	132	76	58%
1991	132	74	56%
1992	158	65	41%
1993	138	43	31%
1994	136	44	32%
1995	113	28	25%
1996	122	42	34%
1997	296	155	52%
1998	473	242	51%
1999	370	142	38%
2000	392	134	34%
2001	322	62	19%
2002	361	29	8%
2003	367	42	11%
2004	339	30	9%
2005	199	23	12%
2006	6	1	17%
2008	277	15	5%

3.3.4.2 Technical Assessment of House Dust Remediation

Consistent with USEPA guidance (USEPA, 2001d), technical assessment was conducted by evaluating the following three questions related to protectiveness of the implemented remedial actions.

Question A: Is the remedy functioning as intended by the decision documents?
Review of documents, ARARs, and risk assumptions indicates that the OU 1 remedy continues to function as intended by the ROD with respect to community-wide house dust RAOs. Decreases in mean house dust lead concentrations have been observed as exterior soil remediation has been completed. Community house dust mean concentrations have remained below 500 mg/kg since 2002, and the health RAOs have been achieved.

The remedy has reduced lead levels to geometric mean concentrations ranging from 201 to 317 mg/kg for vacuums and 148 to 285 mg/kg for dust mats in OU 1 communities in 2008. These lead levels are near the 200-mg/kg lead background concentrations measured in similarly aged housing and socio-economically situated communities in northern Idaho outside the mining district (Spalinger, von Braun, et al., 2000). Since the 2005 Five-Year Review, 12 percent of homes exhibited dust lead levels in excess of 1,000 mg/kg in 2005 and 5 percent in 2008 (see Table 3-9).

USEPA has not yet fully implemented the interior cleaning component of the OU 1 Selected Remedy. Additional work to determine the source of high dust lead concentrations that persist in some homes following completion of residential soil remediation may be warranted. In many cases, it is likely that the elevated levels can be attributed to other sources of contamination including soils/sediments from the Coeur d'Alene River Basin where many residents recreate, hillsides within OU 1, occupational sources, lead-based paint, and/or personal activities, occupations, or hobbies.

Question B: 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 are still valid. Dust lead concentrations indicate minimal change in contributions from soil sources since the 2005 Five-Year Review. The strategy to achieve the blood lead goals was to implement soil removals and capping and stabilization of contaminated areas throughout the Box to reduce house dust lead levels. In combination, these efforts have reduced children's lead intake from soils and dusts to sufficiently low levels to meet the blood lead objectives. USEPA is considering revision of the blood lead health criteria and risk mitigation policies that may affect protectiveness determination for the dust lead RAOs in the future.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?
This 2010 Five-Year review found no new information that calls the protectiveness of the OU 1 remedy into question. Evaluation of 1990 and 2000 interior cleaning pilot studies and of the current residential interior dust RAO concludes that one-time residential interior cleaning is likely not a sustainable remedy for homes with house dust equal to or greater than 1,000 mg/kg lead.

The proposed remedy does not address anthropogenic lead sources that cannot be controlled by CERCLA cleanup activities (i.e., residents' hobbies, habits, and activities, as well as the presence of lead-based paint).

The LHIP is having limited success in determining the sources of elevated dust lead levels in the 5 to 10 percent of OU 1 homes showing lead concentrations greater than or equal to 1,000 mg/kg. No systematic effort has been made to reduce lead paint exposure in the Box, which may be contributing to the small number of homes with elevated dust lead levels.

Remedy Issues

A summary of issues identified with respect to the OU 1 the remedy for house dust lead concentrations is provided in Table 3-10.

TABLE 3-10
Summary of OU 1 Issues for House Dust Lead Concentrations
2010 Five-Year Review, Bunker Hill Superfund Site

Issues	Affects Protectiveness (Y/N)	
	Current (now to 1 year)	**Future (>1 year)**
Alternative House Dust Lead Source(s): Alternative source(s) may contribute to high dust lead concentrations that persist in some homes following completion of residential soil remediation. In many cases, it is likely that the elevated levels can be attributed to other sources of contamination including soils/sediments from the Coeur d'Alene River Basin where many residents recreate, hillsides within OU 1, occupational sources, lead-based paint, and/or personal activities, occupations, or hobbies.	Y	Y
One-Time Interior Cleaning: 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. However recent data confirm that house dust led concentrations have achieved the community mean of 500 mg/kg and that the number of homes exceeding 1,000 mg/kg lead in house dust is declining.	N	Y

Recommendations

A summary of recommendations and follow-up actions with respect to the OU 1 remedy for house dust lead concentrations is provided in Table 3-11.

3.3.5 Blood Lead Level Reduction

3.3.5.1 Status Update

In the 2000 Five-Year Review for OU 1, USEPA concluded that children's blood lead concentrations and interior house dust concentrations were declining as residential soil cleanup was completed. USEPA recommended annual blood lead screenings to determine whether the reductions in blood lead concentrations would be sustained (USEPA, 2000c).

TABLE 3-11
Summary of OU 1 Recommendations and Follow-Up Actions for House Dust Lead Concentrations
2010 Five-Year Review, Bunker Hill Superfund Site

Recommendations/Follow-up Actions	Responsible Entity	Oversight Agency	Proposed Milestone Date	Follow-up Actions: Affects Protectiveness (Y/N)	
				Current (now to 1 year)	Future (>1 year)
Alternative Dust Lead Sources: Determine whether additional work is needed to identify alternative lead sources, such as lead-based paint, that may be contributing to house dust lead levels.	PHD, IDEQ	IDEQ, USEPA	12/2012	Y	Y
One-Time Interior Cleaning: Evaluate need for implementation of the interior cleaning component of the remedy based in part on information on alternative dust lead sources. Determine additional data/monitoring needs to support one-time interior cleaning evaluation.	IDEQ, USEPA	USEPA	06/2013	N	Y

From 2000 to 2002, USEPA and the State of Idaho observed additional reductions in house dust lead and blood lead concentrations. The incidence of blood lead levels greater than 10 µg/dL fell to 2 to 3 percent in the various communities. In addition, the percent of young children exceeding 15 µg/dL decreased to 0 to 1 percent in each community in 2002. Following these reductions, ATSDR ended the door-to-door blood lead survey. For the 2005 Five-Year Review, USEPA and IDEQ repeated the 2000 Five-Year Review analyses incorporating the more recent LHIP data from 2000-2002 (TerraGraphics, 2004). As noted in the 2005 Five-Year Review, based on these analyses, USEPA, PHD, and IDEQ decided to discontinue the door-to-door blood lead survey in the Box.

From 2005 to the present, blood lead sampling in the Box has continued to be offered as a free service by PHD to all children in the community. However, participation rates are low and may not represent the population. For this reason, estimated OU 1 blood lead concentrations have been calculated using USEPA's Integrated Exposure Uptake Biokinetic Model for Lead in Children (IEUBK) model. Modeling results for OU 1 indicate the OU 1 blood lead RAOs are continuing to be met. However, since the RODs were adopted in 1991 and 1992, USEPA guidance has changed. For the Box RODs (OU 1 and OU 2), a community-based approach was applied that requires no more than 5 percent of children in a similarly exposed community should exhibit blood lead levels greater than 10 µg/dL, with no child exceeding 15 µg/dL (USEPA, 1991, 1992). In 1994, USEPA revised guidance to limit a typical child's risk of exceeding 10 µg/dL to 5 percent or less for an individual property; this guidance was applied in the 2002 OU 3 ROD (USEPA, 1994, 1998a, 2002). The 2000 and 2005 Five-Year Reviews determined that the change in USEPA policy did not apply to OU 1, and that the remedy is protective according to the original RAOs in the OU 1 and OU 2 RODs (USEPA, 2000c, 2005).

USEPA acknowledges that there may be individual homes in OU 1 with a greater than 5 percent chance of a child living at that residence experiencing a blood lead level of 10 µg/dL or greater. These exceedances are associated with the high dust lead levels noted above and/or in combination with residual soil concentrations exceeding 700 mg/kg in unremediated properties. In 2008, 5 percent of vacuum samples and 3 percent of dust mat samples exceeded action levels. Based on the most recent vacuum concentrations collected through 2006, it is estimated that 22 percent of OU 1 homes (with paired soil and house dust) pose a greater than 5 percent chance of an average 2-year-old to exceed the 10-µg/dL level. As noted in Section 3.3.4, house dust and lead loading rates are strong predictors of blood lead levels. Therefore, to address the subset of individual homes with estimated exceedances, USEPA, PHD, and IDEQ will continue to evaluate alternative house dust lead sources and the need for implementing the interior cleaning remedy.

3.3.5.2 Technical Assessment of Blood Lead Level Reduction

Consistent with USEPA guidance (USEPA, 2001d), technical assessment was conducted by evaluating the following three questions related to protectiveness of the implemented remedial actions.

Question A: Is the remedy functioning as intended by the decision documents?

The review of documents, ARARs, and risk assumptions indicates that the remedy is functioning as intended by the RODs. By 2002, the blood lead RAO was achieved by reducing soil and dust lead concentrations to levels that sufficiently limited estimated mean soil and dust lead intakes for children. Few blood lead data have been collected since the 2005 Five-Year Review, but available information indicate no significant change. A small number of children (1 to 2 individuals per year) are observed to have blood lead levels of 10 µg/dL or greater in the LHIP screening.

Question B: 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 are still valid. In combination, the remedial actions have reduced children's lead intake from soils and dusts to sufficiently low levels to meet the blood lead objectives.

The cleanup strategy developed for the Box was based on site-specific dose-response analyses of the blood to soil/dust relationship. The RAOs were developed using an early version of what was later released as the IEUBK model for lead in 1990. The dose-response relationship used to develop the RAOs has proven to be extremely consistent as evidenced from extensive soil, dust, and blood lead data collected and analyzed annually from 1988 until 2002, when the OU 1 blood lead screening program was modified (resulting in lower participation rates). The dose-response analyses have been relied on to assess remedial effectiveness and were evaluated in detail in the 2000 Five-Year Review and the HHRE (TerraGraphics, 2004). The dose-response relationship underlying the development of the cleanup strategy was also examined for appropriateness and consistency to support the 2005 Five-Year Review. The 2005 Five-Year Review concluded that substantial reductions in lead from residential soil and dust sources have been accomplished to achieve the blood lead RAO, although the cleanup was not complete at that time.

The blood lead RAOs apply to each community in OU 1. The 2005 Five-Year Review demonstrated that, for those children tested, all communities have achieved compliance with the 10 μg/dL blood lead RAO as of 2002. Two percent of children tested in Kellogg (four children) and 3 percent of Pinehurst children (three children) had levels greater than or equal to 10 μg/dL in 2002. No children in the communities of Wardner and Page showed blood lead levels exceeding 10 μg/dL in 2002. Blood lead levels of children in other OU 1 communities were all below 10 μg/dL (TerraGraphics, 2004).

Since 2002, insufficient blood lead observations have accumulated to re-assess blood lead levels, distributions, or dose-response relationships. However, environmental media data show no significant change since the 2005 Five-Year Review, and predicted blood levels are highly consistent and accurate (see Section 3.3.3.1, Yard Soil Lead Concentrations; Section 3.3.3.3, Right-of-Way Soil Concentrations; and Section 3.3.4, House Dust Remediation.) Therefore, community average blood lead levels are estimated to be lower than the RAO.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

Based on the attainment of the blood lead RAO, ATSDR no longer funds the annual door-to-door blood lead screening program. USEPA is considering lowering the blood lead level of concern used in assessing lead health risk in the future.

USEPA acknowledges that there may be individual homes in OU 1 with a greater than 5 percent chance of a child living at that residence experiencing a blood lead level of 10 μg/dL or greater. To address this concern, USEPA, PHD, and IDEQ will continue to evaluate alternative house dust lead sources and the need for implementing the interior cleaning remedy as noted in Section 3.3.4.

Issues and Recommendations

No issues or recommendations were identified for the OU 1 blood lead level reduction remedial action. The following recommendation does not necessarily affect protectiveness but should be addressed:

Participation rates in the Box blood lead sampling program have been low in recent years as the cleanup nears completion, and sample results from the low number of participants may not represent the population. To address this, USEPA, PHD, and IDEQ should consider whether establishing a program aimed at increasing participation in the blood lead screening program is warranted to help document continuation of reduced blood lead levels as remedial actions are completed. This effort would include consideration of community- and family-level factors that influence care-giver choice to participate in blood lead screening activities.

3.3.6 Lead Health Intervention Program

3.3.6.1 Status Update

The LHIP continues to offer 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:

- Biological (annual fixed-site blood lead testing) and dust lead monitoring;
- Follow-up for children with elevated blood lead levels;
- Education and awareness for parents and children; and
- Securing environmental remediation services.

PHD is the lead agency for implementing the LHIP in the Box, with funding from UMG settlement money held in trust by IDEQ and oversight from IDEQ and USEPA.

Communities in OU 1 were surveyed through door-to-door screening each year from 1988 to 2002 in July through August. Door-to-door solicitation discontinued in 2003 because blood lead RAOs were achieved in 2002. The LHIP continues to provide fixed-site screening at no cost to Box residents. Table 3-12 provides results from 2003 to 2009 for the Box LHIP. Each year, 8 to 18 individuals provided blood lead samples, for a total of 94 children. Four of these children (3 percent) had levels of 10 µg/dL or greater. Four families were offered and three families accepted follow-up services, but one refused a home visit.

Lead health information has been integrated into programs offered by the local health district, including:

- Well Child Program,
- Immunization Clinics,
- Woman Infant and Children (WIC) Clinics, and
- Pregnancy screening and prenatal clinics.

Pregnant women are offered blood lead testing and nutritional counseling. Each year, a public health professional visits area grade schools. Classes are conducted for students in kindergarten through third grade. Various methods are used to teach the concepts of lead exposure, including a puppet show and doll house. The presentation covers the students' role in identification and management of exposure pathways that may affect them or their siblings. The program is presented in May so children can be reminded of the hazards of lead in soil and dust prior to summer vacation, when they are at the greatest risk of exposure.

A physician awareness program was developed in 1986 so local physicians were aware of program activities and the services available to the community. Reference materials and a resource manual regarding lead and other heavy metals were provided to area physicians and the local hospital. As blood lead levels have decreased in recent years, this information has not been updated or provided on a regular basis, but is still available upon request. However, additional follow-up and intervention activities, including sampling, can be conducted upon request on behalf of physicians with special concerns regarding patient(s) with elevated blood lead levels.

TABLE 3-12
Summary of Blood Lead Levels for OU 1 Children, 2003-2009
2010 Five-Year Review, Bunker Hill Superfund Site

Year	City	Number of Observations	Blood Lead Level Range (µg/dl)		Mean 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
2003	KELLOGG	4	2.3	10	0.67	1	6.16	1.95	0	0%	1	25%
	PAGE	0	-	-	-	-	-	-	-	-	-	-
	PINEHURST	2	-	-	-	-	-	-	-	-	-	-
	SMELTERVILLE	1	-	-	-	-	-	-	-	-	-	-
	WARDNER	1	-	-	-	-	-	-	-	-	-	-
	OU 1-WIDE	**8**	**1**	**10.8**	**5.6**	**4.0**	**4.0**	**2.55**	**0**	**0%**	**2**	**25%**
2004	KELLOGG	7	2.9	6.3	4.9	1.24	4.7	1.32	0	0%	0	0%
	PAGE	0	-	-	-	-	-	-	-	-	-	
	PINEHURST	2	-	-	-	-	-	-	-	-	-	-
	SMELTERVILLE	0	-	-	-	-	-	-	-	-	-	-
	WARDNER	0	-	-	-	-	-	-	-	-	-	-
	OU 1-WIDE	**9**	**2.2**	**6.3**	**4.4**	**1.48**	**4.1**	**1.44**	**0**	**0%**	**0**	**0%**
2005	KELLOGG	10	1.4	5	2.1	1.23	1.9	1.60	0	0%	0	0%
	PAGE	1	-	-	-	-	-	-	-	-	-	-
	PINEHURST	5	1.4	1.4	1.4	0	1.4	1.00	0	0%	0	0%
	SMELTERVILLE	1	-	-	-	-	-	-	-	-	-	-
	WARDNER	0	-	-	-	-	-	-	-	-	-	-
	OU 1-WIDE	**17**	**1.4**	**6.1**	**2.1**	**1.42**	**1.8**	**1.63**	**0**	**0%**	**0**	**0%**

TABLE 3-12
Summary of Blood Lead Levels for OU 1 Children, 2003-2009
2010 Five-Year Review, Bunker Hill Superfund Site

Year	City	Number of Observations	Blood Lead Level Range (µg/dl)		Mean 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
2006	KELLOGG	6	1.4	5.0	3.0	1.21	2.8	1.53	0	0%	0	0%
	PAGE	0	-	-	-	-	-	-	-	-	-	-
	PINEHURST	6	1.4	11	3.6	3.87	2.5	2.4	0	0%	1	17%
	SMELTERVILLE	3	1.4	3	2.0	0.90	1.85	1.52	0	0%	0	0%
	WARDNER	1	-	-	-	-	-	-	-	-	-	-
	OU 1-WIDE	**16**	**1.4**	**11**	**3**	**2.4**	**2.5**	**1.83**	**0**	**0%**	**1**	**6%**
2007	KELLOGG	4	2.1	4.8	3.4	1.18	3.2	1.43	0	0%	0	0%
	PAGE	0	-	-	-	-	-	-	-	-	-	-
	PINEHURST	4	1.4	1.4	1.4	0	1.4	1.0	0	0%	0	0%
	SMELTERVILLE	0	-	-	-	-	-	-	-	-	-	-
	WARDNER	0	-	-	-	-	-	-	-	-	-	-
	OU 1-WIDE	**8**	**1.4**	**4.8**	**2.4**	**1.31**	**2.1**	**1.65**	**0**	**0%**	**0**	**0%**
2008	KELLOGG	10	1.4	4.9	2.6	1.23	2.3	1.67	0	0%	0	0%
	PAGE	1	-	-	-	-	-	-	-	-	-	-
	PINEHURST	4	1.4	1.5	1.4	0.05	1.4	1.04	0	0%	0	0%
	SMELTERVILLE	3	4.2	9.0	6.0	2.62	5.7	1.50	0	0%	0	0%
	WARDNER	0	-	-	-	-	-	-	-	-	-	-
	OU 1-WIDE	**18**	**1.4**	**9.0**	**2.8**	**2.10**	**2.3**	**1.80**	**0**	**0%**	**0**	**0%**

TABLE 3-12
Summary of Blood Lead Levels for OU 1 Children, 2003-2009
2010 Five-Year Review, Bunker Hill Superfund Site

Year	City	Number of Observations	Blood Lead Level Range (µg/dl)		Mean 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
2009	KELLOGG	9	2.0	10	3.5	2.49	3.1	1.62	0	0%	1	11%
	PAGE	0	-	-	-	-	-	-	-	-	-	-
	PINEHURST	6	1.3	2.9	2.2	0.693	2.1	1.42	0	0%	0	0%
	SMELTERVILLE	3	2.0	7.2	4.2	2.68	3.7	1.9	0	0%	0	0%
	WARDNER	0	-	-	-	-	-	-	-	-	-	-
	OU 1-WIDE	**18**	**1.3**	**10**	**3.2**	**2.12**	**2.8**	**1.64**	**0**	**0%**	**1**	**6%**

In addition, a senior environmental health professional at PHD is available for consultations regarding sources of exposure to lead and the management of exposure pathways. A variety of locally developed and commercial fact sheets, brochures, coloring books, and videos are available regarding lead and children, and exposure to lead during pregnancy.

Each year, a public health professional visits area public schools, Head Start Programs, and a privately run academy. Presentations are conducted for students in kindergarten through the third grade. The presentations cover the students' role in identification and management of exposure pathways that may affect them or their siblings. Lead health information has been integrated into existing programs offered by the local health district. Local physicians are apprised of program activities and the services that are available.

Follow-up services are offered to the parents of all children exhibiting an elevated blood lead level. Follow-up consists of a home visit by a PHD environmental health professional who provides parents counseling and written information on how to identify sources of lead and reduce their child's exposure. If the parents accept the offer, a home survey and questionnaire are completed and educational materials provided to the parents, as well as nutritional counseling. Follow-up blood screen is offered 3 to 4 months later, and it is recommended that the child's blood lead information be shared with the family physician. The follow-up survey includes:

- A records search of environmental data collected from the residence;
- Sampling of soil, dust, paint, water, and other media as appropriate;
- Counseling regarding the avoidance of locally grown produce;
- Education regarding play activities, including those not associated with the primary residence;
- Evaluation of sources of exposure associated with parental occupations, hobbies, and other household activities;
- Evaluation of past or planned home remodeling activities; and
- Recommendation for those without vacuum cleaners to use one of the high-efficiency particulate air filter (HEPA) vacuums available through the LHIP.

Since the last Five-Year Review, two children have exhibited elevated blood lead levels. Follow-up services were refused on behalf of one child and completed for the second child.

The HEPA vacuum loan program has been a valuable part of the ICP for interior projects to help control dust levels for those homes with no vacuum cleaners. There were an average of 143 vacuum checkouts for Box and Basin properties between 2005 and 2009 (there is no breakdown of the activity by OU). During this period, the number of vacuum loans ranged between 238 (in 2005) and 77 (in 2008). On average, 102 people have checked out vacuums annually from an average of 103 addresses, indicating this resource is still being used by the community.

3.3.6.2 Technical Assessment of Lead Health Intervention

Consistent with USEPA guidance (USEPA, 2001d), technical assessment was conducted by evaluating the following three questions related to protectiveness of the implemented remedial actions.

Question A: Is the remedy functioning as intended by the decision documents?

Review of documents and site evaluations indicates that the LHIP is functioning as intended by the ROD. The LHIP continues to provide voluntary blood lead screening services, environmental health follow-up for children with blood lead levels above 10 µg/dL, and education and awareness programs. Although the number of families participating in the LHIP has declined as blood lead levels declined, the LHIP continues to provide services to children with elevated blood lead levels as well as educational programs to help children and their families identify and manage potential exposure pathways.

In 2002, LHIP solicitation efforts were curtailed in response to achieving blood lead RAOs. Participation has been minimal since (10 to 20 children per year), with 1 or 2 children exhibiting excess absorption each year. Follow-up investigations have been conducted for homes with high dust lead concentrations and for children with high blood lead levels. Since the 2005 review, community-wide dust lead levels have continued to decrease and the percentage of homes with dust lead levels exceeding 1,000 mg/kg has decreased from about 10 percent to 5 percent.

Two homes were referred to PHD for follow-up and intervention due to house a dust result exceeding 5,000 mg/kg lead. To date, the reason for these higher levels of house dust lead concentrations has not been determined.

The LHIP is having limited success in determining the sources of elevated dust lead levels in the 5 to 10 percent of OU 1 homes showing lead concentrations exceeding 1,000 mg/kg. It is unlikely that additional effective intervention actions can be developed without a better understanding of the lead sources and pathway implications of these dusts. There is little understanding of the specific sources of the elevated dust lead levels in homes with dust lead concentrations of 1,000 to 5,000 mg/kg. No systematic effort has been made to reduce lead-based paint exposure in OU 1, and this may be contributing to the elevated dust lead levels observed.

Question B: 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 are still valid. Follow-up information gathered by environmental health specialists will continue to be evaluated to help identify any trends in exposure pathways for children with elevated blood lead levels.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

This Five-Year Review did not find any new information that calls into question the protectiveness of the LHIP component of the remedy.

Issues and Recommendations

No issues or recommendations were identified for the OU 1 LHIP.

3.3.7 Institutional Controls Program

3.3.7.1 Background

The Box ICP was adopted as a final rule in April 1995 for OU 1 and OU 2. The OU 2 ICP is discussed in Section 4.3.17 of this report, and the more recently adopted OU 3 ICP is discussed in Section 5.3.3.6.

The ICP was established to ensure that barriers remain protective, are adequately maintained, and are appropriately installed in new developments and re-development activities, as well as to assure clean materials and appropriate disposal options for the local communities. The importance of an ICP was noted in the NRC's report, which recommended long-term support of institutional control programs to avoid undue human health risks from recontamination (NRC, 2005).

The ICP is adopted as part of the PHD environmental health code. It is designed to ensure barrier integrity and proper construction practices throughout the Box while facilitating community development and commerce. The ICP regulates construction and use changes on all properties within the ICP boundary. The program provides a number of services free to local residents, including education, sampling assistance, clean soils for small projects (less than one cubic yard of material), collection of soil removed in small projects, and a permanent disposal site for contaminated soils generated in the Box. The ICP also regulates and provides information for interior construction and renovation projects that involve ceiling and/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 and include:

- Contaminant management rules,
- Barrier design/permitting criteria,
- Ordinances requiring PHD sign-off on building permits,
- Ordinance amendments to comprehensive plans and zoning regulations,
- Model subdivision ordinances,
- Stormwater management requirements, and
- Road standards and design criteria.

The ICP was adopted after several years of public input through meetings with the Bunker Hill Superfund Site Task Force, local citizens, and government officials. The outcome of these meetings was an ICP established to ensure the long-term integrity of clean material barriers and to accommodate future development of the area. Violation of the rule is a misdemeanor punishable by a $300 per day fine and up to 6 months in jail.

The ICP is a locally based program that is similar to a building permit program. The ICP includes records maintenance, quarterly reporting to IDEQ and USEPA, permitting, surveillance, inspections, and local construction regulations developed and implemented in conjunction with local zoning, building, or planning commissions. The ICP implements a number of programs such as:

- Issuing excavation permits at no charge (Figure 3-7)

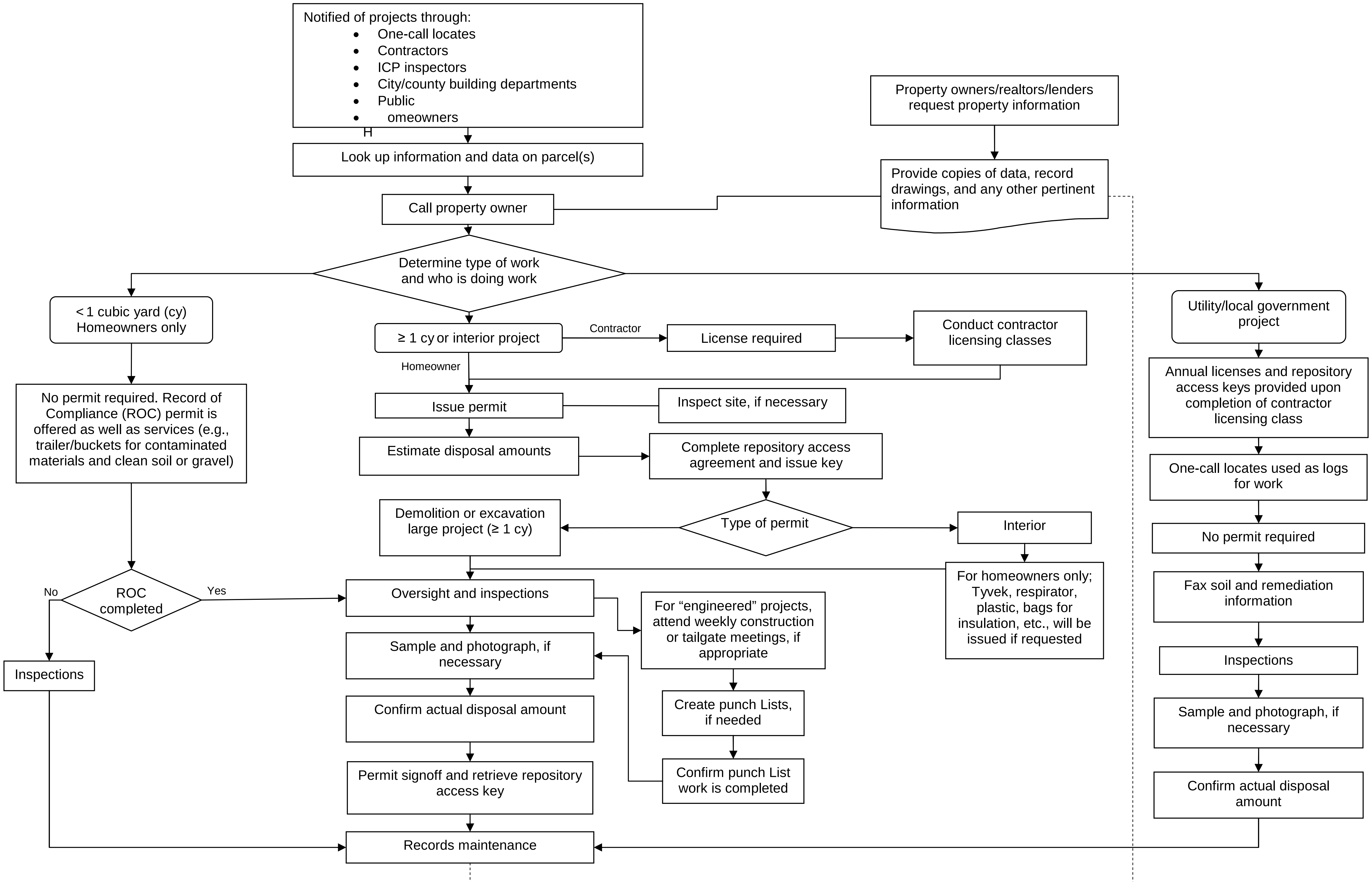
- Supplying clean soil for small projects (less than one cubic yard of material);

- Collecting and disposing of contaminated soil from small projects;
- Directing local residents and developers to the appropriate ICP repository. Disposal of mining-contaminated soils and other material is provided residents and developers free of charge;
- Regulating contaminant migration from one property to another;
- Training and licensing contractors, government entities, and local utilities to ensure that the requirements of the ICP are understood and followed by these entities as they do their work;
- Providing disclosure information for real estate transactions. State and federal laws require disclosure of property-specific information during real estate transactions. PHD provides property owners, prospective land purchasers, lenders, and realtors of the cleanup status of properties (i.e., sampled and not yet remediated, sampled but no remediation required, or remediation completed) along with copies of available as-built maps, ICP permits issued, and available and pertinent sampling data for existing soils on the parcel;
- Providing education and safety materials for indoor construction work that may result in exposures to lead-contaminated dust in attics or dirt crawl spaces;
- As part of the LHIP, a vacuum cleaner loan program, through which HEPA vacuum cleaners are loaned to local residents; and
- Maintaining records of environmental data and property remediation. This information is available to prospective purchasers, homeowners, and realtors.

Implementation and execution of the ICP follows the requirements and standards described in the Code itself (Idaho Administrative Procedures Act [IDAPA] 41.01.01.500 through 41.01.01.543 and 41.01.01.900 through 41.01.01.902). Following is a comprehensive list of documents that assist in guiding work conducted or overseen by the ICP:

- *Bunker Hill Superfund Site, Institutional Controls Program; Barrier Design Criteria & Permitting Requirements* (Welch, Comer, and Associates, 1995a). This document was developed for OU 1 and OU 2. Because certain criteria and requirements are different for OU 3, PHD no longer uses this document. PHD plans to update the document for use in all three OUs;
- *Sampling Plan for Interior Soils* (TerraGraphics, 2008i);
- *Sampling Plan for Residential Interior Dust* (TerraGraphics, 2008j);
- *Sampling Plan for Snow Piles* (TerraGraphics, 2008n);
- *Sampling Plan for Soil and Gravel Sources* (TerraGraphics, 2008m);
- *Sampling Plan for Soil/Gravel Piles and Excavations* (TerraGraphics, 2008k);
- *Sampling Plan for Hillsides Area Soils* (TerraGraphics, 1997a);

FIGURE 3-7
Overview of ICP Activities and Operations
2010 Five-Year Review, Bunker Hill Superfund Site



- *House Dust Collection Protocols* (TerraGraphics, 2008e);
- *Quality Assurance Plan for Material Sampling* (TerraGraphics, 2008g); and
- *Sampling and Analysis Plan (SAP) and Quality Assurance Plan (QAP) for Sampling Newly Designated Residential Properties as part of the Institutional Controls Program (ICP) within the BOX and BASIN at the Bunker Hill Superfund Site* (TerraGraphics, 2008h).

Documents were also developed in the mid-1990s to assist the county and Box cities. The standards set forth in these documents may now be superseded by more current standards adopted by the county and cities. These documents are:

1. *Bunker Hill Superfund Site, Stormwater Management Plan Criteria and Engineering Standards* (Welch, Comer, and Associates, 1995c);
2. *Handbook of Best Management Practices for Stormwater Management and Sedimentation Control Revised for the Environmental Conditions of the Bunker Hill Superfund Site* (Welch, Comer, and Associates, 1995d);
3. *Model Subdivision Ordinance for the Local Governments within the Bunker Hill Superfund Site* (Gale Allen Planning Consulting, 1995). This document was to provide a basic model for land use planners but was not adopted by the county or cities; and
4. *Bunker Hill Superfund Site Road Standards* (Welch, Comer, and Associates, 1995b). This document is outdated, and the *Silver Valley Transportation Plan* (David Evans and Associates, 2010) recommends that local jurisdictions adopt the current Local Highway Technical Assistance Council (LHTAC) *Highway and Street Guidelines for Design and Construction*, 2001.

Educational materials are made available primarily through permitting, contractor classes, and disclosures to property owners, lenders, and realtors. ICP representatives regularly attend pre-bid meetings for proposed projects in the community. One-on-one discussions with engineers and developers are held as large projects begin. In addition, newspaper ads are run twice a year to remind residents to contact the ICP when beginning projects.

The following pamphlets and flyers provide the public with information about the ICP and are available online or in hard copy form from the ICP office:

- *Bunker Hill Superfund Site ICP, Institutional Controls Program*-PHD, Pamphlet #5 September 2007;
- *Bunker Hill Superfund Site ICP, Health and Safety*-PHD, Pamphlet #10 September 2007;
- *Bunker Hill Superfund Site ICP, Contractor Licensing*-PHD, Pamphlet #8 September 2007;
- *Bunker Hill Superfund Site ICP, Large Projects-Exterior*-PHD, Pamphlet #7 April 1995;
- *Bunker Hill Superfund Site ICP, Small Projects*-PHD, Pamphlet #9 April 1995;
- *Bunker Hill Superfund Site ICP, Soil Disposal*-PHD, Pamphlet #3 April 1995;
- *Bunker Hill Superfund Site ICP, Building Demolition*-PHD, Pamphlet #2 April 1995;

- *Bunker Hill Superfund Site ICP, Building Renovation-Interior Projects*-PHD, Pamphlet #6 February 2000;
- *Bunker Hill Superfund Site ICP, Interior Projects*-PHD, Pamphlet #1 February 2000;
- *Bunker Hill Superfund Site ICP, Barrier Option Plan*-PHD, Pamphlet #4 April 1995;
- USEPA Region 10, *Lead-Contaminated Soil, Residential Real Estate Transaction Disclosure Requirements*, Pamphlet # 910-K-05-002, August 2005
- PHD, *Healthy People in Healthy Communities* (general ICP introduction flyer).
- USEPA Region 10, March 2007. *Defending Against Superfund Liability – Guidelines for Property Owners Affected by Mine Waste Within the Bunker Hill Superfund Site*.
- Idaho Division of Environmental Quality. *Do I need a Permit? Who to call when you have an environmental question*.

3.3.7.2 Status Update

Since the last Five-Year Review, PHD has completed the following activities:

- In OU 1, the ICP issued 1,375 permits (Table 3-13).
- For all OUs, the ICP has issued 1,034 licenses to contracting companies and 108 licenses to government entities and utilities
- In OU 1 and OU 2, 1,329 disclosures were provided.

TABLE 3-13
Number of Permits Issued in OU 1, 2005-2009
2010 Five-Year Review, Bunker Hill Superfund Site

Permit Type	Calendar Year					Cumulative 5-Year Total	Annual Average
	2005	2006	2007	2008	2009[a]		
Large Exterior Projects - Excavation Total[b]	161	165	181	174	376	1,057	211
Large Exterior Projects - Demolition Total	14	11	6	9	13	53	11
Interiors Total	17	11	4	3	6	41	8
Records of Compliance Total	67	34	39	44	40	224	45
Totals	259	221	230	230	435	1,375	275

Note: Data provided by PHD.

[a] Includes permits that were written but not issued the last half of the year.

[b] Includes subdivision/planned unit development (PUD) totals.

Database

The ICP maintains a file for all parcels located within the ICP Administrative Boundary. All permits and ROCs are maintained in hard copy form in these files. Contractor licenses, logs of samples collected and results, logs of disposal volumes and counts, and logs of clean soil and gravel provided to homeowners are also maintained by PHD in hard copy, but are not contained in parcel-specific files. For those properties with sampling and remediation information, those data are also kept on file. The ICP owns fire-proof safe cabinets that store the hard copy parcel files. The amount of data available for the site is massive, but is all contained at the ICP for use in permitting, oversight, and inspection activities. This information is also used to assist with disclosures related to land transactions.

The Box database was developed by UMG, with additions by the State of Idaho, to guide and track the OU 1 cleanup, now complete. During cleanup activities, PHD was provided updated versions of the database annually. Upon completion of the OU 1 cleanup in 2008, PHD was provided a final version of the database by UMG for ICP use. Soil data from remediated OU 1 properties not funded by the UMG were added to the database by IDEQ and provided to PHD as well. The type of information stored in these database tables includes parcel numbers, addresses, sample identification numbers, sample results, sampling and remediation dates, remediation barriers and depths, and notes about remediation refusals or properties that did not qualify for remediation. Unlike the Basin, property information cannot be accessed over a secure website by PHD and IDEQ personnel. The hard copy files for these parcels contain the sample results, as-built maps depicting the final remedy, ICP permits, and any ICP notes on copies of the as-builts or sampling information provided by the owner, when available.

Currently, property-specific information generated as part of ICP activities is not maintained in electronic form, posing challenges to data continuity and transportability in the future. In addition, the current system of maintaining property files in paper-only form does not include a back-up system to ensure that information is not lost if project files are lost or destroyed. Integrating ICP-generated information into the existing database would ensure that an up-to-date electronic record is maintained for each property, would provide a back-up system for the current paper-only filing system, and would aid in transferring large amounts of information to future ICP staff for their use.

Staffing

With the expansion of the ICP into the Basin in 2007, PHD has hired one additional full-time equivalent (FTE) to its staff to address ICP permitting and field-related activities. Surveys of contractors that are licensed by the ICP indicate that the program is working well from their perspective, but that ICP personnel appear to be overworked and additional capacity may be needed. Information developed as part of this review (TerraGraphics, 2010a) reveals that the “responsibilities with permitting, daily field inspections, oversight, providing interior supplies and vacuum cleaners and processing disclosures are a considerable burden on ICP staff, particularly during the construction season.” Given that the work elements identified above comprise most of the functions of ICP personnel, this also suggests that staffing levels warrant evaluation to ensure the effective performance of the program.

User Questionnaires

PHD routinely requests feedback from those acquiring permits and licenses on the quality of services provided by PHD. From 2005 to 2008, 36 percent of questionnaires sent to Box home owners and 28 percent of questionnaires sent to Box and Basin contractors and utility/governments were returned. A large majority of responses rated the ICP as good/excellent. Long-term barrier performance is not evaluated as part of the feedback questionnaire.

3.3.7.3 Technical Assessment of Institutional Controls

Consistent with USEPA guidance (USEPA, 2001d), technical assessment was conducted by evaluating the following three questions related to protectiveness of the implemented remedial actions.

Question A: Is the remedy functioning as intended by the decision documents?
The review of documents and site evaluations indicates that the ICP is functioning as designed. PHD has implemented the program according to its rule (IDAPA 41.01.01). Community acceptance and compliance with the program appears to be high, but the community has not been specifically surveyed about remedy functionality. ICP users have been surveyed about the quality of the services provided by the ICP, and they have indicated a very high level of satisfaction with the program. Clean barriers that have been disrupted through excavation have generally been repaired in response to ICP permitting and inspection activities. Although sampling and measurements have not been conducted, new barriers appear to have been installed consistent with the remedy defined in the ROD and in compliance with the ICP rule.

Question B: 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 are still valid. PHD continues to implement the ICP in a manner that maintains the 350 mg/kg lead residential community-wide average in soils.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?
Ongoing and long-term funding for the ICP is a critical component of the remedy. Upon certification of completion of all PRP remedial actions, the CD requires the PRPs to provide permanent funding for the OU 1 ICP that will be placed in a trust fund or similar mechanism. Supportable assumptions and estimate of the costs to fund the ICP into perpetuity is a necessary component of obtaining the long-term funding pursuant to the CD. Long-term disposal is a component of the permanent funding issue that needs to be addressed to ensure a disposal location within the Box continues to be available to the public. In addition, having the appropriate level of staffing for the ICP and adequate information management support for an electronic database is critical to ensure the long-term sustainability and protectiveness of the installed remedies.

Remedy Issues
A summary of issues identified with respect to the OU 1 institutional controls is provided in Table 3-14.

Recommendations
A summary of recommendations and follow-up actions with respect to OU 1 institutional controls is provided in Table 3-15.

TABLE 3-14
Summary of OU 1 Issues Related to Institutional Controls
2010 Five-Year Review, Bunker Hill Superfund Site

Issues	Affects Protectiveness (Y/N)	
	Current (now to 1 year)	**Future (>1 year)**
ICP Funding and Resources: Permanent funding of the ICP is needed to ensure success of the remedy, including consideration of adequate staff and information management support to ensure the long-term effectiveness of the program.	N	Y

TABLE 3-15
Summary of OU 1Recommendations and Follow-Up Actions Related to Institutional Controls
2010 Five-Year Review, Bunker Hill Superfund Site

Recommendations/Follow-up Actions	Responsible Entity	Oversight Agency	Proposed Milestone Date	Follow-up Actions: Affects Protectiveness (Y/N)	
				Current (now to 1 year)	**Future (>1 year)**
ICP Funding and Resources: Secure permanent funding for the ICP, including consideration of adequate staff and information management support to manage the program, as required by the 1994 CD.	UMG, IDEQ, USEPA, PHD	IDEQ, USEPA	12/2012	N	Y

3.3.8 Disposal of Waste from ICP-Permitted Activities

3.3.8.1 Status Update

Long-term disposal is necessary to meet the needs of local residents, contractors, utilities, and local government, while protecting the remedial actions implemented pursuant to the RODs. Since 1991, the Page Pond soil repository has been used as the primary soil repository for the ICP. In addition to the ICP, the Page Repository was used by the PRPs for disposal of soil generated from the residential yard remediation program. See Section 4.3.7 for additional discussion of the Page Repository.

From 2005 to 2009, the Page Repository has received 195 cy of demolition debris, 166 bags of insulation, and 2,937 square yards of carpets and pads from the Box (Table 3-16). In addition, an estimated 118,693 cy of waste material (soil) from the Box have been placed at the Page Repository. On average over the last five years, 9,646 cy of soil have come from OU 1 projects and 14,093 cy of soil have come from OU 2 projects. A large volume of waste was generated from the Wal-Mart developed near Smelterville in 2006, which increased that year's non-populated disposal volume and increased the 5-year annual average (see Table 3-16). An estimated 20,260 cy was placed as fill materials at the Shoshone County

TABLE 3-16
Estimated ICP Disposal Volumes for the Box, 2005-2009
2010 Five-Year Review, Bunker Hill Superfund Site

Waste Category	Disposal Site	Materials Disposed	Units	Calendar Year					Cumulative 5-yr Total	Annual Average
				2005	2006	2007	2008	2009		
Building Demolition	Page Repository									
		Demolition Debris	cy	95	100	0	0	0	195	39
		Insulation	bags	10	30	30	17	79	166	33
		Carpets and Pads	square yard	288	1,900	424	0	325	2,937	587
Soil Disposal	Page Repository Total		cy	25,771	63,547	9,576	11,739	8,060	118,693	23,739
	Populated		cy	10,345	11,892	9,476	9,098	7,419	48,230	9,646
	Non-Populated		cy	15,426	51,655	100	2,641	641	70,463	14,093
	Shoshone County Airport		cy	0	0	0	0	20,260	20,260	N/A
Clean Soil Provided										
Clean soil/gravel delivery			cy	24	13	10	17	16	80	16
Clean soil/gravel delivery			buckets	7	0	0	0	0	7	1
Soil/gravel voucher issued (homeowner pickup)			No. of vouchers	0	0	0	4	0	4	1

Note: Data provided by PHD.

N/A = not applicable

Airport Expansion Project conducted in 2009 (see Table 3-16). In total, wastes generated from licensed and permitted projects throughout the Box from the last 5 years have totaled 139,148 cy (195 cy of demolition debris + 118,693 cy of soil and contaminated materials from OU 1 and OU 2 + 20,260 cy of soil that went to the airport).

The Page Repository has offered several advantages for low-cost disposal. All contaminated materials disposed of at the Page site remain within the Box area of contamination, which has resulted in capping existing tailings. Previously, these tailings had been a continual source of wind-blown dust. Development of Page as a disposal site also eliminated use of the tailings piles as recreational areas for riding all-terrain vehicles.

In 2009, a 1.6-acre expansion of the Page Repository was completed, offering an estimated 75,000 cy of additional capacity. Also in 2009, the original Page Repository footprint was final-graded to drain, permanent drainage features and fencing were installed, and the entire area was seeded with native grasses. However, large portions of the original footprint have not yet established a sustainable vegetative cover. In lieu of an active decontamination system at the Page Repository, the roadways and disposal area are armored with coarse gravel. The gravel initially acts as a clean barrier on which repository users drive and from which they dump waste material to be disposed. Subsequently, the roughness of the graveled roadway acts as an elongated rumble strip, shaking off residual wastes that cling to equipment that does come into contact with the waste. This passive barrier and decontamination system relies on users dumping in designated areas and on maintenance of the clean gravel access road and dumping pad at the Repository. This system is being monitored by IDEQ for effectiveness.

The availability of a disposal site that is open 24 hours per day, 7 days a week has been highly valuable to local residents, utilities, contractors, and local government. In 2008, security measures were installed at the Page Repository, and access was granted through the permitting process with a check-out key card. IDEQ and UMG jointly manage the Page Repository. ICP staff provide oversight of disposal activities on an intermittent basis. The site operates on the honor system, and several problems have been encountered regarding abuse. However, entities served by the ICP (i.e., local residents, utilities, contractors, and local government) recognize the importance of a centrally located and user-friendly disposal site and have cooperated with the ICP to ensure that it remains available. Those who do not adhere to operating parameters are contacted and counseled on appropriate use.

Long-term disposal capacity at Page is a concern, and a new or further expanded facility will be required to accommodate future needs. Contaminated materials are expected to be generated from installation and reconstruction of old and failing infrastructure, as well as continued economic development in OU 1 as well as OU 2. The ability to dispose of contaminated soil, construction materials, and used residential carpets is an essential baseline requirement for operating a successful ICP. UMG is responsible under the 1994 CD to provide a long-term OU 1 ICP repository.

Several factors will need to be considered when evaluating long-term disposal needs for OU 1, including assessment of existing and new waste streams from community construction projects, material handling and segregation, vehicle decontamination procedures, site access, and site management. Estimated long-term anticipated waste volumes for OU 1 were projected at 1,820,000 cy and included future development, infrastructure projects, population growth, and small community projects and repairs (TerraGraphics, 2008q).

Local elected officials and PHD have expressed a desire to use contaminated materials excavated from construction and maintenance activities as fill to support the establishment of developable land. PHD has permitted and overseen such activities in implementing the ICP within the Bunker Hill Box for a number of years. As an example, contaminated fill from ICP-permitted activities has been brought to the Shoshone County Airport to support construction activities. PHD reports that fill placed at the airport has been capped in compliance with the requirements of the ICP. A formal process governing this type of activity in the Box currently does not exist.

USEPA and IDEQ have agreed to evaluate and develop a policy that establishes the appropriate precautions, practices, and documentation requirements that would allow fill activities to be conducted in a manner consistent with cleanup objectives of the OU 1, OU 2, and OU 3 RODs. This policy, referred to as the Community-Fill Policy (CFP), is currently under development and is intended to be applicable to all OUs at the Site when completed but initially would be geographically focused on activities in the Box and the Upper Basin. Community engagement would be included in the development of the CFP. The adoption of a CFP would be conducted though an Explanation of Significant Differences (ESD) or other similar vehicle and would incorporate community input prior to being finalized.

3.3.8.2 Technical Assessment of ICP Waste Disposal

Consistent with USEPA guidance (USEPA, 2001d), technical assessment was conducted by evaluating the following three questions related to protectiveness of the implemented remedial actions.

Question A: Is the remedy functioning as intended by the decision documents?

The review of documents and site evaluations indicates that the ICP repository is functioning as designed. A passive decontamination system that relies on users dumping in designated areas and upkeep of clean gravel access road and dumping pad is currently being used at the Repository. This system is being monitored by IDEQ for effectiveness. Large portions of the original footprint have not yet established a sustainable vegetative cover and are therefore susceptible to wind erosion. Fugitive dust remains an exposure issue for site workers. Although the bulk of ICP-generated materials have been disposed at the Page Repository, USEPA is aware that some ICP-generated materials have been placed in other locations within the Box.

Question B: 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 are still valid. The ICP repository continues to be available to the public and developers and to operate in a manner that assists in maintaining clean barriers in the OU 1.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

Ongoing and long-term provision and operation of an ICP repository is a critical component of the remedy to ensure long-term maintenance of the human health barriers.

Contaminated waste materials from ICP-permitted activities have been disposed of in locations outside of authorize repositories for a number of years. A formal approved process governing this type of activity in the Box currently does not exist. USEPA and IDEQ are currently developing a CFP that will include the necessary precautions, practices, and documentation requirements to meet the objectives of the OU1, OU2, and OU3 RODs.

Remedy Issues

A summary of OU 1 ICP waste disposal issues is provided in Table 3-17.

TABLE 3-17
Summary of OU 1 ICP Waste Disposal Issues
2010 Five-Year Review, Bunker Hill Superfund Site

Issues	Affects Protectiveness (Y/N)	
	Current (now to 1 year)	**Future (>1 year)**
Community-Fill Policy: ICP waste is being disposed of in locations outside of approved repositories.	N	Y

Recommendations

A summary of OU 1 ICP waste disposal recommendations and follow-up actions is provided in Table 3-18.

TABLE 3-18
Summary of OU 1 ICP Waste Disposal Recommendations and Follow-Up Actions
2010 Five-Year Review, Bunker Hill Superfund Site

Recommendations/Follow-up Actions	Responsible Entity	Oversight Agency	Proposed Milestone Date	Follow-up Actions: Affects Protectiveness (Y/N)	
				Current (now to 1 year)	**Future (>1 year)**
Community-Fill Policy: Complete the CFP currently being developed by USEPA and IDEQ for all three OUs.	IDEQ, USEPA	IDEQ, USEPA	12/2011	N	Y

3.3.9 Infrastructure

Sustaining protective barriers is critical to the long-term success of the remedy and relies, in part, on the condition and effectiveness of the supporting infrastructure. Infrastructure such as roads, buildings, and parking lots may serve as barriers to subsurface contaminants. Adequate and appropriately functioning water conveyance systems are necessary to control erosion and recontamination due to flooding. Curbs and gutters, appropriately sized storm drains, culverts, detention facilities, and correctly graded roads all serve to protect the remedy from erosion as well as providing municipal services to local residents. Currently, many of these types of systems or features are deteriorating, undersized or absent, posing a threat to the installed barriers.

3.3.9.1 Infrastructure and Revitalization Plan

The Basin Commission has reviewed community infrastructure needs for all OUs in the development of a Drainage Control Infrastructure Revitalization Plan (DCIRP) funded by USEPA and IDEQ. The DCIRP outlines infrastructure needs of the communities within the Site, including infrastructure needed to protect the remedy as well as infrastructure that is of particular interest to the communities but may not be needed to protect the remedy. Community planners have used the DCIRP to support applications for a range of state and federal grants and loans.

3.3.9.2 South Fork Coeur d'Alene River

Local officials and residents are concerned about inadequate flood control systems for the South Fork Coeur d'Alene River (SFCDR) and its tributaries. USEPA and IDEQ are concerned about the potential for SFCDR and Pine Creek flooding to affect installed remedies. Development, including improvements associated with the OU 1 and OU 2 remedies, occurs within the heavily contaminated historical floodplain. There have been four federal Basin-wide disaster declarations requiring Federal Emergency Management Administration (FEMA) response actions since 1974.

During the Federal Insurance Rate Map (FIRM) update in 2008, the levee systems for the communities and unincorporated areas of Kellogg, Pinehurst, Cataldo, and Osburn were de-accredited due to lack of information about the condition of existing levees, greatly expanding the FEMA-defined 100-year floodplain. In the FIRM update, FEMA assumed that nonaccredited levees provide no flood protection for the Basin communities. Although analysis of the levees has not been conducted, it is likely that existing levees afford some level of flood protection not reflected on the FEMA maps.

An initial estimate of the potential cost to reestablish Superfund remedies at risk to SFCDR flooding was prepared for the Shoshone County Multi-Jurisdictional Hazards Mitigation Plan and indicates that roughly $63.5 million of remediation activity was completed site-wide within the 100-year floodplain as depicted on the 2008 FIRM (TerraGraphics, 2009n). The Shoshone County Hazards Mitigation Plan also estimated that, in Kellogg and associated rural areas, at-risk public and private property in the FEMA-defined 100-year floodplain has an estimated value of $108.2 million. Estimated re-remediation costs alone are $19.7 million. Pinehurst and associated rural areas show respective values of $56.8 million and $11.3 million. Although flooding of this magnitude has not occurred since the listing of the Bunker Hill Superfund Site, the threat of future flooding remains an issue that is important to the cleanup program and local communities.

Comprehensive flood control is a complex, multi-jurisdictional issue that exceeds the expertise and regulatory authority of USEPA and IDEQ cleanup programs and that of the local communities. The Basin Commission agreed in November 2009 to assume a leadership role in evaluating flooding issues associated with the SFCDR and Pine Creek. Flooding is a large, system-wide concern for which a comprehensive review and plan are required to ensure that work with the greatest flood protection potential is ultimately implemented. The Basin Commission has engaged a range of entities with the required combined expertise and regulatory jurisdiction. These entities include USACE, FEMA, the Idaho Bureau of Homeland Security (BHS), USEPA, and IDEQ. USEPA and IDEQ are committed to assisting Basin Commission-led activities to evaluate and plan actions relative to addressing SFCDR flooding issues. No funding source for Basin Commission-led activities has been established.

3.3.9.3 Tributaries and Heavy Precipitation

USEPA is preparing a Focused Feasibility Study (FFS) for the Upper Basin that evaluates remaining risks and remedial alternatives for the site. The Upper Basin FFS Report estimates that 21 percent of the existing installed remedies are at risk of re-contamination within the OU 1 and OU 2 areas of Pinehurst, Smelterville, Kellogg, and Wardner during the 50-year flood (USEPA, 2010b). This excludes potential impacts from the SFCDR and is predicated on an assumption that all existing stormwater-related infrastructure continues to function at full capacity. In evaluating the risks to installed remedies from tributary flooding and heavy precipitation, the FFS Report considered the following threats: flooding with water that contains contaminated sediment, scouring (erosion) of barriers caused by stormwater, and contaminated sediment that is mobilized and carried into the communities by stormwater runoff and deposition (USEPA, 2010b). The follow-on Proposed Plan proposes selection of specific actions within the eight primary Upper Basin communities (Pinehurst, Smelterville, Kellogg, Wardner, Osburn, Silverton, Wallace, and Mullan) to address flooding risks to installed barriers (USEPA, 2010a). The Proposed Plan also establishes a framework for conducting similar analysis and selection of mitigation actions to address flooding concerns in Upper Basin gulches outside the eight primary communities.

3.3.9.4 Rights-of-Way

The RODs for OU 2 and OU 3 (USEPA, 1992, 2002) address cleanup of ROWs in the Box and the Upper Basin, as appropriate to respond to risks to human health. The RODs allow ROWs, which include all state, county, local and private roads, to be remediated such that they provide barriers to underlying metals contamination. Many roads or road shoulders have been remediated during implementation of the Selected Remedies in residential and commercial areas within the Box and Basin communities. However, USEPA and IDEQ recognize that some paved roadways may not provide adequate long-term barriers to underlying contaminated material, and that local and state entities are responsible for the long-term road development and maintenance efforts. USEPA and IDEQ are developing an approach under the existing RODs to address paved and unpaved roads as barriers collaboratively with local, county, and state entities responsible for providing and maintaining roadways in their communities. The objective of this effort is to ensure the long-term effectiveness of barriers installed in ROWs consistent with the transportation and maintenance needs of the Box and Basin communities.

3.3.9.5 Technical Assessment of Infrastructure

Consistent with USEPA guidance (USEPA, 2001d), technical assessment was conducted by evaluating the following three questions related to protectiveness of the implemented remedial actions.

Question A: Is the remedy functioning as intended by the decision documents?

The review of documents, ARARs, and risk assumptions indicates that the remedy is functioning as intended by the RODs. Infrastructure (e.g., roads, sidewalks, parking lots, drainage controls) in OU 1 is an important part of the remedy because it serves as barriers to exposure pathways between contaminated soils and humans and helps ensure that clean barriers remain in place. In general, the infrastructure that is in place in OU 1 communities continues to serve this purpose, though some infrastructure systems or features throughout

OU 1 are deteriorating (e.g., paved roads) or undersized (e.g., drainage features). Under the ICP, local public entities are required to maintain the infrastructure such as roads in a manner to prevent contaminant exposures or migration. The reliance on infrastructure to help protect the remedy is appropriate, and failure to address infrastructure inadequacies in these communities may result in the loss of portions of the installed remedy. USEPA and IDEQ are developing an approach to address roads as barriers. The objective is to ensure the long-term effectiveness of barriers installed in ROWs, recognizing local transportation needs and maintenance responsibilities.

Infrastructure such as storm drain systems and flood control facilities also is relied upon to protect the installed remedy by safely conveying storm and flood waters. In this case, the community infrastructure is not able to safely handle large flow events. To date, one flood has occurred that disrupted barriers significantly, the 1997 Milo Creek flood. The FFS analyzed risk to installed barriers from heavy precipitation and tributary flooding and developed actions to address the risks (USEPA, 2010b). The follow-on Proposed Plan (USEPA, 2010a) proposes selection of specific actions within eight primary Upper Basin communities (Pinehurst, Smelterville, Kellogg, Wardner, Osburn, Silverton, Wallace and Mullan) to address flooding risks to installed barriers. The Proposed Plan also establishes a framework for conducting similar analysis and selection of mitigation actions to address flooding concerns in Upper Basin gulches outside the eight primary communities.

The Basin Commission has assumed the lead in evaluating flooding issues associated with the SFCDR and Pine Creek. In that capacity, the Basin Commission has engaged USACE, FEMA, Idaho BHS, USEPA, and IDEQ who have applicable expertise and regulatory jurisdiction. USEPA and IDEQ will be participating in Basin Commission-led activities related to SFCDR and Pine Creek flooding issues. No funding source for Basin Commission-led activities has been established.

Question B: 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 are still valid. As previously noted, ongoing issues remain related to potential recontamination of protective barriers from flood events or lack of infrastructure improvements. Although these issues do not currently affect the protectiveness of the remedy, there may be recontamination concerns if infrastructure improvements are not implemented.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

Infrastructure improvements and ongoing maintenance of existing infrastructure are needed to ensure long-term success of the remedy. There is uncertainty regarding the remaining service life of these systems. The local communities have expressed concern about their ability to upgrade and maintain existing infrastructure and the associated operations and maintenance obligations needed to ensure long-term protectiveness of the remedy. Traditional funding mechanisms are not conducive to multi-jurisdictional owned projects or combining different utilities within projects. Similarly, the amount of funding needed to holistically address all infrastructure issues within a community typically exceeds the amount of funding that can be secured. Traditional infrastructure funding sources require relatively high local match requirements.

The communities' ability to pay to maintain existing infrastructure or install new systems that provide barriers and protect the CERCLA installed remedy was evaluated prior to the 2005 Five-Year Review (USEPA, 2005). The Box and Basin DCIRP (TerraGraphics, 2009b) program evaluated community assessments, current and continuing obligations, and needs at that time. The trend of decreasing tax revenues, declining population, and reduction in state and federal assistance are increasing local funding burdens, deferring O&M, and delayed replacement of aging infrastructure systems. Resources to repair and install infrastructure have been difficult to secure by local governments. The NRC report noted that ICP and O&M programs include important components that will need perpetual maintenance for hundreds of years. The NRC expressed concern that state funding priorities change and maintaining an effective program is likely to be difficult.

Remedy Issues

A summary of issues identified with respect to infrastructure is provided in Table 3-19.

TABLE 3-19
Summary of OU 1 Infrastructure Issues
2010 Five-Year Review, Bunker Hill Superfund Site

	Affects Protectiveness (Y/N)	
Remedy Issues	**Current (now to 1 year)**	**Future (>1 year)**
Flood Control: Flooding in the SFCDR and Pine Creek poses a threat to portions of the installed remedy. Comprehensive flood control on the SFCDR and Pine Creek is a complex, multi-jurisdictional issue that exceeds the expertise and regulatory authority of USEPA's and the IDEQ's cleanup programs, and that of the local communities.	N	Y
Roads as Protective Barriers: A number of paved roads throughout all OUs are deteriorating, compromising their ability to function as protective barriers.	Y	Y
Infrastructure Maintenance Funding: Infrastructure maintenance and improvements remain an issue. The remedy relies on functioning infrastructure to be sustainable. Resources to repair and install infrastructure have been difficult to secure by local governments.	N	Y

Recommendations

A summary of recommendations and follow-up actions for infrastructure is provided in Table 3-20.

TABLE 3-20
Summary of OU 1 Infrastructure Recommendations and Follow-up Actions
2010 Five-Year Review, Bunker Hill Superfund Site

Recommendations/Follow-up Actions	Responsible Entity	Oversight Agency	Milestone Date	Follow-up Actions: Affects Protectiveness (Y/N)	
				Current (now to 1 year)	Future (>1 year)
Flood Control: Continue working with the Basin Commission and other stakeholders to evaluate and plan actions relative to addressing SFCDR and Pine Creek flooding that may affect cleanups.	Local Governments, IDEQ, USEPA, PHD	IDEQ, USEPA	12/2012	N	Y
Roads as Protective Barriers: Continue working to develop an approach for addressing roads as long-term barriers in collaboration with state, county and local entities.	Local Governments, IDEQ, USEPA, PHD	IDEQ, USEPA	12/2012	Y	Y
Infrastructure Maintenance Funding: Develop appropriate institutions and funding mechanisms to finance and oversee stewardship activities.	Local Governments, IDEQ, PHD	IDEQ, USEPA	12/2012	N	Y

3.4 Performance Evaluation of the OU 1 Remedy

The remedy currently being implemented in OU 1 is expected to be protective of human health and the environment where response actions have already been taken, provided that follow-up action identified in Table 6-2 are implemented. Exposure pathways that could result in unacceptable risks are being controlled or addressed in locations where remedial work has been completed. There are some homes where interior house dust lead concentrations remain high. The need to identify alternative lead sources, such as lead-based paint, will be evaluated. Based, in part, on information related to alternative lead sources, a determination will be made related to the need to implement the interior cleaning component of the OU 1 remedy.

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 below the 500-mg/kg site-wide average RAO. However, in 2008, 5 percent of sampled homes in OU 1 exhibited interior dust lead concentrations greater than 1,000 mg/kg. The 1991 OU 1 ROD contemplated a one-time cleaning of homes exhibiting lead dust concentration above 1000 mg/kg. The 1990 and 2000 interior cleaning pilot studies concluded that one-time residential interior cleaning is likely not a sustainable remedy for homes with house dust equal to or greater than 1,000 mg/kg lead.

The OU 1 remedy is currently protective of human health and the environment where remedial actions have been taken. However, it is possible that flooding and infrastructure issues may affect remedy protectiveness. In addition, the ability of the local communities to improve and maintain infrastructure to protect the remedy is a concern. Provision of a long-term ICP repository is essential to the continued performance of the installed human health barriers.

In 2008, USEPA initiated efforts to identify actions needed to augment the remedial actions taken in OU 1 residential and community areas to improve their long-term sustainability. At the time of the release of this review, a Proposed Plan outlining the elements of a ROD Amendment for the Upper Basin portion of the Site, which includes actions to augment the OU 1 remedy, has been released for public review and comment (USEPA, 2010a). Upon completion of the comment period, USEPA will evaluate the comments received and subsequently issue a ROD Amendment for the Upper Basin portion of the Site.

4 Review of Selected Remedies for Operable Unit 2

This section summarizes the protectiveness evaluation of the Operable Unit (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 Record of Decision (ROD; U.S. Environmental Protection Agency [USEPA], 1992) and its subsequent decision documents (ROD Amendments and Explanation of Significant Differences [ESD] documents). The information in this section is organized as follows:

- 4.1 Overview of the Selected Remedy
- 4.2 Review of Applicable or Relevant and Appropriate Requirements
- 4.3 Review of Operable Unit Work and Remedial Actions
- 4.4 Environmental Monitoring
- 4.5 Performance Evaluation of the Selected Remedy

4.1 Overview of Selected Remedies

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. These areas are the former Industrial Complex and Mine Operations Area (MOA), Smelterville Flats (the floodplain of the South Fork of the Coeur d'Alene River [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). These areas are shown in Figure 4-1. The SFCDR within OU 2 and the non-populated 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, re-establishment 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 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 Potentially Responsible Party (PRP) for the Site (Gulf Resources) resulted in shifting responsibility for OU 2 remedy implementation from a PRP to USEPA and the State of Idaho. Pursuant to Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) requirements for fund-led remedy implementation, USEPA and the State of Idaho entered into a State Superfund Contract (SSC) to implement the OU 2 Selected Remedy (USEPA and Idaho Department of Health and Welfare [IDHW], 1995). The SSC is composed of 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 State of Idaho 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 operation and maintenance (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.

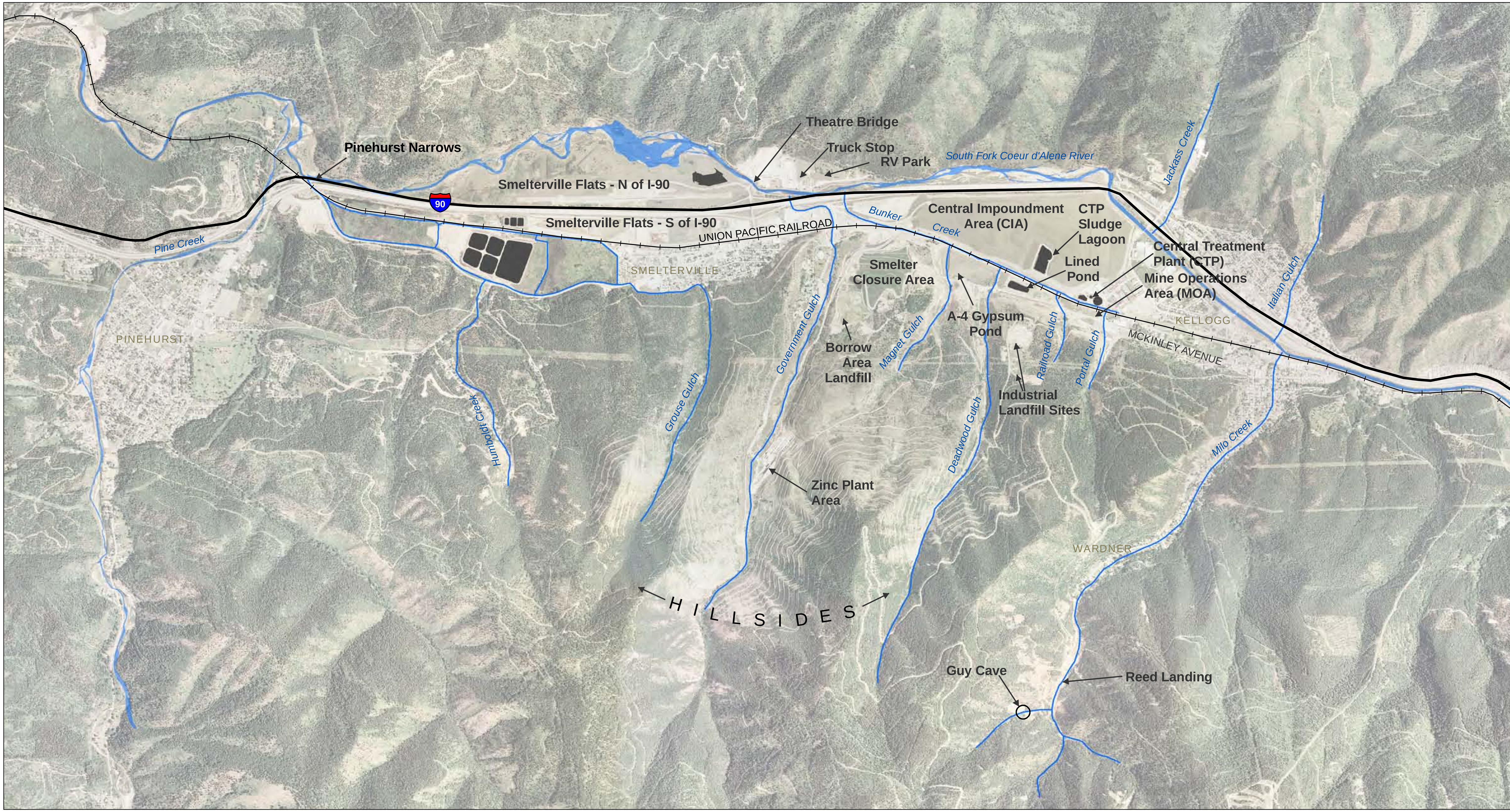
Phase I of remedy implementation includes extensive source removal and stabilization efforts, all demolition activities, all community development initiatives, development and initiation of an Institutional Controls Program (ICP), future land use development support, and public health response actions. 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 almost complete. Table 4-1 lists the volumes of contaminated material and acreage of areas capped as part of the enhanced source removal and consolidation remedial actions conducted as part of Phase I. Development of the Phase II Selected Remedy is being conducted concurrent with this 2010 Five-Year Review (see Section 2.7 for more information).

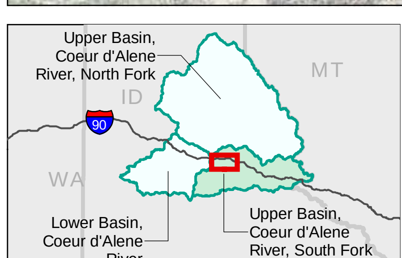
There have been two ROD Amendments (USEPA, 1996a, 2001a) and two ESDs (USEPA, 1996b, 1998b) since the 1992 OU 2 ROD was issued (see Figure 4-2 for a timeline of events in OU 2). The ESDs clarified implementation aspects of portions of the Selected Remedy for OU 2 consistent with Phase I objectives and did not change the Selected Remedy. The ROD Amendments added additional requirements and actions to the overall OU 2 Selected Remedy. These additional requirements and actions are briefly discussed below.

The 1996 OU 2 ESD addressed differences associated with placing Zinc Plant demolition materials in the Smelter Closure Area (SCA), disposal of a portion of the A-1 Gypsum Pond materials in the SCA, and removal and disposal of industrial landfill materials in the SCA (USEPA, 1996b).

The 1996 OU 2 ROD Amendment changed the Selected Remedy for Principal Threat Materials (PTMs) from chemical stabilization to containment. Under the 1996 OU 2 ROD Amendment, PTMs would be contained in a fully lined monocell within the SCA (Section 4.3.8). Mercury-contaminated PTMs were chemically stabilized prior to placement in the PTM monocell (USEPA, 1996a).

The 1998 OU 2 ESD addressed differences associated with the stabilization and removal of contaminated materials located in the tributary gulches within OU 2 (Section 4.3.4), the USEPA financial contribution to the lower Milo Creek/Wardner/Kellogg pipeline system (Section 4.3.13), placement of mine wastes from outside of OU 2 in the CIA (Section 4.3.6), precipitation diversion work associated with Smelterville Flats south of Interstate 90 (I-90) (Section 4.3.5), demolition of the tall stacks at the Lead Smelter and Zinc Plant





Union Pacific Railroad (UPRR)
(now Trail of the Coeur d'Alenes)

River/Creek

N

0 750 1,500 3,000 Feet

Figure 4-1
Operable Unit 2 Site Map
2010 Five-Year Review
BUNKER HILL SUPERFUND SITE

EPA

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TABLE 4-1
Summary of OU 2 Phase I Removals and Remedial Actions to Date
2010 Five-Year Review, Bunker Hill Superfund Site

Area	Approximate Removal Quantity (cy)	Approximate Capped Area (acres)[a]	Other
Hillsides	N/A	N/A	1,088.5 acres revegetated through 2004[b]
Grouse Gulch	5,000[a]	N/A	Stabilization of creek channel, revegetation
Government Gulch	370,000[a]	75[c]	Re-establishment of natural creek channel, demolition of industrial facilities in gulch, removal of demolition debris to Smelter Closure, revegetation
Magnet Gulch	210,000[a]	10.5[c]	Re-establishment of natural and rock-lined creek channel
Smelterville Flats – North of I-90	1,600,000[a]	190.5[d]	River bank stabilization, revegetation of flood plain
Smelterville Flats – South of I-90		103[d,e]	Includes capped acreage up to Slag Pile Area, stormwater drainage system, revegetation
Central Impoundment Area	N/A	260[f]	2.6 million cy added to CIA, geomembrane cover system, slopes covered (rock or vegetated)
Page Pond Area	40,000[a]	N/A	Tailings removed from West Beach in the West Page Swamp
Smelter Closure Area	20,000[a]	44[d]	Consolidation area for demolition debris, 826,000 cy added to the 128,000 already in place,[a] full encapsulated Principal Threat Materials (PTM) cell, geomembrane cover system, revegetation
Borrow Area	[g]	36[e]	
Mine Operations Area (including Boulevard area, Railroad Gulch, and Industrial Landfills)[j]	130,000[a]	17.5[g]	Demolition of industrial facilities
Bunker Creek	80,000[a]	N/A	Re-establishment of natural creek channel, revegetation
Milo Creek	40,000[a]	N/A	Construction of Reed Landing structure
A-4 Gypsum Pond	100,000	13	Drainage control and revegetation
SFCDR Channel	180,000[a]	N/A	
Union Pacific Railroad (UPRR) Right-of-Way (ROW)	50,000[a]	47.5[e]	Construction of the Trail of the Coeur d'Alenes bike trail
Deadwood Gulch	490,000[a]	N/A	Stabilization of creek channel, revegetation

TABLE 4-1
Summary of OU 2 Phase I Removals and Remedial Actions to Date
2010 Five-Year Review, Bunker Hill Superfund Site

Area	Approximate Removal Quantity (cy)	Approximate Capped Area (acres)[a]	Other
Theatre Bridge Area North of SFCDR	N/A	34[e]	
Sweeney Mill Site	120	8	
Total	3,315,120	839	

Note: Removal quantities updated from the 2005 Five-Year Review based on information presented in TerraGraphics Environmental Engineering (TerraGraphics; 2007a).

[a] Does not include riprap or rock-lined channels.

[b] TerraGraphics, 2007a.

[c] Morrison Knudsen Corporation, 1999.
[d] TerraGraphics, 1999c.

[e] GIS calculation based on as-built drawings and/or estimated from aerial images; rounded to the nearest 0.5 acre.

[f] USEPA, 2000b.

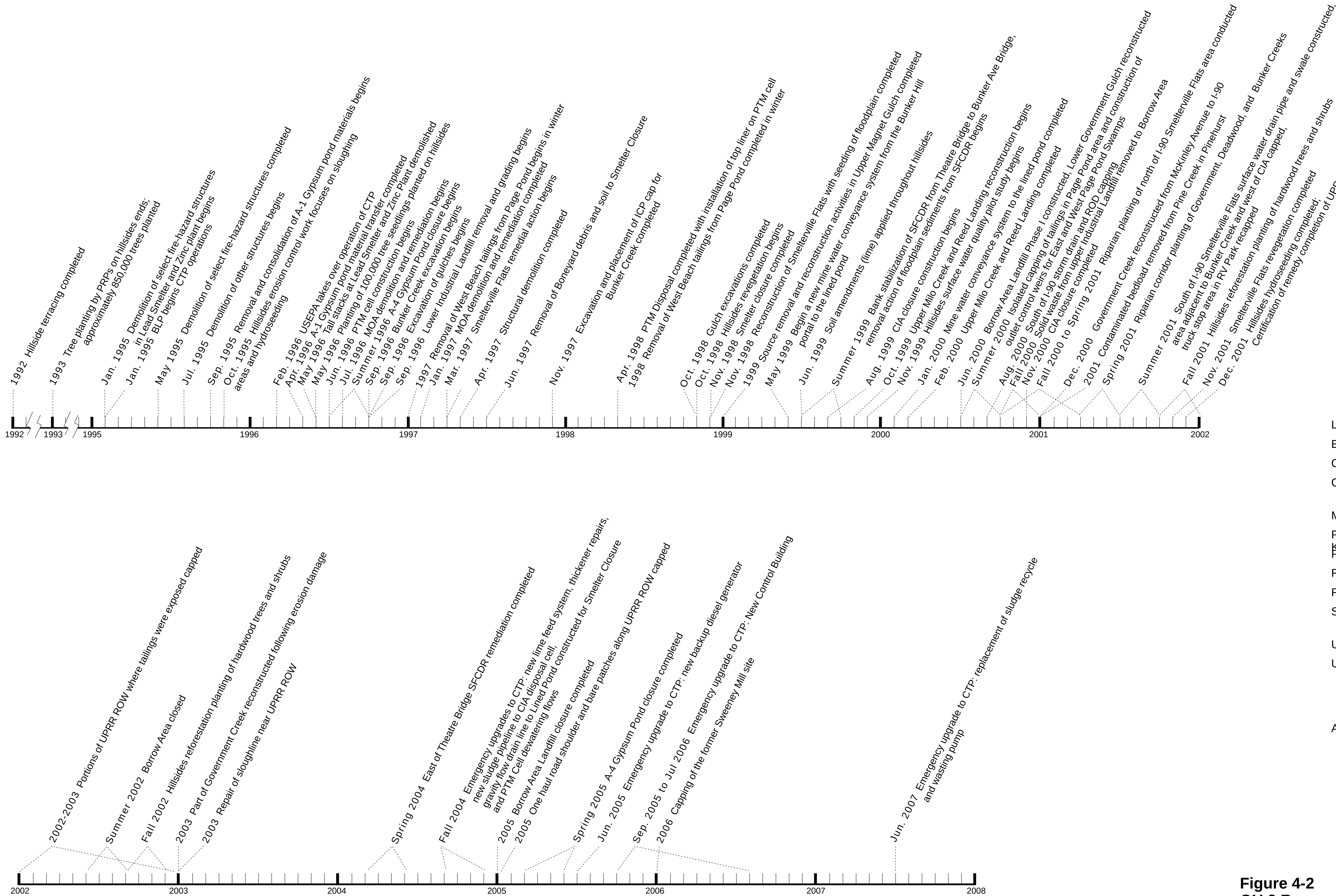
[g] The borrow area was a clean material source and later became a contaminated soil repository. Contaminated material at the borrow area (near-surface material) was stockpiled and used for soil cap (manufactured soil) at the Smelter Closure Area. The clean material was used for fill and soil caps throughout the site. The borrow area benches were later used to create the Borrow Area Landfill.

N/A = not applicable

(Section 4.3.8), decontamination versus demolition of the Zinc Plant Concentrate Handling Building and Warehouse (Section 4.3.8), and demolition of the Phosphoric Acid/Fertilizer Plant Warehouse (Section 4.3.8) (USEPA, 1998b).

The 1992 OU 2 ROD addressed Bunker Hill Mine AMD by requiring that it continue to be treated in the Central Treatment Plant (CTP) prior to discharge to a wetlands treatment system for removal of residual metals. During studies conducted between 1994 and 1996 by the United States Bureau of Mines (USBM), the wetlands treatment system was found to be incapable of meeting the treatment levels estimated in the Feasibility Study (FS) and required by the 1992 OU 2 ROD. The 1992 OU 2 ROD did not contain or otherwise identify any plans for the control or long-term management of the mine water flows or alternatives for treatment of site waters originally slated for treatment in the constructed wetlands. The 1992 OU 2 ROD also did not address the long-term management of sludge from the CTP. To address these issues, USEPA began the Mine Water Remedial Investigation/Feasibility Study (RI/FS) in 1998 (USEPA, 2001f). This study focused on the AMD drainage issues associated with the Bunker Hill Mine and the long-term water treatment needs for OU 2. The subsequently issued 2001 OU 2 ROD Amendment (USEPA, 2001a) included additional remedies and requirements to address:

- AMD source control to reduce the quantity of surface water entering the mine and AMD generated within the mine;



Legend:

BLP	Bunker Limited Partnership
CIA	Central Impoundment Area
CTP	Central Treatment Plant, Kellogg, Idaho
MOA	Mine Operations Area
PRP	Potentially Responsible Party
PTM	Principal Threat Materials
ROD	Record of Decision
ROW	right of way
SFCDR	South Fork of the Coeur d'Alene River
UPRR	Union Pacific Railroad
USEPA	U.S. Environmental Protection Agency

Figure 4-2
OU 2 Removal and Remedial Action Timeline
2010 Five-Year Review
BUNKER HILL SUPERFUND SITE

- AMD collection and control within the Bunker Hill Mine;
- AMD conveyance from the Kellogg Tunnel to the CTP;
- AMD storage in the Lined Pond and the Bunker Hill Mine pool;
- AMD treatment in an upgraded CTP;
- Management of treatment residuals (sludge); and
- Establishment of remediation goals and discharge limits for AMD treatment.

To date, USEPA and the State of Idaho have not concluded negotiations on an SSC Amendment that allows for full implementation of the 2001 OU 2 ROD Amendment. Time-critical components of this ROD Amendment were implemented, however, to avoid potential catastrophic failure of the CTP and to provide for emergency mine water storage (USEPA and Idaho Department of Environmental Quality [IDEQ], 2003d).These time-critical activities focused on preventing discharges of AMD to Bunker Creek and the SFCDR. Until an SSC Amendment is signed allowing for full implementation of the 2001 OU 2 ROD Amendment, control and treatment of AMD and its impact on water quality will continue to be an issue. USEPA and the State continue to discuss the SSC Amendment and the long-term obligations associated with the mine water remedy.

The Phase I remedy has been largely implemented within the Box. The effectiveness evaluation of the ability of Phase I source control and removal activities to meet the water quality improvement objectives of the 1992 OU 2 ROD has been completed, and additional data collection activities and studies have been conducted to assist in evaluating the appropriate Phase II implementation strategies and actions. Section 2.7 summarizes the work USEPA has conducted in support of developing the Phase II remedial actions.

4.2 Review of Applicable or Relevant and Appropriate Requirements

The remedies selected in RODs, ROD Amendments, and ESDs are intended to be protective of human health and the environment and to comply with the federal and state standards that are applicable or relevant and appropriate requirements.

As part of the 2000 and 2005 Five-Year Reviews, the applicable or relevant and appropriate requirements (ARARs) and to be considered (TBC) guidance identified in the 1992 OU 2 ROD were reviewed, and any new or revised standards were identified and summarized within the those OU 2 Five-Year Review Reports. Based upon the initial and second reviews, USEPA determined that the 1992 ARARs and TBCs were still protective of the remedies for OU 2 (USEPA, 2000b).

With this 2010 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. All were evaluated against new or revised standards promulgated since the last Five-Year Review. As with the first and second reviews, USEPA has determined that the OU 2 ARARs and TBCs are still protective.

The following subsections provide a brief discussion of the standards that have been revised or promulgated since the last Five-Year Review.

4.2.1 Threshold Limit Values for Workplace Airborne Hazards

Threshold Limit Values (TLVs) are heath-based guidelines (not standards) prepared by the American Conference of Governmental Industrial Hygienists (ACGIH) to assist industrial hygienists in making decisions regarding safe levels of exposure to various airborne hazards found in the workplace. A TLV reflects the level or conditions to which it is believed that *nearly* all workers may be repeatedly exposed, day after day, over a working lifetime, without adverse health effects. TLVs are reviewed on an annual basis by ACGIH.

TLVs are not universally accepted by occupational physicians and toxicologists. Most TLVs are consensus values developed by chemical manufacturers (Castleman, 1997; Castleman, 2006; Castleman & Ziem, 1988; Castleman & Ziem, 1994; Rappaport, 1993; Roach and Rappaport, 1990; Ziem & Castleman, 1989). As such, their acceptance remains controversial. In addition, risks born by workers are always higher than those sustained by the general public, perhaps because workers are financially dependent upon occupational exposures.

In the 1992 OU 2 ROD, the TLVs for releases of certain airborne contaminants of concern during remedial actions were considered relevant and appropriate site-wide. The most current values are being considered in subsequent OU 2 remedial actions and are to be part of each health and safety plan for protection of onsite workers. Review and revisions of TLVs do not affect the protectiveness of the OU 2 remedy.

4.2.2 Slope Stability

In the 1992 OU 2 ROD, USEPA determined that certain sections of the Surface Mining Control and Reclamation Act (SMCRA) of 1997[1] were relevant and appropriate for removal and backfilling of contaminated soils. This act was revised in July of 2003 to add a requirement to achieve a post-action slope not exceeding the angle of repose or such slope as is necessary to achieve a long-term static safety factor of 1.3 to prevent slides. The 1992 OU 2 ROD identified the static safety factor as 1.0; however, cut or engineered slopes in OU 2 were analyzed and designed to conform to a minimum static long-term factor of safety of 1.5 and a minimum short-term dynamic factor of safety of 1.0. Because slopes in OU 2 were designed and constructed using a more stringent safety factor, the 2003 revised requirement does not affect the protectiveness of the OU 2 remedy.

4.2.3 Drinking Water Quality

Both groundwater and surface water can serve as drinking water and applicable drinking water quality regulations include the Safe Drinking Water Act (40 Code of Federal Regulations [CFR] Section 141)/Idaho Drinking Water Regulations (Idaho Administrative Procedures Act [IDAPA] 58.01.08.050). These regulations are applicable to all public drinking water systems and private wells that supply drinking water to residents of OU 1 and OU 2. They require that contaminant concentrations in drinking water remain below maximum contaminant levels (MCLs) and non-zero MCL goals (MCLGs). The 1992 OU 2

1 30 CFR Parts 816.11; 816.95; 816.97; 816.100; 816.102; 816.107; 816.111; 816.113; 816.114; 816.116.

ROD identified these regulations as relevant and appropriate for groundwater that could be used for drinking water purposes in the future. To meet these requirements, remedial actions have limited contamination to and exposure from groundwater through source removals and containment and the closure of onsite wells and by providing alternative drinking water sources to affected communities and residences. The drinking water MCLs identified as ARARS in the 1992 OU 2 ROD are listed in Table 4-2.

TABLE 4-2
Drinking Water ARARs
2010 Five-Year Review, Bunker Hill Superfund Site

Metal	Maximum Contaminant Level (µg/L)
Arsenic	10
Cadmium	5
Lead	15
Zinc	5,000[a]

[a] Secondary MCL.
µg/L - micrograms per liter

On February 22, 2002, USEPA lowered the MCL for arsenic from 0.05 milligram per liter (mg/L) to 0.01 mg/L.[2] Public water system suppliers must have complied with this new MCL by January 2006. USEPA is currently revising the toxicity value for arsenic, which could affect the protectiveness of the current MCL and the soil cleanup level, currently set at 100 milligrams per kilogram (mg/kg). There were no changes in the drinking water ARARs from 2005 to 2010.

The effectiveness evaluation of the ability of Phase I source control and removal activities to meet water quality improvement objectives, including drinking water requirements, was conducted by USEPA. This evaluation determined that the Selected Remedy for OUs 1 and 2 has not attained the Safe Drinking Water Act (SDWA) groundwater MCLs identified as ARARs in the 1992 OU 2 ROD, nor the above-mentioned revised arsenic MCL, in areas within the Box. As the Focused Feasibility Study (FFS) Report (USEPA, 2010b) for the Upper Basin explains, given the pervasive subsurface contamination under communities, roadways and infrastructure in the Box (and elsewhere in the Upper Basin), it is expected to be very challenging to achieve the MCLs in the groundwater. The ROD Amendment that is currently under development will address water quality but may not achieve drinking water standards for all locations. As appropriate, USEPA will evaluate future monitoring data to determine whether a Technical Impracticability waiver may be warranted at locations where groundwater does not achieve drinking water standards.

4.2.4 Surface Water Quality

Surface water ARARs are applicable to tributaries of the SFCDR, the CTP effluent, and construction or human activities that may result in discharges to surface water. The SFCDR as it passes through the Box is included in OU 3 and is not discussed in this section. The

[2] 66 FR 7061; incorporated by reference into IDAPA 58.01.08.050.

Idaho site-specific aquatic life criteria for cadmium, lead, and zinc in the SFCDR subbasin (IDAPA 58.01.02.284) are the current surface water ARAR for OU 2. These criteria were revised by the State of Idaho in 2002 and approved by USEPA in 2003. These site-specific criteria are expected to provide the same level of protection intended by national USEPA recommendations. No USEPA-approved changes in these criteria occurred between 2005 and 2010.

Ambient water quality criteria (AWQC) referred to in this document are the site-specific water quality criteria. AWQC are quantified using location-specific hardness data. Metal concentrations that exceed the AWQC exceed the water quality criteria. The exceedance is commonly expressed as a ratio of the metal concentration to the calculated AWQC. For example, if the calculated AWQC is 1 mg/L and the dissolved zinc concentration is 10 mg/L, then the dissolved zinc AWQC ratio is 10. Table 4-3 presents the site-specific criteria for the SFCDR subbasin using a range of hardness values.

TABLE 4-3
Surface Water ARARs for Varying Hardness Values
2010 Five-Year Review, Bunker Hill Superfund Site

	Site-Specific Criteria (µg/L) South Fork Coeur d'Alene River Subbasin (HUC 17010302)[a]					
Metal	**Acute**			**Chronic**		
Hardness[b]	30	50	100	30	50	100
Cadmium	0.61	1.03	2.08	0.42	0.62	1.03
Lead	80	129	248	9.1	14.7	28.3
Zinc	88	123	195	88	123	195

[a] From IDAPA 58.0102.284.
[b] Hardness in milligrams of calcium carbonate per liter (mg $CaCO_3$/L).

HUC = Hydrologic Unit Code

IDAPA 58.01.02.260.02 was revised to grant a variance for meeting certain water quality standards for the SFCDR Sewer District's Page Pond Wastewater Treatment Plant (PPWTP). This variance includes ammonia, chlorine, cadmium, lead, and zinc discharged to the West Page Swamp. In 2006, USEPA and IDEQ agreed that the proposal to reroute the PPWTP effluent to the West Page Swamp would no longer be pursued. As a result, USEPA and IDEQ acknowledge that there is no longer a need to consider granting a variance to the PPWTP for discharge into the West Page Swamp.

The ARARs identified in the 1992 OU 2 ROD, 2001 OU 2 ROD Amendment, and the subsequent changes described above continue to be protective. Any potential standard revision will be evaluated by USEPA for their applicability to the site.

The effectiveness evaluation of the Phase I source control and removal activities indicated that the Phase I remedy does not meet the water quality improvement objectives of the 1992 OU 2 ROD. USEPA will evaluate the attainment of the site-specific aquatic life criteria as part of the Phase II remedy, which is being developed concurrently with this Five-Year

Review. A more detailed discussion of the Phase II activities is provided Section 2.7. Previously proposed modifications of the site-specific PPWTP are no longer being considered due to concerns related to National Pollutant Discharge Elimination System (NPDES) issues, introducing additional water into the West Page Swamp with tailings remaining in place, and the potential for expansion of the Page Repository.

4.2.5 Soil Excavation Goals

During implementation of Phase I of the Selected Remedy for OU 2, a chemical-specific soil excavation goal of 1,000 mg/kg lead was used for the OU 2 source removal actions, with the exception of areas within Government and Magnet Gulches (Section 4.3.4), the MOA (Section 4.3.8), and the removal action north of I-90 Smelterville Flats (Section 4.3.5). The 1,000-mg/kg lead excavation goal is based on human health risk levels and not ecological risk levels.

During implementation activities, clean replacement or capping soil contained arsenic concentrations less than 100 mg/kg, cadmium less than 5 mg/kg, and lead less than 100 mg/kg. Chemical-specific debris and processing waste cleanup levels were not specified; however, materials that could not be reprocessed or recycled were either stabilized or were contained onsite in specifically designed repositories. Institutional controls (ICs) were implemented onsite for areas where a barrier has been placed and/or lead concentrations exceed the residential community average of 350 mg/kg lead, with no property exceeding 1,000 mg/kg.

4.3 Review of Operable Unit Work and Remedial Actions

The OU 2 remedial actions and related components of the remedy are reviewed in this section. This review is organized as follows:

- Health and Safety Review
- Operation and Maintenance
- Hillsides
- Gulches
- Smelterville Flats
- Central Impoundment Area
- Page Pond Area
- Industrial Complex
- Mine Operations and Boulevard Areas
- Central Treatment Plant
- Bunker Creek
- Union Pacific Railroad Right-of-Way
- Milo Gulch
- A-4 Gypsum Pond
- South Fork Coeur d'Alene River Removal and Stabilization Project
- Miscellaneous Box Projects
- Institutional Controls Program
- Infrastructure

4.3.1 Health and Safety Review

Health and safety (H&S) is an important component of remedy implementation. Protection of the H&S of workers and the public is planned and managed during remedial activities. H&S plans are required for all construction work funded by USEPA and the State of Idaho and must comply with requirements of the Occupation Safety and Health Administration (OSHA) Hazardous Waste Site Regulations.[3] H&S plans are prepared by the contractor(s) hired to perform the work and then submitted to the agency overseeing the work effort. Contractors are responsible for H&S for their projects, including the work of their subcontractors. Components of a typical H&S plan may include:

- Site description and contaminant characterization;
- Safety and hazard assessment and risk analysis;
- Accident prevention;
- H&S training;
- Medical surveillance;
- Personal protective equipment;
- Monitoring, including air, noise, heat stress, and confined space;
- Safety and work practices;
- Site control measures;
- Personnel and equipment decontamination;
- Logs, reports, and recordkeeping;
- Emergency response plan and contingency procedures; and
- Spill containment plan.

Each contract employee is required to be familiar with the H&S plan and is required to have the necessary OSHA Hazardous Waste Operations and Emergency Response (HAZWOPER) 40-hour training and 8-hour annual refresher training. Daily tailgate meetings to plan the day and discuss activity-specific health and safety issues are held with work crews. A zero-incident goal will be pursued with active planning and management of remedial activities.

Between 2005 and 2010, limited field work took place in OU 2. Lost time was not tracked for the limited work in OU 2, but no obvious safety issues have been noted.

4.3.2 Operation and Maintenance

O&M measures are necessary to maintain the completed remedies at OU 2 locations to ensure continued protection of human health and the environment. By definition, O&M refers to those normal and ordinary activities conducted on a routine basis to ensure the continuing proper function of the remedy. USEPA remains responsible for the remedy until it is functioning as designed and has achieved and sustained the RAOs specified in the ROD.

Formal O&M activities commence once the remedy is determined to be operational and functional (O&F). The O&F determination is the milestone governing the transfer of O&M responsibility from USEPA to the State of Idaho. The State, represented by IDEQ, then assumes O&M responsibility from USEPA as agreed upon through the SSC.

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[3] 29 CFR 1910.129 and 29 CFR 1926.65.

The State and USEPA have developed remedial action specific O&M manuals for OU 2 as well as the Site-Wide (OU 2) O&M Implementation Plan (TerraGraphics, 2006a). Figure 4-3 shows these specific remedial action areas of OU 2.

Ownership of portions of the Borrow Area Landfill (BAL), gulches, hillsides, and SCA have been transferred to Galena Ridge, LLC. Under a 2007 purchase agreement, Galena Ridge, LLC and the State agreed that responsibility for performance of O&M tasks are generally transferred to new property owners and enforced through the ICP or the State O&M program when land transfer occurs. In some cases, the State may retain responsibility for performing O&M tasks for features that are unchanged by development.

O&M of the Phase I remedial actions conducted from 2005 to 2010 is provided in the site-specific sections (e.g., Bunker Creek, CIA, gulches).

4.3.2.1 Operation and Maintenance Manuals

This section presents the status of O&M manual development and the O&M requirements that have been identified in each of the O&M manuals for specific areas within OU 2. This section also discusses the various issues and actions to consider in management of O&M at the Bunker Hill Superfund Site. The O&M program must coordinate with cities, Shoshone County, and PHD to ensure that these entities comply with the remedies and to ensure that contaminated material management remains consistent with public health and ROD requirements. O&M manuals for specific areas are as follows:

- Smelterville Flats (*Smelterville Flats Operation and Maintenance Manual*, TerraGraphics, 2010e) – The Smelterville Flats O&M activities focus on remedial actions along the SFCDR west of Theatre Bridge through the Pinehurst Narrows and the tailings removal areas north of I-90. Smelterville Flats consists of 205 acres of land that harbors an ecologically diverse community of species and surrounds the Shoshone County Airport. This area contains five active monitoring wells. During remediation, a radius of about 10 feet of material was left intact around each monitoring well located within an excavation area. These monitoring wells are outside the O&M responsibilities for the Smelterville Flats region.

  Design features included removal of 1.2 million cubic yards (cy) of jig-tailings-contaminated alluvium and transferring it to the CIA. Also, construction of a floodway and protective dike occurred to protect the remainder of the flats from a 24-hour, 100-year storm event. All exposed tailings along the banks of the SFCDR were stabilized (protected by riprap and a granular filter to prevent material loss) and/or transferred to the CIA during remediation. Incorporation of aquatic habitat also occurred through the establishment of multiple ponds and wetlands on the re-graded floodplain. The entire re-graded area was capped with a minimum of 6 inches of native topsoil. Most of the wetland vegetation of the Smelterville Flats regenerated from soil seed banks or natural importation of wetland seed in floodwaters. Improvements along the SFCDR include river bank construction, sill installation, and spillway and wetland pond development. In addition, a drainage swale and stormwater pipe was installed south of I-90. Table 4-4 lists the RAOs and O&M requirements identified for Smelterville Flats.

Clean barriers within Smelterville Flats south of I-90 and the truck stop and RV Park north of I-90 are the responsibility of the property owners and is managed through the ICP.

- Central Impoundment Area (*Central Impoundment Area Final Operation and Maintenance Manual*, TerraGraphics, 2009d) – The CIA encompasses approximately 225 acres west of Kellogg, south of I-90 and north of McKinley Avenue. The slag pile area, located west of the CIA Landfill, is not included with the CIA for O&M purposes and is expected to be covered under a separate manual upon redevelopment of the area. The CIA originally served as a tailings impoundment for the Bunker Hill Mine and eventually was used as a waste consolidation area during remediation of other areas. The majority of the area is now covered with a geomembrane cover and vegetated growth media. A sludge pond approximately 5.5 acres in size continues to receive sludge from the CTP. Plans for long-term sludge disposal from the CTP involve development of a new lined pond directly east of the current pond. Remedial action features requiring action under the State of Idaho O&M Plan include a geomembrane cover system, 12-inch soil barriers, rock slopes, drainage ditches, drain cleanouts, culverts, fencing, and access roads. Table 4-5 lists the RAOs and O&M requirements identified for the CIA.

- Smelter Closure Area (*Smelter Closure Area Final Operation and Maintenance Manual*, TerraGraphics, 2008s) – The SCA is located on the south side of McKinley Avenue to the west of Government Gulch. The SCA Landfill consists of a 30-acre geomembrane cover placed over demolition debris and contaminated soil that was placed within the old Smelter Plant footprint. Granulated slag and contaminated soil from removal actions in other areas of the site were "infilled" with the demolition debris to minimize void spaces and to provide a surface cushion for the overlying geomembrane. Double-bagged asbestos-containing material (ACM) was placed in the southwest corner of the landfill. The area is unlined with the exception of a 3-acre area referred to as the Principal Threat Material (PTM) Cell. The geomembrane-lined PTM Cell was constructed on the west side of the SCA to provide additional containment for the more highly contaminated materials onsite. Other areas outside the geomembrane footprint have been capped with a 6-inch soil barrier. Remedial actions requiring specific action under the State O&M program include berms, culverts, soil barriers, a geomembrane landfill cover system, a seepage collection system, drainage ditches, fencing, and access roads. Table 4-6 lists the RAOs and O&M requirements identified for the SCA.

- Borrow Area Landfill (*Operations and Maintenance Manual Borrow Area Landfill, Bunker Hill Superfund Site*, CH2M HILL, 2007c) – The Borrow Area Landfill (BAL) has been bought by Galena Ridge, LLC, and the land use has changed. The BAL is a 16.5-acre site located about one-half-mile southeast of Smelterville on a gentle ridge between Government Gulch and Magnet Gulch. The ground sloped between 10 and 15 percent prior to development by Galena Ridge, LLC in 2007. A runoff collection ditch and access road separate the BAL from the SCA to the northeast. Sedimentation ponds are located at the northern, downslope end of the BAL. The western edge of the BAL is bounded by a steep slope (35 to 55 percent) that extends downward to Government Gulch. Currently, undeveloped slopes ranging between 10 and 20 percent are south of, or upgradient from, the BAL.

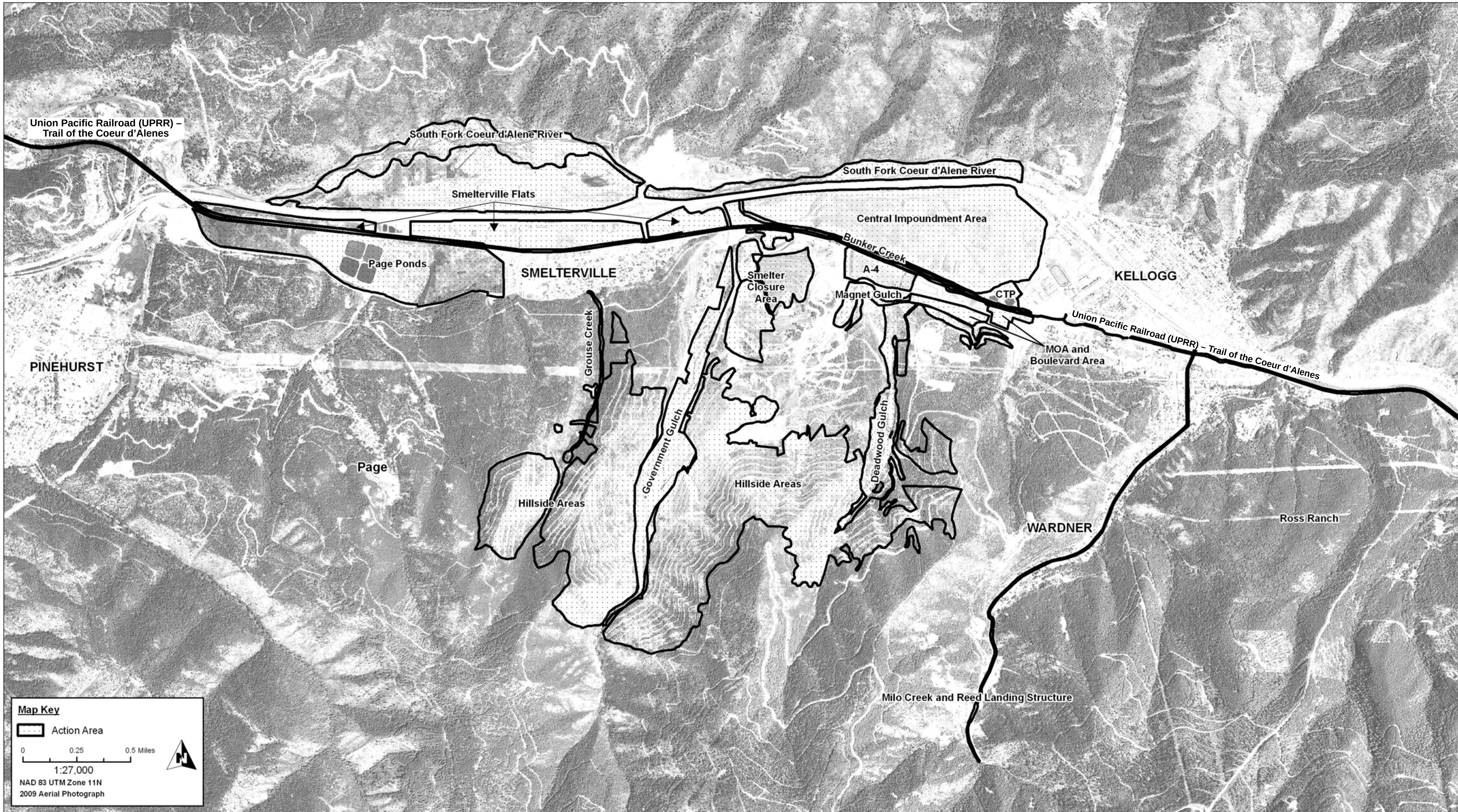


Figure 4-3
OU 2 Remedial Action Areas
2010 Five-Year Review
BUNKER HILL SUPERFUND SITE

382081.FI.06.01.03_BunkerHill_ES042009003SEA . 4-3 OU 2 Remedial Action Areas.ai dk

EPA

TABLE 4-4
O&M Requirements for Smelterville Flats
2010 Five-Year Review, Bunker Hill Superfund Site

Remedial Action Objective	O&M Requirements
1. Minimize risk of direct contact	1 Areas with surface soil and/or rock barriers are intact and show no rill or gully erosion, digging, displacement, or other disturbance.
2. Minimize surface water erosion, sedimentation, and wind dispersion of contaminants	2a. Plant cover of uplands and wetlands is 50 percent or higher throughout the flats with no eroding bare spots. Bare spots are allowed in wetland areas as long soils in these areas are saturated at the time of inspection. 2b. Floodway features show no signs of digging, displacement, or other disturbance. 2c. Keyways to and from detention/retention ponds are not blocked by vegetation, large woody debris, or other materials. 2d. Riprap armoring along lower bank toe remains intact and shows no signs of digging, displacement, or other disturbance. 2e. SFCDR embankments slopes have 75 percent plant cover or higher with no eroding bare spots. Embankments remain stable without extensive evidence of scouring by SFCDR flows. Embankments show no significant signs of digging, displacement, or other disturbance.

Source: *Smelterville Flats Draft Operation and Maintenance Manual* (TerraGraphics, 2007b).

TABLE 4-5
O&M Requirements for Central Impoundment Area
2010 Five-Year Review, Bunker Hill Superfund Site

Remedial Action Objective	O&M Requirements
1. Minimize risk of direct contact	1a. Maintain institutional controls (fence) around capped area. 1b. Enforce vehicle restrictions to prevent damage to the geomembrane 1c. Maintain components of cover system designed to keep geomembrane in place (ditches clear with protective grass, matting, or rock in place; erosion minimized, differential settlement of cap limited to 6 inches over a distance of 20 feet).
2. Minimize infiltration through contaminated media	2a. No closed depressions that could pond water over the cap. 2b. Cover system components in place. 2c. Vegetative cover limited to grass and forbs. The roots of trees and large shrubs may damage the geomembrane and, if allowed to grow, would have a high risk of overturning during high winds, which could expose or puncture the geomembrane.
3. Control erosion	3a. Limit rills or gullies to 6 inch maximum depth at any location and 4-inch maximum depth over more that 10 percent of the surface area. 3b. Maintain healthy plant stands, with a minimum cover of approximately 50 percent. Limit expansion of bare areas.

Source: Central Impoundment Area Final Operation and Maintenance Manual (TerraGraphics, 2009k).

TABLE 4-6
O&M Requirements for Smelter Closure Area
2010 Five-Year Review, Bunker Hill Superfund Site

Remedial Action Objective	O&M Requirements
1. Minimize risk of direct contact	1a. Maintain institutional controls (fence) around capped area 1b. Maintain components of cover system designed to keep geomembrane in place (gas vents unobstructed and in original position, ditches clear, erosion minimized, differential settlement of cap limited to 6 inches)
2. Minimize infiltration through the consolidated waste materials and migration to groundwater	2a. No closed depressions that could pond water over the cap 2b. No ponded water upgradient of the cap that could contribute to lateral groundwater flow through the capped wastes. 2c. Cover system components in place. 2d. Vegetative cover limited to grass and forbs. The roots of trees and large shrubs may damage the geomembrane and, if allowed to grow, would have a high risk of overturning during high winds, which could expose or puncture the geomembrane.
3. Minimize erosion	3a. Limit rills or gullies to 6 inches maximum depth. 3b. Maintain healthy plant stands, with a minimum cover between 25 and 50 percent and no bare spots greater than 5 feet in diameter. 3c. Maintain sediment-free and debris-free, armored, surface water run-on and runoff conveyance system.
4. Minimize risk of direct contact with PTM materials and reduce potential for their migration to groundwater	Maintain integrity of cap as listed above. Minimize infiltration as listed above. Maintain integrity of seepage collection system as listed below.
5. Reduce contamination of surface water and groundwater	Seepage collection system should be free from leaks and damage.

Source: *Central Impoundment Area Final Operation and Maintenance Manual* (TerraGraphics, 2009k).

The BAL site was originally developed as a borrow source for cover materials for other remedial actions within the Bunker Hill site. The original run-on collection ditches and sediment ponds were constructed as part of the borrow area development. Because the surface soils were too contaminated for use as capping soils and the deeper, noncontaminated soils contained too much gravel and larger sized material to make them valuable as capping material, the borrow area was converted to a landfill for wastes from other Bunker Hill remedial activities in 2000.

Between 2000 and 2002, the BAL received approximately 160,000 cy of remediation waste from OUs 1 and 2 and 30,000 cy from the relocation of the Upper Industrial Landfill, as documented in the *Closure Report for Bunker Hill Superfund Site Borrow Area Landfill* (Bay West, 2002). In summer 2002, a cover composed of soil, with an additional geosynthetic clay liner (GCL) beneath the soil in the ditches, was constructed over the wastes to close the BAL (CH2M HILL, 2002; Bay West, 2002). The soil was fertilized, seeded with a local grass mix, and mulched.

The BAL is part of the development by Galena Ridge, LLC. Although specific features and maintenance activities have changed with this development, the general requirements for maintaining the integrity of the remedy remain the same.

- Government Gulch (*Government Gulch Operation and Maintenance Manual*, TerraGraphics, 2010d) – Government Gulch is located east of Smelterville. The State O&M manual focuses on remedial actions and features in Government Gulch excluding the hillsides. Remedial actions implemented on the hillsides in Government Gulch are addressed in *The Hillsides Operations and Maintenance Manual* (TerraGraphics, 2009f). The Government Creek channel is over 8,000 feet in length and drops approximately 440 feet in elevation from 2,670 feet to 2,230 feet. Flow is northerly and discharge is to the SFCDR. Remedial actions requiring specific action under the State O&M program include the reconstructed stream channel, 6-inch soil barriers, culverts, gravel road, sediment basins, grade control structures, fencing, building foundations, and a gabion dam. Table 4-7 lists the RAOs and O&M requirements identified for Government Gulch.

TABLE 4-7
O&M Requirements for Government Gulch
2010 Five-Year Review, Bunker Hill Superfund Site

Remedial Action Objective	O&M Requirements
1. Minimize risk of direct contact	1a. Capped material is not eroding (i.e., tailings or visibility stained material are not exposed.
2. Minimize erosion	2a. Culverts, energy dissipaters, and channels or ponds immediately upstream are clear of debris. 2b. Culverts are free from sediment depth greater than 4 inches in any location. 2c. Filter layer of geotextile or riprap bedding is completely covered. 2d. Non-eroding vegetation in floodplain. 2e. No debris in old concrete channel and no actively-eroding areas around it.[a] 2f. No active channel down-cutting. 2g. Channel can be allowed to meander, but cannot be allowed to undermine adjacent slopes, especially near former Zinc Plant area.
3. Reduce suspended sediment and/or contaminant loading in surface runoff to the SFCDR	3a. Gabion dam provides at least 5 feet of freeboard above sediment level or the equivalent of five seasons of sediment buildup as determined by annual monitoring. 3b. Maintain at least 2 feet of freeboard in sediment basins.
4. Reduce contamination of surface water and ground water	4a. Surface water and ground water monitoring to determine the effectiveness of the remedy is ongoing and not part of the Government Gulch O&M. Construction of additional features such as cutoff walls and groundwater collection and conveyance to the CTP for treatment, could be recommended as an outcome of the monitoring, but would be part of the Phase II remedial activities for the site.

[a] Repair active erosion where the road appears to be in danger of being eroded. Remove loose debris and cut out large trees and brush

Source: *Government Gulch Final Operation and Maintenance Manual* (TerraGraphics, 20010c).

- Deadwood, Magnet, and Railroad Gulches and Boulevard Area (*The Gulches – Including Deadwood Gulch, Magnet Gulch, and Railroad Gulch/Boulevard Area – Operation and Maintenance Manual*, TerraGraphics, 2010f) – A combined O&M manual has been developed to cover O&M requirements for Deadwood Gulch, Magnet Gulch, Railroad Gulch, and the Boulevard Area. These areas were combined because the types of remedial actions conducted in these areas are similar and the long-term performance standards for each area are the same. Remedial actions for these areas include stream channel stabilization, check dams, gabion dams, sediment basins, culverts, and 6-inch soil barriers. Table 4-8 lists the RAOs and O&M requirements identified for these gulches.

TABLE 4-8
O&M Requirements for Deadwood Gulch, Magnet Gulch, and Railroad Gulch/Boulevard Area
2010 Five-Year Review, Bunker Hill Superfund Site

Remedial Action Objective	O&M Requirements
1. Minimize risk of direct contact	1a. Capped material is not eroding (i.e., tailings or visibly stained material are not exposed).
2. Minimize erosion	2a. Culverts, energy dissipaters, and channels or ponds immediately upstream are clear of debris. 2b. Culverts are free from sediment depth greater than 4 inches in any location. 2c. Filter layer of geotextile or riprap bedding completely covered. 2d. Non-eroding vegetation in floodplain. 2e. No active channel down cutting. 2f. Channel can be allowed to meander, but cannot be allowed to undermine riprap aprons, roadways, utilities, or culverts. 2g. Stream flow should not be diverted out of the existing floodway due to sedimentation.
3. Reduce suspended sediment contaminant loading in surface runoff to the SFCDR	3a. Gabion dams provides at least 5 feet of freeboard above sediment level or the equivalent of five seasons of sediment buildup as determined by annual monitoring. When sediment build-up has ceased or significantly slowed, the dams may be removed. Future development is anticipated upslope of this area, which may temporarily increase sediment build-up behind the dams. Until the development is complete and disturbed areas have stabilized, the gabion dams should remain. 3b. Maintain at least 2 feet of freeboard in sediment basins.

Source: *The Gulches—Including Deadwood Gulch, Magnet Gulch, and Railroad Gulch/Boulevard Area—Draft Operation and Maintenance Manual* (TerraGraphics, 2009e).

- Bunker Creek (Bunker Creek Operation and Maintenance Manual, TerraGraphics, 2010c) – Bunker Creek is located at the southern toe of the CIA and north of the Trail of the Coeur d'Alenes bike trail. The creek extends approximately 7,600 feet from east of the CTP to its discharge into the SFCDR via a culvert system beneath I-90. The combined flow of Bunker Creek is primarily made up of discharges from the CTP effluent, drainage from the Smelter Closure and Borrow Areas, and surface water flows from Portal Gulch, Railroad Gulch, the Boulevard Area, Deadwood Gulch, Magnet Gulch, and two CIA outfalls. Remedial actions requiring specific action under the State O&M program include the Bunker Creek stream channel, culverts, 6-inch soil barrier, and mine water line supports. Table 4-9 lists the RAOs and O&M requirements identified for Bunker Creek.

TABLE 4-9
O&M Requirements for Bunker Creek
2010 Five-Year Review, Bunker Superfund Site

Remedial Action Objective	O&M Requirements
1. Minimize risk of direct contact	1a. Capping, rock, riprap, and clean cover soil are in place. 1b. Fencing remains functional until contaminated sediments are removed from channel.
2. Minimize contaminant release water (by minimizing erosion of potentially contaminated soils	2a. Channel and culverts are clear of debris, including beaver dams. 2b. Culvert pipe deflection <5 percent of pipe diameter, bolted connections are tight, pipe is visibly sound. 2c. Culverts are free from sediment depth greater than 4 inches in any location. 2d. Granular filter layer in low flow channel is completely covered. 2e. Non-eroding vegetation in floodplain. 2f. Pipes, pipe marking tape, or pipe bedding is not exposed. 2g. No active erosion around pipe supports. 2h. No active erosion or rilling of ICP cap, roadway surfacing, channel, rock, or riprap.
3. Minimize infiltration through contaminated material	3a. Maintain positive drainage. 3b. ICP barrier is in place.

Source: *Bunker Creek Draft Operation and Maintenance Manual* (TerraGraphics, 2008c).

- Hillsides around the former Industrial Complex (*The Hillsides Operation and Maintenance Manual*), TerraGraphics, 2010g) – The hillsides remedial action area of OU 2 covers an approximately 1,100-acre area that blankets portions of five watersheds south of I-90 near the cities of Smelterville and Kellogg. The area experienced a wide-scale loss of vegetative cover as a result of logging for mine timbers, fire, deposition of heavy metals from nearby smelters, and other effects. Because of these activities, plant cover was essentially lost across wide areas on the hills and soil erosion was significant when remediation efforts began. Remediation efforts focused on re-establishing vegetation cover and providing erosion and sediment controls to minimize transport of contaminated sediment. Remedial actions requiring specific action under the State O&M program include terraces, check dams, and vegetation cover.

  The O&M requirements for the hillsides focus on erosion and sediment control. Check dam maintenance activities include sediment removal and inspecting the structural condition of the dams. Extensive vegetation monitoring was conducted as part of the hillsides re-vegetation effort that that was completed in 2006. Many of the O&M activities for the vegetation monitoring program remain relevant for long-term activities on the hillsides. O&M activities and extensive background information on the hillsides program are described in the *Hillsides Revegetation Project Operations and Maintenance Manual* (CH2M HILL, 2005). Vegetation cover is inspected semi-annually under the State O&M program in order to identify areas of active erosion that may need repair. The long-term O&M requirements expected under the State O&M program are described in

The Hillsides Operation and Maintenance Manual (TerraGraphics, 2010g). Galena Ridge, LLC bought nearly 600 acres of these hillside areas for a master-planned community with a golf course, and development began in 2007. Table 4-10 lists the RAOs and O&M requirements identified for the hillsides.

TABLE 4-10
O&M Requirements for Hillsides
2010 Five-Year Review, Bunker Hill Superfund Site

Remedial Action Objective	O&M Requirements
1. Minimize erosion	1a. Plant canopy cover shall exceed 50 percent within the project area except in those areas with low potential for erosion (i.e. rocky areas). 1b. Plant cover in major gully bottoms shall exceed 70 percent. 1c. Terraces remain stable with no active down-cutting or breaching.
2. Reduce suspended sediment/contaminant loading in surface runoff to the SFCDR	2a. No sediment discharge from check dams. 2b. No short-circuiting or down-cutting of check dams.

Source: *The Hillsides Draft Operation and Maintenance Manual* (TerraGraphics, 2009a).

- Slag Pile Area – By agreement, an O&M manual will be developed by IDEQ once future development occurs and O&M is defined.
- Grouse Gulch – State O&M responsibilities in Grouse Gulch are limited to upper hillsides areas and are included in the Hillsides O&M Manual (TerraGraphics, 2010g) and those remedial actions conducted by PRPs no longer in existence. These PRP remedial actions are addressed in the Draft Site-Wide (OU 2) O&M Implementation Plan (TerraGraphics, 2006a).
- A-4 Gypsum Pond (*Bunker Hill Superfund Site, Gypsum Pond A-4 Closure, Final Operations and Maintenance Plan*, McCulley, Frick, and Gilman [MFG], 2004) – The O&M manual was prepared by the PRP and approved by IDEQ in 2004.
- Milo Creek Conveyance (*Milo Creek Permanent Improvement Project Operations and Maintenance Manual*, TerraGraphics, 2000) – The Milo Watershed District is funded by annual assessments on properties within the Milo Creek Watershed District specifically to perform O&M duties relative to the Milo Creek Conveyance. Federal CERCLA funding was not used to construct the Milo Conveyance and is discussed here for completeness only. O&M of the Milo Creek Conveyance is not part of the State O&M program.
- Reed Landing Structures (*Reed Landing Flood Control Project Operations and Maintenance Manual*, U.S. Army Corps of Engineers [USACE], 2000). O&M responsibility for the Reed Landing Structures is currently retained by USEPA until performance of the Reed Landing Structures is determined by USEPA and IDEQ to be operational and functional. Flow of AMD into the Reed Landing Structures and potential impacts on the structures is the remaining issue to be resolved prior to a determination of O&F.

- UPRR (*UPRR Corridor Post-Closure Operations and Maintenance Plan,* MFG, 2001) – O&M activities for the Box UPRR ROW have been conducted since early spring 2002 as agreed upon following certification of the Box UPRR ROW in 2001 and acceptance of the *UPRR Corridor Post-Closure Operations and Maintenance Plan*. UPRR has been conducting monthly and semi-annual inspections of the ROW and doing necessary repairs to the barriers. Repairs have been made based on the findings during these inspections required in the plan. Repairs have included:

  - Replacement of clean barrier material displaced during flooding events;
  - Removing debris blocking culverts;
  - Installation of fencing and other obstacles to restrict access of motor vehicles causing barrier erosion; and
  - Repair of asphalt damaged by falling rock and tree root growth.

  UPRR has been checking the barrier elevations at pre-established transects along the ROW to determine whether any loss has occurred on an annual basis. This and other repair work has been reported in the following UPRR documents:

  - *Bunker Hill Superfund Site 2004 Annual Status Report for the Union Pacific Area Operations and Maintenance Program* (MFG, 2005).
  - *Bunker Hill Superfund Site 2005 Annual Status Report for the Union Pacific Area Operations and Maintenance Program* (MFG, 2006).
  - *Bunker Hill Superfund Site 2006 Annual Status Report for the Union Pacific Area Operations and Maintenance Program* (MFG, 2007).
  - *Bunker Hill Superfund Site 2007 Annual Status Report for the Union Pacific Area Operations and Maintenance Program* (MFG, 2008).
  - *Bunker Hill Superfund Site 2008 Annual Status Report for the Union Pacific Area Operations and Maintenance Program* (MFG, 2009).
  - *2009 Annual Status Report for the Union Pacific Area of The Bunker Hill Superfund Site Operations and Maintenance Program* (LFR, 2010).

  Over the last 5 years, utility work and new road construction have also disturbed the gravel barriers on the UPRR ROW. This work was overseen by the ICP.

  The Idaho Department of Parks and Recreation (IDPR) manages the trail within the Box boundary and conducts O&M activities under the oversight of the ICP. IDPR assumed some of the management responsibilities in 2002 following the construction of the asphalt trail.

4.3.2.2 Land Transfer

O&M activities are affected by land transfer because changes in property ownership may involve a change in remedy configuration and the entity responsible for performing O&M tasks. Figure 4-4 shows current land ownership for the remedial action areas of OU 2. Land transfer of OU 2 remedial action areas consists of transfers from federal to state ownership, as well as state to private. As depicted in Figure 4-4, the majority of the hillsides and gulches areas of OU 2 are now privately owned. Under the 2007 purchase agreement, Galena Ridge, LLC and the State agreed that responsibility for performance of O&M tasks are generally transferred to new property owners and enforced through the ICP or the State O&M program when land transfer occurs. In some cases, the State may retain responsibility for performing O&M tasks for features that are unchanged by development.

The largest land transfer activity affecting land use in OU 2 has been the transfer of approximately 600 acres of hillsides south of McKinley Avenue between Kellogg and Smelterville to Galena Ridge, LLC, for development of a golf course and a new residential subdivision.

Although the goals and objectives used in the design of the remedial action areas should not change over time or with land use, the performance standards and design features may change when development occurs. The performance standards and design features are identified for each area in the site-specific O&M manuals. Regrading, paving, and addition of new structures will change the characteristics of runoff and infiltration. Such changes will generally be controlled within the guidelines of the ICP, but the site-wide O&M Implementation Plan states that development plans are to be reviewed by the State of Idaho and evaluated by a qualified State-licensed engineer in order to:

- Verify that the changes preserve the goals and objectives of the original remedial action;
- Verify that the changes are at least as protective as the original remedial actions listed in each manual; and
- Specify requirements for follow-up inspection and maintenance (identify specific design elements and attributes, assign new action triggers, and suggest actions to maintain the changes).

4.3.2.3 Operation and Maintenance Responsibilities

O&M activities within the Site are unique because of the large volume of contaminated material being managed in place as part of the selected remedial actions. Until each remedy is determined to be operational and functional, the State of Idaho and USEPA perform a lead role in maintaining remedy features installed under CERCLA action. After a remedy is determined to be operational and functional, the State of Idaho is responsible for ensuring that appropriate O&M occurs for CERCLA installed remedies. In addition, the in-place management of contaminants requires continued maintenance of barriers community-wide in order for the Selected Remedy to remain intact. Thus, O&M responsibilities are held community-wide to varying extents by USEPA, IDEQ, city and county governments, utility districts, and individual property owners. The Site Manager for the State O&M program is expected to be responsible for coordinating the effects of O&M activities with the cities, county, and private entities.

4.3.2.4 Operation and Maintenance Inspections

Beginning September 2009, the State of Idaho has conducted inspections semi-annually following the same procedures that are anticipated now that formal O&M responsibility has been transferred from USEPA. Results of these O&M inspections are summarized in each remediation-specific section.

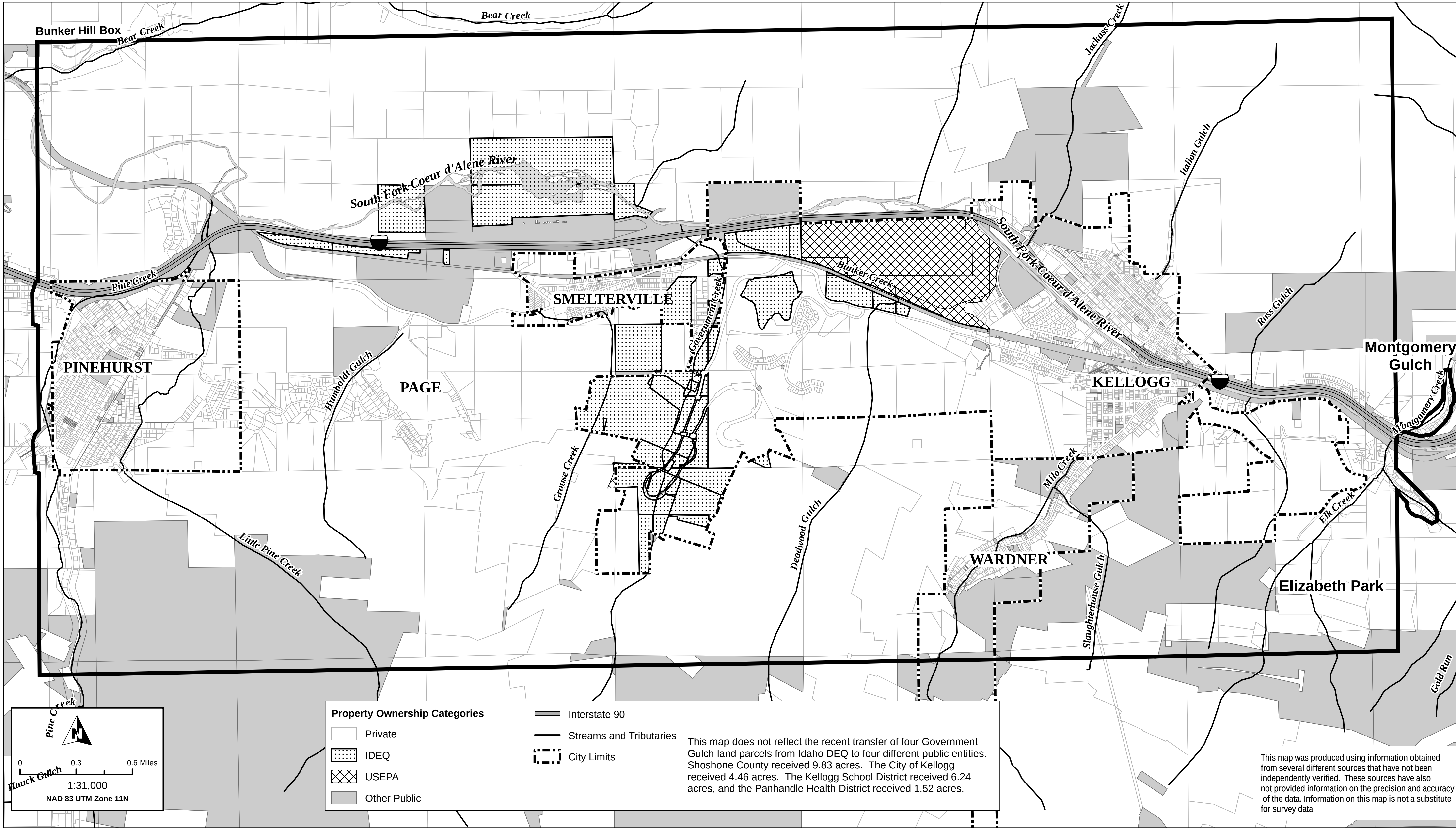


Figure 4-4
OU 2 Land Ownership
2010 Five-Year Review
BUNKER HILL SUPERFUND SITE

4.3.2.5 Technical Assessment

In 1999, IDEQ and USEPA began planning for the transfer of OU 2 O&M responsibilities from the federal government to the State of Idaho for those portions of the Site that were cleaned up under the government-implemented program. In a joint effort by IDEQ and USEPA, O&M manuals have been drafted for each of the CERCLA-funded remedial action areas. The PRPs are responsible for preparing O&M plans and manuals and conducting long-term O&M for remedial actions they completed. Certain PRPs no longer exist and therefore no longer maintain, or ensure maintenance of, remedial actions these PRPs installed. These remedial actions are addressed in the Site-Wide (OU 2) O&M Implementation Plan (TerraGraphics, 2006) to ensure maintenance continues as appropriate.

In accordance with USEPA guidance (USEPA, 2001d), technical assessment was conducted by evaluating the following three questions related to protectiveness of the implemented O&M actions.

Question A: Is the remedy functioning as intended by the decision documents?

O&M responsibilities have recently been transferred to the State of Idaho. Informal inspections conducted by the State of Idaho indicate that the remedies recently transferred to the State O&M program are functioning as intended.

Question B: 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 for each of the O&M areas remain valid. Land use changes have occurred in many of the OU 2 areas. These changes have resulted in increased human activity in hillsides and gulches as well as installation of additional clean barriers since the remedial actions were implemented. Changes in ownership and land use are expected, and continued maintenance of barriers remains important to protecting human health and the environment. Coordination between the State O&M program, ICP, local governments and utility districts, and property owners is critical to ensuring that sufficient O&M occurs to preserve the remedy.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

Potential problems may arise relative to coordinating efforts between multiple entities responsible for O&M of different features. O&M responsibilities will become more burdensome and complex as additional remedial activities are completed and the number of parties involved in performing O&M tasks increase. Proper oversight, coordination, and accountability will be critical to long-term success of O&M and protection of human health and the environment.

Remedy Issues

A summary of issues identified with respect to O&M of the Phase I remedy is provided in Table 4-11.

Recommendations

A summary of recommendations and follow-up actions for O&M is provided in Table 4-12.

TABLE 4-11
Summary of O&M Remedy Issues
2010 Five-Year Review, Bunker Hill Superfund Site

Remedy Issues	Affects Protectiveness (Y/N)	
	Current (now to 1 year)	Future (>1 year)
O&M Needs: Funding and coordination between the State of Idaho O&M program, ICP, local governments and utility districts, and property owners is critical to ensuring that sufficient O&M occurs to preserve the remedy.	N	Y

TABLE 4-12
Summary of O&M Recommendations and Follow-Up Actions
2010 Five-Year Review, Bunker Hill Superfund Site

Recommendations/Follow-up Actions	Responsible Entity	Oversight Agency	Proposed Milestone Date	Follow-up Actions: Affects Protectiveness (Y/N)	
				Current (now to 1 year)	Future (>1 year)
O&M Needs: The 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 implementation of O&M.	IDEQ, USEPA	IDEQ, USEPA	12/2011	N	Y

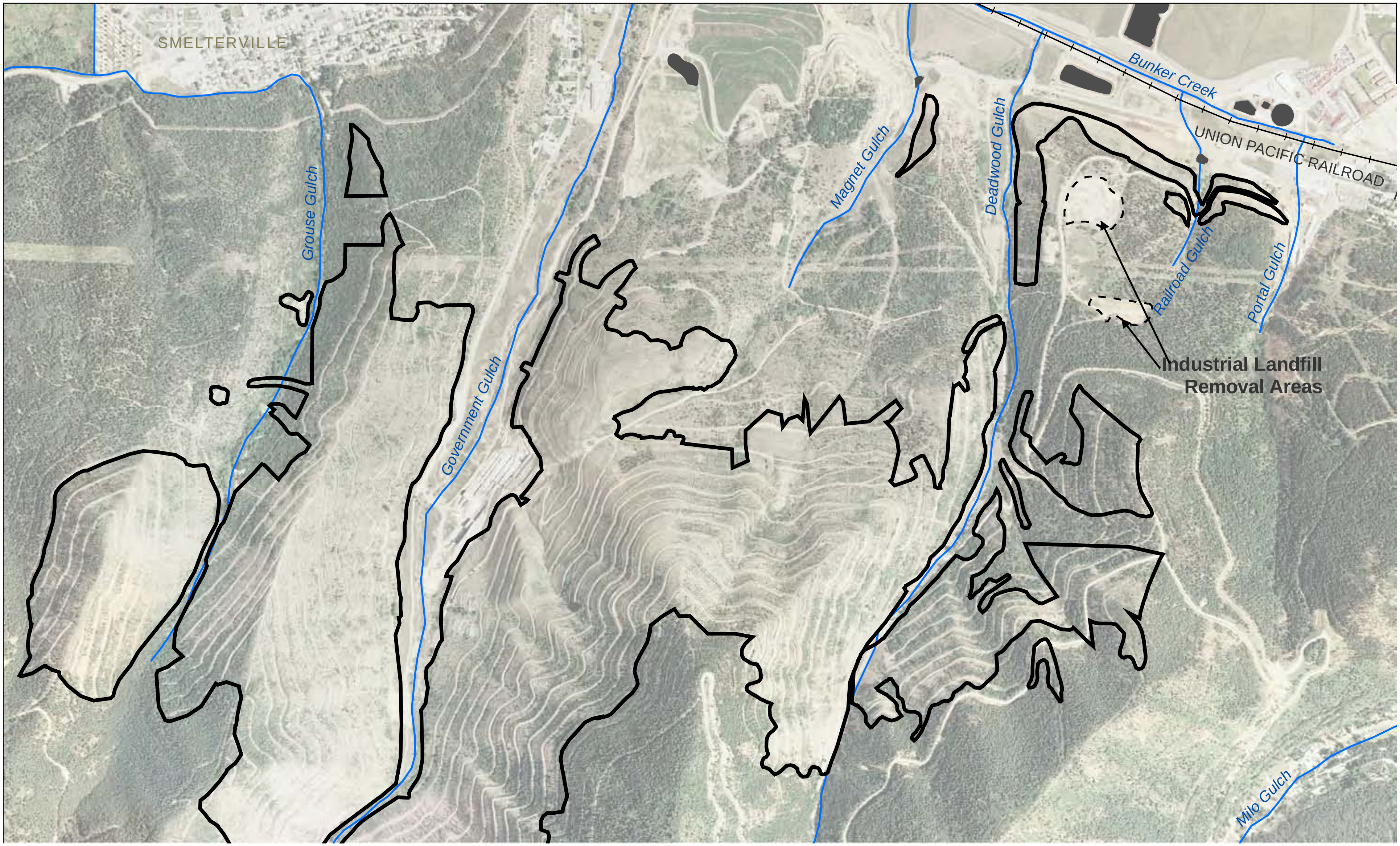
4.3.3 Hillsides

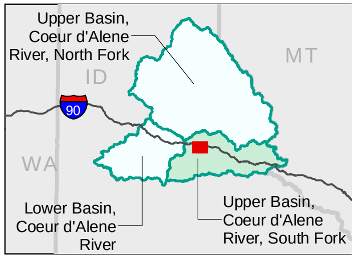
The hillsides include the steep portions of OU 2 that slope upward from the floor of the SFCDR valley and from the gulches (Figure 4-5). This section discusses the hillsides remedial actions and the removal actions required for the two industrial landfills located between Deadwood and Railroad Gulches. “Gulches” or “gulch areas”, as used in the 1992 OU 2 ROD and this Five-Year Review Report, include the flat portions of the gulches exclusive of the hillsides and are addressed in Section 4.3.4).

4.3.3.1 Review of ROD, ROD Amendment, and ESD Requirements

In the 1992 OU 2 ROD, the remedial action for the hillsides was based on the 1990 Administrative Order on Consent (AOC) with Gulf Resources and the Hecla Mining Company for Revegetation and Stabilization.[4] The major requirements of the 1992 OU 2

[4] Administrative Order on Consent; Bunker Hill Superfund Site: Hillsides Revegetation/Stabilization Removal Order; United States Environmental Protection Agency v. Gulf Resources & Chemical Corporation and Hecla Mining Company; EPA Docket No. 1090-10-01-06; October 1, 1990.





Union Pacific Railroad (UPRR) (now Trail of the Coeur d'Alenes)

River/Creek

Hillsides Revegetated Area

Industrial Landfill Removal Area

N

0 375 750 1,500 Feet

Figure 4-5
OU 2 Hillsides Site Map
2010 Five-Year Review
BUNKER HILL SUPERFUND SITE

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EPA

ROD are shown in Table 4-13. The remedial action is to focus on the approximately 3,200 acres of hillsides identified in the AOC work plan. These areas were selected as the areas that were severely eroded, having less than 50 percent vegetative cover. This is based on the RI (Dames & Moore, 1990), which evaluated about 12,000 acres of the hillsides.

TABLE 4-13
Hillsides Remedial Actions Required
2010 Five-Year Review, Bunker Hill Superfund Site

Requirement	Remedial Action Objective/Goal
1992 OU 2 ROD	
Contouring, terracing and revegetation of areas with <50 percent cover (Section 9.2.1)	Reduce erosion and increase infiltration
Spot revegetation of areas with >50 percent cover within areas that are >50 percent cover class and have high potential for contaminant transport (Section 9.2.1)	Control erosion and increase infiltration
Surface armor or soil cover on selected mine waste rock dumps (Section 9.2.1)	Control direct contact or erosion hazard
Enforce existing controls on access (Section 9.2.1)	Human contact
Maintain existing fencing (Section 9.2.1)	Human contact
Solid waste from the industrial landfills located on the east side of Deadwood Gulch will be capped with a low permeability Soil cover. Disturbed areas will be revegetated or receive other appropriate permanent barrier. (Section 9.2.5)	To reduce surface infiltration through potential source materials; to reduce potential groundwater loadings from these sources
1998 OU 2 ESD	
Solid waste from the industrial landfills located on the east side of Deadwood Gulch may be excavated and disposed at either the Smelter or CIA Closure areas. Contour and revegetate disturbed areas.	Reduce surface infiltration through potential source materials; to reduce potential groundwater loadings from these sources

Severely eroded areas within the area that had more than 50 percent vegetative cover are also to be revegetated. The 1992 OU 2 ROD also called for monitoring the performance of vegetation and maintaining erosion control structures until revegetation efforts are proven successful.

Project goals identified the desired end point for land management. The 1990 AOC called for areas having less than 50 percent cover to be revegetated, as well as for the implementation of a number of slope stabilization and erosion control measures. The 1992 OU 2 ROD also discussed a USEPA-approved PRP work plan that sought 85 percent ground cover by plants within 8 to 12 years. It emphasized the establishment of 100-foot-wide riparian corridors. However, the 1992 OU 2 ROD did not identify which stream systems were to receive this treatment, nor did it state that all streams must receive treatment. The 1992 OU 2 ROD set expectations for revegetation efforts to occur in areas where there is a high potential for contaminant transport and to develop new access where it is environmentally acceptable.

The hillsides remedial action includes extensive efforts to contain or manage contaminants posing an environmental threat; however, residual contamination remains. The OU 2 FS (MFG, 1992a) and the 1992 OU 2 ROD noted that certain areas of OU 2, and in particular the hillsides adjacent to the Smelter Complex, may have a potential to affect sensitive species of plants and animals after implementation of remedial actions as a result of contamination left in place. The 1992 OU 2 ROD did not establish specific soil cleanup goals (ARARs) to evaluate risk to environmental receptors. However, the ecological risk assessment (SAIC, 1991) developed soil toxicity reference concentrations that are intended to serve as an indicator of potential impact.

Although residual contamination may pose a threat to environmental receptors at the site, the FS and 1992 OU 2 ROD determined that remediation of all hillside areas to levels below soil toxicity reference contamination was infeasible. Habitat establishment was, however, determined to be both feasible and desirable and is a component of all alternatives presented in the FS. The 1992 OU 2 ROD further states that as habitat is established, and environmental receptors are exposed to residual soil contamination, monitoring will be conducted to evaluate actual impacts on resident populations. Section 4.4.2, Biological Resource Monitoring, summarizes the biological monitoring program being conducted within OU 2.

4.3.3.2 Background and Description of Remedial Actions

The hillsides within the Bunker Hill Superfund Site have been affected by 100 years of mining and metals-refining related activities. These activities include 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 series of consensus-based workshops (two in 1998 and one in 1999) were convened by USEPA to refine the purpose, goals, objectives, and interim performance standards (IPSs) of hillsides remedial actions to address the general guidance provided in the 1992 OU 2 ROD. The guidance statements generated by these workshops and the monitoring plan developed from the guidance statements are discussed in the *Bunker Hill Hillsides Revegetation Conceptual Plan and Monitoring Plan* (CH2M HILL, 1999). These guidance statements formed the basis for long-term monitoring of hillside revegetation performance, which provides the data for adaptive management. IPSs were used for monitoring hillside performance because of the significant uncertainty about the specific relationships between plant cover on hillside soils and various watershed functions. As the hillsides were revegetated, monitoring data were expected to clarify these relationships. Final performance standards (PSs) were subsequently developed as site remediation activities matured and the environment of the hillsides stabilized. These PSs were included in the *Hillsides Revegetation Project Operations and Maintenance Manual* (CH2M HILL, 2005). The O&M manual is currently undergoing revision by IDEQ to ensure consistency with other OU 2 RA O&M manuals.

Table 4-14 describes the various remediation activities conducted at the Bunker Hill hillsides.

TABLE 4-14
Hillsides Remedial Actions Conducted
2010 Five-Year Review, Bunker Hill Superfund Site

Between 1975 and 1982, the Bunker Hill Company planted approximately 2 million tree seedlings over 2,290 acres of the site. In 1991, Pintlar, (affiliated with the OU 2 primary PRP, Gulf Resources), planted 140,000 tree seedlings on just under 300 acres and hydroseeded a total of 45 acres. In 1992 and 1993, Pintlar scheduled approximately 1,287 acres to be planted in these 2 years. However, because this effort was not fully documented, it is uncertain how many acres or trees were actually planted. Pintlar planted 100 to 400 trees per acre on 758 acres and 400 to 450 trees per acre on 215 acres in 1994.
Between 1990 and 1992, the PRPs cut "zero-grade" bench terraces over the hillsides for erosion control and hillside stabilization. Approximately 69 miles of terraces were constructed. Terrace construction shortened slope length, promoted infiltration of runoff into the hillside terraces, and reduced water velocity as it flowed down the hillsides. The 2000 Five-Year Review Report for OU 2 describes the terraces in more detail (USEPA, 2000).
PRPs also installed check dams to minimize further erosion in gullied areas, and erosion control measures at select mine waste dumps.
In 1994, USEPA and the State of Idaho assumed the responsibility for hillsides remedial work. In 1996, USEPA and the State planted 200,000 white pine seedlings in areas that had not been planted by the PRPs. In the fall of 1998 approximately 254 acres were limed and hydroseeded. In the spring of 1999, USEPA and the State limed an additional 834 acres at varying rates of which 365 acres were subsequently hydroseeded in the fall of that year.
Slope Stabilization, Wardner and Smelterville: In 1997, USEPA and the State of Idaho performed hillside stabilization activities at discrete areas at the base of the Smelterville hillside that consisted of cleaning out sloughed soil, reinforcing existing catchment walls, and constructing additional gabion walls to prevent sloughing soil from entering remediated yards. In 1999, USEPA and the State restored capacity behind existing cribbing walls in Wardner by removing accumulated sediment and soil. Also in 1999, BLP removed discrete small mine dumps from the hillside above Wardner.
In 1998 and 1999, USEPA built hundreds of check dams along the hillside terrace benches, including straw bale, log, and concrete "ecology block" dams. More information on check dams can be found in the 2000 Five-Year Review Report for OU 2 (USEPA, 2000b).
Solid waste from the lower industrial landfill located between Deadwood and Railroad Gulch was removed and disposed in the CIA in 1996. The area was re-graded for erosion control purposes by matching existing site contours. No capping was done because all waste material was removed.
Soil amendments were applied to 371 acres in 2000 and 132 acres in 2001, followed by revegetation. The 2001 work represented the final large-scale revegetation operation on the hillsides.
Reforestation activities began in the fall of 2001 and continued into the fall of 2002 with the goal of introducing additional ecosystem diversity and nutrients to the hillsides. A total of 88,500 seedlings were planted on hillsides in scattered groupings.

4.3.3.3 Actions Since Last Five-Year Review (2005-2010)

The hillsides remedial action was fully implemented by 2002. In 2006, the State of Idaho transferred a portion of the hillsides, located above the SCA and BAL, to a third party. Currently, large-scale development activities are occurring in the lower hillsides that include construction of a golf course community, including residences, and associated infrastructure. As part of development, portions of the hillsides remedy were graded or altered to allow for placement of the golf course fairways. Revegetated areas were altered; however, these areas have been or will be vegetated with golf course grass. In compliance with the ICP, development of the golf course and associated residential community has resulted in capping of areas that were not capped during the remedial action. The long-term impacts of the development activities on the hillsides remedial action are uncertain but are expected, with regular maintenance, to further reduce erosion and runoff. Along with the major undeveloped portions of the hillside areas, redeveloped portions will be evaluated as part of regular O&M inspections.

Monitoring of Hillsides Performance

To ensure that the hillsides work meets the requirements of the 1992 OU 2 ROD and overall project goals, a program to monitor hillsides performance began in 2000 and continued through 2006. The Hillsides Monitoring Program included monitoring of surface water quality and vegetation.

During the current Five-Year Review period (2005-2010), surface water quality monitoring for the hillsides was conducted until September 2006. Vegetation cover was monitored in 2005 only. Data collected as part of these monitoring activities suggest that the hillsides were recovering from the perspectives of both general plant cover and the ecosystem functions that such cover provides. Comprehensive reviews of the work conducted during the current Five-Year Review period are provided in CH2M HILL (2006b, 2007b).

As a result of demonstrating steady positive results in meeting the Hillsides Project goals and objectives, the hillsides monitoring program was restructured in 2006 to discontinue the annual vegetation monitoring and water quality monitoring.

The primary requirement of hillsides O&M is to maintain acceptable growth and vitality of the existing hillside plant cover so that it continues to protect downstream surface waters from further sediment discharge. With few exceptions, annual monitoring results prior to development activities suggest that most of the Hillsides Project area will continue to develop satisfactorily without significant additional maintenance actions. Nevertheless, because it is normal for ecosystems to change in species composition and size over time, the key to successful O&M of the Hillsides Project is to identify any adverse impacts over time that could compromise the purpose of the Hillsides Project. Regular O&M inspections will help monitor these changes on both the undeveloped and developed portions of the hillsides areas.

The following subsections provide further information on hillsides monitoring during 2005 and 2006.

Surface Water Quality Monitoring

Water quality measurements serve as an indicator of overall site performance as it relates to watershed-level functions. Water quality indicates the effectiveness of vegetation cover and check dams in reducing transfer of sediments from the hillsides to streams. Surface water quality was measured continuously throughout Water Year (WY) 2006, after which surface water quality monitoring was discontinued and instruments were removed. Results for WY 2006 are similar to the results of previous years' monitoring. The timing and magnitude of seasonal flows were similar to previous years except for various precipitation events. Measured turbidity at the monitoring locations was low in WY 2006. Instantaneous turbidity levels, including summer measurements, exceeded background conditions by more than 50 nephelometric turbidity units (NTUs) only 1 percent of the time. These data suggest less erosion from the hillsides, which is attributable to the success of the erosion control structures and revegetation activities conducted as part of the hillsides remedy.

Surface water quality monitoring included total suspended solids (TSS), flow, and turbidity in Deadwood Creek, Government Creek, and Grouse Creek. Information specific to flow and TSS can be found in CH2M HILL (2006b, 2007b).

Because the hillsides surface water quality monitoring program was discontinued in 2006, no water sample data are available to directly evaluate the impacts of development activities on the hillsides areas with respect to water quality.

Vegetation Monitoring

The revegetation activity was largely completed in 2001, and vegetation monitoring was conducted through 2005. However, vegetation monitoring was discontinued after 2005 because vegetation monitoring indicated steady progress towards successfully covering the hillside ground surfaces with vegetation sufficient to contribute to the goal of controlling erosion and increasing infiltration. A portion of the vegetated areas were disturbed during development activities and replaced with golf course fairways. The result of this development with respect to direct contact, erosion control, and infiltration has been monitored by Panhandle Health and the State of Idaho as part of the ICP and long-term O&M.

Operation and Maintenance Considerations

The Hillsides Monitoring Program was conducted from 2000 to 2006 and guided short-term O&M activities for the site. Hillsides revegetation and stabilization activities were evaluated annually, and results were used to remedy any problems that might have interfered with achievement of the Hillsides Project goals and objectives.

As a result of demonstrating steady positive results, the Hillsides Monitoring Program was discontinued in 2006. Long-term O&M activities for the hillsides include monitoring for surface erosion and repair of rill erosion if needed, cleaning out ditches and culverts on roads near slopes, and inspecting check dams and making necessary repairs. Vegetation only needs to be replaced or repaired if erosion or mass movement disturbs it in a manner that could result in degradation of the human and/or natural environment. A long-term O&M manual that will be prepared and implemented by the State of Idaho is currently in draft form for the hillsides (publication pending).

The State of Idaho conducted an inspection of the hillsides in September 2009. The findings indicate the following:

- Vegetation has been fully established at all but a few isolated rocky sites, terrace cutbanks have poor vegetation, and the area behind the Zinc Plant has grass but very few trees;
- Minimal slope erosion is occurring;
- Check dams are controlling gully erosion, but one ecology block check dam has a minor build-up of sediment; and
- Terraces are functioning as intended.

A site inspection of the lower hillsides where development is occurring was conducted on February 25, 2009. Several golf course fairways have been constructed on the hillsides, which have been revegetated with grass. No significant erosion was observed during the inspection of the developed portion of the hillsides, except for small areas within fairways, and these are being mitigated with erosion control measures. Vegetation added for the purpose of the golf course may provide improved erosion control protection compared to the native vegetation. However, hillsides water quality monitoring ceased in 2006, so any erosion and sediment transport occurring since development was initiated was not directly measured. Development of this area is monitored for compliance with the ICP.

Controls on Access

According to the FS, implementing access controls to the hillsides is a necessary component to reduce the potential for human exposure where residual contamination exists and to provide protection to planted areas from human disturbance. Public use of the hillsides is typically recreational and the 1992 OU 2 ROD states that the majority of hillsides outside the immediate vicinity of the SCA are suitable for unrestricted recreational activities. Therefore, the primary concern regarding access controls to the hillsides is to reduce adverse impacts to planted areas by off-road recreational vehicles.

Access controls currently in place include several gates within Government Gulch and Grouse Gulch in addition to signage at key locations denying entry and alerting potential users about remaining contamination on the hillsides.

Upper and Lower Industrial Landfills

The September 2009 site inspection findings indicated that the vegetative cover is functioning as intended. No erosion was observed at the upper and lower industrial landfills.

4.3.3.4 Technical Assessment of Hillsides Remedial Actions

Consistent with USEPA guidance (USEPA, 2001d), technical assessment was conducted by evaluating the following three questions related to protectiveness of the implemented remedial actions.

Question A: Is the remedy functioning as intended by the decision documents?

The hillsides remedy is functioning as intended by the decision documents. Specific aspects of the remedy performance evaluation are described in the following subsections.

Erosion Control Structures

Check dam performance is critical to achieving an overall Site objective of eliminating contaminated sediment flowing into the SFCDR. According to the inspection of the hillsides conducted by the State of Idaho, check dam performance has been acceptable. Major findings include:

- Check dams are controlling gully erosion, but one ecology block check dam has a minor build-up of sediment;
- Minimal slope erosion is occurring; and
- Terraces are functioning as intended.

Access Control

The hillsides are readily accessible through the development of Upper Magnet Gulch and Deadwood Gulch, as well as through Grouse Gulch. Available access to off-road vehicles operated by the public could lead to additional adverse impacts on the watersheds as well as a potential human health risk in those areas of the hillsides where residual contamination is known to exist. The need for additional access restrictions to the hillsides should be evaluated.

Upper and Lower Industrial Landfills

The 2005 Five-Year Review Report (USEPA, 2005) identified erosion occurring near Monitoring Well BH-ILF-GW-0001. No maintenance of this erosion was reported between 2005 and 2010, and the findings of the September 2009 site inspection suggest the erosion had stabilized due to vegetation growth.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of remedy selection still valid?

The exposure assumptions, toxicity data, and cleanup levels used at the time of remedy selection remain valid for the hillsides remedial action. Section 4.2 summarizes the ARARs review for the applicable OU 2 decision documents. None of the new or revised standards identified in Section 4.2 are ARARs or potential ARARs for the hillsides remedial action.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No other information has come to light that could call into question the protectiveness of the remedy. The hillsides monitoring was discontinued due to improvements in vegetation growth and its positive impact on erosion and subsequent water quality in Deadwood, Government, and Grouse Creeks. A portion of the hillsides were transferred to the State of Idaho, and then to a third party for beneficial use for the community. A golf course, including private residences, is currently being developed on a portion of the lower hillsides. Development has been implemented in accordance with the ICP which ensures installation of human health barriers for the altered use (i.e. residential, recreational, and commercial). Additional access controls to the hillsides may be warranted.

Remedy Issues and Recommendations

Since the 2005 Five Year Review, no new issues or recommendations have been identified for the hillsides remedy. The previous recommendation to assess the need for additional access controls and educational outreach to the public continues to be addressed.

4.3.4 Gulches

The seven gulches of primary concern cited in the 1992 OU 2 ROD for remedial actions are, from west to east, as follows (Figure 4-6):

- Grouse Gulch,
- Government Gulch,
- Magnet Gulch,
- Deadwood Gulch,
- Railroad Gulch,

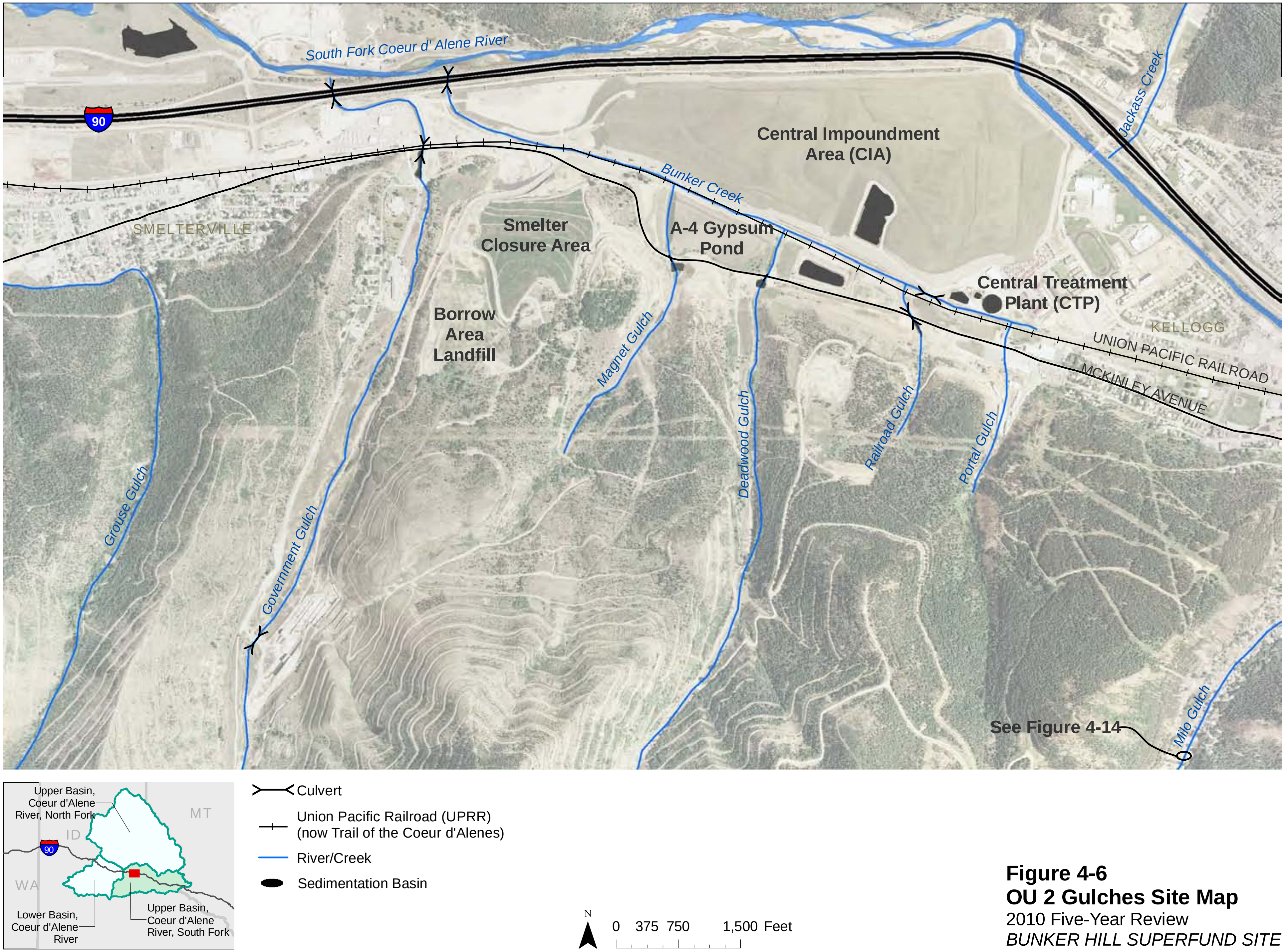

Figure 4-6
OU 2 Gulches Site Map
2010 Five-Year Review
BUNKER HILL SUPERFUND SITE

- Portal Gulch, and
- Milo Gulch.

As noted above, the 1992 OU 2 ROD and this Five-Year Review distinguish between "hillsides" and "gulches." The gulches include the flat portions of the tributary gulches and not the sloping hillsides addressed in Section 4.3.3.

Portal and Milo Gulches are discussed in Sections 4.3.6 and 4.3.9, respectively, because their remedial actions are substantially different from the Phase I remedial actions conducted in the remainder of the gulches. For instance, the 1992 OU 2 ROD-required actions for Portal Gulch, east of Railroad Gulch and south of the MOA, focus on mine water treatment from the Bunker Hill Mine, whose portal (Kellogg Tunnel) is located in Portal Gulch. Mine water pumped from the Bunker Hill Mine is conveyed to the CTP for treatment. See Section 4.3.6 for a discussion of the CTP and the treatment-related actions performed in the Portal Gulch area. The Milo Gulch remedial actions focus on major pipeline projects to convey creek and runoff flows and are addressed in Section 4.3.9.

4.3.4.1 Review of ROD, ROD Amendment, and ESD Requirements

Table 4-15 presents ROD and ROD Amendment requirements that are common to all gulches within OU 2 discussed in this section. ROD, ROD Amendment, and ESD requirements that are specific to a gulch are presented in that gulches subsection below. As stated in Section 4.1, remedy implementation within OU 2 is guided by the CCP, which calls for a phased approach to remedy implementation. Currently, the majority of Phase I remedial actions within OU 2 have been implemented. Therefore, the discussion and evaluation of the remedy to date is based on the Phase I remedial actions implemented and not the entire remedy.

4.3.4.2 Gulch Soil Excavation Goals

During the implementation of Phase I of the Selected Remedy for OU 2, a chemical-specific soil excavation goal of 1,000 mg/kg lead was used for most OU 2 source removal actions. One of the exceptions was for Government and Magnet Gulches. The 1998 OU 2 ESD provided separate upland (outside of the stream corridor) and stream bed excavation goals for these two gulches to minimize the overall combined metals loading from the Site to the SFCDR and to minimize human exposure potential to contaminated soils (USEPA, 1998).

Nonhillside upland area excavation goals in these two gulches were set at 10,000 mg/kg lead, 850 mg/kg arsenic, 9,000 mg/kg zinc, 850 mg/kg antimony, 850 mg/kg mercury, and 850 mg/kg cadmium. Upland areas found to be below an excavation goal (e.g., 10,000 mg/kg lead) but above 1,000 mg/kg lead were generally capped with an ICP-approved barrier consistent with future land use plans. The clean backfill requirement was 100 mg/kg lead.

For stream-bed and floodplain areas in these two gulches, a separate set of analytical goals was set due to the increased likelihood of human exposure via direct contact in the stream or farther down the river, as well as the likelihood of increased leaching from constant wetting and drying. Stream-bed and floodplain area excavation goals were set at 1,000 mg/kg lead, 850 mg/kg arsenic, 1,000 mg/kg zinc, 850 mg/kg antimony, 850 mg/kg mercury, and 850 mg/kg cadmium. Areas found to be above an excavation goal (e.g.,

TABLE 4-15
Remedial Action Requirements Common to all Gulches
2010 Five-Year Review, Bunker Hill Superfund Site

Requirement	Remedial Action Objective/Goal
1992 OU 2 ROD	
Enforce existing controls on access (Section 9.2.1)	Limit direct contact with contaminants
Maintain existing fencing (Section 9.2.1)	Limit direct contact with contaminants
Temporary dust control on material accumulation sites (Section 9.2.1)	Control migration of windblown dust
Re-establish riparian habitat and stream corridor vegetation, establish a vegetated stream corridor of 100 feet (Section 9.2.5)	Minimize erosion and contamination to tributaries and the SFCDR
Revegetate disturbed areas (Section 9.2.5)	Minimize erosion
Install barriers consistent with land-use in remaining areas (a minimum of 6" of clean soil or other barrier will be installed if surface concentrations >1000 mg/kg Pb) (Section 9.2.5)	Minimize direct contact with contaminants
Closure of mine rock dumps identified as posing a direct contact or erosion hazard (Section 9.2.6)	Minimize direct contact with contaminants and contaminant migration
Permanent dust control through containment, "hot spot" removal, soil/rock barriers and revegetation (Section 9.2.6)	Minimize contaminant migration and direct contact risk
2001 OU 2 ROD Amendment	
Contaminated water collected at the site will be treated in the CTP	Provides an alternate treatment location to the collected water wetland

1,000 mg/kg lead) were excavated and reconstructed using geotextiles, soil, and rock compliant with ICP backfill requirements. In those stream-bed and floodplain areas where the excavation goals were not attainable after repeated excavations, materials were removed to a minimum of 2 feet below the last excavation elevation and were backfilled with coarse rock in compliance with the ICP backfill requirement.

4.3.4.3 Grouse Gulch

Background and Description of Phase I Remedial Actions

Grouse Gulch is a small watershed located west of Government Gulch with a perennial creek (Grouse Creek) that passes through the Smelterville city limits. Following a major flood event in 1986, Shoshone County and the Soil Conservation Service constructed four gabion dams across the creek at various locations along its length in an attempt to stabilize the creek bed profile. Past smelting and mining activities resulted in surface contamination of the soils in the gulch area, including point sources of a mine dump, an abandoned tailings pile, and a discharging adit from the Blackhawk Mine, and a seep from the Wyoming Mine. These 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 and was conducted in 1997 using Bunker Limited Partnership (BLP) bankruptcy funds.

Table 4-16 presents the Phase I remedial actions conducted within Grouse Gulch. The goals of the Grouse Gulch remedial action were to minimize further contaminated sediment transport down the gulch and thereby reduce the potential for re-contamination of previously remediated residential areas within the city of Smelterville, and to minimize sediment load into downstream river systems.

TABLE 4-16
Grouse Gulch Remedial Actions Conducted
2010 Five-Year Review, Bunker Hill Superfund Site

Approximately 1,200 cubic yards (cy) of tailings above the uppermost gabion structure were removed from locations closest to the creek and disposed in the CIA.
A new gabion dam was constructed in the lower reaches of the gulch to increase sediment retention time and to augment the sediment retention capacity of the existing gabion dam system in the gulch.
Sediment that had built up behind existing gabion dams was removed to provide more capacity for future runoff events.
The Wyoming mine dump located near the creek was buttressed at its base to minimize the potential for erosion into the creek. To increase its stability, approximately 2,000 cy of mine dump material was removed and disposed at the CIA.
Accumulated sediment and alluvium was removed from downstream portions of the creek within the Smelterville city limits to increase the flow capacity within this portion of the creek and to minimize the potential for overtopping into remediated yards.
Access roads up through the gulch were improved to enable easier O&M of the gabion retention structures.

Note: Data as reported in the 2000 Five-Year Review Report.

Actions Since Last Five-Year Review (2005-2010)

The Grouse Gulch Phase I remedial action was fully implemented in 1997, and no actions have been implemented since.

Operation and Maintenance

Shoshone County is responsible for cleaning out Grouse Gulch sediment basins to help control flooding in Smelterville associated with Grouse Creek. According to Shoshone County, sediment has accumulated behind the gabion dams and is inhibiting flow through the standpipes. Shoshone County has returned flow through these structures, but will remove all sediment during the summer of 2010. In addition, one of the upper gabion dams was observed to be leaning in 2009.

Phase I Remedial Action Assessment Findings

The effectiveness evaluation of the Grouse Gulch Phase I remedial actions, with respect to water quality and performance standards, is presented in the Phase I Remedial Action Assessment Report (CH2M HILL, 2007b). Surface water quality monitoring at the mouth of Grouse Creek indicates that no AWQC exceedances have occurred after Phase I remedial action. This indicates that stabilization of the creek channel and removal and stabilization of contaminant source material piles have reduced the amount of contaminants being released from these sources to Grouse Creek.

4.3.4.4 Government Gulch

Background and Description of Phase I Remedial Actions

Government Gulch is the historic location of several ore processing and acid/fertilizer producing facilities. Several wastewater ponds (typically unlined) and material stockpiles were also located on the floor of the gulch. 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. To provide space for the processing facilities, the creek was re-routed from the east side of the gulch above the Zinc Plant in pipes and open channels to a shotcreted open channel (which deteriorated significantly over time) located on the west side of the gulch below the Zinc Plant. Future redevelopment of Government Gulch will require addressing overland drainage through the Gulch, including the pre-existing shotcrete channel. As Government Creek flows north, it crosses under McKinley Avenue and eventually crosses under I-90 to discharge into the SFCDR. As part of USEPA's 1990 AOC with Gulf Resources and Hecla Mining, sediment retention gabion dams were constructed in Government Creek to settle sediment from surface water.

Table 4-17 presents ROD, ROD Amendment, and ESD requirements specific to Government Gulch in addition to those presented in Table 4-15. Table 4-18 presents the Phase I remedial actions implemented for Government Gulch prior to year 2005. As stated in Section 4.1, permanent remedial solutions (source removal and containment) were given preference over remedial actions focusing on conventional treatment methods that would result in a larger O&M cost burden after remedy implementation. The objective of the Government Gulch Phase I remedial action was to maximize the removal of contaminated source material from the gulch. The lining of Government Creek and groundwater cutoff walls were deferred until the benefits of increased source removals on Government Gulch surface water and groundwater could be fully evaluated. Government Gulch Phase I remedial actions resulted in the removal of approximately 400,000 cy of contaminated material from the floor of Government Gulch.

Actions Since Last Five-Year Review (2005-2010)

The Government Gulch Phase I remedial action was fully implemented in 2001. The State of Idaho has transferred several parcels in Government Gulch to third parties, as follows:

- In 2006, parcels were transferred to support development of the golf course community discussed in Section 4.3.3.3, above. An unlined pond and pump house were subsequently constructed in Government Creek to provide irrigation water to the golf course. A pump station was constructed adjacent to Government Creek. A haul road was also constructed that connects Government Gulch with the area of golf course development.
- In 2010, a single parcel each was transferred to Shoshone County, the City of Kellogg, the Kellogg School district, and Panhandle Health District.

TABLE 4-17
Remedial Action Requirements for Government Gulch
2010 Five-Year Review, Bunker Hill Superfund Site

Requirement	Remedial Action Objective/Goal
1992 OU 2 ROD	
Erosion control structures and sediment basins (Section 9.2.1)	Reduction of suspended sediment/contaminant loading in surface runoff to the SFCDR
Channelize and line Government Creek (Section 9.2.1)	Prevent surface water from coming into contact with contaminated materials in the gulch bottom
Place cutoff wall and surface water diversion above Zinc Plant (Section 9.2.1)	Divert clean groundwater and surface water away from contaminated areas
Place cutoff wall and surface water diversion near mouth of Government Gulch (Section 9.2.1)	Collect contaminated groundwater and surface water for treatment in the collected water wetland
Contaminated materials and demolition debris from the Zinc Plant and Phosphoric Acid/Fertilizer Plant will be placed at the Zinc Plant location and capped with a 10^{-7} cm/sec cap (Section 9.2.1)	Consolidate contaminated materials under an impermeable cap to minimize contaminant migration to surface water and groundwater and eliminate direct contact
Phosphoric Acid/Fertilizer Plant warehouse will be decontaminated (Section 9.2.1)	Retain structure for future use
1996 OU 2 ESD	
Placement of Zinc Plant and Phosphoric Acid/Fertilizer Plant demolition debris and contaminated material in the SCA	Consolidates contaminated material into a single facility and reduces the need to construct and maintain an additional closure in the Zinc Plant Area
Restoration of Government Creek to a natural drainage	Eliminates the need to channelize and line Government Creek
1998 OU 2 ESD	
Phosphoric Acid/Fertilizer Plant warehouse demolished	Issues associated with the condition of the warehouse prevented its purchase by developers. Historic evidence suggested that the historic channel of Government Creek passed through this area, therefore, removal allowed for restoration of Government Creek to its historic channel
Zinc Plant Concentrate Handling and Warehouse buildings retained	At the request of Shoshone County, these structures were retained to be eventually conveyed to Shoshone County for use as maintenance facilities
Tall Stack demolition	As a result of deterioration of stack material and the cost associated with maintaining FAA required stack lighting systems, it was determined that demolition of the tall stacks would be more cost-effective than maintaining the structures
Excavation goals for areas away from Government Creek that will be capped with an ICP-approved cap modified	Contaminant cleanup goals for areas away from Government Creek: lead 10,000 mg/kg, arsenic 850 mg/kg, zinc 9,000 mg/kg, antimony 850 mg/kg, mercury 850 mg/kg, cadmium 850 mg/kg
Stream-bed excavation goals for Government Creek	Contaminant cleanup goals for Government Creek stream bed: lead 1,000 mg/kg, arsenic 850 mg/kg, zinc 1,000 mg/kg, antimony 850 mg/kg, mercury 850 mg/kg, cadmium 850 mg/kg
2001 OU 2 ROD Amendment	
Contaminated surface water and groundwater from Government Gulch will be treated in the upgraded CTP if treatment is determined to be necessary	Provides a location to treat contaminated water from Government Gulch in lieu of the collected water wetland

TABLE 4-18
Government Gulch Remedial Actions Conducted
2010 Five-Year Review, Bunker Hill Superfund Site

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. The entire gulch area received a 6-inch barrier cap of clean soil typical for future industrial use.
Government Creek was reconstructed from the upper reaches of the gulch up to approximately 2,000 feet south of McKinley Avenue. The low flow channel was typically rock-lined; the flood plain channel was vegetated.
Above ground structures associated with the Phosphoric Acid/Fertilizer Plant and Zinc Plant were demolished with the exception of the Zinc Plant Concentrate Handling Building and Warehouse. Salvageable materials were removed and recycled and the remainder of the demolition materials was placed in the SCA.
The tall stack at the Zinc Plant was demolished and debris was buried in place.
A 6-inch clean soil ICP barrier cap was placed outside the channel floodplain area. The entire gulch area was then hydroseeded, with the exception as noted above for the rock-lined low flow channel of Government Creek. Willows were planted in riparian areas of the creek.
Government Creek was reconstructed from about 100 feet south of McKinley Avenue to I-90 which integrated a culvert system beneath McKinley Avenue and a rock-lined creek channel. The light industrial area (lumber mill) received a 6-inch ICP cap.
Riparian corridor planting of applicable portions of Government Creek.

Operation and Maintenance

In 2007, USACE repaired a small section of Government Creek channel that eroded the east bank, just below the riprap apron immediately downstream from the lowermost concrete grade control structure. USACE rebuilt this portion of the creek by re-contouring, armoring, and revegetating the eroded channel. In 2008, the State of Idaho removed about 400 cy of sediment accumulation from behind the gabion dam and disposed of the material at the Page Repository. Since then, the State of Idaho periodically inspects the Government Gulch remedial actions. A long-term O&M manual has been finalized for the Government Gulch remedial action (TerraGraphics, 2010d).

The State of Idaho conducted an inspection of Government Gulch in September 2009. The findings indicate the following:

- The channel, gabion dam, and culverts are functioning as designed;
- The concrete-lined channel on the west side of the road, which was not part of the remedy, is in poor condition;
- The soil barrier near the road crossing may have been contaminated in a limited area by past repair activities. IDEQ and USEPA have agreed to monitor the area pending future development; and
- Accumulated sediment was removed from behind the gabion dam in November 2008.

Phase I Remedial Action Assessment Findings

The effectiveness evaluation of the Government Gulch Phase I remedial actions, with respect to water quality and performance standards, is presented in the Phase I Remedial Action Assessment Report (CH2M HILL, 2007b). The Phase I Government Gulch remedial actions (Table 4-17) have had a significant positive impact on surface water and groundwater quality in Government Gulch. Improvements in surface water and groundwater quality between pre- and post-remediation activities occurred at the majority of monitoring locations. In many instances, contaminant concentrations have decreased up to an order of magnitude; however, contaminant concentrations in groundwater and surface water continue to be well above the MCL or AWQC within much of the gulch.

Dissolved cadmium and dissolved zinc concentrations measured at the mouth of Government Creek monitoring location (BH-GG-0004) routinely exceeds the AWQC. Dissolved cadmium concentrations are typically greater than one-hundred times the AWQC, while dissolved zinc concentrations are typically twenty times the AWQC at this monitoring station.

Dissolved cadmium concentrations in groundwater exceed the MCL in most Government Gulch wells sampled while dissolved zinc concentrations exceed the MCL only in select wells. Concentrations of both dissolved cadmium and dissolved zinc show similar results within the gulch. The highest concentrations in groundwater are located near the former zinc plant; dissolved cadmium concentrations have been detected 100 times greater than the MCL, while dissolved zinc concentrations have been detected 10 times greater than the MCL. Both dissolved cadmium and dissolved zinc concentrations are much lower in groundwater upgradient of the former zinc plant. Groundwater quality trends are decreasing at several monitoring locations, suggesting the full positive benefit of the Phase I remedial action on Government Gulch water quality has not yet been fully realized.

4.3.4.5 Upper Magnet Gulch

Background and Description of Phase I Remedial Actions

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 4.3.14. 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 AOC with Gulf Resources and the Hecla Mining Company.

Much of the native vegetation in Magnet Gulch and surrounding hillsides was significantly affected adversely by smelter emissions, resulting in substantial surface erosion within the gulch (MFG, 1992b).

Table 4-19 presents ROD and ESD requirements specific to upper Magnet Gulch in addition to those presented in Table 4-15. Table 4-20 presents Phase I remedial actions that have been conducted within upper Magnet Gulch. The Phase I remedial actions for upper Magnet Gulch did not differ from the remedial actions identified in the 1992 OU 2 ROD.

TABLE 4-19
Remedial Action Requirements for Upper Magnet Gulch
2010 Five-Year Review, Bunker Hill Superfund Site

Requirement	Remedial Action Objective/Goal
1992 OU 2 ROD	
Erosion control structures and sediment basins	Reduction of suspended sediment/contaminant loading in surface runoff to the SFCDR
Relocate A-1 Gypsum Pond to CIA	Limit direct contact with contaminant and control migration of contaminants to surface water and groundwater. Minimize infiltration through gypsum materials
1996 OU 2 ESD	
Relocation of a portion of the A-1 Gypsum Pond material to the lead SCA	Reduce haul distance required for disposal of gypsum materials
1998 OU 2 ESD	
Excavation goals for areas away from upper Magnet Creek that will be capped with an ICP-approved cap modified	Contaminant cleanup goals for areas away from upper Magnet Creek: lead 10,000 mg/kg, arsenic 850 mg/kg, zinc 9,000 mg/kg, antimony 850 mg/kg, mercury 850 mg/kg, cadmium 850 mg/kg
Stream-bed excavation goals for upper Magnet Creek	Contaminant cleanup goals for upper Magnet Creek stream bed: lead 1,000 mg/kg, arsenic 850 mg/kg, zinc 1,000 mg/kg, antimony 850 mg/kg, mercury 850 mg/kg, cadmium 850 mg/kg

TABLE 4-20
Upper Magnet Gulch Remedial Actions Conducted
2010 Five-Year Review, Bunker Hill Superfund Site

In 1992, Gulf Resources relocated the copper dross flue dust pile from Magnet Gulch to another temporary storage site adjacent to the Lead Smelter. The pile was placed on a concrete slab to prevent contamination of the ground surface and was covered with tarps to prevent air-borne dispersion.
Removal of the A-1 Gypsum Pond to the CIA and SCA.
Removal of mid-Gulch fill materials. Approximately 200,000 cy of material were removed. In addition, the box culvert that the mining companies had constructed beneath the mid-gulch fill to carry the flows of Magnet Creek was located and removed.
Reconstruction and revegetation of Magnet Creek. In 1999, the portion of Magnet Creek above McKinley Avenue was reconstructed on native material and three sediment retention basins were constructed along the creek's alignment to slow down water flow. The channel and banks were rock-lined to minimize erosion. Magnet Gulch was hydroseeded upon completion of the channel work.

Actions Since Last Five-Year Review (2005-2010)

The upper Magnet Gulch Phase I remedial action was fully implemented in 1999. In 2006, the State of Idaho transferred the property in Magnet Gulch, where remedial actions occurred, to a third party. Currently, large-scale development activities are occurring in the upper Magnet Gulch area that include construction of a golf course community and associated infrastructure. As part of development, portions of the upper Magnet Gulch remedy were graded or altered, including:

- Addition of a road crossing with a box culvert south of McKinley Avenue;

- Modification of the West Fork Magnet channel, addition of a detention pond, and replacement of the culvert system under the upper road;
- Modification of the mainstem channel; and
- Abandonment of the upper East Fork gabion.

By mutual agreement, the third-party property owner has agreed to perform maintenance of the West Fork and mainstem drainage features. IDEQ continues to be responsible for ensuring appropriate O&M of these features occurs. IDEQ retains responsibility for the lower sediment basin at McKinley and the East Fork including the lower gabion dam.

The long-term impacts of the development activities on the Upper Magnet Gulch Phase I remedial actions are uncertain and will be evaluated as part of future Five-Year Reviews.

Operation and Maintenance

In September 2009, the State of Idaho inspected the Upper Magnet Gulch remedial actions that were not influenced by development. The findings indicate that the unaltered actions are functioning as intended. An inspection of the Upper Magnet Gulch actions that have been altered by development was conducted on February 25, 2009, and produced the following findings:

- The lower sedimentation basin and the lower gabion dam are in excellent condition and functioning as designed;
- No adverse erosion was observed in the areas of construction; and
- The development activities did not appear to affect the RAOs for the Upper Magnet Gulch remedy. The development activities are currently monitored as part of the ICP.

A long-term O&M manual for the gulches will by prepared and implemented by the State of Idaho and is currently in draft form (publication pending).

Phase I Remedial Action Assessment Findings

The effectiveness evaluation of the Upper Magnet Gulch Phase I remedial actions, with respect to water quality and performance standards, is presented in the Phase I Remedial Action Assessment Report (CH2M HILL, 2007b). The Upper Magnet Gulch Phase I remedial action appears to have had a significant positive impact on both surface water and groundwater quality in Upper Magnet Gulch. Dissolved cadmium and dissolved lead concentrations in Magnet Creek have decreased between the pre- and post-remediation time periods. Dissolved metal concentrations in Upper Magnet Gulch groundwater are significantly lower following remediation than those observed during the pre-remediation time period.

Even though positive impacts have been realized following the remedial action, dissolved metal concentrations in groundwater and surface water continue to exceed the MCLs and AWQC, respectively.

In 2008, the mouth of Magnet Creek was monitored in support of the Bunker Creek Pilot Study (CH2M HILL, 2009b). Dissolved cadmium and dissolved zinc concentrations measured at the mouth of Magnet Creek were significantly higher than concentrations measured at Monitoring Station BH-MG-0001, located near McKinley Avenue. It was presumed that dissolved metals contaminated groundwater routed through a French drain at the toe of the A-4 Gypsum Pond that discharges to the lower end of Magnet Creek caused the concentration increase. However, field observation in September 2009 of the A-4 Gypsum Pond French drain indicated no water was emanating from the drain outlet. The large concentration difference is attributable to dissolved metals contaminated groundwater discharging to the lower portion of Magnet Creek.

4.3.4.6 Deadwood Gulch

Background and Description of Phase I Remedial Actions

Deadwood Gulch is located immediately east of Magnet Gulch. As Deadwood Creek leaves the gulch area, it flows beneath McKinley Avenue between the eastern edge of the A-4 Gypsum Pond and the western edge of the CTP's Lined Pond prior to discharging to Bunker Creek. The Arizona Mine dump filled the narrow valley of Deadwood Gulch in its upper reaches, and various mine adits/portals surfaced in Deadwood Gulch that occasionally discharged. 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. The Arizona Mine Dump that blocked the upper reaches of Deadwood Creek also resulted in significant quantities of gravel and rock bed-load being transported downstream during run-off events.

In the early 1990s, Pintlar (a subsidiary of Gulf Resources, the primary PRP in OU 2) built two gabion dams across Deadwood Creek for sediment retention. The intent of these sediment dams was to slow down the flow during spring runoff such that sediment could be retained within the gulch rather than flowing into downstream water systems. In spring 1995, the northernmost gabion dam was overtopped and damaged by runoff flows. The cause of the overtopping (a sediment-clogged geotextile on the upstream face of the dam) was subsequently removed so that flow cannot build up behind the dam in excess of its design assumptions. This dam and the other Deadwood Gulch gabion dam are performing as designed and are routinely inspected after major storms and during annual inspections.

Table 4-21 presents 1992 OU 2 ROD requirements specific to Deadwood Gulch that are not included in Table 4-15. Table 4-22 describes the Phase I remedial actions conducted in Deadwood Gulch prior to year 2000.

TABLE 4-21
Remedial Action Requirements for Deadwood Gulch
2010 Five-Year Review, Bunker Hill Superfund Site

1992 OU 2 ROD Requirement	Remedial Action Objective/Goal
Erosion control structures and sediment basins	Reduction of suspended sediment/contaminant loading in surface runoff to the SFCDR
Closure of mine rock dumps identified as posing a direct contact or erosion hazard	Minimize direct contact with contaminants and contaminant migration

TABLE 4-22
Deadwood Gulch Remedial Actions Conducted
2010 Five-Year Review, Bunker Hill Superfund Site

Sediment that had collected behind the gabion dam retention structures was removed. The sediment was tested for contaminant levels and was found to be below cleanup goals enabling the sediment to be spread out along areas outside the creek bed and then hydroseeded.
Creek stabilization work consisted of constructing small cobble and boulder grade check dams perpendicular to the creek flow about every 200 to 300 feet.
The Arizona Mine Dump was removed and hauled to the CIA for disposal. Approximately 500,000 cy of material was removed and the stream bed was reconstructed in the previously blocked portion of Deadwood Gulch.
Lower Deadwood Creek from the first gabion down to a sedimentation basin just south of McKinley Avenue was reconstructed. New culverts were installed under McKinley Avenue and a heavy riprap channel was constructed from the north side of the McKinley Avenue culvert down to Bunker Creek.
Deadwood creek riparian corridor planting.

Actions Since Last Five-Year Review (2005-2010)

This remedial action was conducted beginning in 1995 and was fully implemented in 2001. In 2006, the State of Idaho transferred the Deadwood Gulch property south of McKinley Avenue, where remedial actions were implemented, to a third party. Development activities in Deadwood Gulch have been limited to clearing and grubbing in preparation of golf course construction.

Operation and Maintenance

Since completion, Deadwood Gulch has required no maintenance to sustain the integrity of the action. The State of Idaho performed an inspection of the Deadwood Gulch remedial action in September 2009, which resulted in the following findings:

- Channels, sedimentation basins, and culverts are in excellent condition and functioning as designed; and
- No erosion was observed in the areas of golf course construction in Deadwood Gulch.

Construction activities are currently monitored as part of the ICP. A long-term O&M program for the gulches is currently in draft form (publication pending).

Phase I Remedial Action Assessment Findings

The effectiveness evaluation of the Deadwood Gulch Phase I remedial actions with respect to water quality and performance standards is presented in the Phase I Remedial Action Assessment Report (CH2M HILL, 2007b). The Deadwood Gulch Phase I remedial action appears to have resulted in decreased dissolved metal concentrations in Deadwood Creek. This meets the RAO established for Deadwood Gulch in the 1992 OU 2 ROD. However, dissolved cadmium and dissolved zinc concentrations continue to exceed the AWQC. Contaminant metal concentrations in Deadwood Gulch groundwater have shown little change between the pre- and post-remediation time periods.

4.3.4.7 Railroad Gulch

Background and Description of Phase I Remedial Actions

Railroad Gulch is east of Deadwood Gulch and south of the Boulevard Area, a small strip of land adjacent to the south side of McKinley Avenue. Flows from Railroad Gulch cross the eastern end of the Boulevard, cross under McKinley Avenue in a culvert, and discharge into Bunker Creek. The lower portion of the creek channel was undersized and routinely flooded during high-flow spring run-off 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 run-off owing to the steep channel gradient between McKinley Avenue and Bunker Creek.

To address the flooding and erosion damage concerns of the Railroad Gulch channel, the remedial actions presented in Table 4-23 were conducted as part of the Phase I remedy.

TABLE 4-23
Railroad Gulch Remedial Actions Conducted
2010 Five-Year Review, Bunker Hill Superfund Site

The portion of the Railroad Gulch surface water channel that extends across the eastern end of the Boulevard Area, crosses under McKinley Avenue, and then connects to Bunker Creek was reconstructed to increase flow capacity. The channel was lined with riprap. A sedimentation basin was constructed south of McKinley Avenue.
Culverts beneath McKinley Avenue were increased in size to handle the estimated spring run-off flows.
Areas adjacent to the channel that were disturbed during construction capped with at least 6-inches of clean fill and were revegetated.

Actions Since Last Five-Year Review (2005-2010)

The Railroad Gulch Phase I remedial action was fully implemented in 1997. In 2006, the State of Idaho transferred the Railroad Gulch property south of McKinley Avenue where remedial actions were implemented to a third party. Currently, no development activities have occurred in the Railroad Gulch area.

Operation and Maintenance

The State of Idaho performs biannual inspections of the Railroad Gulch remedial action. Results of the September 2009, IDEQ inspection include:

- Channels, sedimentation basins, and culverts are in excellent condition and functioning as designed; and
- During this review period, long-term erosion occurred on the west bank of the Railroad Gulch channel outfall. In 2007, USACE rebuilt this portion of the creek by re-contouring, armoring, and revegetating the eroded channel.

A long-term O&M program for the gulches is currently in draft form (publication pending).

Phase I Remedial Action Assessment Findings

The effectiveness evaluation of the Railroad Gulch Phase I remedial actions with respect to water quality and performance standards is presented in the Phase I Remedial Action Assessment Report (CH2M HILL, 2007b). Although the results are not quantifiable, the

Railroad Gulch Phase I remedial action has likely resulted in a positive impact on water quality in Railroad Gulch through reductions in erosion and flooding potential. Modifications to the existing monitoring program do not appear to be necessary unless additional consideration of groundwater conditions in the lower portion of the Railroad Gulch drainage in the Boulevard Area is warranted. For the purposes of evaluating the Railroad Gulch Phase I remedial action, which was focused on surface water drainage in the gulch, groundwater monitoring does not appear to be necessary.

4.3.4.8 Technical Assessment of Gulch Remedial Actions

Consistent with USEPA guidance (USEPA, 2001d), technical assessment was conducted by evaluating the following three questions related to protectiveness of the implemented remedial actions.

Question A: Is the remedy functioning as intended by the decision documents?

The gulch remedial actions are functioning as intended by the decision documents. The 1992 OU 2 ROD performance objectives for the gulches are to:

- Limit direct contact with contaminated material;
- Reduce erosion and suspended sediment in surface water tributaries of the SFCDR; and
- Reduce contamination to surface and groundwater.

The performance of the gulch remedies was evaluated here with respect to limiting direct contact, reducing erosion and suspended sediment, and reducing contamination to surface water and groundwater. Phase I remedy performance for the gulch actions can be judged on whether the remedy satisfies the following intent of the ROD, its amendment, and ESD documents:

- Stable non-eroding surface water channels;
- Contaminated soil either capped or removed such that migration to surface water and groundwater is substantially minimized; and
- Vegetation reestablished sufficiently such that surface water runoff will not erode caps.

Groundwater and surface water within the gulches was evaluated to determine the potential impacts of the Phase I remedial actions on water quality. The status of ecological receptors is being monitored, and preliminary results of the biological monitoring are presented in Section 4.4.2.

For this Five-Year Review, Phase I remedy performance for the gulches was evaluated by conducting site inspections, reviewing O&M conducted from 2005 through 2009, checking that remaining work as identified in the 2005 Five-Year Review Report had been completed, and reviewing applicable monitoring data.

Gulch-specific aspects of the remedy performance evaluation are described in the following subsections.

Grouse Gulch

The Grouse Gulch remedial action has been in place for 13 years. The 2005 Five-Year Review Report for OU 2 identified no work remaining and no issues associated with the Phase I remedy.

An evaluation of surface water quality data for Grouse Gulch was conducted to determine the effectiveness of the Phase I remedy with respect to water quality goals. Dissolved metal concentrations have not exceeded the AWQC following Phase I remedial action implementation, suggesting the remedy is functioning as intended.

As stated earlier, Shoshone County will be performing required maintenance on the sediment basins and gabion dams, which is required to help control flooding in Smelterville associated with Grouse Creek.

Government Gulch

The Government Gulch Phase I remedial action has been in place for about 12 years. The 2005 Five-Year Review Report for OU 2 identified no work remaining associated with the Phase I remedy; however, the review did identify that USACE would re-cap discrete areas in Government Gulch that were re-contaminated during channel repair work conducted in 2003. IDEQ and USEPA have agreed to monitor this limited area pending future development.

The site inspection conducted for this Five-Year Review indicated that the creek channel was stable, riparian plantings had taken hold along the creek corridor providing additional bank stabilization, and vegetation of capped areas was well established and providing a non-erosive surface for the underlying 6-inch ICP cap. Creek flow turbidity measurements were obtained for Government Creek as part of the monitoring program for the effectiveness of the hillsides remedial actions. This program was discontinued in 2006 due to improved Government Creek turbidity and sediment load, likely resulting from the combination of vegetative cover and check dams. Development activities have occurred on portions of the hillsides and Government Gulch since the monitoring program was discontinued. Development activities included the excavation of an irrigation pond in the Government Creek channel and construction of a haul road between the gulch and the golf course area. No water sample data is available to directly evaluate the impacts of development activities with respect to water quality. The result of this development with respect to direct contact, erosion control, and infiltration has been monitored by Panhandle Health and the State of Idaho as part of the ICP and long-term O&M.

An evaluation of surface water and groundwater quality within Government Gulch was conducted to determine the effectiveness of the Phase I remedy with respect to water quality goals. Declining dissolved cadmium and dissolved zinc concentration trends have been identified at several Government Gulch monitoring wells suggesting a positive impact of the remedy on groundwater quality; however, dissolved cadmium and dissolved zinc concentrations continue to exceed the MCLs in Government Gulch groundwater. The decreasing groundwater trends suggest the full positive benefit of the Phase I remedial action on Government Gulch water quality has not yet been fully realized.

Dissolved cadmium and dissolved zinc concentrations in Government Creek routinely exceed the AWQC. Dissolved cadmium concentrations are typically greater than 100 times the AWQC, while dissolved zinc concentrations are typically 20 times the AWQC at this monitoring station.

Upper Magnet Gulch

The Upper Magnet Gulch Phase I remedial action has been in place for about 11 years. The 2005 Five-Year Review Report for OU 2 identified no work remaining and no issues with the Phase I remedy.

The State of Idaho transferred the property containing the Upper Magnet Gulch remedial actions to a third party and subsequent large scale development in this area has occurred resulting in alterations to the Upper Magnet Gulch remedial actions. It is unclear whether the alterations to the remedial actions will have a long-term impact to the Upper Magnet Gulch or surrounding remedies.

An evaluation of surface water quality in upper Magnet Gulch was conducted to determine the effectiveness of the Phase I remedy with respect to water quality goals. Positive impacts have been realized following the remedial action implementation; however, dissolved cadmium, dissolved lead, and dissolved zinc concentrations in groundwater exceed MCLs, while dissolved cadmium and dissolved zinc concentrations in surface water continue to exceed the AWQC. This evaluation was conducted prior to development of the golf course community. The development impact on Magnet Creek water quality is uncertain.

Deadwood Gulch

The Deadwood Gulch Phase I remedial action has been in place for about 13 years. The 2005 Five-Year Review Report for OU 2 identified no work remaining and no issues with the Phase I remedy. No O&M has been necessary for the Deadwood Gulch Phase I remedy during this Five-Year Review period.

The site inspection conducted as part of this 2010 Five-Year Review indicated that the Deadwood Gulch creek channels are stable and revegetation in the gulch is established and minimizing erosion. The gabion dam structures in Deadwood channel are performing as designed. Based on the site inspection and lack of O&M needed for this remedial action, this documents that no issues currently exist with the performance of the Magnet Gulch Phase I remedy.

An evaluation of surface water and groundwater quality data within Deadwood Gulch was conducted to determine the effectiveness of the Phase I remedy with respect to water quality goals. The Deadwood Gulch Phase I remedial action appears to have resulted in decreased dissolved metal concentrations in Deadwood Creek which meets the RAO established for Deadwood Gulch in the 1992 OU 2 ROD. However, dissolved cadmium and dissolved zinc concentrations continue to exceed the AWQC. Contaminant metal concentrations in Deadwood Gulch groundwater have shown little change between the pre- and post-remediation time periods.

In addition, creek flow turbidity measurements were collected at the mouth of Deadwood Gulch as part of evaluating the effectiveness of hillside remedial actions. This program was discontinued in 2006 due to improved Deadwood Gulch turbidity and sediment load, likely resulting from the combination of vegetative cover and check dams.

Railroad Gulch

The Railroad Gulch remedial action has been in place for about 11 years. The 2005 Five-Year Review Report for OU 2 identified no work remaining and no issues with the Phase I remedy. During this review period, erosion of a section of the Railroad Gulch channel warranted its repair in 2007 by USACE.

The site inspection conducted for this 2010 Five-Year Review indicated that the Railroad Gulch creek channel is stable and revegetation in the gulch is established and minimizing erosion. The sedimentation basin south of McKinley Avenue is functioning as designed with minimal sediment buildup noted at the time of inspection. Culverts crossing under McKinley Avenue were free of debris and sediment buildup.

The Railroad Gulch drainage is typically dry with the exception of snowmelt and heavy precipitation. Surface water sample collected during higher flow conditions exceed the AWQC for dissolved arsenic, dissolved cadmium, and dissolved zinc.

This Five-Year Review Report documents that no issues currently exist with the performance of the Railroad Gulch Phase I remedy.

Question B: 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 for the various gulch remedial actions.

Section 4.2 summarizes the ARARs review for the applicable OU 2 decision documents. None of the standards identified in Section 4.2 call into question the protectiveness of the Phase I gulch remedies.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No new information has come to light that could call into question the protectiveness of the remedy. The Phase I gulches remedy has been fully implemented within the Box. A portion of the gulches property was transferred to the State of Idaho, and then to a third party for beneficial use for the community. A golf course is currently being developed on a portion of the gulches and on the lower hillsides. This development has been implemented consistent with the ICP, which ensures installation of human health barriers for the altered use (i.e., residential, recreational, and commercial). PHD has issued the permits for this activity and conducted oversight of the activities.

The effectiveness evaluation of the Phase I source control and removal activities to meet the water quality improvement objectives of the 1992 OU 2 ROD was completed and has been used to determine appropriate Phase II implementation strategies and actions. A detailed summary of the Phase II remedy development is provided in Section 2.7.

The 2005 Five-Year Review Report (USEPA, 2005) contained a Gulches section that presented an issue and recommendations related to the biological resources monitoring program within the gulches. In this 2010 Five-Year Review Report, all OU 2 biological resource monitoring information is presented in Section 4.4.2.

Remedy Issues and Recommendations

No remedy issues or recommendations were identified for the gulches remedial actions.

4.3.5 Smelterville Flats

The boundaries of the Smelterville Flats area are the northern bank of the SFCDR floodplain, Pinehurst Narrows to the west, the city of Smelterville on the south, and the I-90 West Kellogg interchange on the east (Figure 4-7). The Shoshone County Airport and runway are located in the Flats area north of I-90.

In response to complaints from agricultural interests downstream, mining companies in the Silver Valley constructed a series of plank and pile dams upstream from OU 2, and one large plank and pile dam in the Pinehurst Narrows area in 1910. The plank and pile dam impounded tailings in the SFCDR floodplain in the Smelterville Flats area from OU 2 and upstream sources. In 1926, construction of the Page Pond tailings impoundment began, followed in 1928 by the CIA to act as tailings impoundments for Page and Bunker Hill Mine concentrators and mines, ending direct discharge of tailings and mine wastes from OU 2 sources directly to the SFCDR. Upstream mines and mills continued to discharge tailings directly to the SFCDR and its tributaries until 1968. Flooding in the earlier decades of the last century resulted in the failure of the plank and pile dam at Pinehurst Narrows. Tailings and other mine wastes from Bunker Hill and upstream sources that had been impounded behind the plank and pile dam were redistributed downstream and intermixed with the SFCDR floodplain and stream channel within OU 2. After 1933, the mining companies reworked the tailings in Smelterville Flats in an attempt to recover metals since ore processing techniques improved.

4.3.5.1 Review of ROD, ROD Amendment, and ESD Requirements

Table 4-24 presents the remedial actions required by the 1992 OU 2 ROD, the 1998 OU 2 ESD, and the 2001 OU 2 ROD Amendment for Smelterville Flats.

4.3.5.2 Smelterville Flats Soil Excavation Goals

The removal excavation goal for Smelterville Flats south of I-90 was 1,000 mg/kg lead. The site-specific removal excavation goals for Smelterville Flats north of I-90 were 3,000 mg/kg lead and 3,000 mg/kg zinc. These site-specific goals were based on a number of factors: concentrations found in the sediments typical of the SFCDR, dewatering limitations, the presence of physical barriers (e.g., large woody vegetation next to the river), and the presence of native alluvial material overlying and commingled with tailings throughout the area. Although a significant volume of tailings was removed from the Flats north of I-90, a complete removal was not necessary in order to achieve RAOs. Few removals were conducted in areas near and north of the SFCDR. The areas that were excavated, and most of the areas where contamination remained and where material was too coarse to support vegetation, were capped or constructed with clean materials (less than 100 mg/kg lead).

Topsoil was placed in the upland and floodplain areas and clean rock was placed in the primary river channel construction areas. Capping and revegetation were employed to prevent direct contact with underlying contaminants by humans and animals and to stabilize the floodplain and minimize erosion.

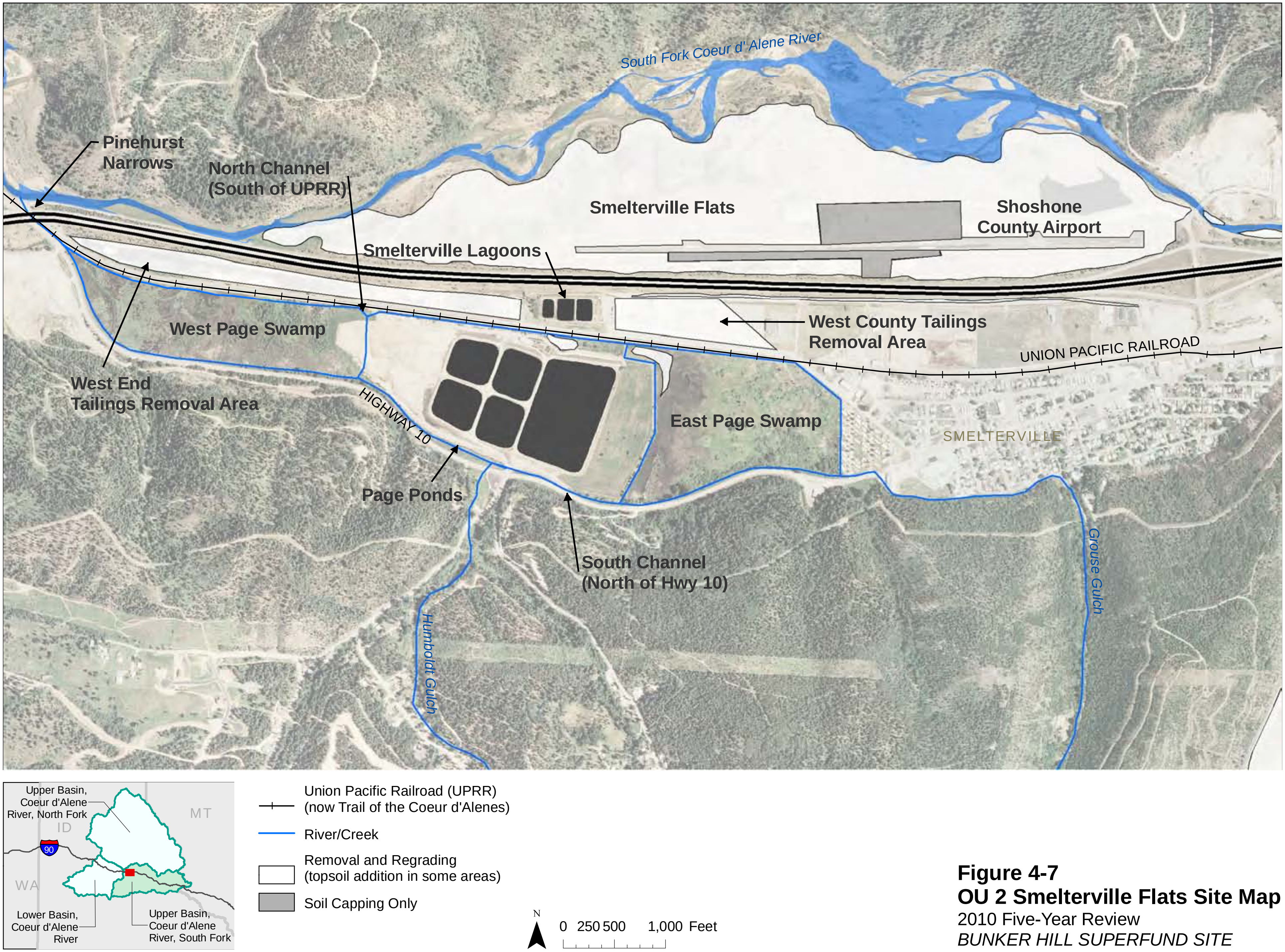

Figure 4-7
OU 2 Smelterville Flats Site Map
2010 Five-Year Review
BUNKER HILL SUPERFUND SITE

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TABLE 4-24
Smelterville Flats Remedial Actions Required
2010 Five-Year Review, Bunker Hill Superfund Site

Requirement	Remedial Action Objective/Goal
1992 OU 2 ROD	
Rock/vegetation barriers on truck stop and RV park (Section 9.2.2)	Minimize direct contact
Temporary dust control during remediation; revegetate as part of long-term solution (Section 9.2.2)	Minimize surface water erosion and wind dispersion of contaminants
Soil or rock barriers on exposed contaminated soils and tailings that cannot be revegetated (Section 9.2.2)	Minimize direct contact
Remove tailings as necessary for natural wetland and floodway construction (Section 9.2.2)	Control migration of contaminants to surface and groundwater, minimize the potential need for future water treatment
Construct groundwater treatment wetland system upstream from Pinehurst Narrows (Section 9.2.2)	Control migration of contaminants to surface and groundwater
Construct collected water wetland treatment system (Section 9.2.2)	Treatment of specific surface waters collected at the site, reduction of contaminants to SFCDR
Construct floodway for SFCDR (Section 9.2.2)	Minimize surface water erosion and sedimentation
1998 OU 2 ESD	
Treatment Wetlands, if constructed will most likely be located in an area different from Smelterville Flats	Treatment of specific surface waters collected at the site, reduction of contaminants to SFCDR
Runoff controls will be constructed south of I-90 in areas expected to be developed and paved	Minimize infiltration and percolation into underlying contaminants
2001 OU 2 ROD Amendment	
Treatment of select site waters originally slated for the wetland treatment systems will occur at the CTP	Provides an alternate location for water treatment

4.3.5.3 Background and Description of Phase I Remedial Actions

Table 4-25 summarizes the remediation activities conducted in the Flats from 1996 to 1998 as reported in the 2000 Five-Year Review Report for OU 2 (USEPA, 2000).

4.3.5.4 Actions Since Last Five-Year Review (2005-2010)

The Smelterville Flats Phase I remedy was fully implemented in 2001. Shoshone County subsequently received a grant to improve the airport. Runway and taxiway improvements have been completed, and hangar and other development activities are planned. Prior to runway and taxiway improvements, excavation and filling to create appropriate grades was completed with, in part, materials that were transported from other ICP-permitted projects in the Box (51,881 cy since 1995.) This fill work began prior to the 2005 Five-Year Review and has continued into the current review period. PHD reports that fill placed at the airport has been capped in compliance with the requirements of the ICP. PHD indicates that this activity has also been taking place in other areas within the Box (OU 1 and OU 2).

TABLE 4-25
Smelterville Flats Remedial Actions Conducted
2010 Five-Year Review, Bunker Hill Superfund Site

The truck stop and recreational vehicle (RV) park are outside of the area defined as Smelterville flats above, but were required to receive a remedy in accordance with the 1992 OU 2 ROD. These two areas are located north of the SFCDR and east of the Theatre Bridge (Figure 4-1) and were capped in the early 1990s. In 1996 to 1997, additional clean material was placed on the RV park (Chavez, 2000). Re-capping of the truck stop area was partially accomplished with a 6-inch layer of topsoil placed over the portion of the property owned by the truck stop. Additional capping consisted of asphalt and shoulder gravel.
USEPA and the State removed tailings from the SFCDR floodplain in 1997 and 1998. The ‘Emerald Pond’ area just west of Theatre Bridge was one of the first completed areas of tailings removal and reconstruction. Grasses and forbs were hydroseeded throughout the Flats area to begin establishment of herbaceous cover.
Tailings were extensively removed in Smelterville Flats north of I-90. The site-specific removal goals for this area were 3,000 mg/kg lead and 3,000 mg/kg zinc. These site-specific goals were based on a number of factors: concentrations found in the sediments typical of the SFCDR, dewatering limitations, the presence of physical barriers (e.g., large woody vegetation next to the river), and the presence of native alluvial material overlying and commingled with tailings throughout the area. Although a significant volume of tailings was removed from the Flats north of I-90, a complete removal was not necessary in order to achieve RAOs. Few removals were conducted in areas near and north of the SFCDR. The areas that were excavated, and most of the areas where contamination remained and where material was too coarse to support vegetation, were capped or constructed with clean materials (<100 mg/kg lead), i.e., 6 to 8 inches of topsoil in the upland and flood plain areas and clean rock in the primary river channel construction areas. The tailings removed within the Flats area north of I-90 were transported to the CIA for disposal. The larger-scale removal is expected to result in less migration of contaminated sediment to surface water and groundwater in the Flats area. Capping and revegetation was done to prevent direct contact with underlying contaminants by humans and animals and to stabilize the floodplain and minimize erosion. Performance monitoring continues to determine the effects of this larger-scale removal action in relation to water quality improvement at the Site.
All areas surrounding the SFCDR upper bank and throughout much of the reconstructed floodplain were hydroseeded.
Surface soil or rock barriers, particularly in the East of Theatre Bridge area of the SFCDR, were placed in lieu of complete removals.
Floodway work for the SFCDR to improve groundwater and surface water quality consisted of: • Grading back the riverbanks • Armoring the lower bank with riprap • Creating a flatter sloped upper bank protected with a combination of riprap, growth media, and live branch plantings • Construction of spillways and sills in the river channel • Construction of low flow channels and overflow channel in the floodplain • Reseeding native, organically enriched topsoils across much of the Flats
Tailings were also removed south of I-90 and were hauled to the CIA for disposal. The removal goal was 1,000 mg/kg lead. The south of I-90 removal areas were re-graded for drainage purposes, and clean borrow soil from the Borrow Area was placed to bring the excavations to a suitable grade for long-term drainage The remediated areas were revegetated to protect the surface cap and to minimize erosion.
Riparian plantings of trees and shrubs were installed during late 2000 and 2001. Noxious weed control programs have been conducted in the north of I-90 Flats area periodically from 2001 through 2004 by USACE.
Improvements to surface water runoff control were implemented in 2001. These improvements consisted of a vegetated swale and storm drain pipe parallel to I-90 from about the Smelterville highway interchange west approximately 6,500 feet to a sedimentation pond in the West End removal area.
The S&P truck stop was capped by the PRP in 2001; however, when the waste rock used for the cap was found to be contaminated, USACE re-capped the area in the summer of 2001 with a minimum 6-inch rock layer to prevent contact with underlying contaminated soils and to prevent dust. In addition, an asphalt cap was constructed in the fueling and turn-around areas to prevent re-exposure of underlying contaminated soils in these high traffic areas.

A formal process governing this type of activity in the Box currently does not exist. However, USEPA and IDEQ have agreed to evaluate and develop a policy that establishes the appropriate precautions, practices, and documentation requirements that would allow fill activities to be conducted in a manner consistent with cleanup objectives of the OU 1, OU 2, and OU 3 RODs. This policy, referred to as the Community-Fill Policy (CFP), is currently under development and is intended to be applicable to all OUs at the Site when completed but initially would be geographically restricted to the Box and the Upper Basin. Community engagement would be included in the development of the CFP. The adoption of a CFP would be conducted though an ESD or other similar vehicle and would incorporate community input prior to being finalized.

Operation and Maintenance

Biannual inspections of the Smelterville Flats remedial action are conducted by the State of Idaho. During this review period, the Smelterville Flats action has required no maintenance to sustain the integrity of the action. A long-term O&M Plan is currently in draft form for Smelterville Flats (publication pending).

The September 2009 IDEQ inspection confirmed the following:

- The wetlands are thriving;
- The south banks of the SFCDR are in excellent condition;
- 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; and
- Patches of spotted knapweed exist.

There are a few small unvegetated areas that appear to be caused by the presence of a white surface coating of a salt. A composite sample of a few of the patches contained 161,000 mg/kg zinc, 1,600 mg/kg cadmium, 1,110 mg/kg calcium, and 291 mg/kg sodium.

Phase I Remedial Action Effectiveness Findings

The effectiveness evaluation of the Smelterville Flats Phase I remedial actions, with respect to water quality and performance standards, is presented in the Phase I Remedial Action Assessment Report (CH2M HILL, 2007b). SFCDR surface water quality appears to have improved with respect to dissolved zinc concentrations, AWQC ratios, and loading.

This suggests that the Smelterville Flats Phase I remedial action is acting to reduce dissolved zinc migration from Smelterville Flats groundwater to the SFCDR and is therefore meeting its RAO.

Decreases in contaminant metal concentrations in groundwater were observed at many of the monitoring wells in Smelterville Flats between the pre- and post-remediation time period. Many of these decreases were noted in monitoring wells located near the SFCDR in the eastern portion of Smelterville Flats. The decreases in concentrations between these time periods at these locations may be more indicative of changes in recharge from the SFCDR and the impacts of upstream remedial actions. However, decreases were also detected in monitoring wells located in the western portion of Smelterville Flats and these would suggest that the Smelterville Flats remedial action has been effective at reducing the amount of contamination in groundwater in these areas and that the full positive benefits of the Smelterville Flats Phase I remedial action have not yet been fully realized.

The biological resource effectiveness monitoring conducted on Smelterville Flats by the U.S. Fish and Wildlife Service (USFWS) for USEPA is discussed in Section 4.4.2 of this document and in monitoring reports prepared by USFWS.

4.3.5.5 Technical Assessment of Remedial Actions

Consistent with USEPA guidance (USEPA, 2001d), technical assessment was conducted by evaluating the following three questions related to protectiveness of the implemented remedial actions.

Question A: Is the remedy functioning as intended by the decision documents?

The Smelterville Flats Phase I remedy is functioning as intended by the decision documents. Specific aspects of the remedy performance evaluation are described below.

As summarized in Table 4-24, the remedial objectives of the Smelterville Flats Phase I remedy are to:

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

Most of the Smelterville Flats Phase I remedy was complete in 1998. Remaining work items were conducted in 2000 and 2001.

Remedy performance of the Smelterville Flats Phase I remedy was evaluated by inspecting the various remedial components that were put in place to achieve the objectives cited above, as follows:

- Soil caps and revegetation. Stable soil caps and vegetation minimize direct contact with contaminants, surface water erosion and wind dispersion of contaminants, and surface water infiltration into underlying contaminants.

- Reconstructed stream banks. Stable stream banks minimize surface water erosion and migration of contaminants to surface water and groundwater.

Based on the above objectives, the site inspection conducted for this Five-Year Review Report focused on the stability of soil caps and reconstructed stream banks and the health of the revegetation efforts. The inspection indicated that the capped areas of Smelterville Flats are stable and provide effective barriers for underlying contaminated material. The vegetation at the Flats was lush and has been regenerating yearly without maintenance efforts. Noxious weed control programs have not been conducted in the Flats during this review period, and the site inspection identified noxious weeds within the Flats. The reconstructed stream banks of the SFCDR in the Flats area are stable and performing adequately to minimize sediment entering into the river.

Evaluating the effectiveness of the Smelterville Flats Phase I remedy with respect to attainment of water quality goals identified groundwater quality improvement in most Smelterville Flats monitoring wells. SFCDR surface water quality appears to have improved with respect to dissolved zinc concentrations, AWQC ratios, and loading. This suggests that the Smelterville Flats Phase I remedial action, coupled with upgradient OU 2 actions, is acting to reduce dissolved zinc migration from Smelterville Flats groundwater to the SFCDR, thus meeting its RAO.

Question B: 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 for the Smelterville Flats remedial action.

Section 4.2 summarizes the ARARs review for the applicable OU 2 decision documents. None of the new or revised standards identified in Section 4.2 call into question the protectiveness of the Smelterville Flats remedy.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

This Five-Year Review did not find any new information that calls into question the protectiveness of the Smelterville Flats Phase I remedy. RAOs for Smelterville Flats are being achieved. Improvements to Smelterville Flats groundwater quality and the SFCDR water quality as it passes through Smelterville Flats have been realized. Erosional processes were not observed during the site inspections conducted in September 2009. Dissolved metals in groundwater exceed the MCLs from several monitoring wells.

The effectiveness evaluation of the Smelterville Flats Phase I actions to meet the water quality improvement objectives of the 1992 OU 2 ROD was completed and has been used to determine appropriate Phase II implementation strategies and actions. Phase II remedial actions are being developed as part of the FFS and include protection of ecological receptors not identified in the 1992 ROD. Reducing the interaction of contaminated groundwater with the SFCDR was considered in the FFS as part of the Phase II remedy development for Smelterville Flats.

Sediment in Smelterville Flats has been sampled by USEPA as part of the BEMP and by USFWS. Elevated metals concentrations, including lead, have been measured in this area and were likely deposited during flooding or peak runoff events. The deposition of contaminated sediments in Smelterville Flats is expected to continue until additional remedial actions are implemented upstream from the Box to address source areas.

The 2005 Five-Year Review Report (USEPA, 2005) contained a Smelterville Flats section that presented an issue and recommendations related to the biological resources monitoring program within Smelterville Flats. In this 2010 Five-Year Review Report, all OU 2 biological resource monitoring information is presented in Section 4.4.2.

Contaminated waste materials from ICP-permitted activities have been disposed of in locations outside of authorized repositories. A formal approved process governing this type of activity in the Box currently does not exist. As discussed above, USEPA and IDEQ are currently developing a CFP that will include the necessary precautions, practices, and documentation requirements to meet the objectives of the OU 1, OU 2, and OU 3 RODs.

Remedy Issues

A summary of issues identified with respect to the Smelterville Flats remedy is provided in Table 4-26.

TABLE 4-26
Summary of Smelterville Flats Remedy Issues
2010 Five-Year Review, Bunker Hill Superfund Site

Remedy Issues	Affects Protectiveness (Y/N)	
	Current (now to 1 year)	**Future (>1 year)**
Community-Fill Policy: ICP waste is being disposed of in locations outside of approved repositories.	N	Y

Recommendations

A summary of recommendations and follow-up actions for the Smelterville Flats remedy is provided in Table 4-27.

TABLE 4-27
Summary of Smelterville Flats Recommendations and Follow-Up Actions
2010 Five-Year Review, Bunker Hill Superfund Site

Recommendations/Follow-up Actions	Responsible Entity	Oversight Agency	Proposed Milestone Date	Follow-up Actions: Affects Protectiveness (Y/N)	
				Current (now to 1 year)	**Future (>1 year)**
Community-Fill Policy: Complete the CFP currently being developed by USEPA and IDEQ for all three OUs.	IDEQ, USEPA	IDEQ, USEPA	12/2012	N	Y

4.3.6 Central Impoundment Area

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 4-8 and covers approximately 260 acres with embankments ranging in height from 30 to 70 feet above the valley floor. The CIA is bordered by I-90 on the north and Bunker Creek on the south.

Figure 4-9 shows the evolution of the CIA from its construction in 1928 through 1977. 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, discussed below. The CIA was built on top of the valley floor as it existed at the time of its construction in 1928. The bottom of the CIA was not lined. The valley floor at that

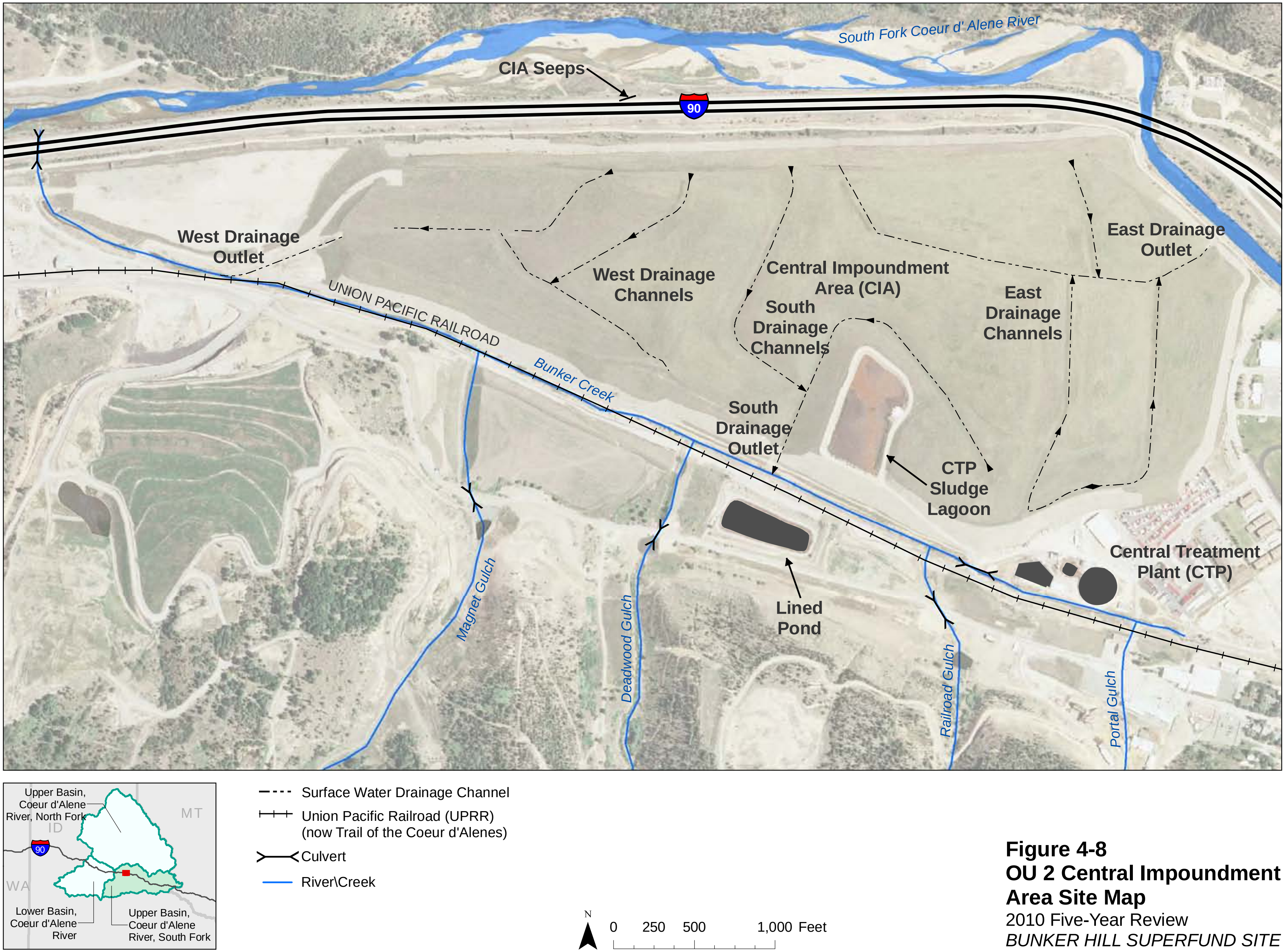

Figure 4-8
OU 2 Central Impoundment Area Site Map
2010 Five-Year Review
BUNKER HILL SUPERFUND SITE

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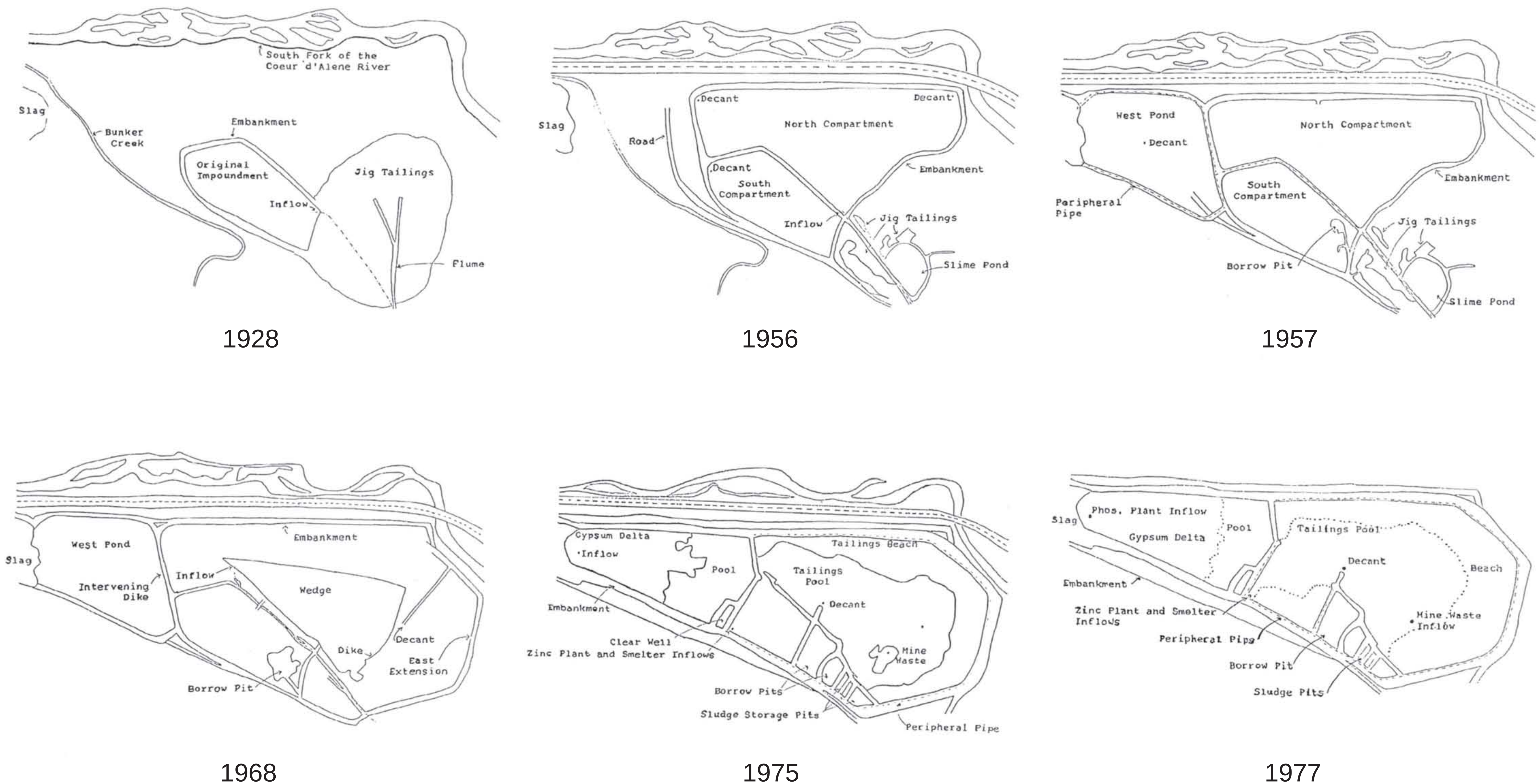


Figure 4-9
Evolution of the Central Impoundment Area
2010 Five-Year Review
BUNKER HILL SUPERFUND SITE

time consisted of jig tailings piles from Bunker Hill mills located near the current southeast corner of the CIA and tailings and waste rock from Bunker Hill and other upstream sources. Historic mapping of the valley floor in this area conducted in 1918 suggests that in the current area of the CIA, the valley floor was mantled with a mixture of jig tailings and alluvium to thicknesses of up to six feet. In the early 1900s, the SFCDR channel was moved from the south side of the valley to the north side of the valley to make room for mining-related facilities. The pre-1900s SFCDR channel is approximately the same as the current Bunker Creek channel.

By 1965, all tailings and effluent generated as a result of Bunker Hill operations were being placed in the CIA. Between 1962 and 1963, 1.2 million cy of tailings were removed from the CIA to construct the I-90 road embankment in the Kellogg area. In 1969, AMD from the Bunker Hill Mine began to be placed in the east cell of the CIA and decanted to SFCDR. In 1974, the AMD was decanted to the CTP, located at the southeast corner of the CIA, for treatment by lime precipitation. Placement of gypsum and process water from the Phosphoric Acid/Fertilizer Plant to the west cell of the CIA began in 1970. Disposal of operational and process waste streams to the CIA was mostly discontinued when industrial operations at the facility ceased in 1982. AMD from the Bunker Hill Mine continued to be placed in the east cell of the CIA and decanted to the CTP until the construction of the lined pond facility in 1995.

In general, tailings and gypsum were delivered to the CIA as slurries. The liquid portion of these slurries and the process effluent and AMD streams were either decanted or allowed to infiltrate through the CIA to the valley floor and eventually to groundwater and surface water near the CIA. The construction methods used to construct embankments and dikes within and surrounding the CIA led to the creation of preferential seepage pathways for CIA liquids. This resulted in a significant amount of seepage from the CIA to surrounding groundwater and surface water.

From the late 1960 through the 1970s, seepage from the CIA was investigated on several occasions. Of particular concern were discrete seepage locations on the southern bank of the SFCDR located coincident with the dividing dike between the east and west cells of the CIA, and another location near the west end of the CIA. During these investigations, it was found that an old stream channel consisting of clean gravel was located under the dividing dike between the east and west cells of the CIA that extends to the discrete seepage location in the south bank of the SFCDR. As stated above, the method of dike construction resulted in dikes acting as preferential seepage pathways. Seepage from the east and west ponds was moving through the dike down to the old stream channel and traveling to the SFCDR. At the time, it was believed that seepage from the CIA was entering the old stream channel and mixing with groundwater from the shallow aquifer in the area and discharging to the SFCDR.

Since the closure of the CIA with an impermeable cap in 2000, the discharge rates measured at these seeps 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.

4.3.6.1 Review of ROD, ROD Amendment, and ESD Requirements

Table 4-28 presents the remedial actions required by the 1992 OU 2 ROD, the 1998 OU 2 ESD, and the 2001 OU 2 ROD Amendment for the CIA.

TABLE 4-28
Central Impoundment Area Remedial Actions Required
2010 Five-Year Review, Bunker Hill Superfund Site

Requirement	Remedial Action Objective/Goal
1992 OU ROD	
Temporary dust control measures (Section 9.2.3)	Minimize releases from this source
Collection of upper zone groundwater north of the CIA for wetland treatment (Section 9.2.3)	Maximize efficient interception of contaminated groundwater from the “CIA seeps”
Repository for consolidation of tailings, gypsum, and other non-principal threat materials removed as part of site removals. (Section 9.2.3)	Prevent direct contact and minimize infiltration through contaminated media
Close CIA with a cap having a hydraulic conductivity of 1X10-6 cm/sec or less, and revegetate. (Section 9.2.3)	Minimize infiltration and control erosion
1998 OU 2 ESD	
Consolidation of industrial waste landfills to the CIA	Prevent direct contact and minimize infiltration through contaminated media
Consolidation of Arizona Mine Dump rock to the CIA	Prevent direct contact and minimize infiltration through contaminated media
Limited quantities of mine waste from other areas of the Coeur d’Alene Basin may be disposed in the CIA	Prevent direct contact and minimize infiltration through contaminated media
Close CIA without removing approximately 30,000 cy of suspected principal threat materials	Increased protectiveness is provided by a lower permeability cap (1X10-7 cm/sec), that is specified in the ROD
2001 OU 2 AMENDMENT	
Create lined sludge impoundment on southeast corner of the CIA after reaching capacity of existing sludge impoundment	Provide location for CTP sludge disposal, reduce water introduced to CIA materials

4.3.6.2 Background and Description of Phase I Remedial Actions

Table 4-29 summarizes the CIA remedial actions implemented as part of the OU 2 remedy.

4.3.6.3 Actions Since Last Five-Year Review (2005-2010)

The CIA Phase I remedy was fully implemented in 2000.

TABLE 4-29
Central Impoundment Area Remedial Actions Conducted
2010 Five-Year Review, Bunker Hill Superfund Site

In 1995 site removal materials and demolition debris from the Mine Operations Area began to be consolidated in the closure area. During 1999, residential soil from USEPA's yard removal program in the Coeur d'Alene Basin was deposited in the CIA. In addition, some contaminated soil from the State of Idaho Trustee projects was also disposed in the CIA.
From 1997 through 1999, approximately 1.2 million cy of tailings from the Smelterville Flats, and additional material from the mine waste dumps and soil from gulch removal actions, were placed and graded on the CIA. From 1999 to 2000, a geomembrane cover system was installed on the surface of the CIA with the exception of approximately 5 acres where the CTP sludge disposal cell is located. The cover system consists of a slag cushion layer, a geomembrane, a slag drainage layer, growth media, and vegetation at the surface. Drainage channels convey surface water off the cover to three discharge points along the CIA perimeter; two drainage channels discharge to Bunker Creek, and the remaining channel discharges to the SFCDR. The side slopes of the CIA were either covered with a minimum 6-inch layer of growth media and vegetated or were rocked depending on the steepness of the slope. The geomembrane cover placed on the CIA and the vegetation and rock placement on the exterior slopes are permanent means to mitigate dust from the CIA. The cap also reduces infiltration of water and metals migration. The area was fenced to prevent unauthorized access.
Remedial design evaluations indicated that it was not cost-effective to collect and treat the CIA seeps, and that once the CIA cap was completed and stormwater controls in place, 90 percent of the seepage in the CIA tailings pile would drain in 10 to 15 years without active collection (CH2M HILL, 1996). The seeps are routinely monitored since placement of the CIA geomembrane cap to evaluate whether the seepage flow and concentration is decreasing over time.
In 2001, perimeter fencing was installed to limit access to the CIA and final grading of access roads was completed.

Operation and Maintenance

The State of Idaho performed an annual inspection of the CIA Phase I remedial actions. During this review period, the CIA has required no maintenance to sustain the integrity of the action. A long-term O&M Plan has been finalized for the CIA. The September 2009 IDEQ inspection confirmed the following:

- The soil barrier is protective;
- There is no noticeable differential settlement;
- A few minor bare areas exist;
- No erosion is occurring; and
- The facility is functioning as designed.

For unknown reasons, bunch-type grasses are doing well on the south side of the CIA but not on the north side. Conversely, non-bunch-type grasses are doing well on the north side but not the south. Noxious weeds, especially spotted knapweed, have aggressively populated the soil cap locally. An independent evaluation was completed in 2008 by employees of Shoshone County Noxious Weeds and USFS. Their evaluation concluded that fire would destroy the well-established and beneficial bunch grasses and that release of spotted knapweed root weevils might be a solution. Weed control is not an element of the remedial action, but rather a property owner obligation.

Phase I Remedial Action Effectiveness Findings

The effectiveness evaluation of the CIA Phase I remedial actions with respect to water quality and performance standards are presented in the Phase I Remedial Action Assessment Report (CH2M HILL, 2007b). The CIA Phase I remedial action is meeting its RAOs and performance standards as defined in the 1992 OU 2 ROD for the portions of the remedy that were implemented in Phase I.

Overall water quality in the upper aquifer in the vicinity of the CIA appears to be improving, which suggests that the CIA Phase I remedial action has had a positive impact on water quality. However, it should be noted that the majority of the benefit to water quality in the vicinity of the CIA would be derived from the cessation of water impoundment on the CIA in 1996. Capping of the CIA materials would only be responsible for reducing the amount of precipitation infiltrating through contaminated materials.

Precipitation is relatively minor in comparison to the volumes of AMD, process water, and stormwater placed on top of the CIA.

Dissolved zinc loading in the SFCDR adjacent to the CIA has decreased from the pre-remediation time period to the post-remediation time period largely due to closure of the CIA. However, the CIA is underlain by pervasive historic contamination and hence this reach continues to be the highest source of dissolved metals loading from groundwater to the SFCDR in the Upper Basin. Contaminant concentrations in the vicinity of the CIA, in both surface water and groundwater, continue to exceed ARARs at the majority of sampling locations.

4.3.6.4 Technical Assessment of Remedial Actions

Consistent with USEPA guidance (USEPA, 2001d), technical assessment was conducted by evaluating the following three questions related to protectiveness of the implemented remedial actions.

Question A: Is the remedy functioning as intended by the decision documents?

The Phase I CIA remedy is functioning as intended by the decision documents. Specific aspects of the remedy performance evaluation are described below.

As summarized in Section 4.3.6.1, the remedial objectives of the Phase I CIA Closure remedy are to:

- Prevent direct contact with contaminated material;
- Minimize infiltration through contaminated media; and
- Maximize efficient interception of contaminated groundwater from the CIA seeps.

To date, the first two objectives of the Phase I CIA remedy have been achieved. The interception of groundwater was deferred to the Phase II remedy, which is currently being evaluated as part of the FFS. Therefore, this assessment focuses on the Phase I CIA remedies.

The CIA closure was complete in 2000. The 2005 Five-Year Review Report for OU 2 found no issues for the CIA closure and identified no remaining work elements.

Protectiveness of the Phase I CIA remedy was evaluated by inspecting the various remedial components that were put in place to achieve the objectives cited above, as follows:

- Geomembrane cover system. The cover system (geomembrane, drainage layer, subgrade drainage piping, growth media, and vegetation) prevents direct contact with underlying contaminated material and greatly minimizes infiltration through the underlying contaminants;
- CIA side-slope grading and caps. The re-graded side slopes of the CIA and the ICP caps placed on them (either rock barriers or growth media and vegetation) prevent direct contact with underlying contaminated materials and minimize infiltration; and,
- Surface water conveyance systems. A series of vegetated swales and rock-lined channels convey and channel precipitation and snow-melt off the CIA geomembrane cover and discharge either into Bunker Creek or the SFCDR. While not satisfying a specific remedial objective, the surface water conveyance system is integral to the function and integrity of the CIA geomembrane cover system.

Figure 4-8 shows the general CIA layout and the locations of the various surface water drainage systems that are discussed below.

The September 2009 site inspection showed that the capped area of the CIA was stable and providing an effective barrier to the underlying consolidated waste materials. No evidence of adverse settlement was found. Vegetation on the capped area was lush and regenerating yearly without maintenance efforts. Noxious weeds were observed on the soil cap during the site inspection. Noxious weed control programs have periodically been conducted on the CIA in an effort to control specific weeds; however, a control program has not been recently implemented. Weed control is not an element of the remedial action, but rather a property owner obligation.

The closure runoff control berms and swales were stable and provide effective means to channel runoff off the closure and into rock-lined perimeter discharge points. The rock-lined surface water discharge channels were stable and showed no signs of rock displacement. No Phase I remedy issues were found the CIA closure system.

Groundwater and surface water was evaluated to determine the potential impacts of the Phase I remedial actions on water quality. The CIA Phase I remedial action appears to have had a positive impact on water quality. Dissolved zinc loading in the SFCDR adjacent to the CIA has decreased from the pre-remediation time period to the post-remediation time period. However, this reach continues to be the highest source of dissolved metals loading from groundwater to the SFCDR in the Upper Basin. Contaminant concentrations in the vicinity of the CIA, in both surface water and groundwater, continue to exceed ARARs at the majority of sampling locations.

Based on the findings of the site inspection and review of applicable documents, the Phase I CIA remedy is performing adequately and as intended by the decision documents.

Question B: 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 for the Phase I CIA remedial action.

Section 4.2 summarizes the ARARs review for the applicable OU 2 decision documents. As noted, the SMCRA of 1977 was revised in 2003 to include a requirement that post-action slopes either not exceed the angle of repose of the slope material or have a long-term static factor of safety of 1.3. The slopes of the CIA that were modified as part of the remedy were all designed to have a long-term static factor of safety of 1.5 or greater, therefore, exceeding the slope safety requirements established by the 2003 SMCRA revision. None of the other new or revised standards in Section 4.2 call into question the protectiveness of the Phase I CIA remedy.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

This Five-Year Review did not find any new information that calls into question the protectiveness of the Phase I CIA remedy. As mentioned under Question A, the collection and treatment of groundwater north of the CIA has been deferred to Phase II and is being evaluated concurrent with the preparation of this Five-Year Review.

The CTP sludge lagoon remains the only uncapped portion of the CIA and was addressed during the Phase I evaluation. In accordance with the 2001 OU 2 ROD Amendment, the unlined CTP sludge lagoon on top of the CIA will be capped and replaced when its disposal capacity is reached and the SSC Amendment is signed that allows for full implementation of the 2001 OU2 ROD Amendment. This work is associated with the CTP and is included here for completeness only.

The effectiveness evaluation of the Phase I source control and removal activities to meet the water quality improvement objectives of the 1992 OU 2 ROD was completed and has been used to determine appropriate Phase II implementation strategies and actions. Phase II remedial actions are being developed as part of the FFS, and are designed to protect ecological receptors. The interception of groundwater north of the CIA, identified as an action in the 1992 OU 2 ROD, is being considered as part of the Phase II remedy development for the FFS.

Remedy Issues and Recommendations

No remedy issues or recommendations were identified for the CIA remedy.

4.3.7 Page Pond Area (PRP Action)

This remedial action is being conducted by the Upstream Mining Group (UMG), a PRP group currently composed only of Hecla Mining Company, with oversight by the State of Idaho and USEPA, pursuant to a consent decree (CD). [5]

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 4-10). The area covers approximately 170 acres, including roughly 70 acres of tailings repository and 100 acres of wetlands and riparian habitat comprising the East and West Page Swamps. Approximately 30 acres in the central portion of the inactive 70-acre tailings repository now serves as the site of the PPWTP, a publicly owned facility

[5] Consent Decree; Bunker Hill; United States of America and State of Idaho v. ASARCO Incorporated, Coeur d'Alene Mines Corporation, Callahan Mining Corporation, Hecla Mining Company, Sunshine Precious Metals, Sunshine Mining Company; Civil Action No. 94-0206-N-HLR; May 10, 1994.

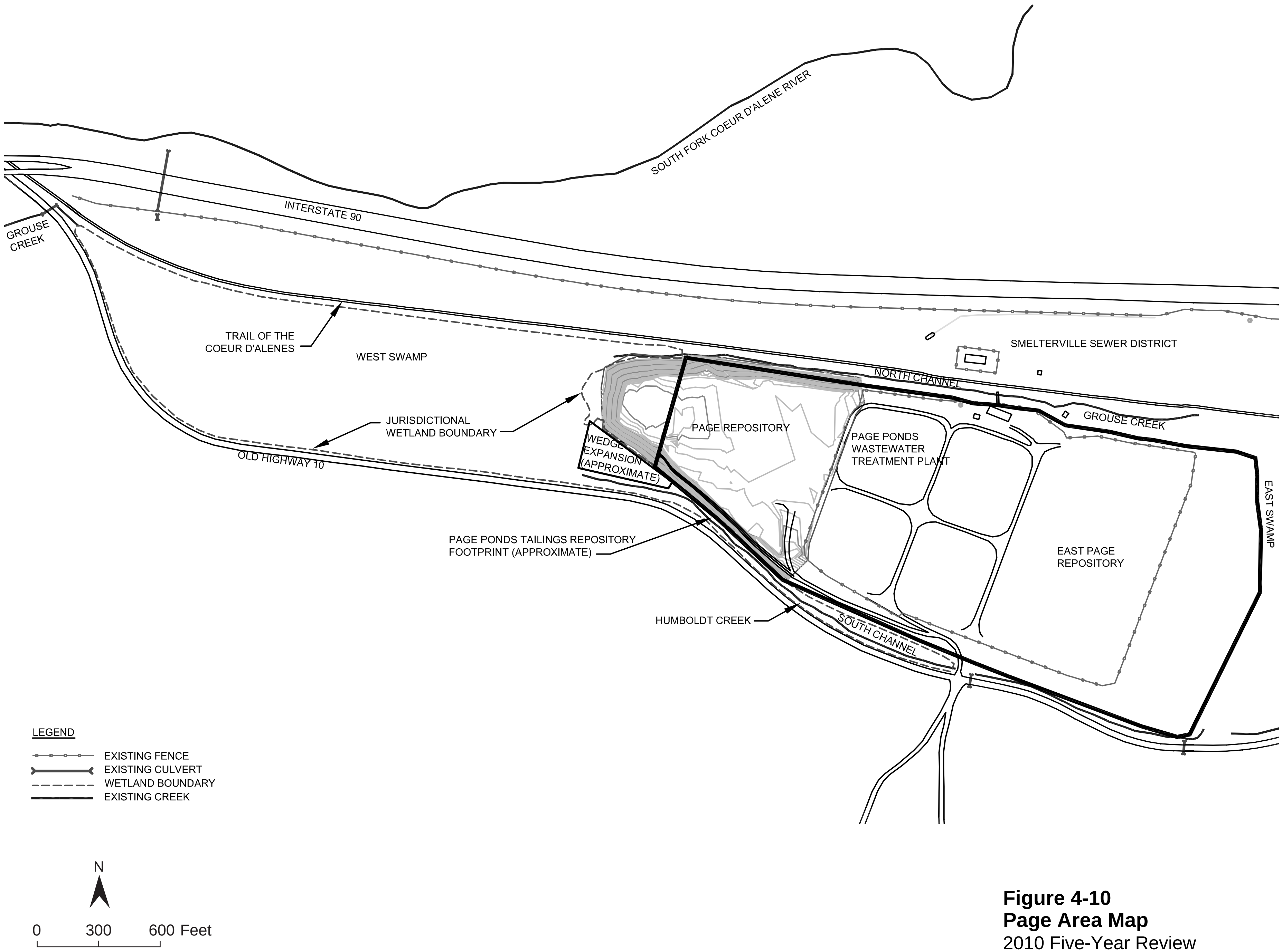


Figure 4-10
Page Area Map
2010 Five-Year Review
BUNKER HILL SUPERFUND SITE

EPA

constructed in 1974. The PPWTP includes four aeration lagoons and a stabilization pond located on top of the tailings impoundment. Treated effluent from the PPWTP is conveyed to an outfall to the SFCDR approximately one-half-mile upstream from the confluence of the SFCDR with Pine Creek.

The Page Repository is essentially surrounded by water, which isolates it from public access except via the access road for the PPWTP. The repository is adjacent to the West Page Swamp on the west and the PWWTP on the east. The wetlands are connected along the north boundary of the repository by the North Channel, which conveys water from the East Swamp to the West Swamp. A smaller channel (the South Channel) is located along the southern boundary of the repository. This channel conveys water that is split by the PPWTP access road. The eastern portion of the channel conveys localized runoff from the southeast corner of the repository and culvert runoff from the south side of Highway 10. This water flows eastward into the East Swamp. The western portion of the South Channel conveys water from Humboldt Creek and water coming from beneath the PPWTP. This water flows westward to the West Page Swamp. Cattails and other wetland plants are thriving in this section of the South Channel, as well as larger shrub and tree populations. The water levels and surface areas of the East and West Swamps fluctuate seasonally. High water levels appear during periods of heavy rainfall and snowmelt in the spring and early summer, and low water levels appear in the late summer and fall dry season.

4.3.7.1 Review of ROD, ROD Amendment, and ESD Requirements

The 1992 OU 2 ROD identified the tailings in the Page Pond area as a source of localized contamination of surface water and groundwater and of windblown dust. Remedial actions specified in the ROD are summarized in Table 4-30**.**

The following specific remedial actions are outlined in the *Bunker Hill Superfund Site, Page Pond Closure Final Remedial Design Report (*RDR; MFG, 1995) (see Section 4.3.7.2).

- The RDR provided for selective removal and stabilization of contaminated soils and wastes around and in the historical mill tailings impoundment;
- The RDR also provided requirements for expansion of the Page Repository, as needed to support the ICP in OUs 1 and 2;
- The RDR design components included upgrades of channels to accommodate peak design flows and installation of water level control weirs at the outlets of the East and West Swamps to maintain a continually submerged condition for residual tailings in the East and West Swamps when possible; and
- The RDR design also prescribed "discharging treated effluent from the PPWTP to the West Swamp, to supplement the natural inflow to the swamps". This was a major component of what became known as "wet closure". Subsequent to issuance of the RDR and with the associated required Page work ongoing, USEPA decided the use of PPWTP discharge did not conform to ARARs, particularly the NPDES requirements specified in the Clean Water Act, Sections 401 and 402.

TABLE 4-30
Remedial Action Requirements for Page Pond
2010 Five-Year Review, Bunker Hill Superfund Site

Requirement	Remedial Action Objectives/Goals	Success Criteria
1992 OU 2 ROD (Section 9.2.4)		
Temporary dust control	Minimize exposure from fugitive dust	Meet ambient air criteria
Institutional controls	Prevent direct exposure to tailings and contaminated soil	Reduce the potential for accidental exposure
Maintenance of existing fencing	Prevent direct exposure to tailings and contaminated soil	Reduce the potential for unauthorized access
Diverting and modifying the channels of Humboldt and Grouse Creeks; consider the effect of modifications on habitat	Isolate the creeks from contact with tailings; minimize habitat destruction	Reduce releases from tailings into surface water; maintain habitats
Removal of exposed tailings from the West Page Swamp area and placement of this material on the Page Pond benches	Minimize exposure from fugitive dust; minimize releases to surface water and groundwater	Meet ambient air criteria; reduce releases from tailings to surface water and groundwater
Regrading, capping, and revegetation of the Page Pond tailings impoundment and dikes after emplacement of West Page Swamp tailings	Minimize exposure from fugitive dust; minimize releases to groundwater	Meet ambient air criteria; reduce releases from tailings to groundwater
Evaluation of wetlands associated with the Page Pond areas for water quality, habitat considerations, and biomonitoring	Minimize habitat destruction	Maintain habitats
Enhancement of existing wetlands in West Page Swamp using hydraulic controls	Improve wetland vegetation and habitats	Enhance vegetation and habitats

4.3.7.2 Background and Description of Remedial Actions

The Page Pond Tailings Repository was used between 1926 and 1969 to contain flotation tailings produced at the Page Mill in Humboldt Gulch. In 1989, USEPA presented various orders to the PRPs to begin remediation of environmental problems within OU 2. In 1994, ASARCO Incorporated, Hecla Mining Company, and Sunshine Mining Company signed a CD[6] with USEPA and committed to implementing remediation at the area known as Page Pond. The PRP is now known as UMG and consists only of Hecla Mining Company.

One key objective of RDR (MFG, 1995) was to close the Page Pond Repository by consolidating and covering the historic tailings.

Currently, the central part of the Page Pond site serves as the PPWTP, which was constructed by the SFCDR Sewer District in 1974. The areas immediately to the east and

[6] Consent Decree; Bunker Hill; United States of America and State of Idaho v. ASARCO Incorporated, Coeur d'Alene Mines Corporation, Callahan Mining Corporation, Hecla Mining Company, Sunshine Precious Metals, Sunshine Mining Company; Civil Action No. 94-0206-N-HLR; May 10, 1994.

west of the PPWTP were used as designated repository areas for contaminated soils removed from the Bunker Hill Superfund Site and are identified as "East Page Repository" and "Page Repository," respectively. The East Page Repository was filled to capacity and has been closed since the mid-1990s.

The need for expanded repository capacity in OU 1 for remaining yard program soils and waste generated through ICP projects was identified prior to the 2005 Five-Year Review (USEPA, 2005). At the time of the 2000 Five-Year Review for OU 2 (USEPA, 2000b), the UMG had only completed removal of tailings from the West Beach, which is in the West Page Swamp area. The UMG conducted additional actions in 2000; however, the UMG has not conducted additional remedial actions in Page Pond since the 2000 construction season. The following are actions completed by the UMG in 2000.

- Exposed tailings in the eastern portion of the North Channel were graded and covered with a 12-inch clean soil barrier and then hydroseeded with native plant species in 2000. During the grading process, the channel also was trimmed to accommodate the design for a 100-year, 24-hour storm flow discharging from the East Swamp.
- An outlet control weir for the East Swamp discharge was constructed across the eastern end of the North Channel. The weir was constructed of compacted earth fill on firm native soil. A geosynthetic liner was placed and capped by a riprap blanket. The sill was cement-grouted at the crest with an armored spillway on the downstream face for erosion control. The weir allows discharge of East Swamp water to an elevation of 2,203.5 feet above mean sea level (msl) and has raised the discharge elevation by approximately 2 feet above the channel. The East Swamp now remains saturated throughout the year.
- An outlet control weir was placed at the discharge point of the West Swamp. The intention was to maintain the water level 2 feet above exposed tailings that remained in the West Beach area. First, the tailings in this area were excavated and removed around the weir location. Second, base material was placed and compacted. To control seepage, a GCL was used on the upstream face of the weir structure and was extended 2 feet below the invert. A cutthroat flume was installed at an invert elevation of 2,189.0 feet with a crest elevation of 2,192 feet. The flume was grouted in place at the weir structure and was covered with a metal enclosure to protect the device from weather damage and vandalism. A riprap blanket on a nonwoven geotextile was placed over the weir structure to increase stability and to provide erosion protection. The disturbed areas were hydroseeded for erosion control.

In addition, USFWS, with funding from USEPA, has completed a biomonitoring report that includes an assessment of waterfowl use of the Page Pond area. The USFWS biomonitoring program is summarized in Section 4.4.2 of this Five-Year Review Report.

4.3.7.3 Actions Since Last Five-Year Review (2005-2010)

Several actions have been completed since 2005:

- Alternatives, designs, and constraints associated with repository capacity have been investigated;

- The surface of the original Page Repository has been graded, seeded, fertilized and mulched;
- A 2-acre expansion has been constructed in a triangular or "wedge" shaped footprint adjacent to the existing south west perimeter. This is known as the Wedge Expansion, and the foundation was completed in November 2009. Details for completion of the Wedge Expansion are contained in the *Draft Bunker Hill Superfund Site (Area 1) 2009 Page Area Construction Completion Report* (UMG, 2009);
- An electric card key gate provides wheeled access only to those persons receiving a permit and card key from PHD;
- A camera was installed at the entrance gate to the repository to ensure that only permitted persons and materials use the repository;
- A chain link fence has been installed along the entire length of the north face of the repository that is adjacent to the Trail of the Coeur d'Alenes;
- Access from Highway 10 is controlled by the natural barrier of Humboldt Creek. Two internal gates have been constructed for the SFCDR Sewer District to access its property. Warning signs are being posted and will be maintained along the fence line and at the gates to alert possible intruders of the potential risk of exposure to contaminated materials within the restricted area (MFG, 1995, 1997a). Access restrictions were inspected on November 13, 2008, and determined to be complete ;
- Interim O&M activities are being conducted at the site, such as maintenance of sediment control facilities (e.g., ditches, sediment traps, flumes) and dust control;
- The 2-acre expansion of the Page Repository is currently jointly operated by IDEQ and UMG because the Repository accepts ICP wastes from both OU 1 and OU 2; and
- USFWS has been conducting biological resource monitoring of the Page Pond area for USEPA; the results are summarized in Section 4.4.2.
- Currently, UMG and IDEQ are developing O&M manuals for both the closed portion of the Page Repository and for the operating repository.
- IDEQ and USEPA are currently developing a Page area sampling and analysis plan for inclusion in the site-wide BEMP.

4.3.7.4 Technical Assessment of Page Pond Remedial Actions

In accordance with USEPA guidance (USEPA, 2001d), technical assessment was conducted by evaluating the following three questions related to protectiveness of the implemented remedial actions.

Question A: Is the remedy functioning as intended by the decision documents?

Biannual site inspections by IDEQ indicate that the remedy continues to function as intended by the ROD. In the last 5 years, the Page Pond area has been the main repository location for Box remedial action waste as well as waste generated through the ICP. IDEQ and USEPA are currently evaluating compliance with the CD and with the requirements of the RDR and the *Bunker Hill Superfund Site, Page Pond Closure Remedial Action Work Plan*

(RAWP; MFG, 1997c). The RDR and RAWP are attachments to the CD and detail work required to be performed by UMG under the CD.

Several challenging situations have arisen in recent years that have affected repository operations. Non-ICP material has periodically been dumped at Page Repository, predominately before installation of the gate camera. PHD has frequently been successful at determining the owner of the non-ICP material and at arranging for the owner to remove the material from Page Repository. Occasionally, large volumes of permitted ICP material have been hauled to the repository with little notice to repository operators. Because the repository is no longer staffed with equipment operators on a daily basis, large hauls with little notice can significantly impede repository traffic and haul routes and efficient final placement of materials into disposal cells.

Question B: 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 are still valid. Section 4.2 summarizes the ARARs review for the applicable OU 2 decision documents. None of the new or revised standards identified in Section 4.2 call into question the protectiveness of the Page Pond remedy.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

This Five-Year Review did not find any new information that calls into question the protectiveness of the Phase I Page Pond remedy.

Remedy Issues

A summary of issues identified with respect to the Page Pond remedy is provided in Table 4-31.

Recommendations

A summary of Page Pond recommendations and follow-up actions is provided in Table 4-32.

TABLE 4-31
Summary of Page Pond Remedy Issues
2010 Five-Year Review, Bunker Hill Superfund Site

Remedy Issues	Affects Protectiveness (Y/N) Current (now to 1 year)	Affects Protectiveness (Y/N) Future (>1 year)
Environmental Monitoring: Although a Page area sampling and analysis plan is under development, a long-term environmental monitoring program has not yet been established.	N	Y
O&M: O&M manuals are under development but not yet completed for the closed portion of Page Repository, the operating portion of Page Repository, or the completed remedial actions.	Y	Y

TABLE 4-32
Summary of Page Pond Recommendations and Follow-Up Actions
2010 Five-Year Review, Bunker Hill Superfund Site

Recommendations/Follow-up Actions	Responsible Entity	Oversight Agency	Proposed Milestone Date	Follow-up Actions: Affects Protectiveness (Y/N)	
				Current (now to 1 year)	Future (>1 year)
Environmental Monitoring: Continue to work with the site-wide monitoring program to integrate special considerations at Page Pond.	UMG, IDEQ, USEPA	IDEQ, USEPA	06/2011	N	Y
O&M: Continue to develop a comprehensive O&M and Site Closure Plan for the Page Repository.	IDEQ, PHD, UMG	IDEQ, USEPA	04/2011	N	Y

The following recommendation does not necessarily affect protectiveness but needs to be addressed: Consider establishing a process whereby advance notice is given to Page Repository operators about large volumes of permitted ICP material planned for disposal at the Page Repository.

4.3.8 Industrial Complex

As defined by the 1992 OU 2 ROD, the Industrial Complex consisted of three main areas: the Lead Smelter (now the SCA), the Zinc Plant (including the Phosphoric Acid Plant), and the MOA (see Figure 4-1). The highest concentrations of contaminant metals within OU 2 were found in the Lead Smelter area. Process material accumulation sites were present within and outside the various facilities. Risk assessments conducted during the remedial investigation resulted in a subset of site process materials that were designated as PTMs based on their higher level of contamination. This section focuses on the remedy implemented for the SCA, the PTM Cell, the BAL, and Area 14. The MOA is discussed separately in Section 4.3.9.

4.3.8.1 Review of ROD, ROD Amendment, and ESD Requirements

Table 4-33 presents the remedial actions required by the OU 2 RODs, ESDs, and the OU 2 ROD Amendments for the Industrial Complex.

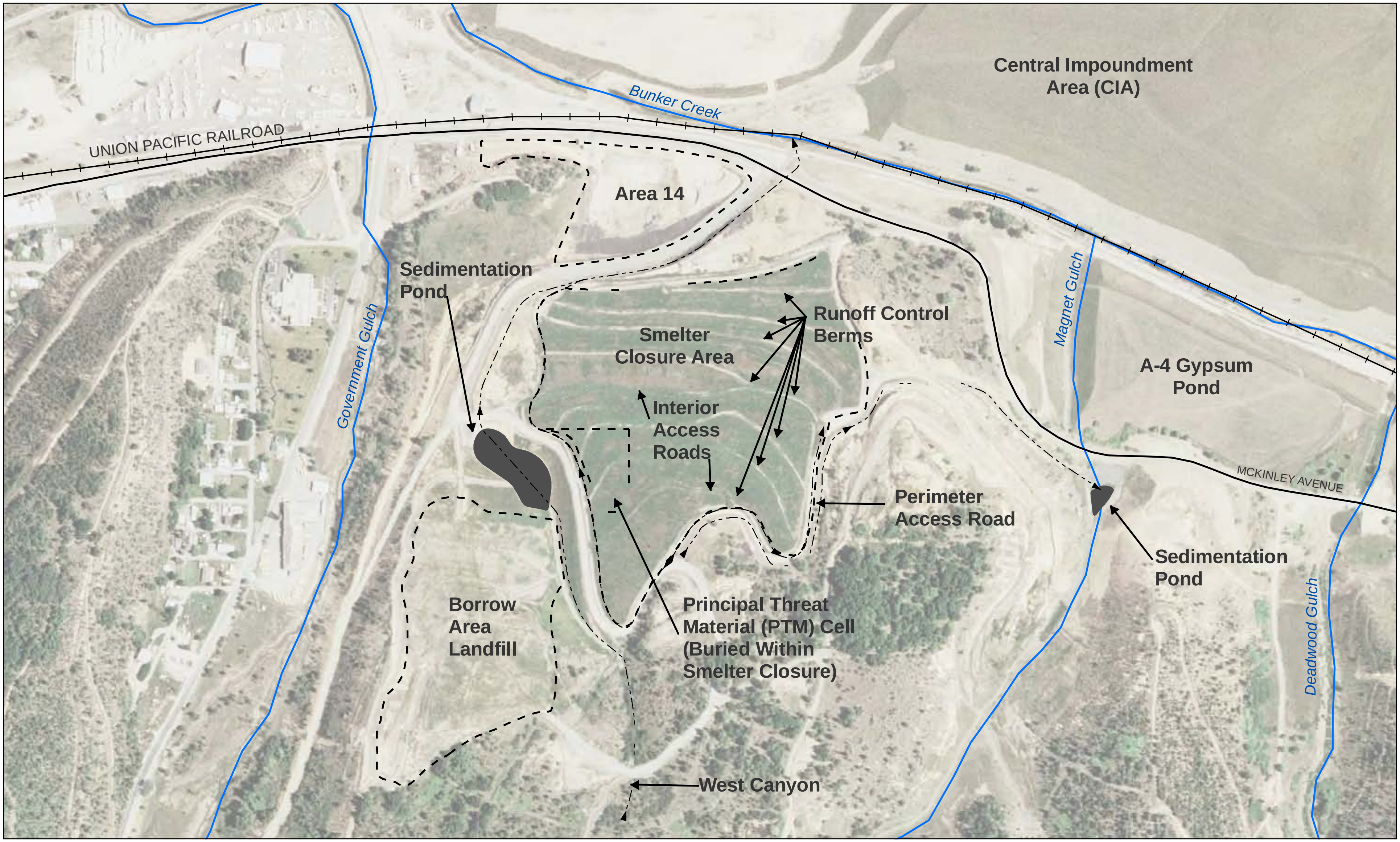
4.3.8.2 Smelter Closure Area and PTM Cell

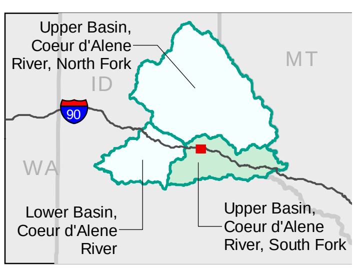
Background and Description of Phase I Remedial Actions

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 4-11) was designed to accommodate up to 420,000 cy of material.

TABLE 4-33
Industrial Complex Remedial Actions Required
2010 Five-Year Review, Bunker Hill Superfund Site

Requirement	Remedial Action Objective/Goal
1992 OU 2 ROD	
Temporary dust control on material accumulation sites (Section 9.2.1)	Control migration of windblown dust
Remove PCB transformers and PCB contaminated soils (Section 9.2.1)	Minimize direct contact risk
Repair or remove asbestos materials (Section 9.2.1)	Minimize direct contact risk
Demolish Lead Smelter, Zinc Plant and Phosphoric Acid Plant structures in-place and cap to reduce infiltration (Section 9.2.1)	Minimize direct contact risk
Relocate Boneyard materials under Smelter Cap (Section 9.2.5)	Minimize direct contact risk
Consolidate under the Smelter Cap: -slag from west cell of CIA - material accumulations including former waste disposal or holding pond sediments within Smelter Complex –contaminated soil, tailings, and mine waste from removal actions conducted within the site boundaries (Section 9.2.5)	Minimize direct contact risk
Close the SCA with a cap having a hydraulic conductivity of 1×10^{-7} cm/sec or less and revegetate to minimize erosion (Section 9.2.5)	Minimize direct contact and infiltration and control erosion
Reprocess principal threat materials (PTM) and other recyclable materials to minimize the volume of materials under the closure cap (Section 9.2.5)	Material reuse
1996 OU 2 ESD	
Place contaminated materials and debris from the Zinc and Phosphoric Acid Plants in the Lead Smelter Closure and eliminate the closure planned for the Zinc Plant Area.	Reduce O&M costs by eliminating Zinc Plant closure.
1996 OU 2 ROD Amendment	
PTMs, except mercury, will be contained under the Lead Smelter Cap in a fully lined monocell. This amends the 1992 OU 2 ROD (Section 9.2.5) that required chemical stabilization of all PTMs. Mercury contaminated material will be stabilized Consistent with the 1992 OU 2 ROD.	Minimize direct contact risk and reduce potential for migration to groundwater
1998 OU 2 ESD	
Demolish 4 stacks in the Lead Smelter and Zinc Plant	Minimize direct contact risk
Maintain the Zinc Plant Concentrate Handling Building and Warehouse Building so that these structures can be turned over to the county for use as maintenance facilities.	Decontaminate structures to minimize direct contact risk
Demolish the Phosphoric Acid Plant Warehouse	Minimize direct contact risk and imminent safety hazard
2001 OU 2 ROD Amendment	
In lieu of constructed wetlands treatment as described in the 1992 OU 2 ROD, contaminated flows from the SCA PTM cell drainage, closure toe drain flow, and flow from an abandoned stormwater drain line originating south of the closure area) will be treated in an upgraded Central Treatment Plant. (Note: since completion of the Smelter Closure in 1998, these contaminated flows have been treated at the existing CTP as an interim measure).	Reduction of contamination to surface water and groundwater





Surface Water Drainage Ditch
River\Creek
Union Pacific Railroad (UPRR) (now Trail of the Coeur d'Alenes)

N
0 125 250 500 Feet

Figure 4-11
OU 2 Smelter Closure Area Site Map
2010 Five-Year Review
BUNKER HILL SUPERFUND SITE

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The SCA remedy presented in Table 4-34 was implemented between 1995 and 1998.

TABLE 4-34
Smelter Closure Area Remedial Actions Conducted
2010 Five-Year Review, Bunker Hill Superfund Site

Demolition debris from the Lead Smelter, Phosphoric Acid, and Zinc Plants was consolidated in the Smelter Closure area.
Boneyard soil and larger wood and metal debris was also deposited in the general Smelter Closure area.
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 was constructed within the boundary of the Smelter Closure in 1996. This geomembrane-lined mono-cell has a seep collection system that conveys seepage, if generated, to the Sweeney pump station and eventually to the CTP for treatment.
PTMs (including the copper dross flue dust relocated from Magnet Gulch) and stabilized mercury contaminated materials were deposited in the PTM cell beginning in 1996. The PTM volume placed in the cell was not surveyed; however, based on general elevations of the top geomembrane cover, it is estimated that about 80,000 to 100,000 cy of PTMs are contained in the PTM cell. The PTM cell was closed with a geomembrane cover in 1997. Contaminated soil from other site removal actions was placed on top of the PTM Cell cover as needed to complete the overall grading of the SCA.
A shallow 3 to 4-foot deep “toe-drain” was constructed along a portion of the northern edge of the closure area to collect underdrain flow and convey this water to the Sweeney Pump Station for eventual treatment at the CTP.
The Smelter Closure area 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.
A perimeter fence with locking gates was constructed around the SCA as an institutional controls measure to prevent access to the area.
In 2004, a gravity collection and conveyance system for drain water collected from the SCA sources described above was designed to replace a pumped system that conveyed water to the Lined Pond for eventual treatment at the CTP. The gravity system was constructed in 2005. The system included a new collection manhole to combine PTM Cell drainage and Smelter Closure drainage, and a 6-inch HDPE pipeline to convey the drain water to the Lined Pond.

Actions Since Last Five-Year Review (2005-2010)

The SCA Phase I remedial action was fully implemented in 1998. In 2007, the SCA parcel was conveyed from USEPA to the State of Idaho with use restrictions incorporated into the transfer deed. In 2009, a small southern portion of the SCA parcel (4.9 acres) was subdivided from the landfill portion and transferred to a third party. The remedial action conducted on the transferred parcel consisted of installation of a 6-inch clean barrier only.

Currently, large-scale development activities (described in previous sections) are occurring in the upper Magnet Gulch and lower hillsides area that include construction of a golf course community 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). Prior to construction of these replacement features, IDEQ reviewed design plans to ensure that the original objective of the remedial action features was met by the replacement designs. According to the 1996 OU 2 ROD Amendment, the purpose of the West Canyon diversion is to reduce groundwater elevations upgradient from the SCA. Although groundwater elevations have remained below the bottom of the PTM monocell during this review period, sampling and groundwater elevation measurements of the SCA groundwater monitoring wells will continue.

Over-irrigation of the golf course upgradient from the SCA may result in increased infiltration into the groundwater system. However, proper irrigation of only the top few inches of topsoil as is generally done on golf courses is not expected to adversely affect the remedy.

Operation and Maintenance

The State of Idaho has been performing periodic inspections of the SCA Phase I remedial action. During this review period, saplings have been observed growing on the SCA landfill cap. Sapling removal was conducted by USACE in 2007, and by the State in 2009. A site inspection of the developed areas surrounding the SCA was conducted on February 25, 2009. Inspection findings confirmed the following:

- Remedial action features are in excellent condition and functioning as designed;
- There is no erosion, differential settling, or bare vegetated areas; and
- Nine conifers and five deciduous shrubs were found on the landfill and subsequently sprayed with herbicide.

A long-term O&M Plan has been finalized for the SCA. IDEQ retains O&M responsibility for the landfill, the channel from the landfill to the lower Magnet sedimentation basin, and the channel leading from the detention basin to Bunker Creek.

Phase I Remedial Action Effectiveness Findings

The effectiveness evaluation of the SCA Phase I remedial actions, with respect to water quality and performance standards, is presented in the Phase I Remedial Action Assessment Report (CH2M HILL, 2007b). The SCA Phase I remedial action is performing as intended and has had a positive impact on groundwater quality in the vicinity of the SCA. Groundwater in the vicinity of the SCA is below the elevation of SCA materials and the bottom of the PTM monocell. However, dissolved cadmium and dissolved zinc concentrations exceed the MCLs in site groundwater, though to lesser levels than they had previously.

4.3.8.3 Borrow Area Landfill

Background

The BAL (Figure 4-11) was developed in 1997 and 1998 to provide "clean" fill for several of the site remediations (CH2M HILL, 2002). A portion of the BAL was subsequently used to dispose lower-level contaminated soil and solid waste from the upper industrial landfill located in Railroad Gulch. Table 4-35 presents activities conducted at the BAL.

TABLE 4-35
Borrow Area Landfill Activities
2010 Five-Year Review, Bunker Hill Superfund Site

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 Borrow Area Landfill, was constructed in 2000 to accept contaminated soil and waste generated by the remaining remedial actions at the site.
Approximately 79,000 cy of solid waste from the upper industrial landfill were placed in the Borrow Area Landfill during the 2000 construction season.
In 2001, approximately 111,000 cy of waste were disposed in the BAL. The disposed material consisted of mine tailings, contaminated soils, railroad wastes, wood wastes, and other waste materials
The BAL closure was performed in 2002. Closure components consisted of final grading on the BAL, modifications to surface water management to provide a long-term system, placement of a soil cover, hydroseeding, and establishing settlement monitoring points.

Actions Since Last Five-Year Review (2005-2010)

The BAL activities were complete in 2002. In 2006, the State of Idaho transferred the BAL property to a third party. Currently, large-scale development activities are occurring in the vicinity of the BAL that include construction of a golf course community and associated infrastructure. The BAL has been converted to a golf course and an associated pond. Conditions in the vicinity of the BAL are expected to change significantly as a result of development activities; however, the development activities with respect to their impacts to the BAL are uncertain.

Operation and Maintenance

The State of Idaho has been performing periodic inspections of the BAL. The February 25, 2009, site inspection of the developed areas of the BAL did not identify issues that would affect the remediation activities conducted at the BAL. A long-term O&M Plan has been finalized for the BAL.

Phase I Remedial Action Effectiveness Findings

No groundwater or surface water data were available for review as part of the Phase I remedial action effectiveness evaluation. Samples were collected from two monitoring wells located downgradient from the BAL beginning in 2007; subsequent monitoring data indicates dissolved cadmium MCL exceedances from one of the two wells. The BAL cannot be fully evaluated due to the limited data available for this site. The BAL does present a potential source of contamination to the hillsides groundwater system. The BAL was capped with a soil cap and would not be expected to greatly reduce the infiltration of precipitation and snowmelt in comparison to native materials. However, the final grading of the BAL cap was designed to encourage runoff from the BAL rather than infiltration. Impacts on groundwater as a result of development on top of the BAL are uncertain.

4.3.8.4 Area 14

Background

Area 14 is within the Industrial Complex. This area is approximately 8 acres bounded to the north by McKinley Avenue, to the south by the SCA and Sweeney Heights including the

Road, to the east by the lead smelter, and to the west by Government Gulch Road. 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 leased to Avista Utilities and Williams Gas. A vehicle decontamination station owned and used by the third party property owner is located on the eastern portion of Area 14. The center-northern portion of Area 14 contains the Sweeney Pump Station, which carries wash water from the vehicle decontamination station to the CTP. Area 14 is currently designated for industrial use. Table 4-36 presents activities at Area 14 before 2000.

TABLE 4-36
Area 14 Activities
2010 Five-Year Review, Bunker Hill Superfund Site

Two former sedimentation ponds (Gilges Pond and Sweeney Pond) and known PTM were excavated and backfilled in 1997 and 1999.

Actions Since Last Five-Year Review (2005-2010)

Description of Actions

In 2006, the former Sweeney Mill area was graded to drain and a 6-inch ICP barrier placed. Approximately 120 cubic yards 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 State of Idaho transferred Area 14 property to a third party. Currently, the eastern portion of the site is used by the property owner for vehicle and equipment storage and decontamination. An ICP barrier has not yet been installed within the eastern portion of Area 14 pending development.

Phase I Remedial Action Effectiveness Findings

The effectiveness evaluation of the Area 14 Phase I remedial actions with respect to water quality and performance standards is presented in the Phase I Remedial Action Assessment Report (CH2M HILL, 2007b). Only one groundwater monitoring location is present in Area 14 and is located in the Coke Yard. Water quality improvements have been realized at this well; however, it is unknown to what degree these improvements are the result of changes in areas upgradient from Area 14 or as a result of subsurface removals conducted within Area 14.

4.3.8.5 Technical Assessment of Smelter Closure Area, Borrow Area Landfill, and Area 14 Remedial Actions

Consistent with USEPA guidance (USEPA, 2001d), technical assessment was conducted by evaluating the following three questions related to protectiveness of the implemented remedial actions.

Question A: Is the remedy functioning as intended by the decision documents?

The SCA and BAL remedial actions are functioning as intended by the decision documents. The remedy for Area 14 has yet to be determined; however, the same RAOs will apply. Implementation of the Area 14 remedy will be prioritized with the OU 2 Phase II remedial actions. Progress of the Phase II remedy development is discussed in Section 2.7.

The September 2009 site inspection 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 lush and regenerating yearly without maintenance efforts. 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. No remedy issues were found for the SCA system or for the BAL.

Based on the observations of the site inspection and the Phase I remedy evaluation, the SCA and BAL remedies are performing as designed and in accordance with the decision documents.

Question B: 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 for the SCA remedial action and the BAL activities.

Section 4.2 summarizes the ARARs review for the applicable OU 2 decision documents. As noted, the SMCRA of 1977 was revised in 2003 to include a requirement that post-action slopes either not exceed the angle of repose of the slope material or have a long-term static factor of safety of 1.3. The final slopes of the SCA and BAL were all designed to have a long-term factor of safety of 1.5 or greater, and, therefore, they exceed the slope safety requirements established by the 2003 SMCRA revision.

None of the changes in the new or revised standards in Section 4.2 call into question the protectiveness of the Phase I remedies for the SCA or Area 14 remedial actions or BAL activities.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

This 2010 Five-Year Review did not find new information that calls into question the protectiveness of the SCA remedial action and BAL activities. Even though portions of the remedy have been removed or altered by the third-party development activities and have resulted in the temporary surface water ponding, groundwater elevations continue to be much lower than the elevation of the SCA waste materials. However, the long-term impact of the altered remedy with respect to the BAL and SCA remedial actions is unclear. An ICP barrier has not yet been installed within the eastern portion of Area 14 pending development.

Remedy Issues and Recommendations

Since the 2005 Five-Year Review, no new issues or recommendations have been identified for the Industrial Complex remedy. The previous recommendations to define and implement remedial action at Area 14 and pursue viable solutions to the SSC impasse and implement the 2001 OU 2 ROD Amendment are currently being addressed.

4.3.9 Mine Operations and Boulevard Areas

Figure 4-12 shows the historic location of the Mine Operations and Boulevard Areas. Historically, the MOA consisted of land and ore processing structures bounded on the north by the UPRR and the CTP and on the south by the cut-slope hillsides leading up to the Bunker Hill Mine.

McKinley Avenue bisects the MOA in the east-west direction. 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.

Performance standards for the remedies include:

- Decontamination procedures for offsite salvage that are consistent with the proposed rule for Best Demonstrated Available Technology (BDAT) treatment technologies for contaminated debris (Federal Register January 9, 1992);
- Management of polychlorinated biphenyl (PCB) containing equipment and other regulated wastes in accordance with the Toxic Substance Control Act (TSCA) and the Resource Conservation and Recovery Act (RCRA);
- Management of asbestos-containing materials in accordance with applicable regulations;
- Soil removal goal: Soil with lead concentration greater than 1,000 mg/kg; and
- Placement of a minimum 6-inch-thick clean fill cap over removal areas if surface concentrations are greater than 1,000 mg/kg lead in compliance with ICP requirements for industrial sites. Clean barrier fill is defined as having less than 100 mg/kg lead.

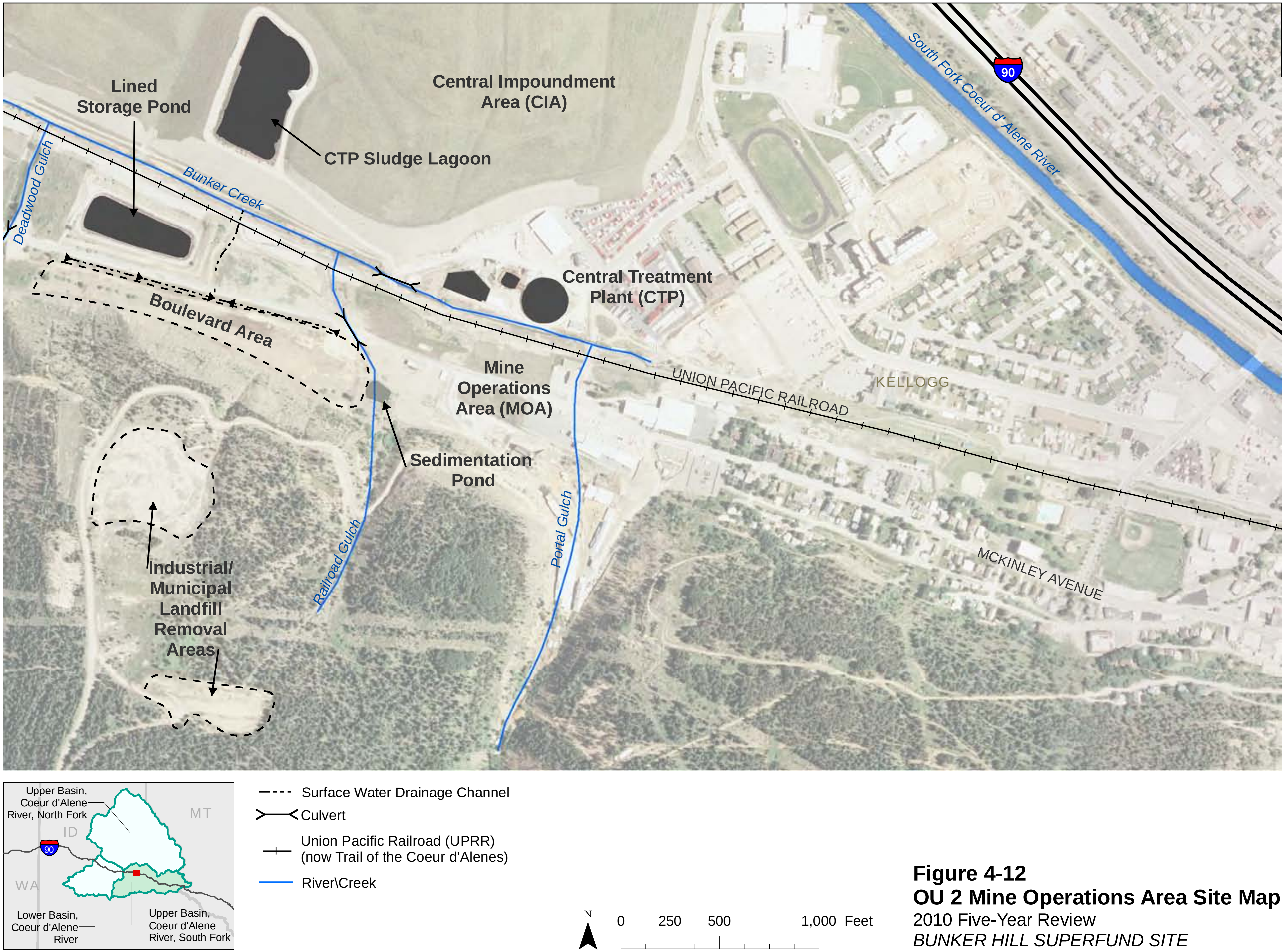
During remediation, the soil removal goal was not achieved in all areas due to the depth and extent of contamination. In these areas, the excavation went as deep as feasible and was then re-graded and capped with an ICP-approved barrier in areas where remaining concentrations were greater than 1,000 mg/kg lead.

4.3.9.1 Review of ROD, ROD Amendment, and ESD Requirements

The required remedial actions outlined in the 1992 OU 2 ROD and the 1996 OU 2 ROD Amendment for the Mine Operations and Boulevard Areas are described in Table 4-37.

4.3.9.2 Background and Description of Phase I Remedial Actions

The mining and ore-processing structures and facilities that were included in this remedial action of the MOA consisted 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. The RI (MFG, 1992b) indicated that the Boulevard Area soils were contaminated to levels exceeding principal threat levels as a result of the historic staging of concentrates in this location.



Surface Water Drainage Channel

Culvert

Union Pacific Railroad (UPRR) (now Trail of the Coeur d'Alenes)

River\Creek

N

0 250 500 1,000 Feet

Figure 4-12
OU 2 Mine Operations Area Site Map
2010 Five-Year Review
BUNKER HILL SUPERFUND SITE

EPA

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TABLE 4-37
Mine Operations and Boulevard Areas Remedial Actions Required
2010 Five-Year Review, Bunker Hill Superfund Site

Requirement	Remedial Action Objective/Goal
1992 OU 2 ROD (Section 9.2.5)	
MOA: Demolish or decontaminate structures consistent with intended future use from the bottom of the mill settling pond	Prevent direct contact
MOA: Close or remove contaminated soil	Prevent direct contact and minimize infiltration through contaminated media
MOA and Boulevard: Remove non-PTM contaminated soils with metal concentrations in excess of what would typically be attributed to mine waste rock or tailings and dispose in the Smelter Closure area. Place a minimum of 6-inches of clean soil or other barrier appropriate to land use as a cover where surface concentrations exceed 1,000 ppm lead.	Prevent direct contact and minimize infiltration through contaminated media
MOA: Process, recycle or stabilize PTM accumulations and consolidate these materials within the Smelter Closure area	Material reuse, minimize material disposed and prevent direct contact
1996 OU 2 ROD Amendment	
Boulevard: Dispose PTMs under the Smelter Closure cap in a fully lined monocell (this amends the 1992 OU 2 ROD (Section 9.2.5) that required chemical stabilization of PTMs)	Prevent direct contact

The MOA facilities operated until the early 1980s. With the bankruptcy of the owner, the MOA land and buildings were deeded to Shoshone County as payment for back taxes. USEPA and the State of Idaho elected to use a site PRP, the BLP, and the USEPA-controlled bankruptcy fund to contract and conduct the remediation of the MOA area. The MOA remediation was completed in 1995 and consisted of the actions in Table 4-38.

TABLE 4-38
Mine Operations Area Remedial Actions Conducted
2010 Five-Year Review, Bunker Hill Superfund Site

Characterization and removal of hazardous materials located within buildings.
Removal of concentrates and ores for reprocessing.
Asbestos abatement and offsite disposal.
Wash-down of buildings prior to demolition
Demolition of buildings and disposal of debris on top of the CIA.
Contaminated soil removal consistent with the ICP.
Site grading and placement of ICP barriers.
Revegetation in designated areas.

Note: Data as reported in the 2000 Five-Year Review Report.

The remediation of the Boulevard Area remediation was completed in 1997 and consisted of the actions in Table 4-39.

TABLE 4-39
Boulevard Area Remedial Actions Conducted
2010 Five-Year Review, Bunker Hill Superfund Site

PTMs and contaminated soil were removed from one to 6 feet deep. PTMs were transported to the Smelter Closure and disposed in the geomembrane-lined PTM Cell; contaminated soil with lead concentrations less than PTM-level (84,600 mg/kg) were disposed in the general Smelter Closure area as in-fill of demolition debris and for closure grading.
Soil was replaced with clean soil and surface water control measures. Surface water flows to a roadside ditch constructed parallel to McKinley Avenue with culverts under McKinley Avenue that eventually conveys Boulevard Area runoff to Bunker Creek.

4.3.9.3 Actions Since Last Five-Year Review

The Mine Operation and Boulevard Areas remedial action was complete in 1997.

Operation and Maintenance

The State of Idaho has been performing annual inspections of the Mine Operation and Boulevard Areas. During this review period, the Mine Operation and Boulevard Areas have required no maintenance to sustain the integrity of the action. A long-term O&M Plan is currently in draft form for the Boulevard Area (publication pending).

Phase I Remedial Action Effectiveness Findings

Data are not available to perform a quantitative assessment of the impact of the Phase I remedial action conducted in the MOA and Boulevard Area on water quality. However, the removal of a large amount of highly contaminated materials and re-grading to enhance runoff would be expected to result in significant beneficial impacts to water quality. It should be noted that removal activities in the MOA and Boulevard Area were not complete and that contaminated materials remain below the ground surface. TerraGraphics and Ralston Hydrologic Services (2006) estimated that 50,000 cy of contaminated materials with concentrations of lead above the 1,000 mg/kg remain in the MOA and Boulevard Area.

4.3.9.4 Technical Assessment of Remedial Actions

In accordance with USEPA guidance (USEPA, 2001d), technical assessment was conducted by evaluating the following three questions related to protectiveness of the implemented remedial actions.

Question A: Is the remedy functioning as intended by the decision documents?

The MOA remedy is functioning as intended by the decision documents. Specific aspects of the remedy performance evaluation are described below. The 2000 and 2005 Five-Year Review Reports made no recommendations for improvement to this remedial action.

The MOA and Boulevard Areas were inspected in September 2009. This site inspection 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.

Also, surface water runoff ditches and culverts are performing as necessary to channel flow to Bunker Creek.

Question B: 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 for the MOA remedial action.

Section 4.2 summarizes the ARARs review for the applicable OU 2 decision documents. None of the new or revised standards identified in Section 4.2 call into question the protectiveness of the MOA remedy.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

This Five-Year Review did not find any new information that calls into question the protectiveness of the MOA remedy.

Remedy Issues and Recommendations

No remedy issues or recommendations were identified for the Mine Operations and Boulevard Areas.

4.3.10 Central Treatment Plant

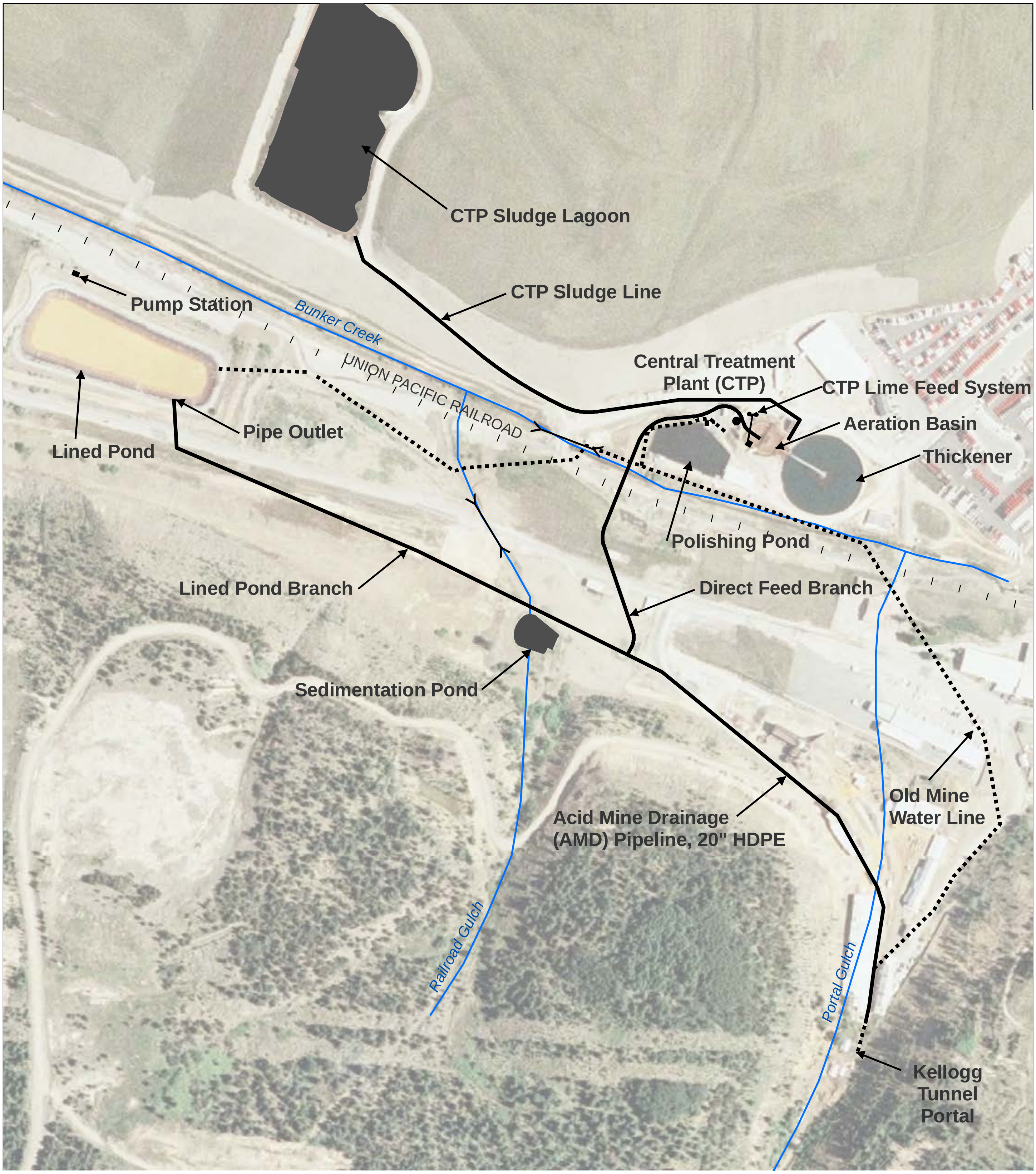
The CTP was constructed in 1974 to treat metals-laden AMD from the Bunker Hill Mine and process water from various Industrial Complex facilities using a lime precipitation process. The CTP is located at the base of the southeast corner of the CIA (Figure 4-13).

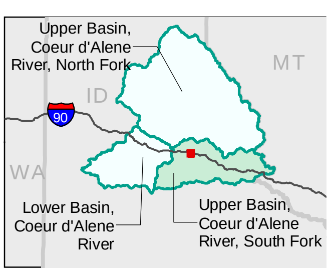
4.3.10.1 Review of ROD, ROD Amendment, and ESD Requirements

The 1992 OU 2 ROD required that AMD be conveyed to the CTP for pre-treatment prior to additional treatment in a constructed wetland system located in Smelterville Flats (see Table 4-40). In February 1998, USEPA and the State of Idaho jointly identified the need to begin evaluations for long-term mine water management. An RI/FS was initiated in August 1998 and completed in 2001 (USEPA, 2001f). This study focused on the AMD issues associated with the Bunker Hill Mine and long-term water treatment needs for the site.

Based on the results of the mine water RI/FS, USEPA issued a ROD Amendment (USEPA, 2001a) that required several upgrades to the CTP and related facilities (see Table 4-40). Also, the 2001 OU 2 ROD Amendment removed the wetland treatment requirement for AMD in lieu of treatment at the CTP (in addition to other aspects of the Selected Remedy that focused on reduction of the production of AMD). The 2001 OU 2 ROD Amendment was necessary because the wetlands system identified in the 1992 OU 2 ROD for treatment of AMD and other site water sources was found to be incapable of meeting treatment levels (USBM, 1998). In addition, the existing treatment facility, which had not been significantly upgraded since it was built in 1974, was not capable of consistently meeting current water quality standards, and required repair and replacement to prevent equipment failure.

Consistent with CERCLA, implementation of this ROD Amendment requires that the State of Idaho and USEPA agree on its implementation and sign an SSC Amendment. To date, USEPA and the State have not concluded negotiations on an SSC Amendment that allows for full implementation of this ROD Amendment. Time-critical components of the 2001





Culvert

Union Pacific Railroad (UPRR)
(now Trail of the Coeur d'Alenes)

N

0 125 250 500 Feet

Figure 4-13
OU 2 Central Treatment Plant Site Map
2010 Five-Year Review
BUNKER HILL SUPERFUND SITE

\\CASTAIC\PROJ\EPA\CDABASIN_382081\GIS\MAPFILES\5YRREVIEW\5YR_OU2_CTP.MXD JCARR3 11/9/2010 10:26:08

EPA

TABLE 4-40
Central Treatment Plant Remedial Actions Required
2010 Five-Year Review, Bunker Hill Superfund Site

Requirement	Remedial Action Objective/Goal
1992 OU 2 ROD	
Pre-treatment of Bunker Hill Mine water prior to treatment in the collected water wetland (Section 9.2.5 and 9.2.10)	Reduce metal concentrations in AMD to levels that can be treated using constructed wetland
2001 OU 2 ROD AMENDMENT	
AMD Mitigations/Source Control: • West Fork Milo Creek Diversion • Phil Sheridan Diversion rehabilitation • Plug in-mine drill holes	Reduce the flow of mine water from the Bunker Hill Mine
AMD Collection: Continue to perform in-mine water collection system maintenance to collect and transport AMD to the Kellogg Tunnel	Prevent AMD from discharging at locations other than the Kellogg Tunnel
AMD Conveyance: • New mine water line from the Kellogg Tunnel to the Lined Pond • Install pipeline to convey mine water from Kellogg Tunnel directly to the CTP	Provide cost effective means of conveying mine water from the Kellogg Tunnel to the CTP and Lined Pond storage area
AMD Storage: • Continued repair and maintenance of the Lined Pond • Construct a new gravity diversion system within the mine to convey water to the mine pool for storage • Install a new mine pool extraction system	Provide storage for AMD to prevent flows greater than treatment capacity under high flow conditions and to allow for periodic maintenance of the CTP.
AMD Treatment: • Upgrade treatment plant capacity to 2,500 gallons per minute (gpm) • Installation of tri-media filters • Installation of a backup power system • Rehabilitate existing equipment • Improvements and additions to the lime feed and polymer makeup systems • Replacement of the existing antiquated and mostly inoperable control system with a modern computer based process control and operator interface system • If CTP capacity greater than 2,500 gpm is required, install a second neutralization/oxidation reactor and additional filters	Meet effluent requirements for the CTP and prevent CTP upsets
Sludge management – construct a lined disposal bed for CTP sludge when additional sludge capacity is required	Provide a lined storage facility for CTP sludge
Site water originally slated for treatment in the constructed wetlands will be treated in the CTP	Provide an alternative location for treatment of contaminated water

OU 2 ROD Amendment were implemented, however, to avoid potential catastrophic failure of the aging CTP and to provide for emergency mine water storage (USEPA and IDEQ, 2003d) These time-critical activities focused on preventing discharges of AMD to Bunker Creek and the SFCDR (see discussion below). Until this SSC Amendment is signed, USEPA cannot use remedial action funds to implement the remainder of the mine water remedy, including additional CTP upgrades identified in the 2001 OU 2 ROD Amendment.

4.3.10.2 Background and Description of Phase I Remedial Actions

When the 1992 OU 2 ROD was written, 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, USEPA and the State decided that it was necessary to improve operational efficiency of the CTP, conduct more routine maintenance, and upgrade some equipment.

In addition, it was decided to cease the historic practice of placing acidic mine water in unlined ponds on top of the CIA. As a result of these decisions by USEPA and the State, the remedial actions presented in Table 4-41 were conducted at the CTP from 1995 to 2005.

TABLE 4-41
Central Treatment Plant Remedial Actions Conducted
2010 Five-Year Review, Bunker Hill Superfund Site

Construction of a geomembrane-lined holding pond on McKinley Avenue to the west of the CTP beginning in the latter part of 1994 with construction completed in 1995. The lined pond pump station and piping conveyed influent directly to the CTP. The purpose of the lined pond is to provide additional water storage capacity, to modulate the flow rate into the treatment plant, and to provide mixing of flows with various contaminant levels prior to treatment at the CTP.
Failure modes and effects analysis of the CTP to identify maintenance needs, to evaluate the impact of various failure scenarios of the CTP, and to prioritize maintenance and equipment purchase needs.
Design of a new mine water pond and sludge holding facility. USEPA's design contractor prepared 90 percent complete construction plans and specifications for a new lined pond and sludge facility that was to be constructed on top of the CIA. At the State's request, the construction of this mine water storage and sludge facility was deferred pending the results of a separate RI being conducted by USEPA of the Bunker Hill Mine's acid mine drainage.
High-density sludge (HDS) study to optimize treatment efficiency and as a means to decrease the sludge volume that would require disposal.
Installation of new mine water discharge line from the Kellogg Tunnel to the lined pond to replace the original line that failed to carry the necessary volume of mine water flows.
Miscellaneous O&M activities, rebuilding the thickener drive-head; closing the east sludge cells when the CIA was capped.
Six-inch minimum ICP barrier placed on the CTP property (approximately 12.4 acres).
A direct-feed mine water pipeline was constructed from the Kellogg Portal to the CTP aeration basin. This direct-feed line bypassed the Lined Pond and added flow management options for the system (i.e., ongoing treatment of mine water while the Lined Pond is down for maintenance.
Under a Time-Critical Removal Action, several repairs and upgrades were made to the CTP and Lined Pond consisting of a new lime storage, make-up, and feed system consisting of two 14-foot-diameter, 100-ton silo assemblies and other equipment (slakers, slurry tank, dust collectors, pumps, etc.), thickener repairs, and a new sludge pipeline.

4.3.10.3 Actions Since Last Five-Year Review (2005-2010)

Under a Time-Critical Removal Action, several repairs and upgrades were made to the CTP during this review period and include:

- Electrical system/motor control center (MCC) upgrade (2006);
- New control system with updated hardware and software (2006);
- New control building to house electrical/MCC panels, control system, break room, lab/sample prep space, office, and locker room facilities (September 2005 – July 2006);
- New 750-kilowatt (kW) standby generator and automatic transfer switch (June 2005); and
- Replaced a sludge recycle pump (January 2007).

The West Fork Milo Creek Diversion (the Diversion) was identified in the Bunker Hill Mine Water RI/FS (USEPA, 2001c) as a viable mitigation to reduce AMD production in the Bunker Hill Mine. The objective of the Diversion is to reduce the AMD volume requiring treatment at the CTP and, subsequently, the volume of sludge requiring disposal. The Diversion consists of collecting and piping surface water flow from the West Fork of Milo Creek around a near-surface fractured bedrock area of Milo Gulch and discharging this flow into the main stem of Milo Creek. The fractured bedrock allows the West Fork flows to readily infiltrate into underground mine workings and provide a water source for the production of AMD. The Diversion is planned to be a pipeline about 2,700 feet long. USEPA has completed design of the Diversion to the 95 percent level, but construction is pending a signed SSC Amendment.

4.3.10.4 Technical Assessment of Remedial Actions

Consistent with USEPA guidance (USEPA, 2001d), technical assessment was conducted by evaluating the following three questions related to protectiveness of the implemented remedial actions.

Question A: Is the remedy functioning as intended by the decision documents?

The various remedial actions implemented at the CTP to date are functioning as designed and as intended by the decision documents. However, as previously stated, the overall CTP and mine water remedy is not yet complete. Therefore, a complete assessment of this remedial action is premature, and 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, 1986a). 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 expired permit establishes maximum discharge characteristics for the CTP outfall effluent. Daily composite samples are obtained from the CTP outfall to Bunker Creek and are tested for zinc, lead, cadmium, total suspended solids, and pH. Monitoring results are summarized each month and submitted to USACE, USEPA, and IDEQ. Discussions with USACE indicate that the CTP consistently meets its current discharge requirements with only occasional minor deviations from the effluent requirements. 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.

Question B: 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 for the CTP remedial action.

Section 4.2 summarizes the ARARs review for the applicable OU 2 decision documents. Of the summarized changes, the changes in the aquatic life criteria for wastewater treatment discharges (IDAPA 58.01.02.284) are applicable to the CTP.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No new information became evident as part of this Five-Year Review that could call into question the protectiveness of the remedy.

As mentioned above, many components of the overall mine water remedy have not yet been implemented. Replacement of the unlined sludge pond on the CIA is one particular component that could improve the protectiveness of the remedy by decreasing infiltration through the CIA (see Section 4.3.6), even though any such infiltration is deemed to be a small quantity. The CTP continues to meet its expired NPDES permit with only minor occasional deviations. A standard process is in place to ensure that treatment plant effluent discharge requirements are met.

Erratic mixing in the CTP aeration basin is an ongoing and continuous problem resulting from its poor configuration and use of a surface aeration-type mixer. This system is unchanged from the original 1973 design and is outdated. Under periods of high influent flow and strength, this heterogeneous mixing often causes pH control difficulties that can affect process performance. In 2008 this situation resulted in an exceedance of the expired NPDES permit limits for zinc in plant discharge. This periodic problem would be alleviated by implementation of the remaining CTP upgrades listed in the mine water ROD Amendment (USEPA, 2001a), and especially replacement of the aeration basin with a modern stirred and aerated reaction tank.

AMD is currently discharging from the Reed and Russell adits in Milo Gulch. These discharges eventually end up in Milo Creek, a tributary to the SFCDR. Although these discharges are not well characterized, the physical appearance would indicate that they are laden with heavy metals, and, given their ability to degrade concrete channel walls of the Reed Landing conveyance, one could conclude that they are very low pH as well. Thus, the continued open discharge of the Reed and Russell adits only undermines the overall surface water quality of the drainage. The mine owner is responsible for maintenance of in-mine flows and ensuring that AMD only discharges from the mine workings at the Kellogg Tunnel. The Reed and Russell adit discharges do not conform to Kellogg Tunnel discharge but could be routed back into the mine so that they flow out of the Kellogg Tunnel.

As discussed in 4.3.10.1 above, an SSC Amendment must be signed to allow for full implementation of the 2001 OU 2 ROD Amendment, control and treatment of AMD and its impact on water quality will continue to be an issue. USEPA and the State of Idaho continue to discuss the SSC Amendment and the long-term obligations associated with the mine water remedy.

Remedy Issues and Recommendations

Since the 2005 Five-Year Review, no new issues or recommendations have been identified for the CTP remedy. The previous recommendations to address AMD discharge from the Reed and Russell adits with the mine owner, and to pursue viable solutions to the SSC impasse and implement the 2001 OU 2 ROD Amendment, are currently being addressed.

4.3.11 Bunker Creek

4.3.11.1 Review of ROD, ROD Amendment, and ESD Requirements

Remedial actions required at Bunker Creek are presented in Table 4-42.

TABLE 4-42
Bunker Creek Remedial Actions Required
2010 Five-Year Review, Bunker Hill Superfund Site

Requirement	Remedial Action Objective/Goal
1992 OU 2 ROD	
Channelize and line Bunker Creek (Section 9.4)	Minimize infiltration through contaminated material and minimize releases to surface water
Treat base flows of Bunker Creek at the collected water wetland if water quality exceeds FWQC (Section 9.2.5)	Minimize releases to surface water
Remove PTM contaminated soils and dispose of in the PTM monocell (Section 9.2.5)	Prevent direct contact and minimize infiltration through contaminated media
Remove non-PTM contaminated soils with lead concentrations greater than 1000 mg/kg and dispose in the Smelter Closure (Section 9.2.5)	Prevent direct contact and minimize infiltration through contaminated media
2001 OU 2 ROD Amendment	
Treat base flows of Bunker Creek at the CTP if water quality exceeds AWQC	Changes treatment location for OU 2 waters from collected water wetland to CTP

The 1992 OU 2 ROD specified that Bunker Creek was to be channelized and lined. The ROD did not specify the type of lining (e.g., compacted soil, geomembrane, concrete) nor the degree of liner permeability that was intended. In 1995, the State of Idaho conducted subsurface exploration (Spectrum Engineering, 1996) to determine the nature and extent of contamination in the Bunker Creek corridor as well as the general geotechnical properties of the underlying materials. Based on the subsurface exploration and the planned elevation of the creek bottom, it was understood at the time that the in-place soil had an existing permeability sufficiently low enough that a separate constructed lining for Bunker Creek was not necessary (CH2M HILL, 1996).

The 1992 OU 2 ROD also stated that the Bunker Creek base flows were to be treated in the collected water wetland should sampling indicate exceedances of AWQC. At the time the

1992 OU 2 ROD was prepared, the collected water wetland was to be constructed in the Smelterville Flats area. The April 1998 OU 2 ESD clarified that because of a greater focus on source removals in Smelterville Flats and in other areas of OU 2 , consistent with the focus of Phase I remedial actions, the wetlands were not planned for immediate construction in the Flats. Based on studies conducted by the USBM between 1994 and 1998, the wetland treatment systems were found to be incapable of meeting treatment levels identified in the 1992 OU 2 ROD. The 2001 OU 2 ROD Amendment addressed treatment of site water originally slated for treatment in the constructed wetlands by requiring treatment at the upgraded CTP.

4.3.11.2 Background and Description of Phase I Remedial Actions

Aerial photography taken in the 1930s indicates that a natural drainage/wetland existed in the Bunker Creek area. 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. Sampling and testing conducted during the RI showed that the corridor was moderately to highly contaminated. Lack of maintenance, sediment deposition from the tributary gulches, flow through underlying contaminated tailings, and discharge of AMD during treatment plant upsets all contributed to poor hydraulic performance and water quality degradation in the Bunker Creek corridor.

The Bunker Creek Phase I remedial action was conducted in 1996 and 1997. The major elements are described in Table 4-43.

TABLE 4-43
Bunker Creek Remedial Actions Conducted
2010 Five-Year Review, Bunker Hill Superfund Site

Reconstructed approximately 7,600 linear feet of the creek channel, including a low flow channel and floodplain. The low flow stream channel was rocked for erosion protection and the floodplain was seeded.
Removed flotation slimes exposed at the surface of channel excavations to a depth of 2 feet below the slimes and backfilled to stream grade with clean compacted backfill material.
Disposed excavated slimes on the CIA.
Incorporated noncontaminated excavated material into the grading of the adjacent floodplain.
Installed culverts and riprap headwalls for three road crossings to maintain necessary site access over Bunker Creek.
Placed minimum 6-inch ICP barriers at the surface of all disturbed areas in the Bunker Creek corridor and hydroseeded.
Riparian plantings of trees and shrubs along the creek corridor in 2001.
ICP capping in area west of CIA closure, completed in 2001.

4.3.11.3 Actions Since Last Five-Year Review (2005-2010)

Bunker Creek Phase I remedial actions were fully implemented by 2001. In 2007, USACE replaced barbed wire fencing between the Trail of the Coeur d'Alenes and the creek with smooth wire.

In 2008, USEPA and IDEQ conducted a study to simulate the lining of Bunker Creek and evaluate the effectiveness of lining Bunker Creek towards improving water quality. Results of this study indicate that the simulated lining of Bunker Creek did not affect dissolved metal concentrations in groundwater or in the SFCDR, and hydrologic impacts on the shallow alluvial aquifer were not observed. During low-flow conditions, Bunker Creek loses about 1.0 cubic foot per second (cfs) to the shallow alluvial aquifer. The lack of effect on the shallow alluvial aquifer is likely the result of the high hydraulic conductivity of subsurface and aquifer materials (CH2M HILL, 2009b). Inconclusive results of the study also may be a result of insufficient study longevity.

Operation and Maintenance

The State of Idaho has been performing an biannual inspection of the Bunker Creek remedial actions. Naturally occurring vegetation was removed in 2007 by USACE in areas that could potentially hinder flows through the Bunker Creek culverts. A long-term O&M Manual has been finalized for the Bunker Creek remedial action.

A September 2009 IDEQ inspection confirmed that the channel and barriers are performing as designed. Past hydrologic modeling indicates that all culverts are undersized, including the one under I-90.

A beaver dam was found near the box culvert on Idaho Transportation Department (ITD) property. ITD was notified and the dam was removed. A follow-up inspection was conducted in February 2010 verifying that the beaver dam at the I-90 culvert had been removed. Several signs of additional beaver activity were observed, including two new beaver dams farther upstream in the Bunker Creek channel. This activity will continue to be monitored for potential impacts on the remedy of Bunker Creek and adjacent areas.

Phase I Remedial Action Assessment Findings

The effectiveness evaluation of the Bunker Creek Phase I remedial actions with respect to water quality and performance standards are presented in the Phase I Remedial Action Assessment Report (CH2M HILL, 2007b). Findings from this report suggest Bunker Creek loses water to the shallow alluvial groundwater system, which was confirmed during the Bunker Creek Pilot Study (CH2M HILL, 2009b). The Bunker Creek Pilot Study was conducted to simulate the lining of Bunker Creek in support the Phase II remedy development for OU 2. The large amount of discharge lost from Bunker Creek suggests that in-place materials are not acting to greatly reduce the interaction of groundwater and surface water in the Bunker Creek corridor.

Surface water quality at the mouth of Bunker Creek does not meet the AWQC for dissolved cadmium and dissolved zinc on a regular basis. The water quality of Bunker Creek is significantly influenced by the water quality of tributary creeks and other discharges. Specifically, during Phase II data collection activities, Magnet Creek discharged to Bunker Creek with a dissolved zinc concentration of about 8 to 10 mg/L.

Dissolved metal concentrations (except dissolved lead) at the majority of Bunker Creek monitoring wells exceed the MCLs. Concentration trends are declining at a number of wells between the pre-and post-remediation time frame, suggesting the removal of contaminated materials from the Bunker Creek channel; these removals, coupled with other Phase I remedies, has resulted in a positive impact on groundwater quality.

4.3.11.4 Technical Assessment of Remedial Actions

Consistent with USEPA guidance (USEPA, 2001d), technical assessment was conducted by evaluating the following three questions related to protectiveness of the implemented remedial actions.

Question A: Is the remedy functioning as intended by the decision documents?

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

The portion of the remedy that is not functioning as intended by the decision documents is minimizing infiltration of Bunker Creek through contaminated media. The 1992 ROD required Bunker Creek to be lined in order to meet the RAO described above. However, based on subsurface exploration and a geotechnical evaluation of the creek bottom, it was believed at the time that the in-place soil had an existing permeability sufficiently low enough that a separate constructed lining for Bunker Creek was not necessary (CH2M HILL, 1996). This in-situ soil liner is not performing to reduce Bunker Creek infiltration. Data collection as part of the Environmental Monitoring Plan (EMP) (CH2M HILL and Ecology and Environment, 2006) and the Bunker Creek Pilot Study (CH2M HILL, 2009b) suggests Bunker Creek loses nearly 1.0 cfs during base-flow conditions (late summer to early fall). Bunker Creek primarily consists of effluent discharge from the CTP. As this treated water is lost from the Bunker Creek channel, it becomes recontaminated as it infiltrates through contaminated materials and contacts the contaminated underlying aquifer.

The State of Idaho conducted a study of Bunker Creek hydrologic and hydraulic system in 2008, and the results are presented in the *Bunker Creek Study: Hydrologic and Hydraulic Models for the Bunker Creek System in Kellogg, Idaho* (TerraGraphics, 2008a). Bunker Creek and its contributing watersheds were modeled using a 100-year, 24-hour-duration storm event. The results indicate that the culvert group located at the downstream end of Bunker Creek, including the I-90 box culvert, are undersized as compared to the capacity of the Bunker Creek channel and would restrict Bunker Creek flow during a 100-year flood event.

The Bunker Creek corridor was inspected in September 2009. The site inspection indicated that the Bunker Creek channel was 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 re-contamination processes and contributing factors in certain segments of Bunker Creek. The same re-contamination factors were present during this third review period, including occasional CTP upsets and contaminant transport from tributary creeks and adjacent surface areas; however, direct discharge from the Bunker Hill mine did not occur following construction of the direct feed line from the Bunker Hill Mine to the CTP. Samples collected from the Bunker Creek channel confirmed the presence of contaminated sediments. The fencing installed between the creek and the Trail of the Coeur d’Alenes is intact and functioning as intended.

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 stated earlier, base flows in Bunker Creek do not meet the AWQC.

Question B: 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 for the Bunker Creek Phase I remedial action.

Section 4.2 summarizes the ARARs review for the applicable OU 2 decision documents. None of the new or revised standards identified in Section 4.2 call into question the protectiveness of the Bunker Creek Phase I remedy.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

This Five-Year Review did not find any new information that calls into question the protectiveness of the Bunker Creek Phase I remedy. Actions have been implemented to prevent direct contact with contaminated materials. However, a significant amount of Bunker Creek water (primarily CTP effluent) becomes recontaminated as it infiltrates through contaminated materials and contacts the underlying contaminated aquifer. The Upper Basin Proposed Plan (USEPA, 2010a) recommends conveying the CTP effluent in a pipeline directly to the SFCDR, thereby reducing this recontamination potential.

It is not feasible to address the contamination in the Bunker Creek channel until an SSC Amendment is signed that allows for the full implementation of the 2001 OU 2 ROD Amendment to prevent further re-contamination of the creek channel as a result of potential CTP upsets.

Remedy Issues

A summary of issues identified with respect to the Bunker Creek remedy is provided in Table 4-44. The 2005 Five-Year Review issue regarding how USEPA cannot fully implement the 2001 OU 2 ROD Amendment is ongoing and, therefore, is not identified as a new issue in the summary table.

Recommendations

A summary of Bunker Creek recommendations and follow-up actions is provided in Table 4-45. The 2005 Five Year Review recommendation to pursue viable solutions to the SSC impasse and implement the 2001 OU 2 ROD Amendment is currently being addressed and, therefore, is not identified as a new recommendation in the summary table.

TABLE 4-44
Summary of Bunker Creek Remedy Issues
2010 Five-Year Review, Bunker Hill Superfund Site

Remedy Issues	Affects Protectiveness (Y/N)	
	Current (now to 1 year)	**Future (>1 year)**
Bunker Creek Culverts: The lower Bunker Creek culverts, including the I-90 box culvert, were determined to be undersized for ccommodating a 100-year flood event.	N	Y

TABLE 4-45
Summary of Bunker Creek Recommendations and Follow-Up Actions
2010 Five-Year Review, Bunker Hill Superfund Site

Recommendations/Follow-up Actions	Responsible Entity	Oversight Agency	Proposed Milestone Date	Follow-up Actions: Affects Protectiveness (Y/N)	
				Current (now to 1 year)	Future (>1 year)
Bunker Creek Culverts: Continue working with the Coeur d'Alene Basin Environmental Improvement Project Commission (Basin Commission) to evaluate and plan actions relative to addressing SFCDR and Pine Creek flooding issues.	Local Governments	IDEQ, USEPA	12/2012	N	Y

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

Two separate remedial actions have been implemented by UPRR in their ROW, which stretches over 71.5 miles between Plummer and Mullan, Idaho. The initial action was conducted in the Box in 1997 and 1998 and is described in this section. The second action was conducted between 2000 and 2004 and focused on the ROW that was outside of the Box; information on that action can be found in Section 5.5, Trail of the Coeur d'Alenes CERCLA Action.

The remedial action in the Box was conducted by UPRR with oversight by IDEQ and USEPA pursuant to a CD.[7] The ROW in the Box runs east/west and is approximately 7.75 miles long and 60 to 200 feet wide (see Figure 4-1). The Engineering Evaluation/Cost Analysis (EE/CA) notes that the UPRR commenced proceedings to abandon the Wallace and Mullan Branches in 1991 (USEPA, 1999b). The Interstate Commerce Commission (ICC), by its initial decision in October 1992 and its subsequent decision in 1994, authorized cessation of rail service. The line was taken out of service and is now being maintained by UPRR and managed by IDPR as part of the larger Trail of the Coeur d'Alenes rails-to-trails recreational facility.

The rail line was originally constructed in the late 1800s and used to transport mining and milling products to and from the Silver Valley. Mine tailings and waste rock were prevalent throughout the valley from the mining activities that date back to the 1880s. In portions of the UPRR ROW, these lead-bearing materials were used in the construction of the original rail bed. Lead-bearing mine tailings and concentrates may also have been deposited on portions of the UPRR ROW from historical flood deposition from the South Fork of the Coeur d'Alene River (SFCDR), as well as from occasional spillage from the rail cars.

[7] Consent Decree, Bunker Hill, United States of America and State of Idaho v. Union Pacific Railroad Company, Stauffer Management Company, Rhone-Poulenc; Civil Action No. 95-0152-N-HLR; March 24, 1995.

4.3.12.1 Review of ROD, ROD Amendment, and ESD Requirements

Portions of the UPRR ROW in the Box (Box ROW) are adjacent to populated areas such as commercial and residential areas of Smelterville and Kellogg (see Figure 4-1). The OU 2 ROD specified that remedial actions for ROWs in residential areas must meet the requirements of the OU 1 ROD (USEPA, 1991). Remedial actions specified in the 1992 OU 2 ROD are summarized in Table 4-46.

TABLE 4-46
Remedial Action Requirements for the UPRR ROW in the Box
2010 Five-Year Review, Bunker Hill Superfund Site

Requirement	Remedial Action Objective/Goal	Success Criteria
UPRR in Populated and Non-Populated Areas		
Temporary dust control	Minimize lead exposure from fugitive dust	Meet ambient air criteria
Enforce existing controls on access	Prevent direct exposure to contaminated soil	Reduce the potential for unauthorized access
Maintain existing fencing	Prevent direct exposure to contaminated soil	Reduce the potential for unauthorized access
Institutional controls	Prevent direct exposure to contaminated soil	Reduce the potential for accidental exposure
Permanent dust control through containment, “hot spot” removal, soil/rock barriers, and revegetation	Minimize lead exposure from fugitive dust	Meet ambient air criteria
Additional Action for UPRR Adjacent to Residential Areas		
Treat consistent with the remedial action selected in the Residential Soils ROD	Minimize lead exposure from fugitive dust; prevent direct exposure to contaminated soil	Meet ambient air criteria; reduce the potential for accidental exposure

Note:
Requirements specified in 1992 OU 2 ROD, Section 9.2.6.

The 1991 OU 1 ROD set a threshold level for lead concentrations in soils of 1,000 mg/kg. Criteria for removal and replacement of soil according to the ROD are as follows:

- If the 0- to 1-inch or 1- to 6-inch depth intervals exceed the threshold level, 6 inches of contaminated material will be excavated and replaced. In addition, if the 6- to 12-inch interval exceeds the threshold level, another 6 inches (total of 12 inches) will be removed and replaced. If the 6- to 12-inch interval does not exceed the threshold level, only a 6-inch excavation and replacement will be done.
- In the case where the 6- to 12-inch depth interval exceeds the threshold level but the 0- to 1-inch and the 1- to 6-inch intervals do not, 12 inches of material will be excavated and replaced.
- If the 0- to 1-inch, 1- to 6-inch, and 6- to 12-inch intervals do not exceed the threshold level, the property will not be remediated.

The 1997 Implementation Plan (MFG, 1997a) stated that the 1992 OU 2 ROD required removal of any process material from the Box ROW with measured lead concentrations exceeding levels typically associated with mine tailings or waste rock. In accordance with this requirement, ore concentrates, ballast, and soils with lead concentrations exceeding 30,000 mg/kg and not attributable to mine tailings or waste rock were excavated from the Box ROW and disposed of in the Smelter Complex and the CIA. In addition, all portions of the Box ROW with lead concentrations in excess of 1,000 mg/kg in the top 12 inches (or 6 inches, depending on location) of ballast or soil were to receive either barrier placement, removal and replacement (to maintain drainage), revegetation, and/or access control, depending on geographic location and current land use.

4.3.12.2 Background and Description of Phase I Remedial Actions

Under an agreement with USEPA and the State of Idaho, some portions of the Box ROW were remediated by USEPA and the State (government response areas) in exchange for use of the ROW for construction of a haul road to transport mine tailings from Smelterville Flats to the CIA. The rest of the Box ROW was remediated by UPRR as part of their CD with USEPA. The UPRR-funded remediation of the Box ROW extended from 1995 through 1999; remediation activities are described in Table 4-47.

TABLE 4-47
Remedial Actions Conducted in the UPRR ROW in the Box
2010 Five-Year Review, Bunker Hill Superfund Site

Areas of spilled ore concentrates (“hot spots”) were identified, removed, and transported to the Smelter Complex and the CIA for eventual disposal.
Rails, ties, and other track material were removed prior to ballast and soil excavation; decontaminated materials were shipped offsite for reuse; contaminated or unusable materials were placed in the CIA.
After rail and tie removal, excavation occurred throughout the UPRR ROW from Elizabeth Park on the east side of the site to where the ROW goes beneath I-90 near the Pinehurst Narrows to the west.
Clean gravel or soil barriers (less than 100 mg/kg lead or arsenic; less than 5 mg/kg cadmium) were placed throughout the UPRR corridor from Elizabeth Park to Enaville except where steep terrain or heavy vegetation restricted application.
Although not required as part of the UPRR remedial action, portions of the UPRR ROW from Smelterville to Elizabeth Park (Kellogg Greenbelt Project) were paved as part of trail construction.

USEPA began remediation of the portions of the Box ROW adjacent to the CIA haul road in 2000. Verification sampling followed these remediation activities. Additional cover material was added to the deficient areas that were discovered during the 2000 Five-Year Review sampling event.

Government certification of the remedy in the Box ROW took place in December 2001. This followed completion of the remaining work outlined in the previous Five-Year Review, submittal and acceptance of the Post-Closure Operations and Maintenance Plan (MFG, 2001), and other pre-certification requirements (construction completion report, pre-certification walk-through, pre-certification report, certification completion report).

Certification of the Box ROW corridor within the Box boundaries triggered the incorporation of this area into the ICP. In accordance with the UPRR CD, a negotiated settlement was provided to the State of Idaho to fund the ICP oversight of the Box UPRR corridor.

Some small segments of the trail barrier at specific road crossings remained to be completed. The three crossing segments to be completed were access to the CIA between Smelterville and Government Gulch, east of Government Gulch Road adjacent to McKinley Avenue, and near the west side of the Concentrator Area. Each of these crossings was paved, and the road crossing near the Concentrator Area crossing was abandoned.

An old fuel bulk plant on the UPRR ROW in Kellogg was removed and remediated in 2004 under the oversight of IDEQ. This facility was operated by a lessor of the UPRR ROW. In 1999 this plant was operational, so remediation did not occur due to the inaccessibility of the area.

An asphalt path was not part of the obligation of the UPRR as negotiated and documented in the CD. However, the City of Kellogg paved large segments of the Box ROW between Smelterville and Elizabeth Park during the Kellogg Greenbelt recreational trail development. Funds for that work were obtained by the City of Kellogg from non-UPRR sources. A 10-foot-wide asphalt recreational trail was extended through the remaining segments in the Box in 2002 to coincide with the Trail of the Coeur d’Alenes (UPRR Wallace-Mullan Branch removal action) outside of the Box.

4.3.12.3 Actions Since Last Five-Year Review (2005-2010)

In 2005, USACE remediated two areas along the Box ROW:

- An area east of Ross Ranch and south of the ROW; and
- A haul road shoulder area south of the former TCI Building located east of the Smelterville Waste Water Treatment Lagoons.

In addition, USACE remediated bare patches along the Box ROW between the meandering trail and the fence in 2006. These patches are located between the east end of Smelterville and the CIA. The capping consisted of placement of 6 inches of gravel barrier.

Operation and Maintenance

O&M activities for the Box ROW have been conducted since the early spring of 2002 as agreed upon following certification of the Box ROW in 2001 and acceptance of the Post-Closure Operations and Maintenance Plan (MFG, 2001). UPRR has been conducting monthly and semi-annual inspections of the ROW and doing necessary repairs to the barriers. Repairs have been made based on the findings during these inspections required in the plan. Repairs have included:

- Replacement of clean barrier material displaced during flooding events;
- Removing debris blocking culverts;
- Installation of fencing and other physical barriers to restrict access of motor vehicles causing barrier erosion; and
- Repair of asphalt damaged by falling rock and tree root growth.

UPRR has been checking the barrier elevations at pre-established transects along the ROW on an annual basis to determine whether any loss has occurred. This and other repair work has been reported in the following UPRR documents:

- *Bunker Hill Superfund Site 2004 Annual Status Report for the Union Pacific Area Operations and Maintenance Program* (MFG, 2005).
- *Bunker Hill Superfund Site 2005 Annual Status Report for the Union Pacific Area Operations and Maintenance Program* (MFG, 2006).
- *Bunker Hill Superfund Site 2006 Annual Status Report for the Union Pacific Area Operations and Maintenance Program* (MFG, 2007).
- *Bunker Hill Superfund Site 2007 Annual Status Report for the Union Pacific Area Operations and Maintenance Program* (MFG, 2008).
- *Bunker Hill Superfund Site 2008 Annual Status Report for the Union Pacific Area Operations and Maintenance Program* (MFG, 2009).
- *2009 Annual Status Report for the Union Pacific Area of The Bunker Hill Superfund Site Operations and Maintenance Program* (LFR, 2010).

Over the last 5 years, utility work and new road construction have also disturbed the gravel barriers on the UPRR ROW. This work was overseen by the ICP.

IDPR manages the trail within the Box boundary and conducts O&M activities under the oversight of the ICP. IDPR assumed some of the management responsibilities in 2002 following construction of the asphalt trail.

Phase I Remedial Action Effectiveness Findings

The Phase I remedial action effectiveness evaluation was not conducted for the UPRR remedy because data were not available to quantify groundwater quality impacts resulting from the removal of contaminated materials from the UPRR ROW. However, the removal actions would be expected to result in an improvement in underlying groundwater quality.

4.3.12.4 Technical Assessment of Box UPRR ROW Remedial Action

Consistent with USEPA guidance (USEPA, 2001d), technical assessment was evaluated by responding to the following three questions related to protectiveness of the implemented remedial actions.

Question A: Is the remedy functioning as intended by the decision documents?

Generally, the remedy is functioning as intended by the 1992 OU 2 ROD and the UPPR Box CD. The gravel barriers are susceptible to noxious and non-noxious vegetation infestation, as are any open land areas throughout eastern Washington, northern Idaho, and western Montana. No noxious weed treatment was negotiated, nor have any known weed control actions been implemented for this rail-line remediation. Although this section of the trail traverses the residential communities of Kellogg and Smelterville, it also traverses some larger parcels of uninhabited ground that make it susceptible to unauthorized vehicle access. Some of the gravel barriers erode with vehicle traffic and water, which could affect the protectiveness of the OU 2 Selected Remedy. Continued maintenance of established asphalt and concrete barriers is important. Some existing asphalt and concrete barriers within the UPRR ROW, mostly within Kellogg, were in place prior to the 1996 remedy implementation. Without maintenance, these barriers will be susceptible to degradation and eventually will need to be either repaired or replaced; otherwise, the remedy in these areas will not be protective because the underlying materials are presumably contaminated. The need for maintenance has been noted as a vulnerability but is not currently considered an issue because UPRR has the responsibility to maintain these barriers as part of the terms of the CD discussed above. The asphalt trail area has increased the durability and stability of that portion of the barrier.

Question B: 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 are still valid. None of the standards identified in Section 4.2 are ARARS or potential ARARs for the Box UPRR ROW remedial action.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

This Five-Year Review did find any new information that calls into question the protectiveness of the Box UPRR ROW remedy. The asphalt and concrete barriers within the City of Kellogg appear to have degraded somewhat, and the remedy in these areas may not be as protective as in 1999. Therefore, without maintenance, the protectiveness of these barriers will continue to diminish and will need to be either repaired or replaced. Stormwater runoff ditches originally installed during the remediation work appear to be compromised and will need repair before more degradation occurs. Newly established pedestrian paths leading down the riverbank to the SFCDR have been established and need to be remediated.

Long-term barrier management and protection of the UPRR ROW in the Box falls under the Post-Closure Operations and Maintenance Plan (MFG, 2001) and the requirements of the ICP. Continued implementation of these plans and programs is relied upon to maintain the integrity of the barriers installed or remaining in place as part of the UPRR ROW in the Box and is expected to minimize re-contamination. The noxious weed issue is not covered by the ICP or the O&M Plan and does not represent a threat to barrier protectiveness, but is considered a nuisance issue and will need to be separately addressed through management operations, as stated above. Erosion caused by motor vehicle access, as well as utility work on the ROW, will continue to present a threat to the barrier integrity and will require vigilance by PHD in overseeing the ICP and preservation of the barriers. Continued oversight of the established asphalt and concrete barrier maintenance is important in preserving the integrity of the barriers and thereby protectiveness of the remedy. The asphalt and concrete barriers within the City of Kellogg appear to have degraded both east and west of the former railroad depot. The concrete parking area on the east side of the former railroad depot is the location of a remnant concrete slab. There are remnant asphalt strips along in the green strip along Railroad Avenue west of Division Street that are no longer used in any capacity. These barriers are remnants of former concrete or asphalt slabs, which existed at the time the removal action was performed, and some are showing degradation due to their age. These will require monitoring and eventual removal and replacement or alteration to provide appropriate protection in the future. UPRR is obligated by the terms of the Post-Closure Operations and Maintenance Plan to maintain these barriers, and their limited remaining life was noted during the certification process. It is highly likely that the remnant barriers in these areas are less protective than in 1999. The cap in one or more stormwater runoff ditches east of the railroad depot originally installed during the remediation work appears to be compromised and needs further assessment and possibly repair as part of the O&M activities. Such maintenance is normal as part of operating a gravel or vegetated cap remedy. Newly established pedestrian paths leading down the riverbank to the SFCDR east of the railroad depot have resulted in barrier erosion and also need to be assessed and possibly remediated. These issues can be addressed by UPRR as part of the normal O&M activities of the UPRR ROW in the Box.

Remedy Issues

A summary of issues identified with respect to the UPRR ROW remedial action in the Box is provided in Table 4-48.

TABLE 4-48
Summary of Remedy Issues for UPRR ROW Remedial Action in the Box
2010 Five-Year Review, Bunker Hill Superfund Site

	Affects Protectiveness (Y/N)	
Remedy Issues	**Current (now to 1 year)**	**Future (>1 year)**
UPRR Barrier Protectiveness: Portions of the barrier along the trail have degraded or been compromised.	Y	Y

Recommendations

A summary of recommendations and follow-up actions for the UPRR ROW remedial action in the Box is provided in Table 4-49.

While not affecting the protectiveness of the remedy, the issue of noxious weeds needs to be addressed.

TABLE 4-49
Summary of Recommendations and Follow-Up Actions for the UPRR ROW Remedial Action in the Box
2010 Five-Year Review, Bunker Hill Superfund Site

				Follow-up Actions: Affects Protectiveness (Y/N)	
Recommendations/Follow-up Actions	**Responsible Entity**	**Oversight Agency**	**Proposed Milestone Date**	**Current (now to 1 year)**	**Future (>1 year)**
UPRR Barrier Protectiveness: Ensure that O&M obligations defined in the CD are met to protect the integrity of the installed barriers.	UPRR	IDEQ, PHD, USEPA	12/2010	Y	Y

4.3.13 Milo Gulch (including Reed Landing)

4.3.13.1 Review of ROD, ROD Amendment, and ESD Requirements

Requirements from the 2001 OU 2 ROD Amendment (USEPA, 2001a) pertaining to Milo Gulch are summarized in Table 4-50.

TABLE 4-50
Milo Gulch Remedial Actions Required
2010 Five-Year Review, Bunker Hill Superfund Site

Requirement	Remedial Action Objective/Goal
1992 OU 2 ROD	
Channelize and line Milo Creek from the Wardner Water System intake to the culvert that directs flow beneath Wardner and Kellogg (Sections 9.2.1 and 9.2.5).	• Minimize contact between Milo Creek surface water, tailings, and waste rock on the gulch floor. • Reduce contaminant transport to the SFCDR as suspended sediment in runoff events. • Minimize surface water infiltration into the underlying Bunker Hill Mine workings.
1998 OU 2 ESD	
Financial contribution by USEPA to the reconstruction of the underground Milo Creek pipeline project beneath Wardner and Kellogg.	Minimize the potential for re-contamination of previously remediated residential yards.
2001 OU 2 ROD Amendment	
Acid mine drainage source control to reduce quantity of surface water entering the mine and AMD created within the mine. Includes West Fork Milo Creek Diversion, rehabilitation of Phil Sheridan Raise, and plugging in-mine drill holes.	Reduce quantity of AMD created in mine, reduce long-term AMD management costs, and improve surface water quality in Bunker Creek and SFCDR.

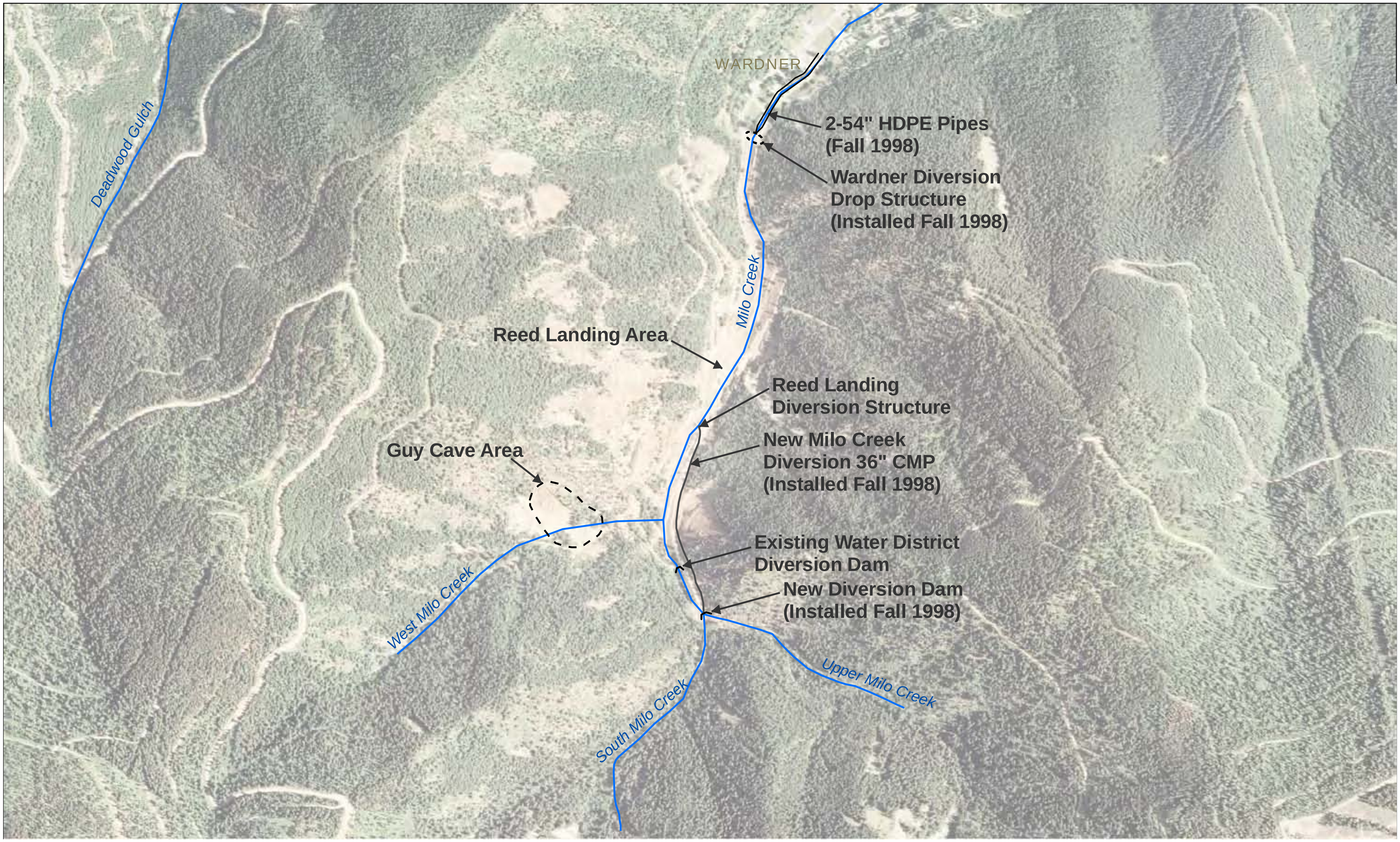
The original work scheduled for Milo Creek was to be conducted by the PRPs. The cleanup plan was renegotiated in 1993-1994 between the State of Idaho and USEPA following the bankruptcy of the major PRP committed to fund Milo Gulch work.

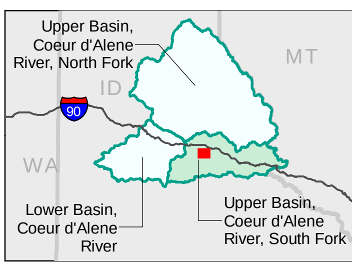
4.3.13.2 Background and Description of Phase I Remedial Actions

Milo Creek drains an approximately 4-square-mile watershed located above and within Wardner and Kellogg and eventually discharges into the SFCDR (see Figure 4-1). For the purposes of this Five-Year Review Report, the Milo Creek watershed is discussed in three segments: the upper watershed, the lower Milo Creek piping system beneath Wardner and Kellogg, and Reed Landing.

Upper Milo Creek Watershed

The upper Milo Creek watershed (Figure 4-14) 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). In the upper reaches of the Basin, there are three forks of Milo Creek (West, South, and Upper) that join to form the mainstem of Milo Creek. Prior to the remediation activities and infrastructure improvements discussed in this report, Milo Creek flowed in a steep, narrow canyon with heavy bedload (sediment, gravel,





River/Creek

N

0 250 500 1,000 Feet

Figure 4-14
OU 2 Milo Gulch and Reed Landing Site Map
2010 Five-Year Review
BUNKER HILL SUPERFUND SITE

\\CASTAIC\PROJ\EPA\CDABASIN_382081\GIS\MAPFILES\5YRREVIEW\5YR_OU2_MILOGULCHREEDLANDING.MXD JCARR3 11/9/2010 10:38:24

EPA

and rocks transported downstream by the force of water). The watershed crest at Wardner Peak is at approximately 6,300 feet msl and drops to 2,300 feet msl in Kellogg.

Historically, the upper Milo Creek watershed primarily supported mining and logging. 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. A large surface depression resulting from underground block-caving mining techniques is located in the western portion of the upper Milo watershed and is referred to as the Guy Cave Area. West Milo Creek flows into this surface depression and drains into the underground mine workings. In addition, several faults are located in the upper Milo watershed and cross the various forks of Milo Creek. It is believed that these fault zones and the proximity of the extensive mine workings beneath this area result in significant surface water infiltration into the mine workings. This clean surface water is then altered through chemical reactions with pyrite and oxygen to become AMD that eventually requires treatment at the CTP.

During the 1997 flood event that caused substantial damage to the downstream infrastructure for Milo Creek, debris overwhelmed the backhoe's ability to keep the trash rack clear and overtopped the culvert. Discussions with workers at the scene suggested that debris accumulation, not flood water, was the major cause of problems at Reed Landing. This observation was never validated with flow data and capacity correlations; however, it was evident that the 4-foot by 4-foot concrete box culvert (4 x 4 culvert) was in a state of disrepair and was failing as substantiated by sink holes. The mine owner repaired one culvert roof cave-in, consistent with his responsibilities as the owner and operator of the Bunker Hill Mine.

Lower Milo Creek Piping System

A second trash rack existed in Milo Creek approximately 300 feet above Wardner to screen excessive bedload prior to flow entering a 48-inch corrugated metal pipe system that conveyed Milo Creek beneath Wardner and Kellogg. This rack was located near a heavily contaminated historic mill site. The City of Wardner staged a backhoe at the pipe intake during flood events to remove accumulated debris from the trash rack.

As Milo Creek entered Wardner at the lower trash rack, it flowed underground through a combination of open channels, 48-inch concrete pipe, 48-inch corrugated metal pipe, and 4 x 4 culverts. The entire flow of Milo Creek was totally contained throughout Kellogg by similar piping materials. Due to the dilapidated and poor condition of this system, a severe flood occurred during a major runoff event in May 1997. Debris accumulations plugged the trash racks and high flows overwhelmed the conveyance system, which eventually resulted in failure of the Milo Creek subsurface conveyance structures downstream in Kellogg. Heavy bedload and debris plugged culvert and pipe systems and resulted in several "blowouts" of culverts, pipe failures, and the creation of sinkholes. In addition, lead-contaminated surface water and sediment flooded through many properties and re-contaminated areas where residential soils had been previously remediated as part of the 1991 OU 1 ROD (see Section 3 for more detailed information on the residential remediations). The affected properties were re-remediated by the Federal Emergency Management Administration (FEMA) and Idaho Bureau of Disaster Services (IBDS) under a Presidential Declaration. USEPA contributed a portion of the funding for the re-remediation.

After the 1997 flood, a basin was excavated in front of the intake to improve debris management. In 1998, a permanent concrete sediment basin was installed by FEMA and IBDS and connected to a new high-density polyethylene (HDPE) conveyance system that replaced the corrugated metal pipe. This new basin traps sediment and bedload, allows floating debris to be collected and removed, and directs stream water into twin 54-inch HDPE pipes through Wardner and Kellogg. Remedial actions conducted in Milo Gulch are listed in Table 4-51.

Reed Landing

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 trash rack screen made of railroad rails was placed over the entrance of the box culvert to prevent oversize materials from entering it. When the screen plugged or the capacity of the 4 x 4 culvert was exceeded, the flows ran overland across the mine dump and spilled over a failing wooden timber crib retaining wall at the face of the dump. During flood events, a backhoe was used to remove debris from the trash rack to ensure that water could enter into the culvert. These actions and other remediation activities at Reed Landing are described in Table 4-52.

TABLE 4-51
Milo Gulch Remedial Actions Conducted
2010 Five-Year Review, Bunker Hill Superfund Site

1995: ~ 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.
Areas in Kellogg re-contaminated after 1997 flood were remediated by FEMA and IBDS under a Presidential Declaration.
A water diversion dam and pipeline was built in 1999 on the mainstem of Milo Creek to minimize contact between Milo Creek surface water and tailings/mine waste rock on the valley floor and to reduce infiltration into the mine workings that underlie the stretch of Milo Creek between the confluence with the South Fork Milo Creek and Reed Landing. Milo Creek flow was piped down to a new piping system beneath the Wardner and Kellogg.

TABLE 4-52
Reed Landing Remedial Actions Conducted
2010 Five-Year Review, Bunker Hill Superfund Site

Removal of the failing timber crib retaining walls and re-grading the nearly vertical face of the landing to at least 2 horizontal to 1 vertical (2H:1V). Haul majority of spoils to the CIA smaller quantity used as in-fill at Guy Cave. This was necessary to prevent the transport of contaminants downstream and re-contamination of residential homes and commercial places of business.
Construction of a reinforced concrete overflow channel across the Reed Landing dump with the capacity to convey a 100-year recurrence interval storm event. This open channel configuration was chosen to allow for ease of access and cleanout given its significant conveyance capacity.
Construction of a stilling basin at the downstream end of the channel to dissipate energy prior to the creek entering a newly constructed 700-foot-long riprap lined channel that joined the existing Milo Creek drainage.
Construction of incidental items such as debris trash-racks and debris basins on the upstream end of Reed Landing to prevent the system from clogging with debris and to allow ease of maintenance.

4.3.13.3 Actions Since Last Five-Year Review (2005-2010)

Remedial Actions

No remedial actions have been conducted since 2000. However, there are additional remedial actions called for in the 2001 OU 2 ROD Amendment (USEPA, 2001a) 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 RA funding and completion of an SSC with IDEQ. In addition to the West Milo Diversion project, other remedial actions called for in the 2001 OU 2 ROD Amendment 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.

Operation and Maintenance

A watershed district was formally established in 1998 by a vote of people residing in Kellogg and Wardner for the purpose of maintaining the Milo structures. Sediment removal at the Wardner structure and Upper Milo was paid for by the State of Idaho while the watershed district was in its infancy. The State of Idaho also paid to connect a storm drain to the Wardner structure, remove a large steel plate left in the Washington structure, and connect a storm drain to the Milo system in lower Kellogg.

The watershed district, which is managed by three directors, has the responsibility of conducting regular O&M activities in accordance with the O&M manual listed below and as necessary to ensure that the Milo Gulch stormwater control system structures continue to function as designed. Funding for the activities is provided by annual property assessments. Tax assessments over the past decade have totaled $50,000. To date, only sediment removal at the Wardner structure and Upper Milo structure has occurred.

Separate O&M manuals have been prepared for the Milo and Reed Landing structures, as follows:

- *Reed Landing Flood Control Project Operations and Maintenance Manual* (USACE, 2000).
- *Operations and Maintenance Plan, Milo Creek Structures and Outfall* (TerraGraphics, 2001).

USACE has been negotiating permanent access to the site to allow O&M activities to be conducted as necessary. Those negotiations have been stalled because the mine owner has launched a legal action against USEPA for construction of the Reed Landing Drainage Enhancement Project. Access negotiations have been suspended pending resolution of the legal action.

Consistent with the rest of the site, O&M activities for the Reed Landing structures will be the responsibility of the State of Idaho once the remedial action is determined to be operational and functional as required under CERCLA. In the meantime, USEPA retains responsibility for the Reed Landing structures.

4.3.13.4 Technical Assessment of Milo Gulch Remedial Actions

In accordance with USEPA guidance (USEPA, 2001d), technical assessment was conducted by evaluating the following three questions related to protectiveness of the implemented remedial actions.

Question A: Is the remedy functioning as intended by the decision documents?

As noted above, the Milo Gulch remedies were constructed between 1995 and 2000. The performance of drainage systems such as those installed in Milo Gulch and at the Reed Landing require a period of years to evaluate for effectiveness as the system incurs varying storm events. To date, moderate (5-year) storms have occurred, and the system has performed as designed.

After 10 years of performance, the hydraulic systems, including pipes and open channels, have required minimal O&M efforts. Channel side slopes and channel inverts have remained stable. It is unknown whether internal piping inspections have been performed. Sediment accumulation has been minimal, reflecting the stabilized channels; however, there is some buildup of coarse gravels at the Reed Landing intake structures, and coarser materials are deposited at the upstream debris racks. This indicates that minor maintenance is needed. Although the small accumulation of gravels and sediments does not currently threaten the system, it does indicate the need for regular maintenance. Water quality monitoring has shown a decrease in particulate lead. However, dissolved zinc levels have not shown appreciable change. This issue is discussed in more detail in Section 4.3.3.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?

The exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy remain valid for the Milo Gulch remedial actions. A summary of the ARARs review for OU 2 decision documents is found is Section 4.2.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

To date, USEPA and the State of Idaho have not concluded negotiations on an SSC Amendment that allows for full implementation of the 2001 OU 2 ROD Amendment. Until this SSC Amendment is signed, USEPA cannot use remedial action funds to implement the remainder of the mine water remedy, including the surface water mitigation work identified for Milo Creek. AMD emanating from the Reed and Russell adits is running through the Reed Landing fill and finding preferential flow paths within the fill. This acid drainage has the potential to cause damage to the Reed Landing conveyance channel or leach metals out of the fill, which could cause voids in the fill and leave the conveyance system inadequately supported. USEPA is currently evaluating near-term vulnerabilities of the drainage system due to continued AMD and of the remaining portion of the historical 4 x 4 culvert.

Remedy Issues

A summary of issues identified with respect to the Milo Gulch remedy is provided in Table 4-53. The 2005 Five-Year Review issues regarding required periodic system maintenance and how USEPA cannot fully implement the 2001 OU 2 ROD Amendment are ongoing and, therefore, are not identified as new issues in the summary table.

TABLE 4-53
Summary of Milo Gulch Remedy Issues
2010 Five-Year Review, Bunker Hill Superfund Site

Remedy Issues	Affects Protectiveness (Y/N)	
	Current (now to 1 year)	Future (>1 year)
AMD Discharge at Reed and Russell Adits: Near Reed Landing, adit drainage flows into an old surface water channel and into the buried historical 4-foot x 4-foot structure, and eventually daylights onto a soil/tailings slope. Slope and 4-foot x 4-foot structure instability or erosion may occur as a result of this flow.	Y	Y

Recommendations

A summary of recommendations and follow-up actions for Milo Gulch is provided in Table 4-54. The 2005 Five-Year Review recommendations to secure access to conduct periodic system maintenance and to pursue viable solutions to the SSC impasse and implement the 2001 OU 2 ROD Amendment are being addressed and, therefore, are not identified as new recommendations in the summary table.

TABLE 4-54
Summary of Milo Gulch Recommendations and Follow-Up Actions
2010 Five-Year Review, Bunker Hill Superfund Site

Recommendations/Follow-up Actions	Responsible Entity	Oversight Agency	Proposed Milestone Date	Follow-up Actions: Affects Protectiveness (Y/N)	
				Current (now to 1 year)	Future (>1 year)
AMD Discharge at Reed and Russell Adits: Continue discussions/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 x 4-foot structure.	USEPA	USEPA	12/2010	Y	Y

4.3.14 A-4 Gypsum Pond Closure (PRP Action)

The A-4 Gypsum Pond is located in the central region of OU 2 near the mouth of Magnet Gulch. It is bounded on the west by McKinley Avenue and Magnet Gulch, on the east by Deadwood Gulch, on the south by McKinley Avenue, and on the north by Bunker Creek. The site encompasses an area extending 1,600 feet from east to west and 550 feet from north to south.

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.

Physical data collected during the Bunker Hill RI indicated that the maximum depth of gypsum is approximately 37 feet. The floor of the pond slopes gently downward from the McKinley Avenue road embankment at the southern boundary of the pond north towards Bunker Creek. The gypsum is contained on the north by a constructed embankment composed of mine waste rock that is 40 to 50 feet above the valley floor and extends approximately 5 to 10 feet above the gypsum surface. The slope of this embankment is 2H:1V, with the toe of the slope ending approximately 100 feet from Bunker Creek. Based on extrapolation of adjacent topography, the volume of gypsum in the A-4 Gypsum Pond is estimated to be approximately 500,000 to 800,000 cy (MFG, 1992b).

4.3.14.1 Review of ROD, ESD & ROD Requirements

Table 4-55 describes the required remedial actions at Gypsum Pond based on the ROD.

TABLE 4-55
A-4 Gypsum Pond Remedial Actions Required
2010 Five-Year Review, Bunker Hill Superfund Site

Requirement	Remedial Action Objective/Goal
1992 OU 2 ROD (Section 9.2.5)	
Add low-maintenance rock and/or soil barrier on A-4 Gypsum Pond or relocate to CIA.	Limit direct contact with contaminants and control migration of contaminants to surface water, groundwater, and the air. Minimize infiltration through the gypsum material.
Re-vegetate disturbed areas.	Minimize direct contact and migration of contaminants.

4.3.14.2 Background and Description of Phase I Remedial Actions

The principal objective of the A-4 Gypsum Pond remedial action was to reduce or eliminate contaminant migration from the pond to groundwater, surface water, and the air. To accomplish this, the 1992 OU 2 ROD required either the relocation of the pond to the CIA or capping of the gypsum in place with a low-maintenance rock or soil barrier.

The final decision was to close the A-4 Gypsum Pond in place. This decision was based upon the engineering feasibility of capping the pond and additional consideration of groundwater and surface water hydrology in that area. Subsequent RDRs and RAWPs prescribed the specific remedial actions that were to be conducted and performance standards that were to be met in order to achieve ROD requirements and objectives (MFG, 1996a and 1996b).

The Stauffer Management Company (SMC) initiated remedial actions in 1996. Table 4-56 summarizes the major remedial actions conducted.

TABLE 4-56
A-4 Gypsum Pond Remedial Actions Conducted
2010 Five-Year Review, Bunker Hill Superfund Site

Constructed run-on ditches along the up-gradient perimeter of the closure area to intercept and divert localized drainage away from the closure surface area.
Capped approximately 13 acres of the closure surface area. The soil was salvaged from the Borrow Area Landfill.
Removed the upper portion of the existing north perimeter embankment and re-graded the downstream face of the embankment to achieve a slope of 2H:1V
Rerouted Magnet Creek over the A-4 Pond through a geomembrane-lined channel. After problems with the above channel lining were encountered, it was decided to excavate and lower the Magnet Gulch channel down to the native soils at the floor of the tailings pond. Excavated gypsum was placed and re-graded on top of the closure area.
Installed a seepage barrier along the north perimeter of McKinley Pond (south of McKinley Avenue), and a new culvert under McKinley Avenue from McKinley Pond, with related headwalls and discharge apron to direct and control outflow from the pond area into Magnet Gulch channel. The culvert was sealed to control leakage from McKinley Pond
Installed a French drain along the toe of the north dike to intercept potential seeps and supplement the lowering of groundwater levels beneath the impounded gypsum. The drain extends ~ 650 toward the east from MGC on the north side of the north embankment. The drain is 3 feet wide and up to 12 feet deep. Drain rock was placed in the trench but was first lined with 8 oz geotextile material.
Constructed a drainage channel and outfall works around the closure area near the eastern perimeter to convey drainage from Deadwood Gulch to Bunker Creek. The channel is stabilized by vegetation. The spillway is stabilized with concrete and riprap.
Completed construction of a primary drainage channel and associated outfall works at the extreme west side of the A-4 Closure Area to convey perennial and seasonal flows of up to 450 cubic feet per second (cfs) that originate from the upper reaches of Magnet Gulch. Drainage is collected in a large, rock gabion structure that extends the length of Magnet Gulch channel within the A-4 facility. The gabions were placed on a grade that ranges from 15 to 50 percent after up to 40 feet of gypsum material was excavated from the area. The base of the channel is at a shallow grade of <5 percent.
Infilled existing solution cavities, plugged and partially removed the former decant piping and re-graded the impounded gypsum to produce a closure subgrade that slopes from a central ridge toward the northwest and northeast corners on the impoundment at a gradient of not less than 2 percent, thereby promoting positive surface drainage from the closure area to engineered discharge points.
Constructed runoff control ditches near the downgradient perimeter of the closure area to intercept and divert localized drainage to either Magnet Gulch or Deadwood Gulch channels.
In 2002, soil was applied to the west end of the A-4 in association with the completion of the Magnet Gulch channel. In 2003, the SMC applied cover soil over 75 percent of the A-4, to replace re-contaminated cover-soil.
Vegetation was established onsite following soil placement in 1996. The species mixture used was comprised primarily of pasture-type grasses. The goal at that time was to influence water infiltration into the soil cap by increasing evapotranspiration. The species selected were aggressive in their growth and quickly achieved the 85 percent RDR cover requirement; however, the vegetation in much of the area was eliminated when the cover soil was replaced again in 2003. The species seed mixture was then reassessed, and new species were introduced into the seed mixture to provide more native type plants that would require less O&M and would be longer lasting. Final seeding was completed in 2005. Final vegetative performance will be a function of O&M.

4.3.14.3 Actions Since Last Five-Year Review

Since the last Five-Year Review, SMC has:

- Reviewed the A-4 closure design and O&M requirements and procedures in 2005;
- Sampling groundwater in 11 wells placed within and around the pond on a monthly basis;
- Sampled surface water above and below the pond in the Magnet and Deadwood Creek channels;
- Conducted a geophysical survey in 2006 to determine whether dissolution cavities were a problem below the pond surface. Neither the 2006 nor an earlier 2004 survey found any substantial problems; and
- Applied surveying methods to check whether settlement had occurred in monuments in the Magnet Channel gabion spillway in 2006 and 2008. No settlement has occurred to date.

In 2008, the mouth of Magnet Creek was monitored in support of the Bunker Creek Pilot Study (CH2M HILL, 2009b). Dissolved cadmium and dissolved zinc concentrations measured at the mouth of Magnet Creek were significantly higher than concentrations measured at Monitoring Station BH-MG-0001, located near McKinley Avenue. It was presumed that dissolved metals contaminated groundwater routed through a French drain at the toe of the A-4 Gypsum Pond that discharges to the lower end of Magnet Creek caused the concentration increase. However, field observation in September 2009 of the A-4 Gypsum Pond French drain indicated no water was emanating from the drain outlet. The large concentration difference is attributable to dissolved metals contaminated groundwater discharging to the lower portion of Magnet Creek. This situation has been evaluated as part of the Upper Basin FFS (USEPA, 2010b) and reviewed concurrent with the preparation of this Five-Year Review.

4.3.14.4 Operation and Maintenance

An O&M Plan for the A-4 Gypsum Pond was approved by IDEQ in 2004 (MFG, 2004). This plan specifies the requirements for scheduled and unscheduled long-term O&M activities at the pond. The plan’s goal is to minimize impacts on human health and the environment while also maintaining focus on ROD requirements and performance standards. It requires SMC to monitor all aspects of the pond remediation activities each year after the spring melt and before snowfall. The plan also calls for inspections to be made following significant storm events that may contribute to a compromise of the protective soil cap over the pond.

Stauffer Chemical has been conducting O&M inspections biannually since the last Five-Year Review in the late spring and late fall and submitting an annual O&M report detailing the work done each year. Results of the inspections include:

- In 2005, sink holes were found around Well A4-4. Erosion rilling occurred in the northwest and northeast corners of the surface. The wire fence was damaged by animal activity. SMC subsequently repaired these items.

- In 2006, several sink holes and large cracks were discovered in the pond surface near the north dike, Well A4-4, around the concrete basin of Seep 2, at the base of the slope of the east dike wall at the mouth of Magnet Gulch, and at the base of the west bank slope west of the Well A4-1. Well A4-1 was replaced with a new well (A4-1R) due to its becoming ineffectual. The grass on the surface of the pond was burned off in May 2006, and a herbicide was used to kill all remaining grasses. The pond surface was tilled and replanted with a new grass blend.
- In 2007, grass thatch was removed from the entire northern slope of the A-4 Gypsum Pond dike and replanted. This was done because the resident grass had become choked out and was not coming back in the spring. O&M inspections found settlement along the southern slope of the north dike, near the mouth of the Magnet Channel, and at the top of the north dike access road. Tree saplings in the Deadwood spillway were removed. Perimeter fence repair was also conducted. A vegetation assessment was done using the point intercept method to monitor grass growth.
- In 2008, sink holes were discovered and filled along the southern slope of the north dike, near Well A4-1, and near the mouth of Magnet Channel at the base of the dike slope. Perimeter fence repair was necessary. A vegetation monitoring study was done on the grass growth, which found the coverage was over 87 percent.
- In 2009, sink holes were discovered near the cement apron around the catch basin on top of the west bank, at the top of the access road on the north bank, in the drainage channel which empties into the Deadwood Channel in the northeast corner of the pond, and at the base of the slope of the north dike at the mouth of Magnet Channel. Magnet Channel riprap failed near the mouth on the western side below the old dike due to dissolution of gypsum under the area. SMC subsequently repaired these items in addition to replacing Monitoring Well A4-2.

4.3.14.5 Technical Assessment of A-4 Gypsum Pond Remedial Actions

In accordance with USEPA guidance (USEPA, 2001d), technical assessment was conducted by evaluating the following three questions related to protectiveness of the implemented remedial actions.

Question A. Is the remedy functioning as intended by the decision documents?

All A-4 Gypsum Pond remedial activities were completed in 2003. A final inspection was performed in 2004, and IDEQ and USEPA are currently evaluating compliance with CD, RDR, and RAWP requirements.

The remedy is functioning as intended by the 1992 OU 2 ROD, the 1994 CD Statement of Work (SOW), the RDR, and the RAWP with the exception of controlling migration of contaminants moving to groundwater. All remedial actions were designed and implemented to meet remedy requirements and objectives. Specific remedial actions completed are described in Table 4-56.

Contaminant migration was specifically observed in Magnet Creek during the Bunker Creek Pilot Study. The dissolved cadmium and dissolved zinc concentrations significantly increased between monitoring station BH-MC-0001 and the mouth of Magnet Creek at Bunker Creek. As discussed in Section 4.3.14.3 above and in Section 4.3.11 (Bunker Creek), the large concentration difference is attributable to dissolved metals contaminated groundwater discharging to the lower portion of Magnet Creek. Dissolved metals from Magnet Gulch may be the largest source of dissolved metals in Bunker Creek surface water during low flow conditions.

As noted in the IDEQ *Pre-Certification Construction Completion Inspection Report* (IDEQ, 2004), all of the above performance standards have been met to date with the exception of the vegetation standard. As mentioned in Table 4-56, prior to 2003 this standard had been met. But with reapplication of cover soil in 2003, the last seeding of grasses took place in fall 2003. This grass mix ended up being predominantly a monoculture of red top grass. It was agreed between the governments and Stauffer that this seeding would be redone. In May 2006, the surface grass duff was burned and then a herbicide was sprayed to kill any remaining grass. A new seed mix was applied in June 2006. This grass stand was surveyed in September 2008 and verified at 87 percent coverage.

The O&M inspection findings and actions have shown that gypsum continues to dissolve and maintenance of the pond cover and monitoring wells will always be necessary.

Question B. 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 are all still valid. Section 4.2 summarizes the ARARs review for the applicable OU 2 decision documents. None of the new or revised standards identified in Section 4.2 call into question the protectiveness of the A-4 Gypsum Pond remedy.

Question C. Has any other information come to light that could call into question the protectiveness of the remedy?

There is no additional new information that calls into question the protectiveness of the remedy.

Remedy Issues

A summary of issues identified with respect to the A-4 Gypsum Pond remedy is provided in Table 4-57.

TABLE 4-57
Summary of A-4 Gypsum Pond Remedy Issues
2010 Five-Year Review, Bunker Hill Superfund Site

Remedy Issues	Affects Protectiveness (Y/N)	
	Current (now to 1 year)	**Future (>1 year)**
A-4 Contaminant Release: Groundwater level measurements indicate that groundwater periodically rises to above the bottom of the Gypsum Pond, in direct contact with tailings.	Y	Y

Recommendations

A summary of recommendations and follow-up actions for the A-4 Gypsum Pond is provided in Table 4-58.

TABLE 4-58
Summary of A-4 Gypsum Pond Recommendations and Follow-Up Actions
2010 Five-Year Review, Bunker Hill Superfund Site

Recommendations/Follow-up Actions	Responsible Entity	Oversight Agency	Proposed Milestone Date	Follow-up Actions: Affects Protectiveness (Y/N)	
				Current (now to 1 year)	Future (>1 year)
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 remedial design report (RDR).	SMC	IDEQ, USEPA,	12/2011	N	Y

4.3.15 South Fork Coeur d'Alene River Removal and Stabilization Project

4.3.15.1 Review of ROD, ROD Amendment, and ESD Requirements

While not specifically mentioned in the 1992 OU 2 ROD and not conducted with CERCLA funds, work on this reach of the SFCDR is an extension of the Smelterville Flats remedial action and is included here for completeness. This work included removal of highly contaminated tailings and tailings/alluvium mixtures, channel reconstruction, and re-vegetation to control migration of contaminants to surface water and groundwater. The 1992 OU 2 ROD requirements and cleanup goals and objectives for this work are the same as those cited in Section 4.3.5 for Smelterville Flats.

4.3.15.2 Background and Description of Phase I Remedial Actions

Field investigations of the portion of the river between Theatre Bridge in Smelterville and Bunker Avenue Bridge in Kellogg found tailings and mixtures of jig tailings and alluvium in the bed and banks that were being eroded during high-water events. Samples of these deposits indicated that, while most contained between 2,000 and 6,000 mg/kg lead, some contained between 10,000 and 20,000 mg/kg lead. The remedial actions in the SFCDR are listed in Table 4-59.

4.3.15.3 Actions Since Last Five-Year Review (2005-2010)

The South Fork Coeur d'Alene River Removal and Stabilization Project was completed in 2004.

TABLE 4-59
SFCDR Remedial Actions Conducted
2010 Five-Year Review, Bunker Hill Superfund Site

In 1999, 3,850 linear feet of north bank between Theatre Bridge and the east end of the Kellogg Gun Range property was stabilized. The bank was initially graded to reduce the slope and remove previously-placed debris. Removed materials were transported to the CIA for disposal. Armoring consisted of a riprap blanket on a geotextile filter cloth placed in direct contact with re-graded embankment material. Modeling results indicated that, during a 100-year event, velocities affecting the channel would vary depending on the channel width. Accordingly, riprap sizes varied from 18 to 24 inches and blanket thicknesses ranged from 24 to 36 inches.
In 1999, 2000, and 2001, contaminated floodplain sediments were excavated and hauled for disposal (mostly at the BAL). Removals focused on the eight areas with the highest heavy metal concentrations. A total of 88,970 cy of material was taken from excavations ranging in depth from 4 to 11 feet bgs. To avoid work directly in the river, the river was temporarily diverted into alternate channels.
In fall 2002, the eastern half of the reach was reconstructed. A buried rock sill was placed in the west bank just north of I-90 (near the Bunker Avenue bridge) to encourage the river to remain in that location. On the outside of the first bend downstream from I-90, the bank was armored with root wads. On the second bend downstream from the interchange and adjacent to I-90, the bank was armored with riprap. Topsoil was imported and placed on the floodplain inside the first bend. Tree and shrub seedlings and grass seed were planted in this area by volunteers from local schools. In spring 2003, 2,500 containerized willows and 2,750 willow cuttings were planted along both banks by Northwest Revegetation and Ecological Restoration.
In fall 2003, the western half of the reach was reconstructed. The outside of one major bend was armored with root wads while the outside of another was armored with riprap. In spring 2004, willow cuttings were planted along portions of both banks and in a wetland. Barren upland areas were seeded.

4.3.15.4 Technical Assessment of Remedial Actions

In accordance with USEPA guidance (USEPA, 2001d), technical assessment was conducted by evaluating the following three questions related to protectiveness of the implemented remedial actions.

Question A. Are the remedies functioning as intended by the decision documents?

The remedy is performing as designed.

Question B. Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of remedy selection still valid?

Section 4.2 summarizes the ARARs review for the applicable OU 2 decision documents. None of the new or revised standards identified in Section 4.2 call into question the protectiveness of the SFCDR Removal and Stabilization Project remedy.

Question C. Has any other information come to light that could call into question the protectiveness of the remedy?

There is no new information that calls into question the protectiveness of the remedy.

An evaluation of surface water and groundwater quality data has been completed within OU 2 to determine the effectiveness of the Phase I remedy. Phase II will consider any shortcomings encountered in implementing Phase I and will specifically address long-term water quality and environmental management issues. Results of observational monitoring of the SFCDR Removal and Stabilization Project will also be a part of this larger evaluation.

Remedy Issues and Recommendations

No remedy issues or recommendations were identified for the SFCDR removal and stabilization remedy.

4.3.16 Miscellaneous Box Projects

4.3.16.1 Review of ROD, ROD Amendment, and ESD Requirements

A number of miscellaneous Box projects have been conducted and funded by PRPS, USEPA, and the State of Idaho over the last 7 years. While these individual projects are not specifically mentioned in any decision document, these smaller-scale projects are extensions and/or compilations of other larger remedial actions at the Site, e.g., Smelterville Flats. As a result, these projects were designed and implemented to meet the RAOs of the larger remedial actions. A number of these smaller projects involved placement of caps performing as barriers to underlying contaminated material only. These caps are regulated by the ICP and therefore are not discussed here. Earlier Five-Year Review Reports provided a listing and description of these projects.

4.3.16.2 Background and Description of Remedial Actions

Projects were selected based on a number of evaluation criteria including: concentration of lead (greater than 1,000 mg/kg); accessibility by public; potential for migration or re-contamination; condition of adjacent properties; and how remediation of each area fit into the overall remedy for the Box.

Once selected, project remedies were based on applicable RDRs for that area. For example, the RDRs for the OU 1 residential remediation program were used for residential, commercial, and ROW properties adjacent to UMG-remediated properties (MFG, 1994). In addition, for all of these projects, current and future land uses and consistency with the ICP were considered in deciding specific actions for each property.

Table 4-60 lists the miscellaneous projects conducted in the Box that are not regulated by the ICP. It also includes the ROD and ESD sections applicable to each project.

4.3.16.3 Technical Assessment of Miscellaneous Box Capping Projects

In accordance with USEPA guidance (USEPA, 2001d), technical assessment was conducted by evaluating the following three questions related to protectiveness of the implemented remedial actions.

Question A. Are the remedies functioning as intended by the decision documents?

The remedies implemented in the above miscellaneous Box projects are functioning as intended. As the various areas in OU 2 are moved into the O&M phase, the State of Idaho's O&M program and ICP will ensure that these individual projects remain protective of the Box Phase I remedies.

TABLE 4-60
Miscellaneous Box Projects Implemented
2010 Five-Year Review, Bunker Hill Superfund Site

Project	Description
1992 OU 2 ROD (Sections 9.2.1 and 9.2.7)	
Lower Government Gulch	2001/2002. This project can be divided into two actions. The first action was completed in late 2000, and included realigning and increasing hydraulic capacity of Government Creek to handle a 100-year flood event (see Section 4.4.2.4). The second action was completed during the 2001 construction season. Vacant or unused areas in lower Government Gulch were capped with 6 inches of gravel. These areas included the area just south and west of the McKinley Avenue intersection with Government Gulch up to the Silver Valley Lab and east of the hillside, the area between the Enyeart Lumber Yard and Bunker Creek, and the area between the Enyeart Lumber Yard and the I-90 interchange in Smelterville. The Enyeart Lumber Yard was capped with asphalt of varying thickness based on the use of heavy equipment to move around lumber. A storm drain system was installed under the asphalt, and the surface was graded to drain toward inlets. Recommendations for maintenance and protection of drainage system and cap were formally provided to the owner.
1992 OU 2 ROD (Sections 9.2.2 and 9.2.7); April 1998 OU 2 ESD	
North Idaho Recycle Yard	2001. This project was completed during the 2001 construction season, and can be considered an extension of the Smelterville Flats remedial action (see Section 4.4.3). The property is located South of I-90 and west of Smelterville. The cap design took into account the typical activities of the property. A concrete paved area for the recycled material drop-off pile and asphalt cap for moving and transporting the material into the building was established. The remainder of the property received a 12-inch-thick gravel cap. The remedial action included surface water drainage through grading and a storm drain system. Recommendations for maintenance and protection of the drainage system and cap were formally provided to the owner.
S&P Truck Stop	2001. This project was completed during the 2001 construction season, and is also considered an extension of the Smelterville Flats remedial action. The site is located on the north side of I-90 just east of the Smelterville, I-90 interchange. The first capping of this truck stop was completed by the PRP (see Section 4.4.3); however, when the waste rock used for the cap was found to be contaminated, USACE re-capped the site. The cap design took into account typical activities at the site including truck parking and use of the gas station. Additional complexity of the site was an existing treatment/monitoring system installed to address fuel contamination beneath the gas station. Based on heavy truck traffic, the area immediately around the gas station and building was paved. The lot behind the gas station and between the road and the river were capped with a minimum of 6 inches of gravel suitable to support routine truck parking. The remedial action included surface water drainage through grading and a storm drain system. Recommendations for maintenance and protection of the drainage system and cap were formally provided to the owner.

Question B. Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of remedy selection still valid?

Sections 3.2 and 4.2 summarize the ARARs review for the applicable OU 1 and OU 2 decision documents. None of the new or revised standards identified in Section 4.2 call into question the protectiveness of the remedies discussed above. Risk parameters identified in the RODs remain valid, and there are no new contaminants of concern. Current and future land uses are taken into account when implementing these remedies.

Question C. Has any other information come to light that could call into question the protectiveness of the remedy?

There has been no new information that would affect the protectiveness of the remedy.

Remedy Issues and Recommendations

No remedy issues or recommendations were identified for the miscellaneous Box project remedies.

4.3.17 Institutional Controls Program

4.3.17.1 Background and Description

The ICP in OU 2 is the same as the ICP implemented in OU 1, as discussed throughout Section 3. Consequently, the ICP in OU 2 faces challenges similar to those in OU 1. The State of Idaho provides funding for the OU 2 ICP, including costs for Page Repository operations associated with disposal from the non-populated areas of the Box. The State will create an irrevocable trust to fund the OU 2 ICP in the long term. The ICP has issued 147 permits since the last Five-Year Review in OU 2 (Table 4-61).

IDEQ and USEPA recognize that securing long-term funding for the OU 2 ICP is a critical issue. IDEQ and USEPA agree that the ICP has both remedial action and O&M components. The 1995 SSC identifies $300,000 of the OU 2 ICP costs to be O&M costs. As part of determining long-term funding, IDEQ and USEPA will need to reach agreement on the components of the OU 2 ICP that are considered remedial action or O&M.

4.3.17.2 Technical Assessment of Institutional Controls Program

In accordance with USEPA guidance (USEPA, 2001d), technical assessment of the ICP was conducted by evaluating the following three questions related to its protectiveness.

TABLE 4-61
ICP Permits Issued in OU 2, 2005-2009
2010 Five-Year Review, Bunker Hill Superfund Site

Permit Type (total number)	Permits Issued						
	2005	2006	2007	2008	2009	Total	Annual Average
Large Exterior Projects – Excavation	45	29	20	38	9	141	28
Large Exterior Projects – Demolition	0	1	0	0	0	1	0
Interiors	0	0	1	0	0	1	0
Records of Compliance	0	0	2	2	0	4	1
Total	45	30	23	40	9	147	29

PUD = planned unit development

Question A: Is the remedy functioning as intended by the decision documents?

The ICP has been functioning as designed. The Panhandle Health District (PHD) has implemented the program according to its regulations. Community acceptance and compliance with the program have been high. Clean barriers that have been disrupted through excavation have been repaired. New barriers have been installed as appropriate for development. Contaminant migration has been controlled to prevent re-contamination of remediated properties.

Question B: 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 are still valid. The PHD continues to implement the ICP in a manner that maintains the residential community average of 350 mg/kg lead in residential yards, with no property exceeding 1,000 mg/kg lead.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

The OU 2 ICP faces issues similar to those in OU 1:

- Maintaining a consistent source of funding; and
- Ensuring disposal locations continued to be available to the public.

Remedy Issues

A summary of issues identified with respect to the OU 2 ICP remedy is provided in Table 4-62. The 2005 Five-Year Review issues regarding permanent funding for the ICP and the need for additional ICP disposal capacity are ongoing and, therefore, are not identified as new issues in the summary tables.

TABLE 4-62
Summary of OU 2 ICP Remedy Issues
2010 Five-Year Review, Bunker Hill Superfund Site

Remedy Issues	Affects Protectiveness (Y/N)	
	Current (now to 1 year)	**Future (>1 year)**
ICP Funding and Resources: Permanent funding of the ICP is needed to ensure success of the remedy, including consideration of adequate staff and information management support. At this time, permanent funding for the OU 2 ICP has not been secured.	N	Y

Recommendations

A summary of recommendations and follow-up actions for the OU 2 ICP is provided in Table 4-63. The 2005 Five-Year Review recommendations to secure permanent funding for the ICP and to establish a long-term ICP repository are being addressed, and, therefore, are not identified as new recommendations in the summary tables.

TABLE 4-63
Summary of Recommendations and Follow-up Actions for OU 2 ICP
2010 Five-Year Review, Bunker Hill Superfund Site

Recommendations/Follow-up Actions	Responsible Entity	Oversight Agency	Milestone Date	Follow-up Actions: Affects Protectiveness (Y/N)	
				Current (now to 1 year)	Future (>1 year)
ICP Funding and Resources: Secure permanent funding for the ICP, including consideration of adequate staff and information management support to ensure the long-term effectiveness of the program.	IDEQ, USEPA, PHD	IDEQ, USEPA	12/2012	N	Y

4.3.18 Infrastructure

Sustaining protective barriers is critical to the long-term success of the remedy and relies in part on the condition and effectiveness of the supporting infrastructure. Infrastructure plays several major roles in the remedial strategy. For example, roads, buildings, and parking lots may serve as barriers to subsurface contaminants. In addition, adequate and appropriately functioning infrastructure (i.e., stormwater conveyance, irrigation and street watering, and hydrologic management facilities) is necessary to control erosion and recontamination due to flooding. Curbs and gutters, appropriately sized storm drains, culverts, detention facilities, and correctly graded roads all serve to protect the remedy from erosion as well as providing municipal services to local residents. Currently, many systems are undersized or absent, posing a threat to the installed barriers.

4.3.18.1 Drainage Control Infrastructure and Revitalization Plan

The Basin Environmental Improvement Project Commission (Basin Commission) reviewed community infrastructure needs for all OUs in the development of a Drainage Control Infrastructure Revitalization Plan (DCIRP) funded by USEPA and IDEQ. The DCIRP outlines infrastructure needs of the communities within the Bunker Hill Superfund Site, including infrastructure needed to protect the remedy as well as infrastructure of particular interest to the communities, which may not be needed to protect the remedy. Community planners have relied on the information gathered in the IRP to apply for a range of state and federal grants and loans.

4.3.18.2 South Fork Coeur d'Alene River and Pine Creek

Local officials and residents are concerned about inadequate flood control systems for the SFCDR and its tributaries. USEPA and IDEQ are concerned about the potential for SFCDR and Pine Creek flooding to impact installed remedies. Development, including improvements associated with the OU 1 remedy, has occurred primarily within the heavily contaminated historical floodplain. There have been four federal Basin-wide disaster declarations requiring FEMA response actions since 1974.

During the Federal Insurance Rate Map (FIRM) update in 2008, the levee systems for the communities and unincorporated areas of Kellogg, Pinehurst, Cataldo, and Osburn were de-accredited due to lack of information about the condition of existing levees, greatly expanding the FEMA-defined 100-year floodplain. In the FIRM update, FEMA assumed that nonaccredited levees provide no flood protection of Basin communities. Although analysis of the levees has not been conducted, it is likely that existing levees afford some level of flood protection not reflected on the FEMA maps.

An initial estimate of the potential cost to re-establish Superfund remedies at risk to SFCDR flooding that was prepared for the Shoshone County Multi-Jurisdictional Hazards Mitigation indicates that roughly $63.5 million of remediation activity was completed site-wide within the 100-year floodplain as depicted on the FIRM (TerraGraphics, 2009a). The Shoshone County Hazards Mitigation Plan also estimated that in Kellogg and associated rural areas, at-risk public and private property in the FEMA-defined 100 year floodplain has an estimated value of $108.2 million. Estimated re-remediation costs alone are $19.7 million.

Pinehurst and associated rural areas show respective values of $56.8 million and $11.3 million. Although flooding of this magnitude has not occurred since the listing of the Bunker Hill Superfund Site, the threat of future flooding remains an issue that is important to the cleanup program and local communities.

Comprehensive flood control is a complex, multi-jurisdictional issue that exceeds the expertise and regulatory authority of USEPA's and the IDEQ's cleanup programs, and that of the local communities. BEIPC agreed in November 2009 to assume a leadership role in evaluating flooding issues associated with the SFCDR and Pine Creek. Flooding is a large, system-wide concern for which a comprehensive review and plan are required to ensure that work with the greatest flood protection potential is ultimately implemented. The Basin Commission has engaged a range of entities with the required combined expertise and regulatory jurisdiction. These entities include USACE, FEMA, Idaho Bureau of Homeland Security (BHS), USEPA, and IDEQ. USEPA and IDEQ are committed to assisting Basin Commission-led activities to evaluate and plan actions relative to addressing SFCDR flooding issues. No funding source for Basin Commission-led activities has been established.

4.3.18.3 Tributaries and Heavy Precipitation

The Upper Basin FFS Report (USEPA, 2010b) estimates that 21 percent of the existing installed remedies are at risk for contamination within OU 1 and OU 2 areas of Pinehurst, Smelterville, Kellogg, and Wardner during the 50-year flood. This excludes potential impacts from the SFCDR and is predicated on an assumption that all existing stormwater-related infrastructure continues to function at full capacity. In evaluating the risks to installed remedies from tributary flooding and heavy precipitation, the FFS Report considered the following threats: flooding with water that contains contaminated sediment, scouring (erosion) of barriers caused by stormwater, and contaminated sediment that is mobilized and carried into the communities by stormwater runoff and deposition. The follow-on Proposed Plan (USEPA, 2010a) proposes selection of specific actions within eight primary Upper Basin communities (Pinehurst, Smelterville, Kellogg, Wardner, Osburn, Silverton, Wallace, and Mullan) to address flooding risks to installed barriers. The Proposed Plan also establishes a framework for conducting similar analysis and selection of mitigation actions to address flooding concerns in Upper Basin gulches outside the eight primary communities.

4.3.18.4 Rights-of-Way

The RODs for OU 2 and OU 3 (USEPA, 1992, 2002) address cleanup of ROWs in the Box and the Upper Basin, as appropriate to respond to risks to human health. The RODs allow ROWs, which include all state, county, local and private roads, to be remediated such that they provide barriers to underlying metals contamination. Many ROWs were remediated during implementation of the Selected Remedies (protective barriers) in residential and commercial areas within the Box and Basin communities. However, USEPA and IDEQ recognize that some paved roadways may not provide adequate long-term barriers to underlying contaminated material, and that local and state entities are responsible for the long-term road development and maintenance efforts. USEPA and IDEQ are developing an approach under the existing RODs to address this issue collaboratively with local, county, and state entities responsible for providing and maintaining roadways in their communities. The objective of this effort is to ensure the long-term effectiveness of barriers installed in ROWs consistent with the transportation and maintenance needs of the Box and Upper Basin communities.

4.3.18.5 Technical Assessment of Infrastructure

In accordance with USEPA guidance (USEPA, 2001d), technical assessment was conducted by evaluating the following three questions related to protectiveness of the implemented remedial actions.

Question A: Is the remedy functioning as intended by the decision documents?

The review of documents, ARARs, and risk assumptions indicates that the remedy is functioning as intended by the RODs. Infrastructure (e.g., roads, sidewalks, parking lots, drainage controls) in OU 2 is an important part of the remedy because it serves as barriers to exposure pathways between contaminated soils and humans and helps to ensure clean barriers remain in place. The infrastructure in these communities continues to serve this purpose, though some infrastructure systems or features throughout OU 2 are deteriorating (e.g., paved roads) or undersized (e.g., drainage features). Under the ICP, local public entities are required to maintain the infrastructure such as roads in a manner to prevent contaminant exposures or migration. The reliance on infrastructure to help protect the remedy is appropriate, and failure to address infrastructure inadequacies in these communities may result in the loss of portions of the installed remedy. USEPA and IDEQ are developing an approach to address roads as barriers. The objective is to ensure the long-term effectiveness of barriers installed in ROWs, recognizing local transportation needs and maintenance responsibilities.

Infrastructure such as storm drain systems and flood control facilities also are relied upon to protect the installed remedy, by safely conveying storm and flood waters. In this case, the community infrastructure is not able to safely handle large flow events. To date one flood has occurred that disrupted barriers significantly, the 1997 Milo Creek flood. The FFS analyzed risk to installed barriers from heavy precipitation and tributary flooding and developed actions to address the risks. The follow-on Proposed Plan proposes selection of specific actions within the eight primary Upper Basin communities to address flooding risks to installed barriers. The Proposed Plan also establishes a framework for conducting similar analysis and selection of mitigation actions to address flooding concerns in Upper Basin gulches outside the eight primary communities.

The Basin Commission has assumed the lead in evaluating flooding issues associated with the SFCDR and Pine Creek. In that capacity, the Basin commission has engaged USACE, FEMA, Idaho BHS, USEPA, and IDEQ who have applicable expertise and regulatory jurisdiction. USEPA and IDEQ will be participating in Basin Commission-led activities related to SFCDR and Pine Creek flooding issues. No funding source for BEIPC-led activities has been established.

Question B: 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 are still valid. As previously noted, ongoing issues remain related to potential recontamination of protective barriers from flood events or lack of infrastructure improvements. Although these issues do not currently affect the protectiveness of the remedy, there may be recontamination concerns if infrastructure improvements are not implemented.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

Infrastructure improvements and ongoing maintenance of existing infrastructure are needed to ensure long-term success of the remedy. There is uncertainty regarding the remaining service life of these systems. The local communities have expressed concern about their ability to upgrade and maintain existing infrastructure and the associated operations and maintenance obligations needed to ensure long-term protectiveness of the remedy. Traditional funding mechanisms are not conducive to multi-jurisdictional owned projects or combining different utilities within projects. Similarly, the amount of funding needed to holistically address all infrastructure issues within a community typically exceeds the amount of funding that can be secured. Traditional infrastructure funding sources require relatively high local match requirements.

The communities’ ability to pay to maintain existing infrastructure or install new systems that provide barriers and protect the CERCLA installed remedy was evaluated prior to the 2005 Five-Year Review (USEPA, 2005). The Box and Basin IRP Program (TerraGraphics, 2009c) evaluated community assessments, current and continuing obligations, and needs at that time. The trend of decreasing tax revenues, declining population and reduction in state and federal assistance are increasing local funding burdens, deferred O&M, and delayed replacement of aging infrastructure systems. Resources to repair and install infrastructure have been difficult to secure by local governments. As discussed in Section 2.6, the National Academies’ National Research Council (NRC) prepared an independent evaluation of the Coeur d'Alene Basin interim Selected Remedy in 2005. The resulting report (NRC, 2005) noted that ICP and O&M programs include important components that will need perpetual maintenance for hundreds of years. The NRC expressed concern that state funding priorities change and maintaining an effective program is likely to be difficult.

Remedy Issues

A summary of issues identified with respect to infrastructure in OU 2 is provided in Table 4-64.

TABLE 4-64
Summary of OU 2 Infrastructure Issues
2010 Five-Year Review, Bunker Hill Superfund Site

Issues	Affects Protectiveness (Y/N)	
	Current (now to 1 year)	**Future (>1 year)**
Flood Control: Flooding in the SFCDR and Pine Creek poses a threat to portions of the installed remedy. Comprehensive flood control on the SFCDR and Pine Creek is a complex, multi-jurisdictional issue that exceeds the expertise and regulatory authority of the USEPA and IDEQ cleanup programs, and that of the local communities.	N	Y
Roads as Protective Barriers: A number of paved roads throughout all OUs are deteriorating, compromising their ability to function as protective barriers.	Y	Y
Infrastructure Maintenance Funding: Infrastructure maintenance and improvements remain an issue. The remedy relies on functioning infrastructure to be sustainable. Resources to repair and install infrastructure have been difficult to secure by local governments.	N	Y

Recommendations

A summary of recommendations and follow-up actions for OU 2 infrastructure is provided in Table 4-65.

4.4 Environmental Monitoring

The 1992 OU 2 ROD requires monitoring to evaluate compliance with ARARs in surface water and groundwater and requires biological resource monitoring to assess the status of ecological receptors. The primary goal of water quality monitoring is to determine the effect that Phase I remedial actions have had on surface water groundwater quality in OU 2 and to inform future remedial action decisions. The goal of the biomonitoring is to assess the impacts on biological receptors as a result of habitat development following implementation of remedial actions.

In 2006, USEPA and IDEQ updated the surface water, groundwater, biological, and remedial-action-specific monitoring plans for OU 2 in the Environmental Monitoring Program (EMP) for OU 2. These programs were implemented in full beginning in the fall of 2006. During the development of the EMP, an independent review of the groundwater and surface water monitoring activities proposed in the EMP was conducted (Parsons, 2006).

TABLE 4-65
Summary of OU 2 Infrastructure Recommendations and Follow-Up Actions
2010 Five-Year Review, Bunker Hill Superfund Site

Recommendations/Follow-up Actions	Party Responsible	Oversight Agency	Proposed Milestone Date	Follow-up Actions: Affects Protectiveness (Y/N)	
				Current (now to 1 year)	Future (>1 year)
Flood Control: Continue working with the Basin Commission and other stakeholders to evaluate and plan actions relative to addressing SFCDR and Pine Creek flooding that may affect cleanups.	Local Governments, IDEQ, USEPA, PHD	IDEQ, USEPA	12/2012	N	Y
Roads as Protective Barriers: Continue working to develop an approach for addressing roads as long-term barriers in collaboration with state, county, and local entities.	Local Governments, IDEQ, USEPA, PHD	IDEQ, USEPA	12/2012	Y	Y
Infrastructure Maintenance Funding: Develop appropriate institutions and funding mechanisms to finance and oversee stewardship activities.	Local Governments, IDEQ, PHD	IDEQ, USEPA	12/2012	N	Y

The recommendations from this independent review were incorporated into the final EMP. In 2009, USEPA and IDEQ employed the adaptive management principles identified in the EMP to optimize the water quality monitoring identified in the EMP for the fall 2009 monitoring event. A reduction in the number of locations requiring water quality monitoring was achieved. In addition, several of the Phase I remedial-action-specific effectiveness monitoring plans were eliminated or revised. The changes in the OU 2 EMP water quality monitoring activities are discussed in detail in Section 4.4.1.

Environmental monitoring in the Basin—including monitoring activities under the OU 2 EMP, the OU 3 Basin Environmental Monitoring Plan (BEMP; see Section 5.6.1), and OU 3 remedial action effectiveness monitoring (see Section 5.6.2)—is being consolidated into a comprehensive BEMP concurrently with preparation of this Five-Year Review Report. The comprehensive BEMP is expected to be completed in 2010 and implemented in fall 2010.

As noted in the 2005 Five-Year Review (USEPA, 2005), air monitoring was discontinued in 2003 because no exceedances had occurred between 2000 and 2003. Both USEPA and IDEQ determined that additional air monitoring would be required only if additional source removal and/or hauling activities were conducted. During the period from 2005 to present, no source removal or hauling actions have occurred and no air monitoring has been performed. Therefore, air monitoring is not discussed further in this document.

The following subsections discuss OU 2 water quality and biological resource monitoring activities and describe how the monitoring data are being managed.

4.4.1 OU 2 Water Quality Monitoring

The 1992 OU 2 ROD, Section 9.2.15, requires water quality monitoring to evaluate compliance with ARARs in surface water and groundwater to evaluate the performance of the remedial actions. The objectives of the OU 2 EMP water quality monitoring network are to:

- Evaluate tributaries to the SFCDR within OU 2 for compliance with AWQC;
- Evaluate groundwater within OU 2 for compliance with MCL/MCLGs;
- Evaluate potential impacts on SFCDR water quality as a result of contributions from OU 2 tributaries and groundwater;
- Evaluate the effectiveness of the overall OU 2 remedy and specific remedial actions within OU 2 with respect to groundwater, surface water, and ecological conditions;
- Provide data for CERCLA-required Five-Year Reviews of the progress on remedy implementation; and
- Improve understanding of processes and variability within OU 2 to assist in Phase I remedial action evaluations and Phase II remedial action design and implementation.

The OU 2 EMP is founded on two main principles, which are intended to enhance practicality, robustness, and cost-effectiveness (CH2M HILL and Ecology and Environment, 2006). The first principle is a focus on the goals of the OU 2 remedy identified in the 1992 OU 2 ROD. The 1992 OU 2 ROD identifies goals with respect to water quality. The key indicators of change used to measure achievement of these goals are:

- Dissolved and total metals in surface water; and
- Dissolved metals in groundwater.

The second principle is a focus on selecting suitable monitoring parameters and frequencies. The monitoring program uses parameters and sampling frequencies that are intended to be sensitive and responsive to the potential rates of relevant environmental changes in OU 2 over the monitoring period. The monitoring program included parameters monitored at relatively long intervals (e.g., 5 years) and parameters measured at more frequent intervals (e.g., semi-annually). This approach reduces sample collection and analysis costs while maintaining adequate monitoring effectiveness in terms of sensitivity and responsiveness.

The original groundwater quality monitoring network for OU 2 was designed and implemented by the PRPs for OU 2 in 1987 during the remedial investigation (RI; MFG, 1992b). As a result of the bankruptcy of the major PRPs for the site in 1994 and subsequent Phase I remedy implementation by USEPA and the State of Idaho from 1996 to 2000, several of the monitoring locations established during the RI were destroyed. Twenty monitoring wells were installed in 2000 to replace a number of these monitoring locations. In addition, in 2006, 23 monitoring wells, many as nested pairs in both the upper and lower aquifers, were installed along transects across the SFCDR valley within OU 2. The current OU 2 EMP groundwater monitoring network consists of 127 monitoring wells and piezometers, of which 82 are currently monitored in the long-term monitoring program. During the development of the OU 2 EMP in 2006 and during subsequent adaptive management reviews of the OU 2 EMP, enhancements have been made to the OU 2 EMP groundwater monitoring network. Enhancements to the groundwater monitoring network during this Five-Year Review period include:

- Ten monitoring wells were installed in 2006 to expand the understanding of the nature and extent of metals contamination in the groundwater system, and three existing monitoring wells were abandoned; and
- Thirty-six piezometers were installed in 2008 in select areas of OU 2 identified in the Source Areas of Concern Report (CH2M HILL, 2008b) to support the development and evaluation of potential Phase II remedial actions.

In general, groundwater monitoring within OU 2 occurred on a sporadic basis from 1987 to 1994 when the PRPs were responsible for the program. The groundwater monitoring program was re-started in 1996 by USEPA and has been generally monitored on a quarterly basis until the implementation of the EMP in 2006. Currently, most OU 2 wells are monitored on a semi-annual basis, with select wells monitored annually or a 5-year basis.

The current OU 2 surface water monitoring network consists of five monitoring locations on the SFCDR co-monitored as part of the BEMP developed for OU 3 and 21 locations monitoring tributaries, swamp outfalls, adit discharge, and the CTP effluent, and the Page and City of Smelterville wastewater treatment plant (WWTP) effluents, currently monitored on a semi-annual basis.

The OU 2 EMP also includes groundwater/surface water interaction monitoring consisting of 11 SFCDR and 4 SFCDR tributary monitoring stations. During this review period, groundwater/surface water interaction monitoring was conducted in 2006, 2007, and 2008. The purpose of this monitoring is to assess contaminant metal loading from groundwater and major OU 2 tributaries to the SFCDR under low-flow conditions. Data obtained during this monitoring were used to evaluate the effectiveness of the Phase I remedial actions, to determine source areas and data gaps presented in the Source Areas of Concern Report (CH2M HILL, 2008b), and to assist in the development of potential Phase II remedial actions. In the OU 2 EMP, future groundwater/surface water monitoring was slated to occur every 5 years (e.g., 2013, 2018) to provide data for upcoming 5-year reviews. As part of the monitoring program optimization, the groundwater/surface water interaction monitoring will not be included in the forthcoming comprehensive BEMP.

In addition to the surface water and groundwater monitoring discussed above, USEPA and the State of Idaho developed five Phase I remedial-action-specific effectiveness monitoring plans for the following Phase I remedial actions:

- Smelter Closure Area,
- Central Impoundment Area,
- Bunker Creek,
- Government Gulch, and
- Smelterville Flats.

The intent of the Phase I remedial-action-specific effectiveness monitoring was to provide data to evaluate the effectiveness of these Phase I remedial actions with respect to their action-specific remedial action objectives and performance standards and to provide additional data that may be beneficial in making decisions regarding the need for potential additional remedial actions in these areas as part of Phase II. Following the evaluation of the effectiveness of Phase I remedial actions (CH2M HILL, 2008b) and the current development of Phase II remedial actions for OU 2 in the upcoming FFS, the need for these remedial action-specific monitoring programs was removed. However, the Phase I remedial-action-specific monitoring associated with the SCA remains intact and will be carried forward in the upcoming comprehensive BEMP because it is required under the 1996 OU 2 ROD Amendment.

4.4.2 Biological Resource Monitoring

In accordance with the 1992 OU 2 ROD and the 2000 Five-Year Review recommendations for OU 2 (USEPA, 2000b), a biological resource monitoring program is being implemented to assess the status of the environmental receptors in the non-populated areas of the Bunker Hill Box. Biological monitoring is a component of the OU 2 EMP, and USFWS has been conducting the biological monitoring activities since 2001 through an interagency agreement with USEPA.

The OU 2 ROD did not select remedial actions for protection of ecological receptors, but habitat establishment is a desired outcome of the Selected Remedy. As habitat is established, biological resource monitoring activities are being conducted to evaluate impacts on resident populations. These monitoring activities examine remediated areas to evaluate the status of biological resources and their habitat in OU 2 and thereby monitor the effectiveness of remedial actions on those resources. The results of the biological monitoring activities in OU 2 will be used to support the development of similar activities in OU 3. Table 4-66 identifies the biological monitoring activities conducted from 2006 through 2009.

TABLE 4-66
OU 2 Biological Monitoring Activities
2010 Five-Year Review, Bunker Hill Superfund Site

Monitoring Component	2006	2007	2008	2009
Benthic Invertebrates – Diversity/Abundance	X			
Benthic Invertebrates – Tissue Metals	X			
Waterfowl – Population	X	X		X
Waterfowl – Blood Lead			X	
Songbirds – Blood Lead		X		
Breeding Bird Survey	X			
Small Mammals			X	
Amphibian Use	X			
Wildlife Fecal Evaluation		X		
Soil, Sediment, and Water – Metal Concentrations			X	

The biological resource monitoring program is in the process of being optimized as part of development of a Basin-wide comprehensive BEMP, which is further discussed in Section 5.6.1. This optimized biological resource monitoring program will be implemented as part of the comprehensive BEMP beginning in 2010.

The biological resource monitoring results from the activities listed in Table 4-66 are intended to determine the status and trends in biological resources within the OU 2 habitat types. The status and trends, if applicable, of biological resources in OU 2 are described in the 2005-2009 Biological Resources Five-Year Review (USFWS, 2010a) and are summarized as follows:

- The preliminary benthic macroinvertebrate community information indicates that the overall health of the SFCDR within OU 2 is in fair ecological condition.
- Arsenic, cadmium, lead, and zinc were detected in all macroinvertebrate samples from all reaches tested. Lead concentrations were highest in the farthest upstream and farthest downstream samples. Zinc and cadmium concentrations were highest in samples collected from the middle reach samples.
- The forested vegetation supporting bird communities has not yet recovered enough within OU 2 to resemble native forested habitats in the ecoregion. As vegetative diversity and structure improves within OU 2, a corresponding shift in avian communities to more closely represent reference areas is expected to occur.
- Blood lead concentrations from all American robins and 88 percent of song sparrows were above reference levels. Of these, 90 percent of the robins and 9 percent of the song sparrows had blood lead concentrations in the range suggested to be clinically poisonous, and 79 percent of the song sparrows were in the subclinical range. Soil samples were collected to assist in bird blood lead evaluations; however, there appeared to be no correlation between the soil and blood data.
- A general lack of amphibians and amphibian species diversity was observed in Smelterville Flats and may indicate suboptimal wetland health.
- Mean cadmium, lead, and zinc concentrations from deer and elk show metals exposure within the OU 2 remediated areas. These results are similar to previous evaluations comparing wildlife fecal metal concentrations within OU 2 remediated areas to reference locations.
- Blood lead concentrations in samples exceeded the suggested toxicity threshold for waterfowl.
- Small mammals using habitat on the CIA and in Smelterville Flats are exposed to metal concentrations above those from reference areas, and in some instances, above levels shown to be associated with adverse effects on small mammals.
- The total waterfowl numbers observed in 2006, 2007, and 2009 at the Page Pond Wetland Complex were 1,944, 2,753, and 6,663, respectively. The total numbers of waterfowl observed in 2006, 2007, and 2009 at Smelterville Flats were 133, 79, and 36, respectively.

4.4.3 Data Management

Environmental monitoring data collected under the EMP and BEMP are managed in a centralized database. Human-health-related data are not included in this database. Environmental data are a strategic, long-term asset that requires a data management system that is stable, accessible, credible, and cost-effective. STORET is the USEPA's web-based repository for historic and future water quality, biological, and physical data. The system is used by states, tribes, USEPA and other federal agencies, universities, and citizens to access the nation's environmental monitoring data.

STORET is currently being used for Site environmental data management and is in transition to the new Water Quality Exchange (WQX) data management system. During the last 5 years, data have been available at www.storet.org, and new website, www.bunkerhilldata.org, has recently been established. This website provides access to site data and tools to help make the data accessible to a wide range of users.

4.5 Performance Evaluation of Selected Remedy

This section presents the performance evaluation of the Selected Remedy for OU 2 by providing an overview in Section 4.5.1 followed by a more detailed evaluation of the Phase I remedy in Section 4.5.2. Only Phase I has been completed. Phase II of the remedy was presented in the FFS and will be formally selected in the ROD Amendment.

4.5.1 Overview

The remedy currently being implemented in OU 2 is expected to be protective of human health and the environment where response actions have already been taken, provided that follow-up actions identified in Table 6-4 are implemented. In the interim, exposure pathways that could result in unacceptable risks are being controlled or addressed in locations where remedial work has been completed.

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 includes extensive source removal and stabilization efforts, demolition activities, community development initiatives, development and implementation of the ICP, land use development support, and public health response actions. Phase I also includes 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 is 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 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.

Also, as summarized in Table 4-1, 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 and development of area-specific O&M manuals.

In 2008, USEPA initiated efforts to identify actions needed to augment the remedial actions taken in OU 2, building on information produced during evaluations of Phase I remedial actions. Results of the evaluation of Phase I source control and removal activities to meet human health and ecological water quality goals have been incorporated into the 2010 FFS (see Section 2.7 for more information on the FFS).

An SSC Amendment that allows for the full implementation of the 2001 OU 2 ROD Amendment needs to be negotiated and signed. Time-critical components of this ROD amendment were implemented to prevent catastrophic failure of the CTP and discharges of AMD to Bunker Creek and the SFCDR. Until an SSC amendment is signed, however, control and treatment of AMD and its impact on water quality will continue to be an issue.

The OU 2 remedy is currently protective of human health and the environment where remedial actions have been taken. However, flooding and infrastructure issues may affect remedy protectiveness. In addition, the ability of the local communities to improve and maintain infrastructure to protect the remedy is a concern. Provision of a long-term ICP repository is essential to the continued performance of the installed human health barriers.

4.5.2 Evaluation of OU 2 Phase I Remedy

Since beginning the implementation of Phase I in 1995, a significant amount of remediation work has been conducted. The remedial efforts have reduced or eliminated the potential for people to come in direct contact with soil/source contaminants, have reduced opportunities for transport of contaminants by surface water and air, and are expected to provide surface water and groundwater quality improvements over time throughout the Site.

A Phase I remedy evaluation was performed to assess the impact of the remedy with respect to OU 2-wide RAOs for surface water and groundwater quality identified in the 1992 OU 2 ROD (USEPA, 1992). These RAOs are:

- Compliance with AWQC in tributaries to the SFCDR within OU 2; and
- Compliance with MCLs for groundwater within OU 2.

The SFCDR was not included in OU 2 because of the large amount of contamination entering OU 2 in the SFCDR from upstream sources located in the upper portions of OU 3.

Therefore, the SFCDR is included in OU 3. However, the impact on SFCDR water quality from OU 2 sources was evaluated. One of the overall goals of the OU 2 remedy was to reduce contamination to the SFCDR from sources within OU 2.

Results of this water quality-based evaluation are present in the Phase I Remedial Action Assessment Report (CH2M HILL, 2007b). The following subsections summarize the OU 2-wide water quality assessment findings. Site-specific information is presented in Section 4.3.

4.5.2.1 Tributary Surface Water Quality

Dissolved cadmium and dissolved zinc concentrations routinely exceed the AWQC in all tributaries in OU 2 except for Italian Gulch, Jackass Creek, and Grouse Creek. Dissolved lead concentrations consistently exceed the AWQC in Portal Gulch and Milo Creek. Although dissolved metal concentrations in the majority of tributaries within OU 2 continue to exceed the AWQC, decreases in concentrations between pre- and post-remediation time periods have occurred in tributaries where water quality-oriented Phase I remedial actions have been implemented (Bunker Creek and Government Creek). The presence of AMD releases from the Reed and Russell Adits in Milo Gulch has resulted in significant degradation of Milo Creek water quality.

4.5.2.2 Groundwater Quality

Dissolved cadmium and dissolved zinc concentrations continue to exceed the MCL in groundwater throughout most of OU 2. However, significant reductions between the pre- and post-remediation time periods have been observed for both. In addition, a large number of decreasing post-remediation trends are present for dissolved cadmium and dissolved zinc throughout OU 2. Increasing dissolved cadmium and dissolved zinc trends have also been noted in some areas within OU 2, particularly in monitoring wells located between the SFCDR and CIA. Increases in dissolved cadmium and dissolved zinc concentrations in this area may be a result of removal and rechannelization work conducted in the SFCDR between 1999 and 2003. Disturbances to the river bed may have increased the amount of surface water infiltrating through contaminated materials in this area, resulting in increasing concentrations at these monitoring wells.

The extent and concentration of dissolved arsenic and dissolved lead contamination in OU 2 groundwater have decreased substantially between the pre- and post-remediation time periods. The majority of dissolved arsenic and dissolved lead contamination during both time periods occurred in the upper aquifer below and downgradient from the CIA. The cessation of AMD impoundment on top of the CIA and capping of the CIA with a low-permeability cap are the likely cause of reductions in this area. Prior to remediation, no groundwater monitoring was conducted in the A-4 Gypsum Pond area. During the post-remediation time period, high concentrations of dissolved lead are present in the A-4 Gypsum Pond area, as well as the highest concentrations of dissolved zinc in groundwater in OU 2 (CH2M HILL, 2007b).

4.5.2.3 Impact on SFCDR Water Quality

Dissolved metal loading to the SFCDR from groundwater and surface water within OU 2 under base-flow conditions has decreased considerably between the pre- and post-remediation time periods. AWQC ratios for dissolved metals in the SFCDR have also shown significant decreases. Between the pre- and post-remediation time periods, dissolved zinc load and AWQC ratios have decreased approximately 30 percent in the SFCDR at the western boundary of OU 2 (Station SF-271).

4.5.2.4 Identification of OU 2 Source Areas of Concern

Based on the results of the Phase I evaluation, source areas within OU 2 were evaluated and identified in the Source Areas of Concern Report (CH2M HILL, 2008b). The identification of source areas was based on the relative impact of these source areas on water quality in the SFCDR as it passes through OU 2. The identification of source areas in this report was used by USEPA and IDEQ to recognize specific areas for additional data collection in support of potential Phase II remedial actions. Field studies and data collection activities were concentrated in 2008.

Subsequent analysis of this data suggested the largest source of dissolved metals contamination to surface water and groundwater at OU 2 is contaminated materials located in floodplains and beneath the populated areas and infrastructure within the OU. Because of the widespread nature of contaminated materials, USEPA's commitment not to displace the community, and the complexity of contaminant transport within OU 2, a remedial approach focusing on groundwater-based actions was developed.

5 Review of Selected Remedies for Operable Unit 3

This section summarizes the protectiveness evaluation of the Operable Unit (OU) 3 remedial actions conducted to date at the Bunker Hill Superfund Site (the Site). The evaluation covers studies and remedial activities within the OU 3 boundary conducted before and after the September 2002 OU 3 Interim Record of Decision (2002 OU 3 ROD; U.S. Environmental Protection Agency [USEPA], 2002). The information in this section is organized as follows:

- 5.1 Overview of Selected Remedies
- 5.2 Review of Applicable or Relevant and Appropriate Requirements
- 5.3 Review of Selected Remedy Work and Remedial Actions
- 5.4 Coeur d'Alene Lake Management Plan
- 5.5 Trail of the Coeur d'Alenes CERCLA Removal Action
- 5.6 Environmental Monitoring and Studies
- 5.7 Performance Evaluation of the OU 3 Remedy

Figure 5-1 is a site map for OU 3, and Figure 5-2 is a timeline of important events.

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, 2002). USEPA conducted several years of intensive studies to determine the extent of contamination and the associated risks to people and the environment in support of this ROD. 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 U.S. Bureau of Land Management (BLM), the U.S. Fish and Wildlife Service (USFWS), and the U.S. Forest Service (USFS).

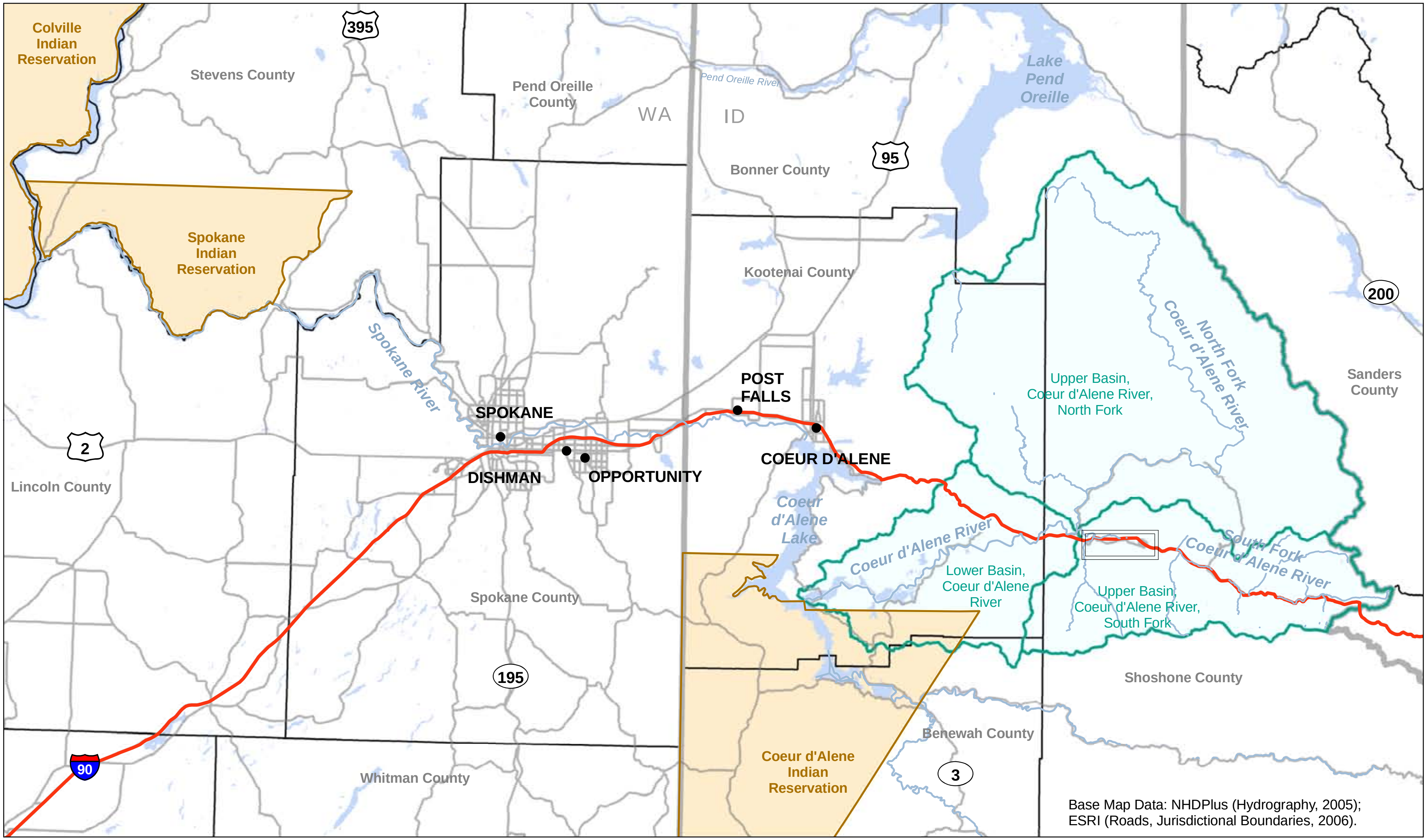
The 2002 OU 3 ROD includes:

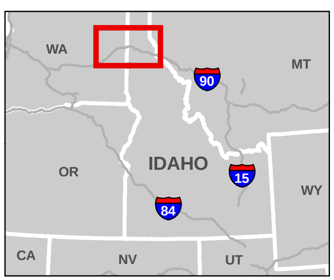
- The full remedy needed to protect human health in the community and residential areas, including identified recreational areas of the Upper Basin and Lower Basin, as well as Washington recreational areas along the Spokane River upstream from Upriver Dam; and

- 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.

The 2002 OU 3 ROD does not address the following:

- Recreational use at areas in the Upper Basin and Lower Basin where cleanup actions are not implemented pursuant to the 2002 OU 3 ROD;





- 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 5-1
Operable Unit 3 Site Map
2010 Five-Year Review
BUNKER HILL SUPERFUND SITE

EPA

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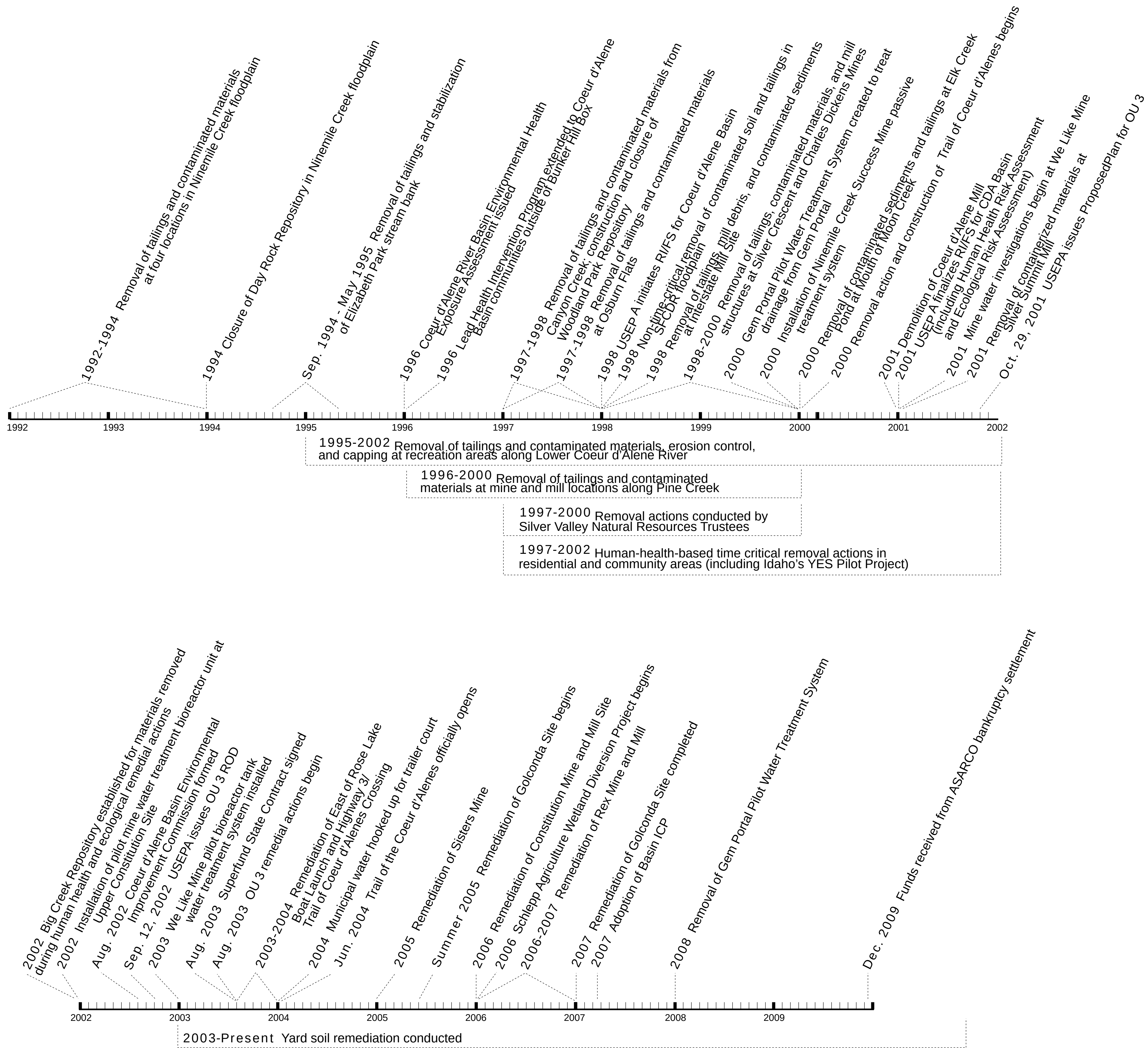


Legend:

OU	Operable Unit
RI/FS	Remedial Investigation/ Study
ROD	Record of Decision
SFCDR Feasibility	South Fork of the Coeur d'Alene River
USEPA	U.S. Environmental Agency

Protection

Figure 5-2
OU 3 Removal and Remedial Action Timeline
2010 Five-Year Review
BUNKER HILL SUPERFUND SITE

- Subsistence lifestyles, such as those traditional to the Coeur d'Alene and Spokane Tribes; and
- Potential future use of groundwater that is currently contaminated with metals.

Although the sediments at the bottom of Coeur d'Alene Lake contain mining contaminants, a remedy for Coeur d'Alene Lake is not included 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. The revised plan was completed in 2009, and initial steps in implementing the plan have been undertaken. The plan has been developed to limit basin-wide nutrient inputs that impair lake water quality conditions, which in turn influence the solubility of mine-related contamination contained in lake sediments. Because contaminants have been left in place in the lake as a result of Upper Basin mining activities, work related to development of the LMP is assessed in this review.

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. USEPA Region 10 continues to work with USEPA Headquarters and other parties to secure funding for full implementation of the 2002 OU 3 ROD.

State of Idaho legislation under the Basin Environmental Improvement Act (Title 39, Chapter 810) established the Coeur d'Alene Basin Environmental Improvement Project Commission (Basin Commission). This commission includes federal, state, tribal, and local governmental involvement. USEPA serves as the federal government representative to the Basin Commission and continues to work closely with the governments and communities as the cleanup plan is implemented. USEPA will continue to be responsible for ensuring that the cleanup work meets the requirements of the 2002 OU 3 ROD as well as Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) laws and regulations.

The National Academies' National Research Council (NRC) independently reviewed the Coeur d'Alene Basin to examine USEPA's scientific and technical practices in site characterization, human and ecological risk assessment, remedial planning, and decision making. The NRC is an independent nongovernmental institution that advises the nation on scientific, technical, and medical issues. The Idaho Congressional delegation requested that the study be performed, and Congress mandated that USEPA fund the study at a cost of $850,000. The NRC convened the Committee on Superfund Site Assessment and Remediation in the Coeur d'Alene Basin, composed of members with a wide range of expertise and backgrounds.

The NRC study began in June 2003. The NRC held public sessions in Washington, D.C.; Wallace, Idaho; Coeur d'Alene, Idaho; and Spokane, Washington. The NRC review of the ROD for OU 3 is entitled *Superfund and Mining Megasites: Lessons from the Coeur d'Alene River Basin* (NRC, 2005). Since the ROD for OU 3 was issued in 2002, USEPA has continued to support data collection efforts throughout the Coeur d'Alene Basin, particularly in the Upper Basin. The additional data have served to improve USEPA's understanding of the Upper Basin and have enabled USEPA to address key NRC recommendations with respect to the fate and transport of dissolved metals in the subsurface and the role that groundwater plays in contaminant loading to surface water. In addition, USEPA remains committed to working closely with the Basin Commission as well as the Commission's Technical Leadership Group (TLG) and Citizens' Coordinating Council (CCC) in implementing the 2002 OU 3 ROD.

5.1.1 Upper and Lower Basins of the South Fork Coeur d'Alene River

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. Young children are primarily exposed to lead through normal hand-to-mouth activities that cause them to ingest house dust, which is often contaminated with lead from exterior soil or other sources such as lead-based paint (Succop, et al., 1998; Manton, et al., 2000; Lanphear, et al., 2002; Laidlaw, Mielke, et al. 2005; Laidlaw and Filippelli, 2008). 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 Basin 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 micrograms per deciliter (µg/dL) and a one percent or less probability of a typical child having a blood lead level greater than 15 µg/dL" (USEPA, 2002). The 2002 OU 3 ROD also describes actions to reduce human exposure to other metals in soil and private drinking water sources.

The following subsections summarize the remedies in residential and community areas, remedies in recreational areas, information for fishermen, and the Institutional Controls Program (ICP). The Idaho Department of Environmental Quality (IDEQ) is the lead agency for implementation of the residential and community area cleanup, with USEPA funding and oversight. USEPA is the lead agency for cleanup of the recreational areas.

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 rights-of-way (ROWs);
- Partial removal and replacement of surface soils that have metal levels greater than 1,000 milligrams per kilogram (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 high-efficiency particulate air filter

(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, boat ramps) that have been prioritized for cleanup. The contaminated soils at 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 Fishermen

The 2002 OU 3 ROD calls for education and information, including health advisories, to be provided to fishermen 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.

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 Panhandle Health District (PHD), was established and 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 Section 12.2 of the 2002 OU 3 ROD and summarized in Table 12.2-1 of the ROD (USEPA, 2002). For protection of the environment, three environmental priorities were identified 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.

The following subsections provide a brief overview of the 2002 OU 3 ROD ecological cleanup actions in the Upper and Lower Basins.

Upper Basin

For the Upper Basin of OU 3, USEPA is updating its cleanup plan to incorporate improved knowledge of conditions at the Site learned partially in response to the NRC review of the ROD for OU 3. A summary of the work conducted to date by USEPA to update the cleanup plan is presented in Section 2.6.

Remedial actions completed to date in the Upper Basin that are expected to result in an ecological benefit were primarily conducted at the mine and mill sites discussed in Section 5.3.4. Under the 2002 OU 3 ROD, actions were identified for the Upper Basin as well as subareas within the Upper Basin including Canyon Creek, Ninemile Creek, Pine Creek, and the South Fork Coeur d'Alene River (SFCDR). Specific actions are presented in Table 12.2-1 of the 2002 OU 3 ROD. Other sites in the 2002 OU 3 ROD will be prioritized as part of the upcoming ROD Amendment and moved into the remedial design/remedial action phase as funds become available.

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, and measures to prevent recontamination. Specific details regarding Lower Basin remedies were largely deferred to future revisions of the 2002 OU 3 ROD, while allowing initial priority work to commence. This approach allows critical source control measures to proceed in the Upper Basin, where contaminant sources and pathways are better defined, while allowing more time to further refine the understanding of the complex Lower Basin system and define 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. Early actions have also have included paving boat ramps and installing engineered bank stabilization structures.

Detailed planning for remedial action in the Lower Basin requires more comprehensive knowledge of the complex mechanisms by which lead and other mine waste heavy 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 (CH2M HILL, 2000) for the Coeur d'Alene Basin was updated for the Lower Basin in 2010 and captured in the Enhanced Conceptual Site Model (ECSM; CH2M HILL, 2010). Existing data, river system knowledge, information learned from pilot projects, and identification of key data gaps have been compiled in the disciplinary technical memoranda that comprise the ECSM. The ECSM synthesizes results from previous studies, reports, modeling, and existing data to enhance understanding of environmental processes in the Lower Basin. The ECSM is composed of the following technical memoranda (TMs):

- TM A – Overview
- TM C – Hydrology
- TM D – Hydraulics and Sediment Transport

- TM E – Fluvial Geomorphology
- FM F – Geochemical Characteristics
- FM G – Contaminant Sources and Characteristics of the Lower Basin
- TM H – Model Selection Criteria and Process
- TM I – Geospatial Data Management
- TM J – Data Gaps and other Uncertainties
- Synopsis
- Executive Summary

Initially, TMs B (Goals and Objectives) and K (Other Factors) were prepared in draft form during the early stages of the ECSM process. However, as the other technical memorandums were written, key issues and elements from TMs B and K were logically integrated into the other documents or deferred to be more appropriately addressed in later stages of Lower Basin remedy implementation.

Development of the ECSM has helped to determine the type and amount of data necessary to measure and model sediment transport and river system dynamics in the Lower Basin. These data will be used to document current trends, define contaminant source areas, refine the sediment budget, calibrate and validate a simulation model, and quantitatively describe baseline conditions against which to predict the effects of potential remedies, document success of remedial actions, and select future remedial actions. Collection of additional data to address these gaps is being integrated into the ongoing Basin Environmental Monitoring Plan (BEMP).

Key findings of the ECSM indicated that sediment contaminated by lead and other heavy metal mine waste continues to be transported throughout the SFCDR, including some of its tributaries, and delivered to the mainstem and flood plains of the Coeur d'Alene River. As documented in the ECSM, the greater proportion of lead-contaminated sediments is now stored, mobilized, transported, and deposited in the Lower Basin or Lake Coeur d'Alene during flood events. USEPA will use all available information to examine Lower Basin remedies previously selected in the ROD for OU 3 and determine whether the selected actions should be modified or supplemented. The Lower Basin work may include review of select remedial actions identified in the 2001 FS Report (USEPA, 2001b), with a view to USEPA's anticipated issuance of a ROD Amendment for the Lower Basin at a future date.

Land use in the Lower Basin is undergoing a transition to recreation within the floodplain of the Coeur d'Alene River, as described in Section 5.3.3.9. The land use and the exposure risks may need to be further examined to determine whether additional actions are necessary as USEPA looks at future actions in the Lower Basin.

5.1.2 Coeur d'Alene Lake

Coeur d'Alene Lake is not included in the 2002 OU 3 ROD Selected Remedy but is discussed in this Five Year Review Report to address all known contamination remaining in OU 3. State, tribal, federal, and local governments committed to developing a revised LMP outside of the Superfund process using separate regulatory authorities. The revised LMP, jointly developed by the Coeur d'Alene Tribe and the State of Idaho, was completed in 2009 (IDEQ and Coeur d'Alene Tribe, 2009).

The sediments at the bottom of the lake contain mining contamination, and the rate of release of metals in the sediments into the water column could increase if the lake water quality deteriorates due to nutrient enrichment. However, more metals are currently entering the lake annually from the Coeur d'Alene River than flowing out of the lake into the Spokane River. This and other information indicate that the lake sediments are a smaller source than riverine inputs.

The scope of the 2009 LMP encompasses the entire Coeur d'Alene Lake Basin. The reason for this is practical: loading of the lake with metals, sediments, and nutrients results from activities that occur around the lake, in upland areas, and along tributary streams and rivers. This scope is essential to effectively address the key influences on water quality. The scope is intended to follow natural boundaries, promote integrated solutions, and maximize the use of available resources to benefit water quality.

The 2009 LMP is organized into two tiers in recognition of the importance of setting priorities to accommodate the challenges posed by the scope and cost of implementing this plan. Tier I is considered the essential core LMP program that will be the initial focus for funding and implementation. It has the following components:

1. Conduct water quality monitoring and use computer modeling to increase scientific understanding of water quality trends;
2. Conduct a Basin-wide nutrient source inventory to set implementation priorities;
3. Use Management Action Tables to coordinate implementation of existing programs with LMP partners; and
4. Develop and implement an education and outreach program to increase the community's awareness of lake conditions and promote lake stewardship.

Tier II of the LMP includes: nutrient reduction projects, special studies, and coordination with total maximum daily load (TMDL) program implementation.

To accomplish the Tier I and Tier II activities, the Coeur d'Alene Tribe and IDEQ plan to create a collaborative "Implementation Team" that will provide the leadership to fully implement the 2009 LMP working with Basin partners.

The Tribe and IDEQ are implementing a comprehensive lake monitoring program to evaluate the effectiveness of the LMP and upstream cleanup and the associated impacts on the lake and the Spokane River. If conditions change or new information that modifies the current understanding becomes available, additional actions will be evaluated. Currently, there is insufficient data from the lake monitoring program to evaluate the effectiveness of the LMP and cleanup activities in a meaningful way. Evaluation of lake conditions will be included in subsequent Five-Year Reviews.

5.1.3 Spokane River

The 2002 OU 3 ROD, Section 12.4, 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 limited 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, which is upstream from Spokane. The identified areas include 10 shoreline areas and one subaqueous area where contaminated sediments have accumulated directly behind Upriver Dam.

Since the 2005 Five-Year Review, remedial actions have been completed at five recreation areas (Starr Road, Island Complex, Murray Road, Harvard Road, and Flora Road) and one subaqueous area (Upriver Dam). Starr Road was completed by USEPA; the remaining areas were funded and completed by the Washington State Department of Ecology (Ecology).

5.1.4 Repositories for Material Generated by OU 3 Cleanup Actions

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, and impacts on groundwater, and others. All locations will also be subject to long-term institutional controls and monitoring to ensure the integrity of the repositories. Public involvement processes are one of the primary components for the siting and design of all repositories.

The 2002 OU 3 ROD, Section 12.5, estimates volumes of material that may require excavation and disposal at about 500,000 to 900,000 cubic yards (cy) in the Upper Basin and up to 2.6 million cy in the Lower Basin. By comparison, there are currently about 2.1 million cy of tailings in the Hecla-Star Tailings Ponds in lower Canyon Creek, about 13.6 million cy of dredge spoils in the Mission Flats area, and about 26 million cy of waste material in the Central Impoundment Area (CIA) located in OU 2.

Current repository operations in support of cleanup actions are occurring at Big Creek Repository (BCR) and East Mission Flats Repository (EMFR). Both of these repositories accommodate wastes generated by citizens or contractors working on private property under an ICP permit. Handling of these materials is part of overall operational activities at the repositories.

The BCR has been operated since 2002 and has sufficient capacity to continue accepting fill from cleanup actions at the current rate through the 2011 construction season. As waste volumes at the BCR approach the capacity of the present configuration, USEPA and IDEQ in 2009 embarked on an open process to locate new repository sites in the Upper Basin. This process built on the existing database and potential sites that were identified in 2002 and earlier. The process relied heavily on input from citizens, local stakeholders, and local elected officials and produced a prioritized ranking of potential sites based on criteria reflecting values important to the local communities. As a result of that process, two repository sites have been identified in the Upper Basin that appear to be feasible and will undergo further evaluation. To maximize existing repository capacity, design modifications to expand the existing capacity at the BCR are also being considered on the north and south ends of the repository.

The EMFR was constructed in 2009 and began receiving remedial action waste in August 2009. About 29,000 cy of contaminated soils were placed in the EMFR in 2009. This repository has an estimated design capacity of 440,000 cy and will be filled in response to project need and volume generation.

5.2 Review of Applicable or Relevant and Appropriate Requirements

As noted in Section 5.1, the 2002 OU 3 ROD (USEPA, 2002) includes a complete remedy for protection of human health in the communities and residential areas, including identified recreational areas of the Upper Basin and Lower Basin. The remedy also includes a complete remedy for protection of human health upstream from the Upriver Dam on the Spokane River and a complete remedy for protection of the environment between the Idaho/Washington border and Upriver Dam. For protection of the environment in areas of the Basin upstream from Coeur d'Alene Lake, the remedy identifies approximately 30 years of prioritized actions.

During this period, USEPA will continually evaluate the effectiveness and protectiveness of these remedial actions as well as the technical practicability of attaining applicable or relevant and appropriate requirements (ARARs). As the 2002 OU 3 ROD is implemented, USEPA will continually evaluate and decide whether any additional CERCLA remedial actions are necessary to attain ARARs or to provide for the protection of human health and the environment, and whether any ARAR waivers should be applied.

In 2008, USEPA initiated efforts to amend the OU 3 ROD in recognition of the need to better define elements of the ecological remedy in the Upper Basin and the need to augment the human health remedy to improve its long-term sustainability. At the time of the release of this Five-Year Review, a Proposed Plan outlining the elements of the ROD Amendment has been released for public review and comment (USEPA, 2010a). After the comment period, USEPA will evaluate the comments received and subsequently issue an amendment to the OU 3 ROD.

Consistent with the National Oil and Hazardous Substances Contingency Plan (NCP),[1] the remedial actions selected in the 2002 OU 3 ROD are an interim measure and will neither be inconsistent with nor preclude implementation of the final remedy that will be identified in subsequent decision documents. Section 13 of the 2002 OU 3 ROD (Statutory Determinations) describes the federal and state ARARs that the remedy will attain. This section also describes other available information that does not constitute an ARAR (e.g., advisories, criteria, and guidance that are useful in selecting, designing, and implementing the remedy).

The remedial actions selected in the 2002 OU 3 ROD are not intended to fully address contamination within the Basin. Thus, achieving certain water quality criteria standards, such as state and federal water quality standards and criteria and maximum contaminant levels (MCLs) for drinking water, are outside the scope of the remedial action selected in the 2002 OU 3 ROD and are not applicable or relevant at this time. The water quality ARARs

[1] 40 Code of Federal Regulations (CFR) 300.430(a)(i)(B) and 40 CFR 300.430(f)(1)(ii)(C)(1).

apply to point source discharges to surface water created by the remedy (e.g., discharge from a water treatment facility). Similarly, MCLs are applicable or relevant and appropriate at residences where an alternative drinking water supply is provided or drinking water is treated. Table 5-1 lists the drinking water ARARS identified in the 2002 OU 3 ROD. The ARARs consist of MCLs for arsenic and cadmium and a treatment technique (TT) for lead. A TT is a required process intended to reduce the level of a contaminant in drinking water.

TABLE 5-1
OU 3 Drinking Water ARARs
2010 Five-Year Review, Bunker Hill Superfund Site

Metal	Maximum Contaminant Level or Treatment Technique Action Level (µg/L)
Arsenic	MCL: 10
Cadmium	MCL: 5
Lead	TT Action Level: 15[a]

[a] The TT for lead requires systems to control the corrosiveness of their water. If more than 10 percent of tap water samples exceed the action level, water systems must take additional steps.

µg/L = micrograms per liter

For this Five-Year Review of the OU 3 remedy, USEPA reviewed the federal, state, and tribal requirements that are applicable or relevant and appropriate to the scope of the remedial action. These requirements are included in the 2002 OU 3 ROD (Section 13.2, Compliance with Applicable or Relevant and Appropriate Requirements). Based on a review of ARARs, guidance, and other documents to be considered (TBC), USEPA determined that all ARARs and TBC items noted in the 2002 OU 3 ROD are accurate with the exception of the changes made since issuance of the 2002 OU 3 ROD, as described in Idaho Water Quality Standards and Wastewater Treatment Requirements, IDAPA 58.01.02.284, and summarized below. Aquatic life criteria for cadmium, lead, and zinc were established in March 2002 and approved by USEPA in 2003. The regulation applies to the SFCDR subbasin,[2] and the criteria for concentration apply to all surface water within the subbasin except for natural lakes. Water quality criteria applicable to areas outside of the SFCDR subbasin (i.e., Coeur d'Alene River) are provided in IDAPA 58.01.02.210.

Table 5-2 presents the hardness-dependent Idaho water quality standards and site-specific criteria for the SFCDR subbasin using a range of hardness values. Use and interpretation of these criteria is discussed in Section 4.2.4. No USEPA-approved changes in these criteria occurred between 2005 and 2010.

The ARARs identified in the 2002 OU 3 ROD and subsequent changes identified above continue to be protective. Revisions to these standards did not occur. USEPA recognizes that other requirements are under development but not yet finalized (e.g., Coeur d'Alene Tribe water quality standards). At such time that other potential standards become final, USEPA will evaluate their applicability to the Site.

[2] Hydrological Unit Code (HUC) 17010302.

TABLE 5-2
OU 3 Surface Water ARARs
2010 Five-Year Review, Bunker Hill Superfund Site

	Idaho Water Quality Standards (µg/L)[a]						Site-Specific Criteria (µg/L) South Fork Coeur d'Alene River Subbasin (HUC 17010302)[b]					
Metal	**Acute**			**Chronic**			**Acute**			**Chronic**		
Hardness[c]	30	50	100	30	50	100	30	50	100	30	50	100
Arsenic	340	340	340	150	150	150	N/A	N/A	N/A	N/A	N/A	N/A
Cadmium[d]	0.62	1.03	2.01	0.42	0.62	1.03	0.61	1.03	2.08	0.42	0.62	1.03
Copper	5.5	8.9	17	4. 1	6.3	11	N/A	N/A	N/A	N/A	N/A	N/A
Lead	17.0	30.1	65	0.66	1.2	2.5	80	129	248	9.1	14.7	28.3
Mercury[e]	2.1	2.1	2.1	0.012	0.012	0.012	N/A	N/A	N/A	N/A	N/A	N/A
Zinc	42	65	120	43	66	120	88	123	195	88	123	195

[a] Standards from IDAPA 58.01.02.
[b] Criteria from IDAPA 58.01.02.284.
[c] Hardness in milligrams of calcium carbonate per liter (mg $CaCO_3$/L).
[d] In 2006, the State of Idaho adopted statewide site-specific aquatic life criteria for cadmium, revising the hardness-dependent criteria equations for cadmium in Section 210.02 of the rules. Until USEPA acts on a change to state water quality standards, the effective water column criteria for dissolved cadmium at 100 milligrams per liter (mg/L) hardness are summarized based on the 2005 version of IDAPA 58.01.02.210.01. A pending rule (Docket 58-0102-0801) before the 2010 Idaho Legislature will lower the cap on hardness for cadmium to 10 mg/L, which is expected to allow for USEPA approval and will change the cadmium aquatic life standards to 1.3 acute and 0.6 chronic accordingly.
[e] In 2005, Idaho adopted USEPA's methylmercury fish tissue criterion for protection of human health. The decision was made to remove the old aquatic life criteria and rely on the fish tissue criterion to provide protection for aquatic life. Thus, current Idaho water quality standards do not have mercury water column criteria for the protection of aquatic life. While USEPA approved of Idaho's adoption of the fish tissue criterion, it has not yet acted on the removal of the water column criteria. Until USEPA acts on this change to state water quality standards, the effective water column criteria for total recoverable mercury are summarized in the table above (IDAPA 58.01.02.210.01, 2004).

HUC = Hydrologic Unit Code
N/A = not applicable

5.3 Review of Selected Remedy Work and Remedial Actions

This section discusses remedial actions in OU 3 that are being implemented under the 2002 OU 3 ROD. As discussed in Section 5.1, this is an interim ROD that represents a significant, but not complete, step toward protection of human health and the environment in the Basin. Work being done under other authorizations separate from the Selected Remedy in the 2002 OU 3 ROD is discussed in Sections 5.4 and 5.5.

USEPA's first priority for implementation of the 2002 OU 3 ROD is to remediate residential and recreational areas that pose direct human health risks. Subsequent actions will include cleanup of areas that pose ecological risks. USEPA has worked extensively with stakeholders through the Basin Commission, TLG, and CCC to prioritize implementation of the interim remedy. USEPA is updating its cleanup plan for the Upper Coeur d'Alene Basin to incorporate improved knowledge of conditions at the Site gained in response to the NRC (2005) review of the 2002 OU 3 ROD, as summarized in Section 2.7.

The following subsections present the progress to date on implementing the 2002 OU 3 ROD remedial actions, removal actions, and related activities:

- 5.3.1 Health and Safety Review
- 5.3.2 Operation and Maintenance
- 5.3.3 Residential and Community Areas
- 5.3.4 Mine and Mill Sites
- 5.3.5 Washington Recreation Areas Along the Spokane River
- 5.3.6 Repositories
- 5.3.7 Clean Waterfowl Feeding Habitat/Agriculture-to-Wetland Conversion Project

The 2005 Five-Year Review Report included an assessment of removal actions that were implemented under CERCLA in OU 3, primarily from 1997 to 2002, before issuance of the 2002 OU 3 ROD. In the 2005 report, three general categories of removal actions were reviewed: Upper Basin mine and mill sites, Lower Basin recreational areas, and the Trail of the Coeur d'Alenes. This 2010 Five-Year Review Report has integrated the assessment of these removal actions into the assessment of Selected Remedy work conducted in OU 3 for all removal actions except the Trail of the Coeur d'Alenes. The Trail of the Coeur d'Alenes removal action is addressed separately (see Section 5.5) because of the large geographic extent of the trail and because it was conducted as a CERCLA action separate from the 2002 OU 3 ROD. The performance of the Trail of the Coeur d'Alenes removal action has been incorporated into the overall performance evaluation of OU 3.

5.3.1 Health and Safety Review

This section describes health and safety (H&S) requirements and practices applicable to work conducted in OU 3. A general overview of H&S requirements for the Site is presented in Section 4.3.1.

IDEQ's property cleanup program, called the Basin Property Remediation Program (BPRP), has performed the majority of remedial work conducted in OU 3. From 2005 through the end of the 2009 construction season, the BPRP incurred 256 safety incidents; 53 caused minor injuries. Two of these injuries resulted in lost work time. Truck drivers continue to be cited most often for safety infractions. These incidents range from minor personal protective equipment (PPE) violations to minor traffic accidents.

In order to maintain the overall high level of safety associated with BPRP implementation, IDEQ will continue to oversee the safety practices of their contractors by:

- Providing daily advice and assisting the remedial contractor's safety personnel with general safety requirements and recommendations;
- Providing contractors with weekly safety guidelines; and
- Working with the IDEQ safety representative to ensure that remedial contractors enforce their H&S Plan requirements.

Other work that is not part of the BPRP has also taken place in OU 3 between 2005 and 2009; however, information related to safety incidents associated with that work was not available for this review.

5.3.2 Operation and Maintenance

5.3.2.1 Status Update

USEPA has developed operation and maintenance (O&M) plans for the Constitution and Golconda Mine and Mill Sites discussed in Section 5.3.4, where work has been completed. An O&M plan is being developed for the Rex Mine and Mill Site. The plans summarize the objectives of the remediation, design criteria, and construction completion details. The plans also provide guidelines for conducting the inspections, reviewing monitoring results, and reporting the findings of the inspections. A summary of the findings of the 2010 inspections is presented in each mine and mill site section.

The Site is subject to potential recontamination due to erosion or neglect of the installed barriers, so there is a need to continually maintain and protect the barriers placed over the contaminated soil. Because the cleanup work in OU 3 has been implemented using CERCLA funding, the State of Idaho is obligated to ensure that the remedies retain their protective functions. Each property owner is responsible for maintaining barriers on their properties. Upon completion of remediation of each property, the owner is provided with a Residential Barrier Maintenance Plan. This plan describes upkeep and maintenance practices that should be followed to ensure that the clean barriers installed as part of the cleanup remain in good condition so that they retain their protective function. Observations by field-based personnel indicate that maintenance of remediated properties by owners (or their representatives) generally appears effective. There is, however, no established approach being used to inspect these properties to determine whether the remedies are retaining their functionality as protective barriers after their warranty periods have ended.

Property owner activities that have the potential to breach barriers, from homeowner improvements to large construction projects, are regulated by the ICP. The ICP is in place to ensure the proper handling and management of contaminated materials and long-term implementation of Superfund remedies. This program regulates construction projects and, in so doing, provides for long-term O&M of established remedial actions within the site (OUs 1, 2, and 3). The program does not regulate active mining operations or agricultural activities.

The success of the ICP in ensuring that barriers are maintained has been demonstrated for over 15 years in the Bunker Hill "Box" (the Box). This effectiveness is also being seen in the Basin. Observations by field-based personnel and inspections of ICP-permitted projects by PHD indicate that maintenance of remediated properties by owners (or their representatives) generally appears effective in maintaining installed barriers. However, it is not clear whether all protective barriers are being adequately maintained by property owners or whether the barriers are able to withstand everyday use in certain locations.

Roughly 1,500 properties were remediated prior to ICP implementation in the Basin. It is not known what, if any, activities that would disturb installed barriers may have taken place on those properties prior to 2007.

5.3.2.2 Technical Assessment of Operation and Maintenance

Consistent with USEPA guidance (USEPA, 2001d), technical assessment was conducted by evaluating the following three questions related to protectiveness of the implemented remedial actions.

Question A: Is the remedy functioning as intended by the decision documents?

Observations by field-based personnel indicate that maintenance by owners (or their representatives) of remediated properties and those cleaned up as time-critical removal actions generally appears effective. There is, however, no established approach being used to inspect these properties to determine whether the remedies are retaining their functionality as protective barriers after their warranty periods have ended.

Question B: 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 remedial action objectives (RAOs) used at the time of remedy selection are still valid.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

All properties located within the ICP boundary and any property outside the boundary that has been sampled and found to have lead or arsenic levels above cleanup levels defined in the 2002 OU 3 ROD must comply with the ICP. While the ICP does provide an effective system for ensuring that barriers within the ICP's permitting process are maintained, it does not ensure that all barriers are properly maintained and functional. For example, some clean sod or gravel barriers may erode and expose underlying contamination as part of everyday uses in certain locations, such as areas used for parking cars or other vehicles on a regular basis. In general, these types of activities are not subject to ICP permitting and oversight and are not monitored by IDEQ or USEPA once the warranty periods have ended. A systematic approach is needed to ensure that the properties that do not obtain ICP permits retain functional and protective barriers.

Remedy Issues

A summary of issues identified with respect to O&M is provided in Table 5-3.

TABLE 5-3
Summary of OU 3 O&M Issues
2010 Five-Year Review, Bunker Hill Superfund Site

	Affects Protectiveness (Y/N)	
Remedy Issues	**Current (now to 1 year)**	**Future (>1 year)**
O&M Needs: It is not clear whether all protective barriers are being adequately maintained by property owners or whether the barriers are able to withstand everyday use in certain locations.	N	Y

Recommendations

A summary of recommendations and follow-up actions for O&M is provided in Table 5-4.

TABLE 5-4
Summary of OU 3 O&M Recommendations and Follow-up Actions
2010 Five-Year Review, Bunker Hill Superfund Site

Recommendations/Follow-up Actions	Responsible Entity	Oversight Agency	Milestone Date	Follow-up Actions: Affects Protectiveness (Y/N)	
				Current (now to 1 year)	Future (>1 year)
O&M Needs: Develop an approach (or program) that defines how barrier integrity for all remediated properties would be maintained and monitored over time.	IDEQ, PHD, USEPA	IDEQ, USEPA	12/2012	N	Y

5.3.3 Residential and Community Areas

This section summarizes the numerous aspects of human health remedy being implemented in the residential and community areas in OU3. The section reports progress on OU 3 soil and drinking water cleanup activities, house dust monitoring, lead health intervention activities, and the activities of the ICP.

5.3.3.1 Property Soil Remediation

Cleanup of soils in residential and commercial properties, common use areas, and ROWs in OU 3 is composed of several actions to address human exposure to metals contamination, including:

- Testing of residential soils and informing property owners of their sample results; and
- Partial removal and replacement of surface soils that have metal concentrations 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.

IDEQ is the lead agency for cleanup of the residential and commercial properties, common use areas, and ROWs, with USEPA funding and oversight. IDEQ's cleanup efforts are commonly referred to as the BPRP.

A more detailed discussion of remedial progress can be found in the 2005 Five-Year Review Report (USEPA, 2005) and the State of Idaho's draft 2010 Five-Year Review support document (TerraGraphics Environmental Engineering [TerraGraphics], 2010a). Since the previous Five-Year Review was completed in 2005, a total of 2,045 properties have been remediated, 434 of which were considered high-risk (resident to young children or pregnant women) at the time of remediation (Table 5-5). An estimated 435,000 cy of contaminated soil has been removed between 2005 and 2009 and placed in designated repositories. There were no properties requiring municipal water hookup, water treatment, or bottled water services during this period.

Figure 5-3 shows required remediation in terms of discrete versus complete remediation on a property, and the types of discrete areas (i.e., yards versus ROWs) that require remediation. Remedial action can be further differentiated by remedy type (e.g., barrier enhancement or removal). Barrier enhancement, or "greening", is required when a sample

TABLE 5-5

Removal and Remedial Actions for Protection of Human Health by Year for OU 3

2010 Five-Year Review, Bunker Hill Superfund Site

Actions	1997	1998	1999	2000	2001	2002	2003	2004	2005[b]	2006[b]	2007[b]	2008[b]	2009[b]
Residential Properties[a]	6	12[c]	23[d]	25	25	28	91	334	337	430	377	354	547[e]
Total Number of High Risk Remediated Properties	6	12	20	25	25	25	22	112	134	118	92	48	42[e]
Schools/Daycares	1	-	3	2	1	-	-	1	-	-	-	-	-
Recreational and Common Use Areas	-	-	4	1	1	-	-	1	-	-	-	-	-
Educational Signage	-	-	9	-	-	-	-	-	-	-	-	-	-
Bottled Water	-	-	10	1	-	-	-	-	-	-	-	-	-
Start of end-of-tap water treatment	-	-	4	1	-	-	-	1	-	-	-	-	-
Municipal Water Hookup	-	-	6	6	-	-	-	1 (Trailer Court)	-	-	-	-	-
Cubic Yards of Contaminated Soil Removed	1,935	1,500	20,000	12,000	6,400	4,800	19,400	58,179	63,847	76,560	76,634	68,617	149,346[e]

[a] A property may not only contain a yard, but may also have discrete areas, such as a ROW, driveway, and play area. If discrete areas of a property were remediated (and not the yard), that property is included in this count. City or county ROWs are also included in this count.

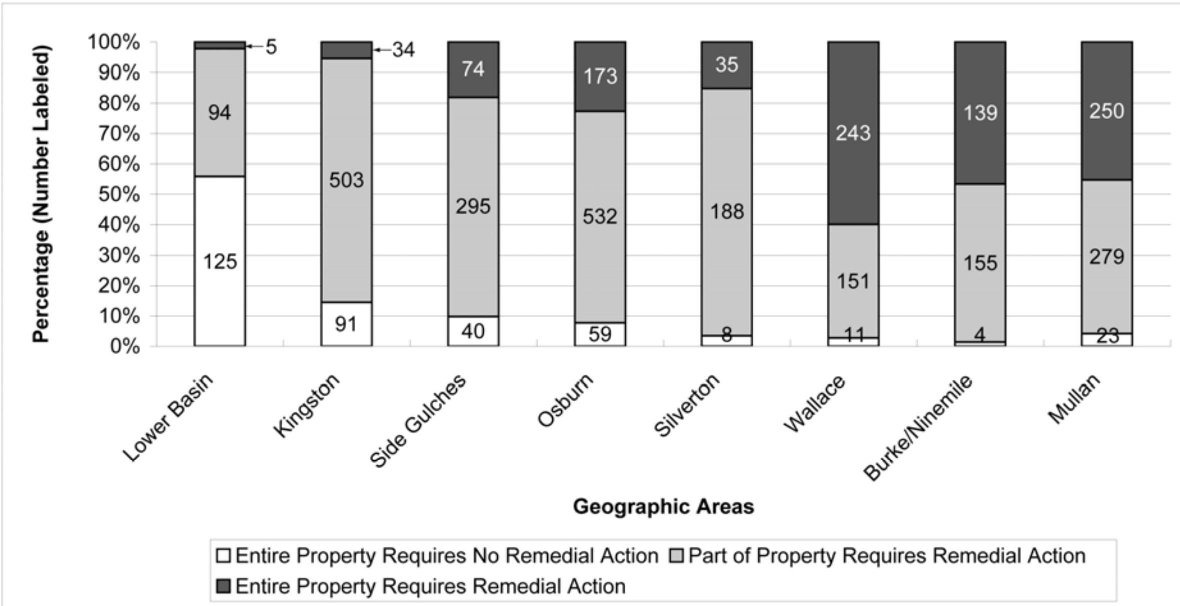
[b] Schools/Daycares and Recreational are included in the Residential Properties Count; in 2005-2009 property types were not tracked separately.

[c] One property slated for remediation in 1997 was completed in 1998.

[d] Two properties had follow-up work (e.g., grading) completed, and one property is now in the Box boundary amended in 2004.

[e] Estimate, because not all information is finalized for 2009.

FIGURE 5-3
Summary of Required Property Remediation in OU 3 by Property and Geographic Area
2010 Five-Year Review, Bunker Hill Superfund Site



location in the 0- to 1-inch or 1- to 6-inch depth interval has a lead concentration between 700 mg/kg and 999 mg/kg and an arsenic concentration less than 100 mg/kg.

Table 5-6 summarizes Basin properties by required remedial action, including properties that require greening in at least one sampled area and properties where greening is the only required remedial action in any of the sampled areas. Through 2009, approximately 22 percent of sampled properties (781) will require greening in at least one sampled area. Of these properties, 79 will require only greening (and no removal) as a remedial action, and 702 properties will require a combination of greening and removal and/or re-sampling.

As sampling has progressed, IDEQ and USEPA have continued to revise the total number of properties requiring remediation in OU 3 residential and community areas. A total of nearly 7,500 parcels exist in OU 3. Approximately 37 percent of all parcels have been remediated to date. Approximately 55 percent of all parcels have been sampled. Five percent of all parcels require no action based on sampling results. Approximately 34 percent of the 7,500 total parcels may not be eligible for sampling and potential remediation under the BPRP (e.g., forest service property, unmaintained hillsides), as determined by IDEQ and USEPA (TerraGraphics, 2008f). Current estimates indicate that sampling of properties eligible for the BPRP is 85 percent complete and property remediation under the BPRP is 65 percent complete.

As remediation proceeds in the Basin communities, there are a number of issues that need to be resolved to determine when cleanup in a community is complete. USEPA and IDEQ are developing criteria to determine when property remediation is complete in a specific community and the Basin as a whole. Results of this ongoing effort will be reported in the next Five-Year Review Report.

TABLE 5-6
Number and Percent of Basin Properties by Remediation Status
2010 Five-Year Review, Bunker Hill Superfund Site

	Burke/Ninemile		Kingston		Lower Basin		Mullan		Osburn		Side Gulches		Silverton		Wallace		All Areas	
Remedial Action Category	**Number of Properties**	**%**	**Number of Properties**	**%**	**Number of Properties**	**%**	**Number of Properties**	**%**	**Number of Properties**	**%**	**Number of Properties**	**%**	**Number of Properties**	**%**	**Number of Properties**	**%**	**Number of Properties**	**%**
No Action	4	1%	91	14%	125	56%	23	4%	59	8%	40	10%	8	3%	11	3%	361	10%
Greening was only Remedial Action	3	1%	24	4%	6	3%	3	1%	19	2%	13	3%	4	2%	7	2%	79	2%
Mixed Removal/Greening	60	20%	116	18%	14	6%	114	21%	148	19%	108	26%	48	21%	94	23%	702	20%
Remedial Action Required, but no Greening	231	78%	397	63%	79	35%	412	75%	538	70%	248	61%	171	74%	293	72%	2369	67%
Total Number of Properties Initially Sampled	298		628		224		552		764		409		231		405		3,511	

The 2002 OU 3 ROD recognizes that roads are barriers to underlying contamination, and the ROD allows for ROWs to be cleaned up in a manner that allows them to act as barriers. To date, many gravel (unpaved) roads and gravel road shoulders have been cleaned up during the cleanup of residential and commercial properties in populated areas. However, an overall strategy has not been prepared for how to address roads as part of implementation of a CERCLA remedy. To address this, the agencies are developing an approach to collaboratively address this issue with local, county, and state officials who also have responsibility for providing and maintaining roads in their communities. The objective is to develop an approach to ensure that USEPA completes its CERCLA cleanup goals and also ensures that communities meet their transportation needs and maintenance responsibilities.

This effort will be integrated into the completion criteria. Results from this effort will be addressed in the next Five-Year Review Report.

The technical assessment of remedial actions implemented for property soil remediation is presented in the following subsection along with the technical assessment of remedial actions implemented for community soil concentrations.

5.3.3.2 Community Soil Concentrations

Status Update

USEPA and IDEQ have monitored lead and arsenic soil concentrations in OU 3 as soil remediation has progressed. Contamination below 12 inches is not remediated except in garden areas, where up to 2 feet (24 inches) are remediated.

Although a community-wide lead concentration level was not established as a Remedial Action Objective (RAO) in OU 3 as it was in OU 1, community mean soil concentrations can be used to evaluate whether average soil lead levels are decreasing as expected. The *Draft Assessment of Residential and Community Mean Soil Exposure Indices in Operational Units 1 and 3, Bunker Hill Superfund Site* (TerraGraphics, 2009a) details the approach used to calculate OU 3 community mean soil lead concentrations.

Substantial reductions have occurred in community mean soil lead concentrations since the inception of the BPRP in 2003. Figures 5-4 and 5-5 show the area-weighted geometric mean lead and arsenic results for all sample locations by geographic area from 1996 through 2009. Community mean lead concentrations are below 400 mg/kg for all geographic areas as of 2009. The earliest changes were noted in Mullan from 2005 through 2007, because the BPRP emphasized cleanup of this community in those years. Substantial reductions were achieved in other Upper Basin communities in the following years. The largest reductions observed from 2004 to 2009 were in Mullan, Burke/Ninemile, and Wallace (Figure 5-4), with 68 percent, 49 percent, and 47 percent reductions in community-weighted means, respectively. Reductions are maximized in areas with highest initial community mean soil lead levels and consequent levels of cleanup.

Community mean soil arsenic concentrations have remained stable over time (Figure 5-5) and are well below the arsenic cleanup level of 100 mg/kg. Although it appears that geometric mean arsenic concentrations have increased in some areas as shown in Figure 5-5, this is an artifact of using an overly high replacement soil concentration of 35 mg/kg arsenic in the computation.

FIGURE 5-4
Area-Weighted Geometric Mean Lead Concentration by Geographic Area and Year
2010 Five-Year Review, Bunker Hill Superfund Site

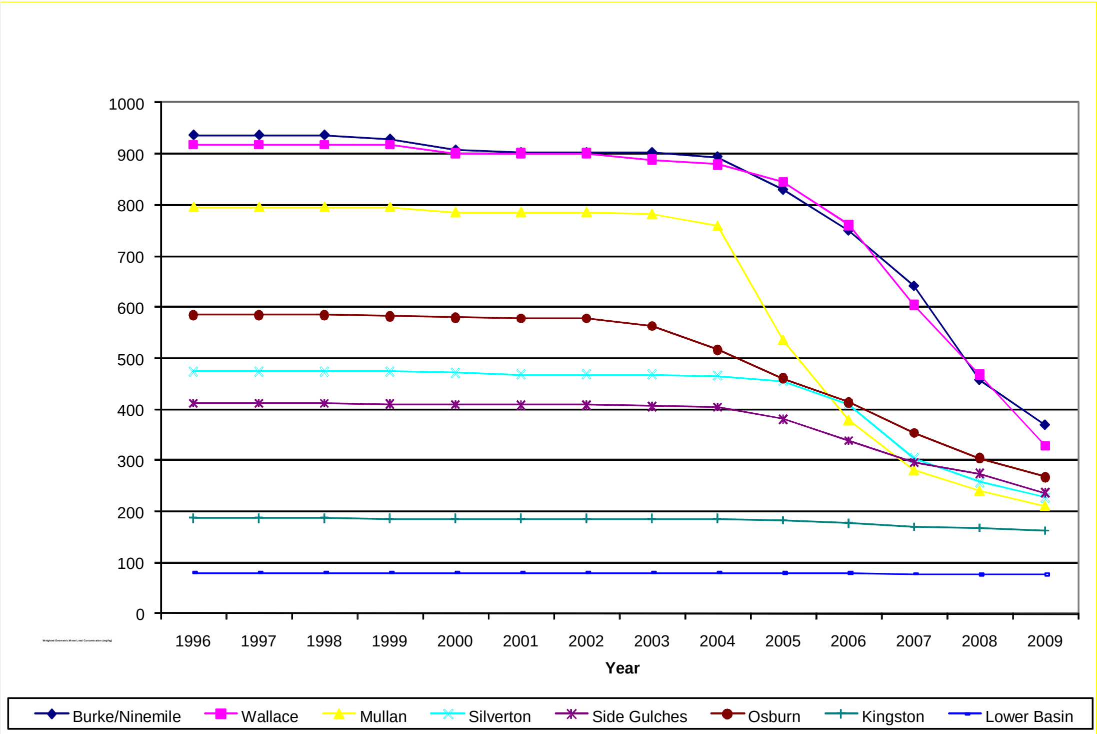
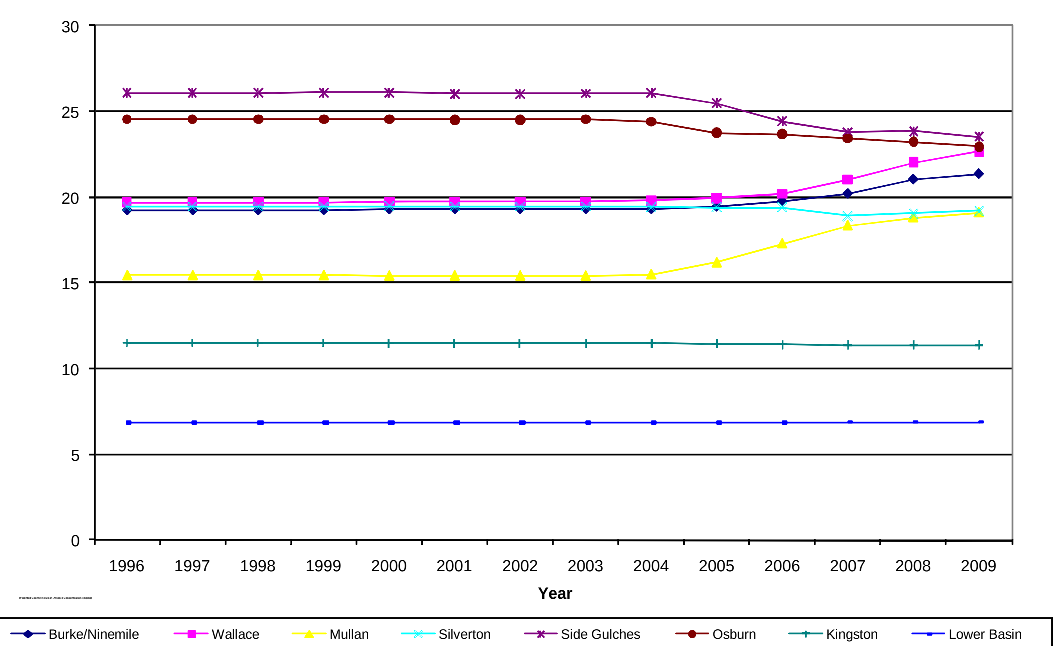


FIGURE 5-5
Area-Weighted Geometric Mean Arsenic Concentration by Geographic Area and Year
2010 Five-Year Review, Bunker Hill Superfund Site



In addition to sampling conducted to support the BPRP, the ICP collected samples in 2009 from city sweepings, potholes, and snow piles collected in the Basin (in cities of Osburn, Wallace, and Mullan), as shown in Table 5-6. Of the three city sweeping samples collected, two were collected in Mullan and one in Osburn. The one high sample with a lead concentration of 2,383 mg/kg was collected in Mullan. Multiple snow-pile sediment samples were collected from each of the three cities. The two snow samples from Osburn were 425 mg/kg and 667 mg/kg, and the remaining samples from Mullan and Wallace ranged from 78 mg/kg to 2,426 mg/kg (Table 5-7).

Pothole samples from all three cities ranged from 977 mg/kg in Wallace to 27,155 mg/kg in Mullan. These results are typical of results from other locations on the Site, because most roads in the Silver Valley were built on mine tailings. The elevated lead levels underscore the need for ongoing road maintenance and the importance of roads as barriers. More than 250 miles of paved roads serve as barriers throughout the Box and the Basin.

Technical Assessment of Property Remediation/Community Soil Concentrations

Consistent with USEPA guidance (USEPA, 2001d), technical assessment was conducted by evaluating the following three questions related to protectiveness of the implemented remedial actions.

Question A: Is the remedy functioning as intended by the decision documents?

USEPA has reviewed sampling and remediation data, and risk assumptions and conclude that the OU 3 soil remedy continues to function as intended by the RODs. Substantial reductions have been achieved in community mean soil lead concentrations since inception of the BPRP in 2003.

A total of 2,045 properties have been remediated since 2005; 434 were considered high-risk properties. Overall, lead content of materials in driveways and ROWs has been reduced, respectively, by 86 and 84 percent in Mullan, 63 and 70 percent in Wallace, 81 and 76 percent in Osburn, 80 and 78 percent in Silverton, 57 and 67 percent in the side gulches, 28 and 38 percent in Kingston, and 6 and 4 percent in the Lower Basin. Lesser but consistent reductions were achieved in yard soils and other sample locations in the same time period. Community mean lead concentrations are below 400 mg/kg lead for all geographic areas as of 2009.

Question B: 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 are still valid.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

Calculated soil concentrations have shown reductions in OU 3 community mean lead concentrations. Some property owners have refused participation in the BPRP. USEPA is working with IDEQ to develop a plan to establish criteria for defining when property remediation is complete in Basin communities. Determining how to address the properties whose owners have refused to participate in the BPRP will be a key part of this plan. The voluntary nature of the residential yards program may limit the protectiveness of the remedy when owners refuse to participate. The inability to sample and remediate (where

TABLE 5-7
Summary of ICP Samples Collected in the Basin, 2007-2009
2010 Five-Year Review, Bunker Hill Superfund Site

Sample Type	Calendar Year		
	2007	2008	2009
Snow Piles			
Number of samples	0	0	11
Minimum Pb Conc. (mg/kg)			78
Maximum Pb Conc. (mg/kg)			2,426
Average Pb Conc. (mg/kg)			933
Standard Deviation			819
Percentage of Samples ≥1000 mg/kg			36%
Potholes			
Number of samples	0	0	14
Minimum Pb Conc. (mg/kg)			977
Maximum Pb Conc. (mg/kg)			27,155
Average Pb Conc. (mg/kg)			4,271
Standard Deviation			6,682
Percentage of Samples ≥1000 mg/kg			71%
City Sweepings			
Number of samples	0	0	3
Minimum Pb Conc. (mg/kg)			470
Maximum Pb Conc. (mg/kg)			2,383
Average Pb Conc. (mg/kg)			1,153
Standard Deviation			1,068
Percentage of Samples ≥1000 mg/kg			33%
Other Soils			
Number of samples	9	53	35
Minimum Pb Conc. (mg/kg)	221	4	32
Maximum Pb Conc. (mg/kg)	356	9,917	1,316
Percentage of Samples ≥1000 mg/kg	0%	28%	6%

Note: Data provided by the Panhandle Health District.
Pb Conc. = lead concentration

warranted) these properties could result in children and pregnant women being exposed to elevated lead (and arsenic) levels on these properties, as well as on adjacent properties.

5.3.3.3 House Dust Concentrations

Status Update

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 (von Lindern, Spalinger, Bero, et al., 2003). USEPA and the State of Idaho are continuing to monitor house dust concentrations as residential soil remediation is completed. House dust has long been recognized as the predominant source of exposure for young children within the Box (Yankel, von Lindern, and Walter, 1977; von Lindern, Spalinger, Petroysan, et al., 2003). House dust concentrations are being measured to assess progress towards meeting the house dust RAO to "… reduce human exposure to lead in house dust via tracking from areas outside the home and air pathways, exceeding health risk goals." (USEPA, 2002).

Two methods are being used to track the concentration of dust in the home: vacuum bags and dust mats (TerraGraphics, 2000b). In addition to providing concentration data, dust mats provide dust and lead loading rates. Dust mat loading rates account for the mass of lead available for exposure and, as such, they were the strongest predictors of blood lead levels in the Basin (TerraGraphics, et al., 2001) Lead loading rates provide additional information regarding the mass of lead being tracked from outside of the house to the interior. Dust loading represents the mass of dust per unit area. It is estimated that a majority of lead in interior house dust originates from exterior soils (TerraGraphics, 2005b).

Although the OU 3 house dust RAO does not include a community mean goal and an individual home action level of 1,000 mg/kg lead, as included in the OU 1 RAOs, examining trends in the number of vacuum samples that are equal to or greater than 1,000 mg/kg lead is useful in understanding reductions in OU 3 house dust exposures compared to OU 1.

Table 5-8 shows the number and percent of vacuum bag concentrations equal to or greater than 1,000 mg/kg lead from 1996 to 2009. Figures 5-6 and 5-7 illustrate the distribution of house vacuum dust lead concentrations throughout OU 3 from 1996 to 2009. Throughout the OU 3 communities, the percent of vacuum bag concentrations equal to or greater than 1,000 mg/kg lead has decreased. In 1996, 21 percent of all Basin vacuum dust lead results were equal to or greater than 1,000 mg/kg, with 44 percent, 33 percent, and 31 percent in Burke/Ninemile, Wallace, and Kingston, respectively (Table 5-8). In 2009, 13 percent of Basin vacuum dust samples were equal to or greater than 1,000 mg/kg lead, with about 30 percent, 25 percent, and 19 percent in Wallace, Burke/Ninemile, and Mullan, respectively (Table 5-8).

Dust mat lead concentrations and dust and lead loading rates from 1996 to 2009 are shown by area in Figure 5-8 and throughout OU 3 in Figure 5-9. Similar to vacuum bag concentrations, dust mat concentrations in 2009 have notably decreased from the pre-ROD observations in 1996 to 1999 in most areas. In 1996, geometric mean dust mat lead concentrations in OU 3 ranged from a low of near 300 mg/kg in Lower Basin homes to 1,000-2,000 mg/kg in Burke/Ninemile, Mullan, and Wallace.

TABLE 5-8
Vacuum Dust Summary Statistics by Year and Area for OU 3, 1996-2009
2010 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
1996	Basin-wide	155	32	21%	16	10%	49	29,725	986	2,425	608	2.38
1998	Basin-wide	71	23	32%	14	20%	23	6,150	1,006	948	723	2.37
1999	Basin-wide	73	20	27%	8	11%	68	5,800	817	916	520	2.69
2002	Basin-wide	76	8	11%	3	4%	62	3,430	507	490	385	2.04
2003	Basin-wide	186	18	10%	11	6%	26	16,700	691	1,435	416	2.41
2004	Basin-wide	293	40	14%	21	7%	15	56,300	849	3,511	383	2.71
2005	Burke/Ninemile	8	2	25%	0	0%	44	1,410	499	531	300	3.08
	Kingston	9	1	11%	0	0%	59	1,350	371	390	263	2.33
	Lower Basin	1	-	-	-	-	-	-	-	-	-	-
	Mullan	13	3	23%	3	23%	60	2,050	618	638	382	2.91
	Osburn	11	3	27%	1	9%	102	1,660	655	544	447	2.65
	Side Gulches	12	3	25%	2	17%	37	2,800	799	877	441	3.42
	Silverton	6	0	0%	0	0%	169	282	226	48	221	1.24
	Wallace	8	1	13%	1	13%	253	3,630	912	1,111	635	2.19
	Basin-wide	68	13	19%	7	10%	37	3,630	603	680	372	2.69
2006	Burke/Ninemile	27	5	19%	2	7%	45	2,490	621	556	428	2.56
	Kingston	87	1	1%	1	1%	28	1,820	298	265	222	2.17
	Lower Basin	57	6	11%	2	4%	42	7,150	440	983	206	2.91

TABLE 5-8
Vacuum Dust Summary Statistics by Year and Area for OU 3, 1996-2009
2010 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
	Mullan	45	8	18%	3	7%	103	2,840	692	500	557	1.96
	Osburn	85	6	7%	2	2%	17	2,330	398	390	286	2.28
	Side Gulches	56	4	7%	2	4%	15	1,850	377	388	258	2.43
	Silverton	29	4	14%	1	3%	37	3,460	556	672	347	2.67
	Wallace	32	13	41%	9	28%	207	10,200	1342	1,794	873	2.38
	Basin-wide	419	47	11%	22	5%	15	10,200	509	763	311	2.61
2007	Burke/Ninemile	31	2	6%	2	6%	87	1,850	439	415	329	2.09
	Kingston	18	0	0%	0	0%	37	834	183	191	131	2.23
	Lower Basin	16	0	0%	0	0%	53	994	280	266	193	2.41
	Mullan	50	11	22%	4	8%	38	3,640	700	605	499	2.45
	Osburn	80	8	10%	6	8%	38	9,970	530	1,146	300	2.48
	Side Gulches	51	1	2%	0	0%	40	1,360	340	281	250	2.25
	Silverton	25	0	0%	0	0%	23	924	370	268	281	2.27
	Wallace	50	17	34%	14	28%	31	9,070	1,243	1,827	660	3.09
	Basin-wide	322	39	12%	26	8%	23	9,970	584	1,015	335	2.69
2008	Burke/Ninemile	24	9	38%	3	13%	97	2,990	862	750	560	2.77
	Kingston	24	1	4%	1	4%	60	2,270	340	450	233	2.18
	Lower Basin	27	1	4%	0	0%	25	1,200	219	251	141	2.51

TABLE 5-8
Vacuum Dust Summary Statistics by Year and Area for OU 3, 1996-2009
2010 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
	Mullan	51	7	14%	5	10%	42	8,890	781	1,406	434	2.69
	Osburn	73	6	8%	4	5%	24	1,800	395	400	272	2.37
	Side Gulches	49	3	6%	1	2%	29	2,150	366	367	258	2.38
	Silverton	19	3	16%	1	5%	30	1,670	493	409	362	2.38
	Wallace	51	15	29%	10	20%	116	3,410	987	901	686	2.37
	Basin-wide	320	45	14%	25	8%	24	8,890	569	798	339	2.71
2009	Burke/Ninemile	20	5	25%	3	15%	80	6,410	1,073	1,745	476	3.46
	Kingston	13	0	0%	0	0%	89	800	266	221	205	2.05
	Lower Basin	18	0	0%	0	0%	10	574	188	174	117	3.06
	Mullan	36	7	19%	4	11%	80	4,630	822	1,005	516	2.57
	Osburn	72	5	7%	3	4%	11	3,860	449	608	290	2.50
	Side Gulches	38	2	5%	0	0%	20	1,250	317	278	235	2.23
	Silverton	21	2	10%	0	0%	34	1,480	395	358	276	2.46
	Wallace	46	14	30%	9	20%	60	15,300	1,230	2,286	660	2.83
	Basin-wide	264	35	13%	19	7%	10	15,300	633	1,226	335	2.89

FIGURE 5-6
Vacuum Bag Lead Concentration Histograms for OU 3, 1996-2004
2010 Five-Year Review, Bunker Hill Superfund Site

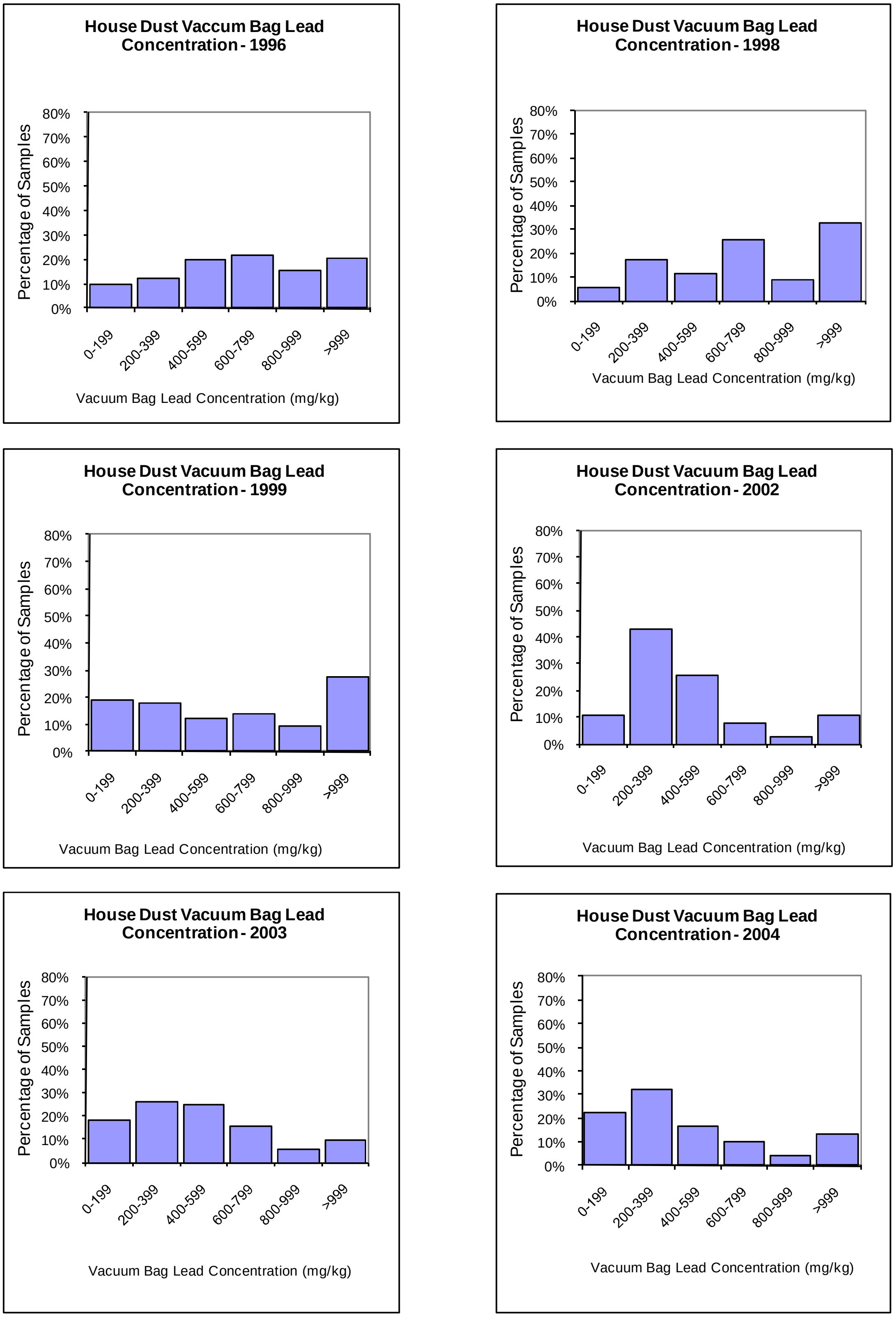


FIGURE 5-7
Vacuum Bag Lead Concentration Histograms for OU 3, 2005-2009
2010 Five-Year Review, Bunker Hill Superfund Site

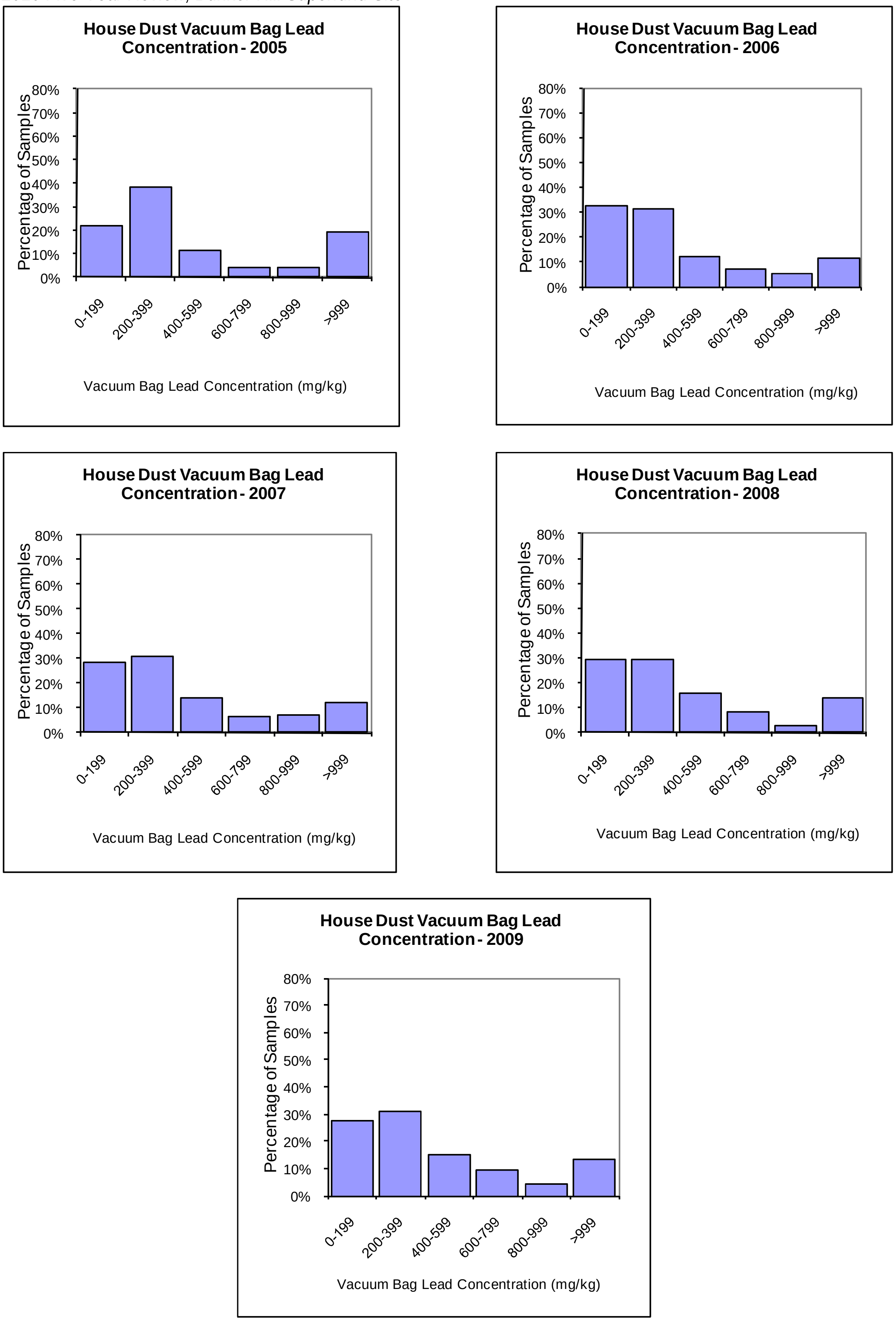


FIGURE 5-8
Mean Dust Mat Lead Concentrations by Year and Area for OU 3, 1996-2009
2010 Five-Year Review, Bunker Hill Superfund Site

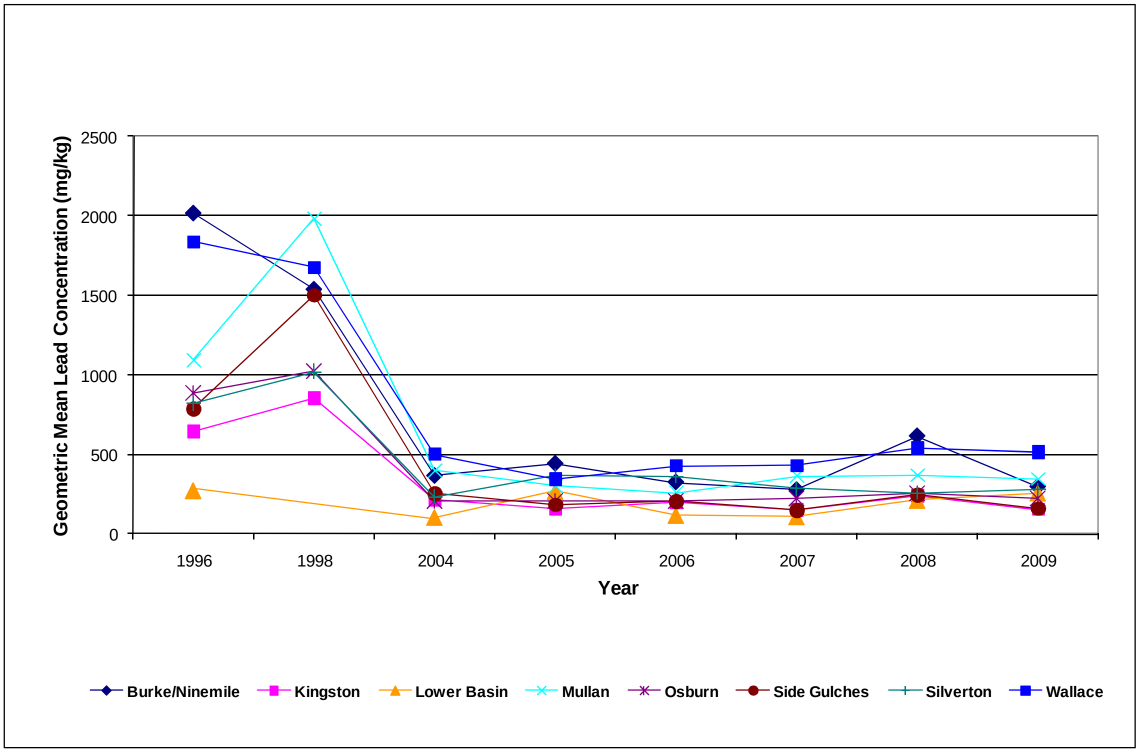


Table 5-9 shows the number and percent of dust mat concentrations equal to or greater than 1,000 mg/kg lead from 1996-2009. The number of dust mat samples equal to or greater than 1,000 mg/kg lead is summarized in Table 5-9.

Dust mat dust and lead loading rates from 1996 to 2009 are shown in Table 5-10 and Figures 5-10 and 5-11.

For most OU 3 communities, geometric mean dust loading rates decreased dramatically from 1996, when they were at their highest (1,038 mg/square meter (m^2)/day to 2,438 mg/m^2/day), to 2004, when they ranged from 395 mg/m^2/day to 1,011 mg/m^2/day. Geometric mean dust loading rates fluctuated between 2004 and 2009, ranging from 400 to 800 mg/m^2/day in Burke/Ninemile, 300 to 700 mg/m^2/day in the side gulches and Silverton, and 200 to 500 mg/m^2/day in Mullan, Osburn, and Wallace.

Dust accumulation rates on mats decreased by about 50 to 75 percent between 1996 and 2009 in all communities except Kingston and the Lower Basin, where there are too few samples in later years to assess trends. Coupled with the reductions in soil lead concentrations, lead loading rates decreased 2 to 30 times, with the largest reductions in Burke/Ninemile and Wallace. This represents a substantial decrease in the amount of contaminated dust entering Basin homes over the last several years and indicates that dust exposures within the communities have also decreased during these years.

In 2007 and 2008, a comparative analysis was conducted to identify the sources and co-factors influencing the persistent high dust lead levels in some households. The

FIGURE 5-9
Dust Mat Lead Concentration Histograms for OU 3, 1996-2009
2010 Five-Year Review, Bunker Hill Superfund Site

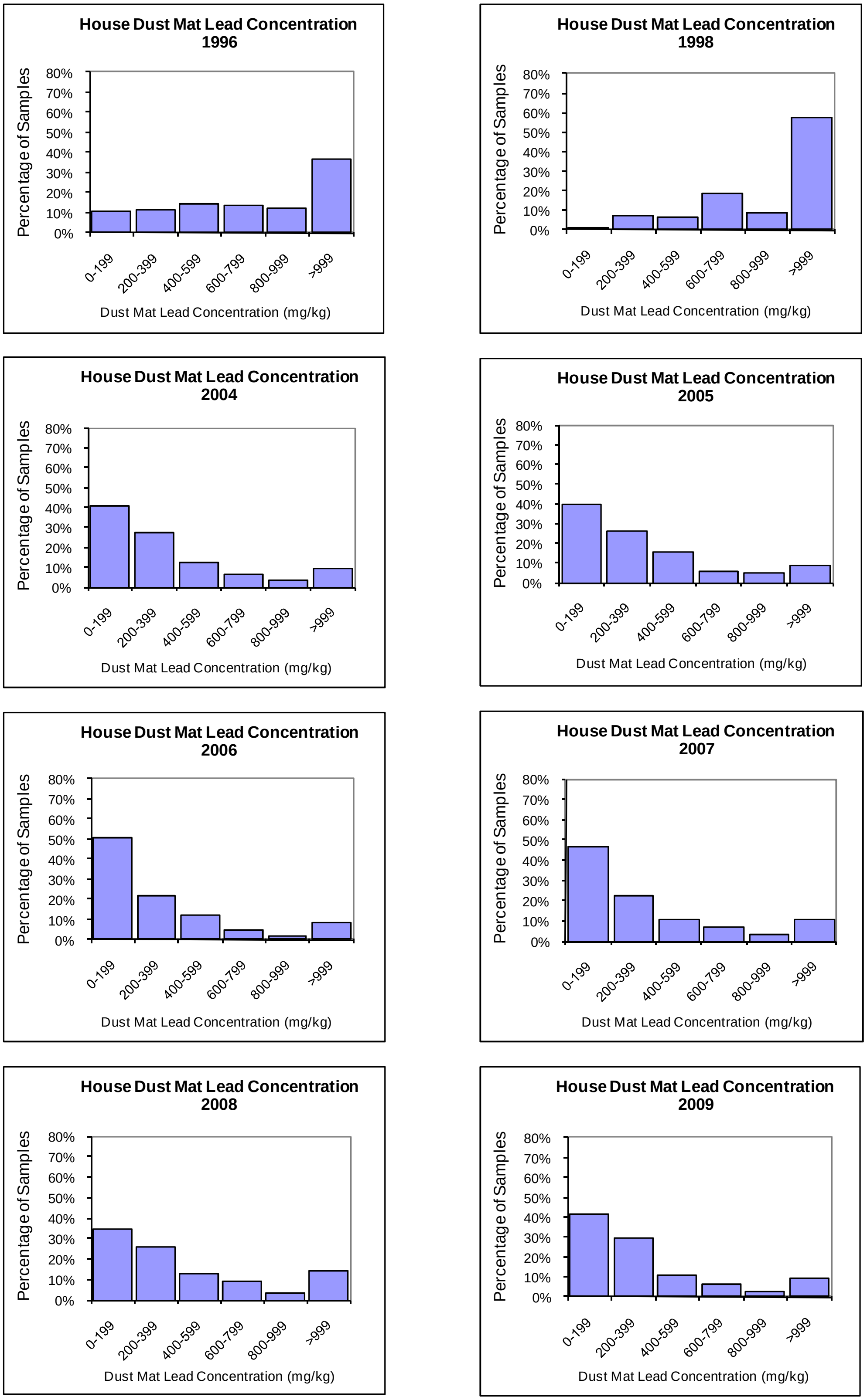


TABLE 5-9
Dust Mat Summary Statistics by Year and Area for OU 3, 1996-2009
2010 Five-Year Review, Bunker Hill Superfund Site

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	Per-cent	Number	Per-cent	Min-imum	Maxi-mum	Arithmetic Mean	Arithmetic Standard Deviation	Geometric Mean	Geometric Standard Deviation
1996	Basin-wide	399	145	36%	81	20%	22	47,626	1,418	3,700	726	2.91
1998	Basin-wide	80	46	58%	30	38%	182	59,500	2,745	7,311	1,310	2.60
2004	Basin-wide	396	37	9%	27	7%	28	91,600	840	5,295	271	2.95
2005	Burke/Ninemile	18	3	17%	2	11%	87	9,070	1,048	2,096	441	3.34
	Kingston	21	0	0%	0	0%	22	960	234	228	158	2.54
	Lower Basin	4	1	25%	1	25%	50	6,200	1,627	3,049	267	8.54
	Mullan	32	2	6%	0	0%	48	1,450	403	318	302	2.22
	Osburn	36	2	6%	2	6%	27	2,270	347	444	210	2.69
	Side Gulches	19	1	5%	1	5%	18	3,380	425	754	183	3.80
	Silverton	16	2	13%	2	13%	25	15,900	1,464	3,911	365	4.33
	Wallace	37	5	14%	3	8%	35	2,030	508	504	343	2.46
	Basin-wide	183	16	9%	11	6%	18	15,900	579	1,463	268	3.02
2006	Burke/Ninemile	33	3	9%	2	6%	52	2,500	484	506	323	2.47
	Kingston	88	7	8%	5	6%	35	4,160	362	601	195	2.69
	Lower Basin	75	6	8%	2	3%	24	3,810	275	594	118	3.02
	Mullan	65	5	8%	0	0%	24	1,270	350	282	258	2.28
	Osburn	100	8	8%	4	4%	30	7,930	459	1,126	204	2.83
	Side Gulches	60	2	3%	1	2%	45	3,160	322	440	204	2.50

TABLE 5-9
Dust Mat Summary Statistics by Year and Area for OU 3, 1996-2009
2010 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	Per-cent	Number	Per-cent	Min-imum	Maxi-mum	Arithmetic Mean	Arithmetic Standard Deviation	Geometric Mean	Geometric Standard Deviation
	Silverton	27	2	7%	2	7%	82	4,670	634	1,091	360	2.45
	Wallace	43	8	19%	5	12%	20	3,690	725	797	427	3.14
	Basin-wide	491	41	8%	21	4%	20	7,930	417	747	218	2.86
2007	Burke/Ninemile	39	3	8%	3	8%	39	4,430	472	750	276	2.56
	Kingston	7	0	0%	0	0%	39	580	201	181	149	2.30
	Lower Basin	7	0	0%	0	0%	20	796	195	269	109	3.08
	Mullan	66	8	12%	6	9%	34	18,100	830	2,287	362	2.88
	Osburn	99	10	10%	6	6%	15	43,900	1,067	4,698	225	3.68
	Side Gulches	54	1	2%	1	2%	25	1,620	232	273	147	2.53
	Silverton	26	4	15%	3	12%	63	6,940	766	1,560	286	3.30
	Wallace	61	12	20%	5	8%	2	4,470	720	838	431	3.12
	Basin-wide	359	38	11%	24	7%	2	43,900	719	2,728	262	3.24
2008	Burke/Ninemile	32	14	44%	9	28%	52	8,800	1,242	1,676	614	3.63
	Kingston	12	1	8%	1	8%	55	1,600	383	447	240	2.64
	Lower Basin	6	1	17%	0	0%	58	1,130	379	436	213	3.24
	Mullan	72	7	10%	2	3%	59	2,020	492	398	367	2.20
	Osburn	99	11	11%	7	7%	19	14,900	698	2,115	255	3.22
	Side Gulches	69	4	6%	3	4%	34	23,700	752	2,926	244	3.11

TABLE 5-9
Dust Mat Summary Statistics by Year and Area for OU 3, 1996-2009
2010 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	Per-cent	Number	Per-cent	Min-imum	Maxi-mum	Arithmetic Mean	Arithmetic Standard Deviation	Geometric Mean	Geometric Standard Deviation
	Silverton	30	2	7%	2	7%	68	4,640	486	898	256	2.64
	Wallace	59	13	22%	8	14%	39	189,000	4,010	24,520	537	3.50
	Basin-wide	379	53	14%	32	8%	19	189,000	1,198	9,838	327	3.14
2009	Burke/Ninemile	30	4	13%	3	10%	26	72,200	3,094	13,207	296	4.80
	Kingston	5	0	0%	0	0%	30	412	208	149	152	2.77
	Lower Basin	5	0	0%	0	0%	60	683	343	241	259	2.56
	Mullan	71	6	8%	3	4%	33	10,200	636	1,317	343	2.65
	Osburn	101	4	4%	4	4%	28	13,500	460	1,404	220	2.59
	Side Gulches	48	1	2%	0	0%	34	1,010	211	188	157	2.16
	Silverton	32	3	9%	3	9%	63	5,490	679	1,398	279	2.97
	Wallace	64	16	25%	8	13%	77	23,800	1,526	3,924	514	3.39
	Basin-wide	356	34	10%	21	6%	26	72,200	890	4,322	280	3.06

TABLE 5-10
Dust and Lead Loading Summary Statistics by Year and Area for OU 3, 1996-2009
2010 Five-Year Review, Bunker Hill Superfund Site

Year	Geographic Area	Number of Dust Loading Samples	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
1996	Basin-wide	399	2,093	2,640	1,406	2.24	3.22	10.76	1.02	3.88
2004	Basin-wide	396	945	1,210	589	2.59	1.17	6.24	0.16	5.47
2005	Burke/Ninemile	18	1,082	1,544	658	2.54	3.93	14.55	0.29	6.98
	Kingston	21	1,732	2,564	882	2.96	0.41	0.73	0.14	4.97
	Lower Basin	4	1,175	1,093	623	4.63	3.41	6.63	0.17	28.85
	Mullan	32	522	636	371	2.14	0.27	0.63	0.11	3.53
	Osburn	36	881	2,148	343	3.23	0.79	3.45	0.07	6.91
	Side Gulches	19	1,053	1,331	519	3.46	0.71	1.50	0.09	10.71
	Silverton	16	718	783	466	2.57	0.64	1.33	0.18	5.35
	Wallace	37	436	389	277	2.90	0.28	0.43	0.09	5.17
	Basin-wide	183	856	1,528	430	2.99	0.90	4.96	0.12	6.15
2006	Burke/Ninemile	33	545	515	386	2.24	0.40	0.63	0.12	4.69
	Kingston	89	815	1,499	458	2.55	0.58	2.81	0.09	4.69
	Lower Basin	75	1,137	1,687	626	2.74	0.64	2.70	0.07	5.88
	Mullan	66	575	801	330	2.75	0.27	0.51	0.09	4.73
	Osburn	100	477	468	333	2.31	0.37	1.44	0.07	5.04
	Side Gulches	62	773	997	475	2.65	0.34	0.71	0.11	4.40
	Silverton	28	491	442	355	2.37	0.30	0.51	0.14	3.23

TABLE 5-10
Dust and Lead Loading Summary Statistics by Year and Area for OU 3, 1996-2009
2010 Five-Year Review, Bunker Hill Superfund Site

Year	Geographic Area	Number of Dust Loading Samples	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
	Wallace	44	435	525	248	3.37	0.34	0.45	0.11	6.56
	Basin-wide	497	689	1,086	400	2.69	0.43	1.76	0.09	4.99
2007	Burke/Ninemile	39	676	553	509	2.15	0.32	0.46	0.14	3.82
	Kingston	7	1,816	1,920	1,053	3.28	0.48	0.70	0.16	5.83
	Lower Basin	7	4,634	7,055	1,896	3.89	0.48	0.50	0.21	5.23
	Mullan	66	550	509	392	2.26	0.43	0.90	0.14	4.29
	Osburn	99	671	1,004	447	2.25	1.14	4.73	0.10	6.14
	Side Gulches	54	971	1,522	525	2.73	0.32	0.75	0.08	4.96
	Silverton	26	552	444	424	2.07	0.61	1.64	0.12	5.08
	Wallace	61	494	427	378	2.05	0.46	0.99	0.16	4.26
	Basin-wide	359	755	1,410	459	2.39	0.62	2.62	0.12	4.95
2008	Burke/Ninemile	32	642	782	380	2.89	0.82	1.27	0.23	7.01
	Kingston	12	1,251	1,341	623	3.88	0.60	0.83	0.15	7.54
	Lower Basin	6	2,175	3,733	979	3.25	0.48	0.54	0.21	4.87
	Mullan	72	362	400	209	3.18	0.21	0.34	0.08	5.01
	Osburn	99	395	593	214	3.33	0.79	4.08	0.06	7.36
	Side Gulches	69	767	1,221	388	3.17	0.49	1.60	0.09	6.17
	Silverton	30	478	531	314	2.50	0.31	1.01	0.08	4.54

TABLE 5-10
Dust and Lead Loading Summary Statistics by Year and Area for OU 3, 1996-2009
2010 Five-Year Review, Bunker Hill Superfund Site

Year	Geographic Area	Number of Dust Loading Samples	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
	Wallace	59	354	350	220	3.01	0.80	3.84	0.12	5.78
	Basin-wide	379	533	896	274	3.26	0.58	2.71	0.09	6.32
2009	Burke/Ninemile	30	1,063	1,784	570	2.65	1.28	3.75	0.17	6.83
	Kingston	5	2,018	2,695	936	4.06	0.47	0.54	0.14	8.74
	Lower Basin	5	1,401	1,742	812	3.12	0.41	0.34	0.21	5.33
	Mullan	71	645	575	436	2.51	0.42	0.83	0.15	4.55
	Osburn	101	638	720	437	2.30	0.25	0.51	0.10	3.99
	Side Gulches	48	1,055	1,185	652	2.77	103.24	713.57	0.12	8.06
	Silverton	32	973	812	677	2.51	0.63	1.17	0.19	4.58
	Wallace	64	646	696	435	2.38	0.70	1.65	0.22	4.03
	Basin-wide	356	793	988	500	2.53	14.38	262.01	0.14	5.01

FIGURE 5-10
Mean Dust Loading Rates by Year and Area for OU 3, 1996-2009
2010 Five-Year Review, Bunker Hill Superfund Site

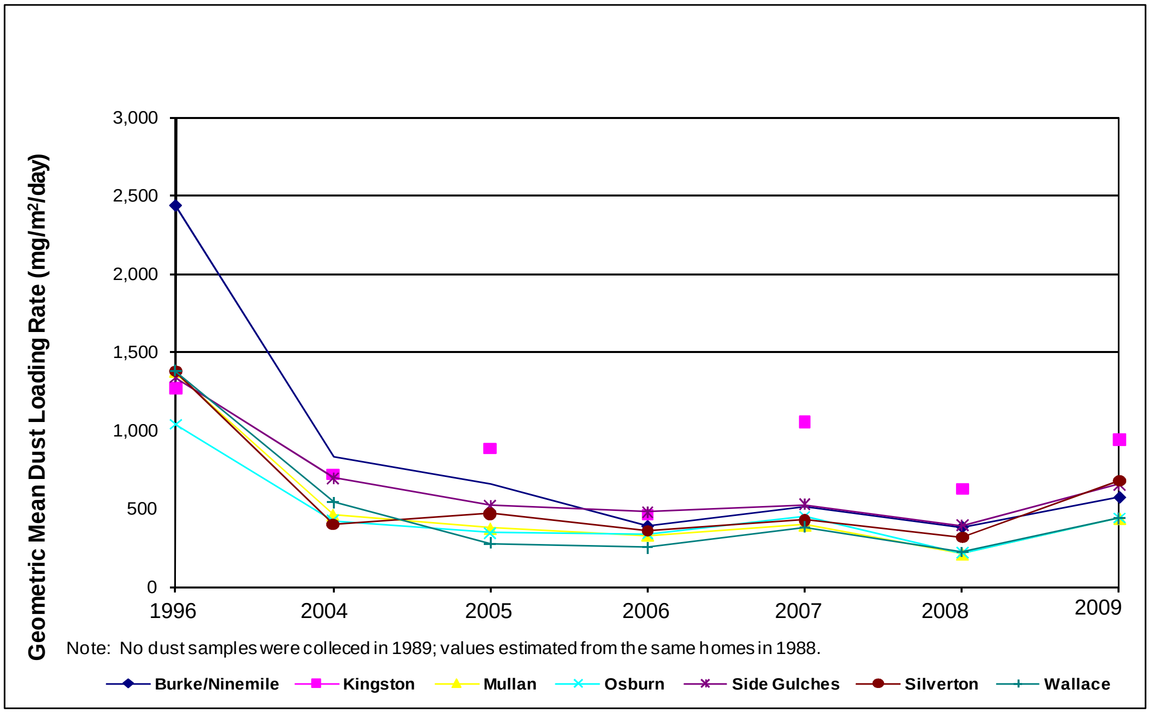
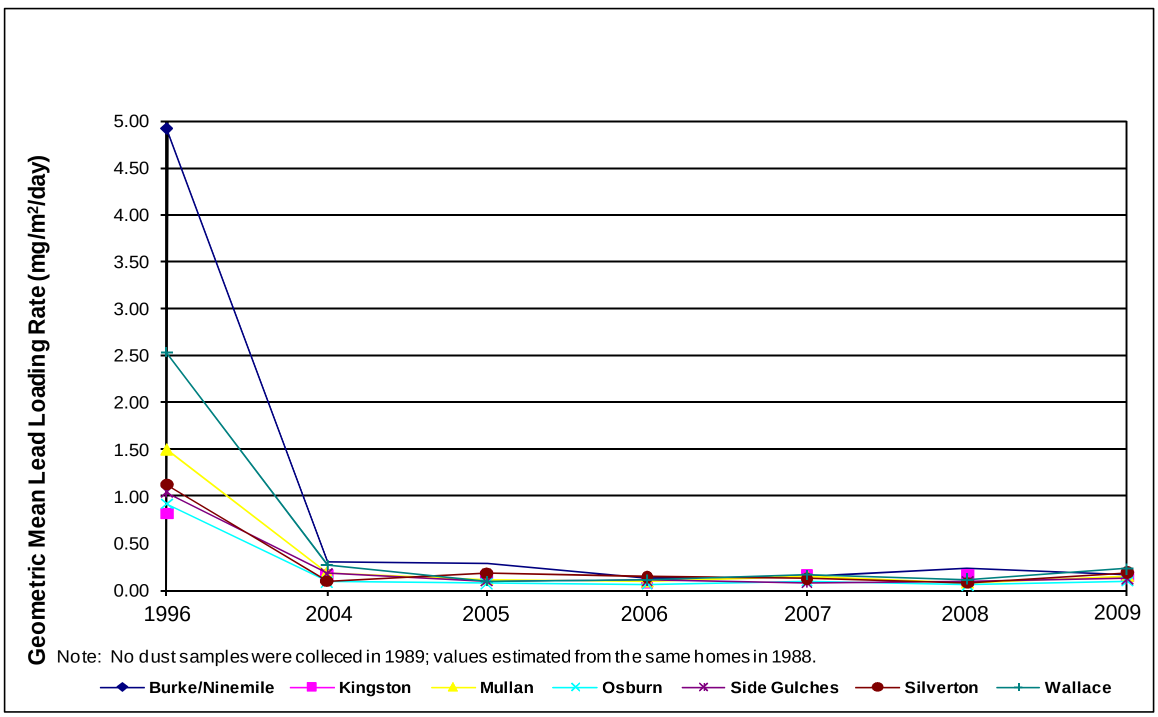


FIGURE 5-11
Mean Lead Loading Rates by Year and Area for OU 3, 1996-2009
2010 Five-Year Review, Bunker Hill Superfund Site



questionnaire responses from 67 homes with house dust concentrations equal to or greater than 1,000 mg/kg lead were compared to those from 431 homes where house dust concentrations were less than 1,000 mg/kg lead. The *Draft 2006 Basin House Dust Data Evaluation Technical Memorandum* (TerraGraphics, 2008p) concluded that, although valuable information was collected regarding activities and behaviors that may influence lead levels in house dust, there were no obvious differences in responses between homes exhibiting high concentrations and those with low dust lead. Similar to prior analyses, the residents' socioeconomic and demographic status, the house age, remodeling activity, and residents' habits and activities could be associated with elevated house dust lead levels. However, these same co-factors were common among low–dust-lead homes and were not necessarily indicators of high concentrations. Responses to these types of questionnaires are most useful in assisting PHD in identifying home characteristics and resident activities that could contribute to house dust lead levels and are best used on an individual home basis.

Although the overall trends show reductions in interior dust and lead concentrations and loading rates, there are still residences where interior lead levels remain high. Annual 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 also decline in response to the remedial actions implemented under the BPRP.

Technical Assessment of House Dust Concentrations

Consistent with USEPA guidance (USEPA, 2001d), technical assessment was conducted by evaluating the following three questions related to protectiveness of the implemented remedial actions.

Question A: Is the remedy functioning as intended by the decision documents?

Review of pertinent documents, ARARs, and risk assumptions indicates that the remedy continues to function as intended by the ROD. USEPA has measured substantial decreases in dust lead content between 1999 and 2004, with nearly constant loading rates and concentrations since. Since 2004, geometric mean vacuum bag dust lead levels in Kingston, the Lower Basin, Osburn, the side gulches, and Silverton have been less than 450 mg/kg. Burke/Ninemile, Mullan, and Wallace have continued to show higher dust lead concentrations. The soil remedy has reduced dust lead concentrations in the majority of homes; however, in 2009, 13 percent of vacuum bags and 10 percent of dust mats exceeded 1,000 mg/kg and 7 percent of vacuum bags and 6 percent of dust mats exceeded 1,500 mg/kg. Achieving substantial reductions in house dust lead levels in Wallace and Burke/Ninemile remains the greatest public health challenge in the Basin.

The percentage of Basin vacuum bag concentrations equal to or greater than 1,000 mg/kg has decreased from 21 percent in 1996 to 13 percent in 2009. In the upper Basin, these percentages are about 30 percent, 25 percent, and 19 percent in Wallace, Burke/Ninemile, and Mullan, respectively. Substantial reductions in house dust lead levels in the Upper Basin are necessary to achieve dust lead levels below 1,000 mg/kg. There is little understanding of the specific sources of the elevated dust lead levels in homes with dust lead concentrations of 1,000 to 5,000 mg/kg.

Question B: 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. The 2002 OU 3 ROD does not establish a target community mean RAO for community soils or house dust, but states that the RAO is intended to "reduce human exposure to lead in house dust via tracking from areas outside the home and air pathways, exceeding health risk goals" (USEPA, 2002). The cumulative nature of lead exposure and the lack of media-specific RAOs requires that risk analyses using paired environmental soil and dust exposure indices be conducted, which requires a substantial sampling and monitoring effort.

USEPA is considering lowering the blood lead health criteria and revising associated risk mitigation policies that could affect protectiveness determination for the dust lead RAOs. The implications of any new health criteria are not known.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

Based on 2009 vacuum dust sampling data, 13 percent of homes in the Basin do not currently meet risk reduction goals defined in USEPA soil lead guidance for CERCLA sites and RCRA corrective action facilities (USEPA, 1994, 1998a). However, soil remediation in the Basin has not been completed and the overall effectiveness of the cleanup strategy in reducing interior dust levels cannot be determined at this time. House dust monitoring will continue in the Basin as cleanup efforts continue to measure the effectiveness of the cleanup strategy. The remedy is expected to be protective when soil remediation is complete and house dust concentrations have been substantially reduced to approach average community soil lead concentrations.

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 actions taken in OU 1. No clearly effective intervention protocol has been identified for the LHIP to implement with regard to dust lead levels in the range of 1,500 to 5,000 mg/kg.

5.3.3.4 Drinking Water Remediation

Status Update

The human health remedy in the 2002 OU3 ROD includes testing private drinking water wells and providing safe drinking water for homes with contamination above action levels defined in the ROD. Beginning in 2000, drinking water samples have been collected from approximately 430 homes. Samples from irrigation systems were collected from 31 properties from 2000 through 2009. These are approximate values because all data from 2009 have not been finalized. The majority of properties where water samples were taken from 2000 through 2009 (approximately 58 percent) were in the Lower Basin and Kingston areas.

Typically, when a drinking water source exceeds a drinking water action level for any of the analytes, IDEQ will provide an alternative drinking water source and cap the well or provide filtration. Table 5-5 shows the number of properties where alternative drinking water sources were provided from 1997 to 2009. No properties requiring alternative drinking water sources were identified between 2005 and 2009.

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, 2002). Sampling results from 2000 through 2009 indicate that 6 percent of properties in the Basin exceed drinking water standards based on purged sample results. As sampling continues into 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.

Technical Assessment of Drinking Water Remediation

Consistent with USEPA guidance (USEPA, 2001d), technical assessment was conducted by evaluating the following three questions related to protectiveness of the implemented remedial actions.

Question A: Is the remedy functioning as intended by the decision documents?

Review of pertinent documents, ARARs, and risk assumptions indicates that the remedy continues to function as intended by the ROD.

Question B: 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.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

There is no information that raises questions about the protectiveness of the drinking water remediation strategy in OU 3.

5.3.3.5 Lead Health Intervention Program

Status Update

The Lead Health Intervention Program (LHIP) was extended to OU 3 in 1996 and continues to offer blood lead testing, educational opportunities for parents and children, and follow-up and intervention services. The LHIP includes:

- Biological (annual fixed-site blood lead testing) and dust lead monitoring;
- Environmental health follow-up for children with elevated blood lead levels;
- Education and awareness for parents and children; and
- Securing environmental remediation services.

As in the Box, PHD is the lead agency for implementing the LHIP in OU 3, with funding from the IDEQ and oversight from IDEQ and USEPA.

Voluntary blood lead screening and exposure surveys have been conducted in the Basin during each of the last 14 summers from 1996 to 2009. The 1996 survey used the door-to-door solicitation method employed in the Box. All other years used fixed-site voluntary blood draws. The 1996 to 1999 survey results were combined and presented in detail in the Human Health Risk Assessment (HHRA; Terragraphics et al., 2001). In 2001, the LHIP protocol was modified to solicit children 6 years old and younger (as opposed to 0 to

9 years), and the analytic screening technique changed from venous to capillary blood screening. Subsequent analyses showed no significant difference in blood lead levels between the two methods (TerraGraphics, 2003a, 2004).

From 1996 to 2009, a total of 1,532 blood lead observations were obtained from 930 individual children residing at 548 households in the Basin. A total of 337 children provided blood lead samples in multiple years. Table 5-11 and Figures 5-12 and 5-13 present blood lead data for all children tested from 1996 through 2009. The table includes the number of children targeted for follow-up health response services each year. Prior to 2001, children between the ages of 6 months through 9 years were tested. Since 2001, blood lead testing was limited to children through 6 years of age. Table 5-12 presents blood lead data by year and geographic area.

Lower participation rates in the Basin blood lead surveys introduce additional uncertainty into analyses of outcome effects, relative to OU 1, where participation rates were greater.

Follow-up lead health counseling consists of a senior environmental health specialist employed by PHD contacting the parents of each child with an elevated blood lead level. Follow-up services are offered to the parents of children exhibiting an elevated blood lead level. Follow-up consists of a home visit by a senior environmental health specialist who provides parents counseling and written information on how to identify sources of lead and reduce their child's exposure. If the parents accept the offer, a home survey and questionnaire are completed and educational materials provided to the parents, as well as nutritional counseling. Follow-up blood screening is offered 3 to 4 months later, and it is recommended that the child's blood lead information be shared with the family physician. The follow-up survey includes:

- A records search of environmental data collected from the residence;
- Sampling of soil, dust, paint, water, and other media, as appropriate;
- Counseling regarding the avoidance of locally grown produce;
- Education regarding play activities, including those not associated with the primary residence;
- Evaluation of sources of exposure associated with parental occupations, hobbies, and other household activities;
- Evaluation of past or planned home remodeling activities; and
- Recommendation for those without vacuum cleaners to use one of the high-efficiency (HEPA) vacuums available through the LHIP.
- PHD has screened 727 blood lead results since the 2002 OU 3 ROD was implemented. Of those tested, 15 children exhibited blood lead levels greater than or equal to 10 µg/dL (3 of those children had levels of 15 µg/dL or greater). Follow-up services were offered to all the families with children having blood lead levels of 10 µg/dL or greater. Eight of these families received follow-up. Parents of seven of the children could not be reached or refused follow-up. Dust generation caused by remodeling was suspected as the primary source of exposure for one child. Contaminated soils were indicated for one

TABLE 5-11
Blood Lead Summary by Year in OU 3, 1996-2009
2010 Five-Year Review, Bunker Hill Superfund Site

Year	Number of Children	Children with Blood Lead Levels ≥ 10 µg/dL		Children with Blood Lead Levels ≥ 15 µg/dL		Children with Blood Lead Levels ≥ 20 µg/dL		Blood Lead Level Range (µg/dL)		Mean Blood Lead Level (µg/dL)		Follow-up Criteria ≥ µg/dL	Number of Follow-ups Completed
		Number	Percent	Number	Percent	Number	Percent	Minimum	Maximum	Arithmetic Mean	Geometric Mean		
1996	96	15	15.6%	6	6.3%	0	0.0%	1.0	18.0	5.3	4.0	10	12
1997	26	4	15.4%	2	7.7%	0	0.0%	1.0	19.0	5.5	4.2	10	3
1998	128	11	8.6%	4	3.1%	2	1.6%	1.0	21.0	5.1	4.1	10	10
1999	272	28	10.3%	13	4.8%	4	1.5%	1.0	29.0	5.4	4.2	10	25
2000	166	15	9.0%	5	3.0%	1	0.6%	1.0	27.0	4.9	4.0	10	15
2001	117	7	6.0%	2	1.7%	0	0.0%	1.4	16.0	4.5	3.7	10	7
2002	103	4	3.9%	0	0.0%	0	0.0%	1.4	13.0	3.7	3.2	10	3
2003	75	3	4.0%	2	2.7%	0	0.0%	1.0	17.1	4.1	3.4	10	3
2004	80	2	2.5%	1	1.3%	0	0.0%	1.4	16.7	3.9	3.4	10	0
2005	81	1	1.2%	0	0.0%	0	0.0%	1.4	12.0	2.9	2.3	10	1
2006	69	1	1.4%	0	0.0%	0	0.0%	1.4	10.0	2.8	2.4	10	1
2007	71	0	0.0%	0	0.0%	0	0.0%	1.4	9.0	2.9	2.6	10	0
2008	73	1	1.4%	0	0.0%	0	0.0%	1.4	14.0	2.4	2.1	10	0
2009	175	3	1.7%	0	0.0%	0	0.0%	1.4	10.0	3.1	2.7	10	0

Note:

Blood lead samples were collected from children between 6 months and 9 years of age from 1996 to 2001 and from children between 6 months and 6 years of age from 2002-2009.

FIGURE 5-12
Mean Blood Lead Levels for Children by Geographic Area in OU 3, 1996-2009
2010 Five-Year Review, Bunker Hill Superfund Site

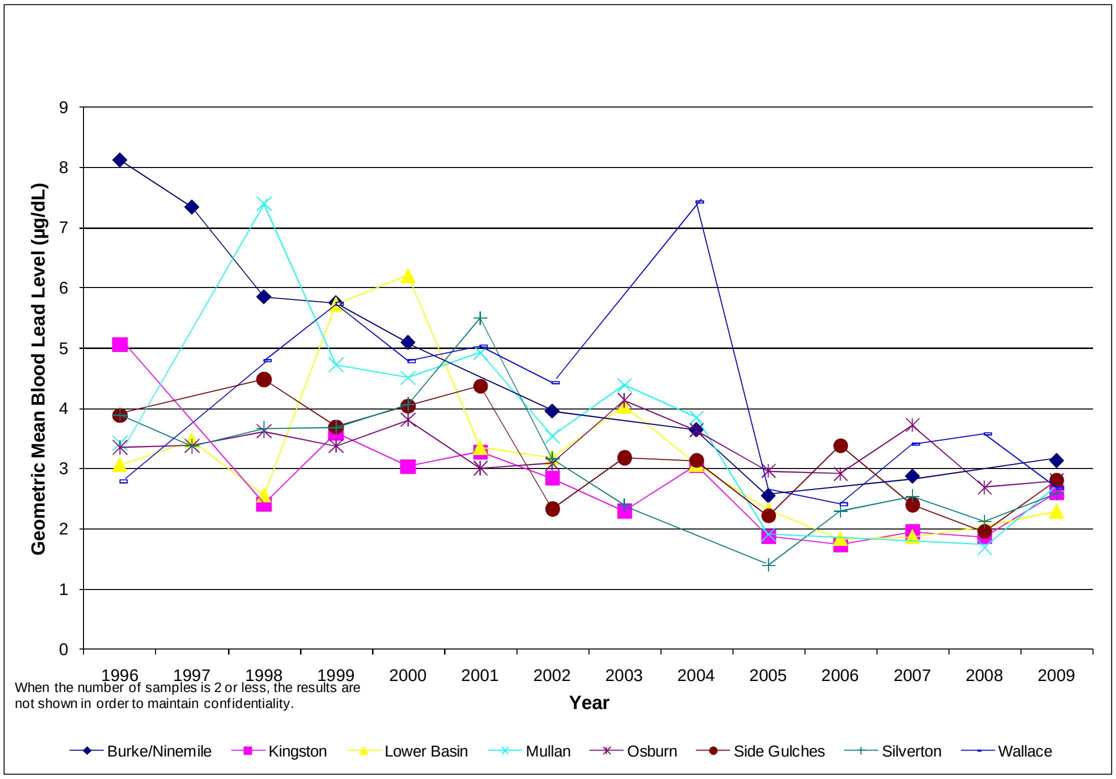


FIGURE 5-13
Blood Lead Levels for All Children Tested in OU 3, 1996-2009
2010 Five-Year Review, Bunker Hill Superfund Site

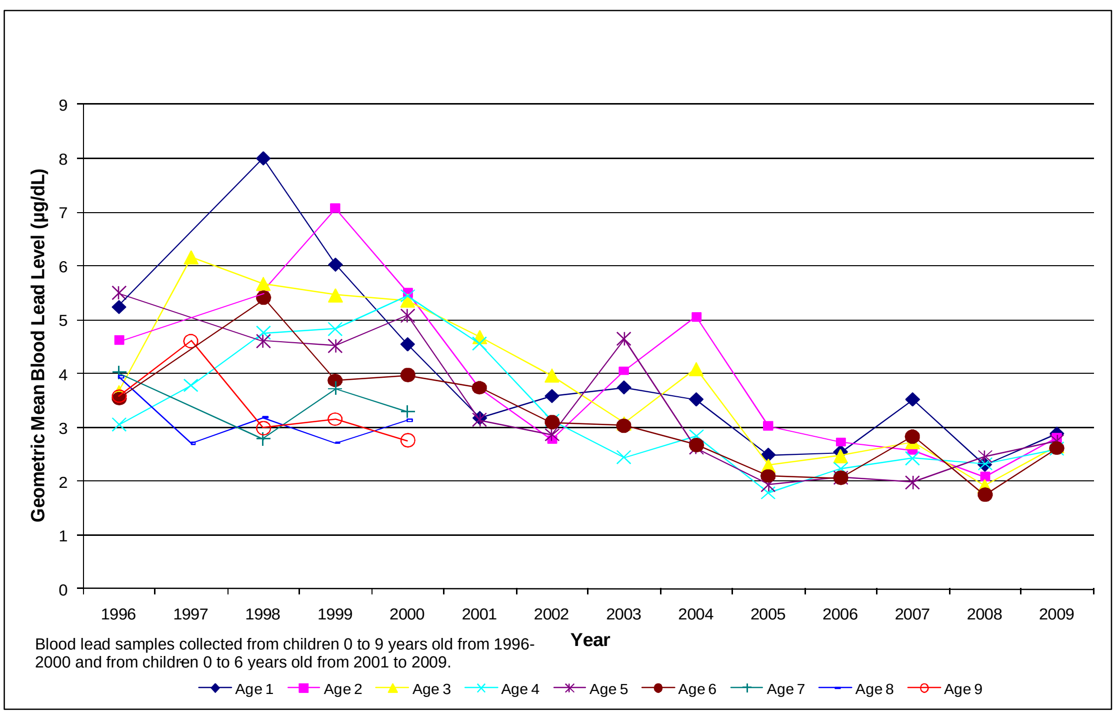


TABLE 5-12
Blood Lead Levels for Children Participating in the LHIP by Geographic Area in OU 3, 1996-2009
2010 Five-Year Review, Bunker Hill Superfund Site

Year	Geographic Area	Number of Children [a]	Number (%) of Children With Blood Lead Levels		Blood Lead Level Range (µg/dL)		Mean Blood Lead Level (µg/dL)			
			≥ 10 µg/dL	≥ 15 µg/dL	Minimum	Maximum	Arithmetic Mean	Arithmetic Standard Deviation	Geometric Mean	Geometric Standard Deviation
1996	Burke/Ninemile	15	6 (40%)	3 (20%)	2.0	17.0	9.3	4.4	8.1	1.78
	Kingston	9	2 (22%)	1 (11%)	2.0	16.0	6.3	4.6	5.1	2.06
	Lower Basin	9	3 (33%)	1 (11%)	1.0	18.0	5.5	6.1	3.1	3.11
	Mullan	11	0 (0%)	0 (0%)	2.0	7.0	3.7	1.6	3.4	1.54
	Osburn	15	1 (7%)	0 (0%)	1.0	13.0	4.0	2.8	3.4	1.82
	Side Gulches	13	3 (23%)	1 (8%)	1.0	16.0	5.2	4.4	3.9	2.15
	Silverton	12	0 (0%)	0 (0%)	2.0	8.0	4.3	1.9	3.9	1.55
	Wallace	12	0 (0%)	0 (0%)	1.0	8.0	3.3	2.3	2.8	1.82
	Basin-Wide	96	15 (16%)	6 (6%)	1.0	18.0	5.3	4.1	4.0	2.07
1997	Burke/Ninemile	6	3 (50%)	2 (33%)	2.0	19.0	10.2	7.7	7.3	2.60
	Kingston	1	-	-	-	-	-	-	-	-
	Lower Basin	4	0 (0%)	0 (0%)	2.0	6.0	3.8	1.7	3.5	1.59
	Mullan	0	-	-	-	-	-	-	-	-
	Osburn	7	0 (0%)	0 (0%)	1.0	7.0	3.9	1.8	3.4	1.85
	Side Gulches	2	-	-	-	-	-	-	-	-
	Silverton	4	0 (0%)	0 (0%)	2.0	8.0	4.0	2.8	3.4	1.94
	Wallace	2	-	-	-	-	-	-	-	-
	Basin-Wide	26	4 (15%)	2 (8%)	1.0	19.0	5.5	4.9	4.2	2.10

TABLE 5-12
Blood Lead Levels for Children Participating in the LHIP by Geographic Area in OU 3, 1996-2009
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Year	Geographic Area	Number of Children [a]	Number (%) of Children With Blood Lead Levels		Blood Lead Level Range (µg/dL)		Mean Blood Lead Level (µg/dL)			
			≥ 10 µg/dL	≥ 15 µg/dL	Minimum	Maximum	Arithmetic Mean	Arithmetic Standard Deviation	Geometric Mean	Geometric Standard Deviation
1998	Burke/Ninemile	19	4 (21%)	3 (16%)	2.0	21.0	7.7	6.1	5.8	2.13
	Kingston	8	0 (0%)	0 (0%)	1.0	7.0	2.9	1.9	2.4	1.91
	Lower Basin	9	1 (11%)	0 (0%)	1.0	13.0	3.6	3.7	2.6	2.22
	Mullan	5	1 (20%)	0 (0%)	6.0	11.0	7.6	2.1	7.4	1.29
	Osburn	22	0 (0%)	0 (0%)	1.0	8.0	4.1	1.9	3.6	1.71
	Side Gulches	14	1 (7%)	0 (0%)	3.0	14.0	5.0	2.9	4.5	1.57
	Silverton	25	0 (0%)	0 (0%)	1.0	8.0	4.1	1.8	3.7	1.71
	Wallace	26	4 (15%)	1 (4%)	1.0	16.0	5.9	3.7	4.8	1.98
	Basin-Wide	128	11 (9%)	4 (3%)	1.0	21.0	5.1	3.7	4.1	1.94
1999	Burke/Ninemile	30	3 (10%)	2 (7%)	1.0	20.0	6.7	4.1	5.7	1.80
	Kingston	47	5 (11%)	3 (6%)	1.0	16.0	4.8	3.9	3.6	2.12
	Lower Basin	21	4 (19%)	2 (10%)	1.0	18.0	7.0	4.5	5.7	1.97
	Mullan	22	3 (14%)	0 (0%)	2.0	12.0	5.4	2.9	4.7	1.67
	Osburn	55	3 (5%)	0 (0%)	1.0	11.0	4.1	2.5	3.4	1.94
	Side Gulches	38	2 (5%)	1 (3%)	1.0	16.0	4.5	2.9	3.7	1.87
	Silverton	25	3 (12%)	2 (8%)	1.0	23.0	5.2	5.1	3.7	2.23
	Wallace	34	5 (15%)	3 (9%)	2.0	29.0	7.1	5.7	5.7	1.88
	Basin-Wide	272	28 (10%)	13 (5%)	1.0	29.0	5.4	4.1	4.2	2.01

TABLE 5-12
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Year	Geographic Area	Number of Children [a]	Number (%) of Children With Blood Lead Levels		Blood Lead Level Range (µg/dL)		Mean Blood Lead Level (µg/dL)			
			≥ 10 µg/dL	≥ 15 µg/dL	Minimum	Maximum	Arithmetic Mean	Arithmetic Standard Deviation	Geometric Mean	Geometric Standard Deviation
2000	Burke/Ninemile	7	2 (29%)	1 (14%)	1.0	15.0	7.0	5.4	5.1	2.55
	Kingston	33	2 (6%)	0 (0%)	1.0	14.0	3.9	3.0	3.0	2.07
	Lower Basin	13	3 (23%)	2 (15%)	3.0	27.0	8.0	7.0	6.2	1.99
	Mullan	6	1 (17%)	0 (0%)	2.0	10.0	5.2	2.9	4.5	1.79
	Osburn	41	2 (5%)	1 (2%)	1.0	15.0	4.5	2.7	3.8	1.78
	Side Gulches	31	1 (3%)	0 (0%)	2.0	10.0	4.4	2.0	4.0	1.53
	Silverton	19	2 (11%)	1 (5%)	1.0	17.0	5.3	3.9	4.1	2.15
	Wallace	16	2 (13%)	0 (0%)	2.0	14.0	5.4	3.1	4.8	1.66
	Basin-Wide	166	15 (9%)	5 (3%)	1.0	27.0	4.9	3.6	4.0	1.91
2001	Burke/Ninemile	2	-	-	-	-	-	-	-	-
	Kingston	35	0 (0%)	0 (0%)	1.4	7.7	3.8	2.0	3.3	1.76
	Lower Basin	16	2 (13%)	1 (6%)	1.4	16.0	4.3	3.9	3.3	2.02
	Mullan	10	0 (0%)	0 (0%)	2.2	9.2	5.5	2.6	4.9	1.71
	Osburn	23	1 (4%)	0 (0%)	1.4	11.0	3.4	2.0	3.0	1.62
	Side Gulches	17	2 (12%)	0 (0%)	1.4	12.1	5.0	2.9	4.4	1.68
	Silverton	4	1 (25%)	1 (25%)	2.2	16.0	7.2	6.2	5.5	2.35
	Wallace	10	1 (10%)	0 (0%)	1.6	12.0	5.7	3.0	5.0	1.76
	Basin-Wide	117	7 (6%)	2 (2%)	1.4	16.0	4.5	2.9	3.7	1.82

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Blood Lead Levels for Children Participating in the LHIP by Geographic Area in OU 3, 1996-2009
2010 Five-Year Review, Bunker Hill Superfund Site

Year	Geographic Area	Number of Children [a]	Number (%) of Children With Blood Lead Levels		Blood Lead Level Range (µg/dL)		Mean Blood Lead Level (µg/dL)			
			≥ 10 µg/dL	≥ 15 µg/dL	Minimum	Maximum	Arithmetic Mean	Arithmetic Standard Deviation	Geometric Mean	Geometric Standard Deviation
2002	Burke/Ninemile	10	0 (0%)	0 (0%)	2.7	6.0	4.1	1.2	3.9	1.35
	Kingston	21	1 (5%)	0 (0%)	1.4	13.0	3.4	2.7	2.8	1.73
	Lower Basin	17	1 (6%)	0 (0%)	1.4	11.0	3.9	2.9	3.2	1.93
	Mullan	8	0 (0%)	0 (0%)	1.4	7.0	3.9	1.7	3.5	1.64
	Osburn	18	1 (6%)	0 (0%)	1.4	13.0	3.7	2.8	3.1	1.79
	Side Gulches	12	0 (0%)	0 (0%)	1.8	3.3	2.4	0.5	2.3	1.23
	Silverton	7	0 (0%)	0 (0%)	1.7	6.2	3.4	1.4	3.2	1.48
	Wallace	10	1 (10%)	0 (0%)	2.3	13.0	5.2	3.4	4.4	1.82
	Basin-Wide	103	4 (4%)	0 (0%)	1.4	13.0	3.7	2.4	3.2	1.70
2003	Burke/Ninemile	1	-	-	-	-	-	-	-	-
	Kingston	15	0 (0%)	0 (0%)	1.4	4.1	2.5	0.9	2.3	1.49
	Lower Basin	18	3 (17%)	2 (11%)	1.0	17.1	5.4	4.7	4.0	2.14
	Mullan	5	0 (0%)	0 (0%)	2.7	6.7	4.6	1.5	4.4	1.42
	Osburn	15	0 (0%)	0 (0%)	2.0	7.5	4.5	2.0	4.1	1.59
	Side Gulches	17	0 (0%)	0 (0%)	1.4	7.9	3.4	1.5	3.2	1.46
	Silverton	3	0 (0%)	0 (0%)	2.2	2.6	2.4	0.2	2.4	1.09
	Wallace	1	-	-	-	-	-	-	-	-
	Basin-Wide	75	3 (4%)	2 (3%)	1.0	17.1	4.1	2.8	3.4	1.74

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			≥ 10 µg/dL	≥ 15 µg/dL	Minimum	Maximum	Arithmetic Mean	Arithmetic Standard Deviation	Geometric Mean	Geometric Standard Deviation
2004	Burke/Ninemile	3	0 (0%)	0 (0%)	3.2	4.7	3.7	0.9	3.6	1.25
	Kingston	18	0 (0%)	0 (0%)	1.6	6.1	3.2	1.1	3.1	1.39
	Lower Basin	18	0 (0%)	0 (0%)	1.4	7.1	3.4	1.6	3.1	1.61
	Mullan	7	0 (0%)	0 (0%)	3.0	5.0	3.9	0.9	3.8	1.25
	Osburn	19	0 (0%)	0 (0%)	1.4	7.4	4.1	1.8	3.6	1.66
	Side Gulches	9	0 (0%)	0 (0%)	1.4	6.2	3.6	1.9	3.1	1.85
	Silverton	1	-	-	-	-	-	-	-	-
	Wallace	5	2 (40%)	1 (20%)	4.3	16.7	8.6	5.3	7.4	1.80
	Basin-Wide	80	2 (3%)	1 (1%)	1.4	16.7	3.9	2.2	3.4	1.65
2005	Burke/Ninemile	10	0 (0%)	0 (0%)	1.4	9.0	3.2	2.5	2.5	1.90
	Kingston	17	0 (0%)	0 (0%)	1.4	5.2	2.1	1.1	1.9	1.53
	Lower Basin	15	1 (7%)	0 (0%)	1.4	12.0	3.2	3.4	2.3	2.13
	Mullan	3	0 (0%)	0 (0%)	1.4	3.5	2.1	1.2	1.9	1.70
	Osburn	16	0 (0%)	0 (0%)	1.4	9.1	4.0	3.0	3.0	2.23
	Side Gulches	11	0 (0%)	0 (0%)	1.4	6.0	2.6	1.5	2.2	1.74
	Silverton	3	0 (0%)	0 (0%)	1.4	1.4	1.4	0.0	1.4	1.00
	Wallace	6	0 (0%)	0 (0%)	1.4	9.8	3.5	3.2	2.7	2.08
	Basin-Wide	81	1 (1%)	0 (0%)	1.4	12.0	2.9	2.5	2.3	1.91

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Year	Geographic Area	Number of Children [a]	Number (%) of Children With Blood Lead Levels		Blood Lead Level Range (µg/dL)		Mean Blood Lead Level (µg/dL)			
			≥ 10 µg/dL	≥ 15 µg/dL	Minimum	Maximum	Arithmetic Mean	Arithmetic Standard Deviation	Geometric Mean	Geometric Standard Deviation
2006	Burke/Ninemile	1	-	-	-	-	-	-	-	-
	Kingston	15	0 (0%)	0 (0%)	1.4	8.0	2.0	1.7	1.7	1.62
	Lower Basin	11	0 (0%)	0 (0%)	1.4	3.5	2.0	0.8	1.8	1.44
	Mullan	1	-	-	-	-	-	-	-	-
	Osburn	15	0 (0%)	0 (0%)	1.4	7.2	3.2	1.6	2.9	1.61
	Side Gulches	12	1 (8%)	0 (0%)	1.4	10.0	3.9	2.4	3.4	1.75
	Silverton	6	0 (0%)	0 (0%)	1.4	6.0	2.6	1.7	2.3	1.71
	Wallace	8	0 (0%)	0 (0%)	1.4	6.7	2.7	1.7	2.4	1.64
	Basin-Wide	69	1 (1%)	0 (0%)	1.4	10.0	2.8	1.8	2.4	1.69
2007	Burke/Ninemile	3	0 (0%)	0 (0%)	2.3	4.1	3.0	1.0	2.9	1.37
	Kingston	13	0 (0%)	0 (0%)	1.4	4.5	2.1	1.1	1.9	1.51
	Lower Basin	11	0 (0%)	0 (0%)	1.4	4.7	2.0	1.0	1.9	1.47
	Mullan	1	-	-	-	-	-	-	-	-
	Osburn	16	0 (0%)	0 (0%)	2.1	9.0	4.0	1.8	3.7	1.50
	Side Gulches	12	0 (0%)	0 (0%)	1.4	3.7	2.5	0.7	2.4	1.37
	Silverton	8	0 (0%)	0 (0%)	1.4	7.1	2.9	1.9	2.5	1.72
	Wallace	7	0 (0%)	0 (0%)	1.5	6.2	3.9	1.9	3.4	1.79
	Basin-Wide	71	0 (0%)	0 (0%)	1.4	9.0	2.9	1.6	2.6	1.62

TABLE 5-12
Blood Lead Levels for Children Participating in the LHIP by Geographic Area in OU 3, 1996-2009
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Year	Geographic Area	Number of Children [a]	Number (%) of Children With Blood Lead Levels ≥ 10 µg/dL	Number (%) of Children With Blood Lead Levels ≥ 15 µg/dL	Blood Lead Level Range (µg/dL) Minimum	Blood Lead Level Range (µg/dL) Maximum	Mean Blood Lead Level (µg/dL) Arithmetic Mean	Mean Blood Lead Level (µg/dL) Arithmetic Standard Deviation	Mean Blood Lead Level (µg/dL) Geometric Mean	Mean Blood Lead Level (µg/dL) Geometric Standard Deviation
2008	Burke/Ninemile	1	-	-	-	-	-	-	-	-
	Kingston	23	0 (0%)	0 (0%)	1.4	4.7	2.0	1.0	1.9	1.48
	Lower Basin	8	0 (0%)	0 (0%)	1.4	4.9	2.2	1.2	2.0	1.55
	Mullan	5	0 (0%)	0 (0%)	1.4	2.2	1.7	0.4	1.7	1.23
	Osburn	14	1 (7%)	0 (0%)	1.4	14.0	3.5	3.4	2.7	2.02
	Side Gulches	5	0 (0%)	0 (0%)	1.6	2.3	2.0	0.4	2.0	1.20
	Silverton	13	0 (0%)	0 (0%)	1.4	3.2	2.2	0.7	2.1	1.43
	Wallace	4	0 (0%)	0 (0%)	2.2	5.5	3.9	1.8	3.6	1.63
	Basin-Wide	73	1 (1%)	0 (0%)	1.4	14.0	2.4	1.8	2.1	1.61
2009	Burke/Ninemile	22	0 (0%)	0 (0%)	1.4	8.0	3.6	2.0	3.1	1.66
	Kingston	34	2 (6%)	0 (0%)	1.4	10.0	3.1	2.3	2.6	1.78
	Lower Basin	20	1 (5%)	0 (0%)	1.4	10.0	2.6	1.9	2.3	1.57
	Mullan	8	0 (0%)	0 (0%)	1.6	4.0	2.8	0.7	2.7	1.34
	Osburn	49	0 (0%)	0 (0%)	1.4	8.0	3.2	1.8	2.8	1.62
	Side Gulches	25	0 (0%)	0 (0%)	1.4	5.3	3.0	1.1	2.8	1.48
	Silverton	9	0 (0%)	0 (0%)	1.4	5.1	2.7	1.0	2.6	1.41
	Wallace	8	0 (0%)	0 (0%)	1.4	5.6	3.0	1.4	2.7	1.64
	Basin-Wide	175	3 (2%)	0 (0%)	1.4	10.0	3.1	1.8	2.7	1.61

child. One of these children played regularly at contaminated beaches in the chain lakes area, and another recreated on the North Fork of the Coeur d'Alene River. Of the remaining four children, flood-related contamination was indicated for one, and no source was identified for the other three.

Section 12.1 of the 2002 OU 3 ROD identifies a dust intervention protocol to be implemented to supplement interim public health response during the BPRP (USEPA, 2002). The dust intervention protocol was designed as a screening technique to identify families with at-risk children who might experience excessive blood lead levels, because low participation in the blood lead surveys was identified as a limitation for the LHIP. The protocol specifies the use of dust mat monitoring data to direct environmental health visits before lead exposure and blood lead concentrations peak in the late summer.

The dust intervention protocol has not been implemented due to resource demands, competing priorities, and questions regarding the efficacy of the monitoring methodology. As an alternative, PHD between 2004 and 2008 offered information and environmental health services to households with dust lead concentrations exceeding 5,000 mg/kg. In 2009, PHD made these offers to homes with dust lead concentrations exceeding 1,500 mg/kg. This totaled 66 homes that PHD attempted to contact and offer environmental health follow-up services. According to PHD records from 2006 to 2009, 24 follow-up interviews were completed. Ten additional participants in the annual house dust sampling programs contacted PHD with questions about their results during this same time period. These 10 participants had dust lead results of less than 5,000 mg/kg.

USEPA, IDEQ, and PHD have not yet established an alternative to the approach used in the 2002 OU 3 ROD, and intervention activities have not have not occurred as planned. USEPA, IDEQ and PHD are evaluating whether an alternative intervention protocol can be developed and implemented in OU 3.

Lead health information has been integrated into programs offered by the local health district, including Well Child Program, Immunization Clinics, Woman Infant and Children (WIC) Clinics, and pregnancy screening and prenatal clinics. Pregnant women are offered blood lead testing and nutritional counseling. Each year, a public health educator visits area grade schools. Classes are conducted for students in kindergarten through third grade. Various methods are used to teach the concepts of lead exposure, including a puppet show and doll house. The presentation covers the students' role in identification and management of exposure pathways that may affect them or their siblings. The program is presented in May so children can be reminded of the hazards of lead in soil and dust prior to summer vacation, when they are at the greatest risk of exposure.

A physician awareness program was developed in 1986 for the Box so local physicians were aware of program activities and the services available to the community. Reference materials and a resource manual regarding lead and other heavy metals were provided to area physicians and the local hospital. As blood lead levels have decreased in recent years, this information has not been updated or provided on a regular basis, but is still available upon request. However, additional follow-up and intervention activities, including sampling, can be conducted, upon request, on behalf of physicians with special concerns regarding a patient with an elevated blood lead level.

In addition, a senior environmental health specialist at PHD is available for consultations regarding sources of exposure to lead and the management of exposure pathways. A variety of locally developed and commercial fact sheets, brochures, coloring books, and videos are available regarding lead and children and exposure to lead during pregnancy.

The HEPA vacuum loan program has effectively helped control dust levels in homes without vacuum cleaners. There were an average of 143 vacuum checkouts for Box and Basin properties between 2005 and 2009 (there is no breakdown of this activity by OU). During this period, the number of vacuum loans ranged between 238 (in 2005) and 77 (in 2008). On average, 102 people have checked out vacuums annually from an average of 103 addresses, indicating this resource is still being used by the community.

Technical Assessment of the Lead Health Intervention Program

Consistent with USEPA guidance (USEPA, 2001d), technical assessment was conducted by evaluating the following three questions related to protectiveness of the implemented remedial actions.

Question A: Is the remedy functioning as intended by the decision documents?

Review of pertinent documents, ARARs, and risk assumptions indicates that the remedy continues to function as intended by the ROD. However, the LHIP dust intervention protocol was not implemented due to excessive resource demands, competing priorities, and questions regarding the efficacy of the monitoring methodology. Alternatively, a dust monitoring program was implemented in 2004. Results exceeding 5,000 mg/kg through 2008 and 1,500 mg/kg in 2009 were provided to PHD for intervention follow-up actions. It is unclear whether these alternative approaches have been successful in identifying households where children with elevated blood lead levels reside or whether intervention efforts have been successful. In addition, although house dust levels are dropping in Basin residences, they are not dropping as fast as anticipated in certain areas within the Basin. House dust monitoring will continue to help measure progress as exterior soil remediation continues. Evaluating the need to establish a community-wide lead-in-soils concentration is also being pursued and is related to the overall cleanup strategy, which includes reducing interior lead dust levels. A community-wide lead concentration may aid in reducing risks by allowing the disposal of lower concentration materials in repositories.

Question B: 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.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

USEPA is considering lowering the blood lead level of concern used in assessing lead health risk. The effect of new health criteria on intervention protocols is unknown.

Remedy Issues

A summary of issues identified with respect to the lead health intervention program is provided in Table 5-13.

TABLE 5-13
Summary of Lead Health Intervention Program Issues in OU 3
2010 Five-Year Review, Bunker Hill Superfund Site

Remedy Issues	Affects Protectiveness (Y/N)	
	Current (now to 1 year)	**Future (>1 year)**
Dust Intervention Protocol: The dust intervention protocol in the 2002 OU 3 ROD is not being implemented	N	Y

Recommendations

A summary of recommendations and follow-up actions for the lead health intervention program is provided in Table 5-14.

TABLE 5-14
Summary of Recommendations and Follow-up Actions for Lead Health Intervention Program in OU 3
2010 Five-Year Review, Bunker Hill Superfund Site

Recommendations/Follow-up Actions	Responsible Entity	Oversight Agency	Milestone Date	Follow-up Actions: Affects Protectiveness (Y/N)	
				Current (now to 1 year)	**Future (>1 year)**
Program Implementation: Determine whether an alternative approach to the 2002 OU 3 ROD's dust intervention protocol can be established and implemented.	IDEQ, PHD, USEPA	IDEQ, USEPA	12/2012	N	Y

A recommendation that does not necessarily affect protectiveness but needs to be addressed is to evaluate the need for intervention services to be provided by nurses as the 2002 OU 3 ROD indicates should be the case.

5.3.3.6 Institutional Controls Program

Status Update

The ICP established for the Box, which is administered by PHD, serves as a model for the Basin to control contaminated soil left in place. The Basin ICP rule, which is based on the Box ICP rule, was adopted by PHD in November 2006, 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 Basin ICP provides a locally enforced set of rules and regulations and permitting and contractor licensing requirements that are established to maintain the integrity of installed barriers and to ensure that new barriers are installed as part of excavation, grading, and certain interior projects conducted within the administrative boundary of the ICP. The general features of the Basin ICP are the same as the in the Box ICP, which are described in Section 3.3.7 of this report.

USEPA, IDEQ, and PHD entered into a Memorandum of Agreement (MOA)[3] that (1) outlines the roles and responsibilities of the agencies, (2) outlines the ICP requirements of the ROD, (3) includes a long-term funding plan for Basin ICP implementation, and (4) establishes a dispute resolution process. This agreement became effective in July 2007.

The ICP records its activities and summarizes them in quarterly reports that are provided to IDEQ and USEPA. The ICP issued a total of 851 permits and Records of Compliance (issued for small projects not requiring a permit) for projects in the Basin from 2007 to 2009 (Table 5-15). Of the permits issued, the majority were for Large Exterior Projects for excavation, with an annual average of 323 and a maximum of 357 in 2009. In addition to large exterior projects, permits were also issued for demolition work (average of 9 per year), interior work (2 per year), and Records of Compliance (54 per year).

TABLE 5-15
Number of ICP Permits Issued in the Basin, 2007-2009
2010 Five-Year Review, Bunker Hill Superfund Site

Permit Type	Calendar Year			Cumulative Total	Annual Average[d]
	2007[a]	2008	2009[b]		
Large Exterior Projects - Excavation Total[c]	54	289	357	700	323
Large Exterior Projects - Demolition Total	4	9	8	21	9
Interiors Total	0	1	2	3	2
Records of Compliance Total	19	41	67	127	54
Totals	77	340	434	851	387

Note: Data provided by PHD.

[a] The Basin ICP began after July 2007.
[b] Includes permits that were written but not issued the last half of the year.
[c] Includes subdivision/planned unit development (PUD) totals.
[d] The Annual Average was calculated from 2008-2009 data (2007 data were not used because ICP began operations part-way through the year).

In addition to issuing permits for specific projects, the ICP also issues licenses to private contracting companies, governmental entities, and utilities working in the Basin to ensure that the requirements of the ICP are understood and followed. As indicated in Section 3.3.7, the ICP issued 1,034 licenses to contracting companies and 108 licenses to government entities and utilities between 2005 and 2009 in all OUs.

State and federal laws require disclosure of property-specific information during real estate transactions. PHD informs property owners, prospective land purchasers, lenders, and

3 Memorandum of Agreement Among the U.S. Environmental Protection Agency Region X, The Idaho Department of Environmental Quality, and the Panhandle Health District for the Bunker Hill Superfund Site OU2 Institutional Controls Program; effective date July 9, 2007.

realtors of the cleanup status of properties (i.e., sampled and not yet remediated, sampled but no remediation required, or remediation completed) along with copies of available as-built maps, ICP permits issued, and available and pertinent sampling data for existing soils on the parcel. A total of 1,448 disclosures have been completed in the Basin since 2005.

The ICP maintains files of all parcels located within the ICP Administrative Boundary. Contractor licenses, logs of samples collected and results, logs of disposal volumes and counts, and logs of clean soil and gravel provided to homeowners are also maintained by PHD in hard copy but are not contained in parcel-specific files. For properties with sampling and remediation information, the data are also kept on file. The ICP stores files in fireproof safe cabinets. The amount of data available for the site is massive, but all data are contained at the ICP for use in permitting, oversight, and inspection activities. This information is also used to assist with disclosures related to real estate transactions.

In 2007, PHD created approximately 7,000 parcel files for the Basin ICP implementation. The remedial action database that processes BPRP sampling data was used to print parcel-specific sampling data for each folder. The same hard copy information is maintained in OU 3 parcel files as described for the Box.

The Basin database system was developed for multiple purposes, but mainly to serve the remedial action program (i.e., entering, processing, and maintaining property sampling data and sampling and as-built maps) and ultimately the ICP. PHD and IDEQ access property information via a secure website. Records may be searched by parcel, owner, or address (through online forms, not interactive maps). The records include updated parcel owners and numbers (currently updated twice a year based on tax assessor information), consent information, sampling results for samples collected from 1996 to the present for residential and commercial properties, sample maps, as-built maps, and refusal information.

As part of the current BPRP, when IDEQ signs off on final as-built maps, copies are delivered to PHD for incorporation into its hard copy files and the electronic version is uploaded and stored in the database. A feature of the database that has yet to be completed involves the identification of parcels that will not be addressed under the BPRP. These are properties that are not sampled or remediated under the BPRP, as determined by IDEQ and USEPA (TerraGraphics, 2008p). In addition, ICP permits and other relevant ICP-related information are not uploaded to the database. The database has been revised a number of times between 2005 and 2009 to meet the needs of the program and its users, and additional changes will be made, as needed, to ensure that a long-term record is maintained for actions related to the cleanup status of all OU 3 properties.

Currently, property-specific information generated as part of ICP activities is not maintained in electronic form, posing challenges to data continuity and transportability in the future. In addition, the current system of maintaining property files in paper-only form does not include a back-up system to ensure that information is not lost if project files are lost or destroyed. Integrating ICP-generated information into the existing database would ensure an up-to-date electronic record is maintained for each property, would provide a back-up system for the current paper-only filing system, and would aid in transferring large amounts of information to future ICP staff for their use.

The 2002 OU 3 ROD lacks a community-wide RAO for lead levels in soil, as exists in the Box, causing disposal challenges for the ICP in the Basin. In the Box, soils with lead levels in excess of 350 mg/kg but less than 1000 mg/kg could be disposed of at the Page Repository site unless capped by an approved barrier. Whereas the Box ROD defined a community mean soil RAO of less than 350 mg/kg, applying a minimum lead concentration to soils and waste was more difficult to implement in the Basin because there was no community-wide soil remedial goal to reference in the OU 3 ROD. When the Basin ICP was adopted in 2007, there was difficulty with disposal options for soils less than 700 mg/kg lead. Without a community-wide average RAO in the OU 3 ROD, soils greater than 350 mg/kg lead but less than 700 mg/kg were refused at BCR. During this time, the USEPA default residential cleanup level of 400 mg/kg was used by PHD to justify sending these soils to BCR. Since 2009, IDEQ has allowed the ICP to send to repositories any Basin soils that are assumed contaminated or have lead concentrations less than 700 mg/kg but greater than 350 mg/kg. USEPA and IDEQ are evaluating the need to develop a community-wide lead level to aid ICP implementation and increase the sustainability and protectiveness of the remedy.

As in the Box, the Basin 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 becoming effective in July 2007. Letters urging compliance with the ICP are required infrequently.

With the expansion of the ICP into the Basin in 2007, PHD has hired one additional full-time equivalent (FTE) to its staff to address ICP permitting and field-related activities in the Basin. Surveys of contractors who are licensed by the ICP indicate that the program is working well from their perspective, but that ICP personnel appear to be overworked and additional capacity may be needed. Information developed as part of this review (TerraGraphics, 2010a) reveals that the "responsibilities with permitting, daily field inspections, oversight, providing interior supplies and vacuum cleaners, and processing disclosures are a considerable burden on ICP staff, particularly during the construction season." Given that the work elements identified above comprise most of the functions of ICP personnel, this also suggests that staffing levels warrant evaluation to ensure the effective performance of the program.

Technical Assessment of the Institutional Controls Program

Consistent with USEPA guidance (USEPA, 2001d), technical assessment was conducted by evaluating the following three questions related to protectiveness of the implemented remedial actions.

Question A: Is the remedy functioning as intended by the decision documents?

The review of documents and site evaluations indicates that the ICP is functioning as designed. The PHD has implemented the program according to its rule (IDAPA 41.01.01). Community acceptance and compliance with the program appears to be high, but the community has not been specifically surveyed about remedy functionality. ICP users have been surveyed about the quality of the services provided by the ICP and they have indicated a very high level of satisfaction with the program. Clean barriers that have been disrupted through excavation have generally been repaired in response to ICP permitting and inspection activities. Although sampling and measurements of ICP-installed barriers were not performed for this Five-Year Review, new barriers appear to have been installed consistent with the remedy defined in the 2002 OU 3 ROD and in compliance with the ICP rule. PHD visually observes the barrier depth, performs multiple inspections for large projects, and receives documentation of samples for clean fill. They discuss and direct contractors and owners as to what to do specific to the property and issue licenses and permits to ensure compliance.

There are currently two repositories and an additional disposal site operated by the City of Mullan that receive ICP waste. USEPA is unaware of any information to indicate that contaminated materials generated by ICP-regulated activities have not been disposed in these locations. Contaminant migration from ICP-regulated properties has been controlled to prevent recontamination of remediated properties through the use of best management practices (BMPs) (e.g., dust suppression practices, erosion and runoff controls).

Question B: 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 are still valid. Although no community-wide average is specified in the ROD, PHD continues to implement the ICP to reduce community-wide average lead soil concentrations, consistent with the long-term risk management strategies adopted at the Site.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

Ongoing and long-term funding for the ICP is a critical component of the remedy. There is currently an existing agreement among USEPA, IDEQ and PHD that defines funding of the Basin ICP. There are, however, concerns that state funding priorities may change and maintaining an effective program would likely to be difficult with reduced funding. Long-term disposal is a component of the permanent funding issue that needs to be addressed to ensure disposal locations that are free and convenient to the local user and support future development governed by the ICP. The lack of a community-wide lead soil concentration ROA complicates ICP disposal decisions and prevents use of a management tool that would help achieve the long-term risk-management strategy for the Site. In addition, having the appropriate level of staffing for the ICP is critical for ensuring the long-term sustainability and protectiveness of the installed remedies.

Remedy Issues

A summary of issues identified with respect to the ICP in the Basin is provided in Table 5-16.

Recommendations

A summary of recommendations and follow-up actions for the ICP in the Basin is provided in Table 5-17.

TABLE 5-16
Summary of Basin ICP Issues
2010 Five-Year Review, Bunker Hill Superfund Site

Remedy Issues	Affects Protectiveness (Y/N)	
	Current (now to 1 year)	**Future (>1 year)**
ICP Funding and Resources: Adequate funding of the ICP is needed to ensure success of the remedy, including consideration of sufficient staff and information management.	N	Y
Community-Wide Lead RAO: The lack of a community-wide lead RAO poses disposal challenges for ICP implementation in the Basin.	N	Y

TABLE 5-17
Summary of Basin ICP Recommendations and Follow-up Actions
2010 Five-Year Review, Bunker Hill Superfund Site

Recommendations/Follow-up Actions	Responsible Entity	Oversight Agency	Milestone Date	Follow-up Actions: Affects Protectiveness (Y/N)	
				Current (now to 1 year)	**Future (>1 year)**
ICP Files: A mechanism for integrating ICP activities into the electronic database needs to be established to ensure the long-term maintenance and transportability of all pertinent property information.	IDEQ, PHD	IDEQ, USEPA	12/2012	N	Y
ICP Funding and Resources: 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.	IDEQ, PHD, USEPA	IDEQ, USEPA	12/2012	N	Y
Community-Wide Lead RAO: Determine whether a community-wide lead level is needed for the Basin. If so, determine the appropriate level and how it would be used.	IDEQ, PHD, USEPA	IDEQ, USEPA	12/2012	N	Y

5.3.3.7 Disposal of Wastes from Human Health Remedial Actions

Status Update

There are currently two locations being used for the disposal of wastes generated by cleanup activities in OU 3:

- Big Creek Repository
- East Mission Flats Repository

Both of these repositories were sited according to the process described in Section 12.5 of the 2002 OU 3 ROD, and they accept remedial action waste as well as contaminated soils generated by commercial activities or residents performing work on their own property pursuant to the ICP.

Section 5.3.6 of this Five-Year Review Report describes the operation and performance of the Big Creek Repository and the East Mission Flats Repository. Both of these repositories are sited, designed, and operated in accordance with the 2002 OU 3 ROD to accept remedial action and ICP-related waste material. Section 5.3.6.3 describes the need to site and construct additional repositories to support future cleanup activities. The technical evaluation of OU 3 repositories is presented in Section 5.3.6.4.

An additional disposal site, located in Mullan, is currently being operated by the City of Mullan: the Mullan ICP Disposal Site (MIDS). This site is secured with a fence and a locked gate, and access is currently controlled by the Mayor of Mullan. The site is provided by the City for disposal of ICP waste from local residents and construction contractors on local projects. This site has not undergone the evaluation process presented in Section 12.5 of the 2002 OU 3 ROD. Until late 2010, no plans had been prepared for this site to guide disposal and monitoring activities.

Since the establishment of the ICP in the Basin in 2007 through spring 2010, small amounts of ICP-generated waste have been disposed of in the MIDS, and few management activities have been conducted. Periodic observations of the facility between 2007 and spring 2010 indicated that wastes have been graded and compacted with the grading equipment. Prior to July 2010, the graded waste material had no discernible relief from the surrounding area.

In July 2010, several large projects resulted in a significant influx of materials to the site (approximately 16,000 cy). The disposal of this large amount of materials at the MIDS revealed that there were no operations or management plans in place to ensure that appropriate materials are brought to the site and that contaminated materials are handled and managed in a manner to ensure that they do not migrate from the disposal site. IDEQ has recently developed such plans, and the effectiveness of their implementation will need to be monitored.

Elected officials and PHD have expressed a desire to use contaminated materials excavated from construction and maintenance activities as fill to support the establishment of developable land. PHD has permitted and overseen such activities in implementing the ICP within the Bunker Hill Box. As an example, contaminated fill from ICP-permitted activities has been brought to the Shoshone County Airport to support construction activities. PHD reports that fill placed at the airport has been capped in compliance with the requirements of the ICP. A formal process governing this type of activity in the Box and Basin currently does not exist and is needed to ensure that these fill activities are conducted and documented in a manner that meets the objectives of the Box and Basin RODs.

The 2007 MOA among USEPA, IDEQ, and PHD established the mutually agreed-upon strategy of disposing of all contaminated materials generated by ICP-permitted activities in OU 3 in authorized repositories. Because this strategy requires disposal in repositories and there is interest by PHD and elected officials in using contaminated materials as fill in OU 3, USEPA and IDEQ have agreed to evaluate and develop a policy that establishes the appropriate precautions, practices, and documentation requirements that would allow such activities to be conducted in a manner consistent with cleanup objectives of the OU 3 ROD, as well as the RODs for OU 1 and OU 2. This policy, referred to as the Community-Fill Policy (CFP), is currently under development and is intended to be applicable to all OUs at the Site when completed but initially would be geographically focused on activities in the Box and the Upper Basin. Community engagement would be included in the development of the CFP. The adoption of a CFP would be conducted though an Explanation of Significant Differences (ESD) or other similar vehicle and would incorporate community input prior to being finalized.

The CFP is not yet completed, but contaminated materials generated by ICP-permitted activities have been placed in OU 3 (e.g., the Shoshone County Transfer Station) outside of approved repositories during the 2010 construction season. This practice is inconsistent with disposal requirements of the OU 3 ROD and the Basin ICP disposal strategy agreed to among USEPA, IDEQ, and PHD. USEPA and IDEQ will work with PHD to ensure that all contaminated wastes generated by ICP-permitted activities disposed of in OU 3 will be disposed of in authorized OU 3 repositories until the CFP is completed. USEPA and IDEQ will continue efforts to complete the CFP.

Technical Assessment of Disposal of Wastes from Human Health Remedial Actions

Consistent with USEPA guidance (USEPA, 2001d), technical assessment was conducted by evaluating the following three questions related to protectiveness of the implemented remedial actions.

Question A: Is the remedy functioning as intended by the decision documents?

The review of documents, ARARs, and risk assumptions indicates that the remedy is functioning as intended by the RODs.

Question B: 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 are still valid.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

Contaminated waste materials from ICP-permitted activities have been disposed of in locations outside of authorized repositories with no formal, approved procedures to ensure that such activities comply with the cleanup objectives of the OU 3 ROD. USEPA and IDEQ are currently developing a CFP that will include the necessary precautions, practices, and documentation requirements to meet the ROD objectives.

The MIDS is currently operated without any management or operations plans in place to govern activities at the site. Lack of such plans could result in the disposal of inappropriate materials at the site as well as offsite migration of contaminants from the site.

Remedy Issues

A summary of issues identified for the disposal of wastes from human health remedial actions is provided in Table 5-18.

TABLE 5-18
Summary of Issues for Disposal of Wastes from Human Health Remedial Actions
2010 Five-Year Review, Bunker Hill Superfund Site

	Affects Protectiveness (Y/N)	
Remedy Issues	**Current (now to 1 year)**	**Future (>1 year)**
Community-Fill Policy: ICP waste is being disposed of in locations outside of approved repositories.	N	Y

Recommendations

A summary of recommendations and follow-up actions for the disposal of wastes from human health remedial actions is provided in Table 5-19.

TABLE 5-19
Summary of Recommendations and Follow-Up Actions for Disposal of Wastes from Human Health Remedial Actions
2010 Five-Year Review, Bunker Hill Superfund Site

				Follow-up Actions: Affects Protectiveness (Y/N)	
Recommendations/Follow-up Actions	**Responsible Entity**	**Oversight Agency**	**Proposed Milestone Date**	**Current (now to 1 year)**	**Future (>1 year)**
Community-Fill Policy: Complete the CFP currently being developed by USEPA and IDEQ for all three OUs.	IDEQ, USEPA	IDEQ, USEPA	12/2012	N	Y

An issue that does not affect protectiveness, but needs to be addressed, is that the MIDS has operated, until recently, without any management or operations plans in place to govern activities at the site. Lack of such plans could result in the disposal of inappropriate materials at the site as well as offsite migration of contaminants from the site. IDEQ has recently developed these plans, and the effectiveness of their implementation needs to be determined. USEPA, IDEQ, and PHD should evaluate the implementation of those plans and, as appropriate, make necessary revisions to the plans or implementing practices.

5.3.3.8 Infrastructure

Sustaining protective barriers is critical to the long-term success of the remedy and relies in part on the condition and effectiveness of the supporting infrastructure. Infrastructure such as roads, buildings, and parking lots may serve as barriers to subsurface contaminants. Adequate and appropriately functioning water conveyance systems are necessary to control erosion and recontamination due to flooding. Curbs and gutters; appropriately sized storm drains, culverts, detention facilities; and correctly graded roads all serve to protect the remedy from erosion as well as providing municipal services to local residents. Currently, many of these types of systems or features are deteriorating, undersized, or absent, posing a threat to the installed barriers.

Infrastructure and Revitalization Plan

The Basin Commission has reviewed community infrastructure needs for all OUs in the development of a Drainage Control Infrastructure Revitalization Plan (DCIRP) funded by USEPA and IDEQ. The DCIRP outlines infrastructure needs of the communities within the Site, including infrastructure needed to protect the remedy as well as infrastructure that is of particular interest to the communities but may not be needed to protect the remedy. Community planners have used the DCIRP to support applications for a range of state and federal grants and loans.

South Fork Coeur d'Alene River

Local officials and residents are concerned about inadequate flood control systems for the SFCDR and its tributaries. USEPA and IDEQ are concerned about the potential for SFCDR and Pine Creek flooding to affect installed barriers. Development, including improvements associated with the OU 3 remedy, occurs within the heavily contaminated historical floodplain. There have been four federal Basin-wide disaster declarations requiring Federal Emergency Management Administration (FEMA) response actions since 1974.

During the Federal Insurance Rate Map (FIRM) update in 2008, the levee systems for the communities and unincorporated areas of Kellogg, Pinehurst, Cataldo, and Osburn were de-accredited due to lack of information about the condition of existing levees, greatly expanding the FEMA-defined 100-year floodplain. In the FIRM update, FEMA assumed that nonaccredited levees provide no flood protection for the Basin communities. Although analysis of the levees has not been conducted, it is likely that existing levees afford some level of flood protection not reflected on the FEMA maps.

An initial estimate of the potential cost to re-establish Superfund remedies at risk to SFCDR flooding was prepared for the Shoshone County Multi-Jurisdictional Hazards Mitigation Plan and indicates that roughly $63.5 million of remediation activity was completed site-wide within the 100-year floodplain as depicted on the 2008 FIRM (TerraGraphics, 2009i). Although flooding of this magnitude has not occurred since the listing of the Bunker Hill Superfund Site, the threat of future flooding remains an issue that is important to the cleanup program and local communities.

Comprehensive flood control is a complex, multi-jurisdictional issue that exceeds the expertise and regulatory authority of USEPA and IDEQ cleanup programs and that of the local communities. The Basin Commission agreed in November 2009 to assume a leadership role in evaluating flooding issues associated with the SFCDR and Pine Creek. Flooding is a large, system-wide concern for which a comprehensive review and plan are required to ensure that work with the greatest flood protection potential is ultimately implemented. The Basin Commission has engaged a range of entities with the required combined expertise and regulatory jurisdiction. These entities include U.S. Army Corps of Engineers (USACE), FEMA, the Idaho Bureau of Homeland Security (BHS), USEPA, and IDEQ. USEPA and IDEQ are committed to assisting Basin Commission-led activities to evaluate and plan actions relative to addressing SFCDR flooding issues. No funding source for Basin Commission-led activities has been established.

Tributaries and Heavy Precipitation

The Upper Basin FFS Report estimates that 36 percent of the existing installed remedies are at risk for contamination within the OU 3 communities of Osburn, Silverton, Wallace, and Mullan (USEPA, 2010b). This excludes potential impacts from the SFCDR and is predicated on an assumption that all existing stormwater-related infrastructure continues to function at full capacity. In evaluating the risks to installed remedies from tributary flooding and heavy precipitation, the FFS Report considered the following threats: flooding with water that contains contaminated sediment, scouring (erosion) of barriers caused by stormwater, and contaminated sediment that is mobilized and carried into the communities by stormwater runoff and deposition (USEPA, 2010b). The follow-on Proposed Plan (USEPA, 2010a) proposes selection of specific actions within eight primary Upper Basin communities (Pinehurst, Smelterville, Kellogg, Wardner, Osburn, Silverton, Wallace, and Mullan) to address flooding risks to installed barriers. The Proposed Plan also establishes a framework for conducting similar analysis and selection of mitigation actions to address flooding concerns in Upper Basin gulches outside the eight primary communities.

Rights-of-Way

The RODs for OU 2 and OU 3 (USEPA, 1992, 2002) address cleanup of ROWs in the Box and the Upper Basin, as appropriate to respond to risks to human health. The RODs allow ROWs, which include all state, county, local, and private roads, to be remediated such that they provide barriers to underlying metals contamination. Many roads or road shoulders have been remediated during implementation of the Selected Remedies in residential and commercial areas within the Box and Basin communities. However, USEPA and IDEQ recognize that some paved roadways may not provide adequate long-term barriers to underlying contaminated material, and that local and state entities are responsible for the long-term road development and maintenance efforts. USEPA and IDEQ are developing an approach under the existing RODs to address paved and unpaved roads as barriers collaboratively with local, county, and state entities responsible for providing and maintaining roadways in their communities. The objective of this effort is to ensure the long-term effectiveness of barriers installed in ROWs consistent with the transportation and maintenance needs of the Box and Upper Basin communities.

Technical Assessment of Infrastructure

Consistent with USEPA guidance (USEPA, 2001d), technical assessment was conducted by evaluating the following three questions related to protectiveness of the implemented remedial actions.

Question A: Is the remedy functioning as intended by the decision documents?

The review of documents, ARARs, and risk assumptions indicates that the remedy is functioning as intended by the RODs. Infrastructure (e.g., roads, sidewalks, parking lots, drainage controls) in OU 3 is an important part of the remedy because it serves as barriers to exposure pathways between contaminated soils and humans and helps ensure that clean barriers remain in place. In general, the infrastructure that is in place in OU 3 communities continues to serve this purpose, though some infrastructure systems or features throughout OU 3 are deteriorating (e.g., paved roads) or undersized (e.g., drainage features). Under the ICP, local public entities are required to maintain the infrastructure such as roads in a manner to prevent contaminant exposures or migration. The reliance on infrastructure to help protect the remedy is appropriate, and failure to address infrastructure inadequacies in these communities may result in the loss of portions of the installed remedy. USEPA and IDEQ are developing an approach to address roads as barriers. The objective is to ensure the long-term effectiveness of barriers installed in ROWs, recognizing local transportation needs and maintenance responsibilities.

Infrastructure such as storm drain systems and flood control facilities also is relied upon to protect the installed remedy by safely conveying storm and flood waters. In this case, the community infrastructure is not able to safely handle large flow events. To date, one flood has occurred that disrupted barriers significantly, the 1997 Milo Creek flood. The FFS analyzed risk to installed barriers from heavy precipitation and tributary flooding and developed actions to address the risks (USEPA, 2010b). The follow-on Proposed Plan (USEPA, 2010a) proposes selection of specific actions within the eight primary Upper Basin communities to address flooding risks to installed barriers. The Proposed Plan also establishes a framework for conducting similar analysis and selection of mitigation actions to address flooding concerns in Upper Basin gulches outside the eight primary communities of Pinehurst, Smelterville, Kellogg, Wardner, Osburn, Silverton, Wallace, and Mullan.

Comprehensive flood control on the SFCDR and Pine Creek is a complex, multi-jurisdictional issue that exceeds the expertise and regulatory authority of USEPA's and IDEQ's cleanup programs and that of the local communities. The Basin Commission has assumed the lead in evaluating flooding issues associated with the SFCDR and Pine Creek. In that capacity, the Basin Commission has engaged USACE, FEMA, Idaho BHS, USEPA, and IDEQ , who have applicable expertise and regulatory jurisdiction. USEPA and IDEQ will be participating in Basin Commission-led activities related to SFCDR and Pine Creek flooding issues. No funding source for Commission-led activities has been established.

Question B: 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 are still valid. As previously noted, ongoing issues remain related to potential recontamination of protective barriers from flood events or lack of infrastructure improvements. Although these issues do not currently affect the protectiveness of the remedy, there may be recontamination concerns if infrastructure improvements are not implemented.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

Infrastructure improvements and ongoing maintenance of existing infrastructure are needed to ensure long-term success of the remedy. There is uncertainty regarding the remaining service life of these systems. The local communities have expressed concern about their ability to upgrade and maintain existing infrastructure and the associated operations and maintenance obligations needed to ensure long-term protectiveness of the remedy. Traditional funding mechanisms are not conducive to multi-jurisdictional owned projects or combining different utilities within projects. Similarly, the amount of funding needed to holistically address all infrastructure issues within a community typically exceeds the amount of funding that can be secured. Traditional infrastructure funding sources require relatively high local match requirements.

The communities' ability to pay to maintain existing infrastructure or install new systems that provide barriers and protect the CERCLA installed remedy was evaluated prior to the 2005 Five-Year Review (USEPA, 2005). The Box and Basin IRP (TerraGraphics, 2009c) program evaluated community assessments, current and continuing obligations, and needs at that time. The trend of decreasing tax revenues, declining population, and reduction in State and federal assistance are increasing local funding burdens, deferring O&M, and delayed replacement of aging infrastructure systems. Resources to repair and install infrastructure have been difficult to secure by local governments. The NRC report noted that ICP and O&M programs include important components that will need perpetual maintenance for hundreds of years. The Committee expressed concern that State funding priorities change and maintaining an effective program is likely to be difficult.

Remedy Issues

A summary of issues identified with respect to infrastructure is provided in Table 5-20.

TABLE 5-20
Summary of OU 3 Infrastructure Issues
2010 Five-Year Review, Bunker Hill Superfund Site

	Affects Protectiveness (Y/N)	
Remedy Issues	**Current (now to 1 year)**	**Future (>1 year)**
Flood Control: Flooding on the SFCDA and Pine Creek poses a threat to portions of the installed remedy. Comprehensive flood control on the SFCDA and Pine Creek is a complex, multi-jurisdictional issue that exceeds the expertise and regulatory authority of USEPA and IDEQ cleanup programs, and that of the local communities.	N	Y
Roads as Protective Barriers: A number of paved roads throughout all OUs are deteriorating, compromising their ability to function as protective barriers.	Y	Y
Infrastructure Maintenance Funding: Infrastructure maintenance and improvements remain an issue. The remedy relies on functioning infrastructure to be sustainable. Resources to repair and install infrastructure have been difficult to secure by local governments.	N	Y

Recommendations

A summary of recommendations and follow-up actions for infrastructure is provided in Table 5-21.

TABLE 5-21
Summary of OU 3 Infrastructure Recommendations and Follow-up Actions
2010 Five-Year Review, Bunker Hill Superfund Site

Recommendations/Follow-up Actions	Responsible Entity	Oversight Agency	Milestone Date	Follow-up Actions: Affects Protectiveness (Y/N)	
				Current (now to 1 year)	Future (>1 year)
Flood Control: Continue working with the Basin Commission and other stakeholders to evaluate and plan actions relative to addressing SFCDR and Pine Creek flooding that may affect cleanups.	Local Governments, IDEQ, USEPA, PHD	IDEQ, USEPA	12/2012	N	Y
Roads as Protective Barriers: Continue working to develop an approach for addressing roads as long-term barriers in collaboration with state, county, and local entities.	Local Governments, IDEQ, USEPA, PHD	IDEQ, USEPA	12/2012	Y	Y
Infrastructure Maintenance Funding: Develop appropriate institutions and funding mechanisms to finance and oversee stewardship activities.	Local Governments, IDEQ, PHD	IDEQ, USEPA	12/2012	N	Y

5.3.3.9 Recreational Areas on Coeur d'Alene River

Transition of private lands from agricultural to recreational usage within the flood plain and along the banks of the Coeur d'Alene River has been occurring 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 flood plains that are presently contaminated and are recontaminated with lead and other mine waste heavy metals during flood events. Further examination of these use patterns will be a consideration as part of the Lower Basin planning described in Section 5.1.12

Guidelines to address sediment deposition from high-water events at recreation sites along the Coeur d'Alene River were adopted in 2008. The guidelines address the following requirements:

- When a recreation site should be closed due to sediment deposition;
- What sites/areas are to be cleaned up;
- How sites are to be cleaned up; and
- Coordination and communication by participating agencies.

The agencies that developed the guidelines are the Idaho Department of Fish and Game (IDFG), Idaho Department of Parks and Recreation (IDPR), IDEQ, USFS, BLM, and PHD.

Agencies that own and/or manage recreation sites are responsible to implement the guidelines.

There has been limited site-specific activity at recreation areas since the 2005 Five-Year Review. Minor work did occur at the sites described in the following subsections.

Blackrock Slough Trailhead/Highway 3 Crossing

Response actions at this site were conducted as a time-critical removal action in 2001 and 2002 including grading, capping, and river bank stabilization. Additional remedial actions were performed at this site in 2004. A more detailed discussion of this work is provided in the 2005 Five-Year Review Report (USEPA, 2005).

During the review period for this 2010 Five-Year Review (2005-2010), USEPA and IDFG completed a joint project on the Blackrock Trailhead of the Trail of the Coeur d'Alenes. In 2005, USEPA contracted the placement of boulder vehicle barriers and paved the area behind the barriers with asphalt. IDFG then installed two picnic tables on the isolated asphalt surface and installed a large, three-panel information kiosk. IDPR currently conducts minor cleanup activities on site as part of bike path operations. IDFG cleans sediment off the asphalt surface resulting from deposition following high-water events.

Medimont and Rainy Hill Boat Launches

Response actions were conducted in 1999 by the USFS including capping parking and access areas with aggregate, placing 3-to -6 inch rock in shallow areas to discourage children from playing in contaminated areas, and placement of boulders for traffic control.

During the review period for this 2010 Five-Year Review (2005-2010), the paving of the entire Rainy Hill parking lot was completed by the owner, USFS, in 2006. New docks were added along with ramp improvements. Future plans call for installation of boulder vehicle barriers at both sites starting in 2010.

Thompson Lake Boat Ramp

Response actions at this site were conducted as a time-critical removal action in 1999 and 2000, including removal of contaminated sediments, grading, capping (asphalt parking area), river bank stabilization, and installation of concrete planks to provide a boat ramp.

During the review period for this 2010 Five-Year Review (2005-2010), IDFG cleaned sediment from the asphalt surface following deposition following high-water events. The asphalt surface will likely be sealed in 2010 or 2011. Wildlife management area signs have been installed.

Anderson Lake Boat Ramp

Response actions were conducted in 1999 by USEPA, including capping parking and access areas with aggregate, placing 3-to -6 inch rock in shallow areas to discourage children from playing in contaminated areas, and placement of boulders for traffic control.

During the review period for this 2010 Five-Year Review (2005-2010), replacement of the U.S. 97 bridge at Harrison, Idaho, near the IDFG Anderson Lake boat launch was completed in 2008. Prior to the bridge work, the boat launch was accessed via a graveled entry road situated on Idaho Transportation Department (ITD) right-of-way. The bridge reconstruction required the gravel entry road be covered by fill material. In response, an asphalt entrance road was constructed on the northeast side of the parking area. In addition to covering the original entrance road, the referenced road fill eliminated a county waste collection site. The waste collection site was subsequently relocated 2 miles to the northwest along U.S. 97. With these exceptions, the launch remains unchanged.

Additional work on the facility is pending. Within the next 2 years, the asphalt parking area and entrance road will be chip sealed. Within the next 10 years, the launch surface is to be extended such that the launch remains functional at low pool. A boarding dock may be installed concurrently with the launch extension.

East of Rose Lake Boat Launch

The East of Rose Lake Boat Launch is located adjacent to Highway 3 and is primarily owned by IDFG, with the eastern part of the property owned by USFS. The area had a dusty, unpaved parking lot with high levels of metals. Average lead concentrations were in excess of 3,500 mg/kg in the soil/sediment, which posed a health risk to humans, especially young children. The key project goal was to reduce human exposure to lead- and arsenic-contaminated soil/sediment and build upon an existing recreational facility to create a clean oasis for public use. USEPA was the project lead and, due to joint ownership issues, USEPA funded cleanup on the IDFG property and USFS funded actions on their property. USACE, under an Interagency Agreement with USEPA, completed the design and managed the construction. The remedial action, completed in 2004, included the following components:

- Capped contaminated soil in the parking lot to accommodate vehicle/trailer parking and constructed a low-water access boat launch;
- Graded the parking lot so the majority of the runoff is directed away from river;
- Stabilized the bank near the boat launch to reduce erosion and human exposure to the contaminated riverbank. Installed a vegetated rock toe wall with some large boulders a few feet away from the previously eroding bank. Downstream from the boat ramp, the slope is graded to the rock base and vegetated with native plants. Upstream from the boat ramp, the rock base grades into layers of synthetic fabric with engineered fill to create a vegetated self-supporting steep slope;
- Closed off the Highway 3 access, replaced it with a safer access off East River Road, and paved the road from Highway 3 to the new parking lot access;
- Closed off informal access road on the USFS property with boulders and planted with native vegetation;
- Installed a protective fence around the historic pioneer schoolhouse located on the property; and
- Monitored to assess effectiveness of remedial action.

Site inspections from 2005 through 2009 have determined that remediation work in the boat launch area continues to prevent public exposure to metals contamination, although sediment and signage issues have been observed following high-water events. Consistent with the project design, IDFG has cleaned contaminated sediment deposited during high-water events off the paved parking area.

Technical Assessment of Recreational Areas

Consistent with USEPA guidance (USEPA, 2001d), technical assessments of the recreational areas were conducted by evaluating the following three questions related to protectiveness of the actions to be implemented.

Question A: Is the remedy functioning as intended by the decision documents? The remedies implemented at the recreation areas are functioning as intended by the 2002 OU 3 ROD (USEPA, 2002). The site inspections indicate the remedies are functioning as intended.

Question B: 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 for the above recreational areas' remedial actions.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy? This Five-Year Review found no new information that calls into question the protectiveness of the recreational area remedies.

5.3.4 Mine and Mill Sites

In the Upper Basin, remedial actions outside of residential property cleanups have primarily focused on mine and mill sites in Canyon Creek, Ninemile Creek, Pine Creek, and the SFCDR. The 2002 OU 3 ROD identifies a number of mine and mill sites for cleanup in the Upper Basin. In cooperation with the Basin Commission's Mine and Mill Sites Project Focus Team (PFT), the following four sites were identified as the initial priority for cleanup: the Sisters Mine Site on Canyon Creek, the Rex Mine and Mill Site on Ninemile Creek, the Constitution Mine and Mill Site on Pine Creek, and the Golconda Mine and Mill Site on the SFCDR. Remedial actions have been implemented at these sites to reduce exposure to recreational users and to reduce lead and sediment loading. Other benefits, such as dissolved metal concentration reductions in groundwater and in surface water, may be achieved. Other sites in the 2002 OU 3 ROD will be prioritized as part of the upcoming ROD Amendment and moved into the remedial design/remedial action phase as funds become available.

Remedial action effectiveness monitoring is conducted at these sites to evaluate the effectiveness of remedial actions conducted to date, evaluate progress toward achievement of ARARs, and gain a better understanding of Upper Basin processes. Monitoring is not conducted at the Sisters Mine because this site is not believed to contribute to the degradation of water quality in the Canyon Creek watershed.

The remedies for the Upper Basin Mine and Mill Sites are described and evaluated in the following subsections. No mine and mill sites are present in the Lower Basin.

5.3.4.1 Sisters Mine

Background and Description of Remedial Action

The Sisters Mine is a small site located within the Canyon Creek Watershed adjacent to the community of Woodland Park near Wallace, Idaho. Mining development at the site was initiated in 1905 but did not become fully established until approximately 1920 (USEPA, 2002). During its operational years (i.e., 1920 to 1929), the mine generated approximately 472 tons of ore and 68 tons of tailings material. The OU 3 Remedial Investigation (RI; USEPA, 2001d) identified waste rock piles at the site.

Major features of the site include:

- An adit (overgrown with vegetation) located on the northern edge of the site;
- A former access road located along the northeast perimeter of the site;
- Two unvegetated and slightly eroded escarpments with slopes of 1.5 horizontal to 1 vertical (1.5H:1V) and 1H:1V;
- Remnant mining track rails located on top of the escarpment; and
- A refuse pile located in the southeast portion of the site containing mining-related and other wastes.

The remedial objective for the Sisters Mine was to protect area residents and recreational users (USEPA, 2002) in order to limit the exposure potential of contacting arsenic- and lead-contaminated soils. Based upon the information collected during the pre-remedial design investigation (Parametrix, 2005), this was best achieved by a combination of site re-contouring, installing clean soil and native vegetative cover, and eliminating access points. Based upon the data collected, no additional action was required to treat the adit discharge and/or underlying groundwater. The design was completed in July 2005 by Parametrix, and the remedy was constructed by IDEQ in July/August 2005.

Description of Remedial Actions

Remedial actions were fully implemented at the Sisters Mine in 2005.

Operation and Maintenance

The Sisters Mine has been visually inspected by the State of Idaho. Since completion of the remedy, the Sisters Mine has required no maintenance to sustain the integrity of the action.

The site inspection of the Sisters Mine site was conducted on March 22, 2010 for the purpose of this Five-Year Review. The terraces and vegetation were observed to be functioning as intended. No erosion and no public use of this area were observed.

5.3.4.2 Rex Mine and Mill

Background

The cleanup locations for the East Fork of Ninemile Creek (EFNMC) are shown in Figure 12.2-2 of the 2002 OU 3 ROD. The Rex Mine and Mill Site is located in the East Fork of the Ninemile Creek Watershed approximately 9 miles north of Wallace, Idaho.

The Rex Site covers approximately 6.5 acres and consists of stockpiled tailings composed of fine-grained, ground rock materials that are remnants after the removal of minerals during the heavy media separation and flotation extraction process that was conducted within the mill complex. The tailings pile completely filled the small drainage with which it is associated, thus impounding the small creek that previously occupied the drainage. The tailings dam at the downgradient end of the site face of the tailings dam was determined to be unstable due to the height and slope of the dam and nature of the tailings. Failure of this dam could have resulted in major impacts on Ninemile Creek, which had already undergone extensive cleanup work by the Silver Valley Natural Resource Trust (SVNRT).

Rex Creek and the Rex Adit flowed through the tailing impoundment and emerged from the pile contaminated with dissolved and suspended metallic constituents, primarily zinc, cadmium, and lead.

In 2004, BLM conducted a limited removal action to stabilize the flow channels and surface water drainage around the tailings pile along with stabilization efforts on the dam face to reduce erosion. BLM has also been collecting flow and water level information for the last several years as part of their investigations of the stability and water discharges at the site.

Description of Remedial Actions

The Rex Mine and Mill Site remedial action was conducted in 2007. The components of this action are listed in Table 5-22.

TABLE 5-22
Rex Mine and Mill Remedial Actions Conducted
2010 Five-Year Review, Bunker Hill Superfund Site

Removal and off-site 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.
Completion of final grading, modifications to surface water management to provide a long-term system for management of surface water, placement of an earthen cover, and hydroseeding.
Stabilization of tailings dam.
Installation of a bat gate at the adit opening.

Operation and Maintenance

The Rex Mine and Mill remedial action has been visually inspected by BLM since completion of the remedy. Erosion near the northwest end of the waste rock pile was observed following the 2008 runoff event. Drainage improvements were implemented at the site, and no subsequent erosion has been observed.

An O&M plan is being developed for the Rex Mine and Mill Site. O&M is currently being conducted by USEPA. USEPA will be working with the property owner and Asarco work Trust to insure long-term O&M at this and other Mine and Mill sites. The site inspection of the Rex Mine and Mill site was conducted on March 22, 2010, for the purpose of this Five-Year Review. The earthen cover and vegetation were observed to be functioning as intended. The Rex Site is a common area for public recreational activities. No impacts on the remedy were observed at the time of the site inspection.

The Rex Creek and Rex Adit flows were observed to completely infiltrate into the subsurface materials prior to reaching the riprap lined channel. It is currently unclear how much, if any, of the infiltrating water is contacting contaminated materials in the tailings impoundment and being transported into Rex Creek below the tailings impoundment dam. Additional monitoring will be required to determine whether the increased loading seen below the site is a result of any infiltration or due to geochemical changes as a result of disturbance of the tailings during the remedial action.

Remedial Action Effectiveness Monitoring

The remedial action effectiveness monitoring requirements, purpose, objectives, and results are presented in Section 5.6.2. The remedial action effectiveness monitoring at the Rex Mine and Mill Site was initiated in fall 2007. Data interpretation and evaluation is presented in the *2008 Data Summary Report and Remedial Action Effectiveness Evaluation for the Coeur d'Alene Remedial Action Monitoring Program* (CH2M HILL, 2009a) and the forthcoming 2009 data summary report.

Remedial action effectiveness monitoring is conducted at the Rex Mine and Mill Site using the following monitoring locations:

- One upgradient and one downgradient EFNMC surface water monitoring location;
- Rex Adit; and
- Two groundwater monitoring wells (one mid-gradient and two downgradient).

The results of the monitoring conducted to date were used to assess attainment of water quality based RAOs. The overall RAO is to reduce metal concentrations that exceed surface water ARARs (Section 5.2). Significant surface water loads and ambient water quality criteria (AWQC) ratio differences were observed between upgradient and downgradient stations. The source of these contributions currently unknown as stated above. The differences in the upgradient and downgradient loads and AWQC ratios have been significant.

The Rex Mine and Mill Site remedial actions were completed immediately prior to the initial sampling rounds, and these disturbances may have elevated or peaked concentrations observed in 2007 and 2008. The full net benefit of the remedial actions may not yet be achieved at this site.

5.3.4.3 Constitution Mine and Mill

Background

The Constitution Mine and Mill Site is on the East Fork of Pine Creek, upstream from its confluence with Gilbert Creek, approximately 8 miles south of Pinehurst. This subarea consists of the Upper Constitution and Lower Constitution, which is an abandoned lead, silver, and zinc mine and mill site. Upper Constitution included two large fine-grain tailings piles containing a total of approximately 36,000 cy of mill tailings. The tailings piles were uncontained and subject to extensive migration via runoff and erosional transport. The East Fork of Pine Creek skirts the tailings piles immediately to the west and had eroded the banks of the lower pile. High concentrations of arsenic (139 mg/kg) and lead (4,930 mg/kg) have been measured in the tailings piles.

Operation and Maintenance

The Constitution Mine and Mill remedial action has been visually inspected by BLM since completion of the remedy. An O&M plan is being developed for the Constitution Site. O&M is currently being conducted by USEPA and BLM. USEPA will be working with the property owner, BLM, and the Asarco work Trust to insure long-term O&M at this and other Mine and Mill sites in the basin. A site inspection for this Five-Year Review was conducted on March 22, 20010. The soil cover and vegetation were observed to be functioning as intended. The Constitution Site is a common area for public recreational activities. No impacts on the remedy were observed at the time of the site inspection, except for damage to the fence enclosing the bioreactor that treats the adit flow prior to discharging to Pine Creek.

Description of Remedial Actions

Remedial actions for this site are designed to prevent direct human contact with metals from recreational exposure and prevent further erosion of the source areas into Pine Creek. The remedial action was implemented in 2006. Table 5-23 presents the components of the Constitution Site remedial action.

TABLE 5-23
Constitution Mine and Mill Remedial Actions Conducted
2010 Five-Year Review, Bunker Hill Superfund Site

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.
Conveying the adit flow into a bioreactor for treatment prior to discharging into Pine Creek.

Remedial Action Effectiveness Monitoring

The remedial action effectiveness monitoring requirements, purpose, objectives, and results are presented in Section 5.6.2. Remedial action effectiveness monitoring at the Constitution Mine and Mill Site was initiated in fall 2007. Data interpretation and evaluation is presented in CH2M HILL (2009a) and the forthcoming 2009 data summary report.

Remedial action (RA) effectiveness monitoring is conducted at the Constitution Mine and Mill Site using the following monitoring locations:

- One upgradient, one mid-gradient, and one downgradient SFCDR surface water monitoring location; and
- Four groundwater monitoring wells (two upgradient, one mid-gradient, and one downgradient).

The results of the monitoring conducted to date were used to assess attainment of water quality based RAOs. The overall RAO is to reduce metal concentrations that exceed surface water ARARs (Section 5.2). Load and AWQC ratio differences were observed between upgradient and downgradient stations; the source of these contributions is unclear at this time and may be the result of the disturbance to the tailings pile during construction, which is expected to stabilize with time. The primary source area appears to originate from the lower segment as bracketed between the mid-gradient and downgradient monitoring locations. Dissolved zinc concentrations in the downgradient monitoring well have exceeded 100 mg/L during the first flush monitoring events. Average dissolved cadmium and dissolved zinc AWQC ratios at the downgradient monitoring location are 2.6 and 3.8, respectively.

Overall, a comparison of pre-remedial action versus post-remedial action data between the current downstream monitoring station and nearest pre-remedial action station suggests a slight improvement in dissolved cadmium, dissolved lead, and dissolved zinc AWQC ratios. A comparison of pre-remedial action versus post-remedial action groundwater monitoring data at interior well locations suggests significant water quality improvement for dissolved cadmium and dissolved zinc.

5.3.4.4 Golconda Mine and Mill

Background

The Golconda Mine and Mill Site is located along the north banks of the Upper SFCDR below Trowbridge Gulch (USEPA, 2002). 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. High concentrations of arsenic (3,010 mg/kg) and lead (65,700 mg/kg) were measured at the surface and in the tailings in the impoundment. This subarea has been used in the past for recreational purposes. It is also adjacent to the Trail of the Coeur d'Alenes, a 70-mile trail along the old Union Pacific Railroad (UPRR) right-of-way and within the city of Wallace (see Section 5.5, below).

The pre-remediation design investigation concluded that addressing erosion and transportation of metals-affected waste material from the mine's waste rock pile and the mill area tailings would reduce transport and loading of metals-affected sediments to the river. Consolidating and containing waste materials onsite or offsite would reduce the risk of human contact with metals. In addition, reducing contact between surface water and onsite waste material (i.e., contact with stormwater runoff and adit flows) will reduce metals loading to groundwater and to the river.

Description of Remedial Actions

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 prevent further erosion of the source areas into the SFCDR. The components of these actions are listed in Table 5-24.

TABLE 5-24
Golconda Mine and Mill Remedial Actions Conducted
2010 Five-Year Review, Bunker Hill Superfund Site

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 hydroseeding.
Conveying the adit flow into a pipeline to bypass the waste rock pile.

Operation and Maintenance

An O&M plan has been completed for the Golconda Mine and Mill Site. O&M is currently being conducted by USEPA. USEPA will be working with the property owner and Asarco

Work Trust to ensure long-term O&M at this and other mine and mill sites. A site inspection of the Golconda Site was conducted on March 22, 2010, for the purpose of this Five-Year Review. Complete access to the site was not possible due to high water. However, a previous site visit conducted by CH2M HILL in October 2009 indicated that the earthen cover, vegetation, and riprap revetments were functioning as intended. No adverse impacts on the remedy were observed at the time of either site inspection.

The public frequently recreated at this site prior to implementation of the remedy, and access was restricted to the site as part of the remedy. No anthropogenic activity was observed at the time of the site inspection. However, extensive noxious weed growth was observed.

Remedial Action Effectiveness Monitoring

The remedial action effectiveness monitoring requirements, purpose, objectives, and results are presented in Section 5.6.2. Remedial action effectiveness monitoring at the Golconda Mine and Mill Site was initiated in fall 2007. Data interpretation and evaluation are presented in CH2M HILL (2009a) and the forthcoming 2009 data summary report.

RA effectiveness monitoring is conducted at the Golconda Mine and Mill Site using the following monitoring locations:

- One upgradient and one downgradient SFCDR surface water monitoring location;
- Golconda Adit; and
- Three groundwater monitoring wells (one upgradient and two mid-gradient).

The results of the monitoring conducted to date were used to assess attainment of water quality based RAOs. The overall RAO is to reduce metal concentrations that exceed surface water ARARs (Section 5.2). This RAO is difficult to evaluate given that measureable differences between upstream and downstream stations are negligible and suggest that the site is not discharging to and adversely affecting the SFCDR; in addition, the AWQC ratio is marginally elevated above the 1.0 value required to comply with the surface water ARAR.

A comparison of pre-remedial action versus post-remedial action data between the current downstream monitoring station and nearest pre-remedial action station suggests a slight improvement in dissolved cadmium and dissolved zinc AWQC ratio and load. A comparison of pre-remedial action versus post-remedial action groundwater monitoring data at interior well locations suggests water quality improvement for dissolved cadmium and dissolved zinc.

5.3.4.5 Coeur d’Alene River Mine and Mill

Background

The site is located on the west side of Osburn in McFerran Gulch. The site consists of the following areas: (1) camp shop area, (2) Chilcott Tunnel (also known as “camp adit”), (3) mine facilities area, (4) Coeur d’Alene Mine portal, (5) waste rock pile, and (6) mill building. With the exception of the waste rock pile, which was stabilized and vegetated previously, actions at the site were done in conjunction with the CD.

Description of Remedial Actions

Remedial actions for the Coeur d’Alene Mine and Mill Site were conducted in 2001, as specified in a consent decree (CD) among USEPA, the Coeur d’Alene Mines Corporation, and Callahan Mining Corporation (Coeur Silver Valley).[4] The remedial actions include demolition of all structures, implementation of access controls, removal of all contaminated soils to minimize direct human exposure, and elimination of major physical safety hazards.

Prior to demolition, all salvageable metal materials were removed, decontaminated, and taken offsite. The mill building was pulled apart using an excavator. A few large timbers were decontaminated and saved. The remainder of the demolition materials, primarily wood, was fed into a large trailer-mounted chipper that reduced the volume by 90 percent. Samples showed the resultant grindings were nonhazardous, and the grindings were spread over the site as mulch.

Once the mill building was removed, the foundations and ore bins were cleaned. Contaminated soils at the lab assay, loading, and mill building areas were excavated. Confirmation samples were taken to ensure that action levels were met. Disturbed areas were backfilled and hydroseeded. Contaminated materials were disposed at the Osburn Tailings Pond mine waste repository. The disposal area was covered with a 1.5-foot-thick layer of clay, and then a vegetated soil cap was installed above it.

Existing fencing was repaired and improved. Both the Chilcott Tunnel entrance and the Coeur d'Alene Mine portal were caved in and blocked with large boulders. Large boulders were also installed to limit access to the site. Signs were hung at appropriate locations.

Operation and Maintenance

A site inspection of the Coeur d'Alene Mine and Mill Site was conducted on May 14, 2010, for the purpose of this Five-Year Review. The vegetation was observed to be functioning as intended. No erosion and no public use of this area were observed. The limited public use of this site is likely due to the barricade across the road at the mouth of McFerran Gulch.

5.3.4.6 Technical Assessment of Upper Basin Mine and Mill Remedial Actions

Consistent with USEPA guidance (USEPA, 2001d), technical assessments of the five above Upper Basin mine and mill sites were conducted by evaluating the following three questions related to protectiveness of the actions to be implemented.

Question A: Is the remedy functioning as intended by the decision documents?

The remedies implemented at the mine and mill sites are functioning as intended by the 2002 OU 3 ROD (USEPA, 2002). The March 2010 site inspection results indicate the remedies are functioning as intended. The remedial action effectiveness monitoring programs are just beginning, and additional monitoring will be required to measure the impacts of the remedial actions with respect to water quality.

Question B: 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 for the above mine and mill sites' remedial actions. See Section 5.2 for a summary review of the 2002 OU 3 ROD ARARs and new or revised standards that have been issued since 2002.

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[4] Partial Consent Decree with Coeur Silver Valley Defendants; United States of America v. ASARCO Incorporated, et al.; Case Nos. 96-0122-N-EJL and 91-0342-N0EJL; April 18, 2001.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

This Five-Year Review found no new information that calls into question the protectiveness of the Upper Basin Mine and Mill Site remedies, except for public use damage to portions of the remedy at the Constitution Site. Recreational users at this site have damaged fencing, a portion of the revegetated cap, and existing monitoring wells.

Although water quality evaluations at these sites conducted as part of the remedial action effectiveness monitoring identify surface water ARAR exceedances, the remedial actions have been recently completed and water quality improvements are not expected to be realized at the time of this review. Additional monitoring should be conducted to measure the impacts of the remedial actions with respect to water quality.

Routine O&M of these sites needs to be coordinated with the responsible entities. O&M plans have only been completed for two of the sites, but no formal O&M has been conducted at any of the five sites.

Remedy Issues

Mine and mill site remedy issues are presented in Table 5-25. Additional information from the upcoming Upper Basin ROD Amendment will be taken into consideration when prioritizing Upper Basin mine and mill sites.

TABLE 5-25
Summary of Upper Basin Mine and Mill Site Issues
2010 Five-Year Review, Bunker Hill Superfund Site

	Affects Protectiveness (Y/N)	
Issues	**Current (now to 1 year)**	**Future (>1 year)**
Mine and Mill Site O&M: O&M of the mine and mill sites where remedial actions have been completed is not formally conducted.	Y	Y
Rex Site Contaminant Release: Rex Creek upstream from the remedial action and the Rex Adit flow infiltrates into the subsurface prior to entering the diversion channel. Infiltrating water could be contacting contaminated materials and transporting dissolved metals into Rex Creek. Significant differences in dissolved metal concentrations have been observed as part of the remedial action effectiveness monitoring. Possible solutions could be lining portions of the diversion channel.	Y	Y

Remedial actions will be implemented at areas of the sites that are determined to contain metals concentrations greater than the action level for human health risks. Actions at the sites will also be taken to reduce or eliminate contaminant inputs into surface water or groundwater to be protective of ecological receptors.

Recommendations

The Upper Basin mine and mill site recommendations and follow-up actions are provided in Table 5-26.

TABLE 5-26
Summary of Recommendations and Follow-Up Actions for Upper Basin Mine and Mill Sites
2010 Five-Year Review, Bunker Hill Superfund Site

Recommendations/Follow-up Actions	Responsible Entity	Oversight Agency	Proposed Milestone Date	Follow-up Actions: Affects Protectiveness (Y/N)	
				Current (now to 1 year)	Future (>1 year)
Mine and Mill Site O&M: Coordinate with responsible entities to formally implement O&M at mine and mill sites with completed remedial actions.	BLM, IDEQ, USEPA	BLM, IDEQ, USEPA	10/2011	Y	Y
Rex Site Contaminant Release: Mitigate the infiltration of Rex Creek and the Rex Adit flow upgradient from the remedial action.	BLM, IDEQ, USEPA	BLM, IDEQ, USEPA	10/2011	Y	Y

5.3.5 Washington Recreation Areas Along the Spokane River

5.3.5.1 Background and Site 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, but all below their respective human health action level.

A health advisory currently exists regarding 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.

The Starr Road and Island Complex recreational areas were prioritized for remedial design due to higher levels of lead contamination and high human use when compared to the other areas along the Spokane River. The Starr Road area is popular with local residents and includes areas associated with rainbow trout spawning habitat.

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 along the Spokane River in Washington have been identified for investigation and remedial action. Improvements in water quality in the Spokane River rely on actions performed upstream. The degree and duration of potential recontamination and the measurement of improvements to ambient surface water quality will be closely tied to the pace and scope of the cleanup actions in the Lower and Upper Basins, as well as to the long-term retention of metal in Coeur d'Alene Lake sediment.

USEPA established a sediment lead cleanup level for the Washington recreation areas along the Spokane River as 700 mg/kg for recreational use (USEPA, 2002), and the arsenic cleanup level is 20 mg/kg in consultation with the Washington State Department of Ecology (Ecology). 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. These reductions will be closely tied to the pace and scope of the cleanup actions in the Lower Basin and Upper Basin, as well as the long-term retention of metals in Coeur d'Alene Lake sediments.

The 2002 OU 3 ROD also states that additional cleanup of critical habitat areas identified by the 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.

Implementation of the remedy for the Spokane River is not anticipated to result in significant reductions of overall metals concentrations in surface water. Overall metals reduction in surface water will likely not be realized until cleanup actions have been completed in the Upper and Lower Basins. The degree of effectiveness of the Coeur d'Alene LMP to prevent mobilization of dissolved and particulate metals within the lake will also heavily influence metals concentration reductions in the Spokane River.

5.3.5.2 Description of Remedial Actions

Since the 2002 OU 3 ROD, USEPA and USACE conducted additional sampling in August 2004 at the Starr Road and Island Complex recreational areas. The goal of the sampling was to gather further information to define cleanup boundaries for the recreational areas. Chemicals analyzed included lead, arsenic, cadmium, and zinc. Both lead and arsenic concentrations from this sampling event were considerably lower than historical concentrations found in 2000; however, lead exceedances, in particular, required remedial action. The design of the Starr Road recreation area was completed in 2005. As part of the design, leachability was assessed using the synthetic precipitation leaching procedure (SPLP) to determine whether excavated material could be reused in construction of a parking lot. In addition, moisture content of the material and frost susceptibility of the material was analyzed. No SPLP metal exceedances were found. In order to determine whether excavated material would be eligible for disposal at either a Subtitle C landfill or Subtitle D landfill, hazardous waste characterization of material was done using toxic characteristics leaching procedure (TCLP). No TCLP exceedances were found. In 2006, remedial action at Starr Road was implemented.

Since the 2005 Five-Year Review, remedial actions have been completed at five recreation areas (Starr Road, Island Complex, Murray Road, Harvard Road, and Flora Road) and one subaqueous area (Upriver Dam). The Starr Road remedial action was completed by USEPA; actions in the remaining areas were funded and completed by Ecology.

Actions at the Starr Road area were completed in 2006 and consisted of the removal and replacement of impacted shoreline soils. 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. The Island Complex and Murray Road areas were both completed 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 (OHW) mark to enhance trout habitat and limit erosion. Irrigation lines were installed and operated for two seasons to help establish the plantings. An extensive sand and gravel cap was placed over impacted sediments at the Murray Road area. Public access trail improvements and signage were also implemented at both locations to assist in foot traffic management and cap protection.

The Harvard Road area remedial action was completed 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. The Flora Road area was completed in 2009. A sand and gravel cap was placed over impacted sediments at Flora Road, and improvements were made to the pedestrian access path that led from the Centennial Trail to the capped area.

The subaqueous Upriver Dam cleanup site was completed in 2006. The primary contaminants of concern at the Upriver Dam were polychlorinated biphenyls (PCBs) unrelated to mining waste; metals were secondary contaminants. The selected remedy was chosen to address both contaminants of concern and where PCB-impacted sediment was present. A three-layer engineered cap was placed over the contaminants on the river bottom behind the dam. The 13-inch-minimum-thickness cap consisted of a bottom layer of coal, followed by sand, then gravel. The remaining sites will be completed by Ecology. No completion schedule has been established to date; timing of the remedial actions will depend on state funding availability.

5.3.5.3 Post-Remediation Evaluations

Post-remediation inspections and sampling were conducted at the Starr Road, Island Complex, and Murray Road areas to evaluate whether erosion or recontamination was occurring. The results are listed in Table 5-27. Shallow sampling (to a depth of 3 inches) was conducted to evaluate whether metals-impacted sediment had been deposited since cap construction. Starr Road was evaluated in 2007 and 2008. Island Complex was evaluated in 2008. Both remedies remained intact, and any subsequently deposited sediment remained below recreational cleanup/human health cleanup/action levels. Murray Road was evaluated in 2008. The remedy remained intact, with minimal to no erosion. However, out of six sediment samples taken, one sample (at 31.4 mg/kg) was found to exceed the recreation cleanup level for arsenic (20 mg/kg). These data suggest that recontamination may be occurring at the site. Additional performance monitoring will be needed to establish depositional trends and to determine whether, and to what extent, recontamination is actually occurring.

TABLE 5-27
Post-Remediation Sampling in Spokane River Recreational Beach Areas in Washington
2010 Five-Year Review, Bunker Hill Superfund Site

Sample Location/Number	Concentration (mg/kg)			
	Arsenic	**Cadmium**	**Lead**	**Zinc**
Cleanup/Action Level	20	80	700	24,000
Starr Road—Fall 2007				
1	4.4	0.35	12.2	84
2	7.01	0.85	30.3	180
3	7.33	0.59	18.9	120
4	6.63	1.03	33.7	33.7
5	11.8	0.35	15.5	170
6	6.69	0.87	24.5	83
7	11.1	1.37	42.3	150
Starr Road—Fall 2008				
1	5.68	0.84	44.2	180
2	7.60	1.8	67.8	255
3	5.76	0.59	24.2	150
4	6.75	1.7	87.6	432
5	6.88	2.0	95.8	375
6	4.9	2.8	127	523
Island Complex—Fall 2008				
1	8.34	1.8	144	688
2	17.7	2.3	77.9	346
3	19.1	2.5	98.5	354
Murray Road—Fall 2008				
1	6.35	1.87	64.8	284
2	16.0	1.38	56.6	279
3	16.3	1.70	73.8	367
4	10.8	1.72	110	409
5	31.4	20.1	52.9	177
6	6.94	0.66	40.2	130

5.3.5.4 Technical Assessment of Remedial Actions

Consistent with USEPA guidance (USEPA, 2001d), technical assessments of the Starr Road, Island Complex, and Murray Road areas were conducted by evaluating the following three questions related to protectiveness of the actions to be implemented. The Upriver Dam cleanup was accomplished to address PCB contamination. No follow-up assessment was conducted with respect to metals.

Question A: Is the remedy functioning as intended by the decision documents?

The remedies implemented at the Starr Road, Island Complex, and Murray Road areas are functioning as intended by the OU 3 ROD (USEPA, 2002). Follow-up inspections and sampling indicate that the remedies are functioning as intended. Only one exceedance above cleanup action levels (for arsenic) was found at Murray Road in the fall of 2008. Additional monitoring will be needed to accurately measure the impacts of the remedial actions with respect to water quality.

Question B: 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 for the above areas. See Section 5.2 for a summary review of the 2002 OU 3 ROD ARARs and new or revised standards that have been issued since 2002.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

This Five-Year Review found no new information that calls into question the protectiveness of the selected remedies at the above sites.

5.3.6 Repositories

This section describes the locations and storage capacities of waste material repositories and presents a technical analysis of the repository remedial actions.

5.3.6.1 Background and Site Description

As part of the OU 3 Selected Remedy, cleanup in the Basin requires construction of repositories for disposal of metals-contaminated soils, sediments, source materials, treatment residuals, and contaminated soils moved by remediation contractors and residents or their contractors. A four-step process was included in 2002 OU 3 ROD that has generally been used to evaluate potential repository locations and specify design requirements and repository operational parameters (USEPA, 2002). The four-step process includes:

- Site identification;
- Technical evaluation;
- Public input/notification; and
- Decision documentation.

The 2002 OU 3 ROD states that USEPA and IDEQ will work with Basin stakeholders in the development and selection of repository locations. Repositories constructed pursuant to the ROD will be designed to reliably 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 2002 OU 3 ROD (Section 12.5) states that estimated volumes of material that may require excavation and disposal are about 500,000 to 900,000 cy of material in the Upper Basin and up to 2.6 million cy in the lower Basin. By comparison, there are currently about 2.1 million cy of tailings in the Hecla-Star Tailings Ponds in lower Canyon Creek, about 13.6 million cy of dredge spoils in the Mission Flats area, and about 26 million cy of waste material in the CIA located in OU 2 (USEPA, 2002). The 2002 OU 3 ROD also states that it is unknown how many repositories will be needed to support the Selected Remedy. Exact repository locations and design requirements are to be developed, with community input, using the above four-step process.

Long before completion of the OU 3 ROD, IDEQ and USEPA worked jointly to provide repositories to facilitate the cleanup in the Basin building upon work begun by the Coeur D'Alene Tribe in 1998. From 2002 until late 2009, the Basin cleanup effort has relied solely on the BCR for disposal capacity. The EMFR began accepting contaminated soils for disposal in August 2009 after a review by the Office of Inspector General, in response to a hotline complaint filed by a citizen's group and a site visit by Mathy Stanislaus, Assistance Administrator for the Office of Solid Waste and Emergency Response (OSWER). The Mullan ICP Disposal Site (see Section 5.3.3.7) is not addressed in this section because it was developed by the city for use by the local citizens to dispose of ICP wastes. The BCR and EMFR have been sited and developed for the Basin cleanup, including ICP waste disposal, and are the primary focus of this section.

Current and long-term disposal needs were estimated in the *Coeur d'Alene Basin Waste Management Strategy* (WMS) (IDEQ and USEPA, 2008) and are summarized in the following subsections. The WMS was developed as a tool for USEPA and IDEQ to project wastesheds by geographic area so that repositories could be sited in appropriate time frames and locations. The WMS relies on estimates of the repository space available and projected wastes generated in the Bunker Hill Superfund Site, including OUs 1, 2, and 3, for the next 25 years.

Big Creek Repository

The BCR is located approximately 4 miles east of Kellogg near the confluence of Big Creek and the SFCDR. The elevation of the valley floor is approximately 2,400 feet above mean sea level (msl) in the site vicinity. Access to the site is from Big Creek Road, an all-weather asphalt road that extends from I-90, Exit 54, to the current Sunshine Mine and runs parallel to the east side of the BCR. The BCR is bounded by the Trail of the Coeur d'Alenes Bike Path directly north of the BCR parcel, Big Creek on the west and south sides, and Big Creek Road on the east side. The former impoundment on which BCR is situated was used for the disposal of tailings produced from the milling of silver, lead, and zinc ore from 1968 to 1979. It has a rectangular footprint of approximately 22 acres, and the vertical relief rises from 20 to 40 feet above the valley floor on the south and north ends of the pond, respectively. Ownership of the parcel was transferred from Sunshine Mining Corporation to IDEQ in July 2003. A more detailed description of the Sunshine tailings pond and surrounding environs is provided in the *Big Creek Repository – Design Analysis Report (*DAR*), Final* (USACE, 2004b) and *Big Creek Repository – Phase II Field Investigation Report* (USACE, 2004a).

East Mission Flats Repository

The EMFR is located on a 23-acre parcel of land owned by IDEQ and is bounded to the northeast by Canyon Road, to the southwest by I-90, and to the north and northwest by private property. It is about one-quarter mile east of the nearest point of Old Mission State Park, north of the Coeur d'Alene River, and is north of I-90, across the freeway from the Old Mission property. The repository lies about 2,135 feet msl and slopes gently from north to south. The southern portion of the repository is occupied by an easement granted to Avista for access to its power lines. The EMFR is located approximately 60 feet inside of the northeastern property lines, 20 feet inside of the northwestern property lines, and approximately 40 feet northeast of the power lines (TerraGraphics, 2009i).

The repository footprint is roughly triangular in shape, covering an area of approximately 14 acres. The total approximate capacity of the repository is designed to safely store about 445,000 cy, which was a reduction from over 600,000 cy in the original design due to community concerns voiced about seeing the repository from the Mission. The designed final elevation of 2,165 feet will allow placement of 30 feet of contaminated soil and clean cover material above the existing ground surface elevation, assuming a base elevation of 2,135 feet.

5.3.6.2 Description of Remedial Actions

The 2002 OU 3 ROD states that repositories constructed pursuant to this ROD will be designed to reliably 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.

Big Creek Repository

The BCR has been in operation since 2002. IDEQ has retained contractors to facilitate management of the remedial action programs in the Basin and to operate and place waste in accordance with the Big Creek DAR (USACE, 2004b) and annual BCR Operations Plans: *Field Activities, March 2005 – December 2005* (Washington Group International [WGI], 2006), *Field Activities, March 2007 through December 2007* (WGI, 2008), and *2008 Big Creak Repository Waste Disposal Report* (North Wind, 2009). Based upon the initial repository design and the current rate of fill, it was determined that the BCR would be at full capacity after the 2007 construction season, driving the need for other viable repository sites by 2008. In 2007, IDEQ evaluated the viability of increasing the repository height to provide additional waste disposal volume and determined that the fill height could be increased up to 30 feet. With this increased fill height, the disposal capacity of the BCR was increased from 250,000 cy to 505,800 cy. Based on the revised design in 2007, IDEQ estimated that the BCR would provide for approximately 6 to 8 more years of operations before disposal capacity would be consumed. Based on the latest survey data from December 2009, approximately 408,000 cy of soils and other materials were disposed at the BCR. The remaining capacity is approximately 98,000 cy.

Annual operations reports for BCR are generated each year, as listed in the previous paragraph. These reports document the source of materials and the estimated quantities, as well as the operational parameters employed for the BCR during that year. Contaminated soils from previous years have required disposal, and concrete, steel, or wood debris must be separated and incorporated onsite or recycled each season. These materials are delivered to the repository along with waste soils or accompany ICP wastes. Occasionally, carpets or other building materials are brought to the ICP disposal location as well. A large chipping machine was mobilized onto the BCR typically each fall to reduce the size of the wood and concrete materials, and they were spread over the surface of the BCR for erosion control, then incorporated into the fill. In 2009, construction was initiated to raise the power lines to allow for the site to be completed in accordance with the DAR (USACE, 2004b).

Because the materials underlying the BCR are high in tailings content, cone penetrometer testing (CPT) was conducted in 2009 to evaluate the site stability as recommended by USACE prior to exceeding the maximum waste elevation of the original BCR design. The CPT results demonstrated the strength of the tailings materials is greater than those values predicted in the stability analysis performed by TerraGraphics (TerraGraphics, 2009d) for the BCR expansion. Therefore, the site was considered stable and determined able to accept further waste placement.

Monitoring of groundwater, pore water pressure in piezometers, settlement monuments, and surface water has been conducted at the BCR since July 2004. The site monitoring is consistent with the *Big Creek Repository Operations Plan Final* (USACE, 2004c) and in accordance with the approved Big Creek Repository Quality Assurance Project Plan Addendum (TerraGraphics, 2006c) and previous monitoring activities conducted by USACE in 2002 and 2003. Surface water and groundwater monitoring results indicate no significant change in water quality in the last 5 years. These details are included in the year-end operations report (WGI, 2006, 2007, 2008; North Wind, 2009). Since 2005, 10 of 16 interior piezometers have been abandoned because they were determined to provide no useful information or had failed. Four replacement piezometers were installed for a total of 10 that were monitored in 2009.

East Mission Flats Repository

Sampling and monitoring activities began in 2007, prior to development of the EMFR to:

- Establish baseline water quality and determine the condition of groundwater at the site;
- Gain a better understanding of groundwater flow direction across and in the vicinity of the site; and
- Provide surface water level measurements to help verify the hydraulic model performed on the site.

These activities and results were summarized in quarterly groundwater monitoring reports for the EMF site, submitted by TerraGraphics to IDEQ as technical memoranda (TerraGraphics, 2008b, 2008d, 2008o, 2008r; 2009b, 2009h, 2009m; 2010b). Data from these initial sampling and monitoring activities will also be included in the Annual EMF Operations Reports submitted to EPA annually. Groundwater monitoring results from five wells on and downgradient from the EMF site indicate that antimony, arsenic, cadmium, lead, and zinc are below regulatory thresholds, whereas arsenic is above the regulatory threshold at an upgradient well located over 1,700 feet from the repository footprint. The following is an Internet link to EMF technical documents:

http://yosemite.epa.gov/r10/cleanup.nsf/sites/east_mission_flats_repository#techdocs

The design of the EMFR was completed in 2009. Repository design details are available in the *East Mission Flats Repository 90% Design Report* issued on June 5, 2009 (TerraGraphics, 2009i). The EMFR is designed to securely hold soil waste generated from the BPRP and ICP operations in OU 3. The EMFR is located in an area that has existing contamination from deposition of mining waste; therefore, it is considered to be within the Area of Contamination (AOC). The AOC includes source areas of mine sites and mill sites in the Coeur d'Alene River valley and depositional areas such as the 100-year floodplain in the lower river valley west of Cataldo where contamination exists. Siting repositories in the AOC is an implementation preference for USEPA and IDEQ. The location of the EMFR is consistent with this policy. The site is within a known and mapped flood plain. Floodwaters have been observed to inundate the site where the repository will occupy by flowing from the Coeur d'Alene River through culverts under Interstate 90 and a small channel pinched between Interstate 90 and Canyon Road.

Extensive analysis has been performed on EMFR addressing both potential affects and leachate analysis and are documented in the Design Report referenced in the above paragraph. Flood modeling was conducted using Hydrologic Engineering Centers - River Analysis System (HEC-RAS) by TerraGraphics and USACE during technical evaluations and remedial design phase. The potential to generate saturated conditions within the repository was analyzed by the State of Idaho. The 90% Design reflects the findings of these analyses and many other technical site evaluations and incorporates appropriate measures to address them. Examples of such design measures are adequate conveyance capacity near the west end of the repository footprint and riprap size to prevent the erosion of surficial soils on the sides of the repository. Compaction requirements are included in the design specifications and incorporated into the repository operations. There are many more such measures too lengthy to list in this review.

The Office of Inspector General (OIG) for USEPA reviewed the EMFR design and provided recommendations in the Hotline Report entitled *Contaminated Soil Waste Repository at East Mission Flats, Idaho* (USEPA, 2009). In response, USEPA Region 10 and IDEQ identified the development of an enhanced monitoring plan as the key element in the corrective action plan submitted by USEPA to OIG. The corrective action plan was accepted by OIG on August 12, 2009. In addition to OIG's review of the repository design, Mathy Stanislaus, the Assistant Administrator of USEPA's OSWER, visited the site on August 18 and 19, 2009, to determine whether the EMF project would move forward. Construction commenced following the acceptance of the corrective action plan and acknowledgement from Mr. Stanislaus that interim placement of contaminated soils should proceed. Waste materials were first received at the repository on August 20, 2009, as part of the first phase of construction activities. Approval for further development and construction of the repository was granted by the USEPA OSWER Assistant Administrator on September 28, 2009.

Based on the final design in 2009, it was estimated that the EMFR with a design capacity of 445,000 cy will provide ample capacity to serve the near-term disposal needs in the Lower Basin. As of December 2009, approximately 28,000 cy of soils and other materials were disposed at the repository. The remaining capacity is approximately 417,000 cy.

Summary of Remedial Actions

Data indicate that the BCR has been constructed in accordance with the 2002 OU 3 ROD and the BCR design have reliably contained waste material from remedial actions as well as wastes generated by citizens complying with the ICP. Although the EMFR has been in operation for only a short period, periodic monitoring has found no increases in chemicals of concern (COCs) in the monitoring well network. Given the short operational time frame, monitoring will continue at the EMFR. Based upon 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.

5.3.6.3 Additional Repository Siting

Safe and secure storage of soils removed as part of the remedial actions and ICP implementation is key to the success of the cleanup. Repositories provide the requisite safe storage capabilities and have been selected in the OU 3 ROD as the disposal method. Because BCR and EMFR will not meet the long-term disposal needs in the Coeur d'Alene Basin, additional repositories are necessary to meet the needs of current and anticipated future cleanup activities. The process to locate repositories in the Coeur d'Alene Basin to accept waste from the OU 3 cleanup actions and the ICP began over a decade ago. In addition to operating the BCR and siting and constructing the EMFR, IDEQ and USEPA have identified other potential repository sites to meet future needs in the Upper Basin.

The current effort to locate additional Upper Basin repository sites commenced in 2008, building on information gathered since 1999. This effort was completed in May 2010 and reflects the knowledge and experience gained from recent siting efforts at East Mission Flats. Extensive public outreach and information gathering, which included the general public, elected officials and their representatives, special interest groups and agency personnel, was launched as part of the site identification/prioritization process. Key outputs of this initiative included potential site identification and siting criteria reflective of values important to the Upper Basin communities. Identified sites were prioritized and ranked using the criteria that were generated and ranked by the stakeholders identified above. The conclusion of the siting process ranked two sites as most suitable for construction of new repositories in the Upper Basin. The proposed sites occupy portions of closed tailings disposal areas at the Osburn Tailings Impoundment (OTI) and the Star Tailings Impoundment (STI). Additional repositories will also be needed in the Lower Basin, although the EMFR will provide sufficient capacity in the interim.

In 2007, the WMS developed waste disposal estimates for the Bunker Hill Superfund Site waste management areas (including OU 1, OU 2, and OU 3 cleanup and ICP-derived wastes) for the next 25 years (2007 to 2032). Based upon the estimated waste volumes in the 2007 edition of the WMS, the interim OU 3 Selected Remedy cleanup actions and ICP waste projections for community redevelopment will result in the need to dispose of approximately 6.4 million cy over the next 25 years in various repositories. It is planned that these waste disposal estimates will be updated based upon actions selected in the upcoming Upper Basin ROD Amendment and will include updated waste projections based on those anticipated to be generated through the ICP.

A challenge associated with siting repositories is the high level of uncertainty associated with predicting waste soil quantities from future cleanup activities. RA waste soil quantities can be estimated with some reliability for a period of 3 to 5 years based upon 5-year work plans, but beyond that it becomes very difficult to determine which sites will be cleaned up and the quantity of RA waste that would need to be placed in repositories. A good understanding of RA waste quantities is highly dependent upon the remedial design phase and funding and is somewhat uncertain at this time because cleanup priorities will begin to transition from the BPRP to mine and mill site and more remote work.

Given that repository siting takes multiple years, the siting repositories will often need to occur before cleanup quantities and locations can be ascertained. Remedial design investigations will provide the best look at the type and quantity of materials needing to be placed in a repository, but will typically not be completed until shortly before remedial action implementation. Uncertainty is very high with community redevelopment projects due to uncertain funding streams and sudden starts or stops in private developments and the challenges associated with local planning timelines. Efforts to better understand timing and quantity of soils needing to be disposed in repositories would greatly benefit the repository siting and operations.

5.3.6.4 Technical Assessment of Repository Remedial Actions

Consistent with USEPA guidance (USEPA, 2001d), technical assessments of the BCR and EMFR were conducted by evaluating the following three questions related to protectiveness of the actions to be implemented.

Question A: Is the remedy functioning as intended by the decision documents?

In addition to the two sites described above, USEPA and IDEQ have operated three other repositories across the Site in OUs 1, 2 and 3. Other agencies such as BLM and USFS have also operated repositories in the Basin and elsewhere. They have proven over time to be an effective way to safely and securely store contaminated soils. A review of documents, ARARs, and risk assumptions shows the operation of repositories is protective of human health and the environment. Quarterly monitoring of groundwater, pore water pressure in piezometers, settlement monuments, and surface water has been ongoing at the BCR since July 2004. Evaluation of the monitoring data indicates that the BCR is operating as intended and is protective of human health and the environment. So far, the EMFR is functioning as intended, but given the short period of record for EMFR operation and monitoring, a more thorough assessment of its performance will likely be needed prior to the next Five-Year Review.

EMFR has been designed to withstand inundation by floodwaters. Monitoring to ensure that the repository performs as designed is essential to securely storing wastes on this site. By closely monitoring the repository, EPA and IDEQ can identify any issues and modify the site in a timely fashion, should it become necessary.

Coordination with the internal planning teams, remedial design teams, and the ICP would greatly enhance understanding of the timing and quantity of soils that will need to be housed in repositories. Such understanding would greatly improve the ability to appropriately manage the repositories and be useful in the timing of siting new repositories.

Question B: 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.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No additional information has come to light that calls into question the protectiveness of the remedy. Siting new repositories has been and remains to be a top priority for USEPA and

IDEQ; siting appropriate repositories was noted by the NRC as a key issue to be addressed for the success of the cleanup.

Remedy Issues

Repository remedy issues are presented in Table 5-28.

TABLE 5-28
Summary of Repository Issues
2010 Five-Year Review, Bunker Hill Superfund Site

Remedy Issues	Affects Protectiveness (Y/N)	
	Current (now to 1 year)	**Future (>1 year)**
Long-Term Disposal Need from ICP: The timing and waste volumes from ICP-regulated activities needing to be placed in repositories should be better quantified.	N	Y
Long-Term Disposal Need from Remedial Actions: The timing and waste volumes from remedial actions needing to be placed in repositories should be better quantified.	N	Y

Recommendations

A summary of recommendations and follow-up actions for the repository remedy is provided in Table 5-29.

TABLE 5-29
Summary of Repository Recommendations and Follow-Up Actions
2010 Five-Year Review, Bunker Hill Superfund Site

Recommendations/Follow-up Actions	Responsible Entity	Oversight Agency	Proposed Milestone Date	Follow-up Actions: Affects Protectiveness (Y/N)	
				Current (now to 1 year)	**Future (>1 year)**
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.	PHD, IDEQ	EPA/IDEQ	12/2011	N	Y
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, USEPA	IDEQ, USEPA	12/2011	N	Y

5.3.7 Clean Waterfowl Feeding Habitat/Agriculture-to-Wetland Conversion Project

USEPA is working with USFWS and Ducks Unlimited, Inc., to perform a pilot study project that is establishing nearly 400 acres of clean feeding habitat for migratory and resident swans, ducks, and other wetland bird species in the Lower Basin. 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.

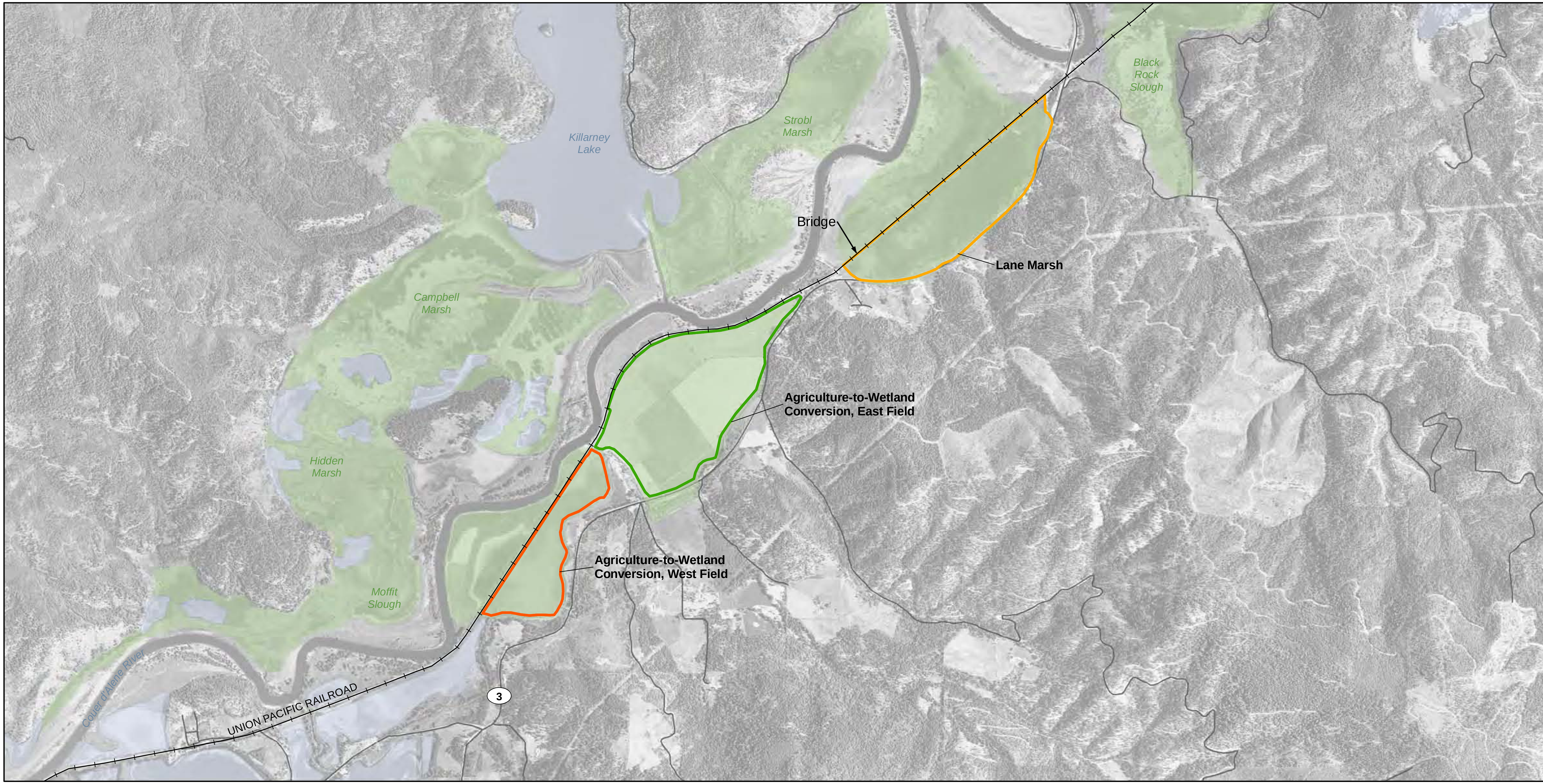
USEPA used settlement monies to purchase a conservation easement from the property owner and is converting farmland to healthy wetland habitat following actions described in the 2002 OU 3 ROD (USEPA, 2002). The conservation easement area, a 396-acre site located near Medimont, Idaho, is divided into two units: the East Field and the West Field (Figure 5-14). Approximately 295 acres are located in the East Field, and 100 acres are located in the West Field. The project includes remediation of elevated soil metals, installation of water control structures, and creation of drainage channels. The Coeur d'Alene Basin Natural Resource Trustees, led by the USFWS in coordination with Ducks Unlimited, began wetland restoration as cleanup was completed. Ongoing restoration includes control of exotic plants, planting native vegetation, and managing water levels to restore wetland habitat.

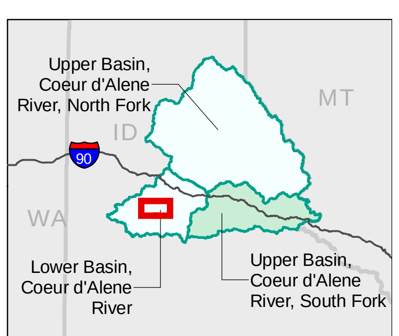
The property was selected as a pilot study location for an agriculture-to-wetland conversion project for a number of reasons, including the interest of the willing private property owner. The conservation easement area is hydraulically separated from the Coeur d’Alene River , which is a source of contaminated sediment in many Lower Basin wetlands, by the Trail of the Coeur d’Alenes (former UPRR rail bed). As demonstrated by relatively low pre-remediation soil lead levels in the property, contaminated sediment from the Coeur d’Alene River water has entered the property only during extreme high-water conditions. Much of the East Field and parts of the West Field met the cleanup goal prior to active remediation. Adjacent Robinson Creek provides a source of clean water for the wetland area (a Water Right was obtained as noted below), so that contaminated water from the Coeur d’Alene River will not be used in the wetland. In addition, the recontamination potential of this site is relatively low, and the site is readily accessible from existing roads.

The overall intent of this action is to provide clean feeding habitat to reduce the exposure pathway by which waterfowl ingest lead-contaminated sediment. In their final report, NRC encouraged “EPA’s efforts to secure agricultural lands, converting them to high-quality feeding grounds…reestablishing wetlands in these areas is a laudable effort…” (NRC, 2005).

5.3.7.1 Review of ROD Requirements

A significant remedial goal of the 2002 OU 3 ROD (USEPA, 2002) is to reduce sediment toxicity and waterfowl mortality. Cleanup and conversion of agricultural lands to clean wetlands was identified as a measure to provide clean feeding areas for waterfowl. The 2002 OU 3 ROD includes the following pertinent RAOs:





Union Pacific Railroad (UPRR) (now Trail of the Coeur d'Alenes)

Major Road

Water Body

Marsh or Slough

Agriculture-to-Wetland Conversion Site

East Field

West Field

N

0 1,500 3,000 Feet

Source: NHDPlus (Rivers, Waterbodies); Idaho Geospatial Data Clearinghouse (Roads 2008).

Figure 5-14
Wetland Remediation Sites
2010 Five-Year Review
BUNKER HILL SUPERFUND SITE

EPA

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- **Ecosystem and physical structure and function** – Remediate contaminated soil, sediment, and water and mitigate mining impacts in habitat areas to be capable of supporting a functional ecosystem for the aquatic and terrestrial plant and animal populations in the Coeur d'Alene Basin. Maintain (or provide) soil, sediment, and water quality and mitigate mining impacts in habitat areas to be supportive of individuals of special-status biota that are protected under the Endangered Species Act (ESA) and the Migratory Bird Treaty Act (MBTA).
- **Soil, sediment, and source materials** – Prevent ingestion of metals and dermal contact by ecological receptors at concentrations that result in unacceptable risks.

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.

5.3.7.2 Background and Description of Remedial Action

Because this is a pilot project and for other implementation purposes, remedial activities have been phased to allow for adaptive management of the remedial action. Remediation began in 2006 and will be completed in 2010. A water right was obtained from the Idaho Department of Water Resources (IDWR) to allow for limited use of clean water from Robinson Creek for the project. The first phase of construction consisted of rehabilitating portions of the levee between Robinson Creek and the East Field. During 2007, all hydrologic and earth-moving activities required to complete the agriculture-to-wetland conversion of the East Field were completed. 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.

Following implementation of the East Field remedial actions, the Coeur d'Alene Basin Natural Resource Trustees, led by USFWS in cooperation with Ducks Unlimited, began restoration activities in the East Field. To date, restoration activities have included upland grass seeding, planting shrubs and trees along the riparian corridor, and restoration of the wetland vegetative community through control of reed canarygrass, invasive species control, and water management.

Remedial activities in the West Field began in 2009 and are scheduled for completion in 2010. Specific elements of the West Field actions include:

- Hydraulic control improvements consisting of installation of water control structures and a new pump station; and

- Remediation of contaminated sediments using shallow soil removal and selective handling methodology. Confirmation sampling conducted in 2009 indicated the need for additional soil remediation, which will be completed in the West Field in 2010.

5.3.7.3 Technical Assessment of Remedial Action

Consistent with USEPA guidance (USEPA, 2001d), technical assessment was conducted by evaluating the following three questions related to protectiveness of the implemented remedial actions.

Question A: Is the remedy functioning as intended by the decision documents?

The East Field agriculture-to-wetland conversion is functioning as intended by the decision documents. The East Field remedy was fully implemented in 2007, and to date, has achieved the RAOs listed in Section 5.3.7.1. In 2007, lead concentrations in confirmation samples from the East Field were below the 530 mg/kg cleanup goal (CH2M HILL, 2007a), 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. Overflow weirs have been installed in creek levees in both the East and West Fields in order to improve the protection of water control structures and reduce the potential for recontamination of the fields under extreme high-water conditions in the Coeur d'Alene River. These overflow weirs are designed to allow water from Canary and Robinson Creeks to enter the East and West Fields during high-flow events. This will create a hydraulic barrier of clean water from Canary and Robinson Creeks and prevent inflow of contaminated water from the Coeur d'Alene River. Restoration activities by the Natural Resource Trustees are ongoing.

BEMP biological resource monitoring data from 2008 and 2009 show that restored habitats in the East Field are attracting some of the highest levels of waterfowl usage, waterfowl feeding, and waterfowl diversity in the Lower Basin during the spring migration (USFWS, 2008, 2009a). Use by waterfowl is expected to increase within the easement area as post-remediation restoration proceeds. Blood lead concentrations in samples collected from waterfowl throughout the Basin also suggest that waterfowl using the East Field are experiencing reduced average exposures to lead (USFWS, 2009a, 2009b).

The West Field remedy has not yet been fully implemented and, therefore, is not evaluated in this technical assessment.

Question B: 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 for the agriculture-to-wetland conversion project.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

This Five-Year Review did not find any new information that calls into question the protectiveness of the East Field agriculture-to-wetland conversion. The West Field conversion has not yet been completed and cannot be evaluated as part of this review.

Remedy Issues

No remedy issues have been identified for the clean waterfowl feeding area/agriculture to wetland conversion project.

Recommendations

Although no remedy issues have been identified, a follow-up action for the agriculture-to-wetland remedy is provided in Table 5-30 that will enhance the operation of the remedy.

TABLE 5-30
Summary of Clean Waterfowl Feeding Area/Agriculture-to-Wetland Conversion Recommendations and Follow-Up Actions
2010 Five-Year Review, Bunker Hill Superfund Site

Recommendations/Follow-up Actions	Responsible Entity	Oversight Agency	Proposed Milestone Date	Follow-up Actions: Affects Protectiveness (Y/N)	
				Current (now to 1 year)	Future (>1 year)
Easement Transfer: Transfer the easement interest to the State of Idaho. The State of Idaho will accept the transfer, without cost to Idaho, to a third-party conservation organization (Ducks Unlimited, Inc.)	USEPA	--	06/2011	N	N

5.4 Coeur d'Alene Lake Management Plan

As noted above, state, tribal, federal, and local governments have committed to developing a revised LMP outside of the Superfund process using separate regulatory authorities. The revised LMP, jointly developed by the Coeur d'Alene Tribe and the State of Idaho, was completed in 2009 (IDEQ and Coeur d'Alene Tribe, 2009). Although not included in OU 3, this plan is discussed here due to the impact of historical Upper Basin mining activity on the lake.

5.4.1 Background

Coeur d'Alene Lake is an increasingly popular recreational destination, an economic catalyst for Northern Idaho and Eastern Washington and the heart of the local community. The lake is part of the aboriginal homeland of the Coeur d'Alene Tribe, and their reservation is located around its southern half. Development along the lake's shoreline has been dramatic in recent years, and it now features multiple resorts and an ever-increasing number of vacation homes. Counties, cities, and towns in the Coeur d'Alene Basin are growing, and the lake is a significant factor in that growth.

Historical mining activity in the Silver Valley has contaminated millions of tons lake sediments with zinc, lead, and cadmium. Other human activities around the Basin, such as logging, farming, and home building, contribute sediments and nutrients (phosphorus and nitrogen) as runoff into the lake. Water quality in the lake has generally improved since the mid-1970s as the era of large-scale upstream mining-related activities tapered off, environmental cleanup activities got underway in the Silver Valley, and environmental regulations were implemented throughout the basin. The challenge today is to ensure that land use activity is managed in ways that will protect the lake's water quality.

Authority to manage the lake's water quality rests with tribal, state, and federal governments. However, authority to manage activities around the Basin that affect water quality in the lake is the responsibility of local, state, federal, and tribal governments. For example, county governments in the basin use their authority under State of Idaho law to promulgate zoning ordinances that regulate private land uses that can affect water quality conditions in the lake. Federal and state resource agencies also exercise authorities over upland activities that may influence water quality conditions in tributary waters and the lake.

5.4.2 Status Update

During 2002, IDEQ and the Coeur d'Alene Tribe, in consultation with government agencies and other stakeholder groups, conducted an in-depth evaluation of the 1996 LMP and its implementation. The evaluation took into account the development of new information and recent legal or regulatory decisions. Local, state, and federal governmental entities participated in this effort, along with industry, business, and environmental representatives. The result was a Draft Coeur d'Alene Lake Management Plan Addendum (December 2002), that offered conclusions and recommendations, but was never formalized or published.

Efforts to collaboratively develop a revised LMP during 2004 that reflected the advice gathered in the 2002 Draft Addendum were unsuccessful because there were disagreements on a number of issues. IDEQ prepared its own draft LMP update in 2004 that was never formalized. The Tribe also prepared its own draft LMP in early 2006 that was never formalized. The mutual recognition of the importance of effective lake management led the Tribe, IDEQ, and EPA to enter into a formal Alternative Dispute Resolution (ADR) process, facilitated by a professional mediator for the purpose of reaching an agreed upon the LMP.

The first phase of the ADR process was an assessment completed by the mediator during 2006. The report developed following the assessment recommended promoting (1) reasonable openness and transparency about the negotiations through briefings and consultation, (2) direct discussions about key interests related to lake management with basin stakeholders, and (3) opportunities for discussion of issues among the Tribe, IDEQ, and USEPA as the governments having regulatory authority under the Clean Water Act. IDEQ, the Tribe, and USEPA jointly adopted many of the report's recommendations, modified others, and began negotiations on the LMP in the spring of 2007 with the assistance of the mediator. The intention was to reach agreement on a draft LMP by using a different approach and avoiding past problems.

IDEQ and the Tribe developed a draft outline for the 2008 Draft LMP during the first part of 2007, and along with USEPA, reached a technical consensus regarding the current water quality conditions in the lake. This information was shared with local, State of Idaho, and federal elected officials, agency representatives, Washington State, business interests, and environmental representatives in September 2007. During October 2007, IDEQ, the Tribe, and USEPA held a series of direct consultations to explore key interests that should be addressed in the LMP. Following these consultations, the Tribe and IDEQ began developing a draft LMP in January 2008. The 2008 Draft LMP was published in June 2008, followed by a

60-day public comment period. This final LMP, completed in March 2009, incorporates revisions to the draft LMP as a result of public comments.

The 2009 LMP reflects the shared view of the Tribe and IDEQ that a collaborative, adaptive, and data-driven approach is the best option at this time to manage water quality in Coeur d'Alene Lake. The 2009 LMP comprehensively identifies the actions and substantial resources that will be required to effectively manage Coeur d'Alene Lake and the large quantities of mining associated hazardous substances in its waters and lakebed sediments. It is intended to serve as a framework for watershed-based lake management that will achieve the primary 2009 LMP goal and management objectives through a public-private partnership model.

The scope of the 2009 LMP encompasses the entire Coeur d'Alene Basin. The reason for this is practical: loading of the lake with metals, sediments, and nutrients results from activities that occur around the lake, in upland areas, and along tributary streams and rivers. This scope is essential to effectively address the key influences on water quality. The scope is intended to follow natural boundaries, promote integrated solutions, and maximize the use of available resources to benefit water quality.

The 2009 LMP recognizes the importance of setting priorities to accommodate the challenges posed by the scope and cost of implementing this plan. The LMP approach has therefore been separated into two tiers. Tier I is considered the essential core LMP program that will be the initial focus for funding and implementation. It has the following components:

1. Conduct water quality monitoring and utilize computer modeling to increase scientific understanding of water quality trends;
2. Conduct a Basin-wide nutrient source inventory to set implementation priorities;
3. Use Management Action Tables to coordinate implementation of existing programs with LMP partners; and
4. Develop and implement an education and outreach program to increase the community's awareness of lake conditions and promote lake stewardship.

Tier II of the LMP includes nutrient reduction projects, special studies, and coordination with TMDL program implementation. To accomplish these activities, the Tribe and IDEQ plan to create a collaborative "Implementation Team" who will provide the leadership to fully implement the 2009 LMP working with basin partners.

The most concrete outcome from this project is agreement on a LMP between the State and Tribe. In 2009, the focus continued on getting the LMP adopted by both the State and the Tribe. USEPA participated actively in the negotiations and supported, but did not sign, that agreement due to its regulatory role. Regular communications with involved stakeholders, such as the business community and conservationists, throughout the process helped secure support for the joint adoption of the LMP by the State and the Tribe. A slightly revised version of that LMP received sufficient support from local jurisdictions and other stakeholders to prompt initial funding by the Idaho Legislature and the Coeur d'Alene Tribal Council in 2009 for the implementation of the LMP. The Governor of the State of Idaho and the Tribal Chairman jointly transmitted the adopted LMP to USEPA, reflecting the success of the Environmental Conflict Resolution (ECR) effort. USEPA does not need to approve the LMP, but expressed support for this successful joint effort by the Tribe and the State to protect and restore their lake.

This is a significant step beyond the unfunded plan from a decade earlier, and reflects increased acceptance of shared jurisdiction over the lake. In 2009, the State and the Tribe continued their joint water quality monitoring efforts of Coeur d'Alene Lake for the second year in a row. USEPA reviewed and approved the joint Monitoring Plan and Quality Assurance Project Plan, and will continue providing laboratory support for the analysis of water quality samples. A less concrete but significant outcome was establishment of effective working relationships to support lake management among the State, Tribe, and USEPA.

5.4.3 LMP Implementation Progress Since April 2009

Implementation of the LMP commenced in April 2009. Since then, both the IDEQ and the Tribe have augmented their staffs to support implementation efforts. Initial implementation activities that have been taken since April 2009 are summarized as follows:

- IDEQ and the Tribe have begun the implementation of the Coeur d'Alene Lake water quality monitoring program. To date, there has not been sufficient data gathered to provide for meaningful assessment of water quality conditions in the lake or the effectiveness of the LMP. Data from the lake monitoring program will be assessed in the next 5 year review.
- The Tribe and IDEQ developed the Needs Assessment to assist in developing an education and outreach plan (LMP, page 26) for Coeur d'Alene Lake. The Needs Assessment will in part be patterned after the survey conducted in the Pend Oreille Lake basin for the Lake*A*Syst program. The "Our Gem" map was updated for reprinting to be used as an outreach tool.
- IDEQ and the Tribe are currently conducting a three-year nutrient source inventory. The focus of the inventory will be on the St. Joe/St. Maries River basins as the starting point due to known, significant phosphorus and nitrogen loadings at the mouth of the St. Joe River and large data gaps upstream from the mouth. Water quality sampling began in March 2010.
- IDEQ and the Tribe are conducting a long-term monitoring survey of aquatic plant populations in northern bays (state jurisdiction waters). A main reason for this plant survey is early detection of Eurasian water milfoil in northern waters.
- IDEQ, IDFG, and Avista continue coordination regarding the utilization of funding from Avista's Federal Energy Regulatory Commission (FERC) settlement agreement to conduct invasive aquatic plant and bank stabilization surveys.
- The Tribe is conducting an erosion assessment along the St. Joe River. Data to be collected include re-bar placement, cross sections, presence/absence of vegetation on the bank, soil samples, and presence/absence of cultural artifacts.

5.4.4 Technical Assessment of OU 3 Coeur d'Alene Lake Management Plan

Question A: Is the remedy functioning as intended by the decision documents?

A decision on a remedy was deferred by USEPA pending the revision and adoption of an LMP that would serve as the management tool for protecting the lake from increased nutrient enrichment and the possible metals mobilization from contaminated bottom sediments.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of remedy selection still valid?

Because no remedy was selected, this question does not apply.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

Because no remedy was selected, this question does not apply.

Remedy Issues

Remedy issues related to Coeur d'Alene Lake are presented in Table 5-31.

TABLE 5-31
Summary of Coeur d'Alene Lake Issues
2010 Five-Year Review, Bunker Hill Superfund Site

Issues	Affects Protectiveness (Y/N)	
	Current (now to 1 year)	**Future (>1 year)**
LMP Implementation: Management of land-use activities to prevent the acceleration of eutrophication under the LMP is necessary to minimize the potential release of metals from contaminated sediments.	N	Y

Recommendations

Recommendations and follow-up actions related to Coeur d'Alene Lake are provided in Table 5-32.

TABLE 5-32
Summary of Coeur d'Alene Lake Recommendations and Follow-Up Actions
2010 Five-Year Review, Bunker Hill Superfund Site

Recommendations/Follow-up Actions	Responsible Entity	Oversight Agency	Proposed Milestone Date	Follow-up Actions: Affects Protectiveness (Y/N)	
				Current (now to 1 year)	**Future (>1 year)**
LMP Implementation: Continue LMP implementation activities and lake monitoring efforts.	Tribe, State	USEPA	11/2015	N	Y

5.5 Trail of the Coeur d'Alenes Removal Action

The UPRR ROW removal action is addressed separately from the Selected Remedy in Section 5.3 because it was conducted as a CERCLA action outside the 2002 OU 3 ROD. Although this action included activities in OU 1 and OU 2 as well is OU 3, only the action conducted in OU 3 is presented in this section.

5.5.1 Background

UPRR performed the CERCLA removal action for its Wallace-Mullan Branch ROW located in OU 3 beginning in 2000 and ending in 2004. The elements of the removal action were selected based on the analysis of alternatives presented in the UPRR Wallace-Mullan Branch Engineering Evaluation/Cost Analysis (EE/CA; USEPA, 1999b). The EE/CA was prepared in accordance with the NCP and USEPA's *Guidance on Conducting Non-Time-Critical Removal Actions under CERCLA* (USEPA, 1993). The range of alternatives presented in the EE/CA included No Action, ICs, Protective Barriers, Removal and Disposal/Consolidation, or Treatment. Removal and Disposal/Consolidation alternative was the preferred alternative.

In October 1999, the USEPA Region 10 Environmental Cleanup Director signed an Action Memorandum, which was the over-arching decision document for this action (USEPA, 1999a). This Action Memorandum, coupled with the parties' willingness to negotiate a settlement agreement in a CD,[5] provided an administrative tool to effectively implement this cleanup action more than 2 years before the release of the 2002 OU 3 ROD. Being able to move this cleanup action forward effectively and efficiently with settlement funds preserved precious federal resources and optimized cleanup efforts elsewhere at the Bunker Hill Superfund Site.

The goals of the UPRR removal 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. The mine waste included jig and flotation tailings, waste rock, concentrates, and ores, all of which were derived from mining activities. These goals led to a removal action objective of minimizing the potential for direct exposure to mine waste and limiting the potential for the environmental transport of contaminants.

The Wallace-Mullan Branch removal action represented a distinct environmental project. The project resolved historical mining-related environmental issues and returned the site to a beneficial use by creating an economic benefit for local communities through the building of a recreational trail. The conversion of the ROW for use as a recreational trail was accomplished under the National Rails-to-Trails Act with the issuance of a Certificate of Interim Trail Use (CITU) by the Surface Transportation Board (STB). The recreational trail serves as a key component of the project by facilitating implementation of the removal action.

The removal action addressed the main line and related sidings of the Wallace-Mullan Branch ROW. The 7.9-mile section of the ROW within OU 2 was previously addressed as part of the 1992 OU 2 ROD (USEPA, 1992) and was excluded from this removal action. Section 4.3.10 of that ROD reviews the segment of the rail line within OU 2.

[5] Consent Decree; United States of America and State of Idaho v. Union Pacific Railroad Company; Coeur d'Alene Tribe v. Union Pacific Railroad Company, et al.;. Case Nos. CV 99-0606-N-EJL and CV 91-0342-N-EJL; December 23, 1999.

Several other areas were not addressed under the removal action in accordance with the CD. Those areas are any spurs or connecting branch lines outside of the Wallace-Mullan ROW, nonsiding areas of the Wallace Yard outside a 26-foot-wide corridor bracketing the main line, and areas of the Hecla Mine tailings impoundment and the Morning Mine waste rock dump that may encroach on the ROW. These areas will be addressed separately. Construction began on the remainder of the Wallace Yard and the spur lines in Ninemile and Canyon Creek canyons in 2010 and is anticipated to be completed by the end of the construction season.

The ROW passes through a wide variety of settings, terrain, and conditions. Through approximately 80 percent of its length, the ROW generally follows the Coeur d’Alene River and is mostly within the flood plain. For the remaining 20 percent of its length, the ROW is adjacent to Coeur d’Alene Lake or in the upland areas of the Coeur d’Alene Indian Reservation. These various settings can generally be characterized into three sections:

- The Upper Basin, which includes the western portion of the Mullan Branch extending from Mullan (Mullan Branch Milepost [MP] 7) to Wallace (Mullan Branch MP 0), and the easternmost portion of the Wallace Branch extending from Wallace (Wallace Branch MP 80) to west of Enaville (Wallace Branch MP 62);
- The Lower Basin starting downstream from the confluence of the South and North Forks of the Coeur d'Alene River west of Enaville (Wallace Branch MP 62) to Harrison (Wallace Branch MP 31); and
- The east shoreline of Coeur d'Alene Lake beginning at Harrison and the upland rolling hills west of Coeur d'Alene Lake to Plummer Junction (Wallace Branch MP 16).

The rail line was constructed in the late 1800s to serve the mining industry in the Silver Valley. In some locations, the line was constructed on top of an existing mantle of fluvially deposited tailings, and in other areas mine waste rock was used as fill material to elevate the line above the river level. Tailings and waste rock were also used as a component of the rail bed ballast throughout the length of the line. The EE/CA reported that approximately 168,000 cy of ballast was placed along the rail bed as part of the original construction. This original ballast material consisted of a mixture of tailings, waste rock, and locally available gravels. The EE/CA found that most of this original ballast was still in place, isolated by the track structure and noncontaminated ballast material that had been placed as part of track maintenance activities during the active life of the line. In the Upper Basin, waste rock and tailings were used as fill to construct portions of the railroad subgrade. In the Lower Basin, subgrade materials were primarily obtained from local quarries.

The rail line primarily served the mining industry in the Silver Valley, transporting ores and concentrates to and from the mines and mining process facilities. At various locations along the rail line, and in particular at sidings and loading/unloading areas, there was evidence of spillage of these ores and concentrates (which have higher concentrations of lead and other heavy metals than the tailings and waste rock).

According to the 2002 OU 3 ROD, an estimated 62 million tons of tailings were discharged to streams within the Coeur d’Alene Basin prior to 1968. Most of the tailings were 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 Upper Basin and Lower Basin and in Coeur d'Alene Lake. The 2002 OU 3 ROD estimated that the total mass and extent of impacted materials (primarily sediments) exceeded 100 million tons dispersed over thousands of acres.

Analytical data from representative soil sampling along the ROW verified the existence of tailings in the floodplain, including a layer beneath the railroad subgrade embankment in some locations. The data also confirmed the use of tailings and waste rock in the original ballast and portions of the subgrade embankment in the Upper Basin.

5.5.2 Description of Removal Action

The objective of the removal action, as stated within the EE/CA, was to minimize the potential for direct exposure to mine waste and limit the potential for the environmental transport of contaminants. This objective was accomplished through the implementation of various work elements that were defined in the CD's Statement of Work (SOW). A listing and brief description of these work elements is as follows:

- **Salvage of the Rail, Ties and Other Track Materials:** This element of work represented the removal of the rail and track structure. The work was performed in accordance with the procedures described in the Track Salvage Work Plan, Attachment A to the CD SOW. The work consisted of the removal, decontamination, and salvage of useable railroad ties and track. Nonsalvageable material was decontaminated and disposed of at properly permitted offsite facilities.

- **Flood Damage Repair:** This element of work was performed in accordance with the Flood Damage Repair Work Plan (FDR Work Plan), Attachment B to the CD SOW. This work involved the repair of flood-damaged portions of the rail bed embankment, scour damage, and removal of flood debris impinging on bridge structures. The objective of this work was 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. A component of this element of work prescribed re-installation of culverts that had been washed out. However, UPRR, subsequent to negotiation of the CD, agreed to design and install bridges in Shingle and O'Gara bays to better allow natural flows and connectivity between the lake and the bays on the upland side of the UPRR embankment. The inverts of the bridge channels were designed to be a more wildlife friendly elevation than the culverts they replaced.

- **Removals, Disposal, and Protective Barriers:** This element of work included the isolation of mine waste materials from certain potential exposure pathways through removal and disposal as well as the placement of protective barriers. The components of this element of work are more fully described in the Removals, Disposal, and Protective Barriers Response Action Work Plan (Attachment C to the CD SOW) and the related Response Action Design Drawings (RAD Drawings) (Attachment D to the CD SOW).

- **Trail:** After implementation of the removal action, the culmination of this element of work was conversion of the ROW to a recreational trail under the management of the State of Idaho and the Coeur d'Alene Tribe. Conversion of the ROW to a recreational trail allows for continued control and management of the ROW as part of the risk management strategy for the ROW. The Trail Element of Work included the installation of amenities for the recreational trail and modifications to the existing railroad bridges to make the bridges suitable for recreational trail use.

- **Residential Use Area:** This element of work addressed mine waste that was found within those portions of the ROW that had a residential type of use. The detailed requirements for this element of work were specified within the Residential Use Area Work Plan, which was submitted as a deliverable under the CD SOW and approved by the Governments.

Construction activities for the Wallace-Mullan Branch removal action began with rail and tie removal in July 2000 in Wallace, Idaho. The last construction activity, modifications to the Chatcolet Bridge, was substantially complete by the end of March 2004. USEPA Region 10, IDEQ, IDPR, and the Coeur d'Alene Tribe provided oversight throughout the construction activities. The Governments Oversight was coordinated through USACE.

The Wallace-Mullan Branch removal action represented a unique construction project that extended over 72 miles. The size and scope of the activities was considerable, including:

- Removal, decontamination, and salvage for reuse of over 46,000 tons of rail and 132,000 railroad ties;
- Removal and offsite disposal of over 175,000 cy of mine-waste-contaminated materials;
- Placement of approximately 200,000 cy of barrier material;
- Cleanup of over 25 residential yard areas;
- Placement of nearly 65 miles of 10-foot-wide asphalt barrier/trail and improvement of another 7 miles of existing asphalt trail through OU 1 and OU 2;
- Repair or replacement of over 70 culverts;
- Placement of over 13,000 tons of rock riprap;
- Repair and modification of 36 bridges, including the Chatcolet Swing Span, for recreational trail use, and installation of five new pedestrian bridges;
- Raising of the 220-foot-long Chatcolet Swing Span (which weighed over 300 tons) and reinstallation as a fixed-span bridge to facilitate continuation of the trail across Coeur d'Alene Lake and to preserve the historical integrity of the swing span portion of the bridge; and
- Installation of trail amenities including 10 trailheads, 7 oasis areas, and 11 stop-and-view areas, including associated tables, benches, compost toilets, and access controls.

5.5.3 Actions Since Last Five-Year Review (2005-2010)

The following subsections describe the certification process that was completed in 2005, maintenance and repair of the action, and the remaining activities. Maintenance and repair of the response action remains the responsibility of UPRR, and they continue to perform the necessary actions.

5.5.3.1 Certification

Paragraph 69 of the CD specifies that if, after a pre-certification inspection, UPRR believes that a portion of the removal action has been fully performed and the performance standards have been attained, it shall submit a written report to the governments requesting certification. Following the pre-certification inspections and resolution of issues identified in those inspections, UPRR submitted Completion of Obligation Reports (CORs) for each portion of the work. Those reports were reviewed and approved by the governments and placed in the public document repositories for the Coeur d'Alene Basin, and the action was certified in early 2005. Copies of the certification letter have also been placed in the public document repositories.

5.5.3.2 Maintenance and Repair

This element of work is a requirement of the CD and CD SOW. It provides for the long-term maintenance of the protective barriers as more fully described within the Maintenance and Repair Plan, Attachment E to the CD SOW. Under the maintenance and repair (M&R) element of work, recontamination of barriers that occurred as part of a high-water runoff event in 2002 were assessed via sampling and analysis and repaired. New barrier material was required in select segments to remediate the erosion of some materials. Certain segments of the asphalt required removal of flood-deposited sediments and debris. Another section of the embankment failed at construction station 1060+00 due to a sustained high-water event caused by the high runoff event and resulting in a sustained high pool elevation in Lake Coeur d'Alene and consequently the tailwaters of the Coeur d'Alene River. A similar high-water event occurred in 2008 caused re-contamination of barriers and a breach at 1048+00. Both breaches were repaired in accordance with an engineered design prepared by the UPRR consultants with clean materials including riprap, rock and barrier materials, and a geosynthetic clay liner to minimize connectivity between the river and a water-control ditch on the upland side of the embankment. The repairs have shown no signs of weakness or degradation in recent inspections.

5.5.3.3 Remaining Activities

With completion of the removal action and following resolution of encroachment issues, the ROW was transferred to the State of Idaho and the Coeur d'Alene Tribe pursuant to the CITU. The State and Tribe share in the management of the ROW under a management agreement between the State and Tribe. The State and Tribe also manage the trail use within the ROW and perform maintenance of the trail facilities (e.g., trash pick-up, restrooms). As part of their obligations under the CD, UPRR has provided a lump-sum cash payment to support the trail maintenance activities by the State and the Coeur d'Alene Tribe.

Under the M&R Element of Work, UPRR retains responsibility for maintenance and repair of protective barriers (including the asphalt barrier and trail within the reservation), rail bed embankments that provide a foundation for the trail portion of the ROW, and certain aspects of the Chatcolet Bridge. The State and Tribe have responsibility for access controls that are necessary to restrict access onto and off of the trail for purposes of managing exposure and protection of barriers. The detailed requirements for these maintenance and repair activities are specified in the M&R Plan.

Pursuant to Paragraph 18 of the CD, UPRR may be requested to conduct future studies or investigations to enable USEPA and the State and Tribe to conduct reviews of the protectiveness of the remedy. As the trail becomes seasoned and use patterns stabilize, the remedy can be more fully assessed and will likely warrant studies and investigations.

As part of the risk management approach for the ROW, the EE/CA considered ICs for the ROW. ICs implemented include the installation of signage and the use of access controls as part of the removal action construction. An additional component of the ICs is the future management of both trail-related and non-trail-related activities that may take place within the ROW, as well as education and awareness for residents of the various communities along the ROW and visitors to the area. Management activities include periodic field inspections, health warning signs, public education, user management signs (e.g., to discourage high-risk behavior), and trail maps. This management is conducted as part of the Coeur d'Alene Basin ICP and is managed by the State of Idaho and administered by the PHD within the State-owned portion only. Authority for the ICP is found in the Idaho Administrative Procedures Act (IDAPA) Section 41[6] and also described in the Response Action Maintenance Plan (RAMP) (Coeur d'Alene Tribe, IDEQ, USEPA, and UPRR, 2008).

The vegetated and gravel barriers are susceptible to invasive and noninvasive vegetative species as are any open land areas. Pursuant to the CD, UPRR was obligated to perform a one-time application of invasive species treatment along the ROW. In the fall of 2003, UPRR applied an herbicide to fulfill their obligations. Follow-up inspections revealed that the effort was not effective. In 2005, UPRR provided a cash settlement to each trail management entity to allow them to perform additional supplemental treatments and better enable the trail managers to apply an invasive species treatment and integrate it with a long-term invasive species management program. The State has applied herbicides on most segments of the ROW outside of the Coeur d'Alene Reservation in both the spring and fall, as needed. The ROW on the reservation has also received weed treatment contracted by the Coeur d'Alene Tribe.

5.5.4 Technical Assessment of Removal Action

In accordance with USEPA guidance (USEPA, 2001d), technical assessment of the UPRR removal action was conducted by evaluating the following three questions related to protectiveness of implemented actions.

Question A: Is the remedy functioning as intended by the decision documents?

The UPRR remedy is functioning as intended by the decision documents. As summarized in Section 5.5.1, the removal action objectives of the UPRR removal action are to:

- Limit the direct exposure to mine waste; and
- Limit the potential for environmental transport of contaminants.

UPRR conducts monthly and event-driven inspections on the trail and reports the results in monthly and annual reports. In addition, trail management personnel representing both the Coeur d'Alene Tribe and IDPR are frequently on the trail and contribute to an annual RAMP report. PHD also inspects the trail regularly to identify any issues that may pose a risk to users and reports on those inspections. The various reports and interviews indicate that the barriers are being maintained and are functioning as designed. Surface water ditches and culverts have been cleaned out as needed and are performing adequately. Trail

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6 Idaho Administrative Code, IDAPA 41.01.01, Rules of the Panhandle Health District 1.

managers continue to monitor trail access and use patterns, including waysides and trailheads. Should unauthorized use patterns develop, management and use strategies will need to be implemented to curb and change those patterns that increase the risk of exposure to trail users. In the last few years, tree roots have been causing asphalt buckling in some segments. UPRR has been taking actions to address those issues and repair the asphalt. Annual RAMP monitoring reports will be produced jointly by the Coeur d'Alene Tribe and the State of Idaho with oversight and assistance from USEPA. These reports are an important management tool to document and monitor trail management activities and issues that arise.

Question B: 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 for the UPRR removal action.

Section 5.2 summarizes the ARARs review for the applicable OU 2 decision documents. None of the new or revised standards identified in Section 5.2 are ARARs or potential ARARs for the UPRR removal action.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

This Five-Year Review did not find any new information that calls into question the protectiveness of the UPRR removal action remedy. Regular inspection of the beach sand at Harrison Beach and sample results taken in 2008 after a high-water event indicates that the barrier is still protective. Additional sand was placed at this beach in 2008 by UPRR to provide adequate barrier. Continued monitoring of erosion rills that cause decreased barrier thickness will be necessary.

Remedy Issues

A summary of issues identified with respect to the UPRR removal action is provided in Table 5-33. The 2005 Five-Year Review issues regarding potential erosion of the Harrison Beach clean sand barrier and potential unauthorized uses that may affect protectiveness are ongoing and, therefore, not identified as new issues in the summary table.

TABLE 5-33
Summary of UPRR Removal Action Issues
2010 Five-Year Review, Bunker Hill Superfund Site

Issues	Affects Protectiveness (Y/N)	
	Current (now to 1 year)	**Future (>1 year)**
UPRR Barrier Protectiveness: Asphalt buckling will need continued monitoring.	N	Y

Recommendations

A summary of recommendations and follow-up actions for the UPRR removal action is provided in Table 5-34. The 2005 Five-Year Review recommendations to monitor performance of the Harrison Beach clean sand barrier and unauthorized uses that may affect protectiveness are being addressed and, therefore, are not identified as new recommendations in the summary table.

TABLE 5-34
Summary of UPRR Removal Action Recommendations and Follow-Up Actions
2010 Five-Year Review, Bunker Hill Superfund Site

Recommendations/Follow-up Actions	Responsible Entity	Oversight Agency	Proposed Milestone Date	Follow-up Actions: Affects Protectiveness (Y/N)	
				Current (now to 1 year)	**Future (>1 year)**
UPRR Barrier Protectiveness: Continue monitoring the barrier and conduct maintenance as needed.	UPRR	Coeur d'Alene Tribe, State of Idaho	11/2015	N	Y

5.6 Environmental Monitoring and Studies

The 2002 OU 3 ROD, Section 12.6, identifies two components for environmental monitoring within OU 3. The first is a long-term Basin-wide environmental monitoring program to provide an overarching status and trends assessment of surface water, biological resources, and sediment/soil conditions in the Basin (Section 5.6.1). The second component is remedial-action-specific effectiveness monitoring to be implemented in conjunction with remedial actions (Section 5.6.2). The implementation of these two aspects of OU 3 environmental monitoring are discussed in detail below. This section also presents information on the Canyon Creek Treatability Study (Section 5.6.3), Gem Portal Pilot Treatment System (Section 5.6.4), Success Mine Pilot Treatment System (Section 5.6.5), Lane Marsh Characterization (Section 5.6.6), and the River Bank Stabilization in the Lower Basin (Section 5.6.7).

The remedy also includes a lead health intervention program that provides for monitoring of human health in the community and residential areas. In addition, the remedy includes monitoring of aquatic food sources, such as fish and water potatoes, for protection of human health. Please refer to Section 5.3 for more information about human health monitoring.

5.6.1 Basin Environmental Monitoring Plan (BEMP)

Establishment of a Basin-wide environmental monitoring plan is required under the 2002 OU 3 ROD (Section 12.6). A monitoring program and an implementing plan is critical to the successful implementation and evaluation of the remedy. A key component of the remedy is use of an adaptive management approach to clean up the Basin. Monitoring the ecological system in the Basin is intended to provide data to help evaluate cleanup efforts and make adjustments where needed to optimize remedy implementation. The NRC Report noted that "the Basin Environmental Monitoring Plan the agency has developed is much more extensive and comprehensive than normal for a Superfund Site. This plan appears to recognize the complexities and uncertainties of the system and should provide much of the information needed to make informed decisions about the most important and effective cleanup approaches." (NRC, 2005, p. 424). Please refer to the 2005 Five-Year Review Report for a summary of the development, goals, and objectives of the BEMP.

Consolidation of the environmental monitoring programs (i.e., OU 3 BEMP, OU 2 EMP, and OU 3 remedial action effectiveness monitoring) in the Basin into a comprehensive BEMP is being conducted concurrently with the preparation of this Five-Year Review. Although the comprehensive BEMP will incorporate the three monitoring programs, their purpose and objectives will remain unchanged.

Basin environmental monitoring was conducted for the three media: surface water, sediment/soil, and biological resources. The following subsections describe BEMP surface water quality monitoring, biological resource monitoring, sediment monitoring, data management, and adaptive management.

5.6.1.1 Surface Water Quality Monitoring

This section summarizes the surface water monitoring program as described in the BEMP and its associated Quality Assurance Project Plan (QAPP), both of which were approved in early 2004 (USEPA, 2004**)**. The surface water monitoring is conducted by the U.S. Geological Survey (USGS) Idaho Water Science Center for USEPA.

Status of Water Quality Monitoring Program

The BEMP surface water monitoring program was implemented in 2004 with a network 15 stations: 7 sentinel and 8 benchmark stations. Sentinel stations were selected to provide information relative to Basin-wide conditions and to evaluate mass transport of metals, nutrients, and sediment. Sentinel stations were sampled eight times per year based on hydrographic events rather than on a fixed-time-interval basis. These events were early fall base flow, initial fall flush, winter base flow, early spring rain-on-snow event, spring snowmelt runoff, and summer hydrograph recession during June through August. Benchmark stations were selected to provide long-term trend information and to evaluate year-to-year variability in concentrations of dissolved metals. Benchmark stations were only sampled every fifth year, augmented with the annual low-flow sampling event each year for dissolved trace metals. Every 5 years, starting in WY 2008, benchmark stations were sampled eight times per year during the same hydrographic conditions as sentinel stations.

Since its inception in 2004, the surface water monitoring program has undergone modifications. Three new stations were added to the BEMP network, resulting in a total of 18 surface water monitoring stations. The new surface water stations are the SFCDR above Placer Creek near Wallace, the SFCDR at Kellogg, and the SFCDR above Pine Creek near Pinehurst.

Another change in the surface water monitoring program is that all of the surface water stations, regardless of designation as sentinel or benchmark, are monitored on an annual basis beginning in WY 2010. However, the frequency of sampling has been reduced and ranges from 2 times per year at 4 of the stations and to 6 times per year at 3 of the stations; 11 of the stations will be sampled 4 times per year. Sampling at all stations is based on hydrographic conditions. Each station will be sampled for instantaneous discharge, total and dissolved metals, hardness, total and dissolved nutrients, and suspended sediment as described in the BEMP and associated QAPP.

In addition to the new stations, the station on the St. Joe River at Chatcolet was relocated upstream to Ramsdell Station. The move to the Ramsdell location was necessitated by stream-flow losses from the river to lateral lakes upstream from the station at Chatcolet. The new station at Ramsdell incorporates the entire stream flow of the St. Joe River, providing a more accurate representation of stream discharge and mass transport from the St. Joe River Basin to Coeur d'Alene Lake.

Water Quality Concentrations and Loads, Water Years 2004-2009

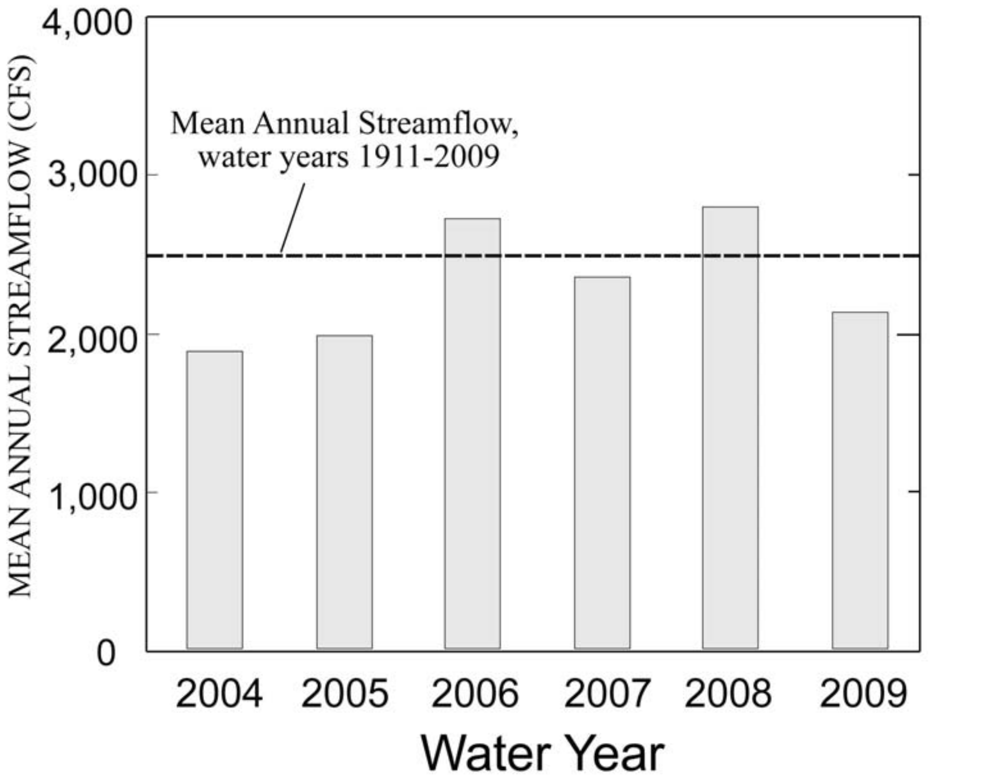
Because the concentrations of chemical constituents in streams vary with changes in stream flow, it is important to collect water quality samples over a range of stream-flow conditions. For instance, in most of the streams in the Coeur d'Alene Basin, zinc is primarily transported in a dissolved phase, and, in general, concentrations decrease as stream flows increase. In contrast, lead is typically transported in streams in a particulate phase, and, when stream flows increase, concentrations of lead can increase dramatically. Although the BEMP design incorporates event sampling to capture variations in stream-flow conditions during each WY, it is important to verify that stream flow during the sampled WYs truly reflect historical stream-flow variations.

In general, stream-flow conditions in the Coeur d'Alene Basin during WYs 2004 through 2009 were representative of long-term historic flow conditions as evidenced by the Coeur d'Alene River near Cataldo (Figure 5-15). Stream flows at all stations during WYs 2004, 2005, and 2009 were below the long-term average, while during WYs 2006 and 2008, stream flows were higher than the long-term average. During WY 2007, stream flows were either near or slightly below the long-term average at most stations.

A statistical summary of selected water quality constituents for 17 BEMP stations for WYs 2004 to 2009 is provided in Table 5-35. In general, the smallest median concentrations of most constituents were found in the North Fork Coeur d'Alene River at Enaville (NF-50) and the St. Joe River at Chatcolet (SJ-60). The largest median concentrations of both dissolved and total metals were found in Canyon Creek (Station CC-287), Ninemile Creek (NM-305), and the two sites on the East Fork of Ninemile Creek (Stations NM-295 and NM 298). Median concentrations of total cadmium, total lead, and dissolved zinc, in Canyon Creek at the mouth were 10.5, 26, and 1,760 micrograms per liter (µg/L), respectively. Median concentrations of the same metals in Ninemile Creek at the mouth were 16, 27, and 2,350 µg/L, respectively. In the SFCDR, the largest median concentrations of all trace metals were found in samples from the station at Smelterville (SF-270) and the next station downstream on the South Fork above Pine Creek near Pinehurst (SF-270A). However, Station SF-270A was only sampled during 2009, so the statistical information for this station may not reflect long-term conditions.

Median concentrations of dissolved and total cadmium and zinc in the mainstem of the Coeur d'Alene River downstream from the confluence of the North and South Forks were lower than those found in the South Fork between stations at Elizabeth Park and Pinehurst. However, median concentrations of dissolved and total lead in the Coeur d'Alene River at Harrison (4.8 and 21 µg/L, respectively) were higher than the median concentrations found in the stations of the South Fork.

FIGURE 5-15
Mean Annual Stream Flow in the Coeur d'Alene River near Cataldo
2010 Five-Year Review, Bunker Hill Superfund Site



Mean annual streamflows in the Coeur d'Alene River near Cataldo (USGS station 12413500) for water years 2004-2009 as compared to the historical average.

Based on loading estimates for 2004 to 2009, Canyon Creek, on average, supplied about twice the load of zinc to the SFCDR (about 61 metric tons per year) as compared to Ninemile Creek (about 30 metric tons per year) (Table 5-36). At both of the stations, zinc was almost exclusively transported in the dissolved form. Combined, Canyon Creek and Ninemile Creek accounted for about 57 percent of the zinc load as measured in the SFCDR at Elizabeth Park (about 160 metric tons per year). On the South Fork between Elizabeth Park and Pinehurst, the mean annual load of zinc in the South Fork, on average, increased by 75 percent to about 280 metric tons per year, again almost exclusively in dissolved form. A further increase in the zinc load of about 90 percent occurred between Pinehurst on the SFCDR and Harrison on the Coeur d'Alene River. However, more than half (about 60 percent) of the increase in the zinc load between Pinehurst and Harrison was transported in particulate form during high-flow events. On average, about 530 metric tons per year of zinc (about 370 metric tons as dissolved) were discharged from the Coeur d'Alene River to Coeur d'Alene Lake, and about 290 metric tons per year of zinc exited the lake in the Spokane River.

TABLE 5-35
Statistical Summary of Selected Water Quality Constituents at 17 BEMP Stations, Water Years 2004-2009
2010 Five-Year Review, Bunker Hill Superfund Site

BEMP Station ID and Name (USGS ID)	Statistic	Total Nitrogen (mg/L)µ	Total Phosphorus (mg/L)	Dissolved Cadmium (µg/L)	Total Cadmium (µg/L)	Dissolved Lead (µg/L)	Total Lead (µg/L)	Dissolved Zinc (µg/L)	Total Zinc (µg/L)	Suspended Sediment (mg/L)
NF-50, NFCDR at Enaville (12413000)	Number of samples	44	44	44	44	44	44	44	44	44
	Median	0.07	0.006	0.04	0.04	0.08	0.20	4.5	4.2	1
	Minimum	<0.03	<0.003	<0.01	<0.01	<0.04	<0.04	2.4	1.9	<1
	Maximum	0.44	0.14	0.21	0.33	0.74	31	51	44	187
SF-208, SFCDR above Deadman Creek near Mullan. (12413040)	Number of samples	8	8	13	8	13	8	13	8	8
	Median	0.23	0.010	0.04	0.17	0.61	4.5	18.6	30.4	5
	Minimum	0.06	0.005	0.03	0.06	0.23	1.2	7.7	13.9	<1
	Maximum	0.39	0.08	0.52	0.33	1.22	14	48	56	103
CC-287, Canyon Creek, Mouth (12413125)	Number of samples	30	30	33	30	33	30	33	30	30
	Median	0.08	0.008	11.1	10.5	12.2	26	1740	1515	2
	Minimum	<0.03	<0.003	3.4	3.5	6.2	13	494	543	<1
	Maximum	0.32	0.042	19.3	18.3	18.9	396	3730	3210	42
NM-295, EFNM, above Success (124131265)	Number of samples	7	6	11	6	11	6	11	6	6
	Median	0.07	0.008	9.6	9.3	10	14	2020	1825	2
	Minimum	0.04	0.006	1.8	1.8	5.9	11	353	362	<1
	Maximum	0.24	0.016	13	12	12	62	3070	2780	7
NM-298, East Fork Ninemile Creek, Mouth (12413127)	Number of samples	8	7	12	7	12	7	12	7	7
	Median	0.12	0.009	29	26	53	65	4945	4160	2
	Minimum	<0.03	0.005	5.7	5.8	25	57	974	962	<1
	Maximum	0.28	0.036	38	32	64	230	6230	5620	10

TABLE 5-35
Statistical Summary of Selected Water Quality Constituents at 17 BEMP Stations, Water Years 2004-2009
2010 Five-Year Review, Bunker Hill Superfund Site

BEMP Station ID and Name (USGS ID)	Statistic	Total Nitrogen (mg/L)µ	Total Phosphorus (mg/L)	Dissolved Cadmium (µg/L)	Total Cadmium (µg/L)	Dissolved Lead (µg/L)	Total Lead (µg/L)	Dissolved Zinc (µg/L)	Total Zinc (µg/L)	Suspended Sediment (mg/L)
NM-305, Ninemile Creek, Mouth (12413130)	Number of samples	15	15	19	15	19	15	19	15	15
	Median	0.10	0.008	17	16	19	27	2350	2500	2
	Minimum	0.06	0.004	5.4	5.7	10	20	5.8	860	<1
	Maximum	0.53	0.287	22	22	28	1390	3790	3520	338
SF-268, SFCDR, Elizabeth Park (12413210)	Number of samples	45	45	45	45	45	45	45	45	43
	Median	0.17	0.008	4.1	4.6	2.5	7.5	662	659	2
	Minimum	0.04	<0.003	1.1	1.8	0.9	3.7	181	270	<1
	Maximum	0.78	0.329	7.6	8.7	5.7	1600	1030	1310	573
SF-269, SFCDR, Kellogg (12413250)	Number of samples	29	29	29	29	29	29	29	29	29
	Median	0.20	0.008	4.1	4.5	3.7	13	668	682	2.0
	Minimum	0.03	<0.003	1.1	1.8	1.0	6	194	285	<1
	Maximum	0.74	0.250	6.3	9.4	11	259	1180	1400	760
SF-270, SFCDR, Smelterville (12413300)	Number of samples	45	45	45	45	45	45	45	45	45
	Median	0.17	0.025	6.6	7.5	3.6	12	885	947	4.00
	Minimum	0.05	0.004	1.2	2.3	1.1	6	217	360	<1
	Maximum	0.64	0.310	13	15	9.8	1960	1670	1820	671
SF-270A, SFCDR, above Pinehurst (12413355)	Number of samples	7	7	7	7	7	7	7	7	7
	Median	0.53	0.064	6.4	7.9	4.6	28	925	1010	6
	Minimum	0.11	0.024	2.1	3.5	1.6	10	345	478	2
	Maximum	0.57	0.111	10.0	9.9	5.1	233	1600	1500	82

TABLE 5-35
Statistical Summary of Selected Water Quality Constituents at 17 BEMP Stations, Water Years 2004-2009
2010 Five-Year Review, Bunker Hill Superfund Site

BEMP Station ID and Name (USGS ID)	Statistic	Total Nitrogen (mg/L)µ	Total Phosphorus (mg/L)	Dissolved Cadmium (µg/L)	Total Cadmium (µg/L)	Dissolved Lead (µg/L)	Total Lead (µg/L)	Dissolved Zinc (µg/L)	Total Zinc (µg/L)	Suspended Sediment (mg/L)
PC-339, Pine Creek, Amy Gulch (12413445)	Number of samples	8	8	13	8	13	8	13	8	7
	Median	0.06	0.008	0.37	0.35	0.20	0.41	101	105	1
	Minimum	<0.03	0.008	0.14	0.15	0.15	0.25	46	48	<1
	Maximum	0.19	0.072	0.51	0.52	1.4	61	159	153	167
SF-271, SFCDR, Pinehurst (12413470)	Number of samples	45	50	45	45	45	45	45	45	49
	Median	0.31	0.038	4.6	5.3	3.0	11	662	709	3
	Minimum	0.10	0.004	0.95	1.8	0.9	5.0	182	292	<1
	Maximum	0.72	0.280	9.2	17	5.9	1020	1550	1430	346
LC-50, Coeur d'Alene River, Cataldo (12413500)	Number of samples	8	8	13	8	13	8	13	8	8
	Median	0.15	0.012	1.9	2.0	1.1	7.3	347	279	3
	Minimum	0.08	0.008	0.27	0.85	0.51	1.7	50	114	1
	Maximum	0.32	0.152	2.7	2.5	2.8	238	439	432	191
LC-60, Coeur d'Alene River, Harrison (12413860)	Number of samples	47	47	47	47	47	47	47	47	49
	Median	0.11	0.010	0.91	1.3	4.8	21	181	214	4
	Minimum	0.03	<0.003	0.48	0.72	0.91	7.8	67	115	<1
	Maximum	0.42	0.171	1.9	7.8	29	1230	432	1080	404
SJ-60, St. Joe River, Chatcolet (12415140)	Number of samples	44	39	39	39	38	39	39	39	38
	Median	0.14	0.016	0.04	0.04	0.07	0.11	1.6	2.0	4
	Minimum	0.04	0.009	<.02	<0.01	<0.04	<0.04	<0.3	<1	<1
	Maximum	0.66	0.230	0.08	0.06	0.32	3.7	17	15	261

TABLE 5-35
Statistical Summary of Selected Water Quality Constituents at 17 BEMP Stations, Water Years 2004-2009
2010 Five-Year Review, Bunker Hill Superfund Site

BEMP Station ID and Name (USGS ID)	Statistic	Total Nitrogen (mg/L)µ	Total Phosphorus (mg/L)	Dissolved Cadmium (µg/L)	Total Cadmium (µg/L)	Dissolved Lead (µg/L)	Total Lead (µg/L)	Dissolved Zinc (µg/L)	Total Zinc (µg/L)	Suspended Sediment (mg/L)
SR-5, Spokane River, Lake Outlet (12417598)	Number of samples	26	26	26	26	26	26	26	26	26
	Median	0.09	0.008	0.17	0.20	0.30	1.1	40	44	2
	Minimum	0.04	0.004	0.04	0.13	0.08	0.61	24	27	<1
	Maximum	0.20	0.013	0.27	0.70	3.6	22	81	71	4
SR-55, Spokane River, ID/WA Border (12419495)	Number of samples	5	5	10	5	10	5	10	5	5
	Median	0.15	0.008	0.10	0.15	0.19	1.2	31	31	1.0
	Minimum	0.13	0.007	0.04	0.11	0.13	0.7	24	30	<1
	Maximum	0.23	0.009	0.16	0.20	0.69	3.3	65	51	3.0

TABLE 5-36
Mean Annual Load of Selected Trace Metals, Water Years 2004-2009
2010 Five-Year Review, Bunker Hill Superfund Site

BEMP Station ID and Name	Dissolved Cadmium	Total Cadmium	Dissolved Lead	Total Lead	Dissolved Zinc	Total Zinc
NF-50, NFCDR, Enaville	0.06	0.09	0.20	3.8	11	13
CC-287, Canyon Creek, Mouth	0.39	0.40	0.57	3.4	61	61
NM-305, Ninemile Creek, Mouth	0.17	0.19	0.29	2.9	28	30
SF-268, SFCDR, Elizabeth Park	0.96	1.1	0.69	21	150	160
SF-271, SFCDR, Pinehurst	1.7	2.0	1.2	28	270	280
LC-60, Coeur d'Alene River, Harrison	2.0	3.5	20	230	370	530
SJ-60, St. Joe River, Chatcolet	0.09	0.10	0.23	0.87	5.0	6.4
SR-5, Spokane River, Lake Outlet	1.0	1.2	3.2	14	280	290

Note: Loads in metric tons per year.

As opposed to zinc, lead is transported in tributary streams and down the South Fork and mainstem of the Coeur d'Alene River primarily in particulate form. During 2004 to 2009, about 90 percent of the mean annual load of lead (about 230 metric tons per year) discharged to Coeur d'Alene Lake from the Coeur d'Alene River was in particulate form. Of the lead entering the lake, about 90 percent was generated between the confluence of the North and South Forks downstream to the station at Harrison (LC-60). On average during 2004 to 2009, about 14 metric tons per year of lead exited Coeur d'Alene Lake in the Spokane River (Table 5-37).

5.6.1.2 Biological Resources Monitoring

Status Update

The biological resources monitoring program was designed to evaluate the following two monitoring hypotheses stated in the BEMP (USEPA, 2004):

- There is an improvement in biotic benchmarks from the recent historical trend or pre-remediation condition; and
- There has been progress toward achieving benchmarks of the selected remedy.

TABLE 5-37
OU 3 Biological Monitoring Activities
2010 Five-Year Review, Bunker Hill Superfund Site

Monitoring Component	2005	2006	2007	2008	2009
Benthic Invertebrates – Diversity/Abundance	X				
Benthic Invertebrates – Tissue Metals	X				
Aquatic Habitat Assessment	X				
Bull Trout Population and Habitat Assessment	X				
Riparian Habitat		X			
Fish – Diversity/Abundance		X			
Fish – Tissue Metals		X			
Waterfowl – Population/Swan Mortality	X	X	X	X	X
Waterfowl – Blood Lead and Fecal Metals Analysis				X	
Songbird – (MAPS) Diversity/Abundance	X	X	X	X	

MAPS = Monitoring Avian Productivity and Survivorship

Biological monitoring is being conducted by USFWS as a component of the BEMP. Implementation of the biological monitoring program began in 2004, and Table 5-37 identifies the biological monitoring activities conducted from 2005 through 2009.

The biological monitoring program is in the process of being optimized as part of development of a Basin-wide comprehensive BEMP. This biological monitoring program will be implemented as part of the comprehensive BEMP beginning in 2010.

The annual data summary reports from the BEMP biological resource monitoring are available on USEPA's website for the Superfund Site (http://yosemite.epa.gov/R10/CLEANUP.NSF/sites/cda) under Technical Documents.

Most of the biological resource monitoring parameters listed in Table 5-37 are conducted with a 5-year monitoring frequency. Because monitoring began in 2004, only one dataset is available for some parameters, and the ability to trend analyses is also limited. However, because limited ecological cleanups have been completed, the biological resource data collected since implementation of the BEMP can be used as baseline or pre-remediation data because Basin-wide ecological benefits are not expected at this time.

Findings

This section presents only the current status, or baseline results, for the biological resources because monitoring was performed only once during this Five-Year Review period and limited ecological actions have been implemented as part of the Selected Remedy of the 2002

OU 3 ROD (USEPA, 2002). The status of biological resources in OU 3 is described in the 2005-2009 Biological Resources Five-Year Review (USFWS, 2010a), and is summarized in the following subsections.

2005 Benthic Macroinvertebrate Diversity and Abundance and Metals Residue Analysis

Arsenic, cadmium, lead, and zinc were detected in benthic macroinvertebrate samples from the four sample locations in Ninemile Creek, Osburn, Pine Creek, and the Spokane River. The mean cadmium, lead, and zinc concentrations were all highest at the Ninemile Creek location. The mean arsenic concentration was lowest in the Ninemile Creek samples and was significantly highest at the Osburn location. The mean cadmium concentration in the Spokane River samples was significantly lower than at the three Coeur d'Alene Basin sample locations.

2005 Aquatic Habitat Quality Assessment

Based on aquatic habitat components measured, a reduction in local aquatic habitat quality potential was observed at the assessment locations. A lack of shrub and tree presence, stream bank undercut, and cover provided by woody debris was observed at the three sites assessed; Ninemile Creek, Pine Creek, and Osburn. Additionally, all sites assessed have a relatively low percent canopy cover and vegetative overhang. All sites were dominated by bare ground and grasses. Sinuosity ratios calculated were marginal to less than marginal for the reaches assessed. As additional aquatic resource (aquatic macroinvertebrate and fish diversity and abundance) data is collected, correlations between biotic population and diversity to habitat quality will be evaluated.

2005 Bull Trout Population and Habitat Assessment Surveys

Habitat and basic water quality parameters in deepwater pools in the mainstem of the Coeur d'Alene and St. Joe Rivers were evaluated to determine potential influences on movements of adfluvial cutthroat and bull trout. Few fish were observed in both the Coeur d'Alene and St. Joe Rivers using the underwater camera technique, and no bull trout were observed. Water chemistry, temperature, and underwater habitat data suggest that pools containing habitat suitable for migratory fish exist within the mainstem of the Coeur d'Alene River. However, elevated water temperatures and a lack of temperature refuge areas in the lower river may be limiting migration.

2006 Riparian Habitat and Quality Assessment

The monitoring locations show a wide range of riparian habitat quality in terms of vegetation communities and ground cover. Past and current management of these locations has affected the structure of the riparian corridor and is likely affecting their use by riparian wildlife. Previous restoration efforts at locations such as Pine Creek and the SFCDR near Osburn, and riparian corridor management for fish and wildlife such as in the Lower Basin, appear to be assisting in restoration of the riparian corridor at locations affected by past mining activity.

2006 Fish Diversity and Abundance and Tissue Metals Residue Analysis

Fish tissue residues were analyzed for metals and provide baseline, or pre-remediation, data. As expected since most cleanup actions have not yet been implemented, the fish diversity and abundance data demonstrate that fisheries benchmarks outlined in the 2002 OU 3 ROD (USEPA, 2002) have not been achieved at the sampling locations.

2008 Waterfowl Blood and Fecal Analyses

Blood samples from waterfowl were collected from the three wetlands: East Field (remediated), Thompson Marsh, and Campbell Marsh (both unremediated). Blood lead levels in waterfowl were elevated at all sites, with 84 percent of waterfowl blood lead concentrations exceeding suggested clinical toxicity thresholds. Mean blood lead concentrations in Basin-wide waterfowl did not statistically differ between the remediated and unremediated site. However, the mean blood lead concentration from mallards captured at the remediated East Field site decreased by 20 percent from those captured at the same site in 1997 (USFWS, 2009a, b). This reduction suggests the remedial action implemented at the site may have reduced waterfowl exposure to lead-contaminated sediment. In contrast, blood lead concentrations from mallards captured at Thompson Marsh have increased slightly over the 22 years and continue to exceed the background and severe clinical toxicity thresholds suggested by Pain (1996).

Canada goose fecal samples were collected from two of the wetlands in which blood was collected from waterfowl (East Field and Thompson Marsh). Fecal samples indicate that waterfowl in OU 3 continue to ingest metals-contaminated sediment. However, despite no significant differences in sediment ingestion between the sites, there were significantly lower metals concentrations in fecal samples from the East Field than from Thompson Marsh. Mean cadmium concentrations in fecal samples collected at Thompson Marsh were over two times higher, and lead concentrations were over seven times higher, than the concentrations in the East Field samples. The lower concentration of metals in fecal samples collected from the East Field site suggest a reduction of waterfowl exposure due to remediation and the presence of attractive habitat characteristics successfully keeping geese onsite long enough to reduce their overall exposure.

Both migratory and resident waterfowl likely use multiple Basin wetlands throughout the year. The combined exposure to lead in a number of wetlands likely elevates observed blood and fecal lead concentrations in waterfowl. However, the apparent reduction of metals concentrations in samples from the remediated East Field site suggests that waterfowl using this wetland may be remaining onsite long enough to reduce their overall exposure.

2005-2009 Waterfowl Population Surveys

Total overall numbers of waterfowl observed between 2005-2009 ranged from 60,786 (2007) to 103,242 (2009). The data demonstrate that Canyon Marsh, Lane Marsh, and Harrison Slough are the highest use waterfowl feeding areas over the 5-year survey period. Frequent use of these wetlands is likely driven by habitat quality, preferred feeding habitat (e.g., shallow water depths), and the subsequent accessibility to food resources by feeding waterfowl. Mean sediment lead concentrations in these areas exceed 530 mg/kg, which is considered to be toxic to waterfowl. Injuries to waterfowl, including death, are expected to persist in areas with lead concentrations exceeding the threshold.

As discussed in Section 5.3.7, the agriculture-to-wetland conversion remedy was started in 2007. Subsequent waterfowl use surveys began in spring 2008, and the data demonstrate that this area attracts some of the highest waterfowl use as well as the highest number of feeding waterfowl and highest diversity of waterfowl in the Basin. Use by waterfowl within the easement area is expected to increase as post-remediation restoration proceeds.

2005-2008 Songbird Diversity and Abundance

Songbird productivity and survivorship data were collected and analyzed at two monitoring locations: near Pine Creek and in the Lower Basin. The data include percent females with brood patches, species reproductive indices, recapture rates, and mean body condition indices. Data collected as part of the BEMP monitoring were compared to data from regional reference locations to evaluate potential site-specific trends in songbird populations. Specific monitoring program details, including reference locations, can be found in the biological resources monitoring annual reports and in the 2005-2009 Biological Resources Five-Year Review (USFWS, 2010a). These results are as follows:

- Data comparisons indicate a lower juvenile return rate at the study locations, as well as site- and species-specific differences in adult survival and reproduction in ground-feeding species compared to reference locations.
- Brood patch results indicate a higher percentage of breeding females at the two BEMP study locations (Pine Creek and Lower Basin) compared to the reference sites.
- Reproductive index results for site and species-specific data varied depending on the monitoring location. Lower Basin reproductive indices were generally higher (indicating better reproduction) than reference locations, whereas reproductive indices for Pine Creek were lower.
- Juvenile American robin recapture rates at the Lower Basin monitoring location were higher than reference locations, and no juvenile American robins were captured at Pine Creek. The difference in recapture rates at BEMP locations compared to reference sites was most apparent in juvenile song sparrow data. There were no juvenile Swainson's thrushes recaptured during the 5 years of monitoring at the two locations, whereas reference and regional rates of juvenile Swainson's thrush recapture was evident. Adult American robin recapture rates at both locations were lower than regional recapture rates and higher than the reference rates. Lower Basin adult song sparrow recapture rates were similar to the rates at the reference locations, and no adult song sparrows were recaptured at Pine Creek. Adult Swainson's thrush recapture rates were lower at both BEMP monitoring locations than at the regional locations.
- Songbird blood lead data demonstrate potential correlations between productivity, habitat characteristics, and ambient lead concentrations in soil at the four BEMP sites monitored. When compared with data from reference areas and regional trends, data from the Pine Creek and Lower Basin locations suggest that metals of concern in the Coeur d'Alene Basin appear to be having a negative influence on songbird population demographics at these sites.

5.6.1.3 Sediment/Soil Monitoring

The soil and sediment monitoring program was designed to evaluate the following three monitoring hypotheses provided in the BEMP (USEPA, 2004):

- There is a decrease in particulate lead concentrations in sediment/soil in the floodplain, the levees, and the riverbed from the recent historical trend or pre-remediation condition;

- Implementation of the remedy has resulted in "unwanted" impacts on the system such as recontamination or excess sedimentation; and
- There has been progress toward achieving benchmarks of the selected remedy.

The benchmarks established in the 2002 OU 3 ROD (USEPA, 2002) will be compared against improvements in sediment and soil quality in the Ninemile Creek, Pine Creek, and SFCDR watersheds; the Lower Basin; and the Spokane River upstream from Upriver Dam. Because few actions have been implemented in OU 3 as part of the Selected Remedy, the achievement of benchmarks and monitoring hypotheses was not evaluated for this Five-Year Review. However, data obtained during implementation of the sediment and soil monitoring program are summarized in the following subsection.

BEMP sediment/soil monitoring has been performed since 2004, and the data have been summarized annually. The specific goal of the BEMP-directed sediment sampling program is to obtain annual representative samples of surficial sediment from the edge of Basin-area creeks and rivers that is deposited during high-flow events. Sixteen sediment sampling stations are identified in the BEMP and consist of locations on the SFCDR and its tributaries in the Upper Basin (Canyon Creek, Ninemile Creek, and Pine Creek), the lower Coeur d'Alene River, and a depositional area of the Spokane River. One monitoring station was removed from the program (Spokane River near the eastern boundary of the Spokane Indian Reservation) because only limited fine-grained materials were present, which were insufficient for monitoring with the collection of annual depositional samples.

Annual BEMP data summary reports from 2004 through 2009 are available on USEPA's website for the Superfund Site (http://yosemite.epa.gov/R10/CLEANUP.NSF/sites/cda). Sampling for this program was conducted by obtaining one bulk sediment sample from each monitoring station and submitting it for metals analysis followed by size fractionation to the clay/silt (<63 micrometers [µm]) and sand (63-250 µm) fractions. Each fraction was then analyzed for metals. Analysis of the bulk sample for metals was added to the program in 2007 to assess actual contaminant concentrations to which potential receptors may be exposed.

The original sediment monitoring program was performed from 2004 through 2009. This program was revised in early 2010 to allow use of revised sampling locations and procedures for 2010 sampling. These programmatic changes are further discussed below.

Findings

Lead concentrations in the sand and silt/clay fractions exhibit similar patterns throughout the Coeur d'Alene Basin. Lead concentrations are highest in the Upper Basin, especially in tributaries of the SFCDR. Lead concentrations decrease with distance downstream through OU 2, and lead detected below the confluence of the North Fork and the South Fork at Cataldo is the lowest in the Basin (except for upstream from Canyon Creek). Lead concentrations rise at the Lower Basin monitoring stations downstream for Cataldo and remain elevated to Coeur d'Alene Lake.

Zinc concentrations measured in sand and silt/clay fractions exhibit patterns similar to those of lead, as described above, except for relatively higher concentrations in the Lower Basin at the Rose Lake and Medimont monitoring locations. These Lower Basin zinc concentrations are similar in magnitude to zinc concentrations measured in the SFCDR tributaries. Bulk sample results were similar to findings in the sand and silt/clay fractions.

Overall, lead and zinc concentrations in sediment were higher and more variable in the silt/clay fraction than the sand fraction in most samples.

The lead and zinc data were evaluated for temporal trends using the Mann-Kendall test for trends. Statistical trends were identified at the following monitoring locations:

- SFCDR above Canyon Creek – decreasing lead and zinc concentration trends in the sand fraction;
- Mouth of Canyon Creek – decreasing lead concentration trend in the sand fraction and decreasing zinc concentration trend in the silt/clay fraction;
- Mouth of Ninemile Creek – decreasing lead concentration trend in the sand fraction and decreasing zinc concentration trend in the silt/clay fraction;
- Pinehurst – increasing lead concentration trend in the silt/clay fraction; and
- Cataldo – decreasing zinc concentration trend in the sand fraction.

Because limited remedial actions have been implemented in OU 3, the cause of these trends is unclear. In addition, the variability of peak river flows and durations, which can affect sediment suspension and deposition, was not evaluated. Additional long-term monitoring of these locations will be required to further assess the temporal trends in lead concentrations.

Sediment/Soil Monitoring Program Limitations and Revisions

Limitations in the sediment monitoring program have been identified in the annual sediment sampling data reports and include the following:

- Data quality may be influenced by anthropogenic disturbances, absences of depositional material due to a low peak runoff event, low quantities of depositional material, or stream morphology changes resulting in inconsistent depositional patterns;
- Sampling has typically been performed for up to 5 months after peak runoff. The long period of time has increased the potential for disturbance of the deposited sediment (e.g., wind, human activities);
- Sampling produced data that represented only a partial and indirect measure of lead and zinc moving through the Coeur d'Alene River system; and
- The BEMP specifies that the sampling approach and methods at each location should be completed the same way each year. The approach does not consider the changing site specific characteristics consisting of channel morphology, the quantity of deposited sediment, vegetation growth, and anthropogenic disturbance, which are likely to affect data quality and comparability.

The adaptive management framework of the BEMP (discussed in Section 5.5.1.9) allows for program revisions driven by the limitations described above. Based on limitations of the original sediment monitoring program and the need for an expanded data collection program to support sediment transport modeling in the Lower Basin, the sediment monitoring program was revised in early 2010 and includes:

- Collection of suspended sediment samples at 11 locations, at a frequency of up to 4 times per year, with analysis to include particle size fractions and concentrations of metals;
- Collection of depositional samples at 19 near-channel and off-channel locations, with analysis to include particle size fractions and concentrations of metals and collection of depositional samples to include the entire deposited layer rather than the surface layer only; and
- Addition of 14 water level monitoring stations in the Coeur d'Alene River and in select lateral lakes.

The limitations of the original sediment monitoring program were considered during the revision process. Select depositional monitoring locations were excluded from the revised program due to inadequate deposition of sediment. The sample collection methodology was revised to incorporate methods believed to more accurately document sediment deposition that occurred during runoff events. Revisions to the sediment/soil sampling monitoring were first implemented in 2010, and, therefore, no trends or findings are available regarding the newer data.

5.6.1.4 BEMP Data Management

The data management program applicable to environmental monitoring in OU 3 is the same as the program for OU 2 and is discussed in Section 4.4.3.

5.6.1.5 Adaptive Management and Future Five-Year Reviews

The 2002 OU 3 ROD calls for an adaptive management framework for remedy implementation. Environmental monitoring under the BEMP is anticipated to evolve during remedy implementation. The BEMP will be modified as necessary to reflect a better understanding of Basin processes and changes in monitoring tools and techniques. The 5-year data analysis and assessment reports will be a key component of the adaptive management review of the progress made under the 2002 OU 3 ROD. Specific components include detection of trends or major trend discontinuities, which may signal a need to update critical assumptions or change management practices and/or adjust the monitoring plan. These evaluations and the experience gained from remedy implementation may help identify and guide "course corrections" that improve remedy performance or cost-effectiveness.

The BEMP assumes that extensive analysis of accumulated monitoring data will be conducted at 5-year intervals timed to support future 5-year remedy reviews. In addition to data collected under the BEMP, the Five-Year Review data analyses may incorporate data collected as part of remedial-action-specific monitoring or other monitoring programs in the Basin (e.g., Lake Environmental Monitoring Plan data). The Five-Year Review analyses and assessments will be documented in BEMP technical memoranda, which will be used to support the future 5-year remedy reviews. The adaptive management approach described above will be carried forward into the forthcoming comprehensive BEMP.

Four major improvements to the BEMP have been achieved as part of the adaptive management framework including increased monitoring at the mouth of Canyon Creek, installation of USGS gauging stations on the SFCDR above Placer Creek and in the Pinehurst Narrows, and revisions to the sediment monitoring program (described above). In addition, optimization of the surface water and biological resource monitoring programs is being conducted concurrent with this Five-Year Review and will be implemented following completion of the comprehensive BEMP.

5.6.2 Remedial Action Effectiveness Monitoring

5.6.2.1 ROD Requirements

Establishment of a remedial action effectiveness monitoring program is required as described in the 2002 OU 3 ROD, Section 12.6. This monitoring is designed to be linked with the status and trends monitoring (discussed in Section 5.6.1.4 of this Five-Year Review Report) and is being developed as part of the design of each remedial action

5.6.2.2 Remedial-Action Effectiveness Monitoring Development

OU 3 action-specific effectiveness monitoring has been addressed by remedial action area (e.g., tributaries, river reaches). The purpose of the effectiveness monitoring is to assess the success and effect of a given remedial action. By comparison, the BEMP will address Basin-wide status and trends by monitoring a limited number of strategic locations (USEPA, 2004). In collaboration with project stakeholders, USEPA determined that collection and evaluation of additional long-term surface water and groundwater monitoring data was warranted at sites where remedial actions had previously been conducted or were planned to occur.

The remedial action effectiveness monitoring was designed to be integrated with existing monitoring programs in the Coeur d'Alene Basin and is discussed in Section 5.6.1.4. As discussed in Section 5.6.1.2, the environmental monitoring programs conducted in the Coeur d'Alene Basin, including OU 3 remedial action effectiveness monitoring, will be consolidated into a single comprehensive BEMP.

5.6.2.3 Remedial Action Effectiveness Goals and Objectives

The key goals of the remedial action monitoring program are to evaluate the effectiveness of remedial actions conducted to date, evaluate progress toward achievement of established benchmarks, and gain a better understanding of Upper Basin processes and data variability. Overall objectives of the remedial action monitoring program are to (1) assess the long-term status and trends of heavy metal contamination in surface water and shallow groundwater, and (2) evaluate remedial action effectiveness with respect to water quality. The remedial action monitoring program includes site-specific monitoring plans that were developed to guide the collection of groundwater and surface water data at sites located in the Upper Basin Watershed.

As stated in the OU 3 2002 ROD (USEPA, 2002), the overall goal of the Upper Basin remedial action effectiveness monitoring program is to evaluate the status and trends for surface water as follows:

- Status/trends of dissolved zinc and cadmium concentrations and ambient water quality criteria (AWQC) ratios in surface water;
- Status/trends of particulate lead concentrations and loads in surface water;

- Trends in lead concentration in the floodplain soils/sediments, levees, and stream bed sediment;
- Progress toward achieving the benchmarks of the Selected Remedy;
- Potential unwanted impacts on the system resulting from implementation of the remediation; and
- Changes or trends in biotic benchmarks (e.g., population diversity, chemical exposure, bioavailability).

Groundwater was not addressed in the OU 3 2002 ROD (USEPA, 2002); however, it was recognized as an important monitoring media for situations in which groundwater data are needed to address specific surface water questions. In addition, the remedial action effectiveness monitoring program does not include sediment or biological monitoring as media of interest; these media are included in the BEMP (USEPA, 2004). Remedial action effectiveness monitoring does include repository monitoring; however, repository monitoring results are presented in Section 5.3.6.2.

5.6.2.4 Remedial Action Effectiveness Monitoring Plan Design

The remedial action effectiveness monitoring is designed to bracket (i.e., upstream/upgradient and downstream/downgradient) selected monitoring locations for both surface water and shallow groundwater. Data from these locations are needed to evaluate load differences, AWQC, and AWQC ratios between surface water stations established in areas upstream and downstream from the remedial action sites. In addition, shallow groundwater monitoring data were included in the remedial action effectiveness monitoring to help characterize the spatial and temporal distribution of heavy metal concentrations and trends at select (existing) groundwater monitoring well locations and potential impacts of groundwater on surface water. The monitoring plan was designed to use indicator parameters of primary concern (various total and dissolved metals) and sampling frequencies that reflect relevant changes in the hydrologic system and are coincident with various hydrologic flow conditions known to affect contaminant fate and transport.

5.6.2.5 Remedial Action Effectiveness Monitoring Activities and Results

Remedial action effectiveness monitoring includes sampling, testing, and evaluation of groundwater and surface water at five locations. These monitoring locations were selected for remedial action effectiveness monitoring based on apparent (or relative) loading potential obtained from preliminary site characterization efforts as described in the 2001 Remedial Investigation/Feasibility Study (RI/FS) Report (USEPA, 2001c, 2001b). The five monitoring locations are:

- Canyon Creek near Woodland Park;
- Constitution Mine and Mill Site;
- Golconda Mine and Mill Site;
- Rex Mine and Mill Site; and
- Success Mine and Mill Site.

The Constitution, Golconda, and Rex Site monitoring programs are discussed in Section 5.3.4. The monitoring programs and results for the Canyon Creek (Woodland Park) and Success Sites are discussed in the following subsections.

Canyon Creek Near Woodland Park

Background and Remedial Actions

Mining operations in Canyon Creek occurred between 1887 and 1990. Prior to 1965, all of the mills along Canyon Creek discharged most, if not all, of their tailings to the stream (URS, 2001). These tailings dispersed within the alluvial floodplain sediments and in the lower floodplain in the vicinity of Woodland Park. Six tailing ponds are also present near Woodland Park and were built on the floodplain, and it is highly probable that they cover deposits of historical jig tailings.

In 1997 and 1998, a time-critical removal of about 600,000 cy of tailings and contaminated sediment was conducted with disposal at the Woodland Park Repository. Soils at removal areas were amended with organic materials and then revegetated. The stream channel of Canyon Creek was stabilized with bioengineering techniques. The Woodland Park Repository is unlined and capped with native soils.

Although remedial actions were conducted at this site, Canyon Creek remains a significant contributor of dissolved metals loading to the SFCDR. Metals-contaminated groundwater has been identified as the primary contributor of metals loading to Canyon Creek in the lower floodplain.

Remedial Action Effectiveness Monitoring Locations and Results

Remedial action effectiveness monitoring is conducted at the Canyon Creek Site using the following monitoring locations:

- One upgradient, one mid-gradient, and one downgradient Canyon Creek surface water monitoring location; and
- Six groundwater monitoring wells (two upgradient, two mid-gradient, and two downgradient).

The results of the monitoring conducted to date were used to assess attainment of RAOs and the site-specific benchmark. The site-specific benchmark for Canyon Creek is to reduce dissolved metal loading to the SFCDR by 50 percent. Although not specified in the OU 3 ROD, this benchmark is inferred during high-flow conditions. A comparison of pre-remediation to post-remediation metal loading for total lead and dissolved zinc did see significant reductions. However, the 50 percent reduction benchmark is difficult to evaluate due to data variability and uncertainty in the pre-remedial action monitoring location and discharge.

The overall RAO is to reduce metal concentrations that exceed surface water ARARs. Dissolved arsenic, dissolved cadmium, dissolved lead, and dissolved zinc concentrations in Canyon Creek routinely exceed the AWQC at the upgradient and downgradient monitoring locations, thus not achieving the RAO. Dissolved cadmium and dissolved zinc concentrations at the downgradient surface water monitoring location range from 12 to 37 and from 9 to 30 times the AWQC, respectively. Dissolved arsenic concentrations have ranged from 11 to 13 times the AWQC, while dissolved lead concentrations have ranged from about one to five times the AWQC, respectively.

Significant concentration differences have been observed between the upgradient and downgradient Canyon Creek monitoring locations for dissolved cadmium and dissolved zinc. Although the Gem Portal and the Hecla-Star Pond 6 discharge to Canyon Creek, groundwater is believed to be the primary contributor of dissolved metals loading into Canyon Creek as it passes through the Site. Elevated dissolved cadmium, dissolved lead, and dissolved zinc concentrations have been detected in groundwater in the vicinity of the lower floodplain near Woodland Park. Concentrations of these constituents have reached about 0.5 mg/L, 1.0 mg/L, and 100 mg/L, respectively.

Success Mine and Mill Site

Background and Remedial Actions Conducted to Date

Mining operations at the Success Mine Site began in 1885 and continued sporadically until 1926, when all underground equipment was removed. It continued to be operated by lessees until its final shutdown in 1956.

In 1993, time-critical removal actions for the Success Site included relocation and riprap armoring of the EFNMC channel, relocation of streamside tailings, placement of in-stream structures for energy dissipation, capping of tailings pile with 1-foot thick overburden rock, and installation of upgradient groundwater and surface water diversions. In 2000, a subsurface cutoff wall was constructed to divert contaminated groundwater to a treatment vault containing apatite. Subsequent evaluation indicated that performance of the apatite treatment system was inadequate.

Remedial Action Effectiveness Monitoring Locations and Results

Remedial action effectiveness monitoring is conducted at the Success Site using the following monitoring locations:

- One upgradient and one downgradient EFNMC surface water monitoring location;
- Success No. 3 Adit; and
- Three groundwater monitoring wells (one mid-gradient and two downgradient).

The results of the monitoring conducted to date are used to assess attainment of RAOs and the site-specific benchmark. The site-specific benchmark for the Success Site is to reduce dissolved metal concentrations to less than 20 times the acute AWQC. Dissolved cadmium and dissolved zinc concentrations in the EFNMC monitoring locations exceeded this benchmark.

Dissolved cadmium and dissolved zinc concentrations in EFNMC significantly exceed the AWQC at the upgradient and downgradient monitoring locations, while dissolved lead concentrations consistently exceed the AWQC at the downgradient monitoring location. The dissolved cadmium and dissolved zinc concentrations routinely exceed 60 times the AWQC at the downgradient surface water monitoring location, while the dissolved lead concentration has reach 7 times the AWQC.

Significant concentration differences (two to three times) have been observed between the upgradient and downgradient EFNMC monitoring locations**.** Because no significant surface water is input to EFNMC at the Success Site, groundwater is believed to be the primary contributor of dissolved metals loading into EFNMC as it passes through the site. Dissolved metal concentrations in groundwater at the Success Site are the highest among the groundwater monitoring performed as part of the remedial action effectiveness monitoring. Concentrations of these constituents have reached about 2.3 mg/L, 2.1 mg/L, and 320 mg/L, respectively.

Note that no remedial actions have been performed in Ninemile Creek since the selection of the interim remedy in the 2002 OU 3 ROD.

5.6.3 Canyon Creek Treatability Study

5.6.3.1 Overview

The 2002 OU 3 ROD selected a remedy that set performance goals for surface water treatment in Canyon Creek and focused on identifying cost-effective technologies for improving downstream water quality in the SFCDR. The location of the Canyon Creek Watershed is shown in 2002 OU 3 ROD Figure 12.2-9.

To reduce zinc loads to the SFCDR, the 2002 OU 3 ROD called for a 50 percent reduction in surface water dissolved metals (see Table 12-2-1 of the OU 3 ROD) at the mouth of Canyon Creek. The Canyon Creek Treatability Study represented the first step to evaluate water treatment options for Canyon Creek. This work was intended to lead to treatment technologies that meet the Canyon Creek water treatment goals. A variety of technologies and approaches, including the use of passive techniques, was evaluated and critiqued by USEPA. Input from the Basin Commission's Water Treatment PFT was included during this review and critique process as well as information generated from other water treatment projects conducted within Canyon Creek and the overall Basin.

5.6.3.2 Background

Because conventional active treatment appeared cost-prohibitive, the 2002 OU 3 ROD identified a passive treatment (p. 12-25) that appeared to meet the treatment goals but at a lower total cost than conventional active treatment. As illustrated by the conceptual drawing of 2002 OU 3 ROD (Figure 12.2-7), passive treatment for Canyon Creek was represented by an innovative treatment pond system. The treatment pond covered a several-acre site hypothetically located downstream from the Star Hecla tailings ponds in the floodplain of Canyon Creek.

The various performance and siting concerns associated with the pond treatment were recognized during development of the 2002 OU 3 ROD. Recognizing these concerns, the 2002 OU 3 ROD acknowledged that the exact nature of the treatment had yet to be determined and could include "active technology components". The ROD called for implementing the water treatment based on the outcome of a demonstration project for treatment of creek water and groundwater near the mouth".[7] The ROD also stated (pp. 12-25, 26) that "if passive treatment does not prove effective, alternative treatment and control systems to achieve the benchmark of a least 50 percent, reduction of dissolved metal loads would be evaluated."

[7] The 2002 OU 3 ROD Table 12.2-1 states: "Pilot and demonstration projects for treatment of creek water and groundwater near the mouth (permeable reactive barrier (PRB) or other technology, potentially including active technology components). Implement water treatment or other technology based on outcome of demonstration project."

Since the 2002 OU 3 ROD was signed, evaluations conducted by USEPA have identified concerns about the ability of a passive treatment, as envisioned in the ROD, to fully meet the ROD goals for Canyon Creek (URS, 2003). Further support for these concerns has resulted from the Success Mine Site apatite-based passive treatment (see Section 5.3.5), which appears to have performed much less effectively than originally expected. Although the alternative—active treatment—was included in the OU 3 FS, it was not explicitly chosen in the ROD because of cost considerations. The Canyon Creek Treatability Study provides information to demonstrate and evaluate the potential effectiveness of conventional and innovative treatment processes for Canyon Creek.

5.6.3.3 Treatability Study Design and Results

The Canyon Creek Treatability Study was divided into two phases. Phase I of the study (URS, 2005) was completed in 2005 and focused on the identification and evaluation of existing conventional technologies potentially applicable to Canyon Creek conditions, and the performance of limited laboratory treatability testing to make recommendations for a Phase II effort. The laboratory-scale treatability studies were conducted, as part of Phase I, on both surface water and groundwater collected from Canyon Creek to evaluate the effectiveness of a variety of combinations of lime stabilization, iron co-precipitation, polymer flocculation, and ballasted micro-sand separation technology. Lime stabilization was evaluated by varying the pH using a lime slurry. Several combinations of the approaches identified in the Phase I testing proved to be very effective with respect to total metal removal and achievement of water quality criteria.

Phase II of the study (CH2M HILL, 2006a) was conducted in 2005 through 2006 and included laboratory screening and field pilot testing. The laboratory screening (proof-of-concept testing) consisted of testing the treatment of Canyon Creek groundwater by reactive media bed (RMB) and sulfate-reducing bioreactor (SRB) processes. This included relatively simple and short-term laboratory tests designed to assess the potential effectiveness and applicability of the RMB and SRB technologies. Unfavorable lab screening results for the RMB technology did not warrant further testing, so that this technology was not included in the field pilot testing program. Based on promising results in SRB lab screening, the SRB technology was included in the field pilot testing program.

Field pilot tests were conducted in the Phase II study to evaluate the effectiveness and technical feasibility of the selected treatment technologies under continuous-flow conditions. Four treatment systems were piloted in the field: (1) high-density sludge (HDS) treatment of Canyon Creek groundwater; (2) HDS treatment of a mixture of Canyon Creek groundwater and Bunker Hill mine water; and (3 and 4) SRB treatment of Canyon Creek groundwater using two different media mixtures.

HDS pilot test results showed that both HDS treatments achieved high removal efficiencies for dissolved zinc and cadmium. The HDS treatment of only Canyon Creek groundwater produced only moderately dense sludge due to the relatively low concentrations of influent metals. However, the HDS pilot treatment of Canyon Creek groundwater and Bunker Hill AMD resulted in dense sludge within a week of operation. From a treatment performance perspective, the pilot test showed that treating Canyon Creek groundwater in conjunction with Bunker Hill AMD at the CTP is feasible.

Pilot testing of SRB treatment found that one of the media mixtures (referred to as SRB-B in the study) exhibited poor treatment performance. The other SRB media mixture showed high removal of dissolved metals. The field pilot test found that metals treatment appeared to be adversely affected by cold temperatures. The pilot test concluded that larger scale, longer term pilot testing of SRB treatment is recommended if this technology is to be considered for full-scale implementation.

Alternative development and screening for the treatment of Canyon Creek groundwater was conducted as part of the Upper Basin FFS. Remedial actions selected to mitigate dissolved metals in Canyon Creek will be presented in the upcoming Upper Basin Rod Amendment, which is described in Section 2.7.

5.6.4 Gem Portal Pilot Treatment System

The Gem Portal drains groundwater from the historic Helena-Frisco and Black Bear Mines near Canyon Creek. The flow from the portal is reported to vary seasonally from 100 up to 600 gallons per minute (gpm) and averages about 230 gpm. Zinc is the principal chemical of concern and typically is found in concentrations ranging from about 7 to 14 mg/L. The Gem Portal flow currently discharges to Canyon Creek.

Under an AOC,[8] Asarco conducted a test of a passive and a semi-passive pilot treatment system to treat the discharge from the Gem Portal. Construction of the pilot system was substantially completed during 2000. A portion (10 to 20 gpm) of the total Gem Portal discharge compromised the influent to the pilot system. The pilot treatment system consisted of a pre-treatment oxidation/settling pond where iron is precipitated and removed. The inflow is then split in half, with half flowing through a sand filter into Cell T-1 (compost bioreactor) and half flowing through a second sand filter into Cell T-2 (gravel bioreactor). The sand filters remove sediments prior to the treatment cells. The pilot system began operation for Cell T-1 and Cell T-2 in January and July 2001, respectively.

In addition to the two pilot cells, Asarco also completed a study of the Vandal_ION™ process for iron and zinc removal. The technology is a co-precipitation and adsorption process whereby the metals are adsorbed onto iron-oxide-coated sand. The sand is kept in motion in a moving bed reactor where the adsorbed metals are removed from the sand by abrasion, separated in a clarifier, and properly disposed.

The systems tested in this study did not achieve the desired degree of dissolved metals removal (CH2M HILL, 2006a). The Gem Portal discharge was evaluated as part of the FFS. Remedial actions selected to mitigate the Gem Portal discharge will be presented in the upcoming Upper Basin ROD Amendment, which is described in Section 2.7.

5.6.5 Success Mine Pilot Treatment System

The Success Mine and Mill Site is located on East Fork Ninemile Creek, which drains into Ninemile Creek, a tributary to the SFCDR. The mine and mill have not been operated for decades, but environmental impacts from the past operation continue. The primary contaminant source at the site is a 200,000- to 350,000-cy mine and mill waste pile (Golder Associates, 2003). The pile is concentrated in a 10-acre tract in the bottom of a

[8] Administrative Order on Consent; Gem Mine Portal, Canyon Creek; United States Environmental Protection Agency v. ASARCO; USEPA Docket No. 10-97-0172; September 30, 1997.

narrow, steep-sided canyon. The Success Site is located within the Coeur d'Alene mining district, approximately 5 miles northeast of the town of Wallace.

The Success Site has been identified as a significant contributor to metals loading into the SFCDR from the Ninemile Creek Watershed. Of the total loading to the SFCDR from the Ninemile Creek drainage, approximately 37 percent of total lead, cadmium, and zinc under high flow, and 87 percent at base flow, can be traced to the Success Site (Golder Associates, 2003). Due to the location of the mine wastes within the drainage, a significant portion of the East Fork Ninemile alluvial aquifer flows through materials with metal concentrations. This results in large dissolved metals concentrations and loadings in the groundwater immediately downstream of the Success Site.

USEPA relocated the East Fork Ninemile Creek in 1995 to eliminate direct surface contact with mine wastes; however, this alteration of the stream channel did little to reduce metal loading from the groundwater. To address this, SVNRT organized a technical committee to focus on selection and completion of a non-time-critical remedial response for the site. Golder Associates completed several reports that outlined the work done at this site (Golder Associates, 2000a, 2000b, 2000c; 2001a, 2001b; 2002a, 2002b; 2003).

Between 2000 and 2001, a pilot treatment system was designed and installed at the Success Site. The system consists of a subsurface grout wall to intercept groundwater that has been in contact with the mine wastes and direct it to a treatment cell. The treatment cell is a concrete vault that has been subdivided into a pre-filter of washed rock followed by a cell of Apatite WE™, a fishbone apatite mixture. The treated water is then discharged into EFNM. A complete description of the treatment system for the Success Site can be found in the as-built report (Golder Associates, 2002b).

Results of this study indicate the apatite system effectively removed dissolved zinc from groundwater, but significant design and operations issues were encountered (due to clogging) that remain to be resolved, especially for treatment of high flow rates (CH2M HILL, 2006a).

5.6.6 Lane Marsh Characterization

The 2002 OU 3 ROD (USEPA, 2002) identified Lane Marsh as a high-priority area for cleanup based on the potential for contributing to lead poisoning of wildlife, high use by waterfowl, high levels of lead in sediments, availability of site access, and relatively low potential for recontamination during flood events. The benchmark for cleanup of wetlands in the Lower Basin floodplain is to reduce sediment toxicity and waterfowl mortality. RAOs identified in the 2002 OU 3 ROD are presented in Section 5.3.7.1 and include reducing the ecological risk to an acceptable level for aquatic and terrestrial life.

Lane Marsh is approximately 213 acres in size and is bounded on the north and west by the Trail of the Coeur d'Alenes (the former UPRR corridor) and on the south and east by Highway 3, as shown in Figure 5-14 located in Section 5.3.7. In August 2008, USEPA performed an initial site characterization of Lane Marsh to better characterize the nature and extent of the contamination. The site characterization consisted of a topographic survey, wetland habitat characterization survey, hydrologic feature assessment, and sediment sampling, as documented in the Initial Site Characterization Report, Lane Marsh Wetland

(CH2M HILL, 2008a). Key findings of the site characterization are presented in the remainder of this section.

Similar to the agriculture-to-wetland conversion described in Section 5.3.7, the Lane Marsh remedy (see below) would require a clean water input to maintain a constant water elevation year-round. The results of the hydrologic feature assessment indicate that available clean water sources to Lane Marsh from upland tributaries may not be sufficient to maintain this water level.

Results from the sediment sampling show that most of the lead contamination is located in the upper 6 inches of the soil column (CH2M HILL, 2008a). Deposition of suspended particulates has contaminated the Lane Marsh Site. The suspended contaminants reach the site via the channel with the Coeur d'Alene River or by being carried to the site during flood events that overtop the Trail of the Coeur d'Alenes. The hydraulic connection between the Coeur d'Alene River and the marsh is present at the southwest end of the site where the railroad grade was breached during flood conditions. A bridge installed in the area of the breach maintains this connection. Contamination in the southwestern portion of the marsh occurs at higher concentrations and greater depths in the vicinity of the breach, the bridge installation, and the hydrologic connection than elsewhere in the site. Based on the vertical distribution of soil lead concentrations throughout Lane Marsh, it appears that this area is the only location where a breach of the railroad grade has occurred and that the remainder of surficial contamination was caused by flood waters overtopping the Trail of the Coeur d'Alenes.

Data and information obtained during the site characterization guided the development of potential remedial strategies for Lane Marsh, as follows:

- Develop a wetland habitat that has a depth of water similar to current conditions (1 to 3 feet) and contains habitat and vegetation similar to those currently present at the marsh;
- Reduce contaminant levels in the marsh to acceptable levels; acceptable levels are defined as an average soil lead concentration of less than 530 mg/kg in the upper 6 inches of the soil column;
- Provide an adequate and clean source of water to inundate the marsh;
- Design the cleanup to have no adverse impacts on the Trail of the Coeur d'Alenes or State Highway 3;
- Incorporate design elements that will result in minimal operation and maintenance requirements where possible;
- Minimize the amount of soil/sediment that is excavated or otherwise manipulated; and
- Perform no offsite disposal of contaminated soil/sediment (lead concentrations greater than 530 mg/kg). All contaminated soil/sediment will remain within the boundary of the wetland consistent with remedial strategies identified in the 2002 OU 3 ROD.

The site characterization efforts were not intended to be conducted at the scale required to perform a full remedial design for the site. Additional data collection would be necessary to more fully develop and design remedial actions. Remedial design for this site would need to mitigate potential recontamination routed through the former UPRR breach and current bridge location and insufficient clean water sources identified during the site characterization.

5.6.7 River Bank Stabilization in Lower Basin

Approximately 13.3 miles of river banks have had stabilization measures implemented in the Lower Basin by the Natural Resources Conservation Service (NRCS). The measures consist of rock overlays of existing riverbanks and do not include removal of contaminated soils. These measures are intended to slow down the erosion of private lands, which is believed to be primarily caused by wakes from boat traffic during the boating season (Addy, 2010). NRCS is funding these activities from the 2002 Farm Bill (H.R. 2646—Farm Security and Rural Investment Act of 2002, Title II: Conservation) and most recently the 2008 Farm Bill (Public Law 110-246-June 18, 2008 Food, Conservation, and Energy Act of 2008, Title II: Conservation). Within Title II: Conservation, of both Farm Bills, it is the Working Lands Program, specifically the Environmental Quality Incentives Program (EQIP) Wildlife Habitat Incentives Program (WHIP), where funding is made. Actions that USEPA takes in the future in these areas will need to consider the stabilizations measures and assess their overall condition at the time of remedial design and determine whether they meet the intent of portions of the 2002 OU 3 ROD or a comprehensive remedy. Steps will be taken to preserve the measures taken by NRCS to the extent that it is practicable.

5.7 Performance Evaluation of the OU 3 Remedy

The remedy currently being implemented in OU 3 is expected to be protective of human health and the environment where response actions have already been taken, provided that follow-up actions identified in Table 6-6 are implemented. 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.

The remedy included in the 2002 OU 3 ROD 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 fully protect human and environmental resources. In 2008, USEPA initiated efforts to amend the RODs for the Upper Basin portion of the Site in order to better define actions needed to protect water quality and human and ecological receptors in the Upper Basin. This effort also included efforts to identify actions needed to augment the remedial actions taken in Basin residential and community areas to improve their long-term sustainability. At the time of the release of this review, a Proposed Plan outlining the elements of the ROD Amendment has been released for public review and comment (USEPA, 2010a). Upon the completion of the comment period, USEPA will evaluate the comments received and subsequently issue a ROD Amendment for the Upper Basin portion of the Site.

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 ESCM (CH2M HILL, 2010), including sediment transport modeling that will help guide effective decisionmaking regarding future remedial actions in the Lower Basin. The ECSM currently shows that the largest portion of contaminated sediments being transported in the Coeur d'Alene River are re-entrained sediments from the banks and bed of the river in the Lower Basin that are mobilized, transported, and deposited during flood events. USEPA, through a collaborative process, is embarking on the planning process to address these issues in the Lower Basin. The Lower Basin evaluations will likely result in the issuance of a Lower Basin ROD Amendment at a future date.

Significant progress has been made in cleaning up properties and ROWs in Basin residential and community areas, with nearly 2,600 properties and ROWs having been remediated by the end of 2009 (roughly 2,900 properties and ROWs are projected to be completed by the end of the 2010 construction season). The ICP was established and became operational in the Basin in 2007. 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. 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). Annual 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 also decline in response to the remedial actions implemented. Blood-lead screening will also continue to be offered annually to identify at-risk children and provide feedback on the effectiveness of cleanup efforts.

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. The remedies constructed at recreational sites along both the Coeur d'Alene and Spokane Rivers are, in general, functioning as designed.

Two 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. The BCR has been in operation since 2002. The EMFR began operation in 2009. Data indicate that the BCR has been constructed in accordance with the 2002 OU 3 ROD and the BCR design and has reliably contained waste material from remedial actions, as well as wastes generated by citizens, communities, and development activities complying with the ICP. Although the EMFR has been in operation for only a short period, periodic monitoring has found no increases in contaminants of concern in the monitoring well network. Given the short operational time frame, monitoring will continue at the EMFR. 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.

USEPA is working with USFWS and Ducks Unlimited to complete a 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 overall intent of this action is to provide clean waterfowl feeding habitat to reduce their exposure to lead-contaminated sediment. A portion of an agriculture-to-wetland conversion project was completed in 2007 and is functioning as intended by the ROD.

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 did indicate that a management plan for the lake would be developed to focus on 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 revision to the LMP (IDEQ and Coeur d'Alene Tribe, 2009). Initial LMP implementation actions have been taken, and lake monitoring efforts are underway. The effectiveness of LMP implementation will be reported in the next Five-Year Review Report.

The Trail of the Coeur d'Alenes was created by a CERCLA removal action under the National Rails-to-Trails Act. The goals of the removal 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. There are numerous entities that routinely assess and inspect the functionality of the trail as both a recreational facility and a protective barrier. The installed barriers are being maintained and are functioning as designed.

The OU 3 remedy is currently protective of human health and the environment in most areas where remedial actions have been taken. However, flooding and infrastructure issues may affect remedy protectiveness. In addition, the ability of the local communities to improve and maintain infrastructure to protect the remedy is a concern.

6 Actions, Issues, and Recommendations

6.1 Operable Unit 1

Table 6-1 presents the issues and Table 6-2 presents the recommendations and follow-up actions identified for Bunker Hill Superfund Site Operable Unit (OU) 1 during this Five-Year Review process.

6.2 Operable Unit 2

Tables 6-3 and 6-4 present the issues and the recommendations and follow-up actions, respectively, identified for OU 2 during this Five-Year Review process.

6.3 Operable Unit 3

Tables 6-5 and 6-6 present the issues and the recommendations and follow-up actions, respectively, identified for OU 3 during this Five-Year Review process.

TABLE 6-1
Summary of Issues – OU 1
2010 Five-Year Review, Bunker Hill Superfund Site

Issues	Affects Protectiveness (Y/N)	
	Current (now to 1 year)	**Future (>1 year)**
Operation and Maintenance		
O&M Needs: It is not clear whether all protective barriers are being adequately maintained by property owners or whether the barriers are able to withstand everyday use in certain locations.	N	Y
House Dust Lead Concentrations		
Alternative House Dust Lead Source(s): Alternative source(s) may contribute to high dust lead concentrations that persist in some homes following completion of residential soil remediation. In many cases, it is likely that the elevated levels can be attributed to other sources of contamination including soils/sediments from the Coeur d'Alene River Basin where many residents recreate, hillsides within OU 1, occupational sources, lead-based paint, and/or personal activities, occupations, or hobbies.	Y	Y
One-Time Interior Cleaning: 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 led 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.	N	Y
Institutional Controls Program		
ICP Funding and Resources: Permanent funding of the ICP is needed to ensure success of the remedy, including consideration of adequate staff and information management support to ensure the long-term effectiveness of the program.	N	Y
Disposal of ICP Waste		
Community-Fill Policy: ICP waste is being disposed of in locations outside of approved repositories.	N	Y
Infrastructure		
Flood Control: Flooding in the SFCDR and Pine Creek poses a threat to portions of the installed remedy. Comprehensive flood control on the SFCDR and Pine Creek is a complex, multi-jurisdictional issue that exceeds the expertise and regulatory authority of USEPA and IDEQ cleanup programs, and that of the local communities.	N	Y
Roads as Protective Barriers: A number of paved roads throughout all OUs are deteriorating, compromising their ability to function as protective barriers.	Y	Y
Infrastructure Maintenance Funding: Infrastructure maintenance and improvements remain an issue. The remedy relies on functioning infrastructure to be sustainable. Resources to repair and install infrastructure have been difficult to secure by local governments.	N	Y

TABLE 6-2
Summary of Recommendations and Follow-Up Actions – OU 1
2010 Five-Year Review, Bunker Hill Superfund Site

Recommendations/Follow-up Actions	Responsible Entity	Oversight Agency	Proposed Milestone Date	Follow-up Actions: Affects Protectiveness (Y/N)	
				Current (now to 1 year)	**Future (>1 year)**
Operation and Maintenance					
O&M Needs: Develop an approach (or program) that defines how barrier integrity for all remediated properties would be maintained and monitored over time.	Upstream Mining Group (UMG), Panhandle Health District (PHD), IDEQ, USEPA	IDEQ, USEPA	12/2012	N	Y
House Dust Lead Concentrations					
Alternative House Dust Lead Sources: Determine whether additional work is needed to identify alternative lead sources, such as lead-based paint, that may be contributing to house dust lead levels.	PHD, IDEQ	IDEQ, USEPA	12/2012	Y	Y
One-time Interior Cleaning: Evaluate need for implementation of the interior cleaning component of the remedy based in part on information on alternative dust lead sources. Determine additional data/monitoring needs to support one-time interior cleaning evaluation.	IDEQ, USEPA	USEPA	6/2013	N	Y
Institutional Controls Program					
ICP Funding and Resources: 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 (CD).	UMG, IDEQ, USEPA, PHD	IDEQ, USEPA	12/2012	N	Y

TABLE 6-2
Summary of Recommendations and Follow-Up Actions – OU 1
2010 Five-Year Review, Bunker Hill Superfund Site

Recommendations/Follow-up Actions	Responsible Entity	Oversight Agency	Proposed Milestone Date	Follow-up Actions: Affects Protectiveness (Y/N)	
				Current (now to 1 year)	Future (>1 year)
Disposal of ICP Waste					
Community-Fill Policy: Complete the Community Fill Policy (CFP) currently being developed by USEPA and IDEQ for all three OUs.	IDEQ, USEPA	IDEQ, USEPA	12/2011	N	Y
Infrastructure					
Flood Control: Continue working with the Basin Commission and other stakeholders to evaluate and plan actions relative to addressing SFCDR and Pine Creek flooding that may affect cleanups.	Local Governments, IDEQ, USEPA, PHD	IDEQ, USEPA	12/2012	N	Y
Roads as Protective Barriers: Continue working to develop an approach for addressing roads as long-term barriers in collaboration with state, county, and local entities.	Local Governments, IDEQ, USEPA, PHD	IDEQ, USEPA	12/2012	Y	Y
Infrastructure Maintenance Funding: Develop appropriate institutions and funding mechanisms to finance and oversee stewardship activities.	Local Governments, IDEQ, PHD	IDEQ, USEPA	12/2012	N	Y

TABLE 6-3
Summary of Issues – OU 2
2010 Five-Year Review, Bunker Hill Superfund Site

Issues	Affects Protectiveness (Y/N)	
	Current (now to 1 year)	**Future (>1 year)**
Operation and Maintenance		
O&M Needs: Funding and coordination among the State of Idaho O&M program, ICP, local governments and utility districts, and property owners is critical to ensuring that sufficient O&M occurs to preserve the remedy.	N	Y
Smelterville Flats		
Community-Fill Policy: ICP waste is being disposed of in locations outside of approved repositories.	N	Y
Page Pond		
Environmental Monitoring: Although a Page area sampling and analysis plan is under development, a long-term environmental monitoring program has not yet been established.	N	Y
O&M: O&M manuals are under development but not yet completed for the closed portion of Page Repository, the operating portion of Page Repository, or the completed remedial actions.	Y	Y
Bunker Creek		
Bunker Creek Culverts: The lower Bunker Creek culverts, including the I-90 box culvert, were determined to be undersized for accommodating a 100-year flood event.	N	Y
UPRR ROW Remedial Action in the Box		
UPRR Barrier Protectiveness: Portions of the barrier along the trail have degraded or been compromised.	Y	Y
Milo Gulch		
AMD Discharge at Reed and Russell Adits: Near Reed Landing, adit drainage flows into an old surface water channel and into the buried historical 4-foot x 4-foot structure, and eventually daylights onto a soil/tailings slope. Slope and 4-foot x 4-foot structure instability or erosion may occur as a result of this flow.	Y	Y
A-4 Gypsum Pond		
A-4 Contaminant Release: Groundwater level measurements indicate that groundwater periodically rises to above the bottom of the Gypsum Pond, in direct contact with tailings.	Y	Y

TABLE 6-3
Summary of Issues – OU 2
2010 Five-Year Review, Bunker Hill Superfund Site

Issues	Affects Protectiveness (Y/N)	
	Current (now to 1 year)	**Future (>1 year)**
Institutional Controls Program		
ICP Funding and Resources: Permanent funding of the ICP is needed to ensure success of the remedy, including consideration of adequate staff and information management support.. At this time, permanent funding for the OU 2 ICP has not been secured.	N	Y
Infrastructure		
Flood Control: Flooding in the SFCDR and Pine Creek poses a threat to portions of the installed remedy. Comprehensive flood control on the SFCDR and Pine Creek is a complex, multi-jurisdictional issue that exceeds the expertise and regulatory authority of the USEPA and IDEQ cleanup programs, and that of the local communities.	N	Y
Roads as Protective Barriers: A number of paved roads throughout all OUs are deteriorating, compromising their ability to function as protective barriers.	Y	Y
Infrastructure Maintenance Funding: Infrastructure maintenance and improvements remain an issue. The remedy relies on functioning infrastructure to be sustainable. Resources to repair and install infrastructure have been difficult to secure by local governments.	N	Y

TABLE 6-4
Summary of Recommendations and Follow-Up Actions – OU 2
2010 Five-Year Review, Bunker Hill Superfund Site

Recommendations/Follow-up Actions	Responsible Entity	Oversight Agency	Proposed Milestone Date	Follow-up Actions: Affects Protectiveness (Y/N)	
				Current (now to 1 year)	Future (>1 year)
Operation and Maintenance					
O&M Needs: The 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 implementation of O&M.	IDEQ, USEPA	IDEQ, USEPA	12/2011	N	Y
Smelterville Flats					
*Community-Fill Polic*y: Complete the CFP currently being developed by USEPA and IDEQ for all three OUs.	IDEQ, USEPA	IDEQ, USEPA	12/2012	N	Y
Page Pond					
Environmental Monitoring: Continue to work with the site-wide water quality monitoring program (i.e., forthcoming revised Basin Environmental Monitoring Plan) to integrate special considerations at the Page Pond.	UMG, IDEQ, USEPA	IDEQ, USEPA	6/2011	N	Y
O&M: Continue to develop a comprehensive O&M and Site Closure Plan for the Page Repository.	IDEQ, PHD, UMG	IDEQ, USEPA	4/2011	N	Y
Bunker Creek					
Bunker Creek Culverts: Continue working with the Basin Commission and other stakeholders to evaluate and plan actions relative to addressing SFCDR and Pine Creek flooding issues.	Local Governments	IDEQ, USEPA	12/2012	N	Y
UPRR ROW Remedial Action in the Box					
UPRR Barrier Protectiveness: Ensure that O&M obligations defined in the CD are met to protect the integrity of the installed barriers.	UPRR	IDEQ, PHD, USEPA	12/2010	Y	Y

TABLE 6-4
Summary of Recommendations and Follow-Up Actions – OU 2
2010 Five-Year Review, Bunker Hill Superfund Site

Recommendations/Follow-up Actions	Responsible Entity	Oversight Agency	Proposed Milestone Date	Follow-up Actions: Affects Protectiveness (Y/N)	
				Current (now to 1 year)	**Future (>1 year)**
Milo Gulch					
AMD Discharge at Reed and Russell Adits: Continue discussions/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 x 4-foot structure.	USEPA	USEPA	12/2010	Y	Y
A-4 Gypsum Pond					
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 remedial design report (RDR).	SMC	IDEQ, USEPA	12/2011	N	Y
Institutional Controls Program					
ICP Funding and Resources: Secure permanent funding for the ICP, including consideration of adequate staff and information management support to ensure the long-term effectiveness of the program.	IDEQ, USEPA, PHD	IDEQ, USEPA	12/2012	N	Y
Infrastructure					
Flood Control: Continue working with the Basin Commission and other stakeholders to evaluate and plan actions relative to addressing SFCDR and Pine Creek flooding that may affect cleanups.	Local Governments, IDEQ, USEPA, PHD	IDEQ, USEPA	12/2012	N	Y
Roads as Protective Barriers: Continue working to develop an approach for addressing roads as long-term barriers in collaboration with state, county, and local entities.	Local Governments, IDEQ, USEPA, PHD	IDEQ, USEPA	12/2012	Y	Y
Infrastructure Maintenance Funding: Develop appropriate institutions and funding mechanisms to finance and oversee stewardship activities.	Local Governments, IDEQ, PHD	IDEQ, USEPA	12/2012	N	Y

TABLE 6-5
Summary of Issues – OU 3
2010 Five-Year Review, Bunker Hill Superfund Site

Issues	Affects Protectiveness (Y/N)	
	Current (now to 1 year)	**Future (>1 year)**
Operation and Maintenance		
O&M Needs: It is not clear whether all protective barriers are being adequately maintained by property owners or whether the barriers are able to withstand everyday use in certain locations.	N	Y
Lead Health Intervention Program		
Dust Intervention Protocol: The dust intervention protocol in the 2002 OU 3 ROD is not being implemented	N	Y
Institutional Controls Program		
ICP Funding and Resources: Adequate funding of the ICP is needed to ensure success of the remedy, including consideration of sufficient staff and information management.	N	Y
Community-Wide Lead Remedial Action Objective (RAO): The lack of a community-wide lead RAO poses disposal challenges for ICP implementation in the Basin.	N	Y
Disposal of Wastes from Human Health Remedial Actions		
Community-Fill Policy: ICP waste is being disposed of in locations outside of approved repositories.	N	Y
Infrastructure		
Flood Control: Flooding on the SFCDR and Pine Creek poses a threat to portions of the installed remedy. Comprehensive flood control on the SFCDR and Pine Creek is a complex, multi-jurisdictional issue that exceeds the expertise and regulatory authority of USEPA and IDEQ cleanup programs, and that of the local communities.	N	Y
Roads as Protective Barriers: A number of paved roads throughout all OUs are deteriorating, compromising their ability to function as protective barriers.	Y	Y
Infrastructure Maintenance Funding: Infrastructure maintenance and improvements remain an issue. The remedy relies on functioning infrastructure to be sustainable. Resources to repair and install infrastructure have been difficult to secure by local governments.	N	Y

TABLE 6-5
Summary of Issues – OU 3
2010 Five-Year Review, Bunker Hill Superfund Site

Issues	Affects Protectiveness (Y/N)	
	Current (now to 1 year)	**Future (>1 year)**
Upper Basin Mine and Mill Sites		
Mine and Mill Site O&M: O&M of the mine and mill sites where remedial actions have been completed is not formally conducted.	Y	Y
Rex Site Contaminant Release: Rex Creek upstream from the remedial action and the Rex Adit flow infiltrate into the subsurface prior to entering the diversion channel. Infiltrating water could be contacting contaminated materials and transporting dissolved metals into Rex Creek. Significant differences in dissolved metal concentrations have been observed as part of the remedial action effectiveness monitoring. Possible solutions could be lining portions of the diversion channel.	Y	Y
Repositories		
Long-Term Disposal Need from ICP: The timing and waste volumes from ICP-regulated activities needing to be placed in repositories should be better quantified.	N	Y
Long-Term Disposal Need from Remedial Actions : The timing and waste volumes from remedial actions needing to be placed in repositories should be better quantified.	N	Y
Coeur d'Alene Lake		
Lake Management Plan Implementation: Management of land-use activities to prevent the acceleration of eutrophication under the LMP is necessary to minimize the potential release of metals from contaminated sediments.	N	Y
UPRR ROW Removal Action		
UPRR Barrier Protectiveness: Asphalt buckling will need continued monitoring.	N	Y

TABLE 6-6
Summary of Recommendations and Follow-Up Actions – OU 3
2010 Five-Year Review, Bunker Hill Superfund Site

Recommendations/Follow-up Actions	Responsible Entity	Oversight Agency	Proposed Milestone Date	Follow-up Actions: Affects Protectiveness (Y/N)	
				Current (now to 1 year)	Future (>1 year)
Operation and Maintenance					
O&M Needs: Develop an approach (or program) that defines how barrier integrity for all remediated properties would be maintained and monitored over time.	IDEQ, PHD, USEPA	IDEQ, USEPA	12/2012	N	Y
Lead Health Intervention Program					
Program Implementation: Determine whether an alternative approach to the 2002 OU 3 ROD's dust intervention protocol can be established and implemented.	IDEQ, PHD, USEPA	IDEQ, USEPA	12/2012	N	Y
Institutional Controls Program					
ICP Funding and Resources: 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.	IDEQ, PHD, USEPA	IDEQ, USEPA	12/2012	N	Y
Community-Wide Lead RAO: Determine whether a community-wide lead level is needed for the Basin. If so, determine the appropriate level and how it would be used.	IDEQ, PHD, USEPA	IDEQ, USEPA	12/2012	N	Y
Disposal of Wastes from Human Health Remedial Actions					
Community-Fill Policy: Complete CFP currently being developed by USEPA and IDEQ for all OUs.	IDEQ, USEPA	IDEQ, USEPA	12/2012	N	Y

TABLE 6-6
Summary of Recommendations and Follow-Up Actions – OU 3
2010 Five-Year Review, Bunker Hill Superfund Site

Recommendations/Follow-up Actions	Responsible Entity	Oversight Agency	Proposed Milestone Date	Follow-up Actions: Affects Protectiveness (Y/N)	
				Current (now to 1 year)	Future (>1 year)
Infrastructure					
Flood Control: Continue working with the Basin Commission and other stakeholders to evaluate and plan actions relative to addressing SFCDR and Pine Creek flooding that may affect cleanups.	Local Governments, IDEQ, USEPA, PHD	IDEQ, USEPA	12/2012	N	Y
Roads as Protective Barriers: Continue working to develop an approach for addressing roads as long-term barriers in collaboration with state, county, and local entities.	Local Governments, IDEQ, USEPA, PHD	IDEQ, USEPA	12/2012	Y	Y
Infrastructure Maintenance Funding: Develop appropriate institutions and funding mechanisms to finance and oversee stewardship activities.	Local Governments, IDEQ, USEPA, PHD	IDEQ, USEPA	12/2012	N	Y
Upper Basin Mine and Mill Sites					
Mine and Mill Site O&M: Coordinate with responsible entities to formally implement O&M at mine and mill sites with completed remedial actions.	BLM, IDEQ, USEPA	BLM, IDEQ, USEPA	10/2011	Y	Y
Rex Site Contaminant Release: Mitigate the infiltration of Rex Creek and the Rex Adit flow upgradient from the remedial action.	BLM, IDEQ, USEPA	BLM, IDEQ, USEPA	10/2011	Y	Y
Repositories					
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	PHD, IDEQ	IDEQ, USEPA	12/2011	N	Y
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, USEPA	IDEQ, USEPA	12/2011	N	Y

TABLE 6-6
Summary of Recommendations and Follow-Up Actions – OU 3
2010 Five-Year Review, Bunker Hill Superfund Site

Recommendations/Follow-up Actions	Responsible Entity	Oversight Agency	Proposed Milestone Date	Follow-up Actions: Affects Protectiveness (Y/N)	
				Current (now to 1 year)	Future (>1 year)
Clean Waterfowl Feeding Area/Agriculture-to-Wetland Conversion *Easement Transfer*: 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.)	USEPA	--	6/2011	N	N
Coeur d'Alene Lake *LMP Implementation*: Continue LMP implementation activities and lake monitoring efforts.	Tribe, State	USEPA	11/2015	N	Y
UPRR ROW Removal Action *UPRR Barrier Protectiveness*: Continue monitoring the barrier and conduct maintenance as needed.	UPRR	Coeur d'Alene Tribe, State of Idaho	Ongoing	N	Y

7 Statement of Protectiveness

7.1 Operable Unit 1

The remedy currently being implemented in Operable Unit (OU) 1 is expected to be protective of human health and the environment where response actions have already been taken, provided that follow-up actions identified in Table 6-2 are implemented. Exposure pathways that could result in unacceptable risks are being controlled or addressed in locations where remedial work has been completed. There are some homes where interior house dust lead concentrations remain high. The need to identify alternative lead sources, such as lead-based paint, will be evaluated. Based, in part, on information related to alternative lead sources, a determination will be made related to the need to implement the interior cleaning component of the OU 1 remedy.

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 Record of Decision (ROD; U.S. Environmental Protection Agency [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 remedial action objectives (RAOs), and the Institutional Controls Program (ICP) has been established and is operating. House dust lead levels have declined to below the 500 milligrams per kilogram (mg/kg) site-wide average RAO. However, in 2008, 5 percent of sampled homes in OU 1 exhibited interior dust lead concentrations greater than 1,000 mg/kg. The 1991 OU 1 ROD contemplates a one-time cleaning of homes exhibiting lead dust concentration above 1000 mg/kg. The 1990 and 2000 interior cleaning pilot studies concluded that one-time residential interior cleaning is likely not a sustainable remedy for homes with house dust equal to or greater than 1,000 mg/kg lead.

The OU 1 remedy is currently protective of human health and the environment where remedial actions have been taken. However, it is possible that flooding and infrastructure issues may affect remedy protectiveness. In addition, the ability of the local communities to improve and maintain infrastructure to protect the remedy is a concern. Provision of a long-term ICP repository is essential to the continued performance of the installed human health barriers.

In 2008, USEPA initiated efforts to identify actions needed to augment the remedial actions taken in OU 1 residential and community areas to improve their long-term sustainability. At the time of the release of this review, a Proposed Plan outlining the elements of a ROD Amendment for the Upper Basin portion of the Site, which includes actions to augment the OU 1 remedy, has been released for public review and comment (USEPA, 2010a). Upon the completion of the comment period, USEPA will evaluate the comments received and subsequently issue a ROD Amendment for the Upper Basin portion of the Site.

7.2 Operable Unit 2

The remedy currently being implemented in OU 2 is expected to be protective of human health and the environment where response actions have already been taken, provided that follow-up actions identified in Table 6-4 are implemented. In the interim, exposure pathways that could result in unacceptable risks are being controlled or addressed in locations where remedial work has been completed.

In 1995, with the bankruptcy of the Site’s major Potentially Responsible Party (PRP), USEPA and the State of Idaho defined a path forward for phased remedy implementation in OU 2. Phase I of remedy implementation includes extensive source removal and stabilization efforts, demolition activities, community development initiatives, development and implementation of the ICP, land use development support, and public health response actions. Phase I also includes 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 acid mine drainage (AMD) is also included in Phase I of remedy implementation.

Phase I remedies have removed and consolidated over 2.8 million cubic yards (cy) of contaminated waste onsite in engineered closure areas (the Smelter and Central Impoundment Area [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.

Also, as summarized in Table 4-1, 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 operation and maintenance (O&M) of OU 2 Phase I remedial actions has been transferred to the State of Idaho upon completion of the remedies and development of area-specific O&M manuals.

In 2008, USEPA initiated efforts to identify actions needed to augment the remedial actions taken in OU 2, building on information produced during evaluations of Phase I remedial actions. Results of the evaluation of Phase I source control and removal activities to meet human health and ecological water quality goals have been incorporated into the 2010 Focused Feasibility Study (FFS; USEPA, 2010b; see Section 2.7 for more information on the FFS).

A State Superfund Contract (SSC) Amendment that allows for the full implementation of the 2001 OU 2 ROD Amendment needs to be negotiated and signed. Time-critical components of this ROD Amendment were implemented to prevent catastrophic failure of the CTP and discharges of AMD to Bunker Creek and the South Fork Coeur d'Alene River (SFCDR). Until an SSC Amendment is signed, however, control and treatment of AMD and its impact on water quality will continue to be an issue.

The OU 2 remedy is currently protective of human health and the environment where remedial actions have been taken. However, flooding and infrastructure issues may affect remedy protectiveness. In addition, the ability of the local communities to improve and maintain infrastructure to protect the remedy is a concern. Provision of a long-term ICP repository is essential to the continued performance of the installed human health barriers.

7.3 Operable Unit 3

The remedy currently being implemented in OU 3 is expected to be protective of human health and the environment where response actions have already been taken, provided that follow-up actions identified in Table 6-6 are implemented. 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.

The remedy included in the 2002 OU 3 ROD (USEPA, 2002) 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 fully protect human and environmental resources. In 2008, USEPA initiated efforts to amend the RODs for the Upper Basin portion of the Site in order to better define actions needed to protect water quality and human and ecological receptors in the Upper Basin. The Upper Basin refers to areas of mining related contamination along the SFCDR, its tributaries, and the Bunker Hill Box. This effort also included efforts to identify actions needed to augment the remedial actions taken in Basin residential and community areas to improve their long-term sustainability. At the time of the release of this review, a Proposed Plan outlining the elements of the ROD Amendment has been released for public review and comment (USEPA, 2010a). Upon the completion of the comment period, USEPA will evaluate the comments received and subsequently issue a ROD Amendment for the Upper Basin portion of the Site.

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 Enhanced Conceptual Site Model (ESCM; CH2M HILL, 2010), including sediment transport modeling that will help guide effective decision-making regarding future remedial actions in the Lower Basin. The ECSM currently shows that the largest portion of contaminated sediments being transported in the Coeur d'Alene River are re-entrained sediments from the banks and bed of the river in the Lower Basin that are mobilized, transported, and deposited during flood events. USEPA, through a collaborative process, is embarking on the planning process to address these issues in the Lower Basin. The Lower Basin evaluations will likely result in the issuance of a Lower Basin ROD Amendment at a future date.

Significant progress has been made in cleaning up properties and rights-of-way (ROWs) in Basin residential and community areas, with nearly 2,600 properties and ROWs having been remediated by the end of 2009 (roughly 2,900 properties and ROWs are projected to be completed by the end of the 2010 construction season). The ICP was established and became operational in the Basin in 2007. 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. 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). Annual 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 also decline in response to the remedial actions implemented. Blood-lead screening will also continue to be offered annually to identify at-risk children and provide feedback on the effectiveness of cleanup efforts.

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. The remedies constructed at recreational sites along both the Coeur d'Alene and Spokane Rivers are, in general, functioning as designed.

Two 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. The Big Creek Repository (BCR) has been in operation since 2002. The East Mission Flats Repository (EMFR) began operation in 2009. Data indicate that the BCR has been constructed in accordance with the 2002 OU 3 ROD and the BCR design and has reliably contained waste material from remedial actions, as well as wastes generated by citizens, communities, and development activities complying with the ICP. Although the EMFR has been in operation for only a short period, periodic monitoring has found no increases in contaminants of concern in the monitoring well network. Given the short operational time frame, monitoring will continue at the EMFR. 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.

USEPA is working with USFWS and Ducks Unlimited to complete a 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 overall intent of this action is to provide clean waterfowl feeding habitat to reduce their exposure to lead-contaminated sediment. A portion of an agriculture-to-wetland conversion project was completed in 2007 and is functioning as intended by the ROD.

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 did indicate that a management plan for the lake would be developed to focus on 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 revision to the Lake Management Plan (LMP; Idaho Department of Environmental Quality [IDEQ] and Coeur d’Alene Tribe, 2009). Initial LMP implementation actions have been taken and lake monitoring efforts are underway. The effectiveness of LMP implementation will be reported in the next Five-Year Review Report.

The Trail of the Coeur d’Alenes was created by a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) removal action under the National Rails-to-Trails Act. The goals of the removal 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 applicable or relevant and appropriate requirements (ARARs). There are numerous entities that routinely assess and inspect the functionality of the trail as both a recreational facility and a protective barrier. The installed barriers are being maintained and are functioning as designed.

The OU 3 remedy is currently protective of human health and the environment in most areas where remedial actions have been taken. However, flooding and infrastructure issues may affect remedy protectiveness. In addition, the ability of the local communities to improve and maintain infrastructure to protect the remedy is a concern.

8 Next Five-Year Review

The Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Section 121(c) requires the U.S. Environmental Protection Agency (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 and Report was delayed to October 24, 2005.

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

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