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POST-REMOVAL MONITORING AND O&M PLAN

Longshot Mine and Mill Site

October 2011

COLVILLE NATIONAL FOREST, WASHINGTON





Submitted to:
USDA Forest Service
Region 6
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1.0 INTRODUCTION

- Millennium Science and Engineering, Inc. (MSE) has been contracted by the United States Department of Agriculture, Forest Service (Forest Service) to complete a Removal Action at the Longshot Mine and Mill Site in the Colville National Forest, Stevens County, Washington, the location of which is illustrated in Figure 1. The Removal Action is scheduled for 2011.
- This Operations & Maintenance (O&M) Plan describes the Cleanup Verification Sampling and Post-Removal Monitoring activities to be conducted at the Longshot Mine and Mill Site beginning in Fall 2011.
  - The plan combines elements of a Sampling and Analysis Plan (SAP) and Quality Assurance Project Plan (QAPP).
  - The plan discusses the laboratory analytical procedures and quality assurance/quality control (QA/QC) methods to be employed both in the field and the lab to ensure data quality.
  - The plan also discusses general O&M activities that may be required.
- Field forms are provided in Attachment A.

1.1 Purpose and Objectives

The purpose of a removal action is to abate, prevent, minimize, stabilize, mitigate or eliminate the release or the threat of a release. The overall objectives of the Longshot Mine Removal Action are to: (1) Eliminate direct contact with high concentrations of metals in the mine waste for all receptors; (2) Reduce or eliminate the migration of contaminants to the environment; and (3) Mitigate physical hazards at the Site.

- The primary objectives of the post-removal sampling and monitoring are to compare post-removal mine waste area and aquatic habitat conditions to pre-removal conditions. This will be accomplished by:
  - Collecting cleanup verification samples from areas that contained mine waste: the Ore Bin, the area beneath Wood and Metal Debris around the mill foundation, and waste rock piles WR-1, WR-2 and WR-3 as illustrated in Figure 2;
  - Assessing surface water samples, Figure 3, collected from four locations: AD1 (Adit discharge), ET3 (Immediately below the lower tailings), BG1 (Ephemeral [background] stream east of from the Site), and ET4 (The end of the ephemeral stream prior to discharge to Mill Creek) for comparison with data collected during the SI and pre-removal data gap investigation;
  - Assessing sediment samples collected from each of the four surface water sampling locations for comparison with data collected during the SI; and
  - Assessing one coeval benthic sample collected at ET4 to evaluate potential impacts to the stream habitat, benthic macroinvertebrate community, and fish species. Benthic samples were not obtained from this location during the SI.
- A bulk sample of wood debris will be collected from the demolition of the mill building to confirm that it is acceptable for solid waste landfill disposal.
- The Site will also be inspected for revegetation success, evidence of erosion, slumps, or other damage.

1.2 Schedule

- Removal action activities, including mill debris and mine waste sampling and analysis are scheduled for the Fall of 2011.

- The first post-removal monitoring event is scheduled for Summer 2012. The second post-removal monitoring event is scheduled for 2013, and the third post-removal monitoring event is scheduled for 2014.
- Specific dates will be depend on weather conditions and Site access. If possible, the second and third monitoring events will be scheduled during the same time of year as the first event.

1.3 Site Description

- The Longshot Mine is an inactive lead-zinc mine and mill, located about 11 miles northeast of Colville, Washington in Stevens County. (See Figure 1.)
- The site is located in the eastern half of Section 18, Township 36 North, Range 41 East of the Willamette Meridian at an elevation of about 3,600 feet.
- Site features include:
  - Remnants of a mill and other wooden structures
  - Two open adits and one open stope
  - Two ponds
  - An unprocessed ore bin
  - Six waste rock piles
  - Three tailings impoundments
- Access to the site is via USFS Spur Road 150 from County Road 4954. (See Figure 3.)
- The site is on a hillside adjacent to an unnamed ephemeral tributary to South Fork Mill Creek.
- Ore from two adits was processed at the mill and tailings were deposited in a series of three impoundments in the ephemeral drainage. (See Figure 3.)
- Unprocessed ore is piled in an ore bin at the mill.
- Water discharges from the lower adit and flows through a small settling pond before disappearing beneath debris surrounding the mill structure.
- There is a second, larger pond in the ephemeral drainage below the last tailings impoundment.
- There are six waste rock piles: three near the upper adit, and three near the lower adit and mill.
- There is a vertical stope near the upper adit that extends into the underground workings.
- There are several collapsed wooden buildings and piles of debris near the lower adit and along the road to the upper adit.

2.0 POST-REMOVAL MONITORING AND O&M ACTIVITIES

- Post-removal monitoring activities will consist of:
  - A general visual inspection of areas disturbed during removal activities at the Site;
  - Collecting cleanup verification soil samples;
  - Collecting surface water, sediment and benthic macroinvertebrate samples;
  - Taking representative photos of the Site with an effort to replicate the photos taken at completion of the Removal Action; and
  - Preparing Annual Monitoring Reports.

2.1 General Site Inspection

A general site inspection will be conducted to assess revegetation success, evidence of erosion, slumps, or other damage. The site inspection will focus on:

- Revegetation success, noxious weeds and evidence of erosion or other damage in the areas from which waste rock is excavated (approximately 0.6 acre):
  - the ore bin at the mill site;

  - the area of additional unprocessed ore beneath the wood and metal debris around the mill foundation;
  - the waste rock piles (WR1, WR2, and WR3) near the lower adit.
- Revegetation success, noxious weeds, settling, sloughing, collapse or other evidence of instability in the backfilled stope feature.
- Signs of vandalism, collapse or other damage of bat gates or backfilled adits.
- Revegetation success and erosion in other reclaimed areas (e.g., road shoulders, staging areas).
- Any evidence of significant erosion or other damage will be photographed and reported to the Forest Service OSC.

2.2 Sample Collection

- Bulk debris, soil, surface water, sediment, and benthic samples will be collected for comparison with site characterization (i.e. samples collected during the SI) and pre-removal monitoring sample results. The list of metals to be analyzed, samples to be collected and sampling methodology are described in Section 3 and summarized in Tables 1 and 2.

2.3 Operations and Maintenance

- The Site will be inspected annually for three consecutive years beginning in 2012.
  - The post-removal inspections will assess revegetation success, evidence of erosion, slumps, or any failures from improperly placed materials during the Removal Action.
  - The post-removal inspections will be conducted concurrently with the post-removal sampling events and the results will be included in the annual monitoring reports.
  - The Forest Service OSC will be notified of any site conditions or damages that require immediate attention.
  - MSE will warranty work conducted during the Removal Action for 1 year during which any site damages or failures resulting from improper construction methods or materials will be repaired by MSE. Failures or damages resulting from natural causes or other means outside of MSE's control, such as vandalism, will not be covered.

3.0 SAMPLING AND ANALYSIS PLAN

- This section describes the sampling methods and procedures for each media; sample management activities such as sample identification, preservation, and shipping; laboratory analysis; decontamination procedures; and investigation derived waste.

3.1 Sampling Methods and Procedures

- The sampling approach and methods are described in the following subsections by media type.
  - Where possible, disposable single-use sampling equipment will be used for sample collection.
  - Field quality control samples will consist of one matrix spike/matrix spike duplicate pair (MS/MSD), and a field blank.
  - All observations, conversations, measurements and photograph descriptions will be recorded promptly in a bound waterproof logbook. The logbook will also record when, where, and how all samples were collected, along with pertinent observations.
  - During the sampling, all disturbances to the environment will be minimized.
  - Upon completion of the sampling, any trash or investigation derived waste generated during the sampling will be removed from the site and properly disposed of.

3.1.1 Bulk Wood Debris

- **Wood Debris:**
  - Wood debris from the demolition of the mill structure will be sampled and analyzed to confirm that this material would not be classified as hazardous waste and is suitable for solid waste landfill disposal.
  - One bulk sample will be collected from representative wood debris and packaged for laboratory analysis.
  - The bulk wood sample will be analyzed for 8 RCRA metals (As, Ba, Cd, Cr, Pb, Hg, Se, Ag) according to EPA analytical methods for both total metals and TCLP metals analysis, as summarized in Table 1.

3.1.2 Soil

- **Soil:**
  - Cleanup verification samples will be collected from several locations, including:
    - The ore bin at the mill site
    - Beneath wood and metal debris around the mill foundation
    - Waste rock pile WR-1
    - Waste rock pile WR-2
    - Waste rock pile WR-3
  - Up to 8 samples will be submitted for laboratory analysis to confirm the effectiveness of removal actions in these areas.
  - Gravel and organic media will be removed and the sample will be placed in a laboratory supplied, 4-ounce jar.
  - The soil samples will each be a composite sample consisting of two 2-ounce subsamples Subsamples will be thoroughly homogenized in a 1-quart plastic bag.
  - Samples will be collected using disposable, single-use hand trowels or shovels.
  - Samples will be placed in 4-ounce sample jars provided by the laboratory and will be properly sealed, labeled, and cooled for transport to the laboratory.
  - Soil samples will be submitted for analysis of 8 RCRA metals (As, Ba, Cd, Cr, Hg, Pb, Se, Ag), as summarized in Table 1.
  - Sample containers will be labeled and packaged as described in Section 4.2. The samples will be documented on a Sediment Sample Collection Record (Attachment A).

3.1.3 Surface Water

- **Surface Water:**
  - Surface water samples will be collected from four locations (Figures 1 and 2):
    - AD1 (Adit discharge),
    - ET3 (Immediately below the lower tailings),
    - BG1 (Ephemeral [background] stream east of the Site), and
    - ET4 (The end of the ephemeral stream prior to discharge to Mill Creek).
  - Stream samples will be collected from a flowing portion of the stream/discharge directly into 250 mL polyethylene bottles provided by the laboratory selected to perform the required analyses. Depending on stream depth, the bottle will be placed upside down into the center of stream and then slowly inverted while under the surface to allow the bottle to fill or the bottle can be placed with the opening pointed slightly upward toward and into the current allowing the container to fill. Sufficient headspace will be left to allow for sample preservative. Care will be taken to prevent disturbing the sediment and organic material during sample collection.
  - If the source is too shallow to collect a sample using either of these methods, disposal Tygon tubing and a portable pump will be used to extract a sample. New tubing will be used for each sample.

- Total Recoverable and Dissolved samples will be obtained. Dissolved samples will be filtered using a 0.45 micron filter and preserved in the field as appropriate for laboratory analysis.
- All stream sampling will proceed from downstream to upstream locations to avoid cross contamination.
- The appropriate preservative (Table 3) will be added to the sample and the container will be tightly capped.
- Based on results of the SI sample analyses and anticipated elevated metals, the samples will be analyzed for Ag, As, Ba, Cd, Cu, Pb, and Zn (Table 2).
- Water samples will also be analyzed for TDS, TSS, Hardness and Sulfate by the laboratory.
- Field parameters to be measured during sample collection include pH, temperature, conductivity, TDS, DO, and ORP or Eh.
- A multi-parameter water quality meter will be used to measure the field parameters by collecting a water sample in a decontaminated 500-mL beaker and submerging the sensor in the sample.
- The instrument will be calibrated and operated per the manufacturer's specifications.
- Field calibrations, measurements, and notations will be recorded in the Field Logbook.
- The flow at each sampling location will be estimated and recorded.
- The sample ID, flow, and field parameters will be documented on a Water Sample Collection Record (Attachment A).

3.1.4 Sediment

- **Sediment:**
  - One sediment sample will be collected from each of the four surface water sample locations.
  - The sediment samples will each be a composite sample consisting of two 2-ounce subsamples. Where appropriate subsamples will consist of one pool and one riffle habitat sample.
  - The sediment samples will be collected from 0 to 18 inches below the streambed using disposable, single-use hand trowels, or disposable push samplers.
  - The composite samples will be homogenized by combining the subsamples in a 1-quart plastic bag and thoroughly mixing.
  - Gravel and organic media will be removed and the sample will be placed in a laboratory supplied, 4-ounce, wide-mouth jar.
  - Any water in the sample will be decanted so that the bottle is filled with as much sediment as possible.
  - The bottles will be labeled and packaged as described in Section 4.2. The samples will be submitted for the analyses summarized in Table 2**.** The lab will be instructed to screen the sediment sample and discard material greater than 2 millimeters in diameter to focus the analysis on the finer material.
  - The samples will be documented on a Sediment Sample Collection Record (Attachment A).

3.1.5 Aquatic Survey and Benthic Macroinvertebrates

- **Benthic Macroinvertebrates:**
  - An aquatic survey will be conducted at ET4 only to evaluate potential impacts to the stream habitat, benthic macroinvertebrate community, and fish species. Benthic samples were not obtained at this location during the SI. However, because this is the best location for observing metal impact, and Mill Creek flow significantly dilutes impact, the survey will be conducted at this location.

- A sample will be obtained prior to initiating Site activity.
- The aquatic habitat survey will be conducted for a 100-meter reach, if possible, following the protocols outlined in the U.S. EPA Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers (Barbour et.al, 1999) and Benthic Macroinvertebrate Biological Monitoring Protocols for Rivers and Streams (Plotnikoff and Wiseman, 2001).
- The aquatic habitat surveys will consist of collecting quantitative as well as qualitative data on water chemistry and physical habitat.
- One macroinvertebrate sample will be collected as a composite sample from pool habitats and riffle habitats. The composite sample will consist of three subsamples from different pool or riffle habitats within the stream reach, if such can be identified in the ephemeral stream.
- Collection of macroinvertebrate samples from specific pool habitats is necessitated by the potential of tails or metals mobilizing into the ephemeral stream and settling or sorbing.
- Samples will be labeled (both inside and outside the container) with information such as identification number, stream name, date, site location, and collector's name.
- Samples will be preserved in ethanol (preservative added in the field) and shipped to Aquatic Biology Associates, Inc. for processing for taxonomy, generally to genus/species (Table 2).

3.1.6 Other Sampling Considerations

- Pore water sampling is not deemed necessary in an ephemeral stream.
- The first monitoring event will be conducted between August 15 and September 15, 2011.
- The monitoring will be limited to the aquatic environment and will be based on the SI using a refined set of sampling locations and analytical parameters as defined in preceding text.
- Annual Monitoring Reports summarizing the analytical results and comparing to previous monitoring results will be prepared and submitted to the Forest Service by the end of November for each calendar year.

3.2 Sample Management

- The following sections describe sample management activities, including sample designation, preservation, and shipping.

3.2.1 Sample Preservation

- Samples will be preserved as appropriate for the required analysis. The method of preservation and sample holding times are summarized in Table 3.
  - Solid media samples will be preserved by chilling and maintaining them at 4 °C.
  - Aqueous samples requiring inorganics analysis will be preserved by adding nitric acid (HNO_3).

3.2.2 Sample Designation

- Sample containers will be sealed at the time of collection and an adhesive label placed over the lid and threads to ensure that the sample container has not been tampered with prior to delivery to the laboratory.
  - A unique, descriptive sample number, date and time of sample collection, sampler's initials, and requested analysis shall be recorded on the label using an indelible ink ball-point pen or permanent marker.

3.2.3 Shipping

- The sample containers will be placed in a cooler suitable for transportation or shipping to the analytical laboratory.

  - Plastic bags filled with ice and sealed shall be placed in the cooler to maintain the samples at 4 °C until delivery to the laboratory.
  - Care shall be exercised to prevent direct contact between the samples and ice.
- Chain-of-Custody forms shall be used to document and track sample possession. The samples in each cooler and the required analysis will be recorded on a Chain-of-Custody.
  - Care will be taken to ensure the required analysis is consistent with the sample labels.
  - The sampler will retain one copy of the Chain-of-Custody and the original will be sealed in a plastic bag and placed in the cooler with the samples.
  - When transferring possession of the samples, the Chain-of-Custody will be signed and dated by the sample custodian.
  - The cooler will be sealed with tape and custody seals placed across the cooler opening and initialed.
  - The surface water and sediment samples will be shipped via Federal Express to SVL Analytical (SVL) Laboratory in Kellogg, Idaho. The benthic macroinvertebrate samples will be shipped via Federal Express to Aquatic Biology Associates, Inc. in Corvallis, Oregon. The Federal Express airbills will be retained as part of the permanent Chain-of-Custody documentation.

3.3 Laboratory Analysis

- Tables 1 and 2 summarize the samples to be collected during the post-removal monitoring and the corresponding laboratory analyses. Table 3 summarizes the analytical methods, required sample volumes, preservatives, and holding times.
  - The metals to be analyzed are based on the results of samples collected during the SI (MSE 2005).
  - The labs will be instructed to hold and maintain all remaining sample volumes for additional analysis, if determined necessary.
- The macroinvertebrate samples will be sorted and subsampled using a Caton type sample splitter.
  - Large debris and inorganic sediment will be inspected for attached invertebrates and removed from the sample and placed back into the original container.
  - A 300-count subsample will be utilized for this project.
  - Macroinvertebrates will be identified to the lowest practical level, usually genus or species.
  - Macroinvertebrates will be identified using published taxonomic keys.

3.4 Decontamination Procedures

- Disposable single-use sampling equipment will be used for sample collection.
  - The need for equipment decontamination is not anticipated.
  - Disposable sampling equipment and any personal protective equipment will be removed from the Site and properly disposed of.

3.5 Investigation-derived Waste

- All decontamination fluids will be allowed to drain onto the ground surface at the Site and infiltrate.
  - Disturbances to the Sites and environment during the monitoring event will be minimized.
  - Upon completion of the monitoring event, any trash or investigation derived waste generated during sampling will be removed and properly disposed of.

4.0 QUALITY ASSURANCE PROJECT PLAN

- This section describes the data quality objectives, field QA/QC procedures, and the analytical laboratory QA/QC methods and procedures.

4.1 Data Quality Objectives

- Data quality objectives (DQO) are qualitative and quantitative statements that describe the study objectives, data to be collected and study boundary, decision rules, tolerable limits on decision errors, and sampling design. DQOs were developed using EPA's seven-step process (EPA 2000), and are presented in Table 4.

4.2 Field QA/QC

- Field QA/QC will consist of:
  - Following standard sampling procedures,
  - Maintaining proper sample handling and documentation,
  - Calibrating and maintaining field instruments, and
  - Collecting field QA/QC samples.
- All sampling methods and procedures will follow standard MSE protocols, unless otherwise noted, and all field equipment will be operated, maintained, calibrated, and standardized in accordance with the manufacturer's recommended procedures.
- Field QA/QC samples will be collected to evaluate the precision, accuracy, and representativeness of the field sampling effort. Field QA/QC samples will consist of one matrix spike/matrix spike duplicate pair (MS/MSD), one equipment blank and one field blank.
- The MS/MSD duplicate pair samples combine the QA/QC objectives of a normal field duplicate and a laboratory MS/MSD sample.
  - The MS/MSD duplicates are collected at the same time and in the same manner as the other samples. However, unlike typical field duplicates, the samples are clearly labeled as MS/MSD samples.
  - The laboratory prepares the MS/MSD samples by adding a known concentration of a specific analyte. The corresponding analytical results measure: (1) the accuracy of the analytical method for the known analyte, and (2) the precision or reproducibility of the overall sampling and analytical procedures for the remaining analytes.
- The samples will be submitted for the analyses listed in Tables 1 and 2.
- The field QA/QC samples will be collected, handled, transported, and analyzed in the same manner as the monitoring samples.

4.3 Laboratory QA/QC

- The analytical laboratory selected for analysis of the monitoring samples is certified by the State of Washington Department of Ecology to perform the required analyses.
- The laboratory will follow EPA Level II protocol for analysis and reporting, including laboratory blanks, laboratory duplicates, and MS/MSDs.
- All samples will be analyzed within the required holding time for each analytical procedure.
- Detected concentrations between the method detection limit (MDL) and practical quantification limit (PQL) will be noted in the analytical summaries.
- All analytical results will be reviewed to ensure that the laboratory QA/QC sample results are within the acceptable limits.

5.0 ANNUAL MONITORING REPORT

- MSE will prepare and submit Annual Post-Removal Monitoring Reports that summarize field observations and analytical results of the samples collected. The reports will include the following:
  - Analytical results of site characterization and pre-removal samples collected from the four monitoring locations: AD1 (Adit discharge), ET3 (Immediately below the lower tailings), ET2 (Ephemeral [background] stream downgradient from the Site), and ET4 (The end of the ephemeral stream prior to discharge to Mill Creek) for comparison with data collected during the SI and pre-removal data gap investigation;
  - Descriptive text and photographs that document the changing Site conditions over time;
  - An interpretation of the analytical results and discussion regarding any observed trends; and
  - Completed field forms, photographs, laboratory analytical results, tables, graphs, and any other supporting documentation.

6.0 REFERENCES

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FIGURES

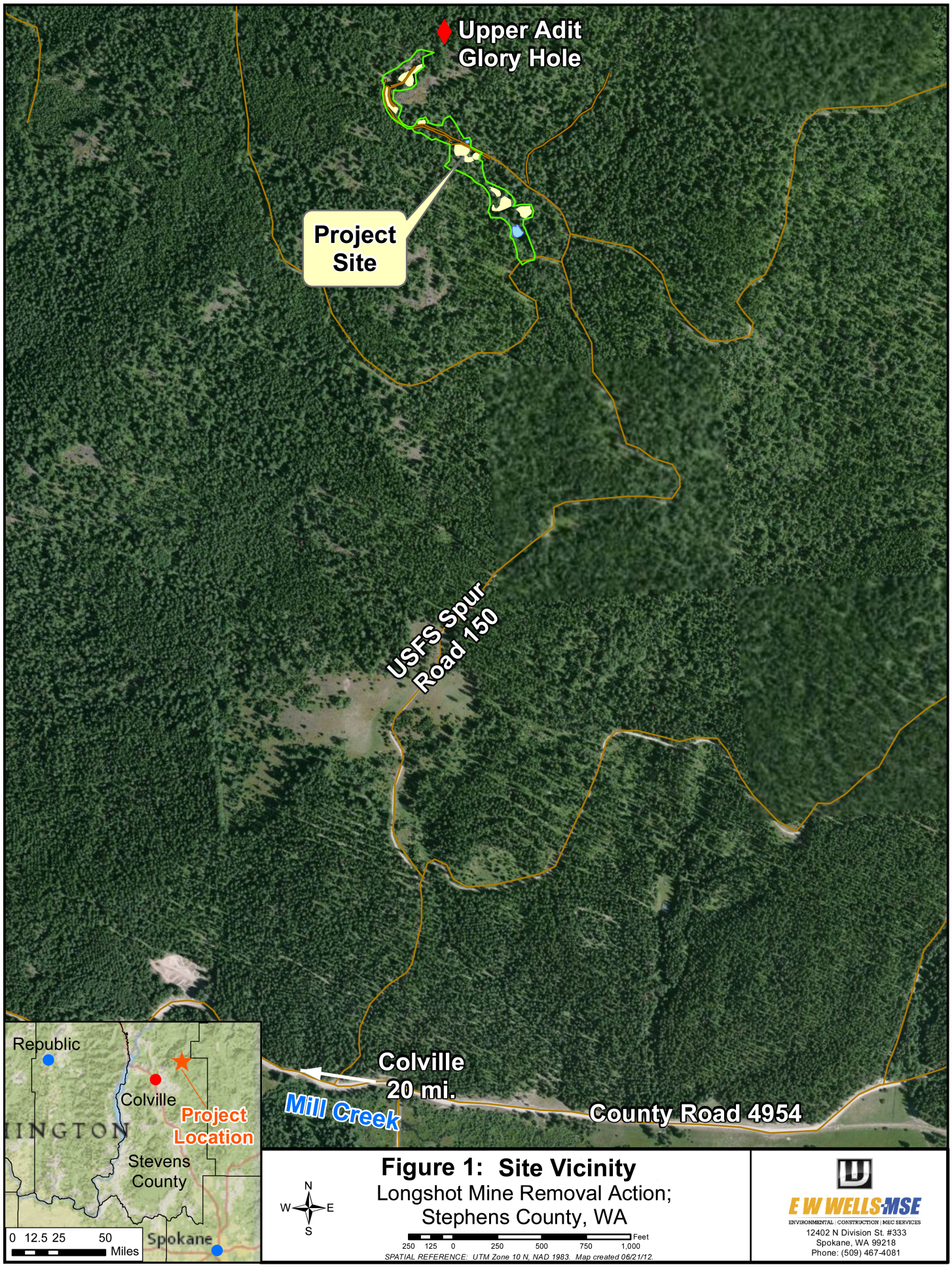


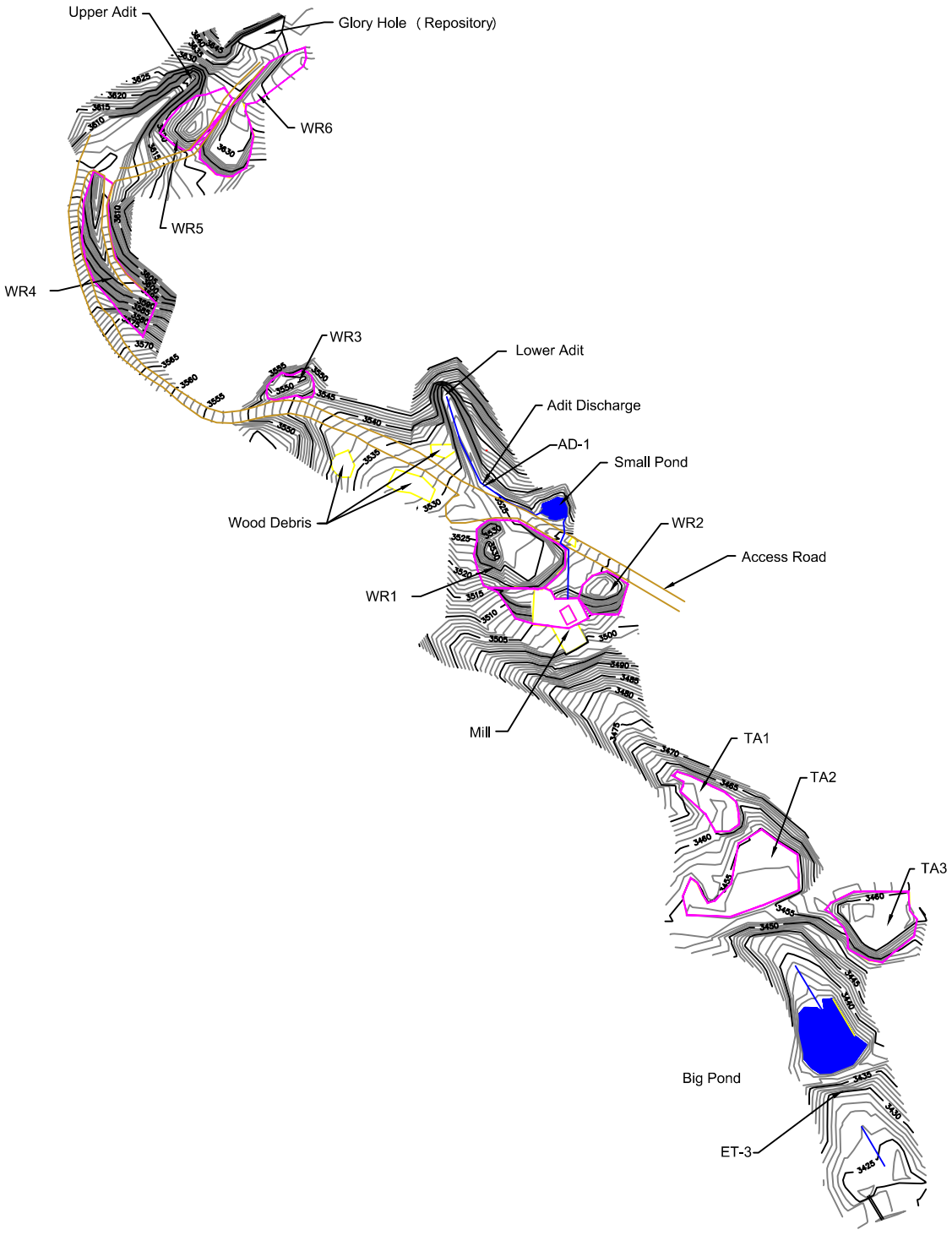
Figure 1: Site Vicinity

Longshot Mine Removal Action;
Stephens County, WA

SPATIAL REFERENCE: UTM Zone 10 N, NAD 1983. Map created 06/21/12.

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O:\Boise\Project Files\US Forest Service\USFS Region 6\Longshot Mine Removal Action-3149\GIS_Maps\Fig1_Overview Area.mxd



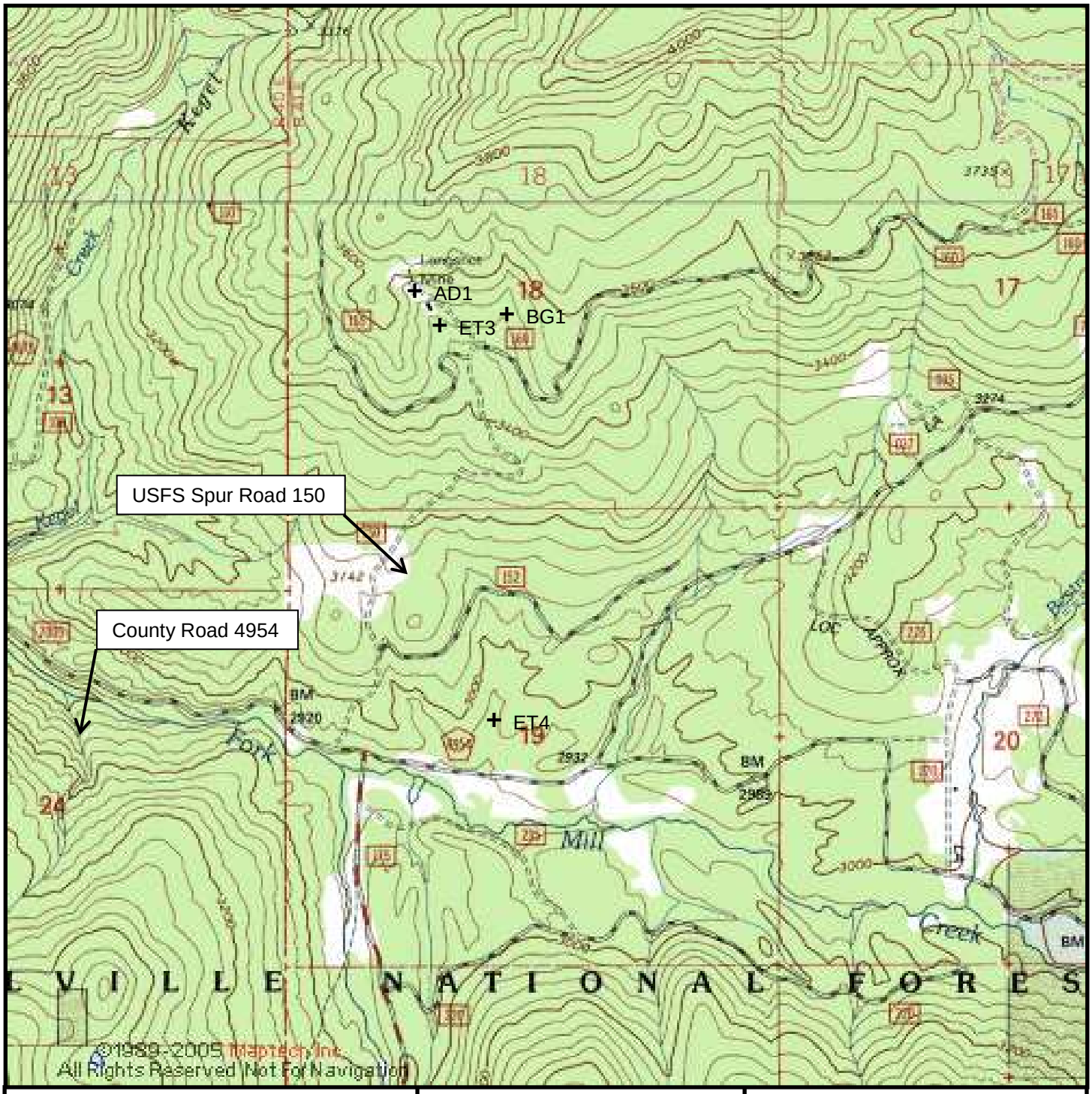
LEGEND

- 5280 Major Contour
- Intermediate Contour
- Road
- Water
- Mine Waste Areas

Figure 2: Site Features, Workings, and Sample Locations
Longshot Mine Removal Action;
Stephens County, WA

100 0 100
SCALE: 1 unit = 100 feet

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LEGEND

+ Sample Location & No.

Approximate Scale:

0 Ft. — 3000 Ft.

Figure 3: Surface Water Sample Locations

Longshot Mine Removal Action;
Stephens County, WA

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TABLES

Table 1. Disposal and Cleanup Verification Samples and Analyses

Location	Medium	Number of Samples	Analyses
(1) Bulk Debris from Mill Demolition	Wood	1	Total Metals: As, Ba, Cd, Cr, Pb, Hg, Se, Ag TCLP Metals: As, Ba, Cd, Cr, Pb, Hg, Se, Ag
(2) Ore bin at Mill Site	Soil	1	Total Metals: Ag, As, Ba, Cd, Pb, Zn
(3) Beneath wood and metal debris around the mill foundation	Soil	1	Total Metals: Ag, As, Ba, Cd, Pb, Zn
(4) Waste Rock Pile WR-1	Soil	1	Total Metals: Ag, As, Ba, Cd, Pb, Zn
(5) Waste Rock Pile WR-2	Soil	1	Total Metals: Ag, As, Ba, Cd, Pb, Zn
(6) Waste Rock Pile WR-3	Soil	1	Total Metals: Ag, As, Ba, Cd, Pb, Zn
(7) Site	Soil QA/QC	1 Blank, 1 MS/MSD	Total Metals: Ag, As, Ba, Cd, Pb, Zn

Table 2. Pre- and Post-Removal Monitoring Samples and Analyses

Location	Medium	Number of Samples	Analyses
(1) Adit Discharge (AD-1)	Surface Water Sediment	1 each medium	Total & Dissolved Metals: Ag, As, Ba, Cd, Pb, Zn Water only add: Sulfate, TDS, TSS, Hardness Field Parameters: pH, Temp, DO, EC, ORP/Eh
(2) Ephemeral Stream East of site (ET-2)	Surface Water Sediment	1 each medium	Total & Dissolved Metals: Ag, As, Ba, Cd, Pb, Zn Water only add: Sulfate, TDS, TSS, Hardness Field Parameters: pH, Temp, DO, EC, ORP/Eh
(3) Ephemeral Stream Below Lower Tailings (ET-3)	Surface Water Sediment	1 each medium	Total & Dissolved Metals: Ag, As, Ba, Cd, Pb, Zn Water only add: Sulfate, TDS, TSS, Hardness Field Parameters: pH, Temp, DO, EC, ORP/Eh
(4) Ephemeral Stream Before Discharge to Mill Creek (ET-4)	Surface Water Sediment	1 each medium	Total & Dissolved Metals: Ag, As, Ba, Cd, Pb, Zn Water only add: Sulfate, TDS, TSS, Hardness Field Parameters: pH, Temp, DO, EC, ORP/Eh
(5) Ephemeral Stream Before Discharge to Mill Creek (ET-4)	Surface Water Benthic Organisms	1	Taxonomy, generally to genus/species
(6) Site	Water QA/QC	1 Blank, 1 MS/MSD	Total & Dissolved Metals: Ag, As, Ba, Cd, Pb, Zn Sulfate TDS, TSS, Hardness,

Notes:
DO = Dissolved oxygen
EC = Electrical conductivity
MS/MSD = Matrix spike/matrix spike duplicate
ORP/Eh = Oxygen reduction potential
TDS = Total dissolved solids
Temp = Temperature
TSS = Total suspended solids

Table 3. Sample Volume, Preservative, and Holding Time Summary

Medium	Laboratory Analysis	EPA Method	Container/Volume	Preservative[(a)]	Holding Time
Bulk Wood	Total Metals: As, Ba, Cd, Cr, Pb, Hg, Se, Ag	6010, 6020, 7471	1-gallon, zip-sealed plastic bag (double bag samples)	none	6 months
	TCLP Metals: As, Ba, Cd, Cr, Pb, Hg, Se, Ag	6010, 6020, 7471 Extraction by 1311	1-gallon, zip-sealed plastic bag (double bag samples)		
Soil	Total Metals: As, Ba, Cd, Cr, Pb, Hg, Se, Ag	6010, 6020, 7471	4-oz soil jar	none	6 months
Sediment	Metals: Ag, As, Ba, Cd, Pb, Zn	6010, 6020	One 4-oz soil jar	None	6 months
Waters	Dissolved Metals: Ag, As, Ba, Cd, Pb, Zn	200.7, 200.8	One 500-mL plastic bottle	HNO_3 to pH<2	6 months
	Total Recoverable Metals: Ag, As, Ba, Cd, Pb, Zn	200.7, 200.8	One 500-mL plastic bottle	HNO_3 to pH<2	6 months
	TDS TSS Hardness as $CaCO_3$ Sulfate	160.1 160.2 130.2/2340C 300.0	One 500-mL plastic bottle	None	7 days 7 days 28 days 28 days
	Benthic Macroinvertebrates Taxonomy to Genus or Species	Barbour, et. al, 1999	Unbreakable, 4-oz, (125 ml) wide mouth, water-tight container	Ethanol	indefinite

Notes:
[a] All samples will be cooled to 4°C.
mL = Milliliter
oz = ounce
HNO_3 = Nitric acid
TDS = Total dissolved solids
TSS = Total suspended solids

Table 4. Data Quality Objectives

STEP 1	STEP 2	STEP 3	STEP 4	STEP 5	STEP 6	STEP 7
State the Problem	**Identify the Decision**	**Identify Inputs to the Decision**	**Define Study Boundaries**	**Develop Decision Rule**	**Specify Tolerable Limits on Decision Errors**	**Optimize Sampling Design**
• The effectiveness of the Removal Action is unknown.	1. Do metals concentrations exceed pre-removal levels? 2. Do metals concentrations exceed state and federal regulatory criteria? 3. Has the aquatic habitat improved post-removal? 4. Did the Removal Action achieve the desired objectives?	• Analytical results of surface water, pore water, sediment, and benthic samples • Results of aquatic habitat survey • State and federal regulatory criteria for surface water and sediment quality	• East and west seeps, and aquatic habitat on Quartz immediately downstream of the Site	• If metals concentrations exceed pre-removal levels and regulatory criteria, evaluate the need for further Removal Action at the Site. Otherwise, continue monitoring.	• Decision errors will be minimized through consistency in sampling locations and methodology. • Field and laboratory QA/QC samples will be used to ensure that data are of known precision and accuracy.	• Sampling locations will be selected based on locations used in the SI. • The analytical suite will be based on analytes that exceeded risk-screening criteria in pre-removal samples collected during the SI.

Notes:
QA/QC = Quality assurance/Quality Control
SI = Site Inspection

ATTACHMENT A

FIELD FORMS

MSE Daily Field Summary

Project:	Longshot Mine and Mill
Project Number:	3149
Location:	Colville National Forest, Washington
Field Personnel:	
USFS Personnel:	
Date:	

FIELD CONDITIONS

Weather:	Temp:
Precipitation:	Wind:

VISITORS TO THE SITE

Name	Company:	Purpose of Visit:

FIELD WORK SUMMARY

MSE Water Sample Collection Record

SAMPLE ID:

Sample Location: Photo:

Description:

Date:

Field Personnel:

Conditions: Weather:

FIELD PARAMETER MEASUREMENT

Field Meter:	Field Parameters:	Observation 1	Observation 2	Observation 3
	Temperature (Celcius)			
	pH (pH units)			
	SpCond (microS/cm)			
	Dissolved O_2 (mg/L)			
	Turbidity			
	ORP (mV)			

Method:

Measurement START Time: Measurement END Time:

FLOW MEASUREMENT

Method: Velocity Meter: Flume: Timed Volumetric:

Description:

Flow:

SAMPLE COLLECTION

Sample Method: Bottle Pump Other:

Sample Collection Time:

	Size			Filtration		Analysis							Preservative			
# Sample Containers	500-mL plastic bottle	250-mL plastic bottle	1000-mL glass bottle	Filtered	Unfiltered	Dissolved metals	Total As, Cr, Hg, Se	Total & WAD CN	Sulfate	As & Cr Speciation	Methyl Mercury	pH & Hardness	HCl	HNO_3	NaOH	NONE

STREAM CROSS-SECTION/COMMENTS

MSE Soil Sample Collection Record

SAMPLE ID:

Sample Location: Photo:

Description:

Date:

Field Personnel:

Conditions: Weather:

METHOD

Grab: Depth:

Composite:

Location/Boring ID	Depth	Comments

SAMPLE COLLECTION

Equipment: Trowel Hand Auger Other:

Sample Collection Time:

# Sample Containers	Size				Analysis								Other
	1-gal Plastic Ziploc Bag	8-oz glass jar	4-oz glass jar	Brass Sleeve	Total Lead	Total Arsenic	TCLP - Lead	TRPH	TPH	MBTEXN	VOCs		

DESCRIPTION/COMMENTS

MSE Sediment Sample Collection Record

SAMPLE ID:

Sample Location: Photo:

Description:

Date:

Field Personnel:

Conditions: Weather:

METHOD

Grab: Depth:

Composite:

Habitat	Depth	Comments

SAMPLE COLLECTION

Equipment: Trowel Push Sampler Other:

Sample Collection Time:

# Sample Containers	Size				Analysis								Other
	500-mL Bottle	12-oz glass jar	8-oz glass jar	Brass Sleeve	Metals	As Speciation	Methyl Mercury	Total & WAD CN	TOC				

DESCRIPTION/COMMENTS

MSE Sample Collection Record

SAMPLE ID:

Sample Location: Photo:

Description:

Date:

Field Personnel:

Conditions: Weather:

METHOD

Grab: Depth:

Composite:

Container	Depth	Comments

SAMPLE COLLECTION

Equipment: Trowel Siphon Other:

Sample Collection Time:

# Sample Containers	Size				Analysis								Other
	1000-mL glass bottle	8-oz glass jar	4-oz glass jar	40-ml VOA vial	8 RCRA metals	TPH	VOCs	SVOCs	TRPH	Oil and Grease	TCLP		

DESCRIPTION/COMMENTS

MSE Sample Collection Inventory

Sample ID	Medium								Location	Sample Type				Analysis											Date	By
	Mine Waste	Background Soil	Surface Water	Pore Water	Sediment	Benthics	Drums/Other	Quality Control		Grab	Composite	Filtered	Unfiltered	Metals	ABA	Paste pH	TAL Metals+CN, Hard	Total Se, Cr, Hg	Sulfate							

MSE XRF Screening Record

Project/Site:

Date:

XRF Instrument:

Settings:

Operator:

XRF SCREENING RESULTS

Location	ID	Result	GPS Coordinates	Comments

DESCRIPTION/COMMENTS