

SECTION 02412 – SLOPE PROTECTION AND MATERIAL REMOVAL

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section applies to the creation of a safe system of work for excavating and recompacting mine waste at the Eagle Mine, Colorado. Work will comprise mobilizing all personnel, equipment, and materials required to perform the work. The work is shown on the contract Drawings and generally comprises high angle rock scaling and rock fall protection measures installation, excavation of a 40° slope and re-compaction of the excavated material in a reinforced soil structure. Where there is a conflict between the drawings and these specifications, the drawings shall control. Notice To Proceed on the various parts of this work is governed by other contract documents.
- B. The means and methods of construction including safety, excavation, installation, and observation of all support shall be the sole responsibility of the Contractor. All construction and testing methods used shall avoid the release of mine-impacted water.
- C. Mobilization . The work will include:
 - 1. Mobilizing all personnel and equipment necessary to complete the work to the Site (Figure 1 – Vicinity Map).
 - 2. Bonding and insurance.
 - 3. Provide all personnel, equipment, labor, and tools necessary to complete the work.
 - 4. Install temporary facilities as needed for construction.
 - 5. Protect existing hydraulic lines and syphon locations from damage.
 - 6. Design Reinforced Soil Structure (RSS) for long term storage of historical mine waste rock. RSS will be designed by Contractor and implemented by ER. Design specifications are:
 - a. Internal Factor of Safety shall be 1.3 or greater for static and 1.01 for pseudo static analysis.
 - b. Design Life shall be at least 50 years
 - c. Assumed soil properties – $\phi' = 39^\circ$, $c = 0$, $\gamma = 130 \text{ lb / ft}^3$.
 - d. Subgrade soil $\phi = 32^\circ$, $c = 0$, $\gamma = 130 \text{ lb / ft}^3$.
 - e. PGA – 0.17g
 - f. Facing elements not required.
 - g. Vertical deflection of the RSS to avoid obstructions such as the syphon point shall be limited to 40°.
 - h. RSS elements shall not be metallic
 - 7. Preparation of all safety and egress equipment prior to initiating work.
 - 8. Provide design for Reinforced Soil Structure to store the excavated mine waste excavated from Areas 1, 2, 3, and 3a. RSS construction will be performed by ER.
- D. Rock Scaling
 - 1. Set up safe system of work.
 - 2. Remove loose rock on the exposed rock faces covered by drape mesh as shown on Drawing C-104.
 - a. Rock scaling will use pry-bars, hydraulic jacks, air bags and other tools to remove loose material from the rock faces.
 - b. Scaling will also include removal of vegetation up to 4-inch diameter trees, shrubs and other vegetation that would hinder the installation of drape mesh.
 - 3. Other locations may require rock scaling as directed by the EPA representative on site.
- E. Install Rock fall protection measures as shown on Drawing C-104, C-502 and C-503

1. Rock bolt steel shall be #8 shall be used for rock support. The location of rock bolts is not known at this stage. However, the contractor should mobilize 100-feet of #8 bar to prevent delays in procurement.
 2. Support anchors for drape mesh shall be #14 bar.
 3. Catch fence anchors shall be 10-feet long #10 bar, with associated accessories
 4. Boreholes for anchors shall be drilled using a 2 1/2 -inch to 3 1/2 -inch drill bit.
 5. The contractor shall bring equipment to install rock bolts up to 20-feet-long.
 6. The catch fence attenuators will require weekly inspections and immediate inspection following any large impacts before work proceeds downslope of the attenuator.
 7. Contractor will maintain attenuators and drape mesh throughout the slope material removal. ER will assume inspection responsibilities during RSS construction.
 8. Catch fences may be removed at the end of the project.
- F. Excavate mine waste rock to competent bedrock, or as approved by the EPA representative on site.
1. Approximately 19,000 cubic yards of material shall be cast from the upper portions of the slope down onto the old rail grade.
- G. Changes to work sequence and methods based on manufacturer's or manufacturer's on-site representative's recommendations will only be made after approval of Prime Contractor and EPA OSC.
- H. The project is located within an inactive mine. Relevant Occupation Safety and Health Administration (OSHA) regulations apply. In addition, mine-impacted water flows in a 3-inch pipe at the toe of the existing lock block wall. This shall be excavated and protected as required. A release of this pressure through the 3-inch pipe could result in flows up to 24 cfs into the Eagle River. All field protocols, safety, and environmental plans should consider these factors.
- I. Demobilization
1. Removal of all equipment and unused materials.
 2. Optional: Remove all drape mesh and attenuators. EPA and ER will determine if it is cost effective to salvage the attenuators. Contractor will include optional cost for removal in bid.

1.2 MATERIALS

Materials and components provided by the Contractor shall be products in Table 1, Table 2, or the Drawings. All materials other than the drain rock shall be provided by the Contractor. If the products are not the products specified, the Contractor shall provide submittals showing the proposed materials meet or exceed the specifications of the identified materials. This list may not be all inclusive depending on Contractor methods.

Table 1: Materials to be Provided by Contractor – Geotextile

Component	Property	Requirement	Test Method
Non-Woven geotextile	Thickness	0.12 to 0.18 inches	-
	Puncture	Puncture – 180 lbf	ASTM D4833
	Grab Strength	270 lbf	ASTM D4632
	Grab Tensile Elongation	50%	ASTM D4632
	Trapezoidal Tear Strength	112 lbf	ASTM D4533
	Mullen Burst Strength	500 psi to 650 psi	ASTM D3786
	Apparent Opening Size	150 µm	ASTM D4751
	Permittivity	0.7 sec ⁻¹	ASTM D4491

Table 2: Drain Rock Gradation

Drain Rock shall be washed material conforming to the following gradation limits:

Sieve Size	Percent Passing by mass
2.00	100
1 1/2	80 – 100
1.00	40 – 100
3/4	25 – 100
1/2	15 – 100
3/8	0 – 65
No.4	0 – 15
No. 30	0 – 5
Mine waste rock sorted with a skeleton bucket or grizzly may be suitable drain rock.	

- A. Steel wire rope shall be ¾-inch 6x19 fiber core
- B. Thread bar for rock bolts, drape mesh, and catch fence anchors shall be 75 ksi / 80 ksi steel supplied by Dwyidag Systems International or approved equivalent.
- C. Maccaferri, double twist drape mesh, or approved equivalent.
- D. Grout for rock bolts shall be GU Cement mixed at 0.4:1.0 Water:Cement ratio or other approved grouting product. Epoxy resin grout may be used if supported by the manufacturer's technical data sheet.

1.3 QUALIFICATIONS

- A. The Contractor and his field superintendent shall demonstrate and document their qualifications for this project by their experience on projects of similar type and complexity:
 - 1. The rope access work shall be undertaken by a specialist contractor experienced at excavating waste rock on 40° slopes using spider excavators (or equivalent).
 - 2. All rope access personnel shall hold SPRAT or IRATA qualifications and work under the direct supervision of a Level 3 Rope Access Technician.
 - 3. Reinforced soil structure shall be designed by a Professional Engineer licensed in the State of Colorado.

4. Contractor may submit other information demonstrating his qualifications for this project for review by the OSC, Prime Contractor, and Engineer.
5. Project superintendent(s) shall have at least five years of recent experience (within last 15 years) in responsible charge of earthworks and rope access methods proposed by the Contractor. If shift supervisors are proposed, shift supervisors shall have at least 3 years of recent experience (within last 10 years) in responsible charge of work performed at mine or slope stabilization sites.

1.4 REFERENCES

A. General:

1. The publications listed below form a part of this specification to the extent referenced.
2. Where a date is given for reference standards, the edition of that date shall be used. Where no date is given for reference standards, the latest edition to the date of this document shall be used.

- B. Code of Federal Regulations (CFR): U.S. Department of Labor, Occupational Safety and Health Administration, Construction Standards and Interpretations, 29 CFR Part 1926, Subpart S, Section 1926.800.

1.5 SUBMITTALS

- A. Work experience resumes of proposed superintendent(s), Rope Access technician's qualifications and ground personnel.
- B. Reinforced Soil Structure Design by a Professional Engineer for review and acceptance at least two weeks prior to the start of construction.

1. RSS design shall include:

- a. List of all assumptions made during the design.
- b. Verification of design methodology and applicable design standards.
- c. Summary of geotechnical constraints and soil parameters.
- d. FoS calculations.
- e. A summary of loading conditions and load cases considered including force diagrams showing the magnitude, location and direction of all forces and resulting foundation loads including load inclination angle, effective footing width and bearing pressures for each load case.
- f. Seismic design criteria.
- g. Maximum allowable differential settlement.
- h. Design life calculations.
- i. Materials ordered prior to the completion of review shall be at the contractor's risk
- j. Material handling, treatment, and placement specifications and other critical design information that includes but is not limited to:
 - (i) Maximum allowable slopes.
 - (ii) Placement and compaction methods.
 - (iii) Design Drawings.
 - (iv) Any soil treatment or amendment rates and procedures.
 - (v) Quality Control procedures.
 - (vi) List of installation tolerances.
 - (vii) A list of how alterations will be addressed during construction.

- C. Shift reports during construction. Submit reports no later than 12 hours after end of the shift. Include the following minimum information:

1. Pre-work inspection notes.
2. Number and classification of crew members and equipment used.
3. Progress reports. For each shift, include the beginning and ending time and station and summary of the work performed.
4. Unusual ground conditions encountered or other observations

5. Time, duration, equipment, and operations affected by down time due to interruptions or delays. Describe, in detail, the nature and cause of the down time.
6. Results of inspections or testing as detailed in other parts of the project documents.

D. Certificates of compliance for all materials permanently incorporated into the work.

1.6 QUALITY ASSURANCE

A. Provide safe access for EPA and EPA's Representative to the rock faces to observe the work as required. The Engineer will endeavor, but is not required, to access the rock faces and catch fence locations at times when it will not disrupt the Contractor's operations and is convenient for the Contractor.

B. Mill certification for rock bolt steel

PART 2- PRODUCTS

2.1 EQUIPMENT

A. Equipment selection is the Contractor's responsibility. Equipment shall be capable of completing work as specified herein and in Drawings within the specified time of completion.

PART 3- EXECUTION

3.1 GENERAL

A. Before commencing work, the Contractor shall obtain all necessary statutory approvals for the work.

B. In case of any emergency or stoppage of work which is likely to endanger the mine, the Contractor shall maintain sufficient qualified personnel, as required, for 24 hours per day, including weekends and holidays, to cope with the emergency or hazardous condition until it is concluded.

C. Work shall be completed in this order: Rock scaling, drape mesh installation, catch fence installation, excavation & RSS construction.

D. RSS construction will be completed by ER after all materials have been removed from the slope. Contractor will inspect and maintain slope protection during materials removal. ER will assume inspection responsibilities during RSS construction.

E. In the case of an impact to the attenuators, a remobilization and repair may be required before work resumes. Contractor will provide an optional cost for remobilization for repair.

F. The old rail grade access road shall not be blocked while the site is unattended between shifts.

G. The Contractor shall maintain clean and safe working conditions on site and shall remove all debris, spills, and other materials not directly used in the work.

END OF SECTION