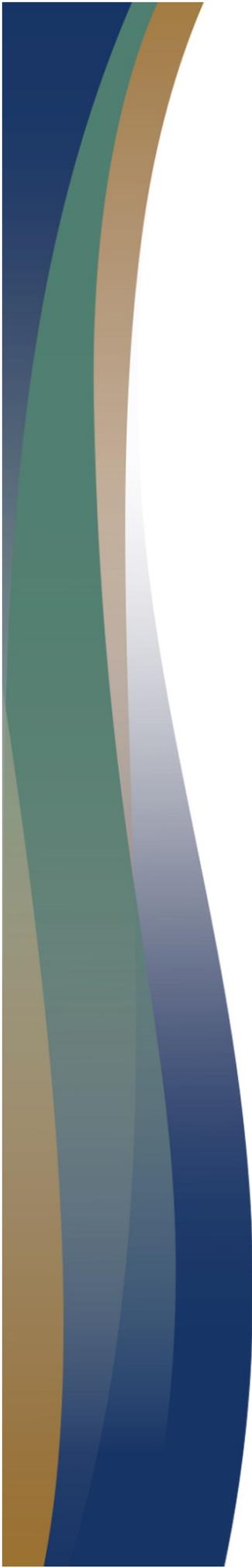


Appendix D.

**Technical Specifications and
Construction Quality Assurance Plan**



TECHNICAL SPECIFICATIONS

**Monte Cristo Mining Area
Mt. Baker-Snoqualmie**

**National Forest
Snohomish County, Washington**

2015 Removal Action

April 2015

PN: 2013230047



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TECHNICAL SPECIFICATION INDEX

Monte Cristo Mining Area Mt. Baker- Snoqualmie National Forest

2015 Removal Action Snohomish County, Washington

DIVISION 0 GENERAL REQUIREMENTS

- 00100 Measurement and Payment
- 00190 Mobilization

DIVISION 2 SITE CONSTRUCTION

- 02110 Obliteration of Abandoned Roadways
- 02130 Clearing and Grubbing
- 02135 Waste Material Disposal
- 02136 Waste Material Disposal (Landfill)
- 02204 Loose Rock Riprap
- 02220 Excavation and Embankment
- 02251 Sediment Control
- 02801 Seeding

DIVISION 13 SPECIAL CONSTRUCTION

- 13001 HPDE Liner
- 13002 Nonwoven Geotextile

DIVISION 00

SECTION 00100

MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.1 Measurement and Payment

Measurement and payment for contract work will be made only for and under those pay items included in the SCHEDULE OF ITEMS. All other work and materials will be considered as included in the payment for items shown. Out of scope work, when the ENGINEER determines work that needs to be done is out of scope, and CONTRACTOR and ENGINEER cannot agree upon a price for such work, shall be performed by the CONTRACTOR at the direction of the ENGINEER and shall be compensated according to Washington DOT Force Account specifications.

When more than one class, size, or thickness is specified in the SCHEDULE OF ITEMS for any pay item, suffixes will be added to the item number to differentiate between items to be bid.

1.2 Determination of Quantities

The following methods of measurement are used to determine contract quantities for payment.

For individual construction items, longitudinal and lateral measurements for area computations will be made horizontally or corrected to horizontal measurement unless otherwise specified. Measurements for seeding, mulching, geotextiles, netting, erosion control blankets, and sodding will be along slope lines.

The average end area method will be used to compute volumes of excavation or embankment. However, if in the judgment of the ENGINEER, the average end area method is impractical, measurement will be made by volume in hauling vehicles or by other three dimensional methods.

Structures will be measured according to neat lines shown on the DRAWINGS or as altered by the ENGINEER in writing to fit field conditions.

For items that are measured by the linear foot, such as pipe culverts, fencing, guardrail, and under drains, measurements will be made parallel to the base or foundation upon which the structures are placed. Pipe and pipe arch culverts shall be measured along center of invert; arches shall be measured at spring line.

For aggregates weighed for payment, the tonnage will not be adjusted for moisture content, unless otherwise provided in SPECIAL PROJECT SPECIFICATIONS.

For bituminous material, volumes will be measured at 60°F or will be corrected to the volume at 60°F by using ASTM D 1250 for asphalts. Emulsified asphalt will be measured at 60°F, or measured by converting the gallonage at another temperature to gallonage at 60°F by means of the following formula:

$$\text{Gallons at } 60^{\circ}\text{F} = \frac{\text{Gallons at } A^{\circ}\text{F}}{1+0.00025 (A^{\circ}\text{F} - 60^{\circ}\text{F})}$$

In which, A°F is the temperature of the material at the time the gallonage is measured. For vehicular shipments, net certified scale weights or weights based on certified volumes will be used as a basis of measurement. Measurements will be adjusted when bituminous material has been lost from the vehicle or the distributor, has been wasted, or has otherwise not been incorporated into this work. Determining true weights of hauling vehicles shall be made by weighing the empty vehicles at least once a day at the times the ENGINEER directs. Each vehicle shall bear a plainly legible identification mark.

When bituminous materials are shipped, net certified weights, or volume corrected for loss of foaming, can be used for computing quantities.

For standard manufactured items, such as fence, wire, plates, rolled shapes, pipe conduits, etc., identified by gauge, weight, section dimensions, etc., such identification shall be considered the nominal weights or dimensions. Unless controlled by tolerances in cited specifications, manufacturer's tolerances will be accepted.

1.3 Units of Measurement

Payment will be by units defined and determined according to U.S. Standard measure as follows:

- A. **Cubic Yard** - A measurement computed by one of the following methods:
 - 1. Excavation, Embankment, or Borrow - The measurement computed by the average end area method from measurements made longitudinally along a centerline or reference line.
 - 2. Material in Place or Stockpile - The measurement computed with dimensions of the in-place material.
 - 3. Material in the Delivery Vehicle - The measurement computed using measurements of material in the hauling vehicles at the point of delivery. Vehicles shall be loaded to at least their water level capacity. Leveling of the loads may be required when vehicles arrive at the delivery point.
- B. **Cubic Yard Mile** - A combination of linear and volumetric measurement meaning the movement of a cubic yard of material 1 mile.
- C. **Each** - One complete unit, which may consist of one or more parts.
- D. **MFBM** - One thousand board feet measure based on nominal widths, thickness, and extreme usable length of each piece of lumber or timber actually incorporated in the job.
- E. **Station** - One hundred linear feet measured horizontally.
- F. **Station Yard** - A combination of linear and volumetric measurement meaning the movement of a cubic yard of material one station.
- G. **Thousand Gallons Mile** - A combination of linear and volumetric measurement meaning the movement of 1,000 gallons of material 1 mile.
- H. **Ton** - Short ton consisting of 2,000 pounds.
- I. **Ton Mile** - A combination of linear and weight measurement meaning the movement of 1 ton of material 1 mile.

1.4 Methods of Measurement

One of the following methods of measurement for determining final payment is designated on the SCHEDULE OF ITEMS for each pay item:

- A. **Designed Quantities (DQ)** - These quantities denote the final number of units to be paid for under the terms of the contract. They are based upon the original design data available prior to advertising the project. Original design data include the preliminary survey information, design assumptions, calculations, drawings, and the presentation in the contract. Changes in the number of units shown in the SCHEDULE OF ITEMS may be authorized under any of the following conditions:
 - 1. As a result of changes in the work authorized by the CONTRACTING OFFICER.
 - 2. As a result of the CONTRACTING OFFICER determining that errors exist in the original design data used to determine designed quantities that cause a pay item to change by 15% or more.
 - 3. As a result of the CONTRACTOR submitting to the CONTRACTING OFFICER a written request showing evidence of errors in the original design data used to determine design quantities that cause a pay item total to change by 15% or more. The evidence must be verifiable and consist of calculations, drawings, or other data that show how the designed quantity is believed to be in error.
- B. **Staked Quantities (SQ)** - These quantities are determined from staked measurements prior to construction.
- C. **Actual Quantities (AQ)** - These quantities are determined from measurements of completed work.
- D. **Vehicle Quantities (VQ)** - These quantities are measured or weighed in hauling vehicles.
- E. **Lump Sum Quantities (LSQ)** - These quantities denote one complete unit of work as required by or described in the contract, including necessary materials, equipment, and labor to complete the job. They will not be measured.

1.5 Price Adjustment for Out-of-Specification Bituminous Materials

Bituminous materials are defined as all types and grades of asphalt cement, liquid asphalt, emulsified asphalt, and dust oil.

If bituminous material fails one or more test requirements, and the CONTRACTING OFFICER determines it is in the public interest to accept the material at a reduced price, the price reduction shall be based on the test results giving the largest percent price adjustment. The CONTRACTOR may remove and replace the defective material or accept the adjustment.

The price reduction shall apply to all pay items affected.

Price adjustment will be based on samples taken in duplicate in accordance with AASHTO T 40 under the supervision of the ENGINEER. Samples shall be sent to an authorized laboratory. The laboratory shall test one of each duplicate sample and retain the other. When any test result is not within the specification limits, the laboratory shall immediately notify the supplier and the ENGINEER. The ENGINEER will then authorize check testing of the retained sample.

If the retained sample tests satisfactorily, the material will be accepted. If the retained sample also fails, the following schedule of price adjustments shall apply. The average of test values for the two samples will determine the basis for price adjustment, except when test results on the samples differ by more than the applicable AASHTO or ASTM Repeatability Unit; then, the test result numerically nearest the specification requirement will be used. (A repeatability unit is defined as D2S or D2S% limit for single operator precision described in ASTM recommended practice C 670.)

The schedule of price adjustments shall not apply to the following tests:

<u>Test</u>	<u>AASHTO Test Method</u>
Spot Test	T 102
Particle Charge	T 59
Ductility	T 51

Bituminous materials failing to meet specifications for these tests shall be removed and replaced.

See Table 00100-1 for the schedule of price adjustments for bituminous materials that do not meet specifications.

Table 00100-1				
Schedule of Price Adjustments for Out-of-Specification Bituminous Materials				
Application	Deviation from Specification Limit Measured in Reproducibility Units*.			
	Less than 1	1 but less than 2	2 but less than 3	3 or greater
Price reduction applicable to bituminous base course and pavement mixture or to seal coat and bituminous material paid for as a separate item.	0%	5%	25%	Remove & Replace
Price reduction applicable to bituminous material paid for as a separate item.	0%	10%	25%	Remove & Replace

* A reproducibility unit is defined as D2S or D2S% limit for multi-laboratory precision described in ASTM recommended practice C 670.

The Sieve Test (AASHTO T 59) results may be exempt from the Schedule of Price Adjustments provided the CONTRACTOR'S quality assurance program includes checking the uniformity of bituminous spread rates in increments no greater than 1 foot over the width of the spray bar and variation between increments is no greater than 5%.

1.6 Earthwork Tolerances

Adjustments of horizontal or vertical alignment, within the tolerances specified in this contract, or shifts of balance points up to 100 feet shall be made by the contractor as necessary to produce the

designed roadway section and to balance earthwork. Such adjustments shall not be considered as "Changes."

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION

DIVISION 00
SECTION 00190
MOBILIZATION

PART 1 - GENERAL

This item is intended to compensate the CONTRACTOR for operations including, but not limited to, those necessary for the movement of personnel, equipment, supplies, and incidentals to the project site; for payment of premiums for bonds and insurance for the project; and for any other work and operations which must be performed or costs that must be incurred incident to the initiation of meaningful work at the site and for which payment is not otherwise provided for under the contract.

Also included are:

- Camp set up and tear down
- Provide bear proof trash containers and regular removal of trash/debris
- Provide Porta Potties, with regular maintenance and disposal
- Provide cooking and eating area tent, as well as shower facilities and blackwater/graywater management
- Provide internet and cell phone (VOIP) communications

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION

DIVISION 02

SECTION 02110

OBLITERATION OF ABANDONED ROADWAYS

PART 1 - GENERAL

1.1 Description

This item shall consist of obliteration and work to prevent erosion and encourage revegetation, in accordance with these specifications, of such old roadways or areas as are indicated on the DRAWINGS or designated on the ground for obliteration.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 Performance

Sections of the abandoned roadway shall be obliterated where shown on the DRAWINGS. The natural drainage pattern shall be restored or maintained or both. The roadbed shall be ripped, plowed, or scarified to promote the establishment of vegetation, and the slopes shall be rounded to approximate the original contour.

Water bars for drainage and barricade berms to control erosion and vehicle access shall be constructed where shown on the DRAWINGS or every 20 vertical feet along roadway.

Structures shall be dismantled, buried, or removed or shown on the DRAWINGS.

Where shown on the DRAWINGS, materials required for the new roadway shall be taken from the abandoned roadway, and excess or unsuitable material or both taken from the new roadway shall be used in obliterating the abandoned roadway.

PART 4 - MEASUREMENT

4.1 Method

The method of measurement will be as described in Section 00100 Measurement and Payment.

The number of miles will be to the nearest 0.1 mile of roadway measured along the centerline.

Only those units and fractions thereof that are outside the limits of the new roadway will be measured. Areas of less than 200 square feet will not be measured.

PART 5 - BASIS

5.1 Quantities

The accepted quantities will be paid for at the contract unit price for each pay item shown in Section 00100, Measurement and Payment.

END OF SECTION

DIVISION 02

SECTION 02130

CLEARING AND GRUBBING

PART 1 - GENERAL

1.1 **Description**

This item shall consist of clearing, grubbing, removing and disposing of all vegetation, dead woody material, and debris within the clearing limits except objects designated to remain. Specifications for other items may refer to these specifications.

1.2 **Areas to be Cleared and Grubbed**

The limits of clearing and grubbing will be established by this Section, by other Section items, or on the DRAWINGS. The clearing and grubbing limits will normally coincide with the designated working limits, however, the ENGINEER may also designate individual trees and snags outside the clearing limits for selective removal and disposal, or he may designate areas within the working limits where clearing and grubbing is not required or allowed within the provisions of this specification.

- **Grading Limits:** Area that is to be excavated or covered with additional materials during construction.
- **Working Limits:** Area consisting of the grading limits plus room for equipment to maneuver to perform the necessary clearing and grubbing. These limits, to be held to a minimum, will be designated for each project.
- **Clearing Limits:** Area consisting of the working limits plus any additional area for a boom or other above ground clearance requirement.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 **General**

Clearing and grubbing shall be confined to designated areas. The ENGINEER will designate the trees, shrubs, and other plants and objects to remain. The CONTRACTOR is to keep the clearing to a minimum and to exercise care to not damage trees and shrubbery within clearing limits when there is no reason for grubbing.

3.2 **Felling**

Trees shall be felled within the clearing limits, usually towards the center, so as to prevent damage to the trees that are to be left standing. When necessary to prevent damage to structures, other trees or property, or to minimize danger to traffic, trees shall be cut in sections from the top downward.

3.3 Clearing Area Within Grading Limits

Clearing shall consist of the removal of all biodegradable material (trees, snags, shrubs, brush, dead woody debris, or plants). Branches of trees extending over the grading limits shall be trimmed.

3.4 Grubbing Area Within Grading Limits

- A. Embankment Areas - In embankment sections where the total depth of fill will be less than three feet above undisturbed earth, grubbing shall consist of the removal of all biodegradable material (stumps, roots larger than two inches in diameter, matted roots, duff, and other protruding or surface objects). The resulting depressions shall be filled and compacted with material specified for the embankment.

In embankment sections where the total depth of fill will be three feet or greater above undisturbed earth, all loose biodegradable material shall be removed. Undisturbed stumps, roots, and nonperishable solid objects which will be a minimum of three feet below the finished surface of embankments, except those in embankments designed to impound water, need not be removed. The stumps that remain shall be cut off not more than six inches above the original ground line.

- B. Areas to be Excavated - In cut sections, the removal of stumps and roots shall be done to such depth that in no case will any portion remaining extend closer than 18 inches to any subgrade or slope surface. Stumps shall be removed and stockpiled in the borrow area as noted on the plans.

3.5 Area Outside Grading Limits but within Clearing Limits

On areas designated for clearing and grubbing outside of the grading limits, stumps may be cut within four inches of the ground and left, in lieu of being removed. All trees, shrubs, and other protruding or surface objects shall be cleared, except the vegetation and objects designated to remain.

3.6 Trimming of Trees

All required trimming shall be done in accordance with approved horticultural practices.

3.7 Timber Used by the Contractor

Timber cut from within the clearing limits, meeting specification requirements, may be utilized by the CONTRACTOR for constructing temporary structures, false-work, etc., as required in the project and also for camp purposes, provided written authorization for such use is obtained from the ENGINEER.

3.8 Timber to be Saved

All sound, green logs or poles, not used by the CONTRACTOR in the project, having a top diameter of two inches or more and a length of four feet or more, as determined by the ENGINEER, shall be saved. Material to be saved shall be trimmed of limbs and tops, sawed into such lengths designated below, and stacked in an area readily accessible for loading and hauling equipment, and where they will not interfere with the grading. Skidding timber outside staked working limits will not be approved.

All timber designated to be saved will be cut as follows:

- Logs with diameters over eight inches and will be cut in 27-foot lengths.
- Limbs, treetops, etc., from two inches to eight inches in diameter will be cut in maximum four-foot lengths (two-foot lengths within campground areas).

Logs not used by the contractor for temporary structures, as noted above, shall be transported to the Mountain Loop Highway and stockpiled at a location to be designated by the Forest Service. Title to all such timber cut from National Forest land shall remain with the United States, subject to disposal by the Forest Service, U.S. Department of Agriculture, in accordance with its regular procedures, unless otherwise specified.

3.9 Clearing or Clearing and Grubbing Requirements for Various Items:

A. Buildings

Construction work shall disturb a minimum of the existing terrain and plant life adjacent to the building site. Only trees, shrubs, stumps, and major roots, which interfere, may be removed. When excavation reveals the major roots of a live and significant tree nearby, the CONTRACTOR shall not remove the tree unless it interferes with the construction and removal is authorized by the ENGINEER.

B. Disposal of Refuse

Debris and refuse shall be disposed of in accordance with Section 02135 or stockpiled onsite to be used as part of the reclamation activities.

PART 4 - MEASUREMENT AND PAYMENT

Clearing and Grubbing will not be paid for separately. Costs incurred shall be covered by the Pay Items indicated in Section 00100

END OF SECTION

DIVISION 02

SECTION 02135

WASTE MATERIAL DISPOSAL

PART 1 - GENERAL

1.1 Description

This item shall consist of the management of excess excavation material and construction debris. The waste disposal area shall be shown on the DRAWINGS or designated by the CONTRACTING OFFICER.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

All excavated material not used in the construction of embankments, backfilling of trenches, or other specified areas within the project limits, along with clearing debris, shall be managed in accordance with the Cultural Resources Monitoring and Treatment Plan or be hauled to the designated onsite disposal area. After this material has been hauled to the disposal area, the piled material shall be covered with soil to a uniform depth of six inches minimum and sloped to 2:1 or flatter. The size and shape of the piled waste material shall be designated by the ENGINEER and/or CONTRACTING OFFICER. The disposal area shall be left suitable for reseeding.

END OF SECTION

DIVISION 02

SECTION 02136

WASTE MATERIAL DISPOSAL (LANDFILL)

PART 1 - GENERAL

1.1 Description

This item shall consist of loading, handling, hauling, and disposal of unsuitable excavated material or refuse resulting from the clearing and grubbing operation; and trash resulting from construction activities, or rubbish dumped by others. The waste disposal site shall be off National Forest lands at the county landfill. The CONTRACTOR shall be responsible for all costs, royalties, arrangements, procurement, cleanup, and work associated with a waste disposal area.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

All unsuitable excavated material or refuse resulting from the clearing and grubbing operation along with other construction refuse shall be hauled to a disposal area. All requirements of disposal and disposal site finish work are the responsibility of the CONTRACTOR. The Government is not responsible for material to be disposed of upon its departure from the project area.

END OF SECTION

DIVISION 02

SECTION 02204

LOOSE ROCK RIPRAP

PART 1 - GENERAL

1.1 Description

This item shall consist of furnishing and placing a protective covering of stone on slopes or around or below culverts, in accordance with these specifications, in conformity with the DRAWINGS and to the lines and grades established.

1.2 Method of Measurement

The quantity to be measured shall be the number of cubic yards, measured in place, completed and accepted. The limiting dimensions shall not exceed those shown on the DRAWINGS or established. No separate measurement shall be made for the polyfiber fabric material placed beneath the riprap when shown on the DRAWINGS, rather, measurement shall be considered to be included in the measurement for loose rock riprap.

PART 2 - PRODUCTS

2.1 Physical Properties

The stones used for this work shall be durable, angular, field, or quarry stones which are sound, hard, and free from laminations, fractures, or other structural defects. They shall be of such quality that they will not disintegrate on exposure to water or weathering.

Stones used shall be such that at least 50% (d50) of the individual stones shall have a minimum diameter as shown on DRAWING. Not more than 10% of the stone shall have a diameter of less than 30% of the d50 measured in the smallest section.

2.2 Source

Riprap shall be obtained from a designated borrow source, salvaged from project excavations, or from a private or commercial source as indicated on the Schedule of Items.

2.3 Polyfiber Fabric

Polyfiber fabric shall be Mirafi No. 700X unwoven, as manufactured by Mirafi, Inc. of Charlotte, North Carolina, or an approved equal.

PART 3 - EXECUTION

3.1 Foundation

The slope or area upon which the riprap is to be placed shall be shaped to the required lines and grades. The surface shall be roughened to provide a surface to which the base stones will key and

be firmly bedded. Foundation trenches shall be excavated at the toe of the slope or area to receive the base stones and provide a secure footing. These trenches shall be of sufficient width and extend a minimum of two feet below the bed of the stream or wash. Slopes and trenches shall be approved before the placing of riprap is begun.

3.2 Placing Riprap

The stones shall be placed or dumped on the approved slope and in the trench to form the cross section desired. They shall be manipulated sufficiently to secure a roughly regular surface and mass stability. All stones shall be firmly keyed or bedded. Insofar as possible, the larger stones shall be placed at the bottom.

When the thickness of the riprap is not shown on the DRAWINGS, it shall be at least 1 ½ times the indicated d50 measured perpendicular to the slope.

When the rock riprap is completed, the area shall be cleaned up by removing all debris and material not used. Material excavated from foundation trenches, etc., shall be satisfactorily disposed of.

END OF SECTION

DIVISION 02

SECTION 02220

EXCAVATION AND EMBANKMENT

PART 1 - GENERAL

1.1 Description

This item shall consist of excavation, fill, and stockpiling for repository, shaping of roadways, and filling of subsidences, borrow excavation, drainage excavation, shaping of stream channels, removal of slide material, excavation of unsuitable material, embankment construction, and disposal of all excavated material necessary for the completion of construction including ditches, channel changes, furrows, slope rounding, benches, berms, dips, approaches, and subsidiary work.

1.2 Excavation

Excavation shall consist of the excavation and disposal of all excavated material at designated locations, regardless of its nature, that is not included under other pay items listed in the Schedule of Items.

1.3 Borrow Excavation

Borrow excavation shall consist of the excavation and utilization of material from sources shown on the DRAWINGS or from commercial sources. Additional sources of borrow excavation shall be approved in advance by the CONTRACTING OFFICER.

1.4 Method of Measurement

The method of measurement will be designated in the schedule of items and measured in accordance with Section 00100.

The measurement of excavation will include:

- Construction excavation
- Rock and unsuitable material below the required grade and unsuitable material beneath embankment areas
- Furrow ditches outside the roadway, except when furrow ditches are included in the Schedule of Items
- Topsoil and other material removed and stockpiled as directed
- Borrow material used in the work, except when borrow is included in the Schedule of Items
- The volume of conserved materials taken from stockpiles and used in the WORK.
- Slide material not attributable to negligence of the CONTRACTOR.
- Developing and/or reshaping stream channels.

The measurement of excavation will not include the following:

- Material used for other than approved purposes.
- Unauthorized excavation or borrow.
- Quantity of material excavated from slope rounding.
- Overbreakage from the backslope in rock excavation requiring blasting.
- Material scarified in place to receive the first layer of embankment.
- Benching or stepping existing ground for embankment foundation.
- Stepping or scaling cut slopes.

When designed quantities are designated in the Schedule of Items as the method of measurement, the original design data has been established on the basis of the undisturbed ground surface elevations.

When staked quantities are shown in the Schedule of Items, excavation quantities will be determined by the average end area method using slope stake information taken prior to construction.

When actual quantities are designated in the Schedule of Items as the method of measurement, preliminary cross sections or comparable measurements will be taken of the undisturbed ground surface and quantities finally measured in accordance with the following.

- When excavation is designated as a pay item in the Schedule of Items, final cross sections or comparable measurements will be taken of the completed and accepted work.
- When embankment is designated as a pay item in the Schedule of Items, measurement will be in the final position.
- When borrow is designated as a pay item in the Schedule of Items, measurement will be in the original position.

1.5 **Basis of Payment**

The accepted quantities will be paid at the contract unit price for each Pay Item shown in the Section 00100.

PART 2 - PRODUCTS

2.1 **Drainage Gravel**

Drainage gravel to meet Washington State Department of Transportation, 2006 Standard Specifications 9-03.12 (4) – Gravel Backfill for Drains or the following:

Drainage gravel shall consist of crushed, processed, or naturally occurring granular material. It shall be free from various types of wood waste or other extraneous or objectionable materials. It shall have such characteristics of size and shape that it will compact and shall meet the following specifications for grading and quality:

Sieve Size	Percent Passing
2" square	99 - 100
1/4" square	0-2

All percentages are by weight.

2.2 Base Material

Base Material shall consist of granular material, either naturally occurring or processed. It shall be essentially free from various types of wood waste or other extraneous or objectionable materials. It shall have such characteristics of size and shape that it will compact readily and shall meet the following test requirements:

Stabilometer "R" Value 72 min.
Swell pressure 0.3 psi max.

The maximum particle size shall not exceed 2/3 of the depth of the layer being placed.

Base material shall meet the following requirements for grading and quality when placed in hauling vehicles for delivery to the roadway or during manufacture and placement into a temporary stockpile. The exact point of acceptance will be determined by the ENGINEER.

Sieve Size	Percent Passing
2" square	75-100
U.S. No. 4	22-100
U.S. No. 200	0-10

Dust Ratio: 2/3 max.
Sand Equivalent 30 min.
All percentages are by weight.

Gravel base material retained on a U.S. No. 4 sieve shall contain not more than 0.20 percent by weight of wood waste.

2.3 Waste Rock

Shall be unclassified material excavated from the waste rock piles as indicated on the DRAWINGS and as directed by the ENGINEER .

2.4 Tailings

Shall be unclassified material excavated from tailing piles indicated on the DRAWINGS and as directed by the ENGINEER.

2.5 Cover Soil

Shall be classified as a GM or SM material. Cover soil within 1 foot of a geomembrane shall have a maximum particle size of 2 inches.

PART 3 - EXECUTION

3.1 Clearing and Grubbing

Clearing and grubbing shall be accomplished in accordance with Section 02130 before work under Section 02220 begins, except the grubbing of stumps, which may proceed concurrently with excavation, and the burning of slash, which may be delayed until weather permits. Excavation and placement operations shall be conducted so material to be treated under Section 02130 will not be incorporated in the work.

3.2 Pioneering

Pioneering operations for the top of excavation slopes, toe of embankments, or pioneer road construction shall prevent undercutting of the final excavation slope, depositing of materials outside of the construction limits, and any restriction of drainage.

3.3 Utilization of Excavated Materials

All suitable, excavated material shall be used in the construction of embankments, repository cover, subgrades, shoulders, slopes, bedding, and backfill for subsidences and for other purposes as shown on the DRAWINGS.

A. Excess Excavation

Designed excess excavation shall be disposed of as shown on the DRAWINGS.

B. Rock for Slope Protection

Excavated rock suitable for protection of embankments or backfill of subsidences may be conserved and used in lieu of a designated materials source.

C. Conserving Material

Material encountered in the excavation, suitable for cover, finishing, topsoil, or other purposes, may be conserved and utilized instead of materials from designated sources. Excessively wet material that is otherwise suitable for embankment or fill shall be field drained and dried before placement.

D. Excavation of Unsuitable Material

Unsuitable material shall be excavated. Disposal will be as shown on the DRAWINGS. Excavated areas shall be backfilled with suitable material when necessary to complete the work. Frozen material shall not be placed in embankments. Rocks that are too large to be incorporated into the embankment shall be broken for incorporation, maneuvered to the face of the embankment, and embedded so that they will not roll or obstruct the use and maintenance of the roadbed, or moved to approved locations.

E. Conservation of Topsoil

When shown on the DRAWINGS, suitable topsoil shall be removed, transported, and deposited in the designated stockpile areas. Topsoil stockpiles shall be deposited no more than 6 feet deep.

3.4 Excavation

Excavation for the repository and other site work will typically be in soils that are classified as type C under OSHA guidelines. CONTRACTOR shall conform to Washington Industrial Safety

and Health Act (WISHA) guidelines for excavation. If workers are in the excavation shoring, trench boxes or sloped sidewalls will be required. Slopes less than 20 feet tall shall be inclined at no more than 1.5H:1V in temporary excavations. Flatter slopes and/or benching may be necessary if soil conditions require it. Temporary covering with impermeable Reinforced Polyethylene tarp, or approved equal shall be used to protect slopes and the base of the repository during periods of wet weather.

The CONTRACTOR shall manage groundwater seeps during construction by collecting and routing seepage away from the repository. Additionally the CONTRACTOR shall employ temporary and permanent erosion and runoff control measures such as ditches and sumps to direct surface runoff away from work areas.

Drainage excavation shall include construction of side ditches, minor channel changes, inlet and outlet ditches, furrow ditches, ditches constructed along roads but beyond the roadway limits, subsidence areas, and other minor earth drainage structures as shown on the DRAWINGS. Excavated material shall be utilized in accordance with paragraph 3.3.3.

3.5 Finishing Subgrade

Rippable rock, and boulders shall be excavated to a minimum depth of six inches below subgrade unless otherwise shown on the DRAWINGS, and replaced with suitable material obtained from within the construction limits or from sources shown on the DRAWINGS. Undrained pockets in a rock surface, within the limits of the work, shall be excavated to properly drain or be filled with approved impermeable material.

For facilities receiving base or surface course, rocks larger than four inches that do not protrude above the subgrade more than one-third of the depth of the base or surface course, or three inches, whichever is less, may be left in place.

For unsurfaced facilities, unless other wise shown on the drawings, the top six inches below the finished surface shall consist of cushion material containing rocks less than three inches in greatest dimension that are developed by scarification, rolling, or importing suitable material obtained from sources shown on the drawings.

The subgrade shall be shaped, dressed, and compacted when required. Low sections, holes, or depressions shall be brought to grade with suitable material.

3.6 Finishing Slopes

Finished slopes shall conform reasonably to the lines staked on the ground or shown on the DRAWINGS. The finished slope shall be left in a roughened condition to facilitate the establishment of vegetative growth. The finish associated with template and stringline or handraking methods will not be permitted. Loose rock, debris, and other material larger than six inches in diameter shall be removed from the slope.

The tops of excavations, excluding areas of solid rock, shall be blended with the adjacent terrain by rounding where shown on the DRAWINGS. Decomposed rock that may be cut without blasting or ripping shall be rounded. Earth overlying rock shall be rounded above the rock. Blasting will not be allowed.

3.7 Overbuilding and Landscape and Stream Protection

Excavated or embankment material shall be confined within the construction limits to avoid overbuilding and to protect the landscape and streams.

3.8 Earth Berms

Permanent earth berms shall be constructed at locations shown on the DRAWINGS. Material used in the construction of berms shall be well graded with no rocks having a diameter greater than one-fourth of the height of the berm.

Acceptable material for the berm may be windrowed or stockpiled at a designated area as specified by the CONTRACTING OFFICER for later use. When the local material is not acceptable, material shall be imported from approved locations or from commercial sources. Material used for berm construction shall contain no frozen material, roots, sod, or other deleterious material. Material shall not be wasted over the embankment slope.

Compaction equipment shall be capable of obtaining compaction requirements without detrimentally affecting the compacted material. The compaction units may be of any type, provided they are capable of compacting each lift of material as specified. Maximum lift will be 12 inches.

3.9 Stream Channel Construction

This work entails the excavation and/or shaping of stream channels as shown on the DRAWINGS. All construction of the channel will conform to all grades, bank slopes, etc., as specified on the DRAWINGS or in other Sections of this Contract. Under no circumstances is coal, gob, or toxic substances to be included in this work. Should coal, gob, or toxic substances be encountered during excavation, the CONTRACTOR will notify the CONTRACTING OFFICER immediately. Basically, if coal, gob, or toxic substances are encountered, the CONTRACTOR will over excavate the channel by three feet, place protective liners as specified in other Sections of this Contract, and haul in suitable fill material to bring the centerline of the channel back up to the desired grade. The CONTRACTING OFFICER will determine the quantities involved for Contract price adjustments for this work. Excavation of the channels will be paid under this Section and according to the units shown in the Schedule of Items. Channel protective measures, such as liners, riprap, etc., will be paid for under other Sections of this Contract.

3.10 Water

Water sources and access are shown on the DRAWINGS. If the CONTRACTOR elects to obtain water from other sources, the CONTRACTOR shall be responsible for obtaining the right to use the water including any royalty costs.

Mobile watering equipment shall have reasonable watertight tanks of known capacity. Equipment used for dust control and finishing operations of subgrade and surfaces shall provide uniform and controlled application of water without ponding or washing. Positive control of water from the driver's position is required at all times.

Payment for furnishing, hauling, and applying water shall be included in the contract unit price for this specification.

3.11 Embankment and Backfill Placing Methods

- A. All Methods - When an embankment or backfill is to be placed across swampy ground or a swampy subsidence and removal of unsuitable material or subgrade treatment is not required, the lower part of the embankment or backfill shall be constructed in a single layer to the minimum depth necessary to support construction equipment or subsequent backfill material. Rocks larger than six-inch diameter shall not be concentrated in any areas of the embankment or backfill.
- B. Specific Methods - All embankments or backfill shall be placed by one or more of the following methods as shown on the DRAWINGS and listed in the schedule of items:

Method 1 - Side Casting and End Dumping. Embankment or backfill may be placed by side casting and end dumping. Where material containing a large amount of rock is used to construct embankments or backfill, a solid embankment or base for additional backfill material shall be provided by working smaller rocks and fines in with the larger rocks and fines to fill the voids.

Method 2 - Layer Placement. Surfaces steeper than a ratio of three to one, upon which embankment is to be placed, shall be roughened or stepped when shown on the drawings to provide permanent bonding of new and old materials.

Embankment or backfill shall be layer placed, except over rock surfaces, in which case material may be placed by end dumping to the minimum depth needed for operation of spreading equipment. Each embankment or backfill layer shall be leveled and smoothed before placement of subsequent layers. Hauling and spreading equipment shall be operated uniformly over the full width of each layer.

Suitable material shall be placed in layers no more than 12 inches thick, except when the material contains rock more than nine inches in diameter, in which case layers may be of sufficient thickness to accommodate the material involved. No layer shall exceed 24 inches before compaction.

Placing individual rocks or boulders greater than 24 inches will be permitted provided the embankment or backfill will accommodate them. Such rocks and boulders shall be at least six inches below subgrade. They shall be carefully distributed and the voids filled with finer material to form a dense and compacted mass.

Where material containing large amounts of rock is used to construct embankments or backfills, the layers may be of sufficient thickness to accommodate the material involved. A solid embankment or backfill with compaction to at least 90% of maximum density as determined by ASTM D1557 or as approved by the ENGINEER shall be constructed by working smaller rock and fines in with the larger rocks to fill the voids and by operating hauling and spreading equipment uniformly over the full width of each layer as the embankment or backfill is constructed.

Method 3 - Controlled Compaction. Embankments or backfills shall be placed as specified in Method 2, except earth embankment or backfill shall be placed in horizontal layers not exceeding eight inches (loose measure) and compacted. Material shall be at a moisture content suitable for attaining the required compaction. Embankments and

backfills and the top one foot of excavation sections shall be compacted to at least 95 percent of the maximum density.

Density requirements will not apply to portions of rock embankments or backfills that cannot be tested in accordance with approved methods. When this condition exists, compaction shall be provided by working smaller rock and fines in with the larger rocks to fill the voids and by operating equipment over the embankment materials.

3.12 Construction Tolerances

The tolerance class shall be as shown on the DRAWINGS. Roadway ditches shall be constructed to flow in the direction of design with the gradient no flatter than one-half of one percent.

Item	Tolerance Class ^a					
	A	B	C	D	E	F
Roadbed Width (Feet)	+/- 0.5	+/- 1	+/- 1	+/- 1	+/- 1	+/- 2
Subgrade Elevation (Feet)	+/- 0.1	+/- 0.2	+/- 0.5	+/- 1	+/- 2	+/- 3
Centerline Alignment (Feet)	0.2	0.5	1	1	2	3
Slopes, Excavation, Embankment, Backfill (Percent)	+/- 3	+/- 5	+/- 5	+/- 5	+/- 10	+/- 10

a Maximum allowable deviation from construction stakes and DRAWINGS.

Deviations shall be uniform in the direction of change for a distance of 200 feet or more along the project centerline.

3.13 Grading Plans

Cross sections and grading plans are provided on the DRAWINGS. The CONTRACTOR shall be held to fixed elevations, as determined by a registered surveyor. Proposed channels shall be construction staked by a registered surveyor and subsequent re-staking shall be included based on field adjustment made by the CONTRACTING OFFICER. A verification survey by a registered surveyor shall be completed and submitted to the CONTRACTING OFFICER for approval at the end of the project. All costs shall be included in a separate line item if survey work is required for the completion of the project. A smooth and finish-graded surface shall be required on all areas before placing topsoil.

3.14 Positive Drainage

The CONTRACTOR shall provide positive drainage for all areas during and after construction. No water should be impounded during or after construction.

All areas which settle below plan elevation or impounded water before completion of the Contract shall be filled in, regraded, and reseeded.

3.15 Erosion Control

The CONTRACTOR shall be responsible for the repair of slope erosion up to the final acceptance of the project. In areas not designated for sheet runoff, the CONTRACTOR shall make an attempt to grade the embankment to drain into existing or proposed swale areas. This

shall include the use of diversion swales and other measures to direct runoff to rock dams, rock channels, etc.

Temporary cut slopes shall be protected by temporary covering with heavy plastic sheeting or other method approved by the ENGINEER.

All drainage swales and ditches must be approved by the CONTRACTING OFFICER prior to placing topsoil and reseeded. The cost of the swales and ditches, if not already in a separate line item, shall be included with the line item for placing of embankments or fill.

3.16 Waste Rock and Tailings Repository

The repository shall be built by placing material in maximum 12-inch loose lifts conditioned to within 3 percent of optimum moisture and compacted to 90% maximum dry density as determined by ASTM D-1557. Maximum thickness of the completed repository shall be 20 feet, exclusive of cover material. Tailings and waste rock placed within 12 inches of the top liner shall be free of boulders, cobbles, and other particles larger than 3 inches in maximum dimension. The tailings and waste rock shall be free of organic debris.

Trucks hauling waste rock and tailings from pre construction locations to the repository shall not be loaded to the point where spillage occurs enroute.

The tailings and waste rock shall be protected from inclement weather whether in transit and after deposition in the repository. Temporary covers approved by the ENGINEER shall be on site and employed to protect the deposited materials from becoming saturated. Work shall be suspended during inclement weather.

3.17 Cover Soil

Cover soil shall be moisture-conditioned and track-walked into place in lifts no more than 12 inches in thickness until the cover material is in a firm condition. If the moisture content of the material is too high to accomplish such compaction, the material should be removed from the site and a less moisture-sensitive fill with fines content of less than 10 percent used. Cover soil within 1 foot of the liner should be relatively free of boulders, cobbles, gravel particles larger than 2 inches in maximum dimension, and organic matter.

END OF SECTION

DIVISION 02

SECTION 02251

SEDIMENT CONTROL

PART 1 - GENERAL

1.1 **General**

Short-term sediment collection for construction activities.

1.2 **Submittals**

- A. Submit manufacturer's certification that sediment collection systems meet or exceed specified requirements.
- B. Submit manufacturer's installation instructions and maintain copy at the jobsite.

1.3 **Delivery, Storage and Handling**

- A. Unload, store and load sediment collection materials in a manner which prevents damage or excessive exposure to sunlight and weather.

PART 2 - PRODUCTS

2.1 **Erosion and Sediment Control Systems**

- A. Comply with type of sediment collection systems indicated in the Contract Documents.
- B. If sediment collection systems are not specified, use any of the alternate materials meeting the minimum requirements of this section and the approved Erosion Control Plan.
- C. Notify the ENGINEER if installation conditions do not match those in the DRAWINGS.
- D. Provide sediment collection materials and use in accordance with the governing agency.

2.2 **Inlet Protection**

- A. Provide a filtering system around an inlet or drain to trap sediment and prevent the sediment from entering the storm drain system in accordance with the STANDARD DRAWINGS.
- B. Filter Fabric Inlet Protection:
 - 1. Filter Fabric: Refer to specifications for Silt Fence.
 - 2. Wooden Stakes: 2 inches x 2 inches or 2 inches x 4 inches with a minimum length of 3.0 feet.
 - 3. Staples: Heavy-duty wire at least 3/8 inches long.
 - 4. Washed Gravel: ¾ inches to 1-1/4 inches in diameter, with less than 5% fines.

- C. Gravel Inlet Protection:
 - 1. Mesh: hardware cloth or wire mesh with 3/8 inch to 1/2 inch openings.
 - 2. Filter Fabric: Refer to specifications for Silt Fence.
 - 3. Washed Gravel: 3/4 inch to 4 inches in diameter.
- D. Block and Gravel Inlet Protection:
 - 1. Mesh: Hardware cloth or wire mesh with 3/8 to 1/2 inch openings.
 - 2. Filter Fabric: Refer to specifications for Silt Fence.
 - 3. Washed Gravel: 3/4 inch to 4 inches in diameter.

2.3 Straw Wattle Barrier

- A. Provide a temporary sediment barrier consisting of Straw Wattles placed and anchored in accordance with the DRAWINGS.
- B. Wattles shall be 9-inch in diameter, certified weed-free, meeting the specifications of Sedimax-SW or approved equal.

2.4 Straw Bale Barrier

- C. Provide a temporary sediment barrier consisting of a row of entrenched and anchored straw bales in accordance with the DRAWINGS.
- D. Bales to be made of densely packed cut straw securely bundled by bailing twine or wire. The material must be certified as weed-free.

2.5 Temporary Berm

- A. Provide a temporary berm or ridge of compacted soil or sandbags, which will intercept and divert runoff from the construction areas.
- B. Construct soil berm from embankment materials.
- C. Construct sandbag berms with high quality sandbags. Each bag to have the following dimensions:
 - 1. Length: 24 to 30 inches
 - 2. Width: 16 to 20 inches
 - 3. Depth or Thickness: 6 to 8 inches
 - 4. Weight: 90 to 130 pounds

2.6 Sediment Basin

- A. Provide a temporary basin to collect, trap, and store sediment produced by construction activities in accordance with the size requirements outlined in Section 3.4.
- B. Construct sediment basins using excavation and embankment materials by either excavating the basin or by placing an earthen embankment across a low area or drainage swale. Provide a riser and pipe outlet with a gravel outlet or spillway to slow the release of runoff.
- C. Fill material should be taken from approved designated borrow areas, and should be of the type and quality conforming to that specified for the adjoining fill material. It should be

free of roots, woody vegetation, oversize stones, rocks exceeding 6-inch diameter, or other objectionable materials. Do not use frozen material.

2.7 Silt Fence

- A. Provide temporary sediment barrier consisting of a filter fabric stretched and attached to supporting posts, with wire fence backing as required by the type of fabric employed as indicated on the DRAWINGS.
- B. Silt fences may be made of burlap or various synthetic materials. Acceptable synthetic materials are pervious polypropylene, nylon, and polyester or polyethylene yarn conforming to the performance specifications listed in Table 1.

Table 1 – Silt Fence Performance Specifications

Physical Property	Requirement
Filtering efficiency	75% to 85% (minimum)
Tensile strength at 20% (maximum) elongation	Standard strength – 360 lbs./ft. (minimum)
	Extra strength – 600 lbs./ft. (minimum)
Slurry flow rate	0.3 gpm/ft. ² (minimum)

- C. Design Life: 6 months for synthetic fences, 2 months for burlap.
- D. Wire Reinforced Backing (if used): 14 gage minimum, with mesh spacing and a width of 2-4 feet.
- E. Post Specifications
 - 1. Length: 4 feet minimum
 - 2. Material: 2 inches x 2 inches or 2 inches x 4 inches pine (or equivalent) or 1.0 pound/foot to 1.3 pound/foot steel

2.8 Culvert Riser

- A. Provide a perforated metal pipe attached to a culvert inlet and extending upward to allowing the inlet area to serve as a temporary sediment trap for the construction area.
- B. Provide materials for the culvert riser that are consistent with the culvert upon which they are attached.

PART 3 - EXECUTION

3.1 Examinations

- A. Verify that slope contours are to required alignment and grade. Place sediment collection system on all drainage ways downstream of disturbed areas of construction and as directed by the ENGINEER and as indicated in the CONTRACT DOCUMENTS.
- B. Examine sediment collection material and equipment for defect or damage.

- C. Verify sediment collection material and equipment delivered to site meets the requirements of the CONTRACT DOCUMENTS.
- D. Provide sediment collection facilities in accordance with governing agency.
- E. Install sediment collection systems in accordance with the DRAWINGS.

3.2 Inlet Protection

- A. Height of Filter Fabric: Limit height of the filter fabric to 15 inches above the crest of the drop inlet.
- B. Sump: Where possible, provide a filter fabric or block-and-gravel protection device with a sediment-trapping sump 12 to 18 inches deep as measured from the crest of the inlet. Side slopes should be 2:1. Provide 30 cubic yards of excavation for each acre of ground disturbed.
- C. Orientation: Place the longest dimension of the basin toward the area of greatest flow.
- D. Filter Fabric
 - 1. Stakes: Place a stake at each corner of the inlet and around the edges at no more than 3 feet apart. Drive the stakes into the ground, if possible, or a minimum of 8 inches.
 - 2. Frame: For stability, install a framework of wood strips around the stakes at the crest of the overflow area, 18 inches above the crest of the drop inlet.
 - 3. Excavate: Excavate a trench eight inches to 12 inches deep around the outside perimeter of the stakes. If a sediment-trapping sump is being provided, then the excavation may be as deep as 24 inches.
 - 4. Staple: Staple the filter fabric to the wooden stakes with heavy-duty staples, overlapping the joints to the next stake. Ensure that 12 to 30 inches of filter fabric extends at the bottom so it can be formed into the trench.
 - 5. Completion: Place the bottom of the fabric in the trench and backfill the trench all the way around, using washed gravel to minimum depth of four inches. Use enough gravel to ensure contact between the filter fabric and the underlying surface.
- E. Gravel and Mesh
 - 1. Preparation: Remove any obstructions to excavating and grading. Excavate sump area, grade slopes, and properly dispose of soil.
 - 2. Secure Inlet: Prevent seepage of sediment-laden-water.
 - 3. Wire Mesh: Place wire mesh over the drop inlet so the wire extends a minimum of 12 inches beyond each side of the inlet structure. Overlap the strips of mesh if more than one is necessary.
 - 4. Fabric: Place filter fabric over the mesh, extending it at least 18 inches beyond the inlet opening on all sides. Ensure that weep holes in the inlet structure are protected by filter fabric and gravel.
 - 5. Stone: Place stone or gravel over the fabric/wire mesh to a depth of at least 12 inches.
- F. Block and Gravel
 - 1. Preparation: Secure the inlet grate to prevent seepage of sediment-laden water.

2. Wire Mesh: Place wire mesh over the drop inlet so the wire extends a minimum of 12 to 18 inches. Overlap the strips of mesh if more than one is necessary.
 3. Fabric: Place filter fabric (optional) over the mesh and extend it at least 18 inches beyond the inlet structure.
 4. Blocks: Place concrete blocks over the filter fabric in a single row lengthwise on their sides along the sides on the inlet. Excavate the foundation a minimum of 2 inches below the crest of the inlet. The bottom row of blocks should be against the edge of the structure for lateral support.
 5. Orientation: The open ends of the block should face outward, not upward, and the ends of adjacent blocks should abut. Lay one block on each side of the structure on its side to allow for dewatering of the pool.
 6. Dimensions: The block barrier should be at least 12 inches high and may be up to a maximum of 24 inches high. It may be from 4 to 12 inches deep, depending on the size of block used.
 7. Finishing: Prior to backfilling, place wire mesh over the outside vertical end of the blocks so that stone does not wash down the inlet.
 8. Gravel: Place gravel against the wire mesh to the top of the blocks.
- G. Inspect regularly and after every storm. Make any repairs necessary to ensure the sediment control device is in good working order.
- H. Remove accumulated sediment and restore the trap to its original dimensions when sediment has accumulated to half the design depth of the trap. Sediment should be disposed at an approved site in a manner that will not contribute to additional siltation.
1. Gravel-and-Mesh Devices: Clean (or remove and replace) the stone filter or filter fabric if it becomes clogged.
 2. Filter Fabric Devices: Replace the fabric immediately if it becomes clogged. Make sure the stakes are firmly in the ground and that the filter fabric continues to be securely anchored.
- I. Inlet protection should remain in place and operational until the drainage area is completely stabilized or up to 30 days after the permanent site stabilization is achieved.

3.3 Straw Bale Barriers

- A. Do not use straw bale barriers where flow rate exceed 1 cubic foot/second or the drainage area is greater than 1.25 acres.
- B. Provide an undisturbed buffer zone of 3 to 6 feet is necessary between the barriers and surface waters to allow safe removal of the barrier and of accumulated sediments.
- C. Embed bales to a minimum depth of 6 inches and backfill for the entire length of the barrier. Each bale should be securely anchored with 2 stakes 2 inches x 2 inches x 36 inches or steel drift pins driven at least 18 inches into the ground.
- D. Install straw bale barriers at the toe of slopes prior to disturbing the slopes. Install the bales a short distance away from the toe of the slope and outside of any ditch channel.
- E. Place the bales in a single row lengthwise on the contour for sheet flow applications, or perpendicular to the contour in concentrated flow applications. When flows are expected to

be high enough to surpass the infiltration capacity of the bales, the center (low point) bales shall be wrapped in filter fabric with a three foot tail stapled securely and extending from the down gradient side of the barrier to prevent scouring. The ends of the adjacent bales must tightly abut one another.

- F. Fill all gaps between bales with tightly wedged straw. For concentrated flow applications, extend the end of the barrier so that the bottom of the end bales are at a higher elevation than the top of the lowest middle bale to assure that sediment laden water flows through or over the barrier instead of around the ends of the barrier.
- G. Perform one inspection during the first runoff-producing event after the installation of the barriers to assure proper functioning. Immediately repair damaged bales, undercutting, or end runs. Replace bales as needed due to disintegrations or rotting.
- H. Remove accumulated sediment and disposed at an approved site in a manner that will not contribute to additional siltation.

3.4 Temporary Berms

- A. Provide berms to prevent minor runoff onto newly constructed slopes until vegetation is established or until permanent measure are in place. Provide berms to intercept flow from the construction area and direct it to sediment removal facilities prior to discharge.
- B. Dimensions
 - 1. Soil Berm: A berm of soil with an approximate height of 12 to 18 inches with a minimum top width of 24 to 28 inches and side slopes of 2:1 or flatter. Berms should be high enough to prevent flow from overtopping. Berms are normally constructed from embankment materials.
 - 2. Sandbag Berm
 - a. Height = 1.5 feet minimum
 - b. Top Width = 1.5 minimum
 - c. Bottom Width = approximately 4 to 5 feet
 - 3. Sandbag Size
 - 4. Length = 24 to 30 inches
 - 5. Depth or Thickness = 6 to 8 inches
 - 6. Weight = 90 to 130 pounds
- C. Construction
 - 1. Soil Berm: Grade to drain to a slope drain inlet. Construct embankments with a gradual slope to one side of the embankment to permit the placement of all temporary berms and slope drains on one side of the embankment. When fills are constructed on side hill slopes, slope the top surface toward the inside so that surface runoff will be away from the fill slope. Compact the entire width of the berm.
 - 2. Sandbag Berm: Install so that the flow under or between bags is prevented. Stack the sandbags in an interlocking fashion to provide additional strength for resisting the force of the flowing water. However, do not stack them more than three high without broadening the foundation using additional sandbags, or providing additional stability.

- D. Inspect and repair temporary berms periodically as well as after each significance rainfall. For sandbag berms, reshaped or replaced sandbags as needed during inspection. When sediment reaches six inches, remove the accumulated sediment and disposed at an approved site in a manner that will not contribute to additional siltation. Leave berms in place until all upstream areas are stabilized and accumulated sediment has been removed. Remove sandbags by hand.

3.5 Sedimentation Basins

- A. Provide sediment basins where physical site conditions or land ownership restrictions preclude the effective use of barrier-type erosion control measures. Provide sediment basins for disturbed areas of more than 10 acres within the same drainage basin or where operations expose critical areas to soil erosion.
- B. Volume and Configuration of Basin
 - 1. Small Areas: Provide at least 65 cubic yards per acre of total drainage area.
 - 2. Larger Areas: For areas greater than 10 acres within the same drainage basin, provide at least 130 cubic yards per acre of total drainage area.
 - 3. Baffles and Spillway: Install baffles or other deflectors to spread the flow throughout the basin. Install an emergency spillway and riser pipe(s).
 - 4. Depth and Surface Area: Determine the surface area based on the standard DRAWING with a minimum of three feet of sediment storage and 3:1 side slopes
 - 5. Approval: Submit design of the sediment basin and obtain ENGINEER'S approval prior to construction.
- C. Construction Requirements
 - 1. Placement: Install the temporary sediment basin before clearing and grading is undertaken. Locate the dam to provide maximum volume capacity for sediment behind the structure. It should not be built within an active stream channel. Install fencing around the basin, as necessary to endure public safety.
 - 2. Preparation: Prepare the dam site by clearing vegetation and removing topsoil before beginning dam construction. For areas under the embankment and any structural works, lea, grub, strip topsoil to remove all trees, vegetation, roots, and other objectionable material. To facilitate clean out and restoration, clear the pool area of all brush, trees, or other debris.
 - 3. Spillway Bed: Level the bed for the pipe spillway to provide uniform support through its entire length under the dam.
 - 4. Spillway: Construct an emergency spillway on undisturbed soil and not on fill. Line the spillway with four inches of concrete, reinforced with 6 inch x 6 inch, 6 inch x 6 inch diameter W1.4 each way wire mesh extending to a minimum of 36 inches down each face of the embankment. The spillway should be at least 18 inches deep with 1:1:5 side slopes.
 - 5. Piping: Secure all pipe joints and fasten watertight. Fasten the riser rigidly and securely to the barrel and seal watertight. Place the barrel on a firm foundation according to the lines and grades shown on the approved CONTRACT DOCUMENTS.
 - 6. Backfill: Place at least 24 inches of hand-compacted backfill (maximum 6 inch lifts) over the pipe spillway before crossing it with construction equipment. Control the movement of

the hauling and spreading equipment over the fill so that the entire surface of each lift will be traversed by not less than one tread tract of the equipment.

7. Discharge: The pipe spillway should discharge at ground elevation below the dam, and not more than 12 inches above any streambed.
 8. Placement of Fill: Scarify areas on which fill is to be placed prior to placement of fill. Place fill materials in 6-inch maximum lifts, compacted by construction equipment. Provide continuous horizontal lifts over the entire length of the fill.
 9. Stabilization: Stabilize the embankment and emergency spillway with vegetation or other stabilization measures.
- D. Sediment basins should be readily accessible for maintenance and sediment removal. Inspect after each rainfall and clean out when half the available sediment storage volume has been filled with sediment. Dispose of removed sediment and stabilize in an approved location such that sediment does not re-enter waters. Sediment may not be dumped into any water of the U.S without appropriate permitting.
- E. Operate and maintain the sediment basin until the drainage area is permanently stabilized by vegetation or other permanent controls.

3.6 Silt Fence Barriers

- A. Provide silt fences near the perimeter of a disturbed area to intercept sediment while allowing water to percolate through.
- B. Provide silt fences along the toe of fills, on the downhill side of large through-cut areas, along streams, at natural drainage areas and above interceptor dikes and as indicated in the CONTRACT DOCUMENTS.
- C. Construct the silt fence after cutting and slashing of trees and before excavating haul roads, fill benches, or any soil disturbing construction activity in the drainage areas.
- D. The silt fences must remain in place until the disturbed areas are permanently stabilized.
- E. Configuration
 1. Maximum Drainage Area: 0.25 acres per 100 feet of fence length.
 2. Maximum Fence Length: 300 feet for 100-foot slope length.
 3. Maximum Slope Length (Upstream Drainage Distance) to Fence
 - a. 100 feet for slopes flatter than 5:1.
 - b. 15 feet for slopes steeper than 2:1.
 4. Maximum Slope Steepness Above Fence: 1:1 grade.
 5. Minimum Toe-in Depth: 6 inches.
 6. Post Spacing
 - a. With wire support fence – 10 feet maximum.
 - b. Without wire fence – 6 feet maximum.
 7. Post Depth (Below Ground Surface): 18 inches minimum.
 8. Undisturbed Buffer Zone: 3 feet minimum between fence and surface waters.
- F. Construction Requirements

1. Maximum Height of the Filter Fence: Between 1.5 and 3 feet above the ground surface (depending on the amount of upslope ponding expected).
 2. Post Spacing: 10 feet apart when a wire mesh support fence is used and no more than 6 feet apart when using extra-strength filter fabric (without a wire fence). The posts should extend at least 18 inches into the ground.
 3. Trench: Excavate a trench about 6 inches wide and 4 to 12 inches deep along the upslope side of the line of posts.
 4. Fastening: If standard strength filter fabric is to be used, fasten the optional wire mesh support fence to the upslope side of the posts using heavy duty wire staples, tie wires, or hog rings. Extend the wire mesh support to the bottom of the trench.
 5. Extra Strength Filter Fabric: Does not require a wire mesh support fence. Staple or wire the filter fabric directly to the posts and extend 8 to 18 inches of the fabric into the trench.
 6. Trees: Do not attach filter fabric to trees.
 7. Joints: Splice fabric together only at a support post, with a minimum 6 inches overlap, and securely seal the joint.
 8. Backfill: Backfill the trench with compacted soil or ¾ inch minimum diameter gravel placed over the filter fabric.
- G. Inspect silt fences periodically for damage (such as tearing by wind, animals, or equipment) and for the amount of sediment, which has accumulated. Remove the sediment when it reaches one-half the height of the silt fence. In situations where access is available, machinery can be used. Otherwise, the silt must be removed manually.
- H. Remove sediment deposits when heavy rain or high water is anticipated. Place the sediment deposits in an area where there is little danger of erosion.

3.7 Culvert Risers

- I. Provide risers at culvert inlet that receive runoff from upstream construction sites or from other erodible areas at indicated on the DRAWINGS. Do not use for drainage areas larger than a 1.25 acres.
- J. Determine the volume of the water storage for the culvert riser based on the total drainage area upstream in accordance with the specifications for Sediment Basins. Ensure water impoundment will not extend to private property unless authorized in writing by the property owner.
- K. Install the culvert riser according to the CONTRACT DOCUMENTS. Fasten the riser pipe rigidly and securely to the culvert barrel. Seal the joint so that it is watertight.
- L. Inspect the rise periodically and following runoff-producing storms. Remove accumulated sediments to restore the design capacity of the sediment deposit area. Dispose of sediment where they are not likely to reenter stream flow or surface runoff.
- M. Remove culvert risers after permanent erosion control measure are in place.

END OF SECTION

DIVISION 02

SECTION 02801

SEEDING

PART 1 - GENERAL

1.1 Description

- A. This item shall consist of broadcast seeding designated areas using specified seed mixtures.
- B. The areas to be seeded shall include cut slopes, fill slopes and other disturbed areas. Disturbed areas recontoured to represent historic features will not be revegetated.

PART 2 - PRODUCTS

2.1 Seed

The seed mix shall be supplied by the Rainier Seeds, Inc. Davenport, Washington. Seed mix will consist of the following and shall be applied to all reclaimed areas:

Seed Mix C	<u>Application Rate</u>
• tufted hairgrass	4 lb/ac
• winter triticale	60 lb/ac
• annual ryegrass	10 lb/ac
• alsike clover	2 lb/ac
• Total = 170 seeds/sq. ft.	

2.2 Mulch

Mulch shall consist of 100% agricultural straw certified as weed free, or Woodstraw™.

PART 3 - EXECUTION

3.1 General

The specified seed mixture shall be uniformly spread on the designated areas to the density in pounds of live seed per acre as specified.

Each area or suitable section of the area to be seeded shall be seeded as soon as the grading and finishing work have been completed and the area prepared and approved for seeding. Seeding shall follow the finishing work as closely as feasible and if possible before the ground has become packed or hardened. No regard shall be given to the season of the year except that no seeding shall be done during windy weather or when the ground is excessively wet or deeply frozen.

3.2 Preparation of Seeding Area

Cut slopes, fill slopes, embankments or other areas to be seeded shall be shaped and finished as specified under the Sections involved. The area, where necessary, shall be worked such that the surface is loose to a depth of at least one inch. Each area shall be approved for seeding by the ENGINEER before seed is applied.

3.3 Seeding and Mulching

The seed or seed mixtures shall be accurately proportioned as stipulated and thoroughly mixed. They shall be remixed as necessary so that a uniform mixture will result as each loading of the seeder is made. Seed shall be applied with a rotary hand seeder or other approved type commercial seeder or by an agreed upon method. All portions of the area shall be uniformly covered to the required density.

Mulch straw be applied at a depth of two to four inches using certified weed-free straw, or Woodstraw™ will be applied according to manufacturer's recommendations, except for areas located in shady areas, in which case mulching is not required. The CONTRACTOR shall install mulch on the embankment slopes and other exposed areas when they are finished and after seeding. All mulched areas will be thoroughly wetted following application.

3.4 Maintenance of Seeded Area

The CONTRACTOR will not be required to maintain an area which has been satisfactorily seeded except that he shall protect the area against traffic by warning signs or barricades or other methods approved by the ENGINEER.

When a seeded area has become damaged by storm or otherwise prior to final acceptance of the project, the ENGINEER may order the area reworked. The damage shall then be repaired as directed and the area reseeded.

END OF SECTION

DIVISION 13
SECTION 13001
HPDE LINER

PART 1 - GENERAL

1.1 Description

This section specifies the manufacture, delivery, and installation and testing of the flexible membrane liner system, including the high-density polyethylene (HDPE) liner, and related work as specified herein.

1.2 Quality Assurance

A. Liner Guarantee and Certification

The HDPE liner manufacturer/installer shall guarantee, in writing, the HDPE liner material against deterioration or defects for 20 years from the date of acceptance by the ENGINEER. The guarantee shall be against defects in material or workmanship and against deterioration due to ozone, ultraviolet light, bacteria, or other deteriorating processes. The HDPE liner manufacturer/installer shall guarantee, in writing, the HDPE liner installation workmanship for five years from the date of acceptance by the ENGINEER. All guarantees shall be made by the manufacturer/installer directly to the OWNER.

The CONTRACTOR and the HDPE liner manufacturer/installer shall also certify, in writing that the installed flexible membrane liner system meets the requirements of these specifications.

B. Quality Assurance/Quality Control

The CONTRACTOR shall establish and maintain a quality assurance/quality control (QA/QC) and testing program throughout the project. The QA/QC program shall include a Quality Assurance/Quality Control Manual describing inspections and reports, sampling and testing (destructive and nondestructive) of the HDPE resin, the HDPE sheet, factory seams, and field seams.

The QA/QC program shall provide and maintain documentation sufficient to assure the ENGINEER that the repository cover has been lined with HDPE liner, meeting or exceeding all of the requirements of these specifications, and that the liner has been fabricated, installed, and seamed to provide leakproof performance during the guarantee period.

C. Quality Assurance/Quality Control Manual

Within seven days after notification of contract award, the CONTRACTOR shall submit to the ENGINEER a complete QA/QC Manual prepared by the HDPE liner manufacturer/installer, for ENGINEER review and approval. At a minimum the QA/QC Manual shall contain the following:

1. General description of the manufacturer/installer's QA/QC organization, personnel, and facilities.
2. Inspection, sampling, testing, and report procedures for evaluating the quality of raw materials used in the manufacture of HDPE sheet for this project.
3. Inspection, sampling, testing, and report procedures for evaluating the quality of the HDPE sheet during manufacture.
4. Inspection, sampling, testing, and report procedures for evaluating factory seams and seaming equipment during fabrication (if factory seams are required) and methods and procedures for correcting defective seams.
5. Inspection and report procedures for evaluating and correcting damage to HDPE sheets during storage and delivery to the job site.
6. Inspection, sampling, testing, and report procedures for evaluating the HDPE sheet during installation.
7. Inspection, sampling, testing, and report procedures for evaluating field seams and field seaming equipment during installation.
8. Methods and procedures for correcting defective field seams during installation.
9. Methods and procedures for assuring material control.
10. Methods and procedures for assuring documentation control.
11. Methods and procedures for the testing and calibration of all laboratory and field-testing equipment.
12. Methods and procedures for the maintenance of all records in a project life.
13. Methods and procedures for the development of "as-built" drawings for the project.
14. In addition to the number, location, and type of inspections and tests, the Manual shall stipulate the range of acceptable results or parameters for each inspection/test type. The inspection/test method should also be delineated.
15. The manual shall include copies of the CONTRACTOR'S Standard Guarantees and Warranties for materials and installation.

D. Testing

Laboratory or field tests required to maintain the QA/QC program described above will be the paid for by and the responsibility of the CONTRACTOR and liner manufacturer/installer.

1.3 Submittals

A. HDPE Liner

The CONTRACTOR shall obtain the following information from the HDPE liner manufacturer/installer:

1. Four complete sets of SHOP DRAWINGS showing seaming, anchoring, and any other installation details required. Site preparation drawings shall be submitted within 30 days after notification of contract award and shall indicate the proposed liner panel layout.

2. Certificates of Compliance with the requirements of the standards and testing methods specified shall be provided within 30 days after contract award.
3. At the time of delivery, the manufacturer/installer and CONTRACTOR shall certify that the liner material is free of holes, delaminations, blisters, air pockets, undispersed raw materials, and any other defects.
4. Within 30 days after notification of Contract award, an installation plan including procedures for unrolling and unfolding, positioning filed seaming, any special details, protection against wind, and anchoring of materials.
5. Within 30 days after notification of Contract award, the manufacturer/installer and CONTRACTOR shall submit the names and qualifications of supervisors assigned to this project, indicating the number of installations completed quantity of area installed, and other pertinent information.
6. A written guarantee/warranty issued to the OWNER.
7. Two 3-foot by 3-foot samples of the HDPE sheet seamed and unseamed.
8. After acceptance of liner material submittals an interface shear test shall be completed by a qualified laboratory to establish the interface friction angle between the component cap materials to evaluate the stability of the selected materials at the planned slope inclinations before construction commences. The interface shear strength between the supplier's proposed geomembrane and geotextile shall have a minimum friction angle of 33 degrees, as tested in accordance with ASTM D5321.

PART 2 - PART 2--MATERIALS

2.1 Materials

A. HDPE Liner

1. HDPE sheeting shall be manufactured from a composition of high quality ingredients suitably compounded of 100% virgin high-density polyethylene resin and specifically compounded for use in hydraulic structures. Reprocessed or reground materials shall not be used. The use of water-soluble formulation ingredients is prohibited.
2. The nominal thickness of all liner sheets shall be as indicated on the DRAWINGS. The HDPE membrane material shall consist of thoroughly mixed HDPE compound. It shall be uniform in color, thickness, size and surface texture. The sheeting shall contain no undispersed materials, divots, deep gas checks, and shall not exhibit cold flow.
3. The liner shall be resistant to tear propagation, fires, rot, mildew, insects, rodents, bacteria, chemicals, and sunlight. The liner shall conform to the physical properties specified below.
4. The chemical resistance of the HDPE membrane liner and seams shall be in keeping with typical properties of high quality polyethylene products currently available through commercial sources.
5. Liner shall be textured both sides.

B. Miscellaneous Materials

1. Extrudate: Extrudate for fusion welding shall be formulated from the same HDPE resin as the liner and shall meet the applicable physical and chemical property requirements.

Properties of HDPE liner shall be as follows:

Property	Unit	Minimum Average Roll Value (MARV)
Thickness (ASTM D 5994)	Mils	60
Tensile Strength at yield (ASTM D 6693)	Lb/in	126
Tensile Strength at break (ASTM D 6693)	Lb/in	90
Elongation at yield (ASTM D 6693)	%	12 (minimum)
Elongation at break (ASTM D 6693)	%	100 (minimum)
Tear Resistance (ASTM D 1004)	Lb	42
Puncture Resistance (ASTM D 4833)	Lb	90

PART 3 - EXECUTION

3.1 Delivery and Handling

- A. Each roll of HDPE liner shall have a waterproof label containing the identification number, thickness, width, length, and proper direction of unrolling and/or unfolding. The HDPE liner manufacturer/installer shall be responsible for the repair or replacement of material damaged or made unserviceable during delivery and handling at no additional cost to the ENGINEER. The HDPE liner manufacturer/installer and CONTRACTOR shall be responsible for delivery, handling, and installation of all of the materials at no additional cost to the ENGINEER.
- B. Liner material shall not be delivered to the site until all required submittal information has been submitted and approved.

3.2 Installation

The liner system shall be installed as shown on the drawings.

A. HDPE Liner

The liner shall be constructed as soon as practical after the completion and approval by the ENGINEER of the subgrade. The HDPE liner installer shall certify in writing that the surface of the subgrade is in acceptable condition to receive the HDPE liner. Each sequential section of HDPE liner shall be secured in an anchor trench and continuously welded to the adjacent sections.

- B. The HDPE liner installer shall be properly trained and qualified to install synthetic liners. All personnel performing field seaming shall be qualified by experience or by passing seaming tests. Qualifications of the seamers shall be provided to the ENGINEER seven days prior to the start of installation of the HDPE liner.

- C. The installation is to be performed in strict conformance with the approved shop drawings, the liner shall be laid out in such a manner as to minimize the number and length of field seams. The edges of the liner shall be permanently anchored in a trench, in accordance with the approved shop drawings. The surface of the areas in contact with the liner shall be free of loose rocks and debris. The liner shall be placed over the prepared surfaces in such a manner as to assure minimum handling and in accordance with the manufacturer's approved installation procedures. No sharp angular rocks or hard objects shall be in contact with the liner.
- D. Liner sheets damaged during installation shall be removed or repaired, in accordance with approved details, at no additional cost to the ENGINEER. A minimum of a four-inch overlap shall be provided for all field seams. The liner shall be placed so as to be free of all wrinkles and air pockets.
- E. The areas to be seamed shall be cleaned and prepared in accordance with the manufacturer's approved recommendations. The seaming equipment used shall be of the fusion welding type. Extrusion Welding may be used if approved by ENGINEER, in situations where hot wedge welding is impractical, such as for repair patches and fabrications. All welding shall be capable of providing a uniform and continuous seam with a minimum width of one inch. All factory and field seams shall be tightly bonded and 100 percent leak proof.
- F. No fish mouths are allowed within the seam area. If fish mouths occur, the material shall be cut, overlapped, and an overlap seam shall be applied. Any liner sheets or seams showing damage by equipment, wind, or other causes, shall be replaced or repaired by the CONTRACTOR, at no additional cost to the ENGINEER.
- G. The liner shall be deployed in a manner allowing the appropriate amount of slackness into the membrane to provide for thermal expansion and contraction.

3.3 Testing

A. Factory Seams

Where factory seams are used, the seams shall be tested for watertightness and mechanical strength and meet the requirements of these specifications. When the fabricated sheets are shipped to the project site, all factory welds must be 100 percent watertight and meet the strength requirements of the specifications.

B. Field Seams

1. Water tightness will be tested over 100 percent of the seam lengths by the vacuum method or by the air pressure method (for double fusion seams only).
2. Physical strength of field welds shall be tested by both destructive and nondestructive test methods in the field and in the laboratory in accordance with methods described in the approved QA/QC manual. Locations where samples are taken shall be repaired in accordance with the manufacturer's approved repair procedures. Seams not meeting the strength requirements of these specifications shall be repaired and/or replaced in accordance with approved procedures. All repaired seams shall be retested for water tightness

END OF SECTION

DIVISION 13

SECTION 13002

NON-WOVEN GEOTEXTILE

PART 1 - GENERAL

1.1 **Scope**

This specification covers the technical requirements for the Manufacturing and Installation of the nonwoven geotextile. All materials shall meet or exceed the requirements of this specification, and all work will be performed in accordance with the procedures provided in these project specifications.

1.2 **References**

- A. American Society for Testing and Materials (ASTM)
- ASTM D 5261, Standard Test Method for Measuring Mass per Unit Area of Geotextiles
 - ASTM D 4632, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles
 - ASTM D 4533, Standard Test Method for Index Trapezoidal Tearing Strength of Geotextiles
 - ASTM D 4833, Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes and Related Products
 - ASTM D 4491, Standard Test Method for Water Permeability of Geotextiles by Permittivity
 - ASTM D 4751, Standard Test Method for Determining Apparent Opening Size of a Geotextile
 - ASTM D 4354, Standard Practice for Sampling of Geosynthetics for Testing
 - ASTM D 4759, Standard Practice for Determining the Specifications Conformance of Geosynthetics

1.3 **Submittals**

- A. Prior to material delivery to project site, the CONTRACTOR shall provide the ENGINEER with a written certification or manufacturers quality control data which displays that the geotextile meets or exceeds minimum average roll values (MARV) specified herein.
- B. The CONTRACTOR shall submit, if required by the ENGINEER, manufacturer's quality control manual for the geotextile to be delivered to the site.
- C. The CONTRACTOR shall submit results of laboratory testing in accordance with ASTM D5321 indicating that the interface shear strength between the supplier's proposed geomembrane and geotextile meet a minimum friction angle of 33 degrees

PART 2 - PRODUCTS

2.1 Geotextile

- A. The non-woven needle punched geotextile specified herein shall be made from polypropylene staple fiber.
- B. The geotextile shall be manufactured from prime quality virgin polymer.
- C. The geotextile shall be able to withstand direct exposure to ultraviolet radiation from Sun for up to 30 days without any noticeable effect on index or performance properties.
- D. Geotextile used for separation between soil and drain rock shall meet or exceed all material properties listed in Table 1.1.

Table 1.1 Recommended Geotextile Filter Fabric Specification

Geotextile Property	ASTM Test Method	Requirements
AOS	D4751	No. 80 max
Water Permativity	D4491	0.3/sec
Grab Tensile Strength	D4632	160 lb.nin.
Grab Failure Strain	D4632	>=50%
Seam breaking strength	D4632	140 lb. min.
Puncture Resistance	D6241	310 lb. min.
Tear Strength	D4533	50 lb. min
Ultraviolet Radiation Stability	D4355	50% strength retained min., after 500 hrs in xenon arc device

- E. Geotextile used for cushion either directly above or below the geomembrane shall have a weight of not less than 8 ounces per square yard to provide the geomembrane with adequate puncture resistance. Recommended specification are presented in Table 1.2

Table 1.2 Recommended Geotextile Cushion Specification

Geotextile Property	ASTM Test Method	Requirements
Mass per Unit Area	D5621	8 oz./yd ²
AOS	D4751	No. 40 max
Water Permativity	D4491	0.10 /sec min.
Grab Tensile Strength	D4632	200 lb. min.
Grab Failure Strain	D4632	>=50%
Seam breaking strength	D4632	180 lb. min.
Puncture Resistance	D6241	430 lb. min.
Tear Strength	D4533	79 lb. min.
Ultraviolet Radiation Stability	D4355	50% strength retained min., after 500 hrs in xenon arc device

2.2 Manufacture

All rolls of the geotextile shall be identified with permanent marking on the roll or packaging, with the manufacturers name, product identification, roll number and roll dimensions.

2.3 Transport

- A. Transportation of the geotextile shall be the responsibility of the CONTRACTOR.

- B. During shipment, the geotextile shall be protected from ultraviolet light exposure, precipitation, mud, dirt, dust, puncture, or other damaging or deleterious conditions.
- C. Upon delivery at the job site, the CONTRACTOR shall ensure that the geotextile rolls are handled and stored in accordance with the manufacturer's instructions as to prevent damage.

PART 3 - EXECUTION

3.1 Quality Assurance

- A. The ENGINEER shall examine the geotextile rolls upon delivery to the site and report any deviations from project specifications to the CONTRACTOR.
- B. The ENGINEER may decide to arrange conformance testing of the rolls delivered to the job site. For this purpose, the ENGINEER shall take a sample three feet (along roll length) by roll width according to ASTM Practice D 4354. The sample shall be properly marked, wrapped and sent to an independent laboratory for conformance testing.
- C. The pass or fail of the conformance test results shall be determined according to ASTM Practice D 4759.

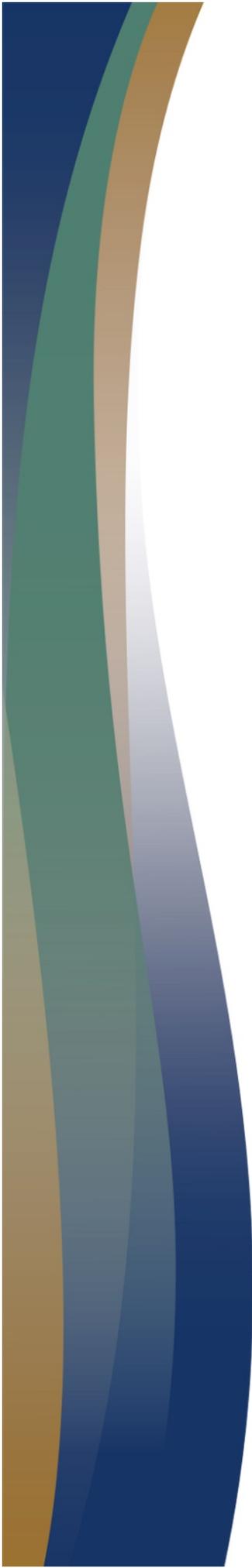
3.2 Installation

- A. The geotextile shall be handled in such a manner as to ensure that it is not damaged in any way. Should the CONTRACTOR damage the geotextile to the extent that it is no longer usable as determined by these specifications or by the ENGINEER, the CONTRACTOR shall replace the geotextile at his own cost.
- B. The geotextile shall be installed to the lines and grades as shown on the contract drawings and as described herein.
- C. The geotextile shall be rolled down the slope in such a manner as to continuously keep the geotextile in tension by self weight. The geotextile shall be securely anchored in an anchor trench where applicable, or by other approved or specified methods.
- D. In the presence of wind, all geotextiles shall be weighted by sandbags or approved equivalent. Such anchors shall be installed during placement and shall remain in place until replaced with cover material.
- E. The CONTRACTOR shall take necessary precautions to prevent damage to adjacent or underlying materials during placement of the geotextile. Should damage to such material occur due to the fault of the CONTRACTOR, the latter shall repair the damaged materials at his own cost and to the satisfaction of the ENGINEER.
- F. During placement of the geotextile, care shall be taken not to entrap soil, stones or excessive moisture that could hamper subsequent seaming of the geotextile as judged by the ENGINEER.
- G. The geotextile shall not be exposed to precipitation prior to being installed and shall not be exposed to direct Sun light for more than 15 days after installation.
- H. The geotextile shall be seamed using heat seaming or stitching methods as recommended by the manufacturer and approved by the ENGINEER. Sewn seams shall be made using polymeric thread with chemical resistance equal to or exceeding that of the geotextile. All

sewn seams shall be continuous. Seams shall be oriented down slopes perpendicular to grading contours unless otherwise specified. For heat seaming, fusion welding techniques recommended by the manufacturer shall be used.

- I. The CONTRACTOR shall not use heavy equipment to traffic above the geotextile without approved protection.
- J. The geotextile shall be covered as soon as possible after installation and approval. Installed geotextile shall not be left exposed for more than 15 days.
- K. Material overlying the geotextile shall be carefully placed to avoid wrinkling or damage to the geotextile.

END OF SECTION



CONSTRUCTION QUALITY ASSURANCE PLAN

**Monte Cristo Mining Area
Mt. Baker-Snoqualmie**

**National Forest
Snohomish County, Washington**

2015 Removal Action

April 2015

PN: 2013230047



A **valmont**  COMPANY

Conserving Resources. Improving Life.

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CONSTRUCTION QUALITY ASSURANCE PLAN INDEX

Monte Cristo Mining Area Mt. Baker- Snoqualmie National Forest

2015 Removal Action Snohomish County, Washington

SECTION

01000	CQA Introduction
01010	CQA Scope of Construction
01039	CQA Project Meetings
01090	CQA References
01300	CQA Submittals
01400	CQA Documentation
02220	CQA General Earthwork
02222	CQA Mass Excavation
02224	CQA Engineered Fill
13001	CQA HDPE Geomembrane
13002	CQA Geotextile

APPENDICES

Appendix A.	Submittal Control Log
Appendix B.	Project Documentation Forms
Appendix C.	Soils Monitoring Forms
Appendix D.	Geosynthetics Monitoring Forms

CQA SECTION 01000

INTRODUCTION

PART 1 - GENERAL

1.1 Project Description

- A. The Monte Cristo Mining Area is located in the Mt. Baker-Snoqualmie National Forest in Snohomish County, Washington approximately 28 air-miles east-southeast of Granite Falls, Washington.
- B. This Construction Quality Assurance (CQA) Manual applies to the construction of the Removal Action described in the Removal Action Work Plan & Design Drawings dated June 26, 2014. The construction is approximately 10 acres in area and includes the following construction features:
 - 1. Excavate waste rock, tailings, and concentrates from the Rainy Mine and Townsite areas (Near Features)
 - 2. Excavate waste rock from the Pride of the Woods Mine (Remote Feature)
 - 3. Provide drainage diversions at the Pride of the Woods, Mystery, and Justice Mines (Remote Features)
 - 4. Transport waste rock and tailings to the onsite repository
 - 5. Build repository covered with native fill, gravel, and geomebrane
 - 6. Provide temporary and long term drainage improvements
 - 7. Post signage
- C. A detailed scope of construction for each unit of construction is presented in Section 01010 of this CQA Manual.

1.2 Purpose

- A. The purpose of this CQA Manual is to provide a detailed guidance document for correct and thorough CQA verification procedures implemented during construction. This CQA Manual is also intended to identify, prevent and correct problems and deficiencies that may occur during construction. This manual details general and specific requirements of the CQA program that will be implemented during construction to verify and document that construction is in compliance with the contract documents and the design intent. Requirements of the CQA program include the following:
 - 1. Product quality assurance verification testing to verify that all materials are in compliance with the technical specifications.
 - 2. Construction monitoring and documentation to verify that each unit of construction is in compliance with the technical specifications and that construction was executed correctly using industry-standard construction methods and the proper materials
 - 3. Review and approval of product submittals to verify that construction materials are in compliance with the technical specifications.

4. Testing to verify that installed or constructed units are in compliance with the technical specifications.
 5. CQA documentation consisting of daily summary reports, CQA field logs, testing forms, installation logs, document control binders, material control logs, testing reports, photographic documentation, technical revisions, design modifications, record as-built drawings and corrective action determination and verification reports.
 6. Preparation of the final certification report that documents the CQA program implemented during construction and that construction was completed in compliance with the contract documents and the design intent. The final certification report will be submitted to the United States Forest Service (USFS).
- B. Although this manual provides a foundation for the CQA program, this manual may be modified and revised as appropriate prior to and during construction. All modifications and revisions to the CQA program will be documented in the final certification report.

1.3 Project Organization

- A. The USFS is the owner and has ultimate responsibility for the project, including overall project management and project funding. For purposes of this CQA Manual, USFS will be referred to as “Owner”. The Owner has contracted with the following organizations to complete construction in accordance with the project documents listed in Section 01090-1.02.
1. Cascade Earth Sciences (CES) - Engineer and CQA Certifying Engineer.
 2. Construction Contractor including: - To Be Determined
 - Geosynthetics Installation Subcontractor
 - Geosynthetics Supplier
- B. CES is the Engineer and CQA Certifying Engineer for the project. As the Engineer, CES is responsible for the design and site engineering related to the design. Site engineering includes: 1) review and approval of product and construction submittals required by the contract documents; 2) technical issues related to construction; 3) interpretation of the technical specifications and the construction drawings; and 4) design modifications and technical revisions.

As the CQA Certifying Engineer, CES is responsible for certifying to the Owner that construction is in compliance with the contract documents and the design intent. Specific responsibilities of the CQA Certifying Engineer include: 1) providing a professional engineer registered in the State of Washington; 2) implementing and managing the CQA program outlined in Part 1.02 of this Section; 3) review of all CQA documentation; and 4) preparation of the final certification report. CES will provide an on-site CQA Team to implement and manage the CQA program consisting of a CQA Officer, CQA Monitors, a CQA Surveyor, and Soils and Geosynthetics CQA Testing Laboratories.

- C. The Construction Contractor is responsible for overall performance of the earthwork, including construction of drainage and erosion control measures including best management practices for storm water pollution prevention, in accordance with the contract documents and as shown on the construction drawings. For purposes of this CQA Manual, the Construction Contractor will be referred to as “Contractor”.

- D. The Geosynthetics Installation Subcontractor is responsible for overall performance of geosynthetic installations in accordance with the contract documents and as shown on the construction drawings. For purposes of this CQA Manual, the Geosynthetics installation Contractor will be referred to as “Installer”.

1.4 CQA Manual Format

- A. This CQA Manual closely parallels the format of the technical specifications in the contract documents. The intent of this parallel format is to avoid discrepancies between the two documents, therefore preventing misinterpretations and misunderstandings between the Owner, Contractor, Installer, and Engineer. This format also organizes all necessary quality assurance verification procedures for each unit of construction into a single section.
- B. Division I of this manual presents general information about the construction project and the CQA program.
- C. Sections 02210 through 02776 of this manual provide detailed and specific CQA procedures to be implemented by the Engineer for each unit of construction. Sections 02210 through 02776 are written instruction and direction for members of the CQA team.

END OF SECTION

CQA SECTION 01010

SCOPE OF CONSTRUCTION

PART 1 - GENERAL

1.1 Section Summary

- A. Work to be performed by the Owner
- B. Contractor's scope of work
- C. Installer's scope of work
- D. Other Subcontractor's scope of work

1.2 Work to be Performed by the Owner

- A. The Owner will provide three reference control points with benchmark elevations in the vicinity of the project. All other necessary control or reference points needed to perform construction will be established by the Contractor.
- B. The Owner will provide a topographic survey of waste rock piles and repository area prior to construction. A final topographic survey will be the basis to determine quantity of material moved to the repository.
- C. The Owner will provide the following construction materials:
 - 1. Native soil and talus for cover and road surfacing
 - 2. Water Supply
 - 3. Seed for revegetation

1.3 Contractor's Scope of Work

- A. The Contractor's scope of work includes the following:
 - 1. Develop access to the Rainy Mine
 - 2. Install a temporary log-stringer bridge during the in-water work window for Glacier Creek (August 1-31)
 - 3. Fell trees at the repository and townsite and haulage to the Mountain Loop Highway
 - 4. Post signage
 - 5. Provide temporary and long term drainage improvements
 - 6. Excavate wasterock, concentrates and tailings from Near Features
 - 7. Excavate wasterock from Remote Features
 - 8. Adit diversions at the Pride of the Woods, Mystery, and Justice Mines (Remote Features)
 - 9. Build repository
 - 10. Build cover for the repository consisting of native fill, gravel, and geomembrane
 - 11. Reclaim disturbed areas

1.4 **Installer's Scope of Work**

- A. The Installer's scope of work includes the following:
1. Mobilization of construction equipment and personnel
 2. Installation of liner system

END OF SECTION

CQA SECTION 01039

PROJECT MEETINGS

PART 1 - GENERAL

1.1 Section Summary

- A. Communication and coordination between the Owner, Engineer, Contractor, Installer, and CQA Team are most important to achieve the common goals of quality construction and successful completion of the project.
- B. A series of project meetings will be held for the purpose of establishing a successful environment of communications, coordination, and overall teamwork; the meetings will be administered by the Engineer or CQA Officer to: 1) clearly define responsibility and authority of each organization involved in the project; 2) resolve communication problems, misunderstandings, and misinterpretations; 3) find solutions to unanticipated developments; and 4) identify, prevent and correct problems and deficiencies that may occur during the construction process.
- C. Project meetings include the following.
 - 1. A Preconstruction Meeting
 - 2. Progress Meetings
 - 3. Preparatory Meetings

1.2 Preconstruction Meeting

- A. A preconstruction meeting will be held to discuss topics relating to the commencement of the project.
- B. The objectives of this meeting are to: 1) clearly define the roles, responsibility, and authority of each organization and individual involved in the project; 2) review specific requirements of the CQA program; and 3) establish a foundation of cooperation to achieve quality construction. The following agenda, as related to construction quality assurance, will be addressed by the Engineer:
 - 1. Introduce and discuss role, authority, and responsibilities of each organization and individual involved in the project
 - 2. Establish lines of communication
 - 3. Review Plans and Specifications
 - 4. Distribution of the CQA Plan
 - 5. Review of CQA activities to be performed
 - 6. Discuss Contractor's construction schedule and workplan
 - 7. Discuss Contractor's Construction Quality Control (CQC) procedures and responsibilities
 - 8. Discuss submittal review and approval procedures
 - 9. Discuss non-conformance and corrective action procedures

10. Discuss construction restrictions due to weather conditions
 11. Discuss and schedule weekly progress meetings
 12. Discuss preparatory meetings
- C. A Meeting/Discussion Summary Report (See Section 01400-1.08) will be completed by the CQA Officer and distributed to all parties in attendance.
- D. The following representatives from each organization are required to attend the preconstruction meeting:
1. Owner or representative
 2. Contractor's Project Manager and on-site Superintendent
 3. Installer's Project Manager and on-site Superintendent
 4. Engineer's Project Manager
 5. CQA Officer
 6. Regulatory Agency Representative(s) (optional)

1.3 Progress Meetings

- A. In coordination with the Engineer, the CQA Officer will schedule and administer weekly progress meetings. The objectives of these meetings are to: 1) maintain lines of communication; 2) review work progress and CQA activities performed previously; 3) discuss upcoming construction and related CQA activities; and 4) maintain and improve the established foundation of cooperation to achieve quality construction. The following agenda will be addressed by the CQA Officer:
1. Review minutes of previous progress meeting
 2. Review work progress
 3. Review and update construction schedule and obtain a two-week look-ahead schedule from the Contractor
 4. Discuss CQA and CQC related field observations, testing results, problems, decisions, and conflicts
 5. Review and update Submittal log
- B. A Meeting/Discussion Summary Report (See Section 01400-1.08) will be completed by the CQA Officer and distributed to all parties in attendance.
- C. The following representatives from each organization are required to attend the weekly progress meetings:
1. Owner or representative
 2. Contractor's on-site Superintendent
 3. Installer's on-site Superintendent (during geosynthetic installation)
 4. Engineer's Project Manager or representative
 5. CQA Officer

1.4 Preparatory Meetings

- A. In coordination with the Engineer, the CQA Officer will schedule and administer informal preparatory meetings prior to beginning construction of the following items:
 - 1. Mass excavation and subgrade preparation
 - 2. Engineered fill placement
 - 3. Liner installation
 - 4. Protective soil placement
 - 5. General earthwork and drainage and erosion control construction, as needed.
- B. The objective of these preparatory meetings is to establish a complete understanding of the upcoming unit of construction and CQA activities that will be implemented during construction. To achieve this objective, the following agenda will be addressed by the CQA Officer:
 - 1. Review “Products” or “Materials” part of the applicable section of the Specifications
 - 2. Review “Execution” part of the applicable section of the Specifications
 - 3. Discuss any construction and grade control staking needed to perform and complete the work
 - 4. Discuss CQA testing, observation, and surveying to be performed
 - 5. Verify that all submittals have been, or will be, received by the CQA Officer and approved by the Engineer in accordance with the schedule
 - 6. Discuss Contractor’s CQC responsibilities
 - 7. Discuss Contractor’s coordination, scheduling, and sequencing of the work
 - 8. Discuss Contractor’s proposed equipment and manpower
- C. A Meeting/Discussion Summary Report (See Section 01400-1.08) will be completed by the CQA Officer and distributed to all parties in attendance.
- D. The following representatives from each organization are required to attend the preparatory meetings:
 - 1. Contractor’s on-site Superintendent
 - 2. On-site Superintendent of Installer or other subcontractor(s), as applicable to the unit of construction
 - 3. CQA Officer
 - 4. CQA Monitor(s), as applicable to the unit of construction

END OF SECTION

CQA SECTION 01090

REFERENCES

PART 1 - GENERAL

1.1 Section Summary

- A. Project Reference Documents
- B. Industry Standards and Technical Reference Documents
- C. Soils Testing Standards and Methods
- D. Geosynthetics Testing Standards and Methods
- E. Acronyms
- F. Contact Addresses and Telephone Numbers

1.2 Project Reference Documents

- A. The following project reference documents provide support and background information for use in conjunction with this CQA Plan.
 - 1. *Removal Action Work Plan & Design Drawings*. CES June 2014, referred to in this CQA Plan as: Plans.
 - 2. *Technical Specifications, Monte Cristo Mining Area*, CES June 2014, referred to in this CQA Plan as: Specifications.

1.3 Industry Standards and Technical Reference Documents

- A. The following industry standards and technical reference documents were used in the preparation of this CQA Plan.
 - 1. As listed in Specifications

1.4 Soils Testing Standards and Methods

- A. The following standard soils testing methods and procedures apply as referenced in the technical specifications and this CQA Plan.
 - 1. ASTM C 136 Sieve Analysis of Fine and Coarse Aggregates
 - 2. ASTM D 422 Standard Test Method for Particle-Size Analysis of Soils
 - 3. ASTM D 698 Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort
 - 4. ASTM D 1140 Standard Test Method for Amount of Material in Soils Finer Than the No. 200 (75- μ m) Sieve
 - 5. ASTM D 1587 Standard Practice for Thin-Walled Tube Geotechnical Sampling of Soils
 - 6. ASTM D 2216 Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil Aggregate Mixtures

7. ASTM D 2434 Standard Test Method for Permeability of Granular Soils (Constant Head)
8. ASTM D 2487 Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System)
9. ASTM D 2488 Standard Practice for Description and Identification of Soils (Visual - Manual Procedure)
10. ASTM D 2922 Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
11. ASTM D 2937 Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method
12. ASTM D 3017 Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
13. ASTM D 4318 Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
14. ASTM D 5084 Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter

1.5 Geosynthetics Testing Standards And Methods

- A. The following standard geosynthetics testing methods and procedures apply as referenced in the technical specifications and this CQA Plan.
 1. ASTM D 638 Standard Test Method for Tensile Properties of Plastics
 2. ASTM D 746 Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact
 3. ASTM D 792 Standard Test Method for Specific Gravity and Density of Plastics by Displacement
 4. ASTM D 1004 Test Method for Initial Tear Resistance of Plastic Film and Sheeting
 5. ASTM D 1204 Standard Test Method for Linear Dimensional Changes to Nonrigid Thermoplastic Sheeting or Film at Elevated Temperatures
 6. ASTM D 1505 Test Method for Density of Plastics by the Density-Gradient Technique
 7. ASTM D 1603 Test Method for Carbon Black in Olefin Plastics
 8. ASTM D 2216 Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock
 9. ASTM D 2412 Determination of External Loading Characteristics of Plastic Pipe by Parallel-plate Loading
 10. ASTM D 3350 Standard Specification for Polyethylene Plastic Pipe and Fittings Materials
 11. ASTM D 5261 Test Methods for Mass Per Unit Area (weight) of Woven Fabrics

12. ASTM D 3895 Standard Test Method for Copper Induced Oxidative Induction Time of Polyolefins by Thermal Analysis
13. ASTM D 4355 Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water
14. ASTM D 6392 Standard Practice for Determining the Integrity of Field Seams Used in Joining Flexible Polymeric Sheet Geomembranes
15. ASTM D 4491 Test Methods for Water Permeability of Geotextiles by Permittivity
16. ASTM D 4533 Test Method for Trapezoid Tearing Strength of Geotextiles
17. ASTM D 4632 Test Method for Breaking Load and Elongation of Geotextiles (Grab Method)
18. ASTM D 4716 Standard Test Method for Constant Head Hydraulic Transmissivity (In-Plane Flow) of Geotextiles and Geotextile Related Products
19. ASTM D 4751 Test Method for Determining the Apparent Opening Size of a Geotextile
20. ASTM D 4833 Standard Test Method for index Puncture of Geotextiles, Geomembranes, and Related Products
21. ASTM D 5035 Standard Test Method for Breaking Force and Elongation of Textile Fabrics (Strip Method)
22. ASTM D 5994 Standard Test Method for Measuring Nominal Thickness Geotextiles and Geomembranes
23. ASTM D 5321/6345 Standard Test Method for Determining the Coefficient of Soil and Geosynthetic or Geosynthetic Friction by the Direct Shear Method
24. ASTM D 5397 Standard Test Method for Notched Constant Tensile Load Test of Geomembrane
25. ASTM D 5596 Standard Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics
26. ASTM D 5617 Standard Test Method for Multi-Axial Tension Test for Geosynthetics
27. ASTM D 5890 Standard Test Method for Swell Index of Clay Mineral Component of Geosynthetic Clay Liners
28. ASTM D 5993 Standard Test Method for Measuring the Mass per Unit Area of Geosynthetic Clay Liners
29. ASTM E 946 Standard Test Method for Water Absorption of Bentonite by the Porous Plate Method
30. ASTM F 904 Standard Test Method for Comparison of Bond Strength or Ply Adhesion of Similar Laminates Made from Flexible Materials
31. FTMS 101C Puncture Resistance
32. ASTM D 5887 Standard Test Method for “Permeability of Geosynthetic Clay Liners (GCLs)”
33. GRI GCL-3 Standard Test Method for ‘GCL Overlap Seam Permeability”

1.6 Acronyms

A. Whenever the following acronyms are referenced in the Specifications or this CQA Plan, the following meanings apply.

1. ACI	American Concrete Institute
2. APWA	American Public Works Association
3. ASTM	American Society for Testing and Materials
4. CFR	Code of Federal Regulations
5. CMP	Corrugated Metal Pipe
6. CQA	Construction Quality Assurance
7. CQC	Construction Quality Control
8. EBA	EBA Engineering
9. EPA	United States Environmental Protection Agency
10. FTB	Film Tear Bond
11. FTMS	Federal Test Method Standard
12. CCL	Geosynthetic Clay Liner
13. GML	Geomembrane Liner
14. GRI	Geosynthetics Research Institute
15. HDPE	High Density Polyethylene
16. IDEQ	Idaho Department of Environmental Quality
17. LCS	Leachate Collection System
18. MQA	Manufacturing Quality Assurance
19. MQC	Manufacturing Quality Control
20. MSHA	Mine Safety and Health Administration
21. MSL	Mean Sea Level
22. NFTB	Non-Film Tear Bond
23. SDR	Standard Dimension Ratio
24. WWF	Welded Wire Fabric

1.7 Contact Addresses and Telephone Numbers

A. The following are addresses, telephone numbers, and fax numbers for individual contacts at each organization involved in the project.

United States Department of Agriculture, Forest Service
Olympic National Forest
Supervisor's Office
1835 Black Lk Blvd SW
Olympia, WA 98512
Contact Name: Mr. Joseph Gibbens, PE
Telephone: (360) 956-2352

Mt Baker-Snoqualmie National Forest
Darrington Ranger District
1405 Emens Avenue North
Darrington, WA 98241
Contact Name: Mr. Peter Forbes
Telephone: (360) 436-1155

Cascade Earth Sciences
P.O. Box 6807
Boise, ID 83707
Contact Name: Jay E. Williams, .PE
Telephone: (208) 724-2261

END OF SECTION

CQA SECTION 01300

SUBMITTALS

PART 1 - GENERAL

1.1 Section Summary

- A. Submittal Control Log
- B. Submittal review and approval procedures

1.2 Submittal Control Log

- A. The Submittal Control Log, Appendix A, lists all submittals required by the technical specifications. The Submittal Control Log will be maintained by the CQA Officer in coordination with the Contractor and Installer during construction. The Submittal Control Log documents: 1) submittal number; 2) referenced specification section; 3) submittal description; 4) submitter; 5) date received; 6) reviewer; 7) action taken determination; and 8) return date.

1.3 Submittal Review and Approval Procedures

- A. Three copies of each submittal listed in the Submittal Control Log will be submitted to the CQA Officer by the Contractor or Installer in accordance with the technical specifications. The submittals will be forwarded by the CQA Officer to the Owner and Engineer for review and approval. The Engineer may perform a preliminary review of submittals for compliance with the technical specifications and issue a verbal Approval for Use to the CQA Officer who, in turn, will notify the Contractor or Installer that no corrective action determinations were required prior to issuing a verbal Approval for Use. All submittals which are not in compliance with the technical specifications must be immediately forwarded to the Engineer for review and corrective action determinations.
- B. At the completion of the review process, the Owner or Engineer will return two copies of each submittal to the CQA Officer with Action Taken determinations stamped on both copies of the submittal. The Action Taken determinations and the return dates will be recorded on the Submittal Control Log. One copy of the reviewed submittal will be returned to the Contractor or Installer and the other copy will be archived by the CQA Officer in the submittal documentation control binder.
- C. The Submittal Control Log will be reviewed and updated in coordination with the Contractor and Installer at the weekly progress meetings.

END OF SECTION

CQA SECTION 01400

DOCUMENTATION

PART 1 - GENERAL

1.1 Section Summary

- A. Daily Summary Report
- B. Daily Field Log (Inspection Data Sheet)
- C. Construction monitoring forms
- D. Laboratory testing reports
- E. Non-conformance/Corrective Action Form
- F. Acceptance Report
- G. Meeting/Discussion Summary Report
- H. Photograph Log
- I. Document Control
- J. As-built Record Drawings
- K. Certification Report
- L. Documentation archive storage

1.2 Daily Summary Report

- A. A summary report will be prepared daily by the CQA Officer. This report will organize and summarize all construction and CQA activities (monitoring and testing) completed during each day. The Daily Summary Report will contain or reference the following information:
 - 1. Title block containing: 1) project name; 2) project number; 3) project location; 4) name of Owner; 5) name of Contractor; 6) date and day; 7) Document Control Number (See Part 1.10); and 8) weather conditions.
 - 2. Summary of construction activities for each unit of construction including equipment, personnel, and subcontractors utilized for each unit of construction and identification of the general area(s) where construction took place.
 - 3. General summary of CQA activities (monitoring and testing) completed for each unit of construction with reference to attached Daily Field Logs (See Part 1.03) which describe construction monitoring, construction testing results, and quality control procedures and test results.
 - 4. General description of any non-conformance with the Plans or Specifications and the corrective action measures taken with reference to attached Non-conformance/Corrective Action Forms (See Part 1.06) which contain a more detailed description of the non-conformance issue and its corrective action.
 - 5. List of any materials received and status of submittal(s).
 - 6. List of project meetings or pertinent discussions with reference to attached Meeting/Discussion Summary Report (See Part 1.08).

- 7. Other miscellaneous information
 - 8. Signature of CQA Officer
- B. A sample Daily Summary Report is included in Appendix B, Project Documentation Forms.

1.3 Daily Field Log (Inspection Data Sheet)

- A. Each CQA Monitor will maintain an individual Daily Field Log (or Inspection Data Sheet) which will be assigned a cross-referencing Document Control Number (See Part 1.10) and contain daily entries of the CQA Monitor.
- B. On the Daily Field Log, the CQA Monitors will provide a written account of construction activities, construction monitoring, construction testing, and quality control procedures performed during the day for the monitored Construction Unit(s), as well as any observations (i.e., notes, charts, sketches, or photograph reference).
- C. Construction monitoring forms (See Part 1.04) and laboratory testing forms (See Part 1.05) will be attached to, or referenced in, the Daily Field Log.

1.4 Construction Monitoring Forms

- A. Construction activities, construction monitoring, and construction testing will be recorded on appropriate Construction Monitoring Forms. The following Construction Monitoring Forms, or similar forms, will be issued by the CQA Officer for this project and are presented in the following appendices:

Appendix C - Soils Monitoring Forms
 Master Testing Control Log – Soils
 Soils Test Request - Sample Custody Log
 Nuclear Density/Moisture Test Data

Appendix D- Geosynthetics Monitoring Forms
 Master Testing Control Log - Geosynthetics
 Geosynthetics Delivery and Control Logs
 Geosynthetic Tests Request - Sample Custody Log
 GML Deployment/Welding Log
 GCL Deployment/Seaming Log
 GML/GCL Repair Log

- B. Completed Construction Monitoring Forms will be submitted by the CQA Monitor to the CQA Officer for review with Daily Field Logs, or at the completion of testing, and will be addressed by the CQA Officer in the Daily Summary Reports.

1.5 Laboratory Testing Reports

- A. Laboratory testing reports will be issued by the Soils and Geosynthetics CQA Testing Laboratories for conformance and construction testing. Laboratory testing reports will be issued for the following testing during the project.
 - 1. Sieve analysis, Atterberg limits, Unified Soil Classification, and Moisture-Density relationship testing for engineered fill material
 - 2. Sieve analysis and permeability for LCS and LDS gravel
 - 3. Conformance testing for geotextiles
 - 4. Conformance testing and seam strength testing for GML
 - 5. Conformance testing for geonet composite
 - 6. Conformance testing for GCL

- B. Laboratory testing reports will be addressed by the CQA Officer in the Daily Summary Report on the date of receipt.

1.6 Non-Conformance/Corrective Action Form

- A. A Non-Conformance/Corrective Action Form will be issued by the Engineer to the CQA Officer who will notify the Contractor or Installer of construction or materials not in compliance with the Plans or Specifications, or for defective workmanship or materials even if in compliance with the Plans and Specifications. The Non-Conformance/Corrective Action Form will contain or reference the following information:
 - 1. Title block containing: 1) project name; 2) project number; 3) project location; 4) name of Owner; 5) name of Contractor; 6) date and day; and 7) Document Control Number (See Part 1.10)
 - 2. Description of the non-conformance issue, construction unit, and location
 - 3. Reference to specification(s) or drawing(s) for which materials or construction are not in compliance
 - 4. Description of Corrective Action measures necessary to fully correct the area of non-conformance with the Plans or Specifications as determined by the Engineer.
 - 5. Specification variance or revisions to the As-built Record Drawings (See Part 1.11) required
 - 6. If necessary, any Daily Field Log, Construction Monitoring Forms, laboratory testing report(s), Meeting/Discussion Summary Report, or Photograph Log pertaining to the non-conformance issue will be referenced by Document Control or Photograph Number to fully substantiate the non-conformance issue and corrective action determination.
 - 7. Signature of the CQA Officer verifying that corrective measures determined by Engineer have been taken by the Contractor or Installer
- B. A sample Non-conformance/Corrective Action Form is included in Appendix B, Project Documentation Forms.

1.7 Acceptance Report

- A. An Acceptance Report will be prepared for each Construction Unit to verify that all materials and construction are in compliance with the Plans and Specifications. The Acceptance Report will reference all relevant Daily Summary Reports, Daily Field Logs (Inspection Data Sheets), and Non-Conformance/Corrective Action Forms by the Document Control Number.
- B. A sample Acceptance Report is included in Appendix B, Project Documentation Forms.

1.8 Meeting/Discussion Summary Report

- A. A Meeting/Discussion Summary Report will be prepared for each scheduled Project Meeting (See Section 01039) and any pertinent discussion between the Contractor and CQA personnel. The Meeting/Discussion Summary Report will contain the following information:
 - 1. Title block containing: 1) project name; 2) project number; 3) project location; 4) name of Owner; 5) name of Contractor; 6) date and time; 7) meeting location; and 8) Document Control Number (See Part 1.10).

2. Meeting name or general discussion subject matter
 3. List of meeting attendees or discussion participants
 4. Minutes of scheduled Project Meetings or synopsis of discussion
 5. List of any items needing resolution resulting from the meeting or discussion
 6. Signature of CQA Officer
- B. A sample Meeting/Discussion Summary Report is included in Appendix B, Project Documentation Forms.

1.9 Photograph Log

- A. All construction activities will be continually photographed to clearly show and define construction methods and as-built conditions of completed units of construction. Photographs will include: 1) product or material sources; 2) construction methods in progress for each unit of construction; 3) completed units of construction; 4) damaged, rejected, or substandard materials and construction; 5) corrective action measures to rectify damaged, rejected, or substandard construction; 6) completed units of construction after completion of corrective action measures; and 7) design modifications. Photographs will be identified by number, date, and time of the photograph. The CQA Officer will maintain a cross-referencing photography log documenting the subject matter of each photograph.
- B. A sample Photograph Log is included in Appendix B, Project Documentation Forms.

1.10 Document Control

- A. A unique Document Control Number will be assigned to all CQA documents generated during construction and implementation of this CQA Plan.
- B. The Document Control Number will organize and index all CQA documentation for cross-referencing, to allow easy access to all documents, and to enable a reviewer to identify and retrieve original CQA documentation for any completed unit of construction.
- C. Complete documentation of all CQA activities will be controlled and secured in a series of three-ring binders maintained at the site by the CQA Officer with a duplicate copy maintained at the offices of the Engineer, at the option of the Engineer. This documentation control structure organizes and indexes all CQA documents and is intended to allow easy access to all documents for review and audit by the Owner, Engineer, or regulatory agencies. The following is a preliminary list and contents of the CQA Documentation Binders to be established and maintained by the CQA Officer.
1. **Title:** Daily Summary Reports and Field Logs
Color code (optional): Blue
Contents: Daily Summary Reports prepared by the CQA Officer and Daily Field Logs completed by the CQA Monitors
 2. **Title:** Project Administration Documentation.
Color code (optional): Red
Contents: Non-conformance/Corrective Action Forms, Acceptance Reports, Meeting/Discussion Summary Reports, Owner correspondence, Engineer correspondence, Installer and Contractor correspondence, and miscellaneous correspondence
 3. **Title:** Contractor Daily Field Reports
Color code (optional): Green

- Contents:** Any daily field reports prepared by the Contractor (or Installer)
4. **Title:** Submittals
Color code (optional): Purple
Contents: Updated Submittal Control Log, submittal transmittal cover sheets, and all reviewed and approved (or other status) submittals
 5. **Title:** Soils CQA
Color code (optional): White
Contents: Construction Monitoring Forms and laboratory testing reports for soils
 6. **Title:** Geosynthetics CQA
Color code (optional): Orange
Contents: Construction Monitoring Forms and laboratory testing reports for geosynthetics
 7. **Title:** CQA Plan
Color code (optional): Teal
Contents: CQA Plan
 8. **Title:** Photography Log
Color code (optional): Yellow
Contents: Construction and CQA photographs and cross-referencing Photograph Logs

1.11 As-Built Record Drawings

- A. As-built Record Drawings will be maintained by the CQA Officer and will be reviewed and verified by the Engineer.
- B. The As-built Record Drawings will show actual as-built conditions of construction and will adequately reflect that construction is in substantial compliance with the design intent of the Plans and Specifications; irrelevant deviations in actual construction that do not substantially affect the design intent will not be incorporated into the As-built Record Drawings but will be addressed in the Certification Report (See Part 1.12).
- C. As-built Record Drawings will be prepared during the construction process by making modifications as they occur to a single set of construction drawings designated as the Site As-built Record Drawings; at the completion of construction the CQA Officer will incorporate all as-built conditions into the Final As-built Record Drawings.
- D. The final As-built Record Drawings will contain revision numbers, dates, and reviewer initials; and will be signed and stamped by the CQA Certifying Engineer.
- E. The CQA Surveyor will perform as-built verification surveys and provide record data for the following units of construction which will be incorporated into the final As-built Record Drawings as appropriate:
 1. Prepared subgrade and engineered fill limits, lines, and grades (As-built Plan to be prepared by the Contractor)
 2. Limits of geosynthetics
 3. Limits, flowlines, thickness, and grades of drainage and erosion control measures

1.12 Certification Report

- A. At the completion of the project, the CQA Certifying Engineer will prepare a Certification Report and submit it to the Engineer. The Certification Report will consist of information

and data generated by the CQA program and will document that landfill construction is in compliance with the design intent of the Plans and Specifications. At a minimum, the Certification Report will contain the following information.

1. Summary of construction methods for each unit of construction completed
2. Summary of the CQA program implemented during construction and specific CQA activities (monitoring and testing) performed for each unit of construction completed
3. Results of conformance testing and construction testing
4. Revisions made to Plans and variances from Specifications allowed
5. Final As-built Record Drawings
6. Statement of compliance with the design intent of the Plans and Specifications, signed and stamped by the CQA Certifying Engineer, a professional engineer or certified engineering geologist registered in the State of Washington.

1.13 Documentation Archive Storage

- A. At the completion of the project and after submittal of the Certification Report and As-built Record Drawings to the Engineer, all original documentation generated by construction and the CQA program will be archived at the on-site office of the Owner with duplicate copies stored at the offices of the Engineer and CQA Certifying Engineer.

END OF SECTION

CQA SECTION 02220
GENERAL EARTHWORK

PART 1 - GENERAL

1.1 Summary

- A. The CQA Officer shall perform CQA procedures as outlined in this Section and follow guidelines for monitoring and testing to verify and document that all general earthwork, including minor excavations for anchor trenches, drainage and erosion control structures, stabilized slopes; roadway berms and fills, backfill of anchor trenches and runouts shown on the Drawings are in compliance with the Specifications.

1.2 Submittals

- A. Collect three copies of each submittal required in the Specifications
- B. Verify compliance with the submittal schedule and update Submittal Log
- C. Perform submittal review and approval procedures in Section 01300-1.03

PART 2 - MATERIALS

2.1 Anchor Trench and Run Out Backfill

- A. Verify that anchor trench backfill material meets the requirements shown on the Drawings.
- B. Verify that anchor-trench and runout backfill meets the requirements in the section of the Specifications applicable to that type of material shown on the Drawings.

2.2 Conformance Testing

- A. Prior to the beginning of construction for any portion of the general earthwork, perform, sample materials and send the samples to the Soils Testing Laboratory for, or verify that the Contractor has performed all tests required in the sections of the Standard Specifications referenced in the Specifications showing compliance with the material requirements in the Specifications.

PART 3 - EXECUTION

3.1 General

- A. If any portion of the general earthwork does not meet the requirements of the Specifications, based on either testing or observations, verify that the Contractor reworks or removes and replaces that portion to meet the requirements of the Specifications.
- B. After construction of any portion of general earthwork is completed, perform the following:
 - 1. Verify all grades and dimensions of completed general earthwork by either field survey or physical measurement.

2. If it is demonstrated by the CQA verification surveying that any portion of the general earthwork does not meet the required grades or dimensions shown on the Plans, verify that the Contractor reworks or removes and replaces that portion to bring the deficient area to grade or the proper dimension in accordance with the Plans and all requirements of the Specifications.

3.2 **Preparation**

- A. Prior to beginning construction of any portion of general earthwork, hold a preparatory meeting in accordance with Section 01039-1.04 of this CQA Plan.

3.3 **Excavation**

- A. Verify that excavation for anchor trenches, drainage and erosion control structures, and the containment berm keyway conforms to Drawings and Specifications.
- B. Verify that the sides and bottom of excavated anchor trenches are relatively smooth and free of individual particles or protrusions greater than 0.75 inches in diameter, ruts or ridges greater in depth or height than 1.0 inches, organics, deleterious material, unsuitable matter, or other objects which could potentially damage the GCL or GML.
- C. Verify that the leading edge of anchor trenches is rounded to avoid sharp bends when placing the GML.
- D. Verify that where excavation is inadvertently carried below subgrade elevations, suitable provision is made by the Contractor for adjustment of same as determined by the Engineer to meet requirements incurred by the deeper excavation; also, verify that inadvertent over-excavation in such locations is rectified by backfilling with engineered fill and compacting to provide a firm and unyielding subgrade in accordance with the requirements of the Specifications.
- E. Verify that the Contractor provides and maintains at all times during construction, ample means and devices with which to promptly remove and properly dispose of all water from any source entering the excavations.
- F. Verify that the Contractor has located all underground utilities prior to performing any minor excavation for drainage and erosion control structures outside the limit of excavation shown on the Drawings.

3.4 **Backfilling**

- A. Verify that anchor trench backfill material is placed in accordance with the requirements shown on the Drawings.
- B. Verify that runout backfill is placed in accordance with the requirements in the section of the technical specifications for placement and compaction applicable to that type of material shown on the Drawing.
- C. Verify that anchor trench backfill is compacted as shown on the Drawings.
- D. Verify compaction requirements are met, where applicable.

END OF SECTION

CQA SECTION 02222

MASS EXCAVATION

PART 1 - GENERAL

1.1 Summary

- A. The CQA Officer shall perform CQA procedures as outlined in this Section and follow guidelines for monitoring and testing to verify and document that all mass excavation, including all clearing, grubbing, excavation, grading, and subgrade preparation, construction of any necessary haul roads, stockpiling of all excavated materials, and provision of temporary dust, erosion, and drainage control measures are as shown on Drawings and in compliance with the Specifications.

PART 2 - MATERIALS (NOT USED)

PART 3 - EXECUTION

3.1 General

- A. If any portion of the mass excavation does not meet the requirements of the Specifications, based on either testing or periodic observations, verify that the Contractor reworks or replaces that portion to meet the requirements of the Specifications.
- B. After any portion of mass excavation is completed, perform the following:
 - 1. Verify all grades and dimensions of completed areas of the mass excavation by field survey.
 - 2. As mass excavation is completed to the final elevation shown on the Drawings, verify by survey that the excavation and the slope above is in conformance with the applicable requirements of the Specifications and report survey results to the Engineer.
 - 3. Perform tests using an x-ray fluorescence (XRF) meter to confirm contaminated material has been removed to the satisfaction of the Owner.
 - 4. If it is demonstrated by the CQA verification surveying that any portion of the mass excavation does not meet the required lines, grades, or dimensions shown on the Plans, verify that the Contractor reworks or replaces that portion to bring the deficient area to grade or the proper dimension in accordance with all requirements of the Specifications.

3.2 Preparation

- A. Prior to beginning construction of any portion of mass excavation, hold a preparatory meeting in accordance with Section 01039-1.04 of this CQA Plan.

3.3 Clearing And Grubbing

- A. Verify that the area above the natural ground surface within the limits of the excavation is cleared of all vegetation, such as trees, logs, upturned stumps and roots, brush, grass, weeds, or other deleterious material.

- B. Verify that the area below the natural ground surface within the limits of the excavation is grubbed to a depth necessary to remove all stumps, roots, buried logs, and other deleterious material.
- C. Verify that clearing and grubbing is performed prior to beginning excavation in any area.
- D. Verify that cleared and grubbed debris are stockpiled separately from excavated material or disposed of in accordance with the Specifications.

3.4 Excavation

- A. Verify that boulders encountered by the Contractor during mass excavation, which cannot be picked up by a scraper are removed, separated by size as directed by the Engineer, and stockpiled in the location shown on the Drawings.

3.5 Grading

- A. Verify that the excavation is constructed in conformance with the lines, grades, and dimensions shown on the Drawings.
- B. Verify that, when completed, the average plane of all excavated slopes conforms to those shown on the Drawings or directed by the Engineer.
- C. Verify that unsuitable materials, as determined by the Engineer, encountered at the subgrade elevation are removed and stockpiled separately from excavated material or disposed in accordance with the Specifications. If, after removal of the unsuitable materials, a surface in accordance with this Section 02222-3.05 and the Specifications does not result, monitor and verify that overexcavation correction procedures in the Specifications are followed.

3.6 Subgrade Preparation

- A. Verify that all completed excavated surfaces (subgrade) shown on the Drawings are free of deleterious material.
- B. Verify that the subgrade surface corrective actions by the Contractor are in conformance with the method approved by the Engineer, the applicable Standard Specifications, and the special provisions in the Specifications.

3.7 Subgrade Material Evaluation

- A. In order to demonstrate that the engineered subgrade materials meet the gradation criteria a Subgrade Material Evaluation shall be performed prior to compaction, using the following test methods and test frequencies:

Property	Test Method	Frequency	Specification for Passing	Number of Tests
Moisture/Density	ASTM D 698	1/5,000 CY or change in material	For CQA program reference only	7
Construction Oversight	Visual Observation	Continuous	Maximum particle size 1/2 inch	N/A
Gradation	ASTM D 422	1/1,000 CY (1/acre/lift)	Well-graded. amenable to compaction	14

3.8 Haul Road Construction

- A. Verify that the location of all haul roads constructed and used by the Contractor are as approved by the Engineer.

3.9 Stockpiling

- A. Verify that the Contractor places all excavated materials in the appropriate stockpile areas designated in the Drawings and in accordance with all requirements in the Specifications.

3.10 Erosion Control

- A. Verify that erosion and sediment control measures are implemented by the Contractor in accordance with the approved Erosion and Sediment Control Plan, and as directed by the Owner for all mass excavation work areas including haul roads and stockpile areas; adjacent areas which have been disturbed; or other affected areas.
- B. Verify that the Contractor maintains erosion and settlement control measures until the final graded surface (prepared subgrade) of the excavation is approved by the Engineer and the Owner, and until the surface is covered with geosynthetic liner materials. If erosion creates a final subgrade surface which is not in accordance with any requirements of the Specifications, verify that overexcavation correction procedures in the Specifications are performed by the Contractor.

3.11 Drainage Control

- A. Verify that the Contractor provides ample means and devices with which to promptly remove and dispose of all water from any source entering the excavation or stockpile area(s) and maintains these at all times during mass excavation and until the final graded surface of the excavation and stockpile are approved by the Engineer and the Design Engineer.

END OF SECTION

CQA SECTION 02224

ENGINEERED FILL

PART 1 - GENERAL

1.1 Summary

- A. The CQA Officer shall perform CQA procedures as outlined in this Section and follow guidelines for monitoring and testing to verify and document that fill materials and construction methods are in compliance with the Specifications.

1.2 Submittals (Not Used)

PART 2 - MATERIALS

2.1 Engineered Fill

- A. Verify that fill material is free of organic, deleterious, or other unsuitable matter and has the following properties required in the Specifications:
 - 1. Maximum particle size of 2.0 inch within 6 inches of geosynthetics in liner.

2.2 Conformance Testing

- A. Prior to fill placement operations, sample the actual engineered fill material to be used at the site and send the samples to the Soils Testing Laboratory to perform at least one of each of the following tests for every 5000 cubic yards of material to be placed or a minimum of two tests, whichever results in the greater number of tests:
 - 1. Particle Size Analysis (ASTM D 422)
 - 2. Atterberg Limits (ASTM D 4318)
 - 3. Unified Soil Classification (ASTM D 2487)
 - 4. Moisture-Density Relationship Curve (ASTM D 698)
- B. Perform conformance test sampling, and verify that the engineered fill material is free of organic, deleterious, or other unsuitable matter at the borrow area before loading into trucks for delivery to the work area.

PART 3 - EXECUTION

3.1 Preparation

- A. Prior to engineered fill placement operations, hold a preparatory meeting in accordance with Section 01039-1.04 of this CQA Plan.

3.2 Placement

- A. Continuously observe all placement operations to verify that the fill material is consistent and has no oversized particles, overly wet or dry areas, organic matter, deleterious matter, or other unsuitable matter.
- B. Verify that engineered fill material is spread in uniform loose lifts not exceeding 12 inches in thickness.
- C. Verify that each loose lift is moisture conditioned and thoroughly mixed to ensure uniformly distributed moisture content.

3.3 Compaction

- A. Continuously observe all compaction operations to verify that the engineered fill material is consistent and has no oversized particles, overly wet or dry areas, organic matter, or deleterious matter.
- B. Verify that the final thickness of compacted lifts does not exceed nine inches.
- C. Perform the following field tests at the frequency shown to verify that the compacted fill has the minimum dry density required in the Specifications and is at a moisture content within three percent of the optimum determined from ASTM D 698:
 - 1. Dry Density and Moisture Content - Nuclear (ASTM D 2922 and D 3017); at least one test per 5000 square feet per lift or a minimum of two tests per lift, whichever results in the greater number of tests or at a change in material.
 - 2. If testing with nuclear gage is impractical, prepare a test pad and observe contractor operations to meet specified compaction. Continuously observe subsequent operations and verify contractor meets procedural requirements to obtain compaction as approved by the Engineer.
- D. If any portion of the fill does not meet the requirements of the Specifications, based on either field test results or observations, verify that that portion is reworked or removed and replaced to meet the requirements of the Specifications.
- E. Verify that the surface of the completed fill conforms to the grades shown on the Plans and at no point on the completed grading plane does the grade vary above or below the designated grades by more than the amount specified in the project specifications; if it is demonstrated by the CQA verification surveying that any portion of the engineered fill does not meet the required lines, grades, or dimensions shown on the Drawings, verify that the Contractor reworks or replaces that portion to bring the deficient area to grade or the proper dimension in accordance with all requirements of the Specifications.

END OF SECTION

CQA SECTION 13001
GEOMEMBRANE LINER

PART 1 - GENERAL

1.1 Summary

- A. The CQA Officer shall perform CQA procedures as outlined in this Section and follow guidelines for monitoring and testing to verify and document that GML materials and installation are in compliance with the Drawings and Specifications.

1.2 Submittals

- A. Collect three copies of each submittal listed in the Specifications
- B. Verify compliance with the submittal schedule and update Submittal Log
- C. Perform submittal review and approval procedures in Section 01300-1.03

1.3 Transport And Storage

- A. During unloading of the GML rolls at the site, perform the following procedure:
 - 1. Obtain a copy of the packing list
 - 2. Complete the GML Delivery and Control Log for each shipment and attach a copy of the packing list. The GML Delivery and Control Log documents the following:
 - a. delivery date;
 - b. roll numbers;
 - c. batch/lot numbers or production dates;
 - d. roll dimensions;
 - e. receipt of MQC test reports;
 - f. CQA conformance test sampling;
 - g. receipt of CQA conformance test results;
 - h. Manufacturer and Product Name or Designation;
 - i. name of CQA monitor observing delivery and storage;
 - j. total quantity delivered with each shipment and the a cumulative total quantity delivered to date; and
 - k. additional notes including rejection of materials, condition of delivered materials, and other materials included with the shipments.
 - 3. Obtain written certification from the Supplier that unloading and storage of the GML rolls has been done in accordance with the Manufacturer's recommended procedures.
 - 4. Verify that GML rolls are transported, unloaded, handled, and stored in a manner that does not damage the GML rolls in accordance with the Manufacturer's recommended procedures and the following requirements:
 - a. Stinger or straps (nylon or other cloth) shall be used to unload and handle the GML rolls to protect the rolls from damage.

- b. The GML rolls shall be stacked no more than three rolls high and with a three-foot wide access path between the stacked rows.
5. Identify and separate damaged or rejected GML rolls.
6. If CQA conformance test sampling, in accordance with Part 2.02C, is to be performed during delivery to the site, determine which GML rolls will be sampled by either individual roll numbers, batch/lot numbers, or production dates and position the rolls for convenient sampling.

PART 2 - PRODUCTS

2.1 GML

- A. Verify that GML material consists of a high density polyethylene (HDPE) GML meeting the product requirements of the Specifications.

2.2 Conformance Testing

- A. Conduct sampling for CQA conformance testing at the site upon delivery or at the manufacturing plant prior to shipment and delivery to the site.
- B. For every 100,000 square feet of material delivered to the site, select at least one GML roll to sample for CQA conformance testing.
- C. Sample the selected GML rolls for CQA conformance testing using the following procedure:
 1. Cut and discard the first three feet of GML material from across the entire width of the roll.
 2. Cut the next 12 inches of material from across the entire width of the roll; this section of material is the CQA conformance testing sample.
 3. Assign a CQA test number to the sample and mark the following information directly on the sample with a paint marker:
 - a. Machine direction of the sample
 - b. Manufacturer's roll number
 - c. CQA test number
 4. Complete the GML Test Request and Sample Custody Log and ship samples to the Geosynthetics Testing Laboratory via overnight delivery.
- D. The following CQA conformance tests will be performed by the Geosynthetics Testing Laboratory to verify compliance with the product requirements of the Specifications:
 1. Tensile Properties (ASTM D638)
 2. Density ASTM D 1505)
 3. Carbon Black Content (ASTM D 1603)
 4. Carbon Black Dispersion (ASTM D 5596)
 5. Sheet Thickness (ASTM D 5994)

- E. Upon completion of CQA conformance testing and receipt of the results, review all results for compliance with the Specifications and report any test results which are not in compliance with the Specifications to the Engineer.
- F. Additional CQA conformance testing or corrective action to be performed in the event of test results which are not in compliance with the Specifications will be determined by the Engineer.

2.3 Extrudate Rod

- A. Verify that extrudate rod is made from the same resin as the GML.

2.4 Field Testing Equipment

- A. Verify that the Installer provides and uses a field tensiometer for seam testing that has been calibrated within the last year and is accurate to within two pounds.
- B. Verify that the installer provides and uses a one-inch (width) by six-inch (length) cutting die for cutting seam test specimens.

PART 3 - EXECUTION

3.1 Preparation And Examination

- A. Prior to GML installation, hold a preparatory meeting in accordance with Section 01039-1.04 of this CQA Plan.
- B. Prior to GML installation, verify that all underlying material installation and construction has been completed in accordance with the Specifications.
- C. Verify that prior to and at the middle of each GML welding work shift and whenever adjustments are made to the welding machines, the installer prepares and tests trial welds for each welding machine that is being used or will be used during that work shift.
- D. Verify that trial welds are prepared for both fusion and extrusion welding machines and sampled using the following guidelines:
 - 1. Trial weld samples for fusion welding machines should be a minimum of six feet in length.
 - 2. Trial weld samples for extrusion welding machines should be a minimum of three feet in length.
 - 3. The trial weld should be centered along and run the entire length of the sample.
- E. Verify that trial welds are tested as follows:
 - 1. Trial welds should be allowed to cool to ambient conditions prior to testing.
 - 2. After cooling, excessive material should be cut from the beginning and the end of the trial weld sample (approximately four-inches from each end).
 - 3. Using the cutting die, four one-inch specimens should be cut at an even spacing along the length of the trial weld.
 - 4. Using the field tensiometer with a rate of separation of two inches per minute, two non-adjacent specimens shall be tested for peel adhesion (peel) and two for bonded seam strength (shear); both sides of fusion welds shall be tested for peel.

- F. Record peel and shear test results for trial welds on the QML Deployment/Welding Log using the following criteria:
 - 1. Peel test specimens:
 - a. The break is either a film tear bond (FTB-passing) or a non-film tear bond (NFTB-failing).
 - b. Percent of peel penetration into the weld (maximum of 10%)
 - c. Quantitative value for peel strength (minimum of 78 ppi)
 - 2. Shear test specimens:
 - a. The break is either a film tear bond (FTB-passing) or a non-film tear bond (NFTB-failing).
 - b. Elongation of shear specimen (minimum of 2 inches)
 - c. Quantitative value for bonded seam strength (minimum of 120 ppi)
- G. If any of the four test specimens do not meet the peel or shear criteria, reject the entire trial weld and verify that the welding machine is not used for installation of the GML until passing a retest consisting of repeating the entire trial weld sampling and testing procedure on a new weld performed with the failing machine.
- H. If the retested trial weld fails, verify that the welding machine is not used for installation of the GML until proper adjustments or repairs are made and passing a retest; if the welding machine continually fails field trial weld testing, verify that the welding machine is tagged and completely removed from work area.

3.2 Installation

- A. Verify that GML panels are deployed parallel to the slope by unrolling down the entire length of the slope and that corrections or adjustments are made to panels which become askew to the parallel line of the slope.
- B. Verify that adjacent GML panel edges are overlapped a minimum of four-inches for fusion welding and alignment of the overlap is kept consistent by marking overlap indicator points.
- C. Verify that GML damaged during handling, transport, or deployment is removed or repaired.
- D. Verify that the underlying soil subgrade or installed geosynthetics are not damaged by GML installation equipment or methods and that any damaged soil subgrade or installed geosynthetics are completely repaired in accordance with the requirements of the applicable section of the Specifications.
- E. Verify that the Installer only deploys the quantity of GML which can be completely welded and anchored by the end of the work shift or day.
- F. Verify that the Installer prepares an adequate number of sandbags to ballast the GML during deployment in accordance with the following guidelines:
 - 1. Only plastic ties should be used to close sandbags; no metal or wire ties are allowed.
 - 2. Sandbags should be removed prior to deploying overlying materials and after completion of permanent GML anchorage.
 - 3. Sandbag fill should not be disposed of within the limits of work unless the fill consists of material which meets the Specification for the material it is disposed upon.

4. GML rolls may also be used for ballast provided that no damage to the deployed GML occurs.
- G. Verify that the Installer deploys and seams the geomembrane in a manner which minimizes wrinkles and provides the proper amount of slack in the installed GML to compensate for contraction due to local temperature extremes prior to covering; no stress-bridging or “fishmouths” are allowed.
- H. Verify that immediately after GML panels running through ditch flow lines or at toes of slopes are welded, sandbags are placed end-to-end along the entire length of the flow or toe line to prevent stress-bridging at those locations; alternatively, to reduce the number of sandbags required and to further prevent stress-bridging, the Installer may anchor the GML near the toes of slopes within a backfilled anchor trench constructed in accordance with the Specifications.
- I. Verify that GML panels are not overlapped or seamed perpendicular to the slope on slopes with a gradient of more than 10 percent, within 20 feet of the top of any slope, and unless the GML is anchored within a backfilled anchor trench constructed in accordance with the Specifications.
- J. Verify that when cutting any GML above another GML, the Installer uses a knife with a hooked blade.
- K. Record the following information on the GML Deployment/Welding Log:
Note: The abbreviations in parenthesis following each verification procedure are used on the GML Deployment/Welding Log.
 1. Temperature (T). Ambient and GML surface temperatures with a description of the current weather conditions. Record every two hours and document dramatic changes in temperature and weather conditions.
 2. Trial Welds (TW). Time of trial weld, type of welding equipment, welding equipment number, welding operator, and results of field peel and shear testing of trial welds.
 3. Panel (P). Assigned panel number, GML roll number, panel dimensions, and area of panel.
- L. Using a graph computation sheet, field sketch a panel layout drawing of the GML panels deployed during the day and attach this field sketch to the completed GML Deployment/Welding Log; the daily field sketches will be transposed to the master panel layout drawing.

3.3 Fusion Welding

- A. Verify that fusion welding operations only take place when the ambient temperature is between 40°F and 110°F unless the special weather welding plans have been submitted by the Installer and approved by Engineer to weld outside this range; measure ambient temperature six-inches above the in-place GML and record readings every two hours on the GML Deployment/Welding Log.
- B. Verify that all GML seams are fusion welded by the double-track method leaving an air gap for leak testing; extrusion welding can only be used for repairs, patches, fabrications, and inaccessible areas.
- C. Prior to welding, verify that all fusion welding machines have performed trial welds and passed field trial weld testing.

- D. Verify that the Installer's power source is capable of producing sufficient and constant voltage under the combined line load of multiple welders and other equipment.
- E. Verify that surfaces to be welded are thoroughly cleaned.
- F. Verify that seams are welded at the same speed, temperature, roller pressure, and gauge settings used to prepare the trial weld and that the welding operators record welding machine numbers, operators, machine settings, times, and dates on each seam welded.
- G. Closely observe each fusion welding machine to verify that the machine is not adversely affecting or damaging the parent GML material outside the welding area.
- H. Record the following information on the GML Deployment/Welding Log:

Note: The abbreviations in parenthesis following each verification procedure are used on the GML Deployment/Welding Log.

 - 1. Seam (S). Assigned seam number, welding equipment number that welded the seam, welding operator, and length of the welded seam.
 - 2. End of Seam Test. (EST). If the Installer's quality control program requires that specimens be taken from the end of each welded seam and tested for peel adhesion, record these results using the same criteria as for trial welds. If the Installer records these results, request a copy of the results and this information can be omitted from the GML Deployment/Welding Log.
 - 3. Seam Test Sample (STS). Assigned sample number, seam number sample is located on, location of sample within the seam, welding machine number, welding operator, and results of field seam testing.

3.4 Extrusion Welding

- A. Verify that extrusion welding is used only for repairs, patches, fabrications, and inaccessible areas.
- B. Prior to welding, verify that all extrusion welding machines have performed trial welds and passed field trial weld testing.
- C. Verify that GML patches overlap the underlying GML panel a minimum of four inches.
- D. Verify that GML patches are cut square with rounded corners and are large enough to extend a minimum of four inches in all directions over the repair area.
- E. Verify that GML patches are tack-welded to the underlying GML panel to prevent movement during grinding and extrusion welding operations.
- F. Verify that the outer edge of repair patches and the adjacent underlying GML are disc-ground to remove surface debris and oxidation and that grinding is not parallel to seam.
- G. Verify that the nozzles of extrusion guns are purged before each use to remove solidified extrudate.
- H. Verify that the extrusion weld completely covers the entire width of the grind area and that extrusion safety welds extend four inches up any intersecting fusion weld.
- I. Verify that a cap strip patch is extrusion welded at all fusion welded seam intersections of three or more GML panels.

3.5 Quality Control

- A. Verify that quality control procedures are performed by the Installer in accordance with the installer's GML Installation Quality Control Manual except where amended or modified by the Engineer or the Specifications.
- B. Verify that the Installer maintains the following quality control documentation during the GML installation in accordance with the Specifications.
 - 1. An accurate GML panel layout drawing which includes; 1) roll and panel numbers, 2) seam numbers; 3) GML limits; 4) anchor trench locations, and 5) seam test sample locations.
 - 2. Daily deployment logs and panel layout drawings to be submitted to the CQA Officer daily which include; 1) panel and seam numbers; 2) panel dimensions; and 3) deployment quantities.
 - 3. Daily welding logs to be submitted to the CQA Officer daily which include; 1) welding machine numbers; 2) operators; 3) machine settings; and 4) times and dates for each seam welded.
- C. Verify that the entire length of each fusion welded seam is air-pressure tested by the installer, with an air pump capable of generating and maintaining 40 psi of pressure and equipped with a regulator and pressure gauge and pressure feed needles having pressure gauges accurate to one psi, in accordance with the following procedure:
 - 1. Seal both ends of the fusion welded seam with vise-grip plate clamps or an extrusion weld; heat may be applied to the seam ends to aid in sealing the seam in conjunction with the clamps but due to the potential hazard of igniting landfill gas, propane torches or any other flame producing device are not allowed.
 - 2. At one end of the seam, insert air pressure needle into the fusion weld channel.
 - 3. Pressurize the channel to 40 psi and maintain pressure for five minutes.
 - 4. Release air from the opposite end of the seam to verify that the entire length of the fusion weld channel was pressurized.
 - 5. If channel pressure is not maintained with a maximum allowable pressure loss of two psi over the five-minute test period or does not stabilize at all, locate the defective area, isolate it, and repeat air pressure test procedures in each direction from the defective area.
- D. Verify that the Installer maintains air-pressure test logs on which are recorded seam numbers, beginning and ending air pressures, beginning and ending test times, lengths of tested seam, defective areas found, and confirmation of repair.
- E. Record the following air-pressure testing information on the GML Deployment/Welding Log:

Note: The abbreviations in parenthesis following each verification procedure are used on the GML Deployment/ Welding Log

 - 1. Air-Pressure Test (AP). Seam number tested, start time of the air pressure test and initial air pressure (psi), termination time of the air pressure test and ending air pressure (psi), and length of seam or portion of seam successfully tested.
- F. Verify that the entire length of each extrusion welded seam and repair is vacuum tested by the Installer in accordance with the following procedures, with a vacuum pump capable of

generating and maintaining 30 inches of mercury and equipped with a clean view window, regulator, and vacuum gauge accurate to one psi:

1. Saturate the extrusion weld with a soap and water solution.
 2. Place view box over the saturated weld, create an air tight seal, and apply vacuum in the box.
 3. Maintain the vacuum for 15 seconds and examine weld for forming bubbles which indicate leaks; mark detected leaks for follow-up extrusion weld repair and retest detected leaks after repair to verify that the leaks were successfully repaired.
- G. Verify that the Installer maintains vacuum test logs on which are recorded repair numbers, vacuum test dates, and vacuum test results.
- H. Record the following vacuum testing information on the GML Repair Log.
- I. Assigned repair number, location and description of repair, vacuum test dates, and vacuum test results.

3.6 Seam Test Sampling

- A. Determine seam analysis sample locations by the stratified random sampling method. The stratified random sampling method allows random selection of a single sewn analysis sample location anywhere within the required 500-lineal feet sampling interval required in the technical specifications. In coordination with the Installer, perform the following seam analysis sampling procedures.
1. Seam analysis samples will be 12-inches wide by 36-inches long with the weld centered down the length of the sample. Samples sizes may be modified at the request of the Installer or CQA Officer. Cut one one-inch specimen from each end of the sample, and field test specimens for peel adhesion in accordance with the Technical specifications. If these specimens pass the field peel test, submit sample for laboratory seam analysis. If either of the specimens fail the field peel test, perform Faded Seam Analysis Procedures in accordance with Section 3.08 of this Section.
 2. Divide the sample into equal two sections, submit one Section for seam analysis and archive storage the second section.
 3. Installer may obtain and test any seam analysis sample at its option.
 4. Repair sample holes and vacuum test repair in accordance with Section 3.04 of this Section.
- B. Based on the seam analysis sampling method of attributes, the CQA Officer may decrease or increase the 500-foot sampling interval based on the following control chart of passing percentages of seam analysis results.

Percent Of Passing Seam Analysis	Sampling Modifications
100	Decrease sampling interval to 1000 lf.
90 - 100	Decrease sampling interval to 750 lf.
60 - 90	Maintain sampling interval at 500 lf.
30 - 60	Increase sampling interval to 250 lf,

Note: Sampling modifications will be considered only after 20 percent of seam analysis is completed.

3.7 Laboratory Testing

- A. Laboratory seam analysis will be performed at the Geosynthetics Testing Laboratory, which is independent of the GML Manufacturer and Installer, and will be performed in accordance with the following procedures.
 - 1. Seam analysis will include peel adhesion and bonded seam strength (ASTM D 6392). Five specimens will be tested for each method.
 - 2. Both sides of fusion welded seams will be tested for peel adhesion.
 - 3. All five of the specimens must meet the Fail Criteria specified in the technical specifications.
- B. Acceptance of the welded GML seams will be based on the results of laboratory seam analysis.
- C. Allow the Geosynthetics Testing, Laboratory 24 hours to complete seam analysis after submission of the samples.

3.8 Failed Seam Analysis Procedures

- A. In coordination with the Installer, perform the following quality assurance verification procedures in the event of a seam analysis sample failure determined by either field testing or laboratory seam analysis.
 - 1. Track the welded seam 10 feet in both directions away from the failed seam analysis sample location. Cut a small 12-inch wide by 12-inch long sample from each location. Cut one one-inch specimen from each end of the sample, and field test specimens for peel adhesion in accordance with Part 3.01 of this Section. If these specimens pass the field peel test, submit a 12-inch wide by 18-inch long re-test sample from both locations for laboratory seam analysis. If either of the specimens fail, the field peel test at either location, continue tracking the welded seam at 10-foot intervals until specimens successfully pass the field peel tests and a sample can be submitted for laboratory seam analysis. If specimens continually fail field peel tests at 10-foot intervals, the entire seam or portion of the welded seam will be repaired at the discretion of the CQA Officer.
 - 2. Verify that the failed length of seam is repaired with an 18-inch wide extrusion welded cap strip. Tack and extrusion welding the leading flap of the fusion welded seam is not permitted. Verify that the extrusion welded cap strip is vacuum tested in accordance with the technical specifications.
 - 3. If the re-test sample fails laboratory seam analysis, repeat the above procedures.
- B. Sample extrusion welded cap strips exceeding 100 feet in length for seam analysis.

END OF SECTION

CQA SECTION 13002

GEOTEXTILE

PART 1 - GENERAL

1.1 Summary

- A. The CQA Officer shall perform CQA procedures as outlined in this Section and follow guidelines for monitoring and testing to verify and document that geotextile materials and installation are in compliance with the Drawings and Specifications.

1.2 Submittals

- A. Collect three copies of each submittal listed in the Specifications
- B. Verify compliance with the submittal schedule and update Submittal Log
- C. Perform submittal review and approval procedures in Section 01300-1.03

1.3 Transport and Storage

- A. Upon delivery of the geotextile rolls to the site, verify that the rolls have been transported with opaque protective coverings and within a closed trailer.
- B. During unloading of the geotextile rolls at the site, perform the following procedure:
 - 1. Obtain a copy of the packing list
 - 2. Complete the Geotextile Delivery and Control Log for each shipment and attach a copy of the packing list. The Geotextile Delivery and Control Log documents the following:
 - a. Delivery date
 - b. Roll numbers
 - c. Batch/lot numbers or production dates
 - d. Roll dimensions
 - e. Receipt of MQC test reports
 - f. CQA conformance test sampling
 - g. Receipt of CQA conformance test results
 - h. Manufacturer and Product Name or Designation
 - i. Name of CQA monitor observing delivery and storage
 - j. Total quantity delivered with each shipment and the cumulative total delivered to date
 - k. Additional notes including rejection of materials, condition of delivered materials, and other materials included with the shipments
 - 3. Obtain written certification from the Supplier that unloading and storage of the geotextile rolls has been done in accordance with the Manufacturer's recommended procedures.
 - 4. Verify that geotextile rolls are transported, unloaded, handled, and stored in a manner that does not damage the geotextile rolls or their protective coverings in accordance with the Manufacturer's recommended procedures and the following requirements:

- a. Nylon or other cloth straps shall be used to unload and handle the geotextile rolls to protect the rolls and their protective coverings from damage.
 - b. The geotextile rolls shall be stacked no more than five rolls high and with a three-foot wide access path between the stacked rows.
5. Verify that damaged protective coverings are repaired or replaced.
 6. Identify and separate damaged or rejected geotextile rolls.
 7. If CQA conformance test sampling, in accordance with Part 2.03C, is to be performed during delivery to the site, determine which geotextile rolls will be sampled by either individual roll numbers, batch/lot numbers, or production dates and position the rolls for convenient sampling.

PART 2 - PRODUCTS

2.1 Geotextile

- A. Verify that geotextiles of each type meets the applicable product requirements of the Specifications.

2.2 Sewing Thread

- A. Verify that sewing thread for geotextiles meets the product requirements of the Specifications.

2.3 Conformance Testing

- A. Conduct sampling for CQA conformance testing at the site upon delivery or at the manufacturing plant prior to shipment and delivery to the site.
- B. For every 100,000 square feet of material delivered to the site, select at least one geotextile roll of each type to sample for CQA conformance testing.
- C. Sample the selected geotextile rolls for CQA conformance testing using the following procedure:
 1. Cut and discard the first three feet of geotextile material from across the entire width of the roll.
 2. Cut the next 18 inches of material from across the entire width of the roll; this section of material is the CQA conformance testing sample.
 3. Assign a CQA test number to the sample and mark the following information directly on the sample with a paint marker:
 - a. Machine direction of the sample
 - b. Manufacturer's roll number
 - c. CQA test number
 4. Immediately re-wrap the sampled geotextile roll with its protective covering; use additional opaque plastic sheeting, if needed, to completely cover the roll.
 5. Complete the Geotextile Test Request and Sample Custody Log and ship samples to the Geosynthetics Testing Laboratory via overnight delivery.

- D. The following CQA conformance tests will be performed by the Geosynthetics Testing Laboratory to verify compliance with the product requirements of the Specifications:
1. Mass Per Unit Area (ASTM D 5261)
 2. Grab Strength (ASTM D 4632)
 3. Trapezoidal Tear Strength (ASTM D 4533) for filter only
 4. Puncture (ASTM D 4833) for filter only
 5. Permittivity (ASTM D 4491) for filter only
 6. Apparent Opening Size (ASTM D 4751) for filter only
- E. Upon completion of CQA conformance testing and receipt of the results, review all results for compliance with the Specifications and report any test results which are not in compliance with the Specifications to the Engineer.
- F. Additional CQA conformance testing or corrective action to be performed in the event of test results which are not in compliance with the Specifications will be determined by the Engineer.

PART 3 - EXECUTION

3.1 Preparation and Examination

- A. Prior to geotextile installation, hold a preparatory meeting in accordance with Section 01039-1.04 of this CQA Plan.
- B. Prior to geotextile installation, verify that all underlying material installation and construction has been completed in accordance with the Specifications.

3.2 Installation

- A. Verify that the geotextile is installed in accordance with Manufacturer's instructions for deployment, seaming, and exposure.
- B. Verify that the geotextile is installed with the machine direction (lengthwise) of the roll oriented down the slope.
- C. Verify that the geotextile is installed with sufficient tension to prevent excessive overlapping, insufficient overlapping, wrinkles, and folds.
- D. Verify that geotextile panels are overlapped with sufficient material to create a prayer fold for sewing.
- E. Verify that the geotextile is adequately ballasted during installation and until geotextile is covered with the overlying material.
- F. Verify that the geotextile is permanently anchored as shown on the Drawings when installation is complete.
- G. Verify that geotextile damaged during installation is removed and/or repaired with a sewn patch.
- H. Verify that terminal ends of geotextile, where the type and purpose of the geotextile changes as shown on the Drawings, are overlapped a minimum of four feet.

- I. Verify that when cutting any geotextile above the GML, the Installer uses a knife with a hooked blade.
- J. Verify that the underlying soil subgrade or installed geosynthetics are not damaged by geotextile installation equipment or methods and that any damaged soil subgrade or installed geosynthetics are completely repaired in accordance with the requirements of the applicable section of the Specifications.
- K. Verify that rocks, excessive dust, excessive moisture or other matter that could cause damage, hamper sewing operations, or clog the geotextile are not trapped under the geotextile or within the overlap.

3.3 Seaming and Repair

- A. Verify that all seams are sewn unless an alternate seaming method is allowed by the Engineer based on the Installer's demonstration of the alternative acceptability.
- B. Verify that overlaps are clean and free of soil materials which could adversely affect sewing operations.
- C. Verify that a prayer fold is made within the overlap prior to sewing.
- D. Verify that a continuous 401 two-thread chain stitch is used to sew the prayer fold.
- E. Verify that damaged geotextile is removed entirely and replaced or repaired in accordance with the following guidelines:
 - 1. Repair (patching) material shall be of the same type as the damaged geotextile.
 - 2. Patches shall extend a minimum of 12 inches in all directions beyond the damaged area with the machine direction of the patch aligned with the machine direction of the damaged geotextile.
 - 3. Patches shall be seamed using the same method used for seaming the damaged geotextile.

END OF SECTION

Appendix E.

Biological Monitoring Plan



Biological Monitoring Plan 2015 Removal Action

Monte Cristo Mining Area Mt. Baker-Snoqualmie National Forest Snohomish County, Washington

April 2015



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**Biological Monitoring Plan
2015 Removal Action
Monte Cristo Mining Area Removal Action
Mt. Baker-Snoqualmie National Forest
Snohomish County, Washington**

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Report Date: April 2015

Project Number: 2013230047

Submitted By: _____
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CONTENTS

1.0	INTRODUCTION.....	1
1.1	Goals and Objectives	1
1.2	Site Location and Description.....	2
2.0	MONITORING PROCEDURES	4
2.1	Murrelet Terms and Conditions.....	4
2.1.1	Refuse Removal and Monitoring – RPM 1	4
2.1.2	Noise Monitoring – RMP 2.....	4
2.2	Murrelet Conservation Measures.....	5
2.2.1	Equipment Operating Times	5
2.2.2	Dogs in Camp.....	5
2.3	Bull Trout Terms and Conditions	5
2.3.1	Turbidity Monitoring: SFSR Tributaries and Glacier Creek - RPM 3	6
2.3.2	Incidental Take and Reporting – RPM 4	7
2.4	Fish Salvage	7
3.0	DOCUMENTATION.....	7
4.0	SCHEDULING	7
5.0	QUALITY ASSURANCE/QUALITY CONTROL.....	8
6.0	REPORTING	9
7.0	REFERENCES.....	9

FIGURES

- Figure 1. Site Layout Map of Monte Cristo Mining Area
Figure 2. Proposed SFSR Tributary Crossings
Figure 3. Proposed Glacier Creek Crossing & Rainy Mine Access

APPENDICES

- Appendix A. Conservation Measures
Appendix B. Copies of Monitoring Forms/Logs
Appendix C. Turbidity Action Level Flow Chart
Appendix D. Biological Monitoring Plan Schedule

1.0 INTRODUCTION

The United States Department of Agriculture, Forest Service (Forest Service) retained Cascade Earth Sciences (CES) to complete an access route for equipment access to the Monte Cristo Mining Area (MCMA) located in the Mt. Baker-Snoqualmie National Forest of Washington. The access route is a component of the Non-Time-Critical Removal Action (RA), which will be completed to address metal contamination of soil, sediment, and water from the MCMA. The RA will be performed for the Forest Service under the Comprehensive Environmental Response and Liability Act (CERCLA) cleanup authorities [42 USC 9604(a) and 7 CFR 2.60(m)] and Federal Executive Order 12580. The RA will be implemented in accordance with the provisions of National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR 300.415(b)(4)(i); and utilizing the U.S. Environmental Protection Agency (EPA) “*Guidance on Conducting Non-Time-Critical Removal Actions under CERCLA*” (EPA, 1993).

The access route and RA necessitated Section 7 Consultation under the Endangered Species Act (ESA). Consequently, the U.S. Fish and Wildlife Service (USFWS) prepared a Biological Opinion (BO) to address potential effects of the RA on the northern spotted owl (*Strix occidentalis caurina*), marbled murrelet (*Brachyramphus marmoratus*), bull trout (*Salvelinus confluentus*), and designated critical habitat. The BO and concurrence indicated the proposed RA "is not likely to jeopardize" the northern spotted owl, marbled murrelet, or the bull trout and "is not likely to destroy or adversely modify" designated critical habitat for these species. Moreover, the concurrence identified insignificant and discountable effects to grizzly bear (*Ursus arctos horribilis*) and gray wolf (*Canis lupus*) (USFWS, 2011). However, Section 9 of the ESA prohibits the “take” of specimens identified as threatened or endangered species. Thus, a provision of the BO recognized Terms and Conditions (T&Cs) and Conservation Measures needed to implement Reasonable and Prudent Measures (RPMs) to monitor conditions for minimization of incidental take of marbled murrelet (murrelet) and bull trout.

In 2013, CES oversaw the development of the MCMA Access Route from the Mountain Loop Highway (Forest Road [FR] 20) at Mowich Camp to the Mine to Market Road (former Snohomish County Road) near Haps Hill. The segment from the Mountain Loop Highway to the connection with the former County Road consisted of approximately 1.6 miles of new development, including construction of 3 temporary log-stringer bridges, and approximately 1.0 miles of clearing/repair to the former Python logging road (FR 4716). The temporary log-stringer bridge at the first crossing was replaced with the permanent structure in early October 2013.

Proposed work in 2014 includes replacement of temporary log-stringer bridges with permanent structures; development of a new Level II road to access the Mountain Loop Highway; and installation of three monitoring wells at the repository to monitor groundwater conditions. The majority of the RA will be completed in 2015, and will include construction of the repository; development of an access route to the Rainy Mine; consolidation of waste materials in the repository; and reclamation.

1.1 Goals and Objectives

The four primary goals for the 2015 RA are as follows:

1. Construct an approximate two-acre permanent onsite repository for consolidation of contaminated waste rock and tailings. The onsite repository will be completed entirely outside murrelet habitat.
2. Complete approximately 2,900 feet of roadway from the Monte Cristo Campground to the Rainy Mine north of Glacier Creek. The new route will allow removal of waste rock from the mine without developing a second crossing across Glacier Creek. The new route will be completed entirely outside murrelet habitat.
3. Conduct an RA in the Lower Glacier/Townsite area to minimize exposure to contaminated media and contaminant loading to the South Fork Sauk River (SFSR), Glacier Creek, and Seventysix Gulch. Performance of the 2015 fieldwork for the RA will result in the excavation and transport of

contaminated media from abandoned mines, processing facilities, haulage ways, terminals, assay shack, and waste rock piles from the Lower Glacier Creek/Townsite areas to the onsite repository. In addition, waste rock removal will be accomplished at the Pride of the Woods Mine in the Henry M. Jackson Wilderness and adit diversion activities will occur at the Mystery and Justice Mines. The RA is expected to be completed during the summer months in 2015.

4. Reclaim and revegetate areas disturbed during the RA. This includes the repository, borrow area, Townsite features, the Pride of the Woods Mine, the Rainy Mine access route, and disturbed areas.

This Monitoring Plan (Plan) provides a framework for outlining procedures to conduct the field activities necessary to achieve compliance of the T&Cs documented in the BO and comply with standard Washington State Hydraulic Permit Activity guidance (Washington Administrative Code [WAC] 220-110 and Revised Code of Washington [RCW] Chapter 77.55). The Plan also incorporates elements of EPA's Green Remediation Best Management Practices: Mining Sites (EPA, 2012) and EPA's suite of green remediation best management practices (BMPs) to limit the environmental footprint of the project. The plan generally follows the scope and purpose of the Memorandum of Understanding (MOU) between the Washington Department of Fish and Wildlife (WDFW, 2012), and integrates the substantive aspects of the MOU as an advisory supplement to the non-discretionary BO T&Cs.

The Plan addresses the following RPMs for murrelet and bull trout.

Murrelet

- RPM 1- Minimize the magnitude and likelihood of take to murrelets. This will require refuse management/removal during and after fieldwork in murrelet habitat.
- RPM 2 - Monitor the nature and extent of activities that are likely to result in incidental take or adversely affect murrelets through habitat impacts. This will be accomplished by conducting sound level recordings when heavy equipment is used in murrelet habitat during the nesting season.

Bull Trout

- RPM 3 - Minimize, monitor, and report on incidental take resulting from suspended sediment concentrations generated by stream crossing installation and removal. This will entail turbidity level monitoring upstream and downstream of the Concentrator crossing (milepost [MP] 5.0) in Glacier Creek during the RA in 2015.
- RPM 4 - Minimize and report on incidental take resulting from increased substrate embeddedness downstream of stream crossings. This RPM requires removal of the Glacier Creek crossing no later than August 31, appropriate channel restoration, and reporting.

Conservation Measures proposed in the BO will be performed in conjunction with the T&Cs for exemption from the prohibitions of Section 9 of the ESA. With the exception of the timing of heavy equipment during murrelet nesting season (see Section 2.2), these measures are generally considered BMPs, and are primarily not addressed in this Plan. However, CES has included a discussion of the Conservation Measures in Appendix A for reference and expects onsite contractors to abide by these provisions.

1.2 Site Location and Description

The MCMA is located in the Mt. Baker-Snoqualmie National Forest, Darrington Ranger District, in Snohomish County, Washington (Figure 1). The Townsite is situated approximately 28 air miles east-southeast of Granite Falls, Washington, which is about 9.5 miles east of Marysville, Washington. The project area includes the 2 tributary crossings at MP 1.03 and 1.29, repository, Townsite, Glacier Creek crossing, and MCMA mines/features.

The aforementioned project areas are located as follows:

- **Log-stringer bridge at MP 1.03:** elevation of 2,330 feet above mean sea level (amsl); Section (Sec) 7 of Township (T) 29 North (N), Range (R)11 East (E) of the Willamette Meridian (WM), latitude 48° 01' 20.66" N, longitude 121° 26' 20.39" W. The bridge is located inside murrelet critical habitat and over a tributary of the SFSR within the range of listed bull trout.
- **Log-stringer bridge at MP 1.29:** elevation of 2,320 feet amsl; Sec 7 of T29N, R11E of the WM, latitude 48° 01' 05.67" N, longitude 121° 26' 17.27" W. The bridge is located inside murrelet critical habitat and over a tributary of the SFSR within the range of listed bull trout.
- **Repository:** elevation of 2,600 feet amsl; Secs 16 and 21 of T29N, R11E of the WM, latitude 47° 59' 33.80" N, longitude 121° 24' 18.39" W. The repository is located outside murrelet critical habitat, but upslope of the SFSR within the range of listed bull trout.
- **Glacier Creek Crossing near Concentrator:** elevation of 2,830 feet amsl; Sec 21 of T29N, R11E of the WM, latitude 47° 59' 08.75" N, longitude 121° 23' 23.06" W. The crossing is located outside murrelet critical habitat, but over Glacier Creek within the range of listed bull trout.
- **MCMA Mines/Features**
 - **Rainy Mine:** elevation of 2,900 feet amsl; Sec 22 of T29N, R11E of the WM, latitude 47° 59' 02.95" N, longitude 121° 22' 59.84" W. The mine is located outside murrelet critical habitat, but adjacent to Glacier Creek within the range of listed bull trout.
 - **Ore Collector:** elevation of 2,970 feet amsl; Sec 22 of T29N, R11E of the WM, latitude 47° 59' 01.52" N, longitude 121° 23' 03.46" W. The collector is located outside murrelet critical habitat, but adjacent to Glacier Creek within the range of listed bull trout.
 - **Concentrator:** elevation of 2,890 feet amsl; Sec 21 of T29N, R11E of the WM, latitude 47° 59' 04.15" N, longitude 121° 23' 20.26" W. The concentrator is located outside murrelet critical habitat, but adjacent to Glacier Creek within the range of listed bull trout.
 - **Assay Shack:** elevation of 2,960 feet amsl; Sec 21 of T29N, R11E of the WM, latitude 47° 59' 02.66" N, longitude 121° 23' 23.77" W. The assay shack is located outside murrelet critical habitat and is situated on a flat area upslope from the floodplain of bull trout-bearing streams.
 - **Comet Tram Terminal and Haulage Ways:** includes an approximately 2,500-foot-long surface network of primitive roadways (1,800 feet) and railroad (700 feet) utilized to transport ore from the Ore Collector to the Concentrator and Concentrator tailings area, and that also includes the roadway to the Assay Shack. The haulage ways are outside murrelet critical habitat and primarily upslope of the floodplain of bull trout-bearing streams.
- **Pride of the Woods Mine:** elevation of 4,400 feet amsl; Sec 23 of T29N, R11E of the WM, latitude 47° 59' 02.66" N, longitude 121° 23' 23.77" W. The mine is located outside murrelet critical habitat and bull trout habitat in Glacier Creek.
- **Justice Mine:** elevation of 3,800 feet amsl; Sec 22 of T29N, R11E of the WM, latitude 47° 58' 53.30" N, longitude 121° 22' 34.38" W. The mine is located outside murrelet critical habitat and is well upslope of bull trout habitat in Glacier Creek.
- **Mystery Mine (Adit #3):** elevation of 4,015 feet amsl, Section 22 of T29N, R11E of the WM, latitude 47° 58' 52.43" N, longitude 121° 22' 12.48" W. The mine is located outside murrelet critical habitat and is well upslope of bull trout habitat in Glacier Creek.

2.0 MONITORING PROCEDURES

Monitoring activities for the installation of the permanent log-stringer bridges are expected to commence upon mobilization of equipment in 2015. CES intends to use field test kits and in-situ monitors for turbidity screening, as a BMP to eliminate the need for off-site laboratory analysis. Monitoring for specific T&Cs will occur within, or will overlap with other T&Cs in several phases of the bridge construction and RA, as described below.

2.1 Murrelet Terms and Conditions

According to the Biological Assessment (BA) prepared by the Forest Service (2010), the project area is within a murrelet Critical Habitat Unit (CHU WA-09-b), which includes the Independence Late Successional Reserve (LSR 116) (Figure 2). The serial age class for these acres provided a total 90% of the CHU acres in old forest stands, which is an approximation of suitable murrelet nesting habitat for this CHU. Murrelet detections have been documented from Barlow Pass to Weden Creek, although the CHU boundary extends approximately 1.5 miles upstream (southeast) from the Weden Creek confluence with the SFSR to about Silvertip Campground.

The USFWS has determined the level of anticipated take is not likely to result in jeopardy to the murrelets or result in the destruction or adverse modification of critical habitat for the murrelet. However, exemption from the prohibitions of Section 9 of the ESA requires the Forest Service to comply with RPMs described in the BO, which for the murrelet, include the following:

- RPM 1: Minimize the magnitude and likelihood of take to murrelets.
- RPM 2: Monitor the nature and extent of activities likely to result in incidental take or adversely affect murrelets through habitat impacts. Report the results of such monitoring.

2.1.1 Refuse Removal and Monitoring – RPM 1

The BO requires monitoring and removal of refuse as a T&C of RMP 1. Monitoring/removal must occur during the seasonal fieldwork period and for 2 years after, at least once every 45 days during the snow-free period of the murrelet nesting season. Based on the critical habitat mapping data provided in the BA, the extent of refuse removal and monitoring will span from the Mountain Loop Highway to about Silvertip Campground.

CES intends to employ good customary solid waste practices throughout the RA, so that garbage is managed and removed from the entire project site, including areas outside the CHU. On-site personnel will also include a discussion of refuse removal and management with the contractor during all health and safety meetings conducted for the 2015 field activities. In addition, CES will confirm the contractors employ effective sanitation practices for proper disposal of food and garbage that could attract corvids (i.e., crows and ravens) and increase the possibility of predation on nesting murrelets and/or juveniles.

The second and third year of monitoring for refuse is scheduled to occur during the nesting season (April 1 to September 15), or from the beginning of the snow-free period, to the September 15 cutoff in 2015 and 2016. CES personnel will inspect the access route alignment within the CHU during this nesting window to collect and remove refuse. Garbage collected during this period will also be recorded and documented in daily diaries when removed.

2.1.2 Noise Monitoring – RMP 2

Noise monitoring is a compulsory T&C under RPM 2 due to potential increased levels of sound and human activity into the project area that may cause disturbance to murrelets. As discussed in Section 2.1, the CHU extends from the Mountain Loop Highway to the south and east to about the Silvertip Campground.

The BO requires noise levels be measured in suitable murrelet habitat at a distance of 45 yards from access route work at 2 locations over 3 days while heavy machinery is operating. Noise levels of 92 decibels (dB) or greater can result in negative effects to murrelets by causing an adult to flush from its nest during food delivery, resulting in a missed feeding opportunity for a fledgling.

The majority of RA activities are anticipated to be completed outside mapped murrelet habitat. During work completed within the murrelet CHU, CES staff will utilize a handheld digital sound level meter, as stipulated in the BO. If sound levels over 92 dB are recorded at 45 yards, CES will estimate the distance out to which 92 dB sound levels extend. Noise level data will be incorporated in the annual monitoring report presented to the Forest Service and USFWS in January 2016. Copies of noise level recording forms are included in Appendix B.

2.2 Murrelet Conservation Measures

The BO includes a list of Terrestrial Conservation Measures intended to minimize potential impacts to terrestrial species. These measures are not T&Cs of the BO. The second conservation measure listed in the BO, limits activities using heavy equipment and other noise-generating equipment that will occur between April 1 and September 15, to a time window between two hours after sunrise and two hours before sunset.

2.2.1 Equipment Operating Times

Approximately 90% of feedings by adult murrelets occur within 2 hours of sunrise and sunset (USFWS, 2011). As discussed, the second Terrestrial Conservation Measure listed in the BO recommends activities using heavy equipment and other noise-generating equipment transpire outside these feeding windows. Based on this, any activities using heavy equipment and other noise-generating equipment that will occur between April 1 and September 15 in the CHU will only occur between two hours after sunrise and two hours before sunset. CES will check approximate sunrise and sunset times daily from the website timeanddate.com in the event equipment is used in the CHU. As such, the majority of RA work in 2015 will not be subject to the murrelet diurnal equipment operation window. Heavy equipment usage in the CHU will be documented in field notebooks and will be incorporated into the annual monitoring report.

Therefore, these activities will not be subject to the murrelet diurnal equipment operation window.

2.2.2 Dogs in Camp

The BO does not include a discussion of domestic dogs at the campsite or near the MCMA. There are no restrictions in place with regard to dogs at the MCMA and there are no indications dogs would be a nuisance to wildlife near the MCMA. Moreover, the CES field camp will be situated outside mapped murrelet habitat. Regardless, as an additional conservative measure, CES and the subcontractors will not allow dogs in camp during the 2014 and 2015 field seasons.

2.3 Bull Trout Terms and Conditions

The USFWS concluded the level of anticipated take is not likely to result in jeopardy to the bull trout or result in the destruction or adverse modification of critical habitat for bull trout. However, in order to be exempt from prohibitions of Section 9 of the ESA, the Forest Service must comply with the following RPMs for bull trout:

- RPM 3: Turbidity monitoring at SFSR tributary crossings and in Glacier Creek during sediment generating activities at an 'interim' distance from the crossing that is less than the full extent of take.
- RPM 4: Minimize and report on incidental take resulting from increased substrate embeddedness downstream of stream crossings.

2.3.1 Turbidity Monitoring: SFSR Tributaries and Glacier Creek - RPM 3

The temporary log-stringer crossing in Glacier Creek at MP 5 in 2015 will necessitate turbidity monitoring. These crossings are depicted on Figures 2 and 3; as well as Sheet C7 of the Work Plan.

CES will use two Campbell Scientific turbidity monitoring stations, including OBS-3+ submersible turbidity probes and CR200x dataloggers, to monitor in-situ turbidity in the stream crossings during fieldwork. The turbidity sensors will be serviced and calibrated in accordance with the manufacturer's instructions. A probe will be deployed at "interim" distances downstream from the crossing, and a probe will be placed just upstream upstream of the crossing to document in-situ turbidity readings at 15-minute intervals. The two probes will each have a continuous datalogger situated on the bank to collect readings. In-situ turbidity readings at the temporary Glacier Creek crossing will commence about July 1, 2015 and will finish about two weeks after the August 31, 2015 bridge removal date specified in the BO.

In addition to the continuous turbidity monitoring, a portable LaMotte Model 2020 Turbidimeter will be used to collect grab samples. CES will collect background turbidity measurements with the LaMotte Turbidimeter from the crossings prior to the start of work to establish baseline conditions, which will be monitored upstream from sediment-generating activities at 10:00 a.m. and 3:00 pm daily. If a noticeable change in background turbidity is observed, additional measurements will be collected.

CES will initiate monitoring in the morning, prior to the start of work activities for each crossing, and will continue for 30-minute intervals during expected peak turbidity periods. If the turbidity measured during three consecutive 30-minute intervals are less than 12.1 nephelometric turbidity units (NTUs) above background, monitoring will continue during the remainder of the workday at a frequency of once every three hours, or if there is a noticeable increase in turbidity.

In the event turbidity measurements exceed the 12.1 NTU threshold above background, monitoring will occur over the full extent of take downstream of the sediment generating activities. Monitoring will be completed at these locations at 30-minute intervals until turbidity measurements fall below 12.1 NTUs over background. The interim distances and full extent of take for the crossings are described in the table below.

Table 1. Stream Crossing Monitoring Site

Stream Station	Distance from Mountain Loop Hwy (miles)	Interim Distance	Distance from SFSR Confluence (feet)	Bull Trout Presence	Structure
Concentrator Crossing	~ 5	300	~ 1,200	Yes	Log-stringer

If turbidity measurements at the full extent of take exceed the authorized amount under the incidental take statement described below, sediment-generating activities will cease, and CES will notify the Forest Service and USFWS of the exceedance.

- 12.1 NTUs above background for more than 7 hours cumulatively over any 10-hour work day
- 22.9 NTUs above background for more than 3 hours cumulatively over any 10-hour work day
- 54.8 NTUs above background for more than one hour continuously
- 81.3 NTUs above background at any time

Data from the in-situ meter will be imported at least every other week and will be recorded on CES field forms to ensure validity. The raw data will be included as an appendix in the annual monitoring report. Turbidity data from the temporary Glacier Creek crossing activities will be included in the annual monitoring report presented to the Forest Service and USFWS in January 2016. A copy of the turbidity monitoring form is included in Appendix B. The turbidity Action Level Flowchart is included in Appendix C.

2.3.2 Incidental Take and Reporting – RPM 4

The T&Cs outlined under RPM 4 in the BO are primarily BMPs that include removal of the Glacier Creek crossing by August 31. A discussion of these BMPs is presented in Appendix A. Monitoring report specifications, including photographic documentation, are presented in Section 6.0.

2.4 Fish Salvage

Fish salvage efforts are discussed in the BO, although they are not presented as an RPM or a specific Conservation Measure. According to the BO, the Forest Service will lead fish salvage efforts in the SFSR tributaries and Glacier Creek. CES will notify the Forest Service prior to all work activities at tributaries and within Glacier Creek. It is expected the Forest Service will provide documentation of these efforts to incorporate into the annual monitoring reports.

3.0 DOCUMENTATION

Field logbooks, data forms, sketches and maps, and photographs will be used to document field activities and data collection. Refuse monitoring and heavy equipment usage will be documented in daily diaries. Other information generated from monitoring activities will be documented on the appropriate forms, which include the following:

- Noise level log
- Turbidity monitoring form
- Field notebooks
- Location sketches

All field records and digital files will be maintained in a project archive. Some operations, such as selection of noise sampling locations, will be based on equipment usage and will be determined in the field during bridge placement activities.

4.0 SCHEDULING

As discussed, monitoring for specific T&Cs will occur within, or will overlap with other T&Cs in several phases of the log-stringer bridge construction and the RA. The tentative schedule and milestones are included in the Gantt chart in Appendix D and are outlined below. This schedule is subject to change based on field conditions and contract authorizations.

2015 Removal Action

- April 15 – October 7, 2015: Refuse monitoring and removal in CHU (every 45 days)
- May 8 – June, 9, 2015: Repository subgrade excavation and stockpile cover material
- May 20, 2015: Groundwater sampling at repository

- June 1 – 26, 2015: Removal Action at the Pride of the Woods Mine
- June 27 – July 1, 2015: Adit diversion at the Justice/Mystery Mines
- July 2 – 4, 2015: Implementation of access route to Rainy Mine
- July 5 – 17, 2015: Removal Action at Rainy Mine
- July 5 – 15, 2015: Installation of temporary log-stringer crossing in Glacier Creek
- July 1, 2015: Place in-situ turbidimeters in Glacier Creek
- August 1 – 31, 2015: Removal Action at Concentrator, Assay Shack, Comet Terminal, Haulage Ways, and Ore Collector
- August 31, 2015: Removal of temporary crossing at Glacier Creek
- September 1 – 22, 2015: Repository closure and final cover construction
- September 15, 2015: Remove in-situ turbidimeter in Glacier Creek
- September 15 - 19, 2015: First post-RA aquatic sampling event
- September 20, 2015: Groundwater sampling at repository
- January 10, 2016: Submittal of draft 2015 annual monitoring report to Forest Service
- January 31, 2016: Submittal of final 2015 annual monitoring report to USFWS

2016 Post Removal Action

- April 1 – September 15, 2016 : Refuse monitoring in CHU (every 45 days)
- April 1, 2016 (or following snowmelt): Commence any remaining cleanup activities for RA (if necessary)
- May 20, 2016: Groundwater sampling at repository
- June 20-25, 2016: Second post-RA sampling event
- September 10-15, 2016: Third post-RA sampling event
- September 20, 2016: Groundwater sampling at repository
- January 10, 2017: Submittal of draft 2016 annual monitoring report to Forest Service
- January 31, 2017: Submittal of final 2016 annual monitoring report to USFWS

5.0 QUALITY ASSURANCE/QUALITY CONTROL

The purpose of the Quality Assurance/Quality Control (QA/QC) component of the Plan is to establish guidelines necessary to provide information that is representative of field conditions. The following standards will be maintained during monitoring activities so the data generated meet data quality objectives.

Field observations and activities, and sample locations will be logged in field books or data forms compiled by on-site personnel. Daily diaries will include a description of all persons entering and leaving the work area, daily start and completion times, and any problems that were encountered. Photographs will be taken to document sampling and other fieldwork activities.

Equipment used for data collection will include Campbell Scientific turbidity monitoring stations, including OBS-3+ submersible turbidity probes and CR200x dataloggers, portable LaMotte Model 2020 Turbidimeter, and a Radio Shack handheld digital sound level meter. The meters will be operated, calibrated, and maintained by trained CES personnel in accordance with manufacturer's specifications. All calibration and maintenance efforts will be documented in daily diaries. In the event of equipment failure, CES will take the meter out of use until the unit can be properly repaired or the unit can be demonstrated to operate within the performance guidelines.

6.0 REPORTING

CES will prepare an annual monitoring report following each year of fieldwork until project completion, as outlined in the incidental take statement [50 CFR 402.14(i)(3)]. The report will include documentation of the compulsory tasks under the T&Cs and impacts to species. The monitoring report will include the following:

- Dates and times of work activities and heavy equipment usage.
- Monitoring results, sample times, locations, measured turbidities and noise levels, and documentation of refuse management and disposal.
- Summary of work activities and measured turbidities/noise levels during those activities.
 - The summary will include four photographs from each crossing before work has begun and four photographs from each crossing after work is complete. The photographs will face the crossing from upstream, downstream, the right bank, and the left bank.
 - The summary will also include documentation of obvious signs of channel bed or bank instability (e.g., headcutting) resulting from the work, any additional actions taken to correct this instability, and the final condition of the work area.
- Summary of corrective actions taken to reduce turbidity and/or noise levels.
- A qualitative description of the final disposition of the working area.
- Incidental take from suspended sediment levels generated during stream crossing installation and removal.
- Incidental take from increased substrate embeddedness downstream from the crossings.
- Documentation of dates of refuse monitoring and removal.
- Deviations from the work plan, and concurrence from the Forest Service and USFWS for the deviation(s).

Annual monitoring reports are due to the Forest Service by January 31 of the year following route development. Based on this, CES will submit a draft report to the Forest Service for review by January 10 of each year. The reports will include all documentation, including photographs, forms, logs, and maps of the RPMs employed for the work activities.

7.0 REFERENCES

EPA, 1993. Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA. EPA Publication 9360.0-32, Office of Emergency and Remedial Response. Washington, D.C.

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- Forest Service, 2011. Mount Baker-Snoqualmie National Forest, Monte Cristo CERCLA Project Botanical Specialist's Report, Ann Risvold, North Zone Botanist.
- USFWS, 2011. Endangered Species Act Section 7 Consultation; Biological Opinion, Monte Cristo CERCLA Project. U.S. Fish and Wildlife Service Reference: 13410-2011-F-0067. Washington Fish and Wildlife Office, Lacey, Washington.
- USGS, 1982a. 7.5 Minute Topographic Map, Bedal, Washington. U.S. Geological Survey, Washington, D.C.
- USGS, 1982b. 7.5 Minute Topographic Map, Monte Cristo, Washington. U.S. Geological Survey.
- WDFW, 2012. Memorandum of Understanding Between Washington State Department of Fish and Wildlife and USDA Forest Service, Pacific Northwest Region Regarding Hydraulic Projects Conducted by USDA Forest Service, Pacific Northwest Region. Cooperator Agreement Number 11-1949. Washington Department of Fish and Wildlife, Olympia, Washington.

FIGURES

- Figure 1.** Site Layout Map of Monte Cristo Mining Area
- Figure 2.** Proposed SFSR Tributary Crossings
- Figure 3.** Proposed Glacier Creek Crossing & Rainy Mine Access

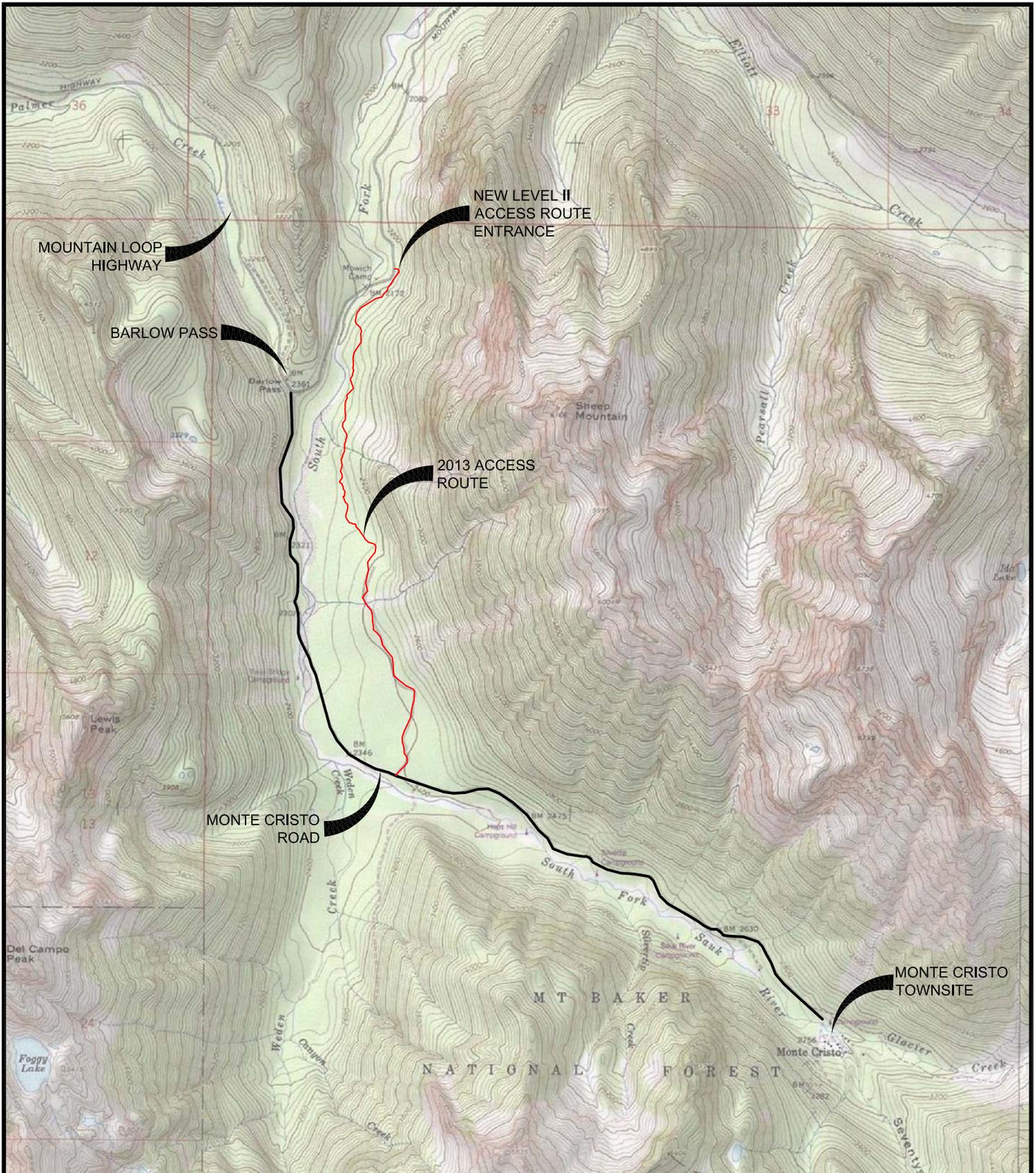
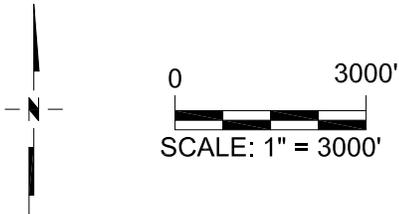


Figure 1. Site Layout Map of Monte Cristo Mining Area



(Source: USGS Topographic Map from ESRI ArcGIS10, ©2013 ESRI)

PROJECT NUMBER: 2013230047	Monte Cristo Mining Area Removal Action Workplan
DATE: 3/4/2014	USDA Forest Service Mt. Baker-Snoqualmie National Forest Snohomish County, Washington
DWG NO: 2013230047 F1 BM.dwg	 CASCADE EARTH SCIENCES A Valmont Industries Company
DWG BY: 6RKB PROJECT MANAGER: 6DGW	
REVISED:	

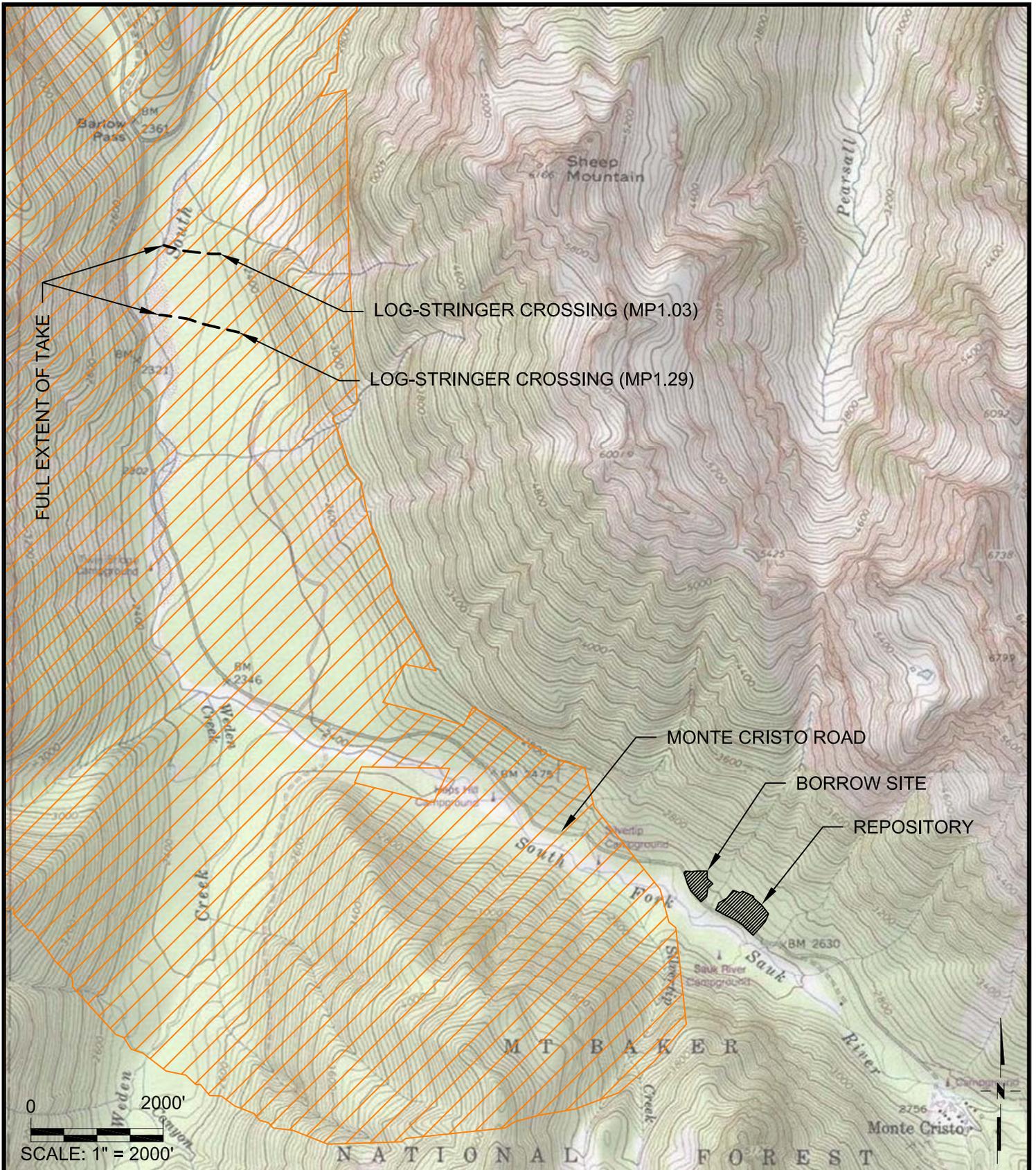


Figure 2. Proposed SFSR Tributary Crossings

EXPLANATION:

-  MARBLED MURRELET CRITICAL HABITAT (LSR-116)

PROJECT NUMBER: 2013230047	Monte Cristo Mining Area Removal Action Workplan
DATE: 2/13/2014	USDA Forest Service Mt. Baker-Snoqualmie National Forest Snohomish County, Washington
DWG NO: 2013230047 F2 BM.dwg	 CASCADE EARTH SCIENCES A Valmont Industries Company
DWG BY: 6RKB PROJECT MANAGER: 6DGW	
REVISED:	

(Source: USGS Topographic Map from ESRI ArcGIS10, ©2013 ESRI and U.S. Fish and Wildlife Service Marbled Murrelet habitat October 4, 2011)

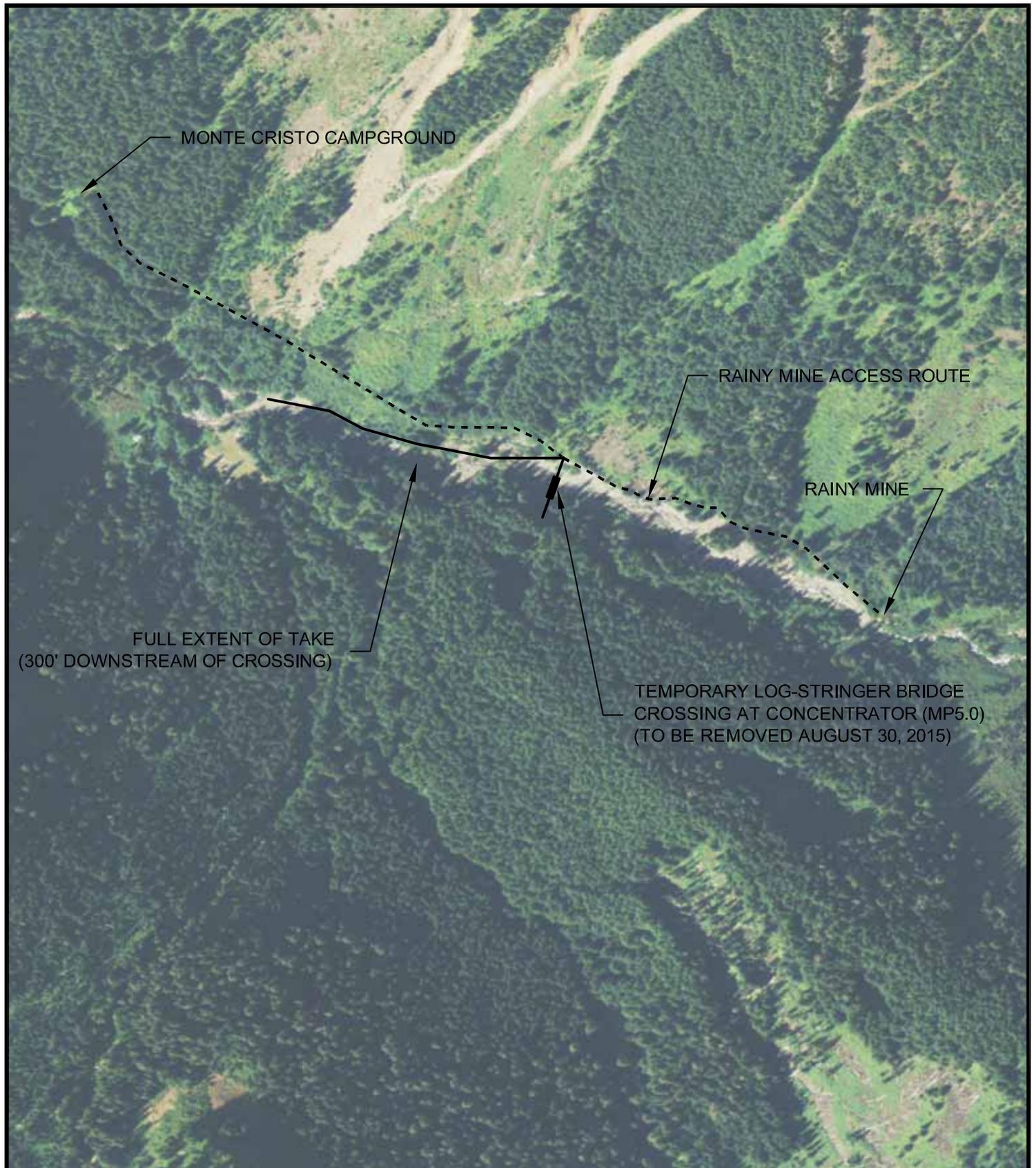


Figure 3. Proposed Glacier Creek Crossing & Rainy Mine Access



(SCALE AND LOCATIONS ARE APPROXIMATE)

(SOURCE: 2013 USDA-FSA-APFO NAIP County Mosaic ORTHO IMAGERY)

PROJECT NUMBER: 2013230047	Monte Cristo Mining Area Removal Action Workplan
DATE: 5/7/2014	USDA Forest Service Mt. Baker-Snoqualmie National Forrest Snohomish County, Washington
DWG NO: 2013230047 F3 BM.dwg	 CASCADE EARTH SCIENCES A Valmont Industries Company
DWG BY: 6RKB	
PROJECT MANAGER: 6DGW	
REVISED:	

APPENDICES

- Appendix A. Conservation Measures**
- Appendix B. Copies of Monitoring Forms/Logs**
- Appendix C. Turbidity Action Level Flow Chart**
- Appendix D. Biological Monitoring Plan Schedule**

Appendix A.
Conservation Measures

APPENDIX A. U. S. FISH AND WILDLIFE SERVICE CONSERVATION MEASURES

The Biological Opinion (BO) prepared by the U.S. Fish and Wildlife Service (USFWS) and Biological Assessment (BA) conducted by the U.S. Forest Service (Forest Service) outlined agreed-upon Conservation Measures in conjunction with Terms and Conditions (T&Cs) and Conservation Recommendations to implement the Reasonable Prudent Measures (RPMs) to be exempt from the prohibitions of Section 9 of the Endangered Species Act (ESA). These Conservation Measures are intended to minimize impacts to terrestrial and aquatic species during construction and the Removal Action (RA).

Terrestrial Conservation Measures

Terrestrial Conservation Measures are provided below along with the proposed or previous enactment of these measures:

- **Blasting will not be used at any point during the proposed action.**

No blasting occurred in 2013 and none will be employed during the improvements in 2014 and RA in 2015.

- **Activities using heavy equipment and other noise-generating equipment that will occur between April 1 and September 15, will only occur between 2 hours after sunrise and 2 hours before sunset.**

To the extent practicable, CES will limit noise-generating equipment use during this window, as discussed in Section 2.1.2 of the Monitoring Plan.

- **The road alignment within engineering plans will be adjusted to minimize the removal of large diameter trees, particularly those that contain possible murrelet nesting platforms. To the extent practicable, the road alignment will follow existing Forest roads, logging roads, an old wagon trail, and other existing features.**

CES has completed the tree felling activities and the nest tree assessment of the 7 trees in excess of 30-inches diameter at breast height (dbh). The access route alignment avoided the majority of potential nest trees in CHU WA-09-b. The former Python logging road (FR 4716) was utilized in its entirety to connect the access route to the former Snohomish County Road at Haps Hill.



The access route avoided the majority of potential nest trees.

- **The “footprint” of the road will be minimized to reduce the removal of trees. The new road will consist of a 14-ft-wide single lane prism with 2-ft-wide ditches on both sides, pullouts for passing, and cut/fill areas in steep terrain.**

CES finished the access route alignment to the former Snohomish County Road at Haps Hill in 2013. The alignment of the access route implemented this Conservation Measure. The USFWS originally estimated 43 trees in excess of 30-inches dbh would be felled for access route implementation. However, only 7 trees in excess of the 30-inch dbh threshold were removed for the alignment.

- **All aquatic activities will follow standard Washington State Hydraulic Permit Activities requirements.**

Construction activities that will use, divert, obstruct, or change the natural flow or bed of state waters will be conducted in a manner that meets the substantive aspects of the HPA. However, since RAs conducted under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) need only comply with these substantive aspects and not the administrative aspects (e.g., permitting), no Joint Aquatic Resources Permit Application (JARPA) will be necessary for the project.

Aquatic Conservation Measures

Aquatic Conservation Measures are outlined below along with the proposed or previous implementation of these measures:

- **To avoid and minimize mobilization and transport of coarse and fine sediments into the active channel:**

- **Water will be diverted around project sites if work is required in the active channel.**

As outlined in the BO, Work area isolation, flow diversion, and partial dewatering are conservation measures intended to reduce the risk of fish stranding and other forms of injury. Substantive aspects of the activities will, to the extent practicable, be completed in accordance with Washington Administrative Code (WAC) 220-110-120; WAC 220-110-080; and Revised Code of Washington (RCW) Chapter 77.55. Since fish may be adversely impacted as a result of the project, the Forest Service will capture and safely move bull trout from the job site to the nearest free-flowing water in general accordance with WAC 110-110-120.

- **Excess material (spoils) will be disposed of properly in uplands to avoid contamination into flowing waters.**

With the exception of the Glacier Creek crossings, it is not expected any excavated materials will be placed into any waterways at the Site. The BO allows for “hundreds to thousands” of yards of fill to be placed in Glacier Creek for the crossings. CES anticipates using temporary log-stringer bridges in Glacier Creek to eliminate the need for fill in the waterway. For all other Site activities, including repository construction, spoils will be placed upland of erosion control features to prevent contamination into flowing waters. Additional details will be provided in the RA Design.

- **Barriers to sediment may include, but are not limited to, straw bales, silt fencing, filter fabric, temporary sediment ponds, check dams of pea gravel-filled burlap bags or other material, and/or immediate mulching of exposed areas.**

Silt fencing with straw waddles anchored on the uphill side of the fences was installed during tree felling activities in 2012, and was reinforced in 2013. Additional sediment barriers were installed at the log-stringer bridges in 2013. These barriers will be inspected in the spring of 2014 to assess effectiveness.

Prior to the 2014 and 2015 field activities, it is expected additional sediment control devices will be installed adjacent to the South Fork Sauk River (SFSR) and tributaries, Glacier Creek, Seventysix Gulch, and minor tributaries to control the migration of sediment into surface water bodies. Further details will be presented in the RA Work Plan, and the design will largely be based on the success of the barriers placed in 2012 and 2013. The location of the sediment control devices will be determined by CES after consultation with the Forest Service On-Scene

Coordinator (OSC). The sediment control devices will be installed in accordance with manufacturer details and specifications and at the direction of CES.

- **Operations during heavy precipitation events will cease until weather conditions improve.**

In 2013, CES stopped work at crossings during heavy precipitation events and reinforced existing sediment control barriers, as necessary. In 2014/2015, work stoppage associated with heavy rainfall events will be assessed and implemented in agreement with the Forest Service OSC. CES will monitor weather forecasts to identify possible heavy precipitation events. If flooding of the work area is expected to occur within 24 hours, soil and sediment control structures in disturbed areas will be examined to ensure they are properly installed for additional runoff. Equipment and materials will also be removed from near-stream construction areas.



Additional silt fencing placed north of tributary crossing following heavy precipitation in August 2013.

Following heavy rainfall events, sediment control structures will be inspected on the uphill side for signs of clogging, barrier to flow, and channelization of flows parallel to the structures. If this occurs, the structures will be replaced or the trapped sediment will be removed.

- **All disturbed ground shall be stabilized using appropriate best management practices, including revegetation with native species.**

All disturbed areas outside the access route will be recontoured and revegetated. Growth media may be added where substrate is inadequate as directed by the Engineer, which is dependent on available growth media onsite. Prior to placement, growth media would be checked with an x-ray fluorescence (XRF) device to document metal concentrations are below the cleanup goal.

Disturbed banks will be revegetated within one year with native or other woody species approved by the Forest Service. It is expected the Forest Service will provide grass and forb seeds. Vegetative cuttings would be planted at a maximum interval of three feet (on center), and maintained as necessary for three years to ensure 80% survival. Design elements of this measure will be included in the RA Work Plan and will be coordinated with the OSC and Forest Service botanist(s) in general accordance with WAC 220-110-070 (2)(h).

- **Wastewater from project activities and water removed from within the work area shall be routed to an area landward of the 100-year floodplain.**

Wastewater generated during construction activities will be routed to an area outside the 100-year floodplain to allow removal of fine sediment and other contaminants prior to being discharged to state waters. Details will be provided in the RA Design. Temporary on-site residency, which will include tents, a cooking and eating area, as well as shower and sanitary facilities, will necessitate on-site storage of wastewater that will be contained and transported offsite for disposal.

- **Disturbed streambeds shall be restored to the natural gradient and bankfull width.**

Design elements of this measure will be included in the RA Work Plan. With the exception of the bridges at three tributary crossings, streambeds will be restored to the overall original condition.

- **Streambanks shall be properly sloped to an angle of stability (natural repose) when removing culverts.**

No culvert removal is anticipated in 2014 or 2015.

- **Measures to protect existing large woody debris already in the stream channel may include:**

- **All non-treated wood will be left in the stream/lake/wetland.**

CES does not intend to remove woody material from Glacier Creek, the SFSR, or wetlands. Placement of permanent log-stringer bridges in 2014 will not likely require any large woody material removal in tributaries. If necessary, logs will be removed in a manner that avoids damage to streambanks and vegetation, and the bank will be restored. Large woody material removal or repositioning will be accomplished in a manner that minimizes the release of bedload, logs, or debris downstream. Large woody replacement will occur downstream of the construction areas where it may provide aquatic habitat.

- **Large woody material removed from a culvert inlet will be put back in the stream, downstream of the culvert.**

CES will place all large woody material removed from culverts downstream from the access route prism to provide aquatic habitat.

- **To avoid/minimize the introduction of chemical contaminants associated with machinery (fuel, oil, hydraulic fluid, etc.) used in project implementation:**

- **Hazardous spill clean-up materials and trained operators will be available on site.**

All personnel who will be performing invasive activities during the RA will be Hazardous Waste Operations and Emergency Response (HAZWOPER)-trained personnel qualified to work in hazardous environments as defined by the Occupational Safety and Health Act (OSHA) 1910.120.

Vehicle use may necessitate a small supply of fuel storage at the Site. A storage area with lined secondary containment will be established at the Site and care will be taken to avoid spills. Refueling will be completed near the fuel storage area, whenever possible. Used materials, including grease, oil, oil filters, antifreeze, cleaning solutions, tires, hydraulic fluid, and transmission fluid will be properly managed by recycling or disposal in an approved off-site facility.

A fuel spill kit will be maintained at the Site with absorbent booms in the event of a spill to a waterway. In the unlikely event of a spill, it will be stopped, contained with sorbent pads or



Fuel storage and lined secondary containment in 2013 at the temporary campsite.

other materials, and recovered. The containment material(s) will be collected and secured for transport offsite and disposal. Spills to state waters would be reported to the following:

- *National Response Center: 1-800-424-8802*
- *Washington Emergency Management Division: 1-800-258-5990 -or- 1-800-OILS-911*

○ **Machinery maintenance will occur outside the Riparian Reserve or at an approved site.**

To the greatest extent practicable, repairs and maintenance will occur at the staging and fueling areas at the Site. If possible, inoperative machinery will be towed or moved from riparian areas for repairs. Non-functioning equipment in the riparian area that cannot be moved will be repaired in an expeditious manner with appropriate containment and spill materials in place during repairs.

○ **Prior to starting work each day, all machinery will be checked for leaks and all necessary repairs made before entering a Riparian Reserve.**

CES and our contractors will inspect equipment on a daily basis for leaks and needed repairs. Buildup of oil and grease on equipment will be removed with rags and wipes, as necessary. Equipment will be operated only after these checks and evidence the machinery is in good condition. Equipment will be shut down and repaired immediately if oil sheen is observed.

- **The disposition of downed wood, such as blown down or felled hazard trees, will be determined based on the Forest woody debris policy with priority given to retaining onsite or stockpiled for use in restoration projects.**

CES will coordinate with the Forest Service OSC regarding the final disposition of downed trees. Additional information will be provided in the RA Work Plan.

- **In-channel activities will be limited to the approved work windows (Washington State Department of Fish and Wildlife [WDFW] Memorandum of Understanding [MOU]) unless coordinated with WDFW and consulting agencies. In addition, key holding areas for adult spawners or high-use areas for rearing fish may need special attention when deciding timing of in-channel activities.**

In-channel activities within Glacier Creek will be completed by August 31, 2015, in accordance with T&C 8 outlined on page 87 of the BO. Alternate dates provided by the WDFW in the MOU will be considered as an advisory recommendation, but the BO provides work to be conducted in Glacier Creek until August 31.

Appendix B.

Copies of Monitoring Forms/Logs

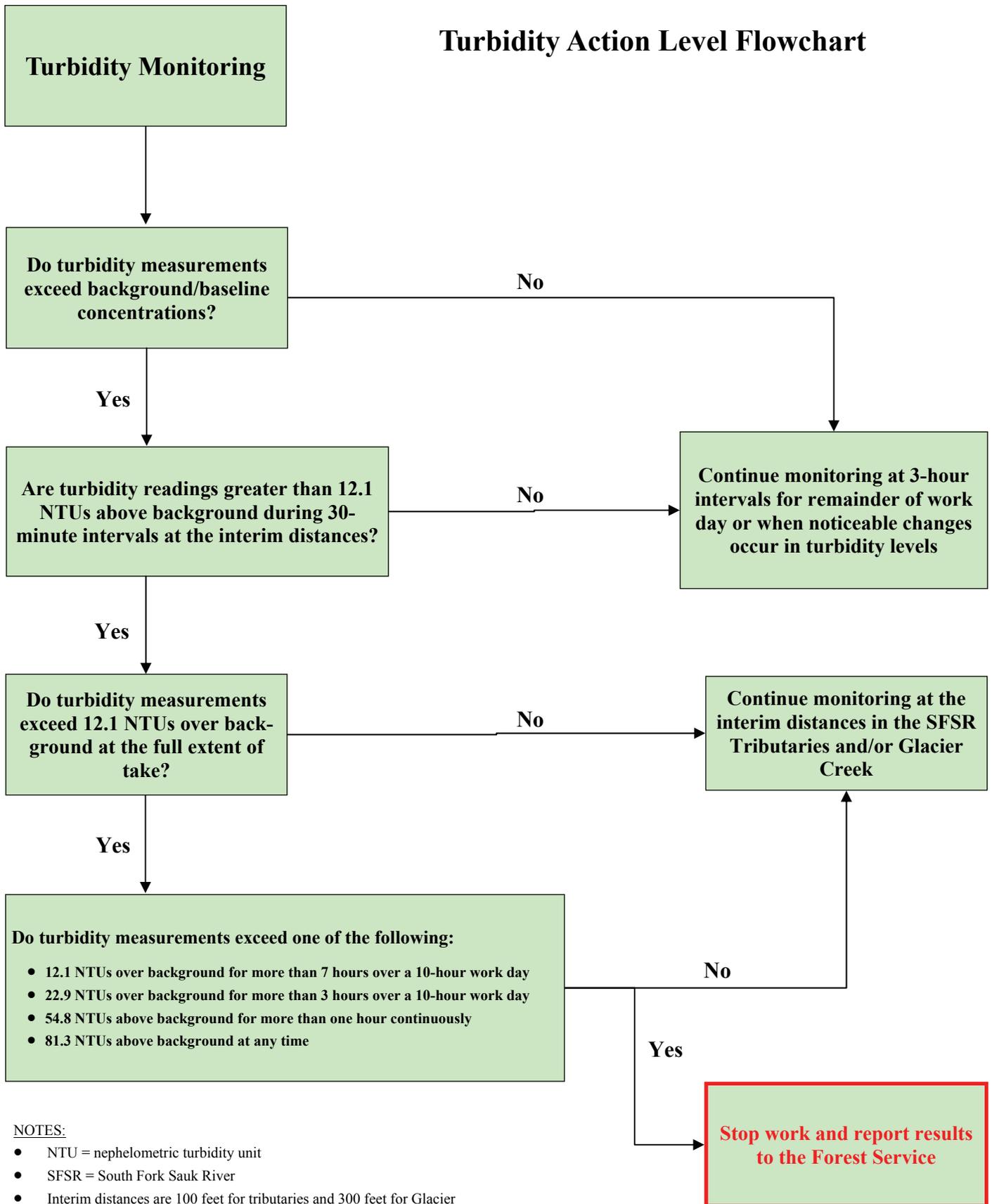
Daily Equipment Log

Project:	Date:	
CES Personnel:		
Subcontractor Personnel:		
Equipment Used	Start Time	Stop Time
<input type="checkbox"/> Pickup Truck		
<input type="checkbox"/> Maintenance Pickup Truck		
<input type="checkbox"/> Caterpillar Articulated Dump Truck (or equivalent)		
<input type="checkbox"/> Wheeled Loader		
<input type="checkbox"/> Caterpillar D6 Dozer (or equivalent)		
<input type="checkbox"/> Caterpillar 312 Excavator (or equivalent)		
<input type="checkbox"/> Caterpillar 325D Excavator (or equivalent)		
<input type="checkbox"/> Caterpillar 305 Excavator (or equivalent)		
<input type="checkbox"/> Caterpillar CP 433C Vibratory Roller		
<input type="checkbox"/> Komatsu CD60R Track/Spin/Dump Machine (or equivalent)		
<input type="checkbox"/> Wood and Brush Chipper		
<input type="checkbox"/> Rock Sorter		
<input type="checkbox"/> Other (Specify)		

Appendix C.

Turbidity Action Level Flow Chart

Turbidity Action Level Flowchart



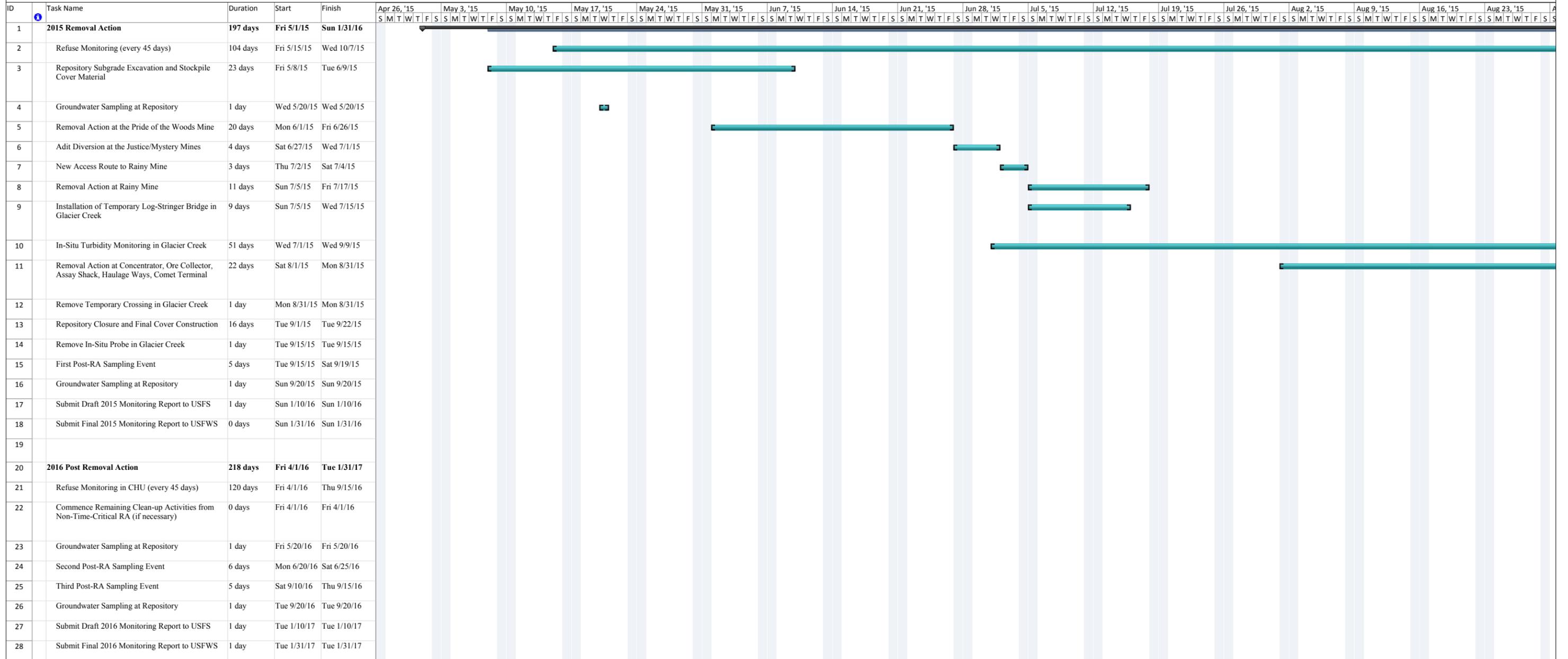
NOTES:

- NTU = nephelometric turbidity unit
- SFSR = South Fork Sauk River
- Interim distances are 100 feet for tributaries and 300 feet for Glacier Creek.
- Full extent of take for tributaries is just above the confluence with the South Fork Sauk River
- Full extent of take for Glacier Creek is just upstream from the confluence with Seventysix Gulch

Appendix D.

Biological Monitoring Plan Schedule

Appendix D. MCMA - Biological Monitoring Plan Schedule for 2015 Removal Action



Appendix F.

**Cultural Resources Monitoring
and Treatment Plan**



Cultural Resources Monitoring and Treatment Plan

Monte Cristo Mining Area Removal Action Mt. Baker-Snoqualmie National Forest Snohomish County, Washington

April 2015



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**Cultural Resources Monitoring and Treatment Plan
Monte Cristo Mining Area Removal Action
Mt. Baker-Snoqualmie National Forest
Snohomish County, Washington**

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Reviewed By: Timothy L. Otis, PE, Senior Engineer

Date: April 2015

Project Number: 2013230047

Submitted By: _____
Timothy L. Otis, PE, Senior Engineer

Cover Photographs: Upper Left – Monte Cristo Townsite; Upper Right – South Fork Sauk River Valley from Mystery Ridge; Middle – South Fork Sauk River near Haps Hill Campground

Disclaimer: The contents of this document are confidential to the intended recipient at the location to which it is addressed. The contents may not be changed, edited, and/or deleted. The information contained in this document is only valid on the date indicated on the original project file report retained by CES. By accepting this document, you understand that neither CES nor its parent company, Valmont Industries, Inc. (Valmont) accepts any responsibility for liability resulting from unauthorized changes, edits, and/or deletions to the information in this document.

CONTENTS

1.0	INTRODUCTION.....	1
1.1	Regulatory Overview and Summary of Historic Properties.....	1
1.1.1	Sauk Wagon Road (06050200056).....	1
1.1.2	Historical Sites (06050200162 and 06050200163).....	2
1.1.3	Everett & Monte Cristo Railway Grade (06050200065).....	2
1.1.4	Monte Cristo Mining Historic District (06050200135).....	2
2.0	NATIONAL HISTORIC PRESERVATION ACT MITIGATION, MINIMIZATION, AND AVOIDANCE MEASURES.....	3
2.1	Mitigation Measures.....	3
2.1.1	Training.....	3
2.2	Treatment Measures.....	4
2.2.1	Access Route Alignment.....	4
2.2.2	Repository Site.....	4
2.2.3	Rainy Mine Access Route.....	5
2.2.4	Monte Cristo Mining Historic District (06050200135).....	5
2.3	Monitoring.....	7
2.3.1	Unanticipated/Inadvertent Discovery.....	8
	Human Skeletal Remains.....	8
	Historic and Archeological Resources/Historic Properties.....	8
	Monitoring and Discovery Procedures Summary.....	8
2.3.2	Artifact Collection and Curation.....	9
2.3.3	Reporting and Documentation.....	9
2.3.4	List of Contacts.....	10
3.0	REFERENCES.....	11

FIGURES

To be Determined

1.0 INTRODUCTION

The United States Department of Agriculture, Forest Service (Forest Service) retained Cascade Earth Sciences (CES) to conduct a Non-Time-Critical Removal Action (RA) at the Monte Cristo Mining Area (MCMA) located in the Mt. Baker-Snoqualmie National Forest of Washington. The RA will be completed to address metal contamination of soil, sediment, and water from the MCMA under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) cleanup authorities [42 USC 9604(a) and 7 CFR 2.60(m)] and Federal Executive Order 12580. The RA will be implemented in accordance with the provisions of National Oil and Hazardous Substances Pollution Contingency Plan, 40 CFR 300.415(b)(4)(i); and utilizing the U.S. Environmental Protection Agency (EPA) “*Guidance on Conducting Non-Time-Critical Removal Actions under CERCLA*” (EPA, 1993).

The MCMA includes 10 mines (mines) and several facilities associated with storage, processing, and ore haulage (facilities; see Sheets G1 and G2). Appendix A of the Removal Action Memorandum (RAM), signed September 28, 2012, identifies avoidance, mitigation, minimization, and monitoring measures to address adverse effects to historic properties for the RA (USDA Forest Service, 2012). These measures were followed during the 2013 work conducted by CES for Access Route implementation and geotechnical testing at the proposed repository site as defined in the MCMA Access Route Phase I and Phase II Cultural Resources Monitoring & Treatment Plans (CES and ASM, 2013a, 2013b). ASM Affiliates, Inc. (ASM) conducted cultural resources monitoring (Iversen, 2013) and an archaeological survey of the repository site (Iversen and Smith, 2013) in association with the 2013 work.

Field activities scheduled for 2015 include construction of an onsite repository; the construction of a temporary crossing at Glacier Creek; construction of access routes to the Rainy Mine; the Monte Cristo Townsite (Townsite); the Rainy Mine; the Pride of the Woods Mine; and adit diversions at the Justice and Mystery Mines. This document details the Cultural Resources measures identified in the RAM pertaining to the 2015 work to provide CES personnel and subcontractors (including Palm Construction and ASM) with a blueprint for equipment operation, RA, and access route development.

1.1 Regulatory Overview and Summary of Historic Properties

The National Historic Preservation Act (NHPA), 16 U.S.C. § 470 et seq, provides that federal agencies take into account the effect of proposed actions (undertakings) on historic properties included or eligible for inclusion in the National Register of Historic Places (National Register) 16 U.S.C. § 470f.

The Forest Service prepared a preliminary survey entitled *A Cultural Resources Study of the Monte Cristo CERCLA Project* (Friel, 2011). Based on this, the Forest Service and the Washington State Historic Preservation Office (SHPO) concurred that the MCMA RA will have an adverse effect on the Monte Cristo Mining Historic District (MCMHD), the Sauk Wagon Road (SWR), and potential effects on the Everett & Monte Cristo Railway (E&MCR). In accordance with commitments made in the RAM, as addressed in Appendix A of the RAM (USDA Forest Service, 2012), the Forest Service completed a more detailed Cultural Resources survey and inventory of resources for the RA (Baldwin and Solmo, 2013; Iversen and Smith, 2013; Kelly et. al, 2014).

1.1.1 Sauk Wagon Road (06050200056)

The SWR is a historic property and includes the physical remains of the wagon road built by the Wilmans brothers from Sauk City to access the Monte Cristo mining claims. The property is associated with the settlement, mining, and logging histories of the area. The SWR is typical of corduroy or puncheon routes developed throughout the region, and is one of only a few surviving examples. The SWR is eligible for the

National Register under Criteria A and D, with a period of significance from 1891-1940, when it was considered abandoned.

The development of the 2013 access route from Mountain Loop Highway to Haps Hill utilized some segments of the SWR to the connection with Forest Road (FR) 4716, resulting in adverse effects to portions of the resource (Iversen, 2013). The Forest Service has committed to avoiding this historic property, where practicable (USDA Forest Service, 2012). Segments of the SWR that are within the areas of potential effect (APE) for the access route completion are discussed in detail in Section 2.2.1. Other recorded segments are outside of the APE (e.g., Blukis Onat, 1989).

1.1.2 Historical Sites (06050200162 and 06050200163)

ASM recorded two archaeological sites during monitoring of the 2013 access route construction (Iversen, 2013). ASM documented a possible culturally modified tree (CMT) (06050200162) located along the east side of the access route between the first and second crossings. The possible CMT consists of a western red cedar with partially healed scars on the northeast and southwest sides of the tree. ASM also recorded an historic-period logging site (06050200163) located at the northern end of the access route near its current egress/ingress from the Mountain Loop Highway. The historic-period logging site consists of twisted wire cable attached to a stump with railroad ties, and a metal barrel hoop. Construction of the 2013 access route, avoided both of these previously undocumented cultural resources. These resources have not been evaluated for the National Register. Section 2.2.1 describes avoidance measures for these sites associated with the 2015 work.

1.1.3 Everett & Monte Cristo Railway Grade (06050200065)

The E&MCR reached Monte Cristo by 1893, and represented the only railroad in Washington State built exclusively for mining operations. The E&MCR has not been inventoried or evaluated in its entirety (Monte Cristo to Hartford). However, the MCMA Access Route Phase II Cultural Resources Monitoring & Treatment Plan stipulates minimization, monitoring, and avoidance measures for this resource (CES and ASM, 2013b).

The existing county road from Haps Hill to the Townsite generally follows the E&MCR alignment. The county road was constructed in part over the existing rail lines, as evidenced by protruding rails in washed out areas along the present roadway. Inventoried portions of the E&MCR grade are located within the APE for the 2015 field activities at the Repository site (Baldwin and Solmo, 2013; Iversen and Smith, 2013). Additionally, undocumented portions of the E&MCR grade's eastern terminus exist within the project's APE for the Townsite RA based on the alignment of the grade as depicted on historic maps (e.g., Anderson Map Company, 1897). Sections 2.2.2 and 2.2.3 describe the minimization and avoidance measures for the E&MCR during the 2015 field activities.

1.1.4 Monte Cristo Mining Historic District (06050200135)

The MCMHD encompasses all of the mines and facilities including the archaeological ruins of buildings and structures, standing structures, isolates, and features of a mining-related settlement. The MCMHD description is provided in the RAM (USDA Forest Service, 2012). Individually and collectively, these resources contribute to the historical significance of the MCMHD. Some of these resources are within the APE for the MCMA RA. Other extant resources are outside of the APE. The MCMHD is eligible for the NRHP, for the purposes of this undertaking. SHPO has concurred.

RA activities scheduled for 2015 at the Townsite, Rainy, Pride of the Woods, Mystery, and Justice Mines will result in adverse effects to the Townsite (06050200100). Portions of the Townsite within the 2015 project APE include the United Companies Concentrator, the Ore Collector, the Comet Mine tram terminal,

the Assay Shack, and the Haulage Way between the Ore Collector and the Concentrator. Other features and/or artifacts associated with the MCMHD may also be present within the 2015 APE at the Glacier Creek crossing and the Rainy Mine access routes. Appendix A of the RAM defines the boundaries of the MCMHD as “generally bounded by “Government Townsite” (platted); the Pride of the Mountains Mine; Glacier Creek and the railroad route/access route on the north side of Glacier Creek; and the Sidney Mine” (USDA Forest Service, 2012). The treatment of these resources within the APE for the 2015 work is discussed in Sections 2.2.3 and 2.2.4.

2.0 NATIONAL HISTORIC PRESERVATION ACT MITIGATION, MINIMIZATION, AND AVOIDANCE MEASURES

The NHPA, 16 U.S.C. § 470 et seq, provides that federal agencies take into account the effect of proposed actions (undertakings) on historic properties included or eligible for inclusion in the National Register of Historic Places (National Register) 16 U.S.C. § 470f. These measures will be implemented in accordance with the commitments made in the RAM.

2.1 Mitigation Measures

Mitigation measures for field activities include a combination of training, documentation including digital photography, narrative recordation, and spatial recordation using Trimble® Geoexplorer® 6000 Series Global Navigation Satellite System (GNSS) units. The following sections outline these measures.

2.1.1 Training

Prior to commencement of the 2015 fieldwork, CES and subcontractor personnel will participate in up to one half-day cultural resources training exercise. The training will include the following:

- A walkthrough and identification of culturally/historically significant areas within the construction areas;
- Recognition of flagged or marked areas considered off limits during field activities;
- Discussion of activities prohibited in or near these flagged areas (e.g., tree felling, all-terrain vehicle usage, walking, etc.);
- Discovery and identification of artifacts, both historic and pre-contact, that may be present; and
- Provisions for requisite activities in the event of disturbance of significant areas or unanticipated discovery of archaeological resources.

New personnel substituted during access route and RA implementation will receive proper training from the ASM Field Director before commencing work. ASM, the Forest Service On-Scene Coordinator (OSC), and the Forest Service Heritage Specialist will keep a list of trained personnel.

The ASM Field Director and/or the Forest Service Heritage Specialist will provide periodic briefings for onsite personnel during the course of the field activities (e.g. daily, weekly, or bi-weekly), as determined necessary and appropriate, to ensure that field personnel are fully informed and have current information regarding protection of resources. As activities or proximity to restricted, off-limits areas change, briefings will be targeted to the specific conditions, activity or resource.

2.2 Treatment Measures

Minimization and avoidance measures are developed to alleviate adverse effects during the 2015 construction activities. Prior to commencement of field activities, the Forest Service will ensure CES and the subcontractors (including Palm Construction and ASM) are informed regarding implementation of preservation measures described below.

2.2.1 Access Route Alignment

The majority of the Access Route from the Mountain Loop Highway to Haps Hill was constructed during the 2013 field season. Yellow flagging delineated segments of the SWR to be protected, including remnants of associated historic bridge abutments near the temporary bridges constructed at the second and third crossings, and designated these areas as “off-limits” to CES and subcontractor personnel. Portions of the Access Route were completed during the 2014 field season and consisted of construction of permanent log-stringer bridges at the second and third crossings, and construction of a permanent egress/ingress route to Mountain Loop Highway. The permanent bridge crossings were constructed in the same locations as the temporary bridges at station 63+83.04 (second crossing) and station 79+03.27 (third crossing) (CES, 2013). The permanent egress/ingress to Mountain Loop Highway replaced the temporary egress/ingress route constructed in 2013. The location of the permanent egress/ingress route was surveyed in 2014 for the exact location of the SWR or other cultural resources. The following minimization and avoidance measures will be implemented for the 2015 work associated with the access route alignment:

- ASM will ensure that flagging delineating areas as “off-limits” during the 2013/2014 field activities are still in place, and will repair or replace any flagging, as necessary;
- Utilization of and/or improvements upon the Access Route during the 2015 work will avoid the potential CMT (06050200162) and historic-period logging site (06050200163) documented along the route. Both sites will be delineated with flagging or other obvious means and will be designated as “off-limits” to CES and subcontractor personnel. If these are evaluated and determined not eligible for the National Register of Historic Places, avoidance will no longer be necessary; however, until evaluation is completed, direct and indirect effects will be avoided;
- ASM will provide a professional archaeologist to monitor all construction excavation activity and review other actions that could affect cultural resources to avoid and protect segments of the SWR identified for preservation.

Prior to the commencement of work in 2015, the access route will be walked to ensure that no inadvertent damage occurred over the winter. If any is identified, ASM will discuss treatment with the OSC.

2.2.2 Repository Site

Archaeological assessments of the repository site resulted in the documentation of intact portions of the E&MCR (06050200065) within the 2015 project’s APE (Baldwin and Solmo, 2013; Iversen and Smith, 2013). Geotechnical testing conducted at the repository site during the 2013 field season avoided the grade with a 20 foot buffer from the edges of the base of the railroad grade berm. The 2015 work associated with construction of the repository site, including access/egress to the site from the county road, will primarily avoid the E&MCR grade and the 20 foot buffer, although encroachment of the 20-foot buffer will be required for the run-on drainage on the upslope end of the repository. A professional archaeologist will monitor all construction excavation and monitoring well installation conducted at the repository site.

Cover soil is proposed to be stockpiled adjacent to the northwest of the repository during the 2015 RA. The proposed cover soil stockpile area will be surveyed by a professional archaeologist prior to logging activities in 2015.

2.2.3 Rainy Mine Access Route

The 2015 field activities include construction of a road on the north side of Glacier Creek to access Rainy Mine for the RA. The access route may result in adverse effects to undocumented contributing features and/or associated artifacts of the MCMHD (06050200135). Section 2.2.4 addresses the minimization measures for potential MCMHD related resources.

2.2.4 Monte Cristo Mining Historic District (06050200135)

The 2015 Townsite RA will result in adverse effects to contributing elements of the MCMHD. These elements within the Townsite (06050200100) include (but are not limited to) the United Companies Concentrator, the Ore Collector, the Comet Mine tram terminal, the Assay Shack, and the Haulage Way between the Ore Collector and the Concentrator. The proposed 2015 work will also result in adverse effects to the MCMHD at the Rainy (06050200156), Pride of the Woods (0605020015), Mystery (06050200148), and Justice (06050200160) Mines. Additionally, construction of the temporary Glacier Creek crossing may result in adverse effects to other contributing features and/or associated artifacts of the MCMHD. As stipulated in Appendix A of the RAM, CES will implement the following measures to the extent feasible within the MCMHD to alleviate adverse effects:

- Prior to RA, document and map the current condition of the United Company Concentrator;
- Document subsurface features of the United Companies Concentrator during RA activities;
- Reconstruct the evidence of the United Companies concentrator by shaping and contouring the clean soil to illustrate footprint and multiple terraces of the original structure;
- Leave large structural members (e.g. buildings and railroad trestle remains) and equipment (e.g. gears, rods, plates, ore bins) in situ;
- Clean and salvage structural remains (wood/metal/bricks) or historic mining debris (pieces of equipment), and return to the approximate original location;
- Reconstruct the topographic footprint of travel ways (e.g. roads, railroad grades and haulage routes) to resemble in the original feature in its original location;
- Surface collect artifacts for analysis and prepare artifacts for curation pursuant to Title 36 CFR Section 79;
- Provide a professional archaeological monitor to record features, photo document, and collect artifacts as determined appropriate and safe;
- Prepare a professional report inclusive of methodology, detailed measurements, drawings, and photographs of the monitoring/treatment actions; and
- On-site historical interpretation will be developed separately and installed after completion of the RA.

In order to facilitate these treatment measures, CES and ASM will consult historic photographs and documentation, as well as recent cultural resources reports completed for the MCMHD (Baldwin and Solmo, 2013; Friel 2011; Johanson and Mattson, 2012; Kelly et al., 2014), and will take digital photographs and document features and associated landforms prior to RA activities. Additionally, CES and ASM will produce maps of select features, rail alignments, and roadways, utilizing two sub-meter accuracy GNSS units in concert. CES and ASM will utilize the photographs, maps, and documentation for comparative purposes in order to reconstruct and return areas altered by the RA within the MCMHD to the appearance of their original condition to the extent possible. When possible, intact features such as large concrete foundations, will be left in place and cleaned subsequent to RA operations. The same procedures will be followed for metal and brick structural remains and members if feasible. While this will be more problematic with wooden features

due to the contamination of this material through its porous surface, if possible, CES will leave wooden features in place or return them to their original location upon completion of RA activities. Procedures for artifact collection and curation are discussed in Section 2.3.2.

The following specific treatment measures will be implemented to the extent feasible:

- Document and map the condition of the United Companies Concentrator as an update to the current site record for this feature (Kelly et al., 2014). The purpose of the recordation is to ensure an adequate record of the feature prior to destruction and enable the Forest Service to implement reconstruction for interpretation to the best possible extent.
- Document artifacts, floors, and functional areas of the United Companies Concentrator during RA activities.
- The following features associated with the United Companies Concentrator (Johanson and Mattson, 2012) will be fully documented and avoided if possible. If avoidance is not feasible, the features will be reconstructed, if possible.
 - Rock, brick, and concrete work associated with the boiler stack foundation
 - Rock, brick, and concrete work associated with the hydro-electric plant
 - Rock wall for the hydro-electric plant
 - Rock, brick, and concrete work associated with the boiler room
 - Settling boxes and retaining wall associated with the boiler room
- The following features associated with the Townsite (06050200100) will be documented during the RA and the current site records for these features (Kelley et al., 2014) will be updated as necessary. Artifacts associated with the features will be collected and large structural members will be left in place, if possible. If RA activities necessitate the removal of structural remains, they will be cleaned, salvaged, and returned to their approximate original locations, if possible.
 - Assay Office
 - Comet & Golden Tram Terminals
 - Ore Collector
 - Twin Cuts
- The following measures will be implemented to the extent possible for the Rainy (06050200156), Pride of the Woods (06050200155), Mystery (06050200148), and Justice (06050200160) Mines and current site records for the mines (Kelly et al., 2014) will be updated as necessary.
 - Historic and archaeologically significant areas at the mines will be marked with flagging after consultation with the Forest Heritage Program Manager and the OSC. Areas delineated as offsite will be taped to minimize disturbance to these features.
 - Mine closures will be set back as far as possible within the mine openings to retain the original settings of the mines.
 - Bat gates will be utilized for mine closures when feasible.
 - Mine features (e.g., tailing piles and building platforms) will be preserved in place when possible
 - Artifacts identified will be documented and collected as appropriate.

- Detailed measurements, mapping, and photographs will be taken for travel corridors (e.g. roads, railroad grades, and haulage routes) prior to RA activities to ensure adequate post-RA reconstructions. Current site records for these features (Kelley et al., 2014) will be updated as necessary.
- If project plans to restore the Pelton Wheel associated with the Powerhouse (6050200174) as a means of water supply are implemented (CES 2013), the following measures will be carried out prior to restoration activities and the current site record (Kelly et al., 2014) will be updated as necessary.
 - Archaeological testing of the site, including any associated water lines or access needs, will be conducted in any areas proposed for ground disturbing activities.
 - Reconstruction and installation of the Pelton Wheel will be conducted in consultation with the Forest Service Heritage Specialist.
- Procedures for artifact collection and curation are discussed in Section 2.3.2.

Portions of the E&MCR (06050200065) exist within the APE (Johanson and Mattson 2012). These may not be fully recorded; however, CES completed a GPS survey of the E&MCR from Barlow Pass to the Concentrator and Townsite features. In order to mitigate and, if possible, minimize or avoid effects to this resource, ASM will visit the resource with CES personnel prior to the RA, to identify if “off limits” areas can be flagged. ASM will monitor the RA activity; if previously unmapped railroad segments/features and/or associated artifacts are identified, they will be mapped and documented. If possible, the RA will avoid any identified sections of the grade, including the trestle bents located west of the United Companies Concentrator.

2.3 Monitoring

ASM will provide an archaeological monitor that meets the Secretary of the Interior’s Professional Qualification Standards (48-FR 44738-9) who is to be present during any ground disturbing activities, and review other activities that could potentially affect historic properties (including but not limited to camp site mobilization, tree felling, soil storage, material stockpiling, borrow areas, equipment staging, and log staging) with CES. In addition, ASM will be onsite during work near areas designated as off limits, to ensure compliance with avoidance and protection measures. The monitor will observe all ground disturbances and examine back dirt and spoils piles from excavations for evidence of cultural resource materials. The monitor will be onsite during construction to record known and unanticipated features and/or historic properties, and photograph and document artifacts as determined appropriate and safe. In the event of unanticipated archaeological resources or unanticipated effects to historic properties, the resource will be protected, and the Forest Heritage Specialist and OSC will be contacted. The ASM monitor will record and document the discovery. The Forest Service will initiate consultation with the SHPO and other interested parties (e.g., Tribes) and evaluate and document the significance. If it is determined to be significant, or contributing to the significance of a historic property, further treatment will be developed that takes into account the project work implementation schedule (see Section 2.3.1). The monitor may temporarily halt activity as necessary to allow photography and recovery of materials and data.

The archaeological monitor will be prepared with the basic equipment needed to perform site documentation, evaluation, and recovery of unanticipated discoveries. The monitor will prepare daily field monitoring verification reports noting their observations, results, and actions taken. Digital photographs will be taken to record the construction activity as well as the character and provenience of any identified cultural resources. The monitor shall record these observations in all-weather horizontal line notebooks with corresponding line numbers. These notebooks are the property of the Forest Service and will be part of the permanent record for the historic property (see Section 2.3.2).

2.3.1 Unanticipated/Inadvertent Discovery

This section outlines procedures to be implemented in the event of discovery of human skeletal remains, or other items specifically identified in the Native American Graves Protection and Repatriation Act (NAGPRA), unanticipated archaeological resources, or unanticipated effects on historic properties.

Human Skeletal Remains

If human skeletal remains are encountered at any time during 2015 field activities, ASM will take the following actions, and ensure that these actions are adhered to by CES and their subcontractors on-site:

- Any potential human remain discoveries will be left *in-situ* pending professional examination.
- Project work in the area of the discovery will halt and the discovery area will be secured and protected.
- The Forest Service Archaeologist/Heritage Specialist and the Snohomish County Medical Examiner will be contacted immediately. ASM will use a satellite phone or handheld radios to contact the Darrington Ranger District Ranger, Peter Forbes, or his designated representative.

The Medical Examiner will determine if the skeletal remains are forensic, and if so, the Snohomish County Sheriff and Forest Service Law Enforcement Officer will be immediately contacted to work with the Medical Examiner. If the Medical Examiner determines that the skeletal remains are not forensic, the Forest Heritage Specialist will notify the Washington State Department of Archaeology and Historic Preservation (DAHP), Physical Anthropologist. If the skeletal remains are determined or suspected to be aboriginal, ASM will provide written confirmation to the Forest Supervisor, Jennifer Eberlien. The Forest Service will assume jurisdiction and will initiate consultation with Indian Tribes who are known or likely to be affiliated with the skeletal remains. Following consultation, the Forest Service will develop a written plan of action.

Historic and Archeological Resources/Historic Properties

If unanticipated archaeological resources and/or unanticipated effects on historic properties are encountered at any time during 2015 field activities. ASM will conduct the following procedures.

- Protect the subject cultural resource(s) from project activities;
- Immediately notify the OSC and the Forest Service Archaeologist/Heritage Specialist;
- Record and document the discovery; and
- The Forest Service will initiate consultation with the SHPO and other interested parties (e.g., Tribes) and evaluate and document the significance. If it is determined to be significant, or contributing to the significance of a historic property, further treatment will be developed that takes into account the project work implementation. If feasible, unanticipated discoveries, such as identifiable and significant features or cultural deposits, may warrant changes in design. If design changes are not practicable, then ASM will conduct additional evaluation and recordation in consultation with the Forest Service Archaeologist /Heritage Specialist.

Monitoring and Discovery Procedures Summary

1. The archaeological monitor will be given final construction plans in advance of proposed excavation activity.
2. The archaeological monitor will be given at least 48 hours advance notice of the need to be onsite, except in the case of inadvertent discovery (including human skeletal remains) or unanticipated effects.

3. The archaeological monitor must be present on site prior to ground disturbing activities occurring.
4. The monitor will brief CES and subcontractor personnel of the potential for pre-contact and historic period archaeological resources and of the monitoring and inadvertent discovery procedures. These procedures will be distributed to the construction crew for reading and initialed by each reader.
5. The archaeological monitor will examine all excavated material including back dirt and soil profiles. Any back dirt may be screened at the discretion of the archaeological monitor. The monitor will inform the on-site construction supervisor if there is a need to temporarily gain access to any excavation to examine it so that safe working conditions can be maintained.
6. If potentially significant previously undocumented cultural resources are encountered during the course of monitoring activities, all work in the immediate vicinity of the find will halt, and ASM will document and assess the discovery. ASM will contact the Forest Service Heritage Specialist to commence consultation with the SHPO and develop appropriate treatment.

2.3.2 Artifact Collection and Curation

ASM will collect a representative sample of artifacts from the ground surface of construction areas within the MCMHD prior to the commencement of construction activities. General artifacts expected based on previous investigations conducted for the MCMHD (Friel 2011; Johanson and Mattson, 2012; Kelly et al., 2014) include window glass, bottle glass, ceramics, metal cans, butchered animal bone, wire-cut brick fragments, milled lumber, sheet-metal, steel cables, and various metal fragments. Artifacts related to railroad features could include rails, spikes, ties, tie plates, and splice plates. Artifacts expected specifically for the Assay Office include muffle fragments, cupels, slag pours, buttons, nails, lead wool, lead shot, lead sheets, glass stoppers, and possible globs of reagents from cardboard boxes or jars. If a total of 10 artifacts of the identical type are collected, the sample will be considered representative for this artifact type and any further artifacts of this type will be documented and mapped but not collected. Larger artifacts and features such as railroad ties or mining equipment would not be collected, but would be documented and mapped, and left in place if possible. ASM will record contaminated surface artifacts not collected, and CES will subsequently deposit them in the repository with other contaminated materials. ASM will follow the same procedures for artifacts identified subsurface during ground disturbing construction activities conducted within the MCMHD when safe and feasible. Artifacts collected will be cleaned with water, bagged, and labeled with appropriate corresponding provenience information prior to being transported to a pre-approved temporary holding area consisting of a canvas tent outside of the “hot zone” associated with the RA operations. Artifacts will be transported from the temporary holding area to the ASM laboratory in Stanwood, Washington on a weekly basis.

ASM will conduct processing and analysis of all artifacts collected at the ASM laboratory in Stanwood, Washington. The procedures used in the initial processing of recovered material include the cleaning (as appropriate), sorting, and cataloging of all items. ASM will individually examine and catalog all items according to class, type, material, count, and weight. To the extent possible, ASM will produce date ranges for the artifacts based on diagnostic characteristics and comparisons with appropriate historic and research documentation, and describe them in the context of the MCMHD. ASM will present the results of the analysis in tabular and narrative form within the project report. Subsequent to the completion of all analyses and acceptance of the project report, ASM will ensure that the MCMA RA collection (i.e., material remains and associated records including archival records essential to understanding the resources [see Title 36 CFR Part.79.4]) are transferred to the Mt. Baker-Snoqualmie National Forest Heritage Specialist.

2.3.3 Reporting and Documentation

ASM will document the results of the current monitoring project through the following:

- Prior to construction of the egress/ingress from the access route to Mountain Loop Highway, ASM will prepare Draft and Final Reports detailing the results of an archaeological assessment for the route. The reports will include minimization and avoidance recommendations for any cultural resources identified within the APE and actions taken in response to these recommendations;
- ASM will submit summaries of the project status every two weeks to the Forest Service Archaeologist/Heritage Specialist. The summaries will include descriptions of any cultural resources identified as well as a brief report on the progress of the project. The reports will include a map of where the work occurred, identifying any location(s) discussed in the summary;
- ASM will complete appropriate DAHP Archaeological Inventory forms for any cultural resources identified during monitoring. ASM will submit the completed forms to the Forest Service Archaeologist/Heritage Specialist for review and submission to DAHP; and
- ASM will prepare Draft and Final Reports at the end of the 2015 construction work. ASM will prepare a draft report within 90 days of completion of field work, and a final report within 120 days of completion of fieldwork. The reports shall detail the result of ASM's activities completed under this plan.

2.3.4 List of Contacts

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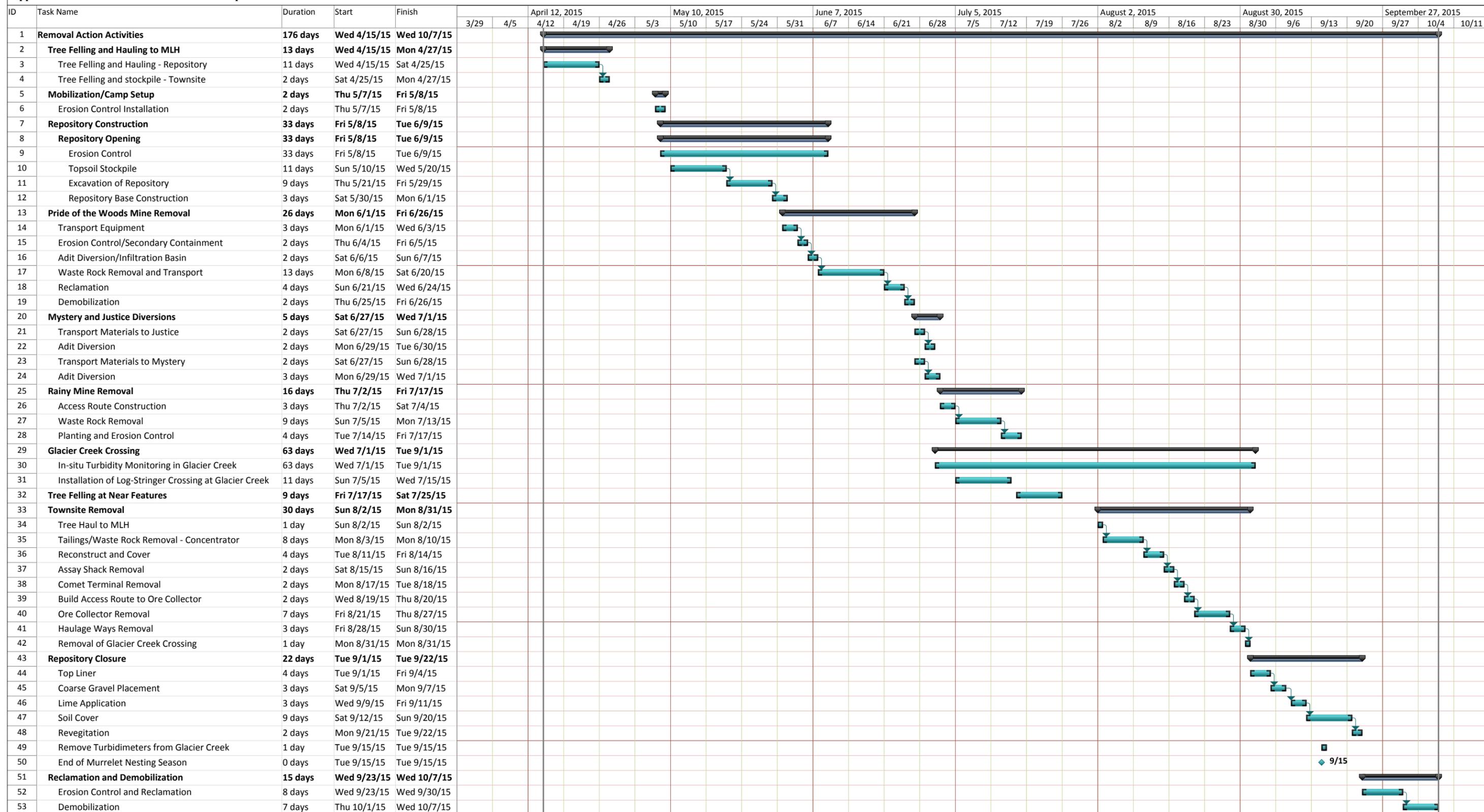
FIGURES

To Be Determined

Appendix G.

**MCMA 2015 Removal Action
Proposed Schedule**

Appendix G. MCMA 2015 Removal Action Proposed Schedule



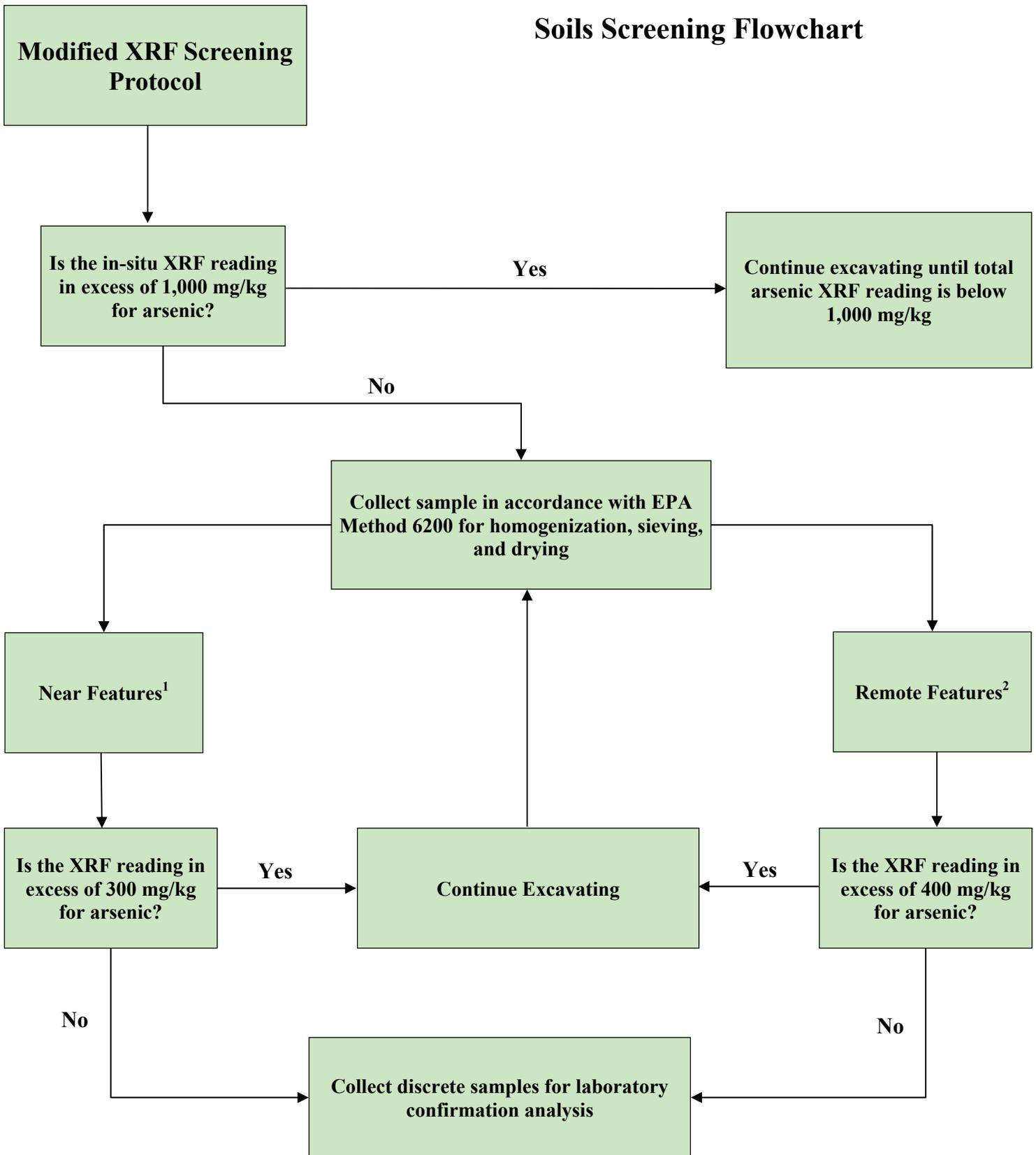
Project: 2015 Removal Action
Print Date: Wed 4/15/15

Task		Summary		External Milestone		Inactive Summary		Manual Summary Rollup		Finish-only	
Split		Project Summary		Inactive Task		Manual Task		Manual Summary		Deadline	
Milestone		External Tasks		Inactive Milestone		Duration-only		Start-only		Progress	

Appendix H.

Modified XRF Protocol for Field Screening

Soils Screening Flowchart



NOTES:

- 1 Near Features include the Rainy Mine, Concentrator, Comet Mine Terminal, Haulage Ways, Ore Collector, and Assay Shack.
- 2 Remote Features include the Pride of the Woods Mine.