SECOND FIVE-YEAR REVIEW REPORT FOR BLACKBIRD MINE SITE LEMHI COUNTY, IDAHO

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8/23/13

Date

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Acronyms and Abbreviations

AOC	Administrative Order on Consent
ARAR	applicable or relevant and appropriate requirement
ARD	acid rock drainage
BMSG	Blackbird Mine Site Group
CCC	criteria continuous concentration
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CMC	criteria maximum concentration
COC	contaminant of concern
COPC	contaminant of potential concern
cy	cubic yard(s)
DLBS	Downstream Low Bar South
DLBW	Downstream Low Bar West
EPA	U.S. Environmental Protection Agency
ESD	Explanation of Significant Differences
FCC	Formation Capital Corporation
FS	feasibility study
gpm	gallons per minute
HDPE	high density polyethylene
HQ	hazard quotient
ICP	Idaho Cobalt Project
IC	institutional control
IDEQ	Idaho Department of Environmental Quality
IDFG	Idaho Department of Fish and Game
IWQS	Idaho Water Quality Standard
MCL	maximum contaminant level
mg/kg	milligram per kilogram
mg/L	milligrams per liter
MOU	Memorandum of Understanding

NCP	National Contingency Plan
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NRDA	Natural Resource Damage Assessment
O&M	operations and maintenance
OU	Operable Unit
PRP	Potentially Responsible Parties
RAO	Remedial Action Objectives
RI	Remedial Investigation
ROD	Record of Decision
SCNF	Salmon-Challis National Forest
site	Blackbird Mine Site
SOW	Statement of Work
Trustees	Natural Resource Trustees
UAO	Unilateral Administrative Order
UCL	upper confidence limit
ULBE	Upstream Low Bar East
U.S.	United States
USFS	U.S. Department of Agriculture Forest Service (United States Forest Service)
USFWS	U.S. Fish and Wildlife Service
WTP	Water Treatment Plant

Executive Summary

This report presents the findings of the second Five-Year Review performed for the Blackbird Mine, Lemhi County, Idaho (the Site). The Five-Year Review was conducted to determine if human health and the environment are being protected through the implementation of the selected remedy.

The remedy for the Blackbird Mine Site as identified in the 2003 Record of Decision (ROD) included collection, storage, and treatment of contaminated waters from mine drainage and mine wastes, diversion facilities to reroute clean and contaminated waters, relocation and capping of waste rock, removal and stabilization of contaminated overbank deposits, natural recovery of in-stream sediments, long-term operation and maintenance, and institutional controls (ICs).

The Five-Year Review was conducted in accordance with the U.S. Environmental Protection Agency (EPA) *Comprehensive Five-Year Review Guidance (*EPA, 2001) and included the following:

- Review of site data to evaluate compliance with the risk-based surface water, sediments, overbank soils, and groundwater performance standards specified by the ROD.
- A site inspection to evaluate whether the remedy is operating and being maintained consistent with the ROD objectives and requirements.
- Review of federal and state regulations promulgated since the last Five-Year Review that could affect the remedy's overall protectiveness with respect to performance standards specified in the ROD.

During the last 5 years, additional study and analysis were conducted to assess whether additional response actions were needed to minimize recurring recontamination of downstream properties. Additionally, questions have been raised concerning oxyhydroxide floc, and whether it is a source of arsenic that poses a potential risk to humans primarily in overbank deposits. Lastly, EPA published a new reference dose for cobalt, which required additional risk assessment evaluations of media of concern and sampling and analysis to determine if additional response actions were needed. Thus, over the last 5 years, the Blackbird Mine Site Group (BMSG) has focused on implementing the monitoring program, characterization and removal of contaminated overbank soils, construction of in-stream stabilization features in Blackbird Creek, and miscellaneous optimization improvements to the overall remedy.

The results of this Five-Year Review indicate that the remedy is not yet performing as intended because not all of the necessary ICs have been implemented. In addition, concentrations of contaminants of concern (COCs) in surface waters and sediments remain above cleanup levels in certain streams, certain overbank soils exceed cleanup levels, effectiveness of the Blackbird Creek stabilizations structures is unknown, and the significance of floc as a source of arsenic that poses a potential risk to humans is unknown. Finally, the full nature and extent of the cobalt groundwater contamination in the Blackbird Creek, Panther Creek, and Bucktail Creek drainage shallow alluvium aquifer has not been fully defined. In addition, a pipeline to divert Bucktail Creek around South Fork Big Deer Creek has not yet been constructed to allow for further monitoring through 2014 to determine if the pipeline is needed.

Implementation of contingent actions in Blackbird Creek including the construction of in-stream stabilization structures and additional soil characterization and removal in Blackbird Creek and Panther Creek provide support for the remedy to function as intended. Continued monitoring and optimization of (if determined to be necessary) the in-stream stabilization structures will be necessary to abate any future high flow events recontaminating overbank soils downstream.

It is anticipated that the remedy will be protective upon completion of all remedial actions, completion of relevant contingent actions, evaluation and optimization (if determined to be necessary) of in-stream

stabilization along Blackbird Creek, implementation of all ICs, and following natural recovery of sediments.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name: Blackbird Mine Site		
EPA ID: IDD980725832		
Region: 10	**State:** Idaho	**City/County:** 25 West of the city of Salmon, Lemhi County

SITE STATUS	
NPL Status: Proposed. Site was proposed by EPA for NPL listing in May 1993, but was not listed due to lack of concurrence by the State of Idaho	
Multiple OUs? No	**Has the site achieved construction completion?** No

REVIEW STATUS
Lead agency: EPA **If "Other Federal Agency" was selected above, enter Agency name:** Click here to enter text.
Author name (Federal or State Project Manager): Fran Allans
Author affiliation: EPA Region 10
Review period: August 2008 – August 2013
Date of site inspection: September 25, 2012
Type of review: Statutory
Review number: 2
Triggering action date: August 25, 2008
Due date *(five years after triggering action date)*: August 25, 2013

Issues/Recommendations

Issues and Recommendations Identified in the Five-Year Review:				
OU(s): N/A	**Issue Category: Remedy Performance**			
	Issue: Concentrations of COCs in sediments remain above current cleanup levels at certain times and places in area creeks downstream from the mine.			
	Recommendation: Continue to implement the sediment monitoring program to determine if further action is warranted.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	8/25/2018

Five-Year Review Summary Form (continued)

Issues and Recommendations Identified in the Five-Year Review:				
OU(s): N/A	**Issue Category: Remedy Performance**			
	Issue: Concentrations of COCs in certain overbank areas soils exceed cleanup levels.			
	Recommendation Conduct removal of soils at (b) (6) pastures/overbank areas.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
Yes	Yes	PRP	EPA	12/31/2014

Issues and Recommendations Identified in the Five-Year Review:				
OU(s): N/A	**Issue Category: Remedy Performance**			
	Issue: Surface water cleanup levels are not currently met in South Fork Big Deer Creek.			
	Recommendation Monitor in South Fork Big Deer Creek through 2014 to determine if the diversion pipeline is warranted.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
Yes	Yes	PRP	EPA	12/31/2014

Issues and Recommendations Identified in the Five-Year Review:				
OU(s): N/A	**Issue Category: Remedy Performance**			
	Issue: Surface water cleanup levels are not currently met in the lower reaches of Big Deer Creek.			
	Recommendation Continue monitoring in Big Deer Creek and identify if any additonal actions are necessary if water quality goals are not achieved and exceedances are due to the Blackbird Mine			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	8/25/2018

Issues and Recommendations Identified in the Five-Year Review:				
OU(s): N/A	**Issue Category: Remedy Performance**			
	Issue: ICs have not been established or implemented at the Cobalt Townsite, former Panther Creek Inn area, and the Blackbird Mine.			
	Recommendation Continue efforts with the PRPs and Department of Justice to have ICs implemented**.**			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	12/31/2013

Five-Year Review Summary Form (continued)

Issues and Recommendations Identified in the Five-Year Review:				
OU(s): N/A	**Issue Category: Remedy Performance**			
	Issue: The nature and extent of cobalt contamination in the Panther Creek shallow alluvium aquifer has not been fully defined.			
	Recommendation: Conduct a study to characterize the nature and extent of groundwater contamination.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	12/31/2013

Issues and Recommendations Identified in the Five-Year Review:				
OU(s): N/A	**Issue Category: Remedy Performance**			
	Issue: Bucktail Creek groundwater concentration of cobalt exceeds the cleanup level. Nature and extent of groundwater contamination in Bucktail Creek and South Fork Big Deer Creek drainage has not been fully characterized.			
	Recommendation: Conduct a study to characterize the nature and extent of groundwater contamination.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	12/31/2013

Issues and Recommendations Identified in the Five-Year Review:				
OU(s): N/A	**Issue Category: Remedy Performance**			
	Issue: The effectiveness of the Blackbird Creek stabilization structures is unknown.			
	Recommendation: Continue to monitor the effectiveness of stabilization structures and conduct future contingent action removals along Panther Creek in overbank areas if they become recontaminated at concentrations above the cleanup levels.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	8/28/2018

Five-Year Review Summary Form (continued)

Issues and Recommendations Identified in the Five-Year Review:				
OU(s): N/A	**Issue Category: Remedy Performance**			
	Issue: The significance of oxyhydroxide floc as a recontamination source is unknown.			
	Recommendation: Continue to monitor arsenic concentrations in oxyhydroxide floc deposits in Blackbird Creek and Panther Creek overbanks when there is an event that results in them being inundated.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	8/25/2018

Protectiveness Statement(s)		
Operable Unit: N/A	*Protectiveness Determination:* Will Be Protective	*Addendum Due Date (if applicable):* Click here to enter date.
Protectiveness Statement: The remedy at the Blackbird Mine Site is expected to be protective of human health and the environment upon completion of all remaining remedial actions, completion of any relevant contingent actions (if determined to be necessary), evaluation and optimization of in-stream stabilization and any potential additional measures along Blackbird Creek, and implementation of all ICs. In the interim, remedial activities completed to date have adequately addressed all exposure pathways that could result in unacceptable risks in those areas.		

SECTION 1

Introduction

1.1 Purpose of the Review

The U.S. Environmental Protection Agency (EPA) Region 10, the lead agency for this site, has conducted a statutory Five-Year Review of the Blackbird Mine Site (site) located in Lemhi County, Idaho. This review was conducted from October 2012 through August 2013 and is the second Five-Year Review for this site.

Investigations, Early Actions, Remedial Designs, and Remedial Actions at this site have been conducted under EPA oversight by the potentially responsible parties (PRPs) for the site. The PRPs identified for the site include: Noranda Exploration, Inc., Noranda Mining, Inc., Blackbird Mining Company Limited Partnership, M. A. Hanna Company, Hanna Services Company and their predecessor Rojet Enterprises, now known as Polyone Corporation, and Alumet Corporation, successor to Alumax Corporation, Pechiney Corporation, and Intalco Aluminum Corporation. Certain PRPs have formed a group named the Blackbird Mine Site Group (BMSG) that has taken the lead in performing investigations and cleanup actions at the site.

The purpose of the Five-Year Review is to evaluate the implementation and performance of the remedy to determine if the remedy is or will be protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in this Five-Year Review report. In addition, this Five-Year Review report identifies issues found during the review, if any, and provides recommendations to address them.

1.2 Authority for Conducting the Review

Five-Year Reviews are required whenever remedial actions result in hazardous substances, pollutants, or contaminants remaining onsite above levels that allow for unlimited use and unrestricted exposure (UU/UE). EPA prepared this statutory Five-Year Review pursuant to Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121(c) and the National Contingency Plan (NCP). CERCLA Section 121(c) 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 action 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 to 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.

EPA interpreted this requirement further in the NCP; 40 *Code of Federal Regulations* (CFR) 300.430(f)(4)(ii) 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 initiation of the selected remedial action.

1.3 Who Conducted the Review

EPA Region 10 conducted this Five-Year Review of the cleanup actions implemented at the Blackbird Mine Site in Lemhi County, Idaho. The Five-Year Review was conducted from October 2012 through August 2013. This report documents the results of the Five-Year Review.

1.4 Lead and Support Agencies

EPA Region 10 is the lead agency and the U.S. Department of Agriculture, Forest Service (USFS) and Idaho Department of Environmental Quality (IDEQ) are the support agencies at this site. EPA and USFS entered into a Memorandum of Understanding (MOU) in November 1995 regarding oversight and management of the site, given that releases from the Blackbird Mine have impacted land under the management of USFS. In the MOU, it was agreed that EPA would be lead agency with USFS serving as support agency and exercising particular consultative and concurrence roles with respect to certain major decisions.

The National Oceanic and Atmospheric Administration (NOAA) has provided extensive input and guidance. USFS, IDEQ, and NOAA are collectively referred to as the Natural Resource Trustees (Trustees). Several other resource agencies also have been actively involved at the Site and have provided extensive input and guidance. These agencies include the National Marine Fisheries Service (NMFS), the U.S. Fish and Wildlife Service (USFWS) and the Idaho Department of Fish and Game (IDFG). The Shoshone-Bannock Tribe and the Nez Perce Tribe have represented Native American interests at the site.

1.5 Other Review Components

This is the second Five-Year Review for the Blackbird Mine Site. The triggering action for this review was the completion of the first Five-Year Review in August 2008. This Five-Year Review is required because hazardous substances, pollutants, or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure.

SECTION 2

Site Chronology

Table 2-1 presents a chronology of cleanup actions and regulatory events that have occurred at the Blackbird Mine Site.

TABLE 2-1
Chronology of Blackbird Mine Site Events
Blackbird Mine Site, Lemhi County, Idaho

Cleanup Actions or Regulatory Events	Date
USFS removed bed tailings, sediments, and debris from approximately 5,000 linear feet of the Blackbird Creek Channel, and deposited the materials outside of the Blackbird channel.	1975
The State of Idaho initiated a Natural Resource Damage Assessment (NRDA) lawsuit for the Blackbird Mine cleanup and natural resource damages restoration pursuant to CERCLA. Subsequently, the United States joined the lawsuit in 1993.	December 1983 to June 1992
EPA proposed to add the Blackbird Mine Site to the National Priorities List (NPL), pursuant to Section 105(a)(8) of CERCLA, 42 United States Code 9605(a)(8). The site was not added to the NPL because of lack of concurrence by the State of Idaho.	May 1993
Unilateral Administrative Order (UAO) issued by EPA to Noranda Mining, Inc (EPA Docket No. 1093-07-04-106). Emergency response actions at the West Fork Tailing Impoundment to minimize the potential for release of tailings into Blackbird and Panther Creeks.	July 1993
Emergency Response design and construction at the West Fork Tailing Impoundment.	1993-1994
AOC issued by EPA to M.A. Hanna Company, and several other parties (EPA Docket No. 10-94-0222) requiring the Respondents to conduct a Remedial Investigation (RI)/Feasibility Study (FS).	November 1994
NRDA Consent Decree entered by federal district court (No. 83-4179 *State of Idaho, et al. v. The M.S. Hanna Company et al*.) committing the Settling Defendants to, among other things, restore water quality in Panther Creek and Big Deer Creek to a level that will support all life stages of salmonids, implement a Natural Resource Restoration Plan for returning Snake River Chinook salmon to Panther Creek, and implement the future remedial actions under separate order or consent decree.	June 1995
AOC issued by EPA to the BMSG (EPA Docket No. 10-95-0083) requiring non time-critical removal actions to control sources of acid rock drainage (ARD), overbank deposit removal actions, and collect waters in the Bucktail Creek and Meadow Creek drainage basins for treatment. These actions are referred to as the Early Actions.	June 1995
Early Action designs and construction (multiple designs were completed for the Early Actions, and these designs were generally completed during the spring of each year for that year's construction season).	1995-2002
Remedial Investigation completed.	November 2001
Feasibility Study completed.	June 2002
Proposed Plan issued by EPA.	August 2002
Record of Decision (ROD) issued by EPA.	March 2003
Unilateral Administrative Order (UAO) issued by EPA to the BMSG (EPA Docket No. CERCLA-10-2003-0112) requiring the BMSG to implement Remedial Designs and Remedial Actions consistent with the ROD; the UAO was amended in August 2003, February 2011, and February 2013. The Statement of Work (SOW) attached to the UAO has been modified seven times.	July 2003, August 2003, February 2011, February 2013
Remedial Action designs and construction (multiple designs were completed for the Remedial Actions, and these designs were generally completed during the spring of each year for that year's construction season).	August 2003 to August 2012
Explanation of Significant Differences (ESD) to the ROD was issued by EPA to change the cobalt water quality cleanup level from 0.038 milligrams per liter (mg/L) to 0.086 mg/L.	July 2007
First FYR conducted	August 2008

TABLE 2-1
Chronology of Blackbird Mine Site Events
Blackbird Mine Site, Lemhi County, Idaho

Cleanup Actions or Regulatory Events	Date
ESD to the ROD was issued by EPA to establish cleanup levels for cobalt in overbank deposits in Blackbird Creek and Panther Creek, and lowered the cleanup level for cobalt in groundwater. Revised recreational-use scenarios for certain USFS lands, increasing the arsenic and cobalt cleanup levels.	May 2012

SECTION 3

Background

3.1 General Site Description

Discovered in 1893, the Blackbird Mine Site is located within one of the largest of North America's cobalt deposits. The mine sits within the Salmon-Challis National Forest (SCNF), approximately 25 miles west of the town of Salmon in Lemhi County, Idaho. The former mining town of Cobalt is located approximately 8 miles east from the mine along Panther Creek (Figure 3-1). The River of No Return Wilderness area is located approximately 5 miles north of the mine site. The Blackbird Mine consists of approximately 830 acres of private patented mining claims and surrounding National Forest land.

The Blackbird Mine Site is located within the Northern Rocky Mountain physiographic province and is topography characterized by deep stream cut canyons having steep and rocky slopes. Regional elevations range from 3,000 feet at the confluence of Panther Creek and the Salmon River, to approximately 9,000 feet near the site.

The mine site lies within two primary drainages: Bucktail Creek and Meadow/Blackbird Creek (Figure 3-1). The northern portion of the mine site includes the area surrounding the Blacktail open-pit and several sub-basins that drain into Bucktail Creek. The southern portion of the mine site drains into Meadow Creek, eventually draining into Blackbird Creek. Both drainage basins discharge to Panther Creek, which is one of seven major tributaries to the Salmon River.

Mining at the Blackbird Mine first began in 1893 by the Blackbird Copper-Gold Mining Company until 1907. From 1917 until 1920, the Haynes-Stellite Company mined and milled approximately 4,000 tons of ore from a site located along the east side of Blackbird Creek, approximately 1.2 miles downstream of the present Blackbird Mine Site. Mining activities slowed until 1938 when the Uncle Sam Mining Company reopened two old adits and built a 75-ton-per-day flotation mill at the present Blackbird Mine Site.

The Calera Mining Company purchased the site in 1943 and began full-scale mining activities in 1949. Calera Mining Company expanded the mill to accommodate 1,000 tons per day. In 1954, Calera initiated open-pit activities in the Blacktail Pit resulting in the deposition of approximately 3.8 million tons of waste rock in the headwaters of the Blackbird and Bucktail Creeks. Starting around 1950, mine tailings from milling operations were deposited in the West Fork Tailings Impoundment. The impoundment dam is approximately 150 feet high and 600 feet long. The tailing deposit covers an area of approximately 9 acres and is 1,250 feet long. During the 1950s, Calera continued the underground mining operations at the site resulting in the formation of a number of waste piles outside mine adits, totaling approximately 1 million tons.

Calera sold their interest in the Blackbird Mine to Machinery Center Company in 1963. The Machinery Center Company operated the mine site for 4 years, producing copper. However, the mine site was sold in 1967 to the Idaho Mining Company, a subsidiary of the Hanna Mining Company, who engaged in an exploration program on the property for the next few years and sought to reopen the mine.

In 1977, Noranda Exploration entered into an option agreement with the Idaho Mining Company, allowing Noranda to explore and acquire interest in the mine property. In December 1979, Noranda Mining, Inc. and Hanna Services Company created the Blackbird Mining Company, wherein Noranda Mining became the general partner responsible for reopening the mine. By 1982, all exploratory activities were suspended at the Blackbird Mine due to poor market conditions.

The mining activities resulted in construction of approximately 14 miles of underground workings (12 levels with more than 15 adits and portals) and a 12-acre open-pit mine. Additionally, the mine site included a mill, graded roads, numerous piles of waste rock, a tailings impoundment, sedimentation

ponds, office, maintenance shop, and warehouse structures. A small reservoir located on upper Blackbird Creek provided potable water. Lemhi County and USFS roads provide access to the site.

A water treatment plant (WTP) was placed in service in 1981 to treat acid mine drainage from the 6850 adit. Discharges from the treatment plant to Blackbird Creek are permitted under National Pollutant Discharge Elimination System (NPDES) permit no. ID-002525-9.

Subsequent to mining operations, debris flows, erosion, and acid rock drainage (ARD) resulted in the spreading of arsenic, cobalt, and copper from the original mining waste disposal areas to downstream locations. The tailings and waste rock materials were deposited in overbank areas along Bucktail Creek, South Fork Big Deer Creek, Big Deer Creek, Blackbird Creek, and Panther Creek.

3.2 Land Uses of the Site and Surrounding Areas

The Blackbird Mine consists of approximately 830 acres of private patented mining claims and 10,000 acres of unpatented claims. The Blackbird Mine is surrounded by SCNF land. The former Cobalt Townsite is located on Panther Creek road approximately 8 miles east of the mine and has no permanent residences. The closest inhabited town is Salmon, which is approximately 25 miles east of the mine site and the location of the Lemhi County seat. The Panther Creek drainage basin downstream of the mine is rural and sparsely populated with seasonal and year-round residences. The following sections describe in more detail the land use of the Blackbird Mine Site and the surrounding areas impacted by the mine.

3.2.1 Blackbird Mine Site

The Blackbird Mine is currently inactive. Workers at the mine operate the WTP and perform long-term operations and maintenance (O&M) of the remedial actions and facilities. For safety reasons, vehicular access by the public to the mine site is restricted by a gate near the West Fork Tailing Impoundment; however, the mine area can be accessed by the public on foot or by horseback. The groundwater at the mine is not currently used for domestic water supply. The O&M workers at the site use bottled water for drinking water.

3.2.2 Panther Creek Properties and Forest Lands

Panther Creek from Blackbird Creek to the confluence with the Salmon River is a steeply incised creek valley interspersed with flatter areas (Figure 3-3). Most of the land along the creek is public land under the jurisdiction of USFS. The public lands are used for recreational activities, including fishing, hunting, sightseeing, and camping. There are a number of undeveloped campsites along the creek and one developed campground at Deep Creek. There are a number of private properties along the creek, especially at the flatter areas. Most of the private properties include residences (full-time and part-time) and some agricultural uses (primarily pasture). Residences along the Panther Creek drainage use private wells or springs to obtain water.

3.2.3 Idaho Cobalt Project

In June 2008, USFS completed an environmental impact statement and has provided approval of the Idaho Cobalt Project (ICP) in a ROD. The ICP is a proposed cobalt and copper mine that will include two underground mine areas, a mill, a waste disposal site, and associated facilities on National Forest and private lands within and adjacent to the Blackbird Mine Site (Figure 3-4). The area affected by the proposed mineral development project will consist of surface disturbance on approximately 115 acres (USFS, 2008). The Formation Capital Corporation (FCC) is the proposed developer of the ICP, which consists of 146 unpatented mining claims for a total of 2,529 acres of mineral rights.

Surface and groundwater drain from the ICP site into Bucktail Creek, South Fork Big Deer Creek, Big Deer Creek, and Panther Creek, all of which are being cleaned up under the Blackbird Mine remedial

actions. In addition, a portion of the ICP (the Sunshine Mine) will be located within the Blackbird Mine Site near the upper end of the Bucktail Creek drainage.

The date for completion of construction and commencement of active mining is not known.

3.3 History of Contamination

The following sections discuss the history of contamination at the site for both the mine site itself and for the areas downstream from the mine site.

3.3.1 Blackbird Mine Site

RIs were conducted from 1995 through 2001 and are described in detail in the RI report and an Addendum (Golder, 2001a and 2001b). RIs included studies to determine the nature and extent of contamination in waste rock deposits, tailings deposits, surface waters, in-stream sediments, overbank soil deposits, and groundwater at the Blackbird Mine Site and surrounding area. The RI was completed after construction of most of the Early Actions at the mine site. The Early Actions (described in Section 3.4) resulted in reduction in dissolved metals transported in surface water from the mine area and in removal of contaminated overbank deposits along Panther Creek. A major focus of the RI was to determine the metals loading from residuals and remaining sources following implementation of the Early Actions. Information developed during the RI also was used to complete both human health and ecological risk assessments.

The initial list of contaminants of potential concern (COPCs) at the site included arsenic, cobalt, copper, manganese, nickel, and zinc. This list was narrowed down through the risk assessment process, and the final contaminants of concern (COCs) include arsenic, cobalt, and copper. Sampling results from the RI for each of the contaminated media at the site are summarized below:

- Waste Rock Deposits – Waste rock piles were sampled for arsenic, copper, and cobalt. Among the waste rock piles sampled, maximum concentrations of arsenic, cobalt, and copper were 5,900 milligrams per kilogram (mg/kg), 3,210 mg/kg, and 20,200 mg/kg, respectively.

- Tailings Deposits – Approximately 2 million tons of tailings were deposited in the West Fork Tailings Impoundment during the active mining operations. Maximum concentrations of arsenic and copper (cobalt was not measured) in the tailings impoundment were 554 mg/kg and 650 mg/kg, respectively.

- Overbank Deposits - Maximum concentrations of arsenic, cobalt, and copper in the overbank areas along Blackbird Creek were 138,000 mg/kg, 97,700 mg/kg, and 41,000 mg/kg, respectively.

- In-stream Sediments – Following completion of the Early Actions, sampling was conducted during 2000 and 2001. Stream bottom sediments were sampled in Blackbird Creek. Maximum concentrations for arsenic, cobalt, and copper were 717 mg/kg, 4,250 mg/kg, and 1,330 mg/kg, respectively.

- Groundwater – Groundwater samples were collected from nine monitoring wells at the site. Maximum concentrations of arsenic, cobalt, and copper in the monitoring wells were 0.048 mg/L, 6.83 mg/L, and 19.8 mg/L, respectively.

- Surface Waters – The surface waters at the Site were sampled at different times of the year. The primary purpose of the surface water sampling was to determine the remaining sources of metals loading that needed to be addressed through remedial actions. Results of the surface water sampling indicated that the water quality cleanup levels were being exceeded in Panther Creek, South Fork Big Deer Creek, and Big Deer Creek downstream from the mine influences. During periodic sampling in 2000, maximum concentrations of arsenic, cobalt, and copper in Panther Creek were 0.006 mg/L, 0.075 mg/L, and 0.012 mg/L, respectively. Maximum concentrations of arsenic, cobalt, and copper in

South Fork Big Deer Creek were 0.002 mg/L, 0.089 mg/L, and 0.155 mg/L, respectively. Maximum concentrations of arsenic, cobalt, and copper in Big Deer Creek were 0.003 mg/L, 0.011 mg/L, and 0.021 mg/L, respectively.

3.3.2 Downstream Contamination

Contaminated sediments, tailings, waste rock, and soil (deposits) from the Blackbird Mine Site were transported down Blackbird Creek and Bucktail Creek during high flow events and were deposited at overbank areas and in-stream areas along Panther Creek, South Fork Big Deer Creek, and Big Deer Creek. There is also evidence of transport and deposition of contaminated materials at several areas along Panther Creek by irrigation waters diverted from Panther Creek.

- Overbank Deposits Along Panther Creek – A number of overbank areas along Panther Creek were contaminated with sediments containing elevated concentrations of arsenic (in the 2003 ROD, arsenic was determined to be the primary risk driver from a human health standpoint). The contaminated areas on USFS lands included an area called Riprap Bar, the Deep Creek Campground, and an area near the confluence with Napias Creek (Figure 3-3). The contaminated areas on private lands included the former Panther Creek Inn, Cobalt Townsite, Noranda Pastures, (b) (6) property, (b) (6) property, (b) (6) property, (b) (6) property, (b) (6) property, (b) (6) property (b) (6)), (b) (6) property, (b) (6) property, and (b) (6) property. Maximum concentrations of arsenic, cobalt, and copper in the overbank sediments along Panther Creek were 1,940 mg/kg, 391 mg/kg, and 928 mg/kg, respectively.

- Other Overbank Deposits – Along South Fork Big Deer Creek and Big Deer Creek, arsenic and metals were of concern in the overbank deposits. Maximum concentrations of arsenic, cobalt, and copper in the overbank sediments along South Fork Big Deer Creek were 820 mg/kg, 1,600 mg/kg, and 42,000 mg/kg, respectively. Maximum concentrations of arsenic, cobalt, and copper in the overbank sediments along Big Deer Creek were 268 mg/kg, 619 mg/kg, and 17,200 mg/kg, respectively.

- In-stream Sediments – Arsenic and metals were of concern in the in-stream sediments. Maximum concentrations of arsenic, cobalt, and copper in the in-stream sediments in Panther Creek were 203 mg/kg, 246 mg/kg, and 313 mg/kg, respectively. Maximum concentrations of arsenic, cobalt, and copper in the in-stream sediments in South Fork Big Deer Creek were 176 mg/kg, 397 mg/kg, and 7410 mg/kg, respectively. Maximum concentrations of arsenic, cobalt, and copper in the in-stream sediments in Big Deer Creek were 13 mg/kg, 70 mg/kg, and 385 mg/kg, respectively.

The properties along Panther Creek obtain their drinking water from wells or springs. The wells and springs were sampled during the RI, and three of these drinking water sources had arsenic concentrations above the maximum contaminant level (MCL) of 0.010 mg/L. These included: (b) (6) spring (0.078 mg/L), (b) (6) ell (0.023 mg/L), and abandoned Panther Creek Inn well No. 2 (0.016 mg/L). EPA conducted an evaluation of these wells, examining their hydrogeology and geochemistry, and determined that the elevated arsenic concentrations were not the result of contamination from the Blackbird Mine (EPA, 2003).

High runoff during spring snowmelt in 2008 and 2009 resulted in deposition of overbank materials with elevated concentrations of arsenic and cobalt along Blackbird and Panther Creeks in certain of the areas where remediation was completed. Remedial activities to address the recontamination from high flow events are discussed in Sections 4.4.8 through 4.4.10.

3.3.3 Waste Management Area

The Waste Management Area (WMA) for the Site is shown on Figure 3-2. The WMA includes the mine area itself, including all of the remaining waste rock dumps. The WMA also extends downstream along

the two major drainages to the most downgradient features of the remedial actions—the lower Pumpback Station in Bucktail Creek and the downstream end of Blackbird Creek at Panther Creek Road.

3.4 Initial Response Actions

Initial response actions at the Blackbird Mine Site were conducted under EPA's removal authority and included both time-critical removals (Emergency Removal Actions) and non time-critical removals (Early Actions). The locations of the initial response actions are shown on Figures 3-2, 3-3, and 3-5.

3.4.1 Time-critical Removal (1993 to 1994)

An Emergency Removal Action was conducted in 1993 and 1994 at the West Fork Tailings Impoundment to stabilize the dam and to minimize the potential for release of tailings into Blackbird and Panther Creeks. This action was taken in accordance with an Action Memorandum and pursuant to an AOC issued by EPA to the BMSG in July 1993 (EPA Docket No. 1093-07-04-106). Prior to these actions, West Fork Blackbird Creek flowed through a buried concrete culvert beneath the tailings pile, and there was concern that mass failure of the tailings storage facility was possible if the culvert became plugged.

The Emergency Removal Actions included the following (Knight Piesold, 1994):

- Construction of a concrete-lined spillway excavated through bedrock at the dam to pass a 500-year flood
- Construction of a new channel for the West Fork Blackbird Creek over the top of the impoundment to convey the 500-year flood; the channel consists of a flood-flow channel, a low-flow channel, and a 2-foot-thick compacted clay liner
- Installation of a slurry cutoff trench into bedrock at the upstream end of the impoundment to minimize alluvial groundwater discharge into the tailings
- Filling of the existing concrete drainage culvert beneath the tailings with pea gravel

3.4.2 Non Time-critical Removals (1995 to 2002)

Non time-critical removal actions (Early Actions) were initially implemented to address releases of dissolved cobalt and copper into area streams downstream from the mine site. Concentrations of cobalt and copper were significantly elevated in stream waters and sediments such that the populations of benthic invertebrates and resident fish were severely impacted. In addition, historic populations of anadromous fish (including threatened and endangered species) no longer existed in area streams. Subsequent to initiation of the Early Actions, it was discovered that overbank sediments along Panther Creek were significantly elevated in arsenic. Human health risk assessments established that there were unacceptable risks associated with the arsenic in the overbank deposits at many of the properties along Panther Creek (CH2M HILL, 1998 and 1999). The Early Actions therefore included cleanup of contaminated overbank deposits at both private properties and USFS properties along Panther Creek.

The Early Actions were initiated during the summer of 1995 and were continued each year through 2002. These actions were conducted in accordance with an Action Memorandum and pursuant to an AOC issued by EPA to the BMSG in June 1995 (EPA Docket No. 10-95-0083, as amended). The Early Actions were conducted in five phases, with the initial phases focused on controlling sources of ARD that were impacting water quality. Generally, Phase I facilities were built during the 1995 construction season, Phase II facilities were built during the 1996 and 1997 construction seasons, and Phase III facilities were initiated during the 1997 construction season and completed during the summer of 1998.

Subsequent to the initiation of Early Actions to address water quality (Phases I through III), EPA determined that arsenic-contaminated materials were present along Blackbird Creek and that some of

these materials had been transported down Blackbird Creek and deposited at overbank areas along Panther Creek. Phases IV and V of the Early Actions therefore focused on overbank deposit removal actions, which were conducted along Panther Creek and Blackbird Creek to abate potential risk to human health associated with elevated levels of arsenic present in these deposits. Phase IV and V actions also reduced the potential risk to terrestrial and aquatic ecological receptors. Phase IV activities were initiated in 1998 and completed in 1999. Phase V activities were initiated in 1999; however, a major forest fire during 2000 caused delays, and Phase V was not completed until 2001.

During the fall of 2002, additional Early Actions were performed under the 1995 AOC to collect contaminated waters in the Bucktail Creek and Meadow Creek drainage basins that were not intercepted during previous actions.

Subsequent to the Early Actions removals, removals of overbank materials occurred and were considered remedial actions. A detailed discussion on the additional overbank material removals is included in Section 4.4.

3.4.2.1 Meadow Creek and Blackbird Creek

Early Actions in Meadow Creek and Blackbird Creek drainages included:

- Construction of an earth filled clay-core dam (7100 Dam) to collect and store water draining from the waste rock dumps in the Meadow Creek drainage basin
- Installation of piping from the 7100 Dam and from the underground workings at the 6850 adit to the existing WTP
- Upgrade and expansion of the existing WTP to increase flow capacity to 800 gallons per minute (gpm) and to improve effluent quality
- Installation of a sludge pipeline from the WTP to the underground mine at the Hawkeye Ramp to dispose of sludge generated by the WTP
- Construction of contaminated water collection ditches and pipelines to route contaminated water to the 7100 Dam reservoir
- Installation of a series of clean water ditches and pipelines to divert clean water around the contaminated areas and the 7100 Dam reservoir
- Relocation and consolidation of waste rock from the canyon walls of Meadow Creek, Blackbird Creek, and Hawkeye Gulch to the Meadow/Blackbird Creek bottoms
- Covering of waste rock in the Meadow Creek and Blackbird Creek bottoms with a clean earth cap and installation of drains beneath the cap to route contaminated waters to the WTP
- Construction of concrete channels across the top of the capped waste rock to convey Meadow Creek and Blackbird Creek
- Removal of visually obvious and eroding tailings from overbank deposits along Blackbird Creek
- Construction of three sediment basins along Blackbird Creek

3.4.2.2 Bucktail Creek Drainage

Early Actions in the Bucktail Creek drainage included:

- Construction of an earth filled clay-core dam (7000 Dam) to collect, store, and divert contaminated water to the WTP through the underground workings via the 6930 adit and 6850 level

- Construction of a groundwater collection system downstream of the 7000 Dam, with a pump station (upper Bucktail Pump Station) and pipelines to the 6930 adit
- Relocation of waste rock piles into the Blacktail Pit
- Construction of a series of clean water ditches and pipelines to divert water around the waste rock dumps and the 7000 Dam, and to deliver water to Bucktail Creek downstream of the 7000 Dam
- Construction of a contaminated water collection ditch (7200 ditch) to divert contaminated water to the 7000 Dam
- Construction of a series of sediment control ditches within the waste rock piles
- Installation of two debris traps in the Bucktail Creek channel
- Construction of two temporary sediment control dams (upper and lower sediment dams) along Bucktail Creek
- Removal of contaminated debris flow material along Bucktail Creek between the upper and lower sediment dams with disposal at the Blacktail Pit

3.4.2.3 Overbank Deposit Removal Actions

Beginning in late 1998 and continuing through 2002, overbank deposit removal actions were conducted along portions of Panther Creek and Blackbird Creek. These actions were primarily focused on removal of mine-related materials containing elevated concentrations of arsenic. The overbank deposit removal actions included:

- Removal of the contaminated materials until testing indicated that the underlying soils were below the cleanup levels, or until the water table was reached
- Disposal of removed materials at the West Fork Tailings Impoundment
- Backfilling of excavated areas with clean soil and revegetation with native species or pasture grasses, as appropriate
- Stabilization of excavated areas with installation of riprap, grade control structures, and/or bend way weirs

Removal actions were completed at the following sites on private properties (Figure 3-3):

- At the former Panther Creek Inn and the former Panther Creek Inn campground
- Cobalt Townsite and the adjacent pasture area (Noranda Pastures) immediately downstream of the Cobalt Townsite
- (b) (6) area located approximately 2 miles downstream from the Cobalt Townsite
- (b) (6) property located approximately 5.5 miles upstream from the confluence of Panther Creek and the Salmon River
- (b) (6) Property located approximately 5.3 miles upstream from the confluence of Panther Creek and the Salmon River
- (b) (6) Property located 6.1 miles upstream from the confluence of the Panther Creek and the Salmon River

Removal actions were completed at the following sites on USFS lands:

- The Riprap Bar area approximately 1 mile downstream from the Cobalt Townsite
- Deep Creek Campground located just upstream of the confluence of Deep Creek and Panther Creek.
- Napias Creek area just upstream from the confluence of Napias and Panther Creeks.

Removal actions were completed at Blackbird Creek targeting pipeline break materials, overbank deposits exceeding criteria, and streambed sediments. Removal actions and in-stream stabilization along the Blackbird Creek occurred from the Blackbird Mine Site WTP to the confluence of Panther Creek.

3.5 Basis for Taking Remedial Actions

The ecological risk assessments (Golder 2000 and CH2M HILL 2001), and a human health risk assessment (CH2M HILL 2002) determined that there were still unacceptable risks associated with contamination remaining following implementation of the Emergency Removal Actions and Early Actions. The remaining contamination that needed to be addressed through remedial actions included:

- Water Quality – Concentrations of dissolved cobalt and copper remained above the water quality cleanup levels in Panther Creek, Big Deer Creek, and South Fork Big Deer Creek. This remaining contamination posed unacceptable risks to aquatic organisms.
- Groundwater – Concentrations of arsenic and copper in monitoring wells at the mine were above the MCLs for potable water. The groundwater would pose unacceptable risks to human health if used as a drinking water source.
- Overbank Deposits – Concentrations of arsenic in overbank deposits not addressed during the Early Actions posed an unacceptable risk to human health and to ecological receptors. These deposits were located along Blackbird Creek and along lower Panther Creek. In addition, overbank deposits along Blackbird Creek could pose a risk to human health if mobilized during high flow events and deposited at overbank areas downstream along Panther Creek.
- In-stream Sediments – Concentration of arsenic, cobalt, and copper in the in-stream sediments posed an unacceptable risk to human health and to ecological receptors. In-stream sediments themselves posed a risk to aquatic organisms in Panther Creek, Big Deer Creek, and South Fork Big Deer Creek. In addition, in-stream sediments in Blackbird Creek could pose a risk to human health if mobilized during high flow events and deposited at overbank areas downstream along Panther Creek.

SECTION 4

Remedial Actions

4.1 Regulatory Actions

Remedial Actions at the Blackbird Mine Site were conducted subsequent to the Emergency Removal and Early Actions and have been governed by several regulatory and enforcement actions. These include the following:

- EPA issued a ROD for the Blackbird Mine Site in March 2003 that specified the preferred alternative for Remedial Actions at the Site (EPA, 2003).
- EPA issued a UAO to the BMSG in July 2003 for Remedial Design and Remedial Actions at the Blackbird Mine Site (EPA Docket No. 10-2003-0112), and amended it in August 2003, February 2011, and February 2013. The SOW has been modified seven times since the UAO was issued in July 2003.
- EPA issued an ESD to the ROD in July 2007. This ESD changed the dissolved cobalt cleanup level in site waters from 0.038 mg/L to 0.086 mg/L based on site-specific biological studies.
- EPA issued an ESD to the ROD in May 2012. The ESD documents two significant changes of the remedy selected in 2003 ROD:
  - Established cleanup levels for cobalt in overbank deposits for Blackbird, South Fork Big Deer Creek, Big Deer Creek, and Panther Creeks and lowered the cleanup level for groundwater from 1.53 mg/L to 0.009 mg/L (See Table 4-2 for all cleanup levels)
  - Revised recreational-use scenario for certain USFS lands along Panther Creek raising the arsenic cleanup level from 590 mg/kg to 1,180 mg/kg and the cobalt cleanup level from 390 mg/kg to 780 mg/kg
  - Cleanup levels for cobalt in Blackbird Creek for overbank deposits and in-stream sediments are: 2,700 mg/kg downstream of mine gate and 5,500 mg/kg upstream of mine gate.

4.2 Remedial Action Objectives and Cleanup Levels

4.2.1 Remedial Action Objectives

Remedial action objectives (RAOs), developed during the FS and finalized in the ROD, provide a general description of what the cleanup action was to accomplish. Table 4-1 lists the RAOs for this Site.

TABLE 4-1
Remedial Action Objectives for Blackbird Mine Site
Blackbird Mine Site, Lemhi County, Idaho

Media	Receptors of Concern	Remedial Action Objectives
Surface Soils	Human	Reduce direct contact (such as ingestion and dermal contact) with surface soils containing COCs in excess of the cleanup levels.
		Reduce migration of surface soil and overbank deposits to downstream areas that would deposit concentrations of contaminant of concern (COCs) in excess of the cleanup levels established at those downstream areas.

TABLE 4-1
Remedial Action Objectives for Blackbird Mine Site
Blackbird Mine Site, Lemhi County, Idaho

Media	Receptors of Concern	Remedial Action Objectives
	Aquatic	Reduce migration of metals into the water column of the streams so that the cleanup levels for the COCs established for the streams are not exceeded.
		Reduce migration of the surface soils to in-stream sediments so that the cleanup levels for the COCs established for in-stream sediments are not exceeded.
Groundwater	Human	Prevent use of contaminated groundwater underlying waste management areas.
Surface Water	Human	Maintain water quality for protection of human health.
	Aquatic	Reduce direct contact with surface water containing COCs in excess of the cleanup levels.
		Restore and maintain water quality and aquatic biota conditions capable of supporting all life stages of resident salmonids and other fishes in South Fork Big Deer Creek and Big Deer Creek.
		Restore and maintain water quality and aquatic biota conditions capable of supporting all life stages of resident and anadromous salmonids and other fishes in Panther Creek.
		Reduce concentrations of COCs in Blackbird Creek to improve water quality such that cleanup levels are not exceeded in Panther Creek and to support some aquatic life in Blackbird Creek.
		Reduce concentrations of COCs in Bucktail Creek to improve water quality such that cleanup levels are not exceeded in South Fork of Big Deer and Big Deer Creeks.
Sediments	Aquatic	Reduce direct contact with in-stream sediments containing COCs in excess of the cleanup levels.
		Reduce migration of in-stream sediments to downstream areas so that the cleanup levels for the COCs established for in-stream sediments at those downstream areas are not exceeded.
		Restore and maintain sediment quality and aquatic biota conditions capable of supporting all life stages of resident salmonids and other fishes in South Fork Big Deer Creek and Big Deer Creek.
		Restore and maintain sediment quality and aquatic biota conditions capable of supporting all life stages of resident and anadromous salmonids and other fishes in Panther Creek.
		Reduce concentrations of COCs in Blackbird Creek to improve sediment quality such that cleanup levels are not exceeded in Panther Creek and to support some aquatic life in Blackbird Creek.
		Reduce concentrations of COCs in Bucktail Creek to improve sediment quality such that cleanup levels are not exceeded in South Fork of Big Deer and Big Deer Creeks.

Source: EPA, 2003
Note:
COC = contaminant of concern

4.2.2 Cleanup Levels

Cleanup levels for overbank deposits, in-stream sediments, surface water, and groundwater at the Site were established for arsenic, cobalt, and copper in the ROD and ESDs for the various drainages. These cleanup levels were based on promulgated standards, site-specific risk assessments, and/or biological studies. The cleanup levels are summarized in Table 4-2.

TABLE 4-2
Summary of Cleanup Levels for Blackbird Mine Site Media
Blackbird Mine Site, Lemhi County, Idaho

Drainage	Media	Arsenic	Cobalt	Copper
Panther Creek	Overbank Deposits—Residential Use	100 mg/kg	97 mg/kg	NE[a]
	Overbank Deposits—Recreational Use (USFS Campgrounds)	280 mg/kg	180 mg/kg	NE[a]
	Overbank Deposits--Recreational Use (Other Undeveloped Camping Areas)	400 mg/kg	260 mg/kg	NE[a]
	Overbank Deposits—Recreational Day Use on Road Side	590 mg/kg	390 mg/kg	NE[a]
	Overbank Deposits—Recreational Day Use on Opposite side Road Side	1,180 mg/kg	780 mg/kg	NE[a]
	In-stream Sediments	35 mg/kg	80 mg/kg	149 mg/kg
	Surface Water[b]	0.010 mg/L[c]	0.086 mg/L	IWQS[d]
South Fork Big Deer Creek	Overbank Deposits—Recreational Day Use	NE[a]	NE[a]	NE[a]
	In-stream Sediments	35 mg/kg	436 mg/kg	637 mg/kg
	Surface Water	0.010 mg/L[c]	0.086 mg/L	IWQS[d]
Big Deer Creek	Overbank Deposits—Recreational Day Use	NE[a]	NE[a]	NE[a]
	In-stream Sediments	35 mg/kg	80 mg/kg	149 mg/kg
	Surface Water	0.010 mg/L[c]	0.086 mg/L	IWQS[d]
Blackbird Creek	Overbank Deposits—Upstream from Mine Gate	8,500 mg/kg	5,500 mg/kg	NE[a]
	Overbank Deposits—Downstream from Mine Gate	4,300 mg/kg	2,700 mg/kg	NE[a]
	In-stream Sediments—Upstream from Mine Gate	8,500 mg/kg	5,500 mg/kg	NE[a]
	In-stream Sediments—Downstream from Mine Gate	4,300 mg/kg	2,700 mg/kg	Narrative Goal[e]
	Surface Water	0.010 mg/L[c]	Narrative Goal[e]	Narrative Goal[e]
Bucktail Creek	Overbank Deposits—Recreational Day Use	NE[a]	NE[a]	NE[a]
	In-stream Sediments	Narrative Goal[e]	Narrative Goal[e]	Narrative Goal[e]
	Surface Water	Narrative Goal[e]	Narrative Goal[e]	Narrative Goal[e]
Groundwater	Residential	0.010 mg/L	0.009 mg/L	3.060 mg/L
	Mine Worker	0.010 mg/L	0.023 mg/L	3.060 mg/L

[a] NE = Cleanup level Not Established for this contaminant because there was no unacceptable risk shown.
[b] Water Quality cleanup levels for arsenic are total and for cobalt and copper are dissolved.
[c] IDEQ human health water quality standard.
[d] IWQS = Idaho Water Quality Standard: The standard is hardness-based, and the typical hardness in area creeks varies from approximately 20 mg/L to 100 mg/L.
[e] The cleanup level is a non-numeric narrative goal. See text below for an explanation of the narrative goals.

IDEQ performed Use Attainability Analyses of Blackbird Creek and Bucktail Creek and determined that certain uses and water quality criteria could not be applied to these creeks (IDEQ, 1997 and 2002). The ROD therefore did not require that numeric surface water cleanup levels for cobalt and copper be met in Blackbird Creek or Bucktail Creek. However, the ROD required that narrative goals be met. The non-numeric narrative goals established in the ROD are:

- Blackbird Creek – "The remedial goal for Blackbird Creek is to improve water and sediment quality such that cleanup levels are not exceeded downstream in Panther Creek. In addition, the remedial goal for Blackbird Creek is to support aquatic life at levels similar to that of nearby reference streams, although not necessarily to support salmonids or metals-sensitive macroinvertebrate taxa."
- Bucktail Creek – "The remedial goal for Bucktail Creek is to improve water and sediment quality such that cleanup levels are not exceeded downstream in South Fork Big Deer Creek or in Big Deer Creek."

4.3 Remedy Description

The ROD (EPA, 2003) selected site-specific Remedial Actions to take place at the Blackbird Mine Site subsequent to the Emergency Removal and Early Actions. The Emergency Removal and Early Actions were incorporated as part of the Remedial Actions by the ROD. Because the Blackbird Mine affects three different drainages, the Remedial Actions for the Blackbird Mine Site were divided into three remediation areas: (1) Blackbird Creek, (2) Bucktail Creek, and (3) Panther Creek. The remedies selected in the ROD for each of these drainages are described below and shown on Figures 3-2, 3-3, and 3-5. The actual implementation of the Remedial Actions, including the schedule of construction activities, is described in Section 4.4.

4.3.1 Blackbird Creek

The selected remedy for the Blackbird Creek drainage area included:

- Collection of Meadow Creek seeps
- Covering the West Fork Tailings impoundment and treating tailings impoundment seepage
- Removal with selective stabilization of overbank deposits along Blackbird Creek
- Natural recovery of in-stream sediments in Blackbird Creek
- Institutional controls (ICs)

The selected remedy consisted primarily of removing overbank deposits along Blackbird Creek with selective physical stabilization by armoring to reduce the risks of direct human contact with the overbank deposits. The removal and selective stabilization also reduce the risk of remobilization during high flow events in Blackbird Creek with downstream deposition at overbank areas along Panther Creek.
The selected remedy also included collection and treatment of cobalt in groundwater draining from the West Fork Tailings Impoundment. Groundwater draining from the West Fork Tailings Impoundment is high in cobalt and iron and typically accounts for over half of the cobalt loads measured at the mouth of Blackbird Creek. At the time that the ROD was issued, the dissolved cobalt cleanup level for surface waters at the Site had been established at 0.038 mg/L, and concentrations of dissolved cobalt in Panther Creek were greater than the cleanup level during much of the year (typically about 0.050 to 0.060 mg/L during low flow conditions). Subsequent to the issuance of the ROD, the BMSG conducted a study of site-specific cobalt toxicity under EPA and Trustee oversight. Based on the results of this toxicity study, EPA revised the surface water cobalt cleanup level for the Site from 0.038 mg/L to 0.086 mg/L. Surface water monitoring in Panther Creek since 2003 has indicated that the dissolved cobalt concentrations have been consistently less than the revised cobalt cleanup level. Therefore, EPA determined that treatment of groundwater from the West Fork Tailings Impoundment to address cobalt in surface waters is no longer required.

IC objectives consist of requirements to protect the remedy, requirements to preclude uses that would result in unacceptable risks (such as residential use), and maintenance of access controls (fencing and gates) to limit unauthorized use (see Section 7.1.6 for details of the ICs).

4.3.2 Bucktail Creek

The selected remedy for the Bucktail Creek drainage area included:

- Groundwater seep collection and treatment
- Diversion of Bucktail Creek around the South Fork Big Deer Creek
- Natural recovery of sediments
- ICs

The selected alternative has groundwater seep collection and treatment as well as natural recovery for stream sediments. This alternative includes diverting Bucktail Creek in a pipeline or ditch around South Fork Big Deer Creek to discharge directly into Big Deer Creek. The groundwater seep collection cannot intercept all of the groundwater, and Bucktail Creek still has elevated metals, which would prevent water quality goals from being met in South Fork Big Deer Creek. By diverting Bucktail Creek around South Fork Big Deer Creek in a pipeline or ditch, water quality goals in both South Fork of Big Deer and Big Deer Creeks can be met with this alternative. IC objectives are similar to those required for Blackbird Creek.

4.3.3 Panther Creek

The selected remedy was a combination of removal of contaminated soils and ICs. The contaminated areas at the (b) (6) properties were comparatively small. Therefore, soil in overbank deposits was removed to the human health cleanup level for arsenic. The contaminated overbank deposits at the (b) (6) property included both small and large areas. Soil in the smaller areas was removed. However, the larger areas require ICs, described in Section 6.1.3, to preclude future residential and intensive recreational development.

Soil management ICs are also needed at some of the properties where overbank deposits were removed as part of Early Actions or Remedial Actions to preclude unacceptable future exposure if underlying soils with elevated arsenic and cobalt concentrations are brought to the surface (as a result of erosion, digging or construction activities). The private properties that require ICs for underlying soils are: former Panther Creek Inn, Cobalt Townsite, Noranda Pasture, (b) (6). The properties under USFS control that require ICs are the Riprap Bar and Deep Creek Campground. The ICs are described in Section 7.1.6.

4.3.4 Groundwater

Some of the groundwater monitoring wells at the mine have concentrations of arsenic, copper, and cobalt above the MCLs or risk-based levels (see Section 6.3.2 for recent groundwater monitoring results). There are currently no drinking water wells at the mine. Potential ingestion of contaminants in groundwater in drinking water wells at the mine will be addressed through ICs. Contaminated groundwater migration off of the mine was not addressed in the ROD due to:

Groundwater downgradient of the waste management area shown on Figure 3-2 was not contaminated above the MCL for arsenic. In addition, cobalt and copper were not shown to pose a potential risk from groundwater ingestion.

No drinking water wells downgradient from the mine are impacted by mine sources. In the Blackbird Creek drainage, the nearest drinking water well is at the former Panther Creek Inn, located approximately 2.5 miles downgradient from the nearest significant contaminant source (the West Fork Tailings

Impoundment). Water quality monitoring at this well indicated that concentrations of arsenic, cobalt, and copper were significantly lower than the MCLs or risk-based levels at the time of issuance of the ROD. In 2012, the second ESD to the ROD revised the cobalt groundwater cleanup level from 1.53 mg/L to 0.009 mg/L. The well at the former PCI property has cobalt concentrations significantly higher than the 0.009 mg/L cleanup level; therefore, the 2012 ESD provides that ICs are needed to assure no one uses the groundwater for drinking water. Cobalt in groundwater at the PCI and downstream along Panther Creek is discussed further in Sections 6 and 7. In the Big Deer Creek drainage, there are currently no drinking water wells downgradient from the mine.

4.3.5 Contingent Actions

There was uncertainty whether some of the components of the remedial actions would be effective in meeting the RAOs and cleanup levels. Therefore, the ROD determined that monitoring and evaluations would be needed after construction of the remedial alternative. Based on the monitoring results and further evaluations, contingent actions may be necessary for some areas of the site in the future if cleanup levels are not met. The ROD identified contingent actions that include:

- Actions to reduce the hydraulic head upstream of the cutoff wall on upper Blackbird Creek to reduce seepage through the wall and metals loading from groundwater discharging to Blackbird Creek. As an alternative, groundwater could be intercepted downgradient from the cutoff wall and pumped to the existing WTP for treatment.
- Increases to the water storage and/or treatment capacity, and/or revisions to the treatment schedule, if there is insufficient capacity to meet water storage and treatment needs.
- Additional removal of overbank deposits along Blackbird Creek.
- Run-on/run-off controls for the cover on the West Fork Tailings Impoundment, if monitoring indicates excessive erosion or water quality impacts from runoff.
- Measures to reduce the water table beneath the West Fork Tailings Impoundment, if the water table begins to rise to a level that threatens the stability of the dam.
- Additional collection and treatment of Bucktail Creek seeps, if they result in unacceptable metals loading to Big Deer Creek.
- Removal of Bucktail Creek sediments and/or overbank materials, or installation of a passive (or semi-passive) treatment system near the confluence of the South Fork Big Deer Creek and Big Deer Creek, if water quality goals in Big Deer Creek are not achieved because of metals leaching from sediments/overbank materials along Bucktail Creek.
- Alternatives to address metals discharges to South Fork Big Deer Creek from groundwater and/or overbank materials if water quality goals in South Fork Big Deer Creek are not achieved.
- Additional removals along Panther Creek if monitoring results following storm events indicate deposition of overbank deposits that exceed remediation goals.
- Monitoring the selected response actions to determine if the mixing zone for the copper water quality standard and cobalt cleanup level is protective of cold water biota to meet the substantive NPDES requirements for both Panther Creek and Big Deer Creek. If monitoring indicates that the mixing zones are not protective of cold water biota, alternatives will be evaluated to meet the substantive NPDES mixing zone requirements.
- Alternatives to address metals loads to Big Deer Creek downstream from South Fork Big Deer Creek if monitoring indicates that these loads result in exceedances of water quality goals in Big Deer Creek.

4.4 Remedy Implementation

Remedial Actions specified in the ROD have been constructed from 2003 through 2012. The remedial actions constructed during each of these years are described below. Several of the Remedial Actions specified in the ROD have not yet been completed and are discussed in Section 4.4.11. Remedial designs for each year's remedial action construction were generally completed during the spring and early summer of that year's construction.

4.4.1 2003 Construction

- Upper and Lower Blackbird Creek – Overbank construction activities on Upper and Lower Blackbird Creek began in late August 2003 and were completed by early November 2003. Remedial activities included excavation of overbank materials to arsenic cleanup levels (8,500 mg/kg arsenic in the Upper Blackbird Creek and 4,300 mg/kg arsenic in the Lower Blackbird Creek) with disposal at the West Fork Tailings Impoundment. In selected areas, overbank deposits were stabilized with riprap to avoid mobilization during high flow events.

- Meadow Creek – Construction of the 7560 Dam and collection ditch to route clean waters around the 7100 Dam. The actions also included removal of a small earth fill dam (7350 Dam) to allow contaminated waters to flow to the 7100 Dam catchment area.

- Bucktail Creek – Construction of 4-inch and 6-inch-diameter high density polyethylene (HDPE) piping from the upper Bucktail Pumpback Station to the 6930 adit to increase conveyance capacity for contaminated groundwater collected downgradient from the 7000 Dam.

4.4.2 Summer 2004 Construction

- Overbank Deposits – Overbank deposits were remediated along Panther Creek from mid-August through September 2004. Contaminated soil was excavated and hauled to the West Fork Tailings Impoundment for disposal. Depending on location, clean replacement soils were spread over the excavated areas and revegetated. Overbank deposits were remediated along lower Panther Creek at the (b) (6) properties. Also, overbank deposits were remediated at the former Panther Creek Inn and Campground in areas where removals were not conducted during the Early Actions in 1998.

- Lower Blackbird Creek – Contaminated in-stream and overbank deposits were removed from the Blackbird Creek channel downstream from the Panther Creek Road bridge. In addition, earthen containment berms and deflector structures were constructed along the Blackbird Creek channel in this reach to reduce the potential for channel migration and erosion.

4.4.3 Fall 2004 through Winter 2005 Construction

Construction began on several elements of the remedial actions in fall of 2004 and continued into early 2005 until construction was shut down by winter weather. The construction elements installed during the fall of 2004 and early 2005 included:

Upper Blackbird Creek – Construction of a new pumping well downgradient from the groundwater cutoff wall near the WTP, with piping to the WTP. This well collects contaminated groundwater that bypasses the cutoff wall and directs it to the WTP for treatment.

Upper Bucktail Creek – The eastern embankment section of the upper Bucktail Creek sediment dam was removed to expose the native subgrade soils and seeps/springs along the east side of the drainage. Excavated soils were placed as embankment fill upgradient of the western part of the dam, and to establish a temporary diversion dam upgradient of the fill area. Seep collection structures with associated

piping were installed to collect contaminated seeps and direct their flow to the lower Bucktail pumping station.

Overbank Deposits Along Panther Creek – High flows during the spring of 2003 resulted in mobilization of arsenic-contaminated materials along Blackbird Creek with transport downstream and redeposition at areas along Panther Creek that had been previously cleaned up during the Early Actions. Testing indicated that some of these redeposited overbank materials contained arsenic above the cleanup levels and therefore needed to be removed. Overbank deposits were excavated from the Cobalt Townsite, Noranda Pastures, and (b) (6) property and were hauled to the West Fork Tailing Impoundment for disposal. A 12-inch layer of clean fill material was subsequently placed in selected portions of the removal areas.

4.4.4 2005 through 2006 Construction

The following remedial action construction activities were completed during the 2005 and 2006 construction seasons. This construction was originally planned to be completed during the 2005 construction season, but portions of the construction had to be delayed until the 2006 construction season due to the onset of winter weather in 2005.

4.4.4.1 Bucktail Creek Construction

- Reconstruction of the Bucktail Creek channel through Upper Bucktail Sediment Dam removal area
- Construction of seepage collection structures for three contaminated seeps between the Upper Bucktail Sediment Dam and the Lower Bucktail Pump Station
- Construction of a gravity drain line from the Upper Bucktail Sediment Dam area to the Lower Bucktail Pump Station with connections to seep collection structures and groundwater pumping wells
- Construction of the lower Bucktail Pumping Station and associated piping to pump contaminated waters to the upper Bucktail Pumping Station
- Modifications to the upper Bucktail Pump Station to handle increased flows

4.4.4.2 Blackbird Creek Construction

- The walls of the concrete channel conveying clean waters of Blackbird Creek were damaged by high groundwater and winter freeze-thaw conditions in the area upgradient from the groundwater cutoff wall and at the confluence of Blackbird Creek and Meadow Creek. Significant repair actions were required to address this problem including: excavation of the soils adjacent to the channel; placement of drain piping at the base of the channel walls; backfill adjacent to the channel with free-draining talus rock materials; insulation of the channel and talus materials to reduce freezing potential in the backfilled materials; installation of steel struts at the top of the channel; and instrumentation to detect future movement of the channel walls during freeze-thaw conditions.
- It was discovered that an old concrete culvert beneath the fill materials adjacent to the WTP was carrying water contaminated with high concentrations of cobalt and copper. A manhole over this culvert was modified to collect the contaminated waters, and a pump and piping system was installed to pump the waters to the WTP for treatment.

4.4.4.3 Overbank Deposits Along Panther Creek

- Overbank deposits were removed from two targeted areas at the (b) (6) Property along lower Panther Creek. Excavated materials were hauled to the West Fork Tailings Impoundment for disposal. The removal areas were backfilled with clean fill and reseeded.

4.4.5 2007 Construction Summary

Minimal construction was performed during the 2007 construction season, mainly to complete and refine construction elements begun in previous years. This construction included completion of the Blackbird Creek channel wall modifications, as well as modifications to the pumping control system at the Lower Bucktail Pumping Station to correct a problem with cavitation during pump startup.

4.4.6 2008 Construction Summary

There were no significant construction activities during the 2008 year.

4.4.7 2009 Construction Summary

The following sections describe the remedial action construction activities that were completed during the 2009 construction season. The removals conducted along Blackbird and Panther Creeks were in response to the high flow events encountered during the spring of 2008.

4.4.7.1 Blackbird Creek Removals and Stabilization

- Tailings pipeline break materials and overbank removals, including bed load deposits located above the water table and below the seasonal high water mark were targeted for removal between the Blackbird Creek WTP and the former Panther Creek Inn, mostly from the south side along the alignment of the old concrete tailings pipeline (Figure 4-1). Overbank and pipeline break materials with arsenic concentrations greater than 500 mg/kg were removed, and concentrations between 300 and 500 mg/kg were either removed or stabilized. A total of about 42,700 cubic yards (cy) of tailings, overbank, and bed load materials were removed (Golder, 2011b). Backfill of removal areas was conducted in selected areas.
- In areas where removal of materials with elevated arsenic concentrations was not feasible due to stability and safety issues, materials were armored to protect against mobilization during high flow events. This included:
- Riprap armoring along exposed banks that could not be removed
- Riprap armoring at bendway wires or hard points for protection and stability of bench materials
- Riprap armoring at the base of the slope to prevent erosion from Blackbird Creek

Limited in-channel stabilization construction was also conducted in 2009 for Blackbird Creek. The entire in-channel stabilization effort is described in Section 4.4.8.1.

4.4.7.2 Panther Creek Overbank Removals

Overbank removals were conducted along Panther Creek at one public property and three private properties including Deep Creek Campground, (b) (6) Property, (b) (6) Property. Backfill of removal areas were conducted in accordance with the current work plan. The details of the removal of each area are described below:

- Deep Creek Campground – 150 to 200 cy removed
- (b) (6) Property; pasture – 1,235 cy removed
- (b) (6) Property; pasture, low bar area, and campground – 2,570 cy removed
- (b) (6) Property; pasture and bar area – 1,330 cy removed

4.4.8 2010 Construction Summary

The following sections describe the remedial action construction activities completed during the 2010 construction season. Primary construction activities included addressing the recontamination of Blackbird

and Panther Creeks from the spring high flow events of 2008 and 2009, including overbank removal and in-channel stabilization.

4.4.8.1 Blackbird Creek Overbank Removals and In-channel Stabilization

Three main types of materials along Blackbird Creek were targeted for testing and removal; pipeline break materials, overbank deposits, and streambed sediments. Removal activities were performed between Blackbird Creek Stations 280+00 and 324+00, 231+50 to 241+50, 171+50 to 181(Figure 4-1). A total of approximately 81,000 cy of pipeline break, overbank, and bedload material were removed and relocated (Golder, 2011).

Although the in-channel stabilization of Blackbird Creek occurred in both 2009 and 2010 construction seasons, the details for the entire stabilization effort will be described in this section. In-channel stabilization for Blackbird Creek construction was segregated into eight distinct areas (Figure 4-1). A total of 28,800 cy of bed load and overbank material was excavated and hauled to West Fork Tailings Impoundment, and a total of 28,900 cy of riprap was used for armoring. The construction activities in each stabilization area are described below.

Area 1 – Construction of 13 grade control structures plus bed load, and slope side removals with elevated arsenic and/or high erosion potential into Blackbird Creek.

Area 2 – Construction of seven grade control structures.

Area 3 – Construction of 13 grade control structures and six bendway weirs for added stability to protect the road from channel migration, removal of road side bank materials to widen the flood plain, and slope side overbank removals and stabilization to abate erosion.

Area 4 – Construction of 19 grade control structures, 23 bendway weirs, and bedload and slope side removals.

Area 5 – Construction of six grade control structures, four bendway weirs, and bank/channel armoring.

Area 6 – Construction of 10 grade control structures, 15 bendway weirs, and slopeside/roadside overbank removals and riprap armoring.

Area 7 – Construction of eight grade control structures, eight bendway weirs, slope side overbank removals, and roadside riprap armoring.

Area 8 – Construction of five grade control structures, five bendway weirs, slopeside/roadside overbank removals, and placement of riprap armoring to stabilized the road bank.

4.4.8.2 Panther Creek Overbank Removals and Stabilization

A total of approximately 6,000 cy of overbank materials were removed from two private properties along Panther Creek: (1) Silling Headgate and Irrigation Ditch and (2) Silling Lower Pasture Area.

4.4.8.3 Lower Bucktail Sediment Dam Decommissioning

During the fall of 2010, the Lower Bucktail Sediment Dam was decommissioned and the reestablishment of Lower Bucktail Creek was implemented. Accumulated sediments (approximately 260 cy) in the reservoir area and approximately 16,000 cy of stream material were excavated during the reestablishment of the creek.

4.4.9 2011 Construction Summary

The following sections describe the remedial action construction activities completed during the 2011 construction season. Overbank removals were in response to sampling conducted in 2011.

4.4.9.1 Blackbird Creek

To address clogging and accommodate additional flow; the cutoff wall drainage system was improved. The following modifications were implemented:

- Installation of a new manhole (MH-3) and a new HDPE tightline between MH-3 and MH-4
- Installation of a new manhole (MH-4) and a new HDPE tightline between MH-4 and MH-1
- Installation of new 12-inch HDPE pipe inside a 24-inch grouted steel casing underneath the concrete channel connection MH-2 and MH-1
- Installation of 12-inch tightline from MH-1 to the WTP influent room
- Installation of new 8-inch-diameter HDPE tightline pipe connecting the “Envirocon” pipe through the new manhole located to the west of the truck shop

4.4.9.2 7100 East and 7410 Diversion Ditch Lining

To address observed leakage along the 7100 and 7410 diversion ditches, they were modified by excavation of in place material and placement of clay, geotextile fabric, and riprap. A total of 2,012 lineal feet of the 7100 East diversion ditch and 1,968 lineal feet of the 7410 diversion ditch were lined.

4.4.9.3 Mill Creek East Channel Transitioning

Leaks from the Mill Creek East channel transitions were identified as potentially contributing to the observed increased flows in the Blackbird Creek channel. The channel transition was improved to reduce leakage at the transition between natural channel and concrete channel utilizing clay lining and riprap (Golder, 2012a).

4.4.9.4 Panther Creek Overbank Removal

Results from the 2011 overbank characterization sampling determined the areas targeted for the 2011 construction overbank removal. The Panther Creek overbank removal activity occurred in three areas on the (b) (6) property. A total of 324 cy of sediment were removed from Downstream Low Bar South (DLBS) overbank, 1,026 cy of sediment removed from Downstream Low Bar West (DLBW) overbank, and 168 cy of sediment removed from Upstream Low Bar East (ULBE) overbank areas of the (b) (6) property. The overbank removals and backfill were conducted accordingly to the approved work plan.

4.4.10 2012 Construction Summary

The following sections describe the remedial construction activity for 2012. The activities included the Blackbird Creek upper shop drainage improvements and Panther Creek overbank removals.

4.4.10.1 Blackbird Creek Warehouse Drainage Improvements

The Blackbird Creek warehouse drainage was modified to provide additional drainage capacity to the waste rock cap sub-surface collection system, targeting the seepage area with construction of manholes and trench drains (Golder, 2013a). The following improvements were implemented at the upper shop drainage:

- Excavation, trenching, and removal of waste rock in preparation for manhole, tightline, and drain line installations
- Installation of two new upper drainage manholes
- Installation of a new access manhole
- Installation of 8-inch HDPE pipe tightline from upper drainage manholes

- Installation of multiple trenched trains to convey flow into the upper drainage manholes
- Backfill, compaction, and capping of trenching and manhole excavations

4.4.10.2 Panther Creek Overbank Removals

The overbank removals were completed at five properties along Panther Creek; Charles and Claire (b) (6) Low Bar 1 and 2), the (b) (6) property ((b) (6) s Middle Pasture), the Deep Creek Campground, the (b) (6) s Overbank Area), and the (b) (6) property ((b) (6)). The volumes for excavation and backfill for each of the properties are as follows:

- 738 cy removed and 854 cy backfilled at (b) (6) Low Bar 1
- 1,141 cy removed and 814 cy backfilled at (b) (6) Low Bar 2
- 504 cy removed and 461 cy backfilled at (b) (6) Middle Pasture
- 12 cy removed and 14 cy backfilled at Deep Creek Campground
- 35 cy removed and 35 cy backfilled at (b) (6) Overbank Area
- 246 cy removed and 256 cy backfilled at (b) (6)

4.4.11 Remedial Actions Not Yet Completed

One remedial action and a number of contingent actions identified in the ROD have not yet been constructed. These actions are discussed in the following sections.

4.4.11.1 Bucktail Creek Diversion Pipeline

One of the elements of the remedial actions selected in the ROD for the Bucktail Creek drainage is a pipeline to divert the waters of Bucktail Creek around the South Fork Big Deer Creek. This diversion pipeline is included in the ROD because modeling conducted during the FS indicated that remedial actions in upper Bucktail Creek would not be effective to meet water quality cleanup levels in South Fork Big Deer Creek. The diversion pipeline would extend from the vicinity of the Lower Bucktail Sediment Dam to Big Deer Creek downstream from the South Fork Big Deer Creek (Figure 3-2). By removing the metals loads coming from Bucktail Creek, the ROD concluded that water quality cleanup levels would be expected to be met in South Fork Big Deer Creek once the contaminated in-stream sediments in South Fork Big Deer Creek are allowed to recover naturally.

EPA originally decided to schedule the construction of the bypass pipeline to occur in 2010, 3 years after completion of the upper Bucktail Creek remedial actions to allow the effectiveness of the upper Bucktail Creek remedial actions to be determined and to allow the residual materials along Bucktail Creek to begin to recover naturally. The BMSG requested that monitoring continue through 2011 to better determine the rate of natural recovery. A statistical evaluation based on the monitoring data through 2011 indicated that South Fork Big Deer Creek may be able to meet water quality cleanup goals through natural recovery. Therefore, EPA decided to monitor for an additional 3 years (through 2014). Following this additional monitoring, EPA will again evaluate the need for the bypass pipeline.

4.4.11.2 Status of Contingent Actions

The status of the contingent actions identified in the ROD is discussed below.

- **Actions to reduce the hydraulic head upstream of the cutoff wall on upper Blackbird Creek—** Rather than reduce hydraulic head upstream of the cutoff wall, a new pumping well was constructed downstream from the cutoff wall to intercept contaminated water that bypasses the cutoff wall. Water from this well is pumped to the WTP for treatment. This contingent action is completed.

- **Increases to the water storage and/or treatment capacity**—The BMSG prepared a report to evaluate the need for additional water storage and/or treatment capacity (Golder, 2008a). This report concluded that additional measurements were required during a year of greater-than-average snowpack to provide definitive determinations concerning the need for additional storage and/or treatment capacity. In 2011, the peak spring runoff occurred very late and very rapidly and the existing treatment plant was not able to treat all of the runoff water. The BMSG constructed temporary treatment facilities near the WTP and treated the excess water for about 23 days during the peak runoff. The BMSG conducted a study to evaluate options for increasing storage and/or treatment capacity (Golder 2011). Based on this study, EPA selected the option to increase the hydraulic capacity of the existing WTP from 1,000 gpm to 1,200 gpm, and to construct new treatment facilities capable of treating up to 1,300 gpm for a combined total treatment capacity of 2,500 gpm. These upgrades and additions to the treatment system will be completed during 2013.

- **Additional removal of overbank deposits along Blackbird Creek**—As a result of the re-contamination of overbank areas along Panther Creek from the high runoff events in Blackbird Creek in 2003, 2008, and 2009, additional removals and stabilization were conducted along Blackbird Creek in 2009 and 2010. The details of these additional removals and stabilization are included in Section 4.4.8.1.

- **Run-on/run-off controls for the cover on the West Fork Tailings Impoundment**—Monitoring to date does not indicate that there is significant erosion of the cover on the West Fork Tailings Impoundment, therefore run-on/runoff controls do not appear to be required.

- **Measures to reduce the water table beneath the West Fork Tailings Impoundment, if the water table begins to rise to a level that threatens the stability of the dam**—Monitoring indicates that the water table within the West Fork Tailings Impoundment rose approximately 10 to 15 feet between 1995 and 2010, but has stabilized since 2010. Stability analyses indicate that the current level of the water table could rise as much as an additional 30 feet before it would threaten the stability of the dam. EPA will continue to monitor the water table.

- **Additional collection and treatment of Bucktail Creek seeps, if they result in unacceptable metals loading to Big Deer Creek**—The remedial actions in upper Bucktail Creek (see Section 4.4.3 and 4.4.4) have resulted in collection of all identified contaminated springs and seeps along upper Bucktail Creek. It is not likely that additional contaminated springs or seeps will be discovered in the future; however, if any are discovered, they can be connected to the collection system in upper Bucktail Creek.

- **Removal of Bucktail Creek sediments and/or overbank materials, or installation of a passive (or semi-passive) treatment system, if water quality goals in Big Deer Creek are not achieved**—Water quality goals are currently being met at the monitoring station downstream from the confluence of South Fork Big Deer Creek and Big Deer Creek (BDSW-03); therefore, this contingent action is not required.

- **Alternatives to address metals discharges to South Fork Big Deer Creek from groundwater and/or overbank materials if water quality goals in South Fork Big Deer Creek are not achieved**—As described in Section 4.4.11.1, EPA will evaluate monitoring data through 2014 to determine if the water quality goals can be met in South Fork Big Deer Creek through natural recovery. If EPA determines that the water quality goals cannot be met, the Bucktail Bypass Pipeline will be constructed.

- **Additional removals along Panther Creek if monitoring following storm events indicates that re-deposition at overbank areas exceed remediation goals**—High flow events occurred during the spring of 2003, 2008, and 2009 that caused unacceptable contamination in several of the overbank areas along Blackbird and Panther Creeks. These areas were sampled, characterized, and the re-contaminated soils were subsequently removed in 2004, 2009 through 2012. Additional measures were taken along Blackbird Creek to reduce the amount of contaminated materials released by Blackbird Creek during future large runoff events (construction of in-stream stabilization structures described in Sections 4.4.7 through 4.4.10 above). If future high runoff events in Blackbird Creek result in re-contamination of overbank areas along Panther Creek at concentrations above the cleanup levels, additional removals will be conducted. In addition, the (b) (6) property owners have elected to not have removals completed on their property until the Blackbird Creek stabilization structures demonstrate their effectiveness. Finally, the former PCI soils are currently above residential cleanup levels and above the long term camping cleanup levels. This area will need to be addressed with ICs.

- **Monitoring to determine if the mixing zones are protective of cold water biota in Panther Creek and Big Deer Creek**—This monitoring has not yet been conducted. EPA anticipates that this monitoring will be conducted in Panther Creek and Big Deer Creek during spring and fall of 2013.

- **Alternatives to address metals loads to Big Deer Creek downstream from South Fork Big Deer Creek if monitoring indicates that these loads result in exceedances of water quality cleanup levels in Big Deer Creek**—The potential sources of these dissolved copper loads have been studied extensively by the BMSG, in consultation with EPA and the Natural Resource Trustees (see Section 6.1.1.1.2 for additional information concerning these loads). The source of the copper loads has not been definitively determined to be associated with the Blackbird Mine. EPA has decided to monitor these loads to determine if there are changes in these loads or their characteristics over time, and to determine if the water quality cleanup levels can be achieved without additional remedial actions. If water quality cleanup levels cannot be achieved, and if additional investigations can be identified that can more definitively determine the source(s) of the loads, additional investigations will be conducted in the future.

4.5 Summary of Operations and Maintenance

The BMSG performs O&M and regular monitoring at the Site. The O&M is conducted in accordance with a series of O&M plans that have now been consolidated into a sitewide O&M manual (Golder, 2007b). In addition to ongoing O&M, the BMSG conducts regular inspections of the various facilities as required by the O&M manual. EPA, IDEQ, and USFS also conduct annual inspections of the aboveground facilities and the underground mine facilities. Golder Associates, on behalf of the BMSG, conducts dam safety inspections of the 7000 Dam, the 7100 Dam, and the West Fork Tailings Impoundment every 5 years. In addition, the Idaho Department of Water Resources conducts dam safety inspections, typically every other year.

SECTION 5

Progress Since Last Five-Year Review

The first Five-Year Review was completed in 2008. Section 5.1 summarizes the findings of the 2008 Five-Year Review. Section 5.2 describes the actions taken since the 2008 Five-Year Review was completed.

5.1 2008 Five-Year Review Summary of Findings

The 2008 Five-Year Review Report confirmed that the components of the remedy completed to date had been constructed as outlined by the ROD. There was one component of the remedial action, a number of contingent actions that had not been constructed, and two ICs that were not implemented from the ROD. Water quality in most of the creeks exhibited vast improvement, mine groundwater concentrations remained above MCLs, and in-stream sediments continue to exceed cleanup standards. However, the protectiveness of the remedy at the Blackbird Mine Site was expected to be protective of human health and the environment upon completion of the remaining remedial actions, contingent actions, and implementation of ICs. The following actions were recommended in the 2008 Five-Year Review:

- Monitor dissolved copper load along Big Deer Creek to determine if water quality cleanup levels can be met.
- Determine if Spring 2008 high flow event in Blackbird Creek contributed to additional contamination deposited in overbanks along Panther Creek.
- IC implementation.

5.2 Actions Taken Since 2008 Five-Year Review

Table 5-1 summarizes the actions taken in response to the recommendations and follow-up actions identified in the 2008 Five-Year Review.

TABLE 5-1
Actions Taken Since Last Five-Year Review
Blackbird Mine Site, Lemhi County, Idaho

Issues from Previous Review	Recommendations/ Follow-up Actions	Party Responsible	Completion Date	Outcome
There are dissolved copper loads along Big Deer Creek; the sources and significance of these loads could not be determined with certainty. These loads may continue to cause exceedances of the copper water quality cleanup levels in portions of Big Deer Creek.	Monitor the dissolved copper loads along Big Deer Creek to determine if the copper water quality cleanup level can be met in Big Deer Creek. If the Big Deer Creek loads continue to result in exceedances of water quality cleanup level, and if additional investigations can be identified, they will be conducted.	EPA	Ongoing	Continued monitoring of the dissolved copper loads along Big Deer Creek and continue to access if Big Deer Creek can meet cleanup levels.

TABLE 5-1
Actions Taken Since Last Five-Year Review
Blackbird Mine Site, Lemhi County, Idaho

Issues from Previous Review	Recommendations/ Follow-up Actions	Party Responsible	Completion Date	Outcome
High flows in Blackbird Creek in Spring 2008 caused erosion and channel realignment along Blackbird Creek, with downstream deposition of contaminated sediments along the banks of Panther Creek.	Sample the materials deposited in the overbank areas along Panther Creek. Depending on the results of this sampling, removals of the deposited materials may be required. Further evaluation of alternatives for additional measures to reduce the release of materials during high flow events in Blackbird Creek would need to be implemented.	BMSG	Ongoing	Characterization and removals of the overbank deposits from high flows events in Panther Creek. Evaluated multiple alternatives to address recontamination releases. Design and construction of in-stream stabilization structures for Blackbird Creek. Continued monitoring of effectiveness of in-stream stabilization structures
Not all of the ICs at the Site have been implemented. In addition, USFS has not yet established administrative procedures on USFS properties at the mine site and along Panther Creek. Currently, no unacceptable uses are occurring on the properties. If these ICs are not established and implemented, the protectiveness of the remedy may be impacted. Likewise, the long-term effectiveness of the soil management program will require the cooperation and diligence of both the BMSG and the affected landowners to assure no unacceptable exposures occur.	Continue to work toward having the necessary ICs implemented at the Cobalt Townsite and the mine. If ongoing negotiations and discussions are not successful, an enforcement action to seek compliance with the UAO may be necessary. Finally, consult with USFS to seek modification of the MOU to obtain assurances that administrative procedures are put in place on properties under the control of USFS to assure protectiveness.	BMSG, EPA, and USFS	Ongoing	To date, PRP has refused to implement all necessary ICs at owned land. The USFS is in the process of establishing additional administrative controls on USFS properties to assure no inconsistent uses occur on USFS lands.

SECTION 6

Five-Year Review Process

6.1 Administrative Components

The community on EPA's mailing list and the PRPs (the BMSG) were notified that EPA would be conducting the Five-Year Review of the Blackbird Mine Site in 2013 in postcards dated February and March, 2013 (Appendix A). The Five-Year Review was led by Fran Allans, Remedial Project Manager for EPA, and included input from EPA's oversight contractor, and review by USFS and the State of Idaho.

Components of the Five-Year Review included:

- Document review
- Data review
- Site inspection
- Community involvement
- Five-Year Review report development and review

6.2 Document Review

Existing documents relevant to the Five-Year Review were reviewed for this report. The type of documents reviewed included: Early Action design and construction completion reports; the RI/FS; the ROD and ESDs; Remedial Action construction completion reports; yearly monitoring reports; O&M documents and reports; and the Environmental Impact Statement for the Idaho Cobalt Project. A complete list of the documents reviewed is included in Section 12.

6.3 Data Review

Monitoring data as required by the Performance Monitoring Plan (Golder, 2011a) is summarized in an annual report prepared by the BMSG. The 2012 data and historical trend data for surface water, groundwater, and in-stream sediments was provided in the annual Monitoring Report (Golder, 2013b), and is described below. The cleanup levels established in the ROD and updated by the submittal of two ESDs are described in Section 4.2.2. Monitoring locations discussed in the following sections can be reviewed on Figure 6-1.

6.3.1 Surface Water Quality Data

The ROD requires that surface water cleanup levels be met in three area streams impacted by the Blackbird Mine. These include Panther Creek downstream from Blackbird Creek, Big Deer Creek downstream from South Fork Big Deer Creek, and South Fork Big Deer Creek downstream from Bucktail Creek. The COCs in surface waters for the identified streams are arsenic, cobalt, and copper. The arsenic standard of 0.050 mg/L in Blackbird Creek and 0.014 mg/L in the remaining creeks continues to be met consistently since the last Five-Year Review. Hence, the monitoring focus has been on copper and cobalt. The surface water cleanup level for dissolved copper is the Idaho Water Quality Standard (IWQS) and is based on hardness. At the typical hardness values seen in these streams, the IWQS cleanup level for dissolved copper varies from about 0.0035 mg/L to about 0.010 mg/L. There is no Idaho Water Quality Standard for cobalt; therefore EPA established a risk-based value of 0.038 mg/L in the ROD as the dissolved cobalt water quality cleanup level. Subsequent to the issuance of the ROD, the BMSG conducted a site-specific cobalt toxicity study. Based on the results of this toxicity study, EPA issued an ESD to the ROD (EPA, 2007) that revised the surface water cobalt cleanup level from 0.038 mg/L to 0.086 mg/L. Non-numeric cleanup goals for Blackbird and Bucktail Creek are to improve water and

sediment quality such that cleanup levels can be met in the downstream creeks that have numeric water quality cleanup levels.

The UAO SOW established a rigorous sampling methodology for determining whether surface water cleanup levels are being met in area streams. The SOW required that this sampling begin as determined by EPA following completion of the remedial actions. The rigorous sampling methodology requires four 96-hour sampling events per year at each monitoring station. Three sampling events are conducted in the spring, and one sampling event is conducted during the fall. During each sampling event, 12 samples are collected and each station, then the 12 samples are analyzed statistically to determine if an exceedance of the water quality cleanup levels has occurred. The UAO SOW also established a statistical methodology for determining when the water quality cleanup levels are met in each stream. This methodology essentially requires that there be no unacceptable exceedances of the cleanup levels at any water quality sampling station for a 5-year period.

To evaluate changes in concentrations and potential metal loading along the drainages, synoptic surface water sampling are conducted on the Blackbird, Panther Creek, Bucktail, and South Fork and Big Deer Creek drainages in the springs of each year.

In addition to the 96-hour sampling events and synoptic sampling, weekly surface water sampling is conducted for 2.5 months in the spring at Blackbird, Panther, and Big Deer Creeks. This data is primarily used to determine when significant increasing copper trends were occurring, compared to 96-hour sampling events.

In 2012, automated samplers at PASW-09 and BDSW-09 were installed to collect acute criteria monitoring of copper during high water storm events. The sampling is automatically triggered by the USGS gauging station BBSW-02. No significant storm event occurred to trigger the automated sampling.

Water quality data from 2008 to 2012 for surface waters and overall concentration trends are summarized below.

6.3.1.1 Panther Creek 96-Hour and Weekly Sampling Results

Water quality concentrations are measured at four stations along Panther Creek from above Blackbird Creek to below Big Deer Creek (Stations PASW-11, 09, 05, and 04X) during the four 96-hour sampling events each year. As shown in Table 6-1, concentrations observed in Panther Creek exceeded the chronic criteria for copper at least at one station for 2008, 2009, 2010, and 2011 and peak concentrations ranged from 0.007 to 0.020 mg/L. In 2012, the highest concentration of dissolved copper was 0.0031 mg/L at PASW-09. The water quality cleanup levels for dissolved copper were achieved at all Panther Creek stations during all 96-hour sampling events for 2012. The historical concentrations of dissolved copper at the measured stations PASW-09 and PASW-04X are shown in Figures 6-2 and 6-3, respectively. Cobalt concentrations have remained below the cleanup level of 0.086 mg/L for the last 5 years at all sampling stations.

In 2012, the weekly sampling data and USGS station flow measurements collected for the Weekly Sampling Event (April 1 through June 15) suggests that the peak concentrations occurred a few days before the first 96-hour sampling event. In general, the weekly sampling has shown that the 96-hour sampling events have occurred within 2 weeks or less of the peak concentrations for the past 5 years.

6.3.1.2 Big Deer Creek 96-Hour and Weekly Sampling Results

Water quality concentrations are measured at five stations along South Fork Big Deer Creek and Big Deer Creek (SFSW-01, SFSW-04, BDSW-01, BDSW-03, and BDSW-04) during the four 96-hour sampling event. Consistently, SFSW-01 has been the sampling station with the highest observed concentration of copper, exceeding the chronic criteria for the last 5 years (Table 6-1). Exceedance of copper has also

occurred at other sampling stations during the last 5 sampling event years. Concentrations of copper at SFSW-01 ranged from 0.01 to 0.025 mg/L during the last 5 years. Historic concentration trends at two Big Deer Creek Stations (1 and 3) show a significant decreasing trend from 1995 to 2006. Concentrations from 1995 to present are shown on Figures 6-4 and 6-5 for Stations BDSW-03 and BDSW-01, respectively. A statistical evaluation of all available data for South Fork Big Deer Creek stations through 2011 indicated that concentrations in the creek could potentially meet cleanup goals by natural recovery. The peak concentration of copper at SFSW-01 in 2008 was 0.025 mg/L and 0.016 mg/L in 2012.

Similar to Panther Creek, weekly sampling data and observations of flow measurements suggest that the peak concentrations occurred before the first 96-hour sampling event. At the Big Deer Creek monitoring location (BDSW-03), the peak copper concentration occurred on or before April 4, which was the start of the 96-hour sampling event. Concentrations appeared to decrease from peak and begin to increase during the first round. Hence, concentrations generally decreased during all rounds of the 96-hour sampling event. Weekly sampling events from previous sampling event years have indicated that the 96-hour sampling events have occurred within weeks of the peak concentrations.

TABLE 6-1
96-Hour Peak Concentration Sampling Results From 2008 to 2012 at Panther Creek and Big Deer Creek
Blackbird Mine Site, Lemhi County, Idaho

	Panther Creek Station Location	Panther Creek Station Location	Big Deer Creek Station Location	Big Deer Creek Station Location
Year	**Copper (mg/L)**	**Cobalt (mg/L)**	**Copper (mg/L)**	**Cobalt (mg/L)**
2008	PASW -09	PASW-09	SFSW-01	SFSW-01
	0.014	0.049	0.025	0.032
	CC: 0.0035		CC: 0.0069	
2009	PASW-09	PASW-09	BDSW-03	BDSW-03
	0.020	0.059	0.010	0.010
	CC: 0.0052		CC: 0.0036	
2010	PASW-05	PASW-09	SFSW-01	SFSW-01
	0.007	0.064	0.025	0.029
	CC: 0.0035		CC:0.0084	
2011	PASW-05	PASW-09	SFSW-01	SFSW-01 and SFSW-02
	0.017	0.04	0.015	0.018
	CC : 0.0035		CC: 0.009	
2012	PASW-09	PASW-09	SFSW-01	SFSW-01
	0.0031	0.044	0.016	0.027
	CC: 0.0035		CC: 0.0142	

Notes:

Cobalt cleanup level is 0.086 mg/L for all stations.

CC = Chronic Criteria

6.3.1.3 Blackbird Creek and Panther Creek Synoptic Sampling

The dissolved copper loading increased with each downstream station during the sampling event, with the exception between BBSW-03 and BBSW-02, which is a change from previous synoptic sampling results.

This increase is likely due to flow measurement error on the USGS station at BBSW-02. Cobalt loads located between BBSW-03 and BBSW-02 are attributed to the West Fork Tailings Impoundment. However, these stations have seen a decrease from previous years due to the lower flows and concentrations.

6.3.1.4 Bucktail Creek, South Fork Big Deer Creek, and Blackbird Synoptic Sampling

The spring synoptic sampling event results displayed dissolved copper load increasing between all stations. The dissolved cobalt also increased across the stations with the exception of SFSW-01 and BDSW-03. The highest loading increases occurred between BDSW-03 and BDSW-01 for both copper and cobalt, which is a change in the historical loading trend. Typical highest loading for cobalt and copper occur upstream between BTSW-01.6 and BTSW-01.

Three separate fall synoptic sampling events occurred in 2012 (July, September, and October). The September event was executed as a full synoptic event, while the other two events were considered mini-synoptic events.

Dissolved copper and cobalt increased during the July mini-event. The largest loading was observed between BTSW-01 and SFSW-02. The full September synoptic event was consistent with previous years, displaying a dissolved copper loading increasing across all stations with the largest occurring between BTSW-01 and SFSW-02. Consistent with previous October synoptic sampling events, dissolved copper loading increased across all stations, with the largest increase between BTSW-01 and SFSW-02. The largest increase in dissolved cobalt loading occurred between BTSW-01 and SFSW-02, which is also consistent with previous October synoptic sampling events.

6.3.2 Groundwater Quality Data

Groundwater quality is measured in 11 wells within the Blackbird Creek drainage. Five wells are located near the WTP. In addition to the WTP wells, sampling continued at some West Fork Impoundment monitoring wells since 2009. The COCs in groundwater at the Site include arsenic, cobalt, and copper.

The following wells are sampled during the annual WTP sampling event: BBMW-03A, BBMW-05A, BBMW-06A, BBMW-07A, and BBMW -08A (Figure 6-6). The measured concentrations of arsenic in these wells ranged from 0.005 mg/L (BBMW-08A) to 0.0285 mg/L (BBMW-06A). Overall containment trends from 2004 to present suggest that the concentrations have been relatively stable or variable since 2004. Concentrations of cobalt ranged from 0.406 mg/L (BBMW-03A) to 8.51 mg/L (BBMW-05A). Concentrations of cobalt appear to be decreasing in BBMW-03A and BBMW-07A, while all other locations appear relatively stable or variable since 2004. Copper concentrations ranged from 0.002 mg/L (BBMW-07A) to 14.4 mg/L at BBMW-08A. Copper concentration trends in these wells consist of declining (BBMW-06A and BBMW-03A), increasing (BBMW-05A and BBMW-08A), and variable (BBMW-07A).

The following wells are sampled during the annual West Fork Impoundment sampling event: WFMW-01D, WFMW-01S, WFMW-09, WFMW-13S, WFMW-1109, and WFMW-1101 (Figure 6-7). Piezometric data suggests that a gradual water increase has been occurring since 2000. Concentrations of arsenic in the West Fork wells in 2012 ranged from 0.005 mg/L (multiple wells) to 0.140 mg/L at WFMW-01S. Arsenic concentrations have remained relatively stable at WFMW-13S, but have shown an increase in the other wells within the monitoring network. Concentrations of cobalt ranged from non-detection at WFMW-13S to 3.090 mg/L at WFMW-01S. Cobalt concentrations exhibit a declining trend at wells WFMW-1S, WFMW-1D, WFMW-09, and WFMW-13S. Cobalt concentrations in WFMW-1109 and WFMW-1101 are variable, but little data are available to assess a trend. Concentrations of copper in the wells remain low ranging from 0.001 mg/L to 0.041 mg/L, and trends remain relatively stable.

The most recent sampling of a groundwater well at the former PCI property occurred in 2009 to observe the groundwater concentrations in the shallow alluvial aquifer along Panther Creek. The results of the sampling event indicted that groundwater exceeds the cobalt standard with a concentration of 0.325 mg/L. The cobalt groundwater contamination extends beyond the Blackbird Creek drainage waste management area. Additional groundwater well sampling at the former PCI is not currently scheduled at this time.

To assess the possible current groundwater concentrations near Bucktail Creek, monitoring well BTMW-03B was sampled in 2012. BTMW-03B is located above the Upper Bucktail road crossing and is upgradient of the collection systems that feed the Lower Bucktail Pump Station. Prior to sampling in 2012, BTMW-03B was sampled during the RI in 2000. The dissolved arsenic concentration in BTMW-03B was a non-detection, dissolved copper was 19.8 mg/L, and dissolved cobalt was 6.83 mg/L in 2000. Sample results for the 2012 sampling of BTMW-03B is as follows: dissolved arsenic was a non-detection, dissolved copper was 0.055 mg/L, and dissolved cobalt was 0.042 mg/L. Although cobalt exceeded the cleanup level for cobalt in groundwater (0.023 mg/L), this well exhibits a significant decrease in concentrations from 2000.

6.3.3 Sediment Data

In-stream sediment data for 2012 for Panther Creek, Big Deer Creek, Blackbird Creek, and South Fork Big Deer Creek are summarized below. In addition to the Performance Monitoring Plan sediment sampling requirements, sediment sampling occurred in the in-stream stabilization areas for Blackbird Creek (see Section 4.4.8.1) to assess the stabilization effectiveness and the effect of the West Fork Tailings Impoundment. Finally, floc samples were collected from the toe ditch of the West Fork embankment. The in-stream sediment cleanup levels are summarized in Section 4.2.1.

6.3.3.1 Panther Creek 2012 Sampling

Sediment data were collected from seven sampling stations along Panther Creek downstream from the mouth of Blackbird Creek. The arsenic concentrations ranged from 4 to 71 mg/kg (cleanup level of 35 mg/kg). Cobalt concentrations ranged from 5 to 91 mg/kg (cleanup level of 80 mg/kg). Copper concentrations ranged from 6 to 128 mg/kg (cleanup level of 149 mg/kg). Overall, the sampling locations have been seeing a decreasing trend during the last four annual sampling events.

6.3.3.2 Big Deer Creek 2012 Sampling

Sediment data were collected from two stations located downstream of the mouth of South Fork Big Deer Creek. The arsenic concentrations downstream from South Fork Big Deer Creek were non-detection and 4 mg/kg (cleanup level of 35 mg/kg). Cobalt concentrations were 1 and 25 mg/kg (cleanup level of 80 mg/kg). Copper concentrations were 2 and 116 mg/kg (cleanup level of 149 mg/kg). Concentrations at these sampling stations have remained relatively stable during the last four sampling events.

6.3.3.3 South Fork Big Deer Creek 2012 Sampling

Sediment data were collected from three stations located downstream of the mouth of Bucktail Creek. The arsenic concentration downstream from Bucktail Creek ranged from 9 to 30 mg/kg (cleanup level of 35 mg/kg). Cobalt concentrations ranged from 5 to 102 mg/kg (cleanup level of 436 mg/kg). Copper concentrations ranged from 8 to 1,040 mg/kg (cleanup level of 637 mg/kg). Arsenic and cobalt concentrations have seen a decreasing trend over the last four sampling events, while copper has remained relatively stable.

6.3.3.4 Blackbird Creek 2012 and In-stream Stabilization Sampling

Sediment data were collected from four stations downstream of the mouth of Meadow Creek. Cleanup levels for Blackbird Creek consist of a narrative as explained in Section 4.2.2. The arsenic concentrations in Blackbird Creek ranged from 8 to 343 mg/kg. Cobalt concentrations ranged from 10 to 303 mg/kg.

Copper concentrations ranged from 78 to 836 mg/kg. Blackbird creek sampling stations have seen a decreasing trend in arsenic and relatively stable cobalt and copper trends.

Total arsenic and cobalt concentrations in Blackbird sediments upstream and downstream of the West Fork Tailings Impoundment were tracked to evaluate trends for in-stream stabilization performance and evaluate the effect of the tailings in sediment quality. Two in-stream fine-grained sediment samples were collected at each of the eight in-stream stabilization areas (Figure 4-1). In addition, a baseline pebble count/grain size distribution sampling occurred where characterization of finer-grained sediments occurred at multiple depths (0 to 6 inches and 6 to 12 inches) at each stabilization area.

Concentrations observed from the in-stream sediment sampling were generally lower than those samples collected upstream of the West Fork Impoundment. In comparison to 2011 sampling data, the 2012 mean for arsenic, cobalt, iron, total sulfur, sulfide sulfur, and sulfate sulfur concentrations increased. However, the difference between 2012 and 2011 means were within the standard deviation. Floc samples collected at the toe ditch of the West Fork embankment exhibit elevated concentrations of arsenic (1,145 mg/kg), iron (223,000 mg/kg), total sulfate (1.72 mg/kg), sulfate (1.66 mg/kg), and sulfide (0.51 mg/kg) compared to those samples collected upstream and downstream from West Fork. However, the concentration of cobalt was lower at 68 mg/kg. With the exception of cobalt, concentrations at the toe ditch were slightly lower 2012 than 2011.

Baseline pebble count fine-grained sediment samples were similar to the in-stream sediment sampling. Concentrations up-stream ranged from 390 to 889 mg/kg and 155 to 390 mg/kg for arsenic and cobalt in-stream sediments, respectively. Downstream arsenic concentrations for in-stream sediments ranged from 405 to 946 mg/kg, and cobalt ranged from 86 to 972 mg/kg. Fresh deposit sample results for arsenic were similar across the stabilization areas (with the exception of Area 3, with a concentration of 398 mg/kg), ranging from 578 to 780 mg/kg. Cobalt concentrations were variable ranging from 166 to 369 mg/kg. Furthermore, concentrations at surface (0 to 6 inches) were similar to those collected at depth (6 to 12 inches).

6.3.3.5 Overbank Deposits

To characterize the current concentrations of the overbank deposits along Blackbird Creek and Panther Creek from previous high flow events, sampling was conducted in 2012. Previous characterization to Blackbird and Panther Creeks from initial contamination and follow-on high flow events prompted the overbank removals that are described in Sections 3.4.2.3 and 4.4. The 2012 sampling event was limited to confluence of Blackbird Creek and Panther Creek and areas downstream of Panther Creek.

6.3.3.6 Panther Creek

During the 2012 sampling event, the former Panther Creek Inn along Blackbird Creek, former Panther Creek Inn along Panther Creek, and Upper Cobalt Townsite overbank sampling areas were sampled. Sample concentrations were used for 95 upper confidence limit (UCL) calculations for comparison to cleanup criteria.

The purpose of these sampling locations was to (1) characterize current conditions along Blackbird Creek below the Panther Creek Road bridge and in overbank areas along Panther Creek in the former Panther Creek Inn campground and (2) resample Upper Cobalt Townsite to confirm 95 percent UCL calculation (Golder, 2013c). The former Panther Creek Inn is above the residential cleanup levels for a potential residential future use scenario. EPA is in the processes of evaluating the data to determine if it is above recreational and camping cleanup levels. The arsenic and cobalt UCLs for the Upper Cobalt Townsite were below cleanup levels.

6.3.3.7 2008 Forest Service Overbank Area Sample Reanalysis

To obtain cobalt concentrations from samples that were collected in 2008 and only analyzed with XRF for arsenic, the BSMG submitted the samples from four Panther Creek areas located on USFS property to a certified laboratory. All 95 percent UCL calculations of the laboratory data were under the arsenic and cobalt cleanup levels.

6.4 Site Inspection

EPA conducts regular site inspections at the Blackbird Mine Site to inspect remedial action construction activities and to review the ongoing O&M at the Site. These inspections are typically conducted in the autumn of each year, and the most recent inspection was conducted in September 2012. EPA also regularly reviews the annual monitoring reports for the Site. Because of these regular inspections and reviews, EPA considered the site inspection conducted in September 2012 to be sufficient for the purposes of the Five-Year Review.

6.5 Community Involvement

As discussed in Section 6.1, EPA provided an announcement to the community to encourage involvement during the Five-Year Review processes. EPA received no communications from the community.
The community near the Blackbird Mine is a sparsely inhabited rural area with few year-round residents.

SECTION 7

Technical Assessment

Section 7 presents a technical assessment of the remedy performance as implemented at the Site. As outlined in EPA's *Comprehensive Five-Year Review Guidance* (EPA, 2001), this assessment is structured to answer the following three questions:

- Is the remedy functioning as intended?
- Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?
- Has any other information come to light that could affect the remedy's protectiveness?

These questions are addressed in the following sections.

7.1 Question A: Is the Remedy Functioning as Intended?

No, the remedy is not yet performing as intended because not all of the necessary ICs, not all remedial actions, and necessary contingent remedial actions have been implemented. In addition, concentrations of COCs in surface waters and sediments remain above cleanup levels in certain streams. It is anticipated that the remedy will function as intended for all elements upon completion of all remedial actions, completion of relevant contingent actions, evaluation and optimization (if determined to be necessary) of in-stream stabilization along Blackbird Creek, implementation of all ICs, and following natural recovery of sediments. The discussion of remedy function is separated into discussions of water quality, groundwater, in-stream sediments, and overbank deposits.

7.1.1 Water Quality

There have been significant improvements to water quality in the creeks downstream of the Site since initiation of cleanup actions. The improvements vary among the creeks for which water quality cleanup levels have been established in the ROD. The specifics are discussed in the following sections (also see Section 6.3.1 for additional information on water quality and for the UAO SOW methodologies for determining when water quality cleanup levels have been met). Water quality data focus on copper and cobalt because the data indicate that the arsenic standard is met consistently in all area streams. The data are provided for 2012 because this is the most recent year for which validated data are available. In addition, overall concentration trends are discussed.

7.1.1.1 Panther Creek

In Panther Creek, water quality has improved substantially, with peak dissolved copper concentrations downstream from Blackbird Creek decreasing from 0.218 mg/L in 1995 to 0.003 mg/L in 2012. This represents a 99 percent reduction in peak concentrations. Peak dissolved cobalt concentrations at this location have been reduced from 0.273 mg/L in 1995 to 0.044 mg/L in 2012, an 84 percent reduction. In 2012, Panther Creek surface water concentrations for cobalt and copper are below the cleanup levels, meeting water quality standards during all 96-hour sampling events. The overall concentration trend of dissolved copper at the measured stations along Panther Creek have remained stable or slightly decreasing (Figures 6-2 and 6-3). Cobalt concentrations have remained stable and well below the cleanup level.

7.1.1.2 Big Deer Creek and South Fork Big Deer Creek

In Big Deer Creek, water quality also has improved substantially. At the first station just downstream from the mouth of South Fork Big Deer Creek (Station BDSW-03A), peak copper concentrations have been reduced from 0.342 mg/L in 1995 to 0.004 mg/L in 2012. This represents close to two orders of magnitude in reduction of concentrations. Peak cobalt concentrations have been reduced at this location

from 0.110 mg/L in 1995 to 0.0039 mg/L in 2012, a 96 percent reduction. However, multiple station locations during the 2012 sampling events exhibited copper concentrations that exceeded the cleanup criteria in Big Deer Creek and South Fork Big Deer Creek, specifically BDSW-01, which is located at the confluence of the Big Deer Creek and Panther Creek. Studies to determine the source of downstream exceedances have determined that observed elevated concentrations of copper cannot be definitively attributed to Blackbird Mine Site. BDSW-01 has consistently exceeded cleanup criteria during the last five annual sampling events. All cobalt concentrations during the last five sampling events were below the water quality cleanup level.

EPA originally decided to schedule the construction of the bypass pipeline to occur in 2010, 3 years after completion of the upper Bucktail Creek remedial actions to allow the effectiveness of the upper Bucktail Creek remedial actions to be determined and to allow the residual materials along Bucktail Creek to begin to recover naturally. The BMSG requested that monitoring continue through 2011 to better determine the rate of natural recovery. A statistical evaluation based on the monitoring data through 2011 indicated that South Fork Big Deer Creek may be able to meet water quality cleanup goals through natural recovery. EPA therefore decided to monitor for an additional 3 years (through 2014). Following this additional monitoring, EPA will again evaluate the need for the bypass pipeline.

7.1.1.3 Blackbird Creek and Bucktail Creek

Monitoring in Blackbird Creek in 2012 indicated that there had been no exceedances of the surface water cleanup level for arsenic (0.010 mg/L). With the exception of arsenic in Blackbird Creek, the ROD does not require numeric surface water cleanup levels to be met in Blackbird Creek and Bucktail Creek, because use attainability analyses performed by the State of Idaho have determined that certain uses and water quality criteria cannot be attained on these creeks (see Section 5.3.1.4). The ROD includes non-numeric cleanup goals for Blackbird Creek and Bucktail Creek, which are to improve water and sediment quality such that cleanup levels can be met in the downstream creeks that have numeric water quality cleanup levels. In addition, the remedial goal for Blackbird Creek is to support aquatic life at levels similar to nearby reference streams, although not necessarily to support salmonids or metals-sensitive macroinvertebrate taxa, the creek is moving toward this goal. Panther Creek met the water quality cleanup levels in 2012; therefore, the non-numeric goal for water quality was met in Blackbird Creek and the remedy is functioning as intended. The water quality cleanup levels were not met at all stations in South Fork Big Deer Creek and Big Deer Creek in 2012; therefore the non-numeric goal for water quality has not yet been met in Bucktail Creek, and the remedy is not yet functioning as intended.

7.1.2 Groundwater

As noted in Section 6.3.2, monitoring wells at the mine indicate that groundwater at the mine does not consistently meet MCLs or risk-based levels for arsenic, cobalt, and copper. The groundwater at the mine is not currently used for drinking water. ICs that run with the land and are enforceable against future landowners or users have been determined to be needed to protect against use as a drinking water source (see Section 7.1.6). Once the ICs are implemented, the remedy with regard to groundwater should function as intended.

The 2009 sampling event at the former PCI groundwater well indicated that groundwater is contaminated with cobalt above the revised, risk-based cleanup level. In order to assess the full nature and extent of groundwater contamination, further characterization will be needed. An IC that runs with the land and is enforceable against future landowners or users has been determined to be needed at the former PCI property to protect against use as a drinking water source (see Section 7.1.6).

The 2012 sampling results at the monitoring well upgradient of the collection systems (BTMW-03B) indicated that the groundwater near Bucktail Creek has possibly improved (only one sample collected in 12 years) and that the remedy is performing as intended. Furthermore, the sampling results suggest that

surface water concentrations are not an expression of groundwater contamination. Concentrations in BTMW-03B show a 99 percent reduction in dissolved copper and dissolved cobalt since 2000. However, the recent sampling event exceeded the current cobalt standard of 0.023 mg/L with a concentration 0.042 mg/L.

7.1.3 In-stream Sediments

As noted in Section 6.3.3, data on in-stream sediments in Panther Creek, South Fork Big Deer Creek, and Big Deer Creek vary considerably, with certain of the stations meeting the sediment cleanup levels for some of the parameters (arsenic, cobalt, and copper), with the exception of Big Deer Creek that met cleanup levels at both sampling stations in 2012. Sediment concentration trends of creeks upstream from Panther Creek (Blackbird Creek, Bucktail Creek, Big Deer Creek, South Fork Big Deer Creek) have relatively stable trends during the last five sampling events. Concentrations during the last five sampling events at Panther Creek station has shown decreasing trend. However, the in-stream sediment cleanup levels have not yet been achieved consistently downstream from the mine. Once the sediments are cleaned up through natural recovery, it is anticipated that the remedy will function as intended.

The non-numeric narrative cleanup goals for sediments in Blackbird Creek and Bucktail Creek have not yet been met either, because the cleanup goals have not yet been met in the downstream creeks. Once the sediments are cleaned up in the downstream creeks through natural recovery, the remedy in Blackbird Creek and Bucktail Creek will function as intended.

7.1.4 Overbank Deposits

All overbank deposits along Blackbird Creek and Panther Creek that posed an unacceptable human health risk due to arsenic contamination from the Blackbird Mine Site were cleaned up to the soil cleanup levels as part of the Early Actions or Remedial Actions. However, high flow events have contributed to recontamination of the overbank deposits along in Blackbird Creek and Panther Creek. In response to these high flow events, overbank characterization, removal of contaminated overbank deposits, and construction of in-stream stabilization features were implemented (see Section 4.4.8). Two annual reviews (2011 and 2012) of performance of the in-stream stabilization in Blackbird Creek indicates that the structures are performing as intended and will potentially abate possible future high flow recontamination of Panther Creek overbanks. When the remaining areas that exceed the cleanup level (see Section 6.3.4) undergo soil removal, along with continued performance and optimization reviews of in-stream stabilization features, then the remedy should function as intended. Based on the request of the property owner, one of the remaining areas is not planned to undergo removals of contaminated overbank deposits until the recent installation of the stabilization structures in Blackbird Creek demonstrate effectiveness to abate further overbank recontamination in Panther Creek. EPA is in the process of determining whether removal of contaminated overbank deposits is necessary at the former PCI property to address the recreational and camping risk scenarios and the possible need for the implementation of ICs.

7.1.5 Operation and Maintenance

The BMSG performs O&M at the Site. The O&M is conducted in accordance with a sitewide O&M Manual (Golder, 2007b). In addition to ongoing O&M, the BMSG conducts regular inspections of the various facilities as required by the O&M manual. EPA, IDEQ, and USFS also conduct annual inspections of the aboveground facilities and the underground mine facilities. The O&M and inspection procedures are adequate to maintain the protectiveness of the remedy.

Costs for O&M since 2008 are summarized in Table 7-1. These costs were obtained from the BMSG. In general, recent O&M costs have been constant in 2008 and 2009. The 2011 and 2012 water treatment costs were higher than past years due to the installation and operation of supplemental treatment systems and construction of the sludge drying beds. The costs for dams, ditches, and roads were much higher in

2011 due to costs for removal of the lower sediment pond in Bucktail Creek, improvements to the Meadow Creek cap collection system and lining of two of the clean water diversion ditches in the Meadow Creek basin. Elevated monitoring costs for 2011 and 2012 were primarily due to the additional synoptic sampling events in Bucktail Creek and Big Deer Creek and installation of the USGS monitoring stations in Blackbird Creek and Panther Creek.

TABLE 7-1
Operations, Maintenance, and Monitoring Costs for the Blackbird Mine Site Remedy
Blackbird Mine Site, Lemhi County, Idaho

Description	2008	2009	2010	2011	2012	Yearly Average for 2008-2012
WTP, Pumping, Non-civil Site Maintenance	$605,176	$683,482	$632,823	$748,504	$917,212	$717,439
Civil Engineering Structures and Improvements	$417,655	$383,473	$417,689	$1,186,276	$513,198	$583,658
Underground Mine	$89,325	$37,983	$768,156	$787,278	$549,359	$446,420
Monitoring and Reporting	$471,924	$479,215	$438,239	$493,819	$535,732	$483,786
Total O&M Cost	$1,584,080	$1,584,153	$2,256,907	$3,215,877	$2,515,501	$2,231,304

Source: Blackbird Mine Site Group

7.1.6 Implementation of Institutional Controls

As described in Section 4, the 2003 ROD as changed by the 2012 ESD, required ICs in the Blackbird and Bucktail Creek drainages to protect the remedy, preclude uses that would result in unacceptable risks (such as residential use), and maintenance of access controls (fencing and gates) to limit unauthorized use. Along Panther Creek, the ROD provided that soil management ICs are needed at some of the properties where overbank deposits were removed as part of Early Actions or Remedial Actions to preclude unacceptable future exposure if underlying soils with elevated arsenic concentrations are brought to the surface (as a result of erosion, digging, or construction activities). The 2012 ESD now includes cobalt cleanup levels that need to be maintained. The private properties that require ICs for underlying soils are: former Panther Creek Inn, Cobalt Townsite, Noranda Pasture, Riprap Bar, (b) (6) , Deep Creek Campground, and (b) (6) . The properties under USFS control that require ICs are the Riprap Bar and Deep Creek Campground.

Consistent with the ROD, the 2003 UAO requires that any UAO Respondent that owns or controls any property within the site must provide access, and they shall implement the ICs, including providing long-term, permanent, enforceable easements or comparable instruments that run with the land and are binding upon future landowners (see Paragraph 70 of Amendment 1 of the UAO). The UAO also requires that the Respondents refrain from using the site, or such other property, in a manner that would interfere with or adversely affect the implementation, integrity, or protectiveness of the remedy. Specific restrictions include, but are not limited to, the following:

1. Prohibit the use of contaminated groundwater for drinking water purposes in the Blackbird Creek Drainage Basin and the Bucktail Creek Drainage Basin
2. Prohibit residential use and intensive recreational use (e.g., camping in excess of 14 days) of property located in the Blackbird Creek Drainage Basin and the Bucktail Creek Drainage Basin containing arsenic in excess of 100 mg/kg
3. Restrict construction and related activities that may impact the integrity of the remedy and/or the attainment and maintenance of Performance Standards

Additionally, the UAO also requires that Respondents use best efforts to obtain access and ICs on property not under their ownership and control and that the ICs need to be long-term, permanent, enforceable easements or comparable instruments that run with the land and are binding upon future landowners. Additionally, SOW Sections 2.1.1.8, 2.1.2.5, and 2.1.3.5 provided for the specific purposes and objectives for ICs in each of the drainage basins, which were also set forth in the 2003 ROD (see Section 4.3).

ICs for the downstream privately owned properties have been put into place, where appropriate. An Idaho Uniform Environmental Covenant was recorded on the (b) (6) Property on December 10, 2007, which effectuates restrictions consistent with the ROD and SOW. Prior to recording of the covenant, a title search was conducted and confirmed that there were no prior recorded interests that could potentially eliminate or undermine the long-term effectiveness of the covenant. The O&M Manual requires that the BMSG monitor the landowner's compliance with the covenant.

On the other properties with contaminated soil in the subsurface, the UAO provided that a county ordinance containing soil management requirements be submitted to the Lemhi County Commissioners. Unfortunately, on January 14, 2008, the County Commissioners rejected adopting the ordinance.
On May 5, 2008, EPA approved a work plan under which the BMSG will implement a soil management program and provide a disposal repository to the landowners if they excavate soil that cannot be placed back in the excavation location (BMSG, 2008). Under the work plan, the BMSG is required to:

- Conduct quarterly monitoring of properties where contamination has been left at depth to determine if underground construction is planned. If underground construction is planned, the BMSG will provide information about the requirements to avoid recontamination during construction.
- Provide transportation of contaminated soils to the repository if all contaminated soils cannot be replaced in excavations, and provide clean replacement soils to the landowner if necessary.
- Provide testing of excavated soils as needed and testing of adjacent soils after construction to assure that recontamination has not occurred.
- Provide annual notice to the landowners about the potential presence and location of contaminated subsurface soils, specific information on notification, handling, transport, and disposal practices, and offers of technical assistance from the BMSG.

EPA will oversee and enforce the BMSG's obligations under the UAO and soils management work plan and address private property owners' compliance with procedures and directions for managing contaminated subsurface soils along Panther Creek. The soils management plan is currently meeting project RAOs.

The (b) (6) property has a Uniform Environmental Covenants Act (UECA) covenant, and two property owners have recorded a deed notice on their property. Discussions to date with certain other downstream landowners indicate a reluctance to record a deed notice or covenant on the title of their property. Given that there is a soils management plan in place and we have reviewed that it is being implemented and has been effective in avoiding unacceptable exposure to subsurface soils, we believe the ICs in place for downstream property owners are sufficient.

To date, no ICs have been implemented for the mine site or the Cobalt Townsite which is owned by the Blackbird Mine Company Limited Partnership. Negotiations and development of an easement to USFS for the Cobalt Townsite have been ongoing for a significant amount of time. Likewise, discussions and negotiations for placement of an Idaho Uniform Environmental Covenant on the mine have not yet resulted in a recorded covenant. The Noranda Mining and Eastland Management (a subsidiary of Rio Tinto) jointly own the former PCI property, which does not currently have an IC in place. Future

residential use of groundwater and exposure to contaminated soils above future residential use levels poses a human health risk, warranting an IC put into place. The UAO prohibits Respondents from conducting activities inconsistent with the ROD and monitoring and inspections demonstrate that no unacceptable uses or exposures are occurring on those properties. The UAO requirements can be enforced against the current landowners if unacceptable uses or exposures were to occur.

The final Environmental Impact Statement for the Idaho Cobalt Project was issued by USFS on June 12, 2008. The final Environmental Impact Statement and Blackbird Mine ROD include requirements for modifications to the Plan of Operations for the Idaho Cobalt Project that will require approval by EPA and USFS Remedial Project Managers on road designs, or any excavation or construction that could disturb the historical mine wastes or remedial infrastructure.

The Forest Service is in the process of establishing additional administrative ICs for lands administered by the USFS (i.e., Deep Creek Campground, Rip Rap Bar and USFS land at the Mine Site).

In 2009, the owner of the Idaho Cobalt Project obtained a right-of-way by condemnation on existing roads across the Blackbird Mine Site to access their mineral claims and to use and make such modifications and erect such structures on the roads as it determines necessary to use and enjoy their right-of-way. The right-of-way is a significant property right that is not subject to the ROD and use restrictions required by the ROD, because no IC running with the land was recorded on the mine site title prior to the condemnation action—thus demonstrating the need for controls that run with the land. In 2011, the owner of the right-of-way entered into a Administrative Settlement Agreement and Order on Consent with EPA and agreed to allow EPA to oversee work it conducts on the roads.

7.1.7 Monitoring Activities

Monitoring activities are extensive at this Site and are conducted regularly for water quality, WTP effluent, monitoring wells, in-stream sediments, fish, and benthic organisms. As needed, monitoring is also conducted at the overbank areas along Panther Creek (see Section 6.3.4). Monitoring is conducted in accordance with the Performance Monitoring Plan for the site (Golder, 2006b). The monitoring is adequate to determine the protectiveness and effectiveness of the remedy.

7.1.8 Opportunities for Optimization

The BMSG has implemented the following measures since the last Five Year Review to optimize the Blackbird Mine remedy and/or to improve the operation and maintenance of the remedial actions:

- Lining of clean water diversion ditches—there are two major clean water diversion ditches in the Blackbird Creek drainage that were leaking and not diverting as much clean water as anticipated around contaminated areas. These ditches were re-constructed and lined with clay to reduce the leakage and improve the diversion of clean water around the contaminated areas.

- Removal of contaminated materials and construction of stabilization structures along Blackbird Creek—significant quantities of contaminated sediments along Blackbird Creek were removed and a series of stabilization structures and bendway weirs were constructed in eight areas along Blackbird Creek. These measures removed much of the source of contaminants from Blackbird Creek and reduced erosion potential for the remaining contaminants along Blackbird Creek that were re-contaminating previously cleaned up overbank areas along Panther Creek during high flow events.

- Construction of sludge drying beds—the location for disposal of sludges from the Water Treatment Plant was nearing capacity. The BMSG constructed a series of sludge drying beds for disposal of the sludges until more permanent sludge disposal options could be implemented.

- Improvements to the groundwater collection system beneath the Meadow/Blackbird Creek cap—the drainage system for the collection of groundwater that is transported beneath the cap for treatment at the Water Treatment Plant has suffered plugging problems in the past several years. The BMSG reconstructed much of the collection system upstream from the groundwater cutoff wall to improve the drainage and reduce the plugging.
- Upgrading of the Water Treatment Plant—high flows in 2012 overwhelmed the hydraulic capacity of the existing WTP. The BMSG upgraded the hydraulic capacity of the existing plant from 1,000 gpm to 1,200 gpm, and is in the process of adding facilities for an additional 1,300 gpm of treatment capacity to increase the total treatment capacity to 2,500 gpm.

7.1.9 Early Indicators of Potential Remedy Problems

Nothing was identified during the preparation of this Five-Year Review that would be an early indicator of potential remedy problems.

7.2 Question B: Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives Still Valid?

Yes, the exposure assumptions and RAOs are still valid. However, there have been changes to the cleanup levels and toxicity data (Section 7.2.4). The cleanup levels established in the ROD have been updated by in May 2012 ESD. The ESD documents two significant changes of the cleanup levels selected in the 2003 ROD:

- Established cleanup levels for cobalt in overbank deposits for Blackbird Creek and Panther Creeks, as well as residential groundwater, and lowered the cleanup level for mine site groundwater from 1.53 mg/L to 0.009 mg/L (Table 4-2)
- Revised recreational-use scenario for certain USFS lands along Panther Creek raising the arsenic cleanup level from 590 mg/kg to 1,180 mg/kg and the cobalt cleanup level from 390 mg/kg to 780 mg/kg

7.2.1 Changes in Applicable or Relevant and Appropriate Requirements

During the review of the ARARs established in the ROD, the surface water federal Ambient Water Quality Criteria (AWQC) cleanup level of 0.014 mg/L for Blackbird Creek, Panther Creek, South Fork Big Deer Creek, and Big Deer Creek was identified as not currently applicable or relevant and appropriate. Panther Creek, South Fork Big Deer Creek, Big Deer Creek, and Blackbird Creek are currently designated by the State of Idaho as a secondary contact recreation use areas. The numeric criteria for arsenic in waters designated for recreation use areas is 0.010 mg/L.

7.2.2 Changes in Exposure Pathways or Land Use

The former Panther Creek Inn was previously designated as a current residential use. However, due to the closure of the Panther Creek Inn and the purchase of the property by Noranda Mining and Eastland Management (a subsidiary of Intalco), the anticipated future use is future residential use and recreational. No other current and/or anticipated future land and water uses at or near the Blackbird Mine Site have changed since the ROD.

7.2.3 New Contaminants or Contaminant Sources

No new contaminants have been identified at the Blackbird Mine Site.

7.2.4 Changes in Toxicity or Contaminant Characteristics

In August 2008, EPA published revised toxicity values for cobalt. Revised risk calculations based on the revised toxicity values indicated that some overbank deposits and groundwater at the site have cobalt concentrations that exceed the hazard quotient (HQ) of 1 for non-cancer risks for ingestion of groundwater under worker and residential use scenarios as well as ingestion of soils under the recreation use and residential use scenarios. Table 4-2 describes the new cobalt cleanup levels due to the revised toxicity values.

Furthermore, risk calculations based on incidental ingestion and dermal contact of surface water with cobalt in Panther and Blackbird creeks based on the recreational exposure scenarios used in the Site-Wide Human Health Risk Assessment for the Blackbird Mine Site and updated toxicity values concluded that there were no unacceptable risks shown.

A review of human health risk assessment documents since 2008 indicated that the newer guidance released is not directly relevant to the Blackbird risk calculations or remedial action goals. The Regional Screening Levels (RSLs) published by EPA twice a year have not changed for arsenic and cobalt since the new cobalt values in 2008.

7.2.5 Changes in Remedial Action Objectives

EPA has reviewed the RAOs listed in Section 4.2.1. There have been no changes to the RAOs, and the RAOs remain valid.

7.3 Question C: Has 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.

7.4 Technical Assessment Summary

The remedy is not yet performing as intended because implementation of the selected remedial actions and necessary contingent remedial actions have not been completed, and not all of the necessary ICs have been implemented. In addition, concentrations of COCs in surface waters and sediments remain above cleanup levels in certain streams. In general, the exposure assumptions, cleanup levels, and RAOs used at the time of the remedy selection are still valid. A revised toxicity value for cobalt was established leading to the conclusion that concentrations exceed HQ of 1 for non-cancer risks for groundwater and soils.

Implementation of contingent actions in Blackbird Creek including the construction of in-stream stabilization and additional soil characterization and removal in Blackbird Creek and Panther Creek provide support for the remedy to function as intended. Continued monitoring and optimization (if determined to be necessary) of the in-stream stabilization will be necessary to abate any future high flow events recontaminating overbank soils downstream. Furthermore, if the stabilization structures are ineffective in mitigating future recontamination of overbank areas in Panther Creek, then future removal actions of overbank deposits would likely be necessary.

It is anticipated that the remedy will function as intended for all elements upon completion of all remedial actions, completion of relevant contingent actions, evaluation and optimization of in-stream stabilization along Blackbird Creek, implementation of all ICs, and following natural recovery of sediments.

SECTION 8

Issues Raised During Five-Year Review

Table 8-1 presents the issues identified in this Five-Year Review.

TABLE 8-1
Issues Potentially Affecting the Remedy's Current or Future Protectiveness
Blackbird Mine Site, Lemhi County, Idaho

Issue	Affects Current Protectiveness? (Yes/No)	Affects Future Protectiveness? (Yes/No)
(1) Concentrations of COCs in sediments remain above current cleanup levels at certain times and places in area creeks downstream from the mine.	No	Yes
(2) Concentrations of COCs in certain overbank area soils exceed cleanup levels.	Yes	Yes
(3) Surface water cleanup levels are not currently met in South Fork Big Deer Creek.	Yes	Yes
(4) Surface water cleanup levels are not currently met in the lower reaches of Big Deer Creek	No	Yes
(5) ICs have not been implemented at the Cobalt Townsite, former Panther Creek Inn area, and the Blackbird Mine.	No	Yes
(6) The full nature and extent of cobalt contamination in the Panther Creek shallow alluvium aquifer has not been fully defined.	No	Yes
(7) Bucktail Creek groundwater concentration of cobalt exceeds cleanup level. Nature and extent of groundwater contamination in Bucktail Creek and South Fork Big Deer Creek drainage have not been characterized.	No	Yes
(8) The effectiveness of the Blackbird Creek stabilization structures is unknown.	No	Yes
(9) The significance of floc as a recontamination source is unknown.	No	Yes

SECTION 9

Recommendations and Follow-up Actions

Table 9-1 lists the recommended follow-up actions related to the issues identified in Section 8.

TABLE 9-1
Recommendations/Follow-up Actions Regarding Issues Potentially Affecting the Remedy's Current or Future Protectiveness
Blackbird Mine Site, Lemhi County, Idaho

Issue	Recommendations/Follow-up Actions	Responsible Party	Oversight Agency	Milestone Date	Follow-up Actions Affect Protectiveness? (Yes/No)	
					Current	Future
(1) Concentrations of COCs in sediments remain above current cleanup levels at certain times and places in area creeks downstream from the mine.	Continue to implement the sediment monitoring program to determine if further action is warranted.	BMSG	EPA	8/25/2018	No	Yes
(2) Concentrations of COCs in certain overbank area soils exceed cleanup levels.	Implement remedial actions. Conduct removal of soils at (b) pastures/overbank areas.	BMSG	EPA	12/31/2014	Yes	Yes
(3) Surface water cleanup levels are not currently met in South Fork Big Deer Creek.	Monitor in South Fork Big Deer Creek through 2014 to determine if the diversion pipeline is warranted.	BMSG	EPA	12/31/2014	Yes	Yes
(4) Surface water cleanup levels are not currently met in the lower reaches of Big Deer Creek	Continue monitoring in Big Deer Creek, and identify if any additional actions are necessary if water quality goals are not achieved and exceedances are due to the Blackbird Mine.	BMSG	EPA	8/25/2018	No	Yes
(5) ICs have not been implemented at the Cobalt Townsite, former Panther Creek Inn area, and the Blackbird Mine.	Continue efforts with BMSG and Department of Justice to implement ICs	BMSG	EPA	12/31/2013	No	Yes
(6) The full nature and extent of cobalt contamination in the Panther Creek shallow alluvium aquifer has not been fully defined.	Conduct a study to characterize the nature and extent of contamination.	BMSG	EPA	12/31/2013	No	Yes
(7) Bucktail Creek groundwater concentration of cobalt exceeds cleanup level. Nature and extent of groundwater contamination in Bucktail Creek and South Fork Big Deer Creek drainage have not been characterized.	Conduct a study to characterize the nature and extent of contamination.	USFS	EPA	12/31/2013	No	Yes
(8) The effectiveness of the Blackbird Creek stabilization structures is unknown.	Continue to monitor the effectiveness of stabilization structures, and conduct future contingent action removals along Panther Creek in overbank areas if they become recontaminated at concentrations above cleanup levels.	BMSG	EPA	8/25/2018	No	Yes

(9) The significance of floc as a recontamination source is unknown.	Continue to monitor arsenic concentrations in oxyhydroxide floc deposits in Blackbird Creek	BMSG	EPA	8/25/2018	No	Yes

SECTION 10

Protectiveness Statement

The remedy at the Blackbird Mine Site is expected to be protective of human health and the environment upon completion of all remaining remedial actions, completion of any relevant contingent actions, evaluation and optimization of in-stream stabilization and any potential additional measures along Blackbird Creek, and implementation of all ICs. In the interim, remedial activities completed to date have adequately addressed all exposure pathways that could result in unacceptable risks in those areas.

SECTION 11

Next Review

Hazardous substances, pollutants, or contaminants above levels that allow for unrestricted use and unlimited exposure remain at the site. Therefore, another Five-Year Review is required. The next Five-Year Review will be conducted no later than August 2018, but may be conducted earlier at EPA's discretion.

SECTION 12

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Figures

Appendix A
Public Notices

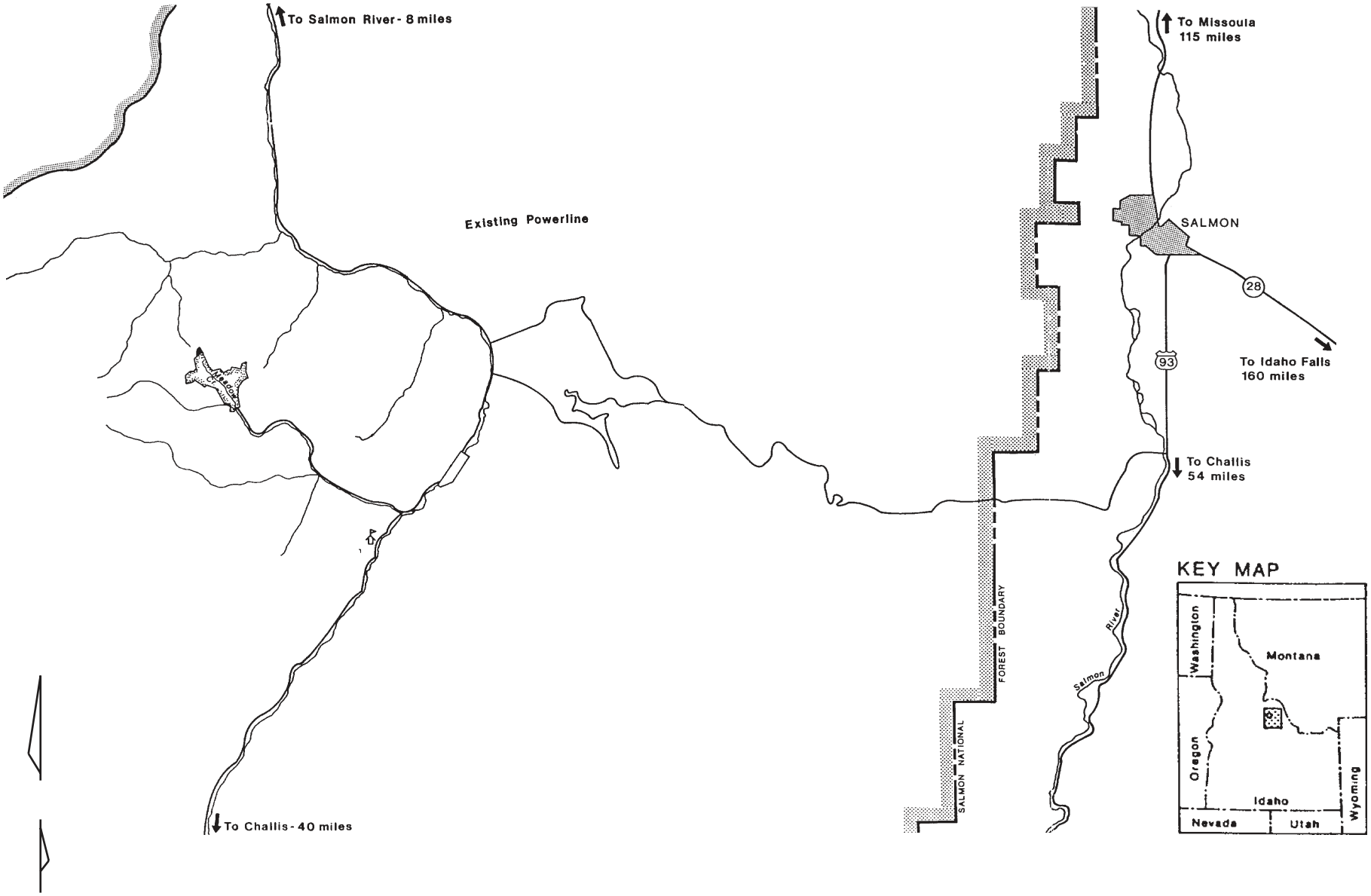


FIGURE 3-1
Regional Overview Map
Blackbird Mine Site 2013 Five Year Review
Lemhi County, Idaho

CH2MHILL®

ES041513033443PHX Figure 3-1_01 AS (04/2013)

LOWER BUCKTAIL PUMPBACK
STATION

LEGEND

Boundary of Waste
Management Area

DOWNSTREAM END OF
STABILIZATION AREA NO. 8

FIGURE 3-2
Blackbird Mine Waste
Management Area
Blackbird Mine Site 2013 Five Year Review
Lemhi County, Idaho

ES041513033443PHX Figure 3-2_03 AS (05/2013)

FIGURE 3-3
Properties Cleaned Up
Along Panther Creek
Blackbird Mine Site 2013 Five Year Review
Lemhi County, Idaho

CH2MHILL®

ES041513033443PHX Figure 3-3_01 AS (04/2013)

FIGURE 3-4
Idaho Cobalt Project Overview Map
Blackbird Mine Site 2013 Five Year Review
Lemhi County, Idaho

Source: Formation Capital Corporation

ES041513033443PHX Figure 3-4_01 AS (04/2013)

AREA 3

AREA 2

AREA 1

AREA 4

AREA 5

AREA 6

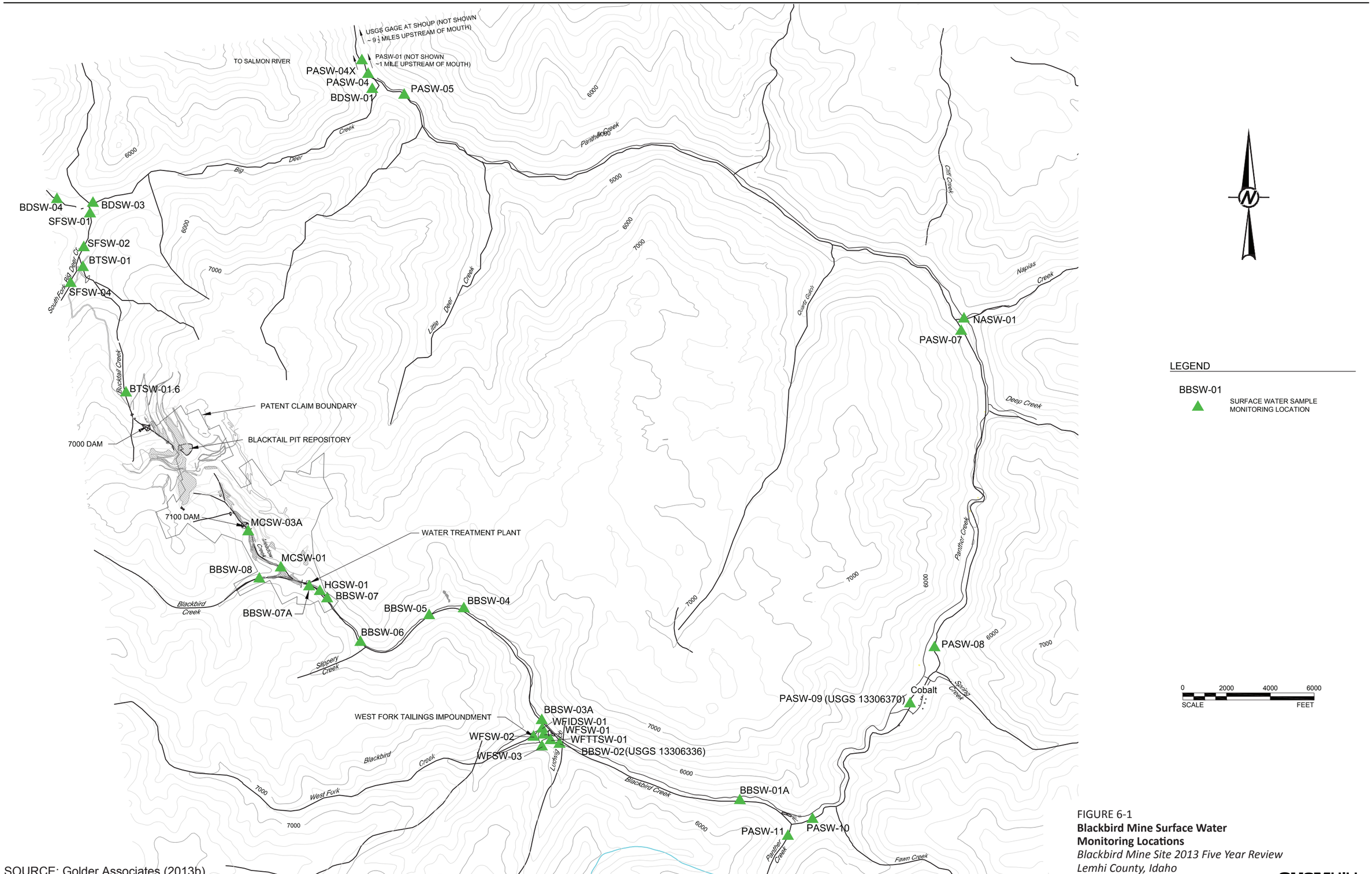
AREA 7

AREA 8

FIGURE 4-1
Blackbird Creek Stations and Stabilization Areas
Blackbird Mine Site 2013 Five Year Review
Lemhi County, Idaho

SOURCE: Golder Associates (2011b)

ES041513033443PHX Figure 4-1_01 AS (04/2013)

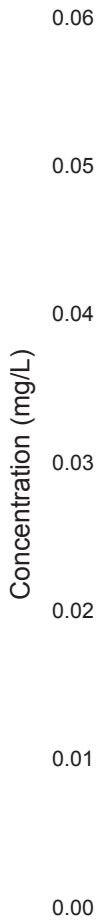


SOURCE: Golder Associates (2013b)

FIGURE 6-1
Blackbird Mine Surface Water Monitoring Locations
Blackbird Mine Site 2013 Five Year Review
Lemhi County, Idaho

CH2MHILL

ES041513033443PHX Figure 6-1_01 AS (04/2013)



IWQS - Idaho Water Quality Standards
CCC - Criteria Continuous Concentration (chronic criteria)
CMC - Criteria Maximum Concentration (acute criteria)

LEGEND

IWQS CMC

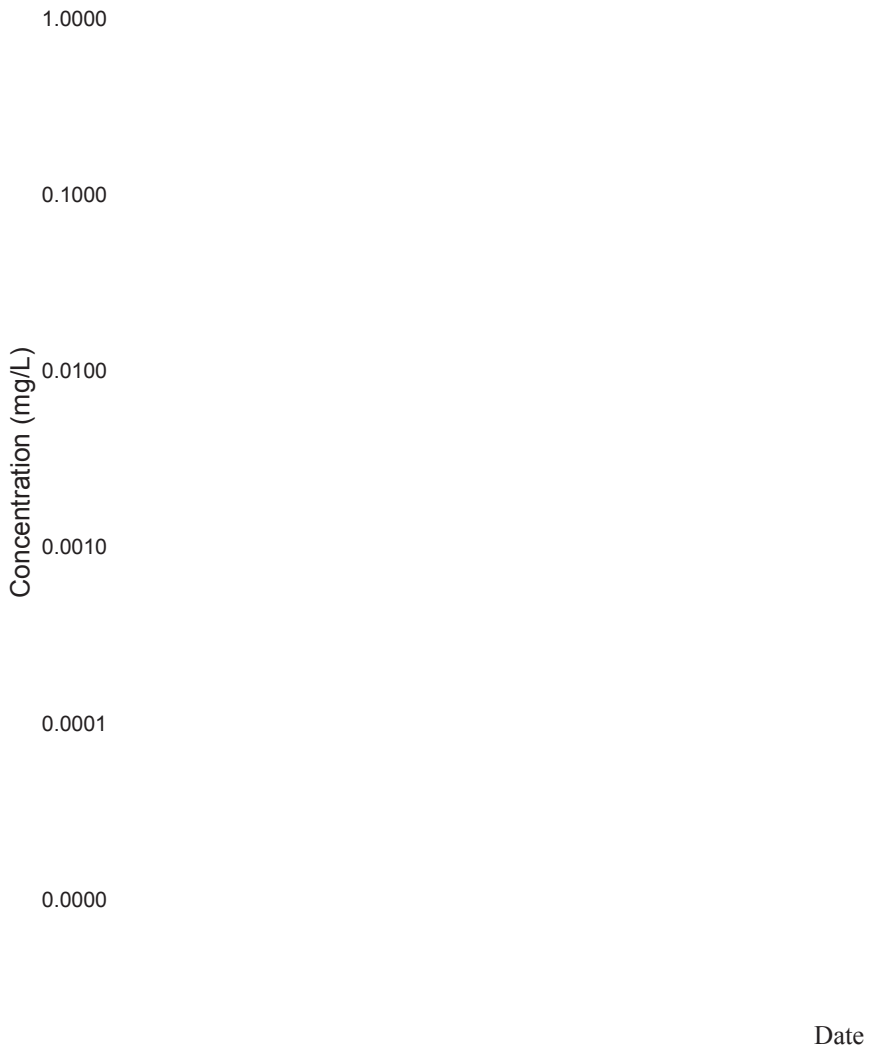
Cu Conc

IWQS CCC

SOURCE: Golder Associates (2013b)

ES041513033443PHX Figure 6-2_01 AS (04/2013)

FIGURE 6-2
Dissolved Copper Concentrations Vs. IWQS at PASW-09, 1999 Through 2012
Blackbird Mine Site 2013 Five Year Review
Lemhi County, Idaho



IWQS - Idaho Water Quality Standards
CCC - Criteria Continuous Concentration (chronic criteria)
CMC - Criteria Maximum Concentration (acute criteria)

LEGEND

IWQS CMC

Cu Conc

IWQS CCC

SOURCE: Golder Associates (2013b)

ES041513033443PHX Figure 6-3_01 AS (04/2013)

FIGURE 6-3
Dissolved Copper Concentrations Vs. IWQS at PASW-04 and PASW-04X, 1998 Through 2012
Blackbird Mine Site 2013 Five Year Review
Lemhi County, Idaho

1.0000

0.1000

Concentration (mg/L)
log scale

0.0100

0.0010

0.0001

Date

IWQS - Idaho Water Quality Standards
CCC - Criteria Continuous Concentration (chronic criteria)
CMC - Criteria Maximum Concentration (acute criteria)

LEGEND

IWQS CMC

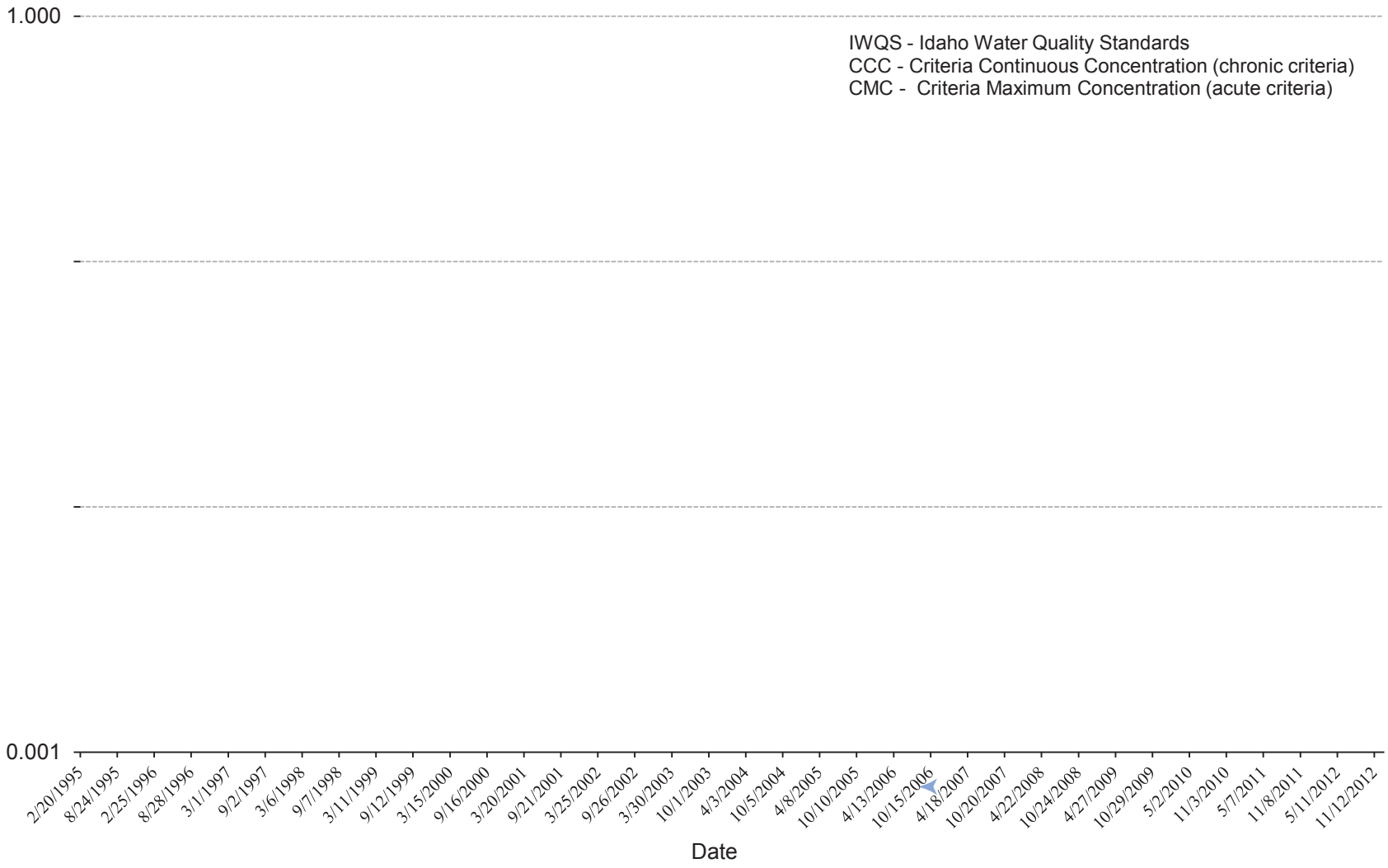
Cu Conc

IWQS CCC

SOURCE: Golder Associates (2013b)

ES041513033443PHX Figure 6-4_01 AS (04/2013)

FIGURE 6-4
Dissolved Copper Concentrations Vs. IWQS at BDSW-03, 1995 Through 2012
Blackbird Mine Site 2013 Five Year Review
Lemhi County, Idaho



LEGEND

IWQS CMC

● Cu Conc

IWQS CCC

SOURCE: Golder Associates (2013b)

ES041513033443PHX Figure 6-5_01 AS (04/2013)

FIGURE 6-5
Dissolved Copper Concentrations Vs. IWQS at BDSW-01, 1995 Through 2012
Blackbird Mine Site 2013 Five Year Review
Lemhi County, Idaho

CH2MHILL®

HGSW-02

HAWKEYE GULCH

EXISTING
CUTOFF WALL

PUMP BACK
PIPE

BBMW-05A

BBMW-08A

6850 DRAIN

BBPW-1

TIGHTLINE DRAIN

BBMW-06A

BBMW-03A

BBMW-07A

GROUTED
RIPRAP

BBMW-03B AND C

CONCRETE
CHANNEL

4" FOUNDATION
DRAIN

HGSW-01

HGSW-07A

MW-02 A, B AND C

SEDIMENT
POND #2

BBSW-07

ACCESS ROAD

MW-01 A, B AND C

LEGEND

GROUNDWATER MONITORING
WELL LOCATIONS (APPROXIMATE)

GROUNDWATER EXTRACTION
WELL LOCATIONS

SURFACE WATER SAMPLING
LOCATIONS (APPROXIMATE)

POWER POLE

NOTE: HGSW-03 IS LOCATED ABOVE THE PORTAL IN THE HAWKEYE GULCH NORTH OF HGSW-02.

0 50 100

SCALE

SOURCE: Golder Associates (2013b)

ES041513033443PHX Figure 6-6_01 AS (04/2013)

FIGURE 6-6
Monitoring Well Sampling Locations in Upper Blackbird Creek
Blackbird Mine Site 2013 Five Year Review
Lemhi County, Idaho

LEGEND

- GEOTECHNICAL MONITORING WELLS
- SURFACE WATER SAMPLING LOCATIONS
- GROUNDWATER MONITORING WELL
- GEOTECHNICAL BORING CONVERTED TO MONITORING WELL
- 2011 AND 2012 BORE HOLE AND MONITORING WELL LOCATIONS
- U/G — UNDERGROUND CULVERT

REFERENCES

1. CONTOUR ARE BASED ON LIDAR DATA COLLECTED BY AEROMETRICS 2012-08-05
2. SURVEY CONTROL PROVIDED BY WADE SURVEY
3. AERIAL IMAGERY WAS GATHERED IN CONJUNCTION WITH THE LIDAR AND IS DATED 2012-08-05.

NOTES

1. Horizontal Datum: State Plane Coordinate System Idaho Central Zone, NAD83/91, US Feet
2. Vertical Datum: North American Vertical Datum 1988 (NAVD88)

OVERALL SITE VIEW

SCALE: A

FIGURE 6-7

Monitoring Well Sampling Locations at West Fork Tailings Impoundment

Blackbird Mine Site 2013 Five Year Review

Lemhi County, Idaho

SOURCE: Golder Associates (2013b)

ES041513033443PHX Figure 6-7_01 AS (04/2013)

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United States Environmental Protection Agency

Region 10

Input Wanted for the Blackbird Mine Superfund Site Cleanup in Idaho

February 2013

The U.S. Environmental Protection Agency is preparing the second Five-Year Review of the Blackbird Mine Superfund Site cleanup in Lemhi County, Idaho, approximately 13 miles south of the Salmon River and 21 miles west of Salmon, Idaho, within the Salmon-Challis National Forest.

Gold, cobalt and copper mining resulted in about 12 acres of open pit, 14 miles of underground workings, 4.8 million tons of waste rock in multiple piles, and two million tons of tailings located within the West Fork Tailings Impoundment.

The EPA has been cleaning up this site since 1993 and has formally updated the cleanup plan several times to address the needs of the site. The EPA continues to oversee the ongoing monitoring at the site.

This review examines whether the soil, surface water and groundwater cleanup at this site continues to protect people and the environment.

The initial cleanup included:

- Collecting and treating contaminated waters.
- Stabilizing and/or relocating waste rock piles.
- Stabilizing the West Fork Tailings Impoundment.
- Removing contaminated sediments and soils along the banks of Blackbird Creek and Panther Creek.
- Constructing stabilization structures along Blackbird Creek.

You can find more information about this site at:
http://go.usa.gov/Yz3F

You Can Get Involved!

The EPA welcomes your participation. If you have information that may help us or would like to be contacted for an interview, contact Fran Allans, EPA Site Manager, at **allans.fran@epa.gov** or 208-378-5775.

TDD or TTY users may call the Federal Relay Service at 1-800-877-8339 and give the operator Fran Allans' phone number.

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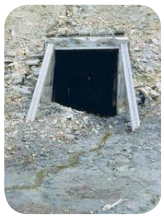

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