

Kiewit Infrastructure West Co.
Klamath River Renewal Project
Technical Specifications

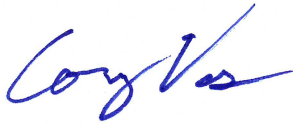
31 05 00 - MATERIALS FOR EARTHWORK

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PART 1 - GENERAL

1.1 SUMMARY

- A. This specification describes the aggregate material and geotextile requirements, including but not limited to:
1. E2 – Pipe Zone Material.
 2. E3 – Structural Fill.
 3. E4 – Select Fill.
 4. E6/E8 – Bedding Material.
 5. E7a/E7b/E7c – Erosion Protection.
 6. E9/E9a/E9b – General Fill Material.
 7. E10 – Random Fill.
 8. E11 – Class II Aggregate Base.
 9. CR1/CR2 – Concrete Rubble.

1.2 RELATED SECTIONS

- A. Section 31 10 00 – Clearing, Grubbing and Stripping.
- B. Section 31 23 00 – Excavation and Fill Placement.
- C. Section 31 25 00 – Erosion and Sedimentation Controls.
- D. Section 31 60 00 – Foundation Preparation.
- E. Section 31 71 00 – Tunnel Construction.
- F. Section 32 50 00 – Roads, Bridges and Culverts.

1.3 REFERENCE STANDARDS

- A. Highway and Transportation Officials:
1. AASHTO M 43 - Standard Specification for Sizes of Aggregate for Road and Bridge Construction.
 2. AASHTO M 147 - Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base, and Surface Courses.
 3. AASHTO T 180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 10-lb Rammer and an 18-in. Drop.

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B. ASTM International:

1. ASTM C136/C136M - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
2. ASTM D123 - Standard Terminology Relating to Textiles.
3. ASTM D276 - Test Method Identification of Fibres in Textiles.
4. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort 56,000 ft-lbf/ft³.
5. ASTM D2419 - Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
6. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
7. ASTM D3744 - Standard Test Method for Aggregate Durability Index.
8. ASTM D3776 - Standard Test Methods for Mass Per Unit Area (Weight) of Fabric.
9. ASTM D3786 - Standard Test Method for Bursting Strength of Textile Fabrics - Diaphragm Bursting Strength Tester Method.
10. ASTM D4253 - Standard test method for maximum index density and unit weight of soils using a vibratory table.
11. ASTM D4254 - Standard test method for minimum index density and unit weight of soils and calculation of relative density.
12. ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
13. ASTM D4354 - Practice for Sampling of Geosynthetics for Testing.
14. ASTM D4355 - Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus).
15. ASTM D4439 - Terminology for Geotextiles.
16. ASTM D4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
17. ASTM D4533 - Standard Test Methods for Trapezoid Tearing Strength of Geotextiles.
18. ASTM D4632 - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
19. ASTM D4751 - Standard Test Methods for Determining Apparent Opening Size of Geotextile.
20. ASTM D4759 - Practice for Determining the Specification Performance of Geosynthetics.
21. ASTM D4873 - Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples.
22. ASTM D6241 - Standard Test Method for the Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50-mm Probe.
23. ASTM D6913 - Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis.
24. ASTM D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

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- C. California State Parks Accessibility Guidelines, 2015 Edition.
- D. California Department of Transportation (CalTrans) - Standard Specifications:
 - 1. Section 96 – Geosynthetics.
 - 2. Section 26 – Aggregate Bases.
- E. Oregon Department of Transportation (ODOT) - Standard Specifications:
 - 1. Section 02320 – Geosynthetics.

1.4 DEFINITIONS

- A. **Bedding** – Material obtained from existing borrows or by blasting and/or crushing rock, cobbles, and boulders, to be used underneath erosion protection.
- B. **D₅₀** – The diameter of the median rock size in the erosion protection gradation.
- C. **Filter** – Natural or processed sand, gravel and cobbles, crushed rock, crushed gravel, or a mixture of these materials.
- D. **Optimum Moisture Content** – The moisture content corresponding to the maximum dry density as determined by the standard Proctor compaction test using ASTM D1557.
- E. **Erosion Protection** - Rock material with specified gradations used for the prevention of soil erosion caused by exposure to river flows.
- F. **Riprap** – Previously installed rock material which may require sorting to meet Erosion Protection gradation specifications.
- G. **Aggregate Base** – Road surface material (per Caltrans Standard Specifications, Section 26, 4-26) for all newly constructed non-asphalt surface roads.

1.5 SUBMITTALS

- A. Items listed in this section are to be submitted to the Engineer for information prior to the start of any Works, unless noted otherwise.
- B. Quality Control Plan.
- C. Aggregate/Geosynthetic Supplier Accreditation.

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- D. Material Certificates: submit test results from manufacturers for review and approval by the engineer.
- E. Quality Control Test Results: submit test results from QC control tests from materials sourced onsite for review and approval by the Engineer.
- F. Material source plan: a detailed plan for each source of material including the proposed methods of exploitation and processing (if applicable).

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with relevant state standards (i.e. State of Oregon for JC Boyle and State of California Department of Transportation Standards for all other sites).
- B. Work shall be in conformance with Drawings, submittals, and other project documents.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General.
 - 1. Materials should be obtained as specified in Section 31 23 00 – Excavation and Fill Placement.
 - 2. Materials shall be composed of durable particles free of organic matter, ice, snow, and other frozen materials. Organics are allowed in Type 10 random fill.
 - 3. All materials shall be well-graded within their gradation limits.
 - 4. Materials shall be in conformance with gradation bands shown on the Drawings.
- B. Aggregate Materials Description and Requirements.
 - 1. See Clause 2.1, C. for gradation plots.
 - 2. Type E2 – Pipe Zone.
 - a. Material description: Gravel and Sand.
 - b. Placement and Compaction: Placed and spread evenly in maximum 6-inch lifts compacted to 95% maximum dry density as determined by ASTM D1557. If a well-defined density vs moisture curve cannot be determined from ASTM D1557, material shall be compacted to 75% relative density as per ASTM D4253 and ASTM D4254.
 - 3. Type E3 – Structural Fill.

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- a. Material description: Gravel, and Sand.
- b. Placement and Compaction: Placed and spread evenly in maximum 8-12 inch lifts compacted to 95% maximum dry density as determined by ASTM D698 (Section 5.3.1 - coarse granular fill), to be observed continuously (i.e. probe testing each lift, at 20 ft intervals pending results of test fill). Method specification for achieving required compaction shall be determined by the Engineer following test fill, per ASTM D698.
- c. Plasticity: Plasticity Index < 12, Liquid Limit <35 as determined by ASTM D4318.
4. Type E4 – Select Fill.
 - a. Material description: Cobbles, Gravel, and Sand.
 - b. Placement and Compaction: Placed and spread evenly in maximum 18-inch lifts compacted to 95% maximum dry density as determined by ASTM D1557. If a well-defined density vs moisture curve cannot be determined from ASTM D1557, material shall be compacted to 75% relative density as per ASTM D4253 and ASTM D4254.
5. Type E5 – Road Embankment Fill.
 - a. Material description: Cobbles, Gravel, Sand and Fines.
 - b. Placement and Compaction: Placed and spread evenly in maximum 12-inch lifts compacted to 95% maximum dry density as determined by ASTM D1557.
 - c. Plasticity: Plasticity Index < 12, Liquid Limit <35 as determined by ASTM D4318.
6. Type E6/E8: Bedding.
 - a. Material description: Cobbles and Gravel.
 - b. Placement and Compaction: Placed and spread E6/E8 evenly in maximum 12-inch lifts in a non-segregating manner. Provide nominal compaction using construction equipment (e.g. track walk, static rolling, bucket tamping, etc.).
7. Type E7 – Erosion Protection.
 - a. Material description: Boulders and Cobbles.
 - b. Erosion protection is categorized by type a/b/c as shown in the following table. All E7 erosion protection shall meet or exceed the gradations for each type as shown in Table 1.

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Table 1 – Type E7 – Erosion Protection Details

| E7 Type | Nominal Diameter (in) | D₁₅ Min (in) | D₅₀ Min (in) | D₈₅ Min (in) |
|----------------|------------------------------|--------------------------------|--------------------------------|--------------------------------|
| E7a | 9 | 5.5 | 8.5 | 11.5 |
| E7b | 21 | 13.0 | 20.0 | 27.5 |
| E7c | 36 | 22.0 | 34.0 | 47.0 |

- c. Placement: See Section 3.4. Thicknesses as shown on Drawings.
- d. Erosion protection to be hard, durable, able to withstand long exposure to weathering, and have a minimum bulk saturated surface dry (SSD) specific gravity of 2.64 for the Oregon Site and 2.74 for the California Sites.
- e. Erosion Protection should have a durability index of 40 or greater and a sand equivalent of 75 or greater.
- f. Size to meet or exceed the size dimensions specified on the rock intermediate dimension (secondary axis).
- g. Rock particles with a minimum dimension less than 1/3.5 the maximum dimension shall not be used.
8. Type E9 – General Fill.
 - a. Material description: Boulders, Cobbles, Gravel, Sand and Fines.
 - b. Placement and Compaction: Type E9 material placed and spread evenly in maximum 24-inch lifts. Provide nominal compaction using construction equipment (e.g. track walk, static rolling, bucket tamping, etc.).
9. Type E9a – General Fill.
 - a. Material description: Boulders, Cobbles, Gravel, Sand and Fines.
 - b. Placement and Compaction: Type E9a material is end dumped or placed with no compaction requirement.
10. Type E9b – General Fill for Final Stabilization.
 - a. Material description: Boulders, Cobbles, Gravel, and Sand.
 - b. Placement and Compaction: Type E9b material placed and spread evenly in maximum 24-inch lift. Provide nominal compaction using construction equipment (e.g. track walk, static rolling, bucket tamping, etc.).
11. Type E10 – Random Fill.
 - a. Material description: Overburden, rock, or organics.
 - b. No gradation requirements.
 - c. Placement: Material shall only be placed in designated disposal sites, as per the design drawings.
 - d. Compaction: Material shall be track walked to achieve nominal compaction.

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12. Type E11 – Class II Aggregate Base.
 - a. Material description: Gravel and Sand.
 - b. Aggregate must be clean and consist of any combination of the following: Broken stone, Crushed gravel, Natural rough-surfaced gravel, Sand, Processed reclaimed asphalt concrete, PCC, LCB, or CTB. Use either 1-1/2-inch or 3/4-inch maximum aggregate gradation unless otherwise specified. Do not change selected aggregate gradation without authorization.
 - c. Caltrans 26-1.02B Class 2 Aggregate Base Aggregate quality characteristics must comply with the requirements shown in Table 2.

Table 2 – Type E11 – Aggregate Quality Characteristics

| Quality Characteristic | Requirement | |
|---------------------------|-----------------|---------------------|
| | Operating Range | Contract Compliance |
| Resistance (R-value, min) | -- | 78 |
| Sand equivalent (min) | 25 | 22 |
| Durability index (min) | -- | 35 |

13. Type E12 – Engineered Streambed Material.
 - a. Material description: Boulders, Cobbles, Gravel, Sand and Fines.
 - b. Placement and Compaction: See Section 3.6. Thicknesses as shown on Drawings.
14. Type E13 – Drain Rock.
 - a. Material description: Crushed, clean, angular gravel.
 - b. Placement and Compaction: Placed and spread evenly in maximum 6-8 inch lifts, compacted using bucket tamping or hand tools.
 - c. Drain Rock should have a durability index of 40 or greater and a sand equivalent of 75 or greater.
15. Type CR1/CR2 – Concrete Rubble.
 - a. Material description: Broken Concrete/Reinforced Concrete, Boulders, Cobbles, Gravel, and Sand. Broken concrete destined for the disposal sites shall limit the protruding reinforcing bars to 9 inches in length. Where reinforcing bars are bent over the broken concrete pieces, the bent reinforcing bars shall be limited to 24 inches in length with a maximum of 4 inches from the surface of the broken concrete. Where reinforcing railroad rails are present in the concrete pieces, the protruding railroad rail shall not exceed 3 feet in length.

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- b. Placement and Compaction of Type CR1: End – Dumped Placement. Concrete rubble shall be end-dumped. During placement of concrete rubble, care shall be taken to fill voids with soil and rock materials. Concrete rubble shall not be used for final stabilization cover material of the disposal sites. Placement of concrete rubble in the scour hole at the J.C. Boyle facility differs from the specifications outlined in this section. See Technical Specification 31 23 00 Excavation and Fill Placement for the scour hole backfilling requirements.
- c. Placement and Compaction of Type CR2: Placed and spread evenly in maximum 36-inch lift to provide a reasonably level surface for safe passage of equipment and then track walked. During placement of concrete rubble Type CR2, care shall be taken to fill voids with soil and rock materials as per Section 3.5.

C. Aggregate Material Gradation Limits.

1. Table 3 shows the gradation limits for the aggregate materials described in B excluding Types E7 – Erosion Protection (shown in B.) and E10 – Random Fill (no gradation requirements). The table below shall be used for plotting gradation minimum and maximum limits. Sieve sizes as required to test the materials shall be selected by the Contractor to provide the necessary information for acceptance of the material tested.

Table 3 – Aggregate Material Gradation limits

| Material Type | Coarse Limit | | Fine Limit | |
|---------------|-------------------------|-------------------------------|-------------------------|-------------------------------|
| | US Standard Sieve Sizes | Percent Passing by Weight (%) | US Standard Sieve Sizes | Percent Passing by Weight (%) |
| E2 | 1.5" | 100 | 1/4" | 100 |
| | #16 | 5 | #200 | 12 |
| E3 | 3" | 100 | 3/4" | 100 |
| | #4 | 60 | #200 | 30 |
| | #200 | 5 | | |
| E4 | 4" | 100 | 3/8" | 100 |
| | #10 | 10 | #16 | 60 |
| | | | #200 | 10 |
| E5 | #4 | 100 | 3/8" | 100 |
| | #10 | 10 | #16 | 60 |

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| Material Type | Coarse Limit | | Fine Limit | |
|---------------|-------------------------|-------------------------------|-------------------------|-------------------------------|
| | US Standard Sieve Sizes | Percent Passing by Weight (%) | US Standard Sieve Sizes | Percent Passing by Weight (%) |
| | | | #200 | 30 |
| | | | | |
| E6 | 3" | 100 | 1" | 100 |
| | 1" | 10 | 3/8" | 10 |
| | | | | |
| E8 | 12" | 100 | 3" | 100 |
| | 3" | 10 | 1" | 10 |
| | | | | |
| E9 | 20" | 100 | 3/8" | 100 |
| | 3/4" | 10 | #16 | 60 |
| | | | #200 | 30 |
| | | | | |
| E9a | 20" | 100 | #16 | 100 |
| | 3/4" | 10 | #200 | 40 |
| | | | | |
| E9b | 20" | 100 | 3/8" | 100 |
| | 3/4" | 10 | #16 | 60 |
| | | | #200 | 10 |
| | | | | |
| E11 | 1" | 100 | 3/4" | 100 |
| | 3/4" | 90 | #4 | 60 |
| | #4 | 35 | #30 | 30 |
| | #30 | 10 | #200 | 9 |
| | #200 | 2 | | |
| | | | | |
| E12 | 60" | 100 | 40" | 100 |
| | 40" | 85 | 20" | 85 |
| | 12" | 50 | 1" | 50 |
| | 3/8" | 0 | #200 | 0 |
| | | | | |
| E13 | 4" | 100 | 1.5" | 100 |
| | 3" | 30 | 1" | 5 |
| | 2" | 25 | | |
| | 1" | 5 | | |
| | | | | |

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| Material Type | Coarse Limit | | Fine Limit | |
|---------------|-------------------------|-------------------------------|-------------------------|-------------------------------|
| | US Standard Sieve Sizes | Percent Passing by Weight (%) | US Standard Sieve Sizes | Percent Passing by Weight (%) |
| CR1 | 36" | 100 | 3/8" | 100 |
| | 12" | 10 | #16 | 60 |
| | | | #200 | 30 |
| CR2 | 24" | 100 | 3/8" | 100 |
| | 6" | 10 | #16 | 60 |
| | | | #200 | 30 |

D. Geotextiles.

- Geotextile installed for erosion and sediment control features shall provide bare soil retention, nurture vegetation, and provide high performance turf reinforcement. An acceptable product is Mirafi TM-Series or equivalent.
- Geotextiles to be installed as per the Manufacturers recommendations and specifications and the following California and Oregon guidelines:
 - California Stormwater BMP Handbook – Construction.
 - Construction Stormwater Best Management Practiced Manual, 1200-C NPDES General Permit, State of Oregon, Department of Environmental Quality.
- Geotextile installed for separation between subgrade and earthfill materials shall be a nonwoven, needle-punched fabric that meets the relevant state's minimum physical property requirements, either Table 1 from Caltrans Section 96 "Geosynthetics" (shown in Table 4), or Table 2 from ODOT Section 02320 "Geosynthetics and Slope Protection" (shown in Table 5). All numeric values in Table 4 except AOS represent MARV in the weakest principal direction. Values for AOS represent maximum average roll values. Geotextile shall not be installed until conformance test results are reviewed and the geotextile is accepted by the Engineer.

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Table 4 – Nonwoven Separation Geotextile Caltrans Requirements

| Property | Value | Test Method |
|------------------------------|------------------------|-------------|
| Grab Tensile Strength | 250 lbs | ASTM D4632 |
| Grab Tensile Elongation | < 50% | ASTM D4632 |
| Tear Strength | 90 lbs | ASTM D4533 |
| CBR Puncture Strength | 500 lbs | ASTM D6241 |
| Permittivity | 0.05 sec ⁻¹ | ASTM D4491 |
| Apparent Opening Size (AOS) | 0.012 in | ASTM D4751 |
| UV Resistance (at 500 hours) | 70% strength retained | ASTM D4355 |

Table 5 – Nonwoven Separation Geotextile ODOT Requirements

| Property | Value | Test Method |
|------------------------------|------------------------|-------------|
| Grab Tensile Strength | 113 lbs | ASTM D4632 |
| Grab Tensile Elongation | 50% | ASTM D4632 |
| Tear Strength | 41 lbs | ASTM D4533 |
| CBR Puncture Strength | 223 lbs | ASTM D6241 |
| Permittivity | 0.05 sec ⁻¹ | ASTM D4491 |
| Apparent Opening Size (AOS) | No. 30 US Sieve | ASTM D4751 |
| UV Resistance (at 500 hours) | 50% strength retained | ASTM D4355 |

PART 3 - EXECUTION

3.1 DELIVERY, STORAGE AND HANDLING OF GEOSYNTHETICS

- A. Geosynthetic labeling, shipment, and storage shall follow ASTM D4873. Product labels shall clearly show the manufacturer or supplier name, style name, and roll number. During all periods of shipment and storage, the geotextile shall be protected from direct sunlight, ultraviolet rays, temperature greater than 140 degrees Fahrenheit, and mud, dirt, dust, and debris. At no time shall the geotextile be exposed to sunlight for a period exceeding 14 days.
- B. Each geosynthetic roll shall be wrapped with a material that will protect the geosynthetic from damage due to shipment, water, sunlight, and contaminants.

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- C. During storage, geosynthetic rolls shall be elevated off the ground and adequately covered to protect them from the following: site construction damage, precipitation, extended ultraviolet radiation including sunlight, chemicals that are strong acids or strong bases, flames including welding sparks, excess temperatures, and any other environmental conditions that may damage the physical property values of the geosynthetic.

3.2 INSTALLATION OF GEOTEXTILES

- A. The Contractor shall handle all geotextiles in such a manner as to ensure the geotextile is not damaged.
- B. The surface on which the geotextile is to be placed shall be prepared to a smooth condition free of debris or obstructions which may damage the geotextile. The subgrade shall be approved by the Engineer prior to geotextile placement. Care shall be taken not to entrap stone, excessive dust, or moisture in the geotextile. The Contractor and Installer shall not operate equipment over the geotextile without meeting minimum cover requirements of capping operations. The Contractor shall follow the Manufacturer's recommendations and these Specifications during installation of the geotextile.
- C. Geotextiles shall be deployed free of wrinkles and folds. On slopes, the geotextiles shall be anchored at the top and unrolled down the slope. In the presence of wind, all geotextiles shall be weighted with sandbags or other material which will not damage the geotextile.
- D. Adjacent geotextile panels shall have minimum two-foot overlaps. All seams shall be oriented parallel to (in the direction of) the slope. Seams constructed perpendicular or transverse to the direction of the slope will not be accepted. The geotextile shall be examined over the entire surface after installation to ensure that no potentially harmful objects are present.
- E. Damaged geotextiles and geotextiles contaminated with dirt shall be repaired immediately. Repairs shall be made with the same geotextile product style as the original material. All repairs shall meet the approval of the Engineer, prior to cover placement.
- F. Geotextile panels which require repair to be replaced with new material. Replacement material shall have a minimum overlap of two feet at the entire perimeter. All seams shall be oriented parallel to (in the direction of) the slope. Seams constructed perpendicular or transverse to the slope will not be accepted.
- G. Placement of cover on the geotextile shall be accomplished in a manner as to ensure that the geotextile is not damaged. Cover material shall be placed within 15 days of deployment.

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- H. Cover material shall be placed such that excess tensile stress is not mobilized in the geotextile. Cover placement operations shall comply with the requirements and limitations of the contract documents and project design documents.

3.3 INSTALLATION OF AGGREGATE MATERIALS

A. Excavation:

1. Excavate aggregate materials from Site locations as indicated in the Drawings and as specified in Section 31 23 00 – Excavation and Fill Placement.
2. Materials shall be obtained from approved locations or from on-site excavation borrow sites operated by the Contractor.
3. Contractor operated borrow sites shall be developed in accordance with all applicable State Acts.

B. Stockpiling:

1. Separate different aggregate materials with dividers or stockpile apart to prevent intermixing of aggregate types or contamination.
2. Direct surface water away from stockpile site to prevent erosion or deterioration of materials as per Section 31 25 00 – Erosion and Sedimentation Controls.
3. Stockpile hazardous materials on impervious material and cover to prevent erosion and leaching until they are disposed.

C. Placement: Place aggregate materials at Site locations as indicated on the Drawings and as specified in Section 31 23 00 – Excavation and Fill Placement.

D. Additional specific installation details for Type E7 – Erosion Protection included in section 3.4.

3.4 INSTALLATION OF EROSION PROTECTION - TYPE E7A/E7B/E7C

- A. Erosion Protection – Type E7a/E7b/E7c shall be placed mechanically in a well interlocked fashion in locations shown in the Drawings to provide scour protection.
- B. Erosion protection - Type E7a/E7b/E7c shall not be placed until foundation preparation is completed, geotextile installed (if applicable) and the subgrade surfaces have been observed by the Engineer.
- C. The maximum drop high for Erosion protection - Type E7a/E7b/E7c placement is 2 feet.
- D. Erosion protection - Type E7a/E7b/E7c shall be mechanically tamped after placement.

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- E. Erosion protection - Type E7a/E7b/E7c layer shall be constructed to the full course thickness in one operation and in such a manner as to avoid displacement of the underlying materials.
- F. The rock shall be delivered and placed in a manner that results in a reasonably homogenous appearance, with the larger rocks uniformly distributed and firmly in contact with one another and with smaller rocks and spalls filling the voids between the larger rocks.

3.5 INSTALLATION OF CONCRETE RUBBLE

- A. The installation of concrete rubble section does not apply to areas where Type E9 – General Fill is specified separately of concrete rubble. The Drawings denote separate concrete rubble placement from Type E9 – General Fill at locations such as the powerhouse backfill, and the installation of concrete rubble section only applies to the CR2 denoted locations.
- B. Concrete rubble shall be covered by a minimum of 2 ft of cover material.
- C. During the placement of Type CR2 - concrete rubble, care shall be taken by the contractor to infill voids between concrete pieces with soil and rock using the procedure below:
 - 1. After a lift of concrete rubble has been placed, a layer of Type E9 general fill material shall be placed over the concrete rubble layer. The lift shall then be track walked to push the general fill into the voids and compact the concrete rubble.
 - 2. If voids are still visible after the area has been track-walked another layer of E9 general fill shall be placed and the process repeated until the voids are no longer visible.
 - 3. The thickness of the Type E9 fill that blankets the concrete rubble lift prior to nominal compaction will be dependant on the void ratio of the concrete and will be adjusted on an as-needed basis by the contractor. The Type E9 general fill layer shall be thin enough to avoid material bridging that would prevent the infilling of the voids.
 - 4. The contractor shall avoid overfilling the concrete rubble and creating continuous layers of Type E9 material.
- D. The placement of Type CR1 – concrete rubble shall remain end dumped and will not require the more stringent placement method outlined in Clause 3.5, C. Type CR1 is only specified on the drawings where slope stability is not a requirement, except for the scour hole which is governed by its own placement requirements as per Section 31 23 00 – Excavation and Fill Placement.

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- E. Where a capping layer is specified above segregated materials, or large particle material with cavities and/or voids, filter material may be specified by the Engineer.

3.6 INSTALLATION OF ENGINEERED STREAMBED MATERIAL

- A. Contractor shall begin construction of the roughened channel from the downstream end, constructing downstream apron prior to constructing the roughened channel. Order of work will begin with downstream boulder buttress construction, engineered streambed material and roughness element construction, and upstream boulder buttress.
- B. Boulder buttresses will be spaced as shown on the Drawings.
- C. Intermediate roughness elements (i.e. random boulders and boulder clusters, 2 ft to 3.5 ft in size, located between buttresses) shall be placed to create a complex flow field. These roughness elements will require field fitting to create a network of bifurcating and confluencing low flow paths.
- D. Engineered streambed material shall be placed and spread evenly in 1 ft lifts and compacted with vibratory roller.
- E. Once firmly compacted, final surface shall undergo high pressure hose treatment to direct fines into the interstitial spaces to improve compaction.
- F. Final channel grade will have an average longitudinal slope between boulder buttresses as shown on the Drawings. The roughened channel surface will have localized highs and lows. Roughness elements will not be included in calculation of roughened channel slope.
- G. Final testing will require percolation test every 30 ft along roughened channel. Sandbags may be used to isolate a zone for testing (2 ft area min.). If percolation rate is exceeded greater than 120 min/in (4 hr minimum measurement period), further compaction and/or filling of interstitial spaces with high pressure fines/water is required.
- H. The Engineer shall direct field survey and percolation and compaction testing for the roughened channel and provide final approval.

3.7 QUALITY

- A. For materials procured off-site or from commercial suppliers, the Contractor shall provide quality control certificates in accordance with the testing frequencies detailed in Table 6.

31 05 00 - MATERIALS FOR EARTHWORK

- B. The Contractor will be responsible for field quality testing (control tests) for all fill materials excavated from on-site borrow areas that are incorporated in the permanent work at the frequencies detailed in Table 66. Minimum testing requirements: frequency is “1 per” the number of cubic yards of material as required for the Work.

Table 6 – Control Testing Schedule

| Material Type | Moisture Content (ASTM D2216) | Particle Size Distribution (ASTM D6913) | Laboratory Compaction (ASTM D1557 or D4523 & D4524 as applicable) | Specific Gravity and Absorption (ASTM D854 and ASTM D6473) | Atterberg Limits (ASTM D4318) | Durability Index (ASTM D3744) | Sand Equivalent (ASTM D2419) |
|-------------------------------------|-------------------------------|---|---|---|-------------------------------|-------------------------------|------------------------------|
| | 1 per | 1 per | 1 per | 1 per | 1 per | 1 per | 1 per |
| E2 – Pipe Zone | 650 | 650 | 650 | 3,250 | - | - | - |
| E3 – Structural Fill | 650 | 650 | 650 | 3,250 | 3,250 | - | - |
| E4 – Select Fill | 1,300 | 1,300 | 1,300 | 3,250 | - | - | - |
| E5 – Road Embankment Fill | 1,300 | 1,300 | 1,300 | 3,250 | - | - | - |
| E6 / E8 – Bedding | - | 650 | - | - | - | - | - |
| E7a/E7b/E7c – Erosion Protection | - | Visual | - | 2000 | - | 2000 | Source |
| E9/E9a/E9b – General Fill | - | 20,000 | - | - | - | - | - |
| E10 – Random Fill | - | - | - | - | - | - | - |
| E11 – Class II Aggregate Base | 500 | 500 | 2,000 | - | - | - | - |
| E12 – Engineered Streambed Material | - | Visual | - | 2,000 | - | 2,000 | - |
| E13 – Drain Rock | - | Source | - | Source | - | - | Source |
| CR1/CR2 – Concrete Rubble | - | Visual | - | - | - | - | - |

NOTES:

- CONTROL TESTING TO BE PERFORMED PRIOR TO USE OF MATERIALS IN THE WORKS TO CONFIRM MATERIAL COMPLIANCE. CONTROL TESTING MAY BE UNDERTAKEN ON STOCKPILED MATERIALS OR PRIOR TO DELIVERY OF COMMERCIAL PRODUCTS TO SITE. RECORD TESTING (SECTION 31 23 00 EXCAVATION AND FILL PLACEMENT) TO BE UNDERTAKEN ONCE MATERIALS ARE PLACED TO CONFIRM COMPLIANCE OF IN-SITU MATERIALS.
- SOME E7A/E7B/E7C AND E13 CONTROL TESTS ARE USED TO CHARACTERIZE A SOURCE. ONE OF EACH TEST IS REQUIRED AT LOCATIONS OF PLANNED SOURCING, EITHER FROM A BORROW AREA OR MANUFACTURER.
- IF TESTING VOLUME NOTED IN TABLE 6 EXCEEDS THE VOLUME OF PLACED FILL FOR A SPECIFIC AREA, THEN PERFORM A MINIMUM OF 1 TEST PER AREA.

31 05 00 - MATERIALS FOR EARTHWORK

- C. If in the judgement of the Engineer, the volume of material represented by a failed control test is anticipated to result in work that deviates from design intent, remove, or dispose of the non-complying material. Rework shall be performed at the Contractor's expense.
- D. Material quality, including such fill parameters as frozen/unfrozen state and inclusion of topsoil, shall be verified by the Engineer prior to fill placement.
- E. Aggregate Moisture Control:
 - 1. Moisture Adjustment: Moisture content shall be adjusted as necessary to facilitate compaction. Moisture control shall be achieved by either windrowing, scarifying or adding water to achieve workable moisture content.
 - 2. Water may be added to the material at the source or after the material has been brought into its final position, whichever is more practical. The Contractor shall obtain uniform moisture distribution in the lift by disking, blading, or other approved methods. The amount of water applied shall be controlled so that free water will not appear on the surface during or subsequent to compaction operations.
 - 3. Material deposited on fill that is too wet shall be removed or spread and permitted to dry, assisted by disking or blading, if necessary, until the moisture content is reduced to the specified limits.
 - 4. When the top surface of a layer becomes too dry or too smooth to permit suitable bonding with the subsequent layer, the Contractor shall loosen the material by scarifying or disking. The Contractor shall then moisten the loosened material to acceptable moisture content and re-compact the material to the specified density.
- F. Any omissions or failure on the part of the Engineer to reject the work or materials shall not be construed as acceptance of unsuitable materials.
- G. A testing laboratory will furnish test data on all materials manufactured for incorporation into permanent project structures. Certification shall meet the relevant state requirements.

END OF SECTION 31 05 00

Kiewit Infrastructure West Co.
Klamath River Renewal Project
Technical Specifications

31 10 00 – CLEARING, GRUBBING AND STRIPPING

Prepared by:



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31 10 00 – CLEARING, GRUBBING AND STRIPPING

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31 10 00 – CLEARING, GRUBBING AND STRIPPING

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31 10 00 – CLEARING, GRUBBING AND STRIPPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This specification describes the construction and quality management requirements for Clearing, Grubbing and Stripping activities.
- B. This specification applies to the Clearing, Grubbing and Stripping as specified in this Section and set out in the Drawings.

1.2 RELATED SECTIONS

- A. Section 31 05 00 – Materials for Earthwork.
- B. Section 31 23 00 – Excavation and Fill Placement.
- C. Section 31 25 00 – Erosion and Sedimentation Controls.
- D. Section 31 30 00 – Earthwork Methods.
- E. Section 31 60 00 – Foundation Preparation.
- F. Section 31 80 00 – Care of Water.

1.3 REFERENCE STANDARDS

- A. Conform to Siskiyou County code within the State of California for disposal of debris.
- B. Conform to Klamath County code within the State of Oregon for disposal of debris.
- C. California Stormwater Quality Association:
 - 1. California Stormwater BMP Handbook – Construction.
- D. State of Oregon Department of Environmental Quality:
 - 1. Construction Stormwater Best Management Practices Manual, 1200-C NPDES General Permit.

31 10 00 – CLEARING, GRUBBING AND STRIPPING

1.4 DEFINITIONS

- A. **Clearing** – The felling and removal of trees, shrubs, and vegetation to within 18 inches of the ground within areas of the Site so designated on the Drawings.
- B. **Grubbing** – The removal of roots and stumps within areas of the Site so designated on the Drawings.
- C. **Stripping** – The complete removal of all vegetation and organic matter to a maximum depth of 3 feet within areas of the Site so designated on the Drawings.
- D. **Organics and Woody Debris** – All organic matter including trees, shrubs, roots, stumps, and other vegetation existing in the Site areas.
- E. **Merchantable Timber** – Tree or portion of a tree suitable for harvesting and transport to a processing plant.

1.5 SUBMITTALS

- A. Project Record Documents: Record actual locations of abandoned utilities and services, foundations, and other appurtenances.

1.6 QUALITY ASSURANCE

- A. Work shall be in conformance with the Drawings, submittals, and other project documents.

PART 2 - PRODUCTS

2.1 EQUIPMENT

- A. Equipment shall be the responsibility of the Contractor.

2.2 CLASSIFICATION OF MATERIALS

- A. Materials removed during Clearing, Grubbing and Stripping are to be classified as either organics and woody debris or merchantable timber and stored as described on the Drawings and as specified in this Section.

31 10 00 – CLEARING, GRUBBING AND STRIPPING

PART 3 - EXECUTION

3.1 GENERAL

- A. Site clearing operations must not commence until temporary erosion and sedimentation controls measures are in place.
- B. The Contractor shall clear, grub and strip all ground surfaces prior to fill placement in any area to the limits as shown on the Drawings.
- C. The Contractor shall clear, grub and strip all ground surfaces prior to excavation if the excavated materials are to be used for construction purposes and have specified material requirements.
- D. In order to reduce erosion and contamination of the surface runoff to a minimum at all times, Clearing, Grubbing and Stripping shall be scheduled to be performed only as and when required to enable each portion of the Work to be carried out.

3.2 PREPARATION, PROTECTION AND EXAMINATION

- A. Call Local Utility Line Information service at (800) 332-2344 (Oregon) or (811) (California) not less than three working days before performing Work.
 - 1. Request underground utilities to be located and marked within and surrounding construction areas.
 - 2. Obtain local as constructed record documents for local and private utilities.
- B. Obtain protocols on protection of utilities and cultural resources. Locate, identify, and protect utilities indicated to remain, from damage. Protect benchmarks and other survey control points from damage or displacement.
- C. The Contractor shall stake out the areas where Clearing, Grubbing and Stripping are to be carried out. Markings of the area limits should be clearly visible and remain in place following the completion of the Clearing, Grubbing and Stripping activities.
- D. The Contractor must minimize the tracking of mud and soil from the project area on to the existing paved or public roads. Soil or mud tracked from the Work area and on to the roads shall be removed daily.

31 10 00 – CLEARING, GRUBBING AND STRIPPING

3.3 CLEARING

- A. Clear the areas of the site as designated on the Drawings or in the Technical Specifications including the felling of all trees, shrubs, and vegetation to within 18 inches of the ground.
- B. Collect all organics and woody debris for eventual disposal or stockpiling.
- C. Any clearing, which the Contractor elects to perform for his own purposes, shall be subject to approval by the Owner. This clearing must be performed in accordance with the requirements of this Specification. Prior to the clearing of any area, which is not required for the construction of the permanent Works, the Contractor shall submit to the Owner for approval, full details of the clearing it proposes to perform.

3.4 GRUBBING

- A. Grubbing shall include the complete removal of all roots and stumps in areas designated on the Drawings. Removal of root structures shall be to the bottom of the root or 18" below grade level.
- B. Grubbed debris can be temporarily stockpiled or windrowed within the work area, but ultimately is to be removed to designated stockpile or disposal locations.
- C. Where Grubbing will result in erosion, measures shall be taken to mitigate such as per Section 31 25 00 - Erosion and Sedimentation Controls.
- D. Grubbing shall be completed as soon as Clearing operations allow.

3.5 STRIPPING

- A. Stripping includes the complete removal of all vegetation and organic matter to a maximum depth of 3 feet.
- B. Stripping shall be performed in a manner that maximizes the salvage of the organics for eventual site restoration.
- C. Stripped debris can be temporarily stockpiled or windrowed within the work area, but ultimately is to be removed to designated stockpile or disposal locations.
- D. Where Stripping will result in erosion, measures shall be taken to mitigate such as per Section 31 25 00 - Erosion and Sedimentation Controls.

31 10 00 – CLEARING, GRUBBING AND STRIPPING

- E. Stripping shall be completed in conjunction with grubbing operations or as soon as grubbing operations allow.

3.6 REMOVAL AND STOCKPILING

- A. After an area has been cleared, stripped, grubbed and the debris removed, remove surface organics and woody debris and windrow, or stockpile this material.
- B. Stockpile locations shall not interfere with any other part of the Work and shall be located at a minimum 50 feet away from proposed or existing structures.
- C. Stockpile the organics and woody debris in a neat workmanlike manner ensuring that it is stable and protected from erosion. Care shall be exercised during stockpiling to prevent compaction and possible mixing of the organics with subsoil.

3.7 QUALITY

- A. The Contractor shall provide the Owner and Engineer access to the site at all times.
- B. The Contractor is responsible for performing work in accordance with the Drawings and performing quality control.
- C. The Engineer shall inspect the area to determine whether removal of material has been completed satisfactorily.

END OF SECTION 31 10 00

SECTION 31 05 19 - GEOTEXTILES

PART 1 -- GENERAL

1.1 SUMMARY

- A. The CONTRACTOR shall provide geotextiles, complete and in place, in accordance with the Contract Documents.
- B. **Definitions:** The following definitions apply to the WORK of this Section:
1. Fabric: Geotextile, a permeable geosynthetic comprised solely of textiles.
 2. Minimum Average Roll Value (MinARV): Minimum of series of average roll values representative of geotextile provided.
 3. Maximum Average Roll Value (MaxARV): Maximum of series of average roll values representative of geotextile provided.
 4. Nondestructive Sample: Sample representative of finished geotextile, prepared for testing without destruction of geotextile.
 5. Overlap: Distance measured perpendicular from overlapping edge of one sheet to underlying edge of adjacent sheet.
 6. Seam Efficiency: Ratio of tensile strength across seam to strength of intact geotextile, when tested according to ASTM D 4884.
 7. Woven geotextile: A geotextile fabric composed of polymeric yarn interlaced to form a planar structure with uniform weave pattern.
 8. Nonwoven geotextile: A geotextile fabric composed of a pervious sheet of polymeric fibers interlaced to form a planar structure with uniform random fiber pattern.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. The following standards are referenced in this Section:

| | |
|-------------|--|
| ASTM D 4355 | Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture, and Heat in a Xenon-Arc Type Apparatus |
| ASTM D 4491 | Standard Test Methods for Water Permeability of Geotextiles by Permittivity |
| ASTM D 4533 | Standard Test Method for Trapezoid Tearing Strength of Geotextiles |
| ASTM D 4595 | Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method |

| | |
|-------------|---|
| ASTM D 4751 | Standard Test Method for Determining Apparent Opening Size of a Geotextile |
| ASTM D 4833 | Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products |
| ASTM D 4884 | Standard Test Method for Strength of Sewn or Thermally Bonded Seams of Sewn Geotextiles |
| ASTM D 4886 | Standard Test Method for Abrasion Resistance of Geotextiles (Sand Paper/Sliding Block Method) |

1.3 CONTRACTOR SUBMITTALS

- A. Furnish submittals in accordance with Section 01 33 00 - Contractor Submittals.
- B. Shop Drawings
 - 1. Manufacturer material specifications and product literature.
 - 2. Installation drawings showing geotextile sheet layout, location of seams, direction of overlap, and sewn seams.
 - 3. Description of proposed method of geotextile deployment, sewing equipment, sewing methods, and provisions for holding geotextile temporarily in place until permanently secured.
- C. Samples
 - 1. Geotextile: One-piece, minimum 18-inches long, taken across full width of roll of each type and weight of geotextile. Label each with brand name and furnish documentation of lot and roll number from which each sample was obtained.
 - 2. Field Sewn Seam: 5-foot length of seam, 12-inches wide with seam along center, for each type and weight of geotextile.
 - 3. Securing Pin and Washer: 1 each.
- D. Certifications
 - 1. Certification from geotextile manufacturer that products satisfy the indicated requirements.
 - 2. Field seam efficiency test results.

PART 2 -- PRODUCTS

2.1 NONWOVEN GEOTEXTILE

- A. Nonwoven geotextile shall be composed of a pervious sheet of polymeric fibers interlaced to form a planar structure with uniform random fiber pattern. Products shall be calendared or finished so that yarns will retain their relative position with respect to each other.
- B. Polymeric yarn shall be long-chain synthetic polymers (polyester, polypropylene, or polyethylene) with stabilizers or inhibitors added to make filaments resistant to deterioration due to heat and ultraviolet light exposure.
- C. **Geotextile Edges:** Selvaged or finished to prevent outer material from separating from sheet.
- D. **Unseamed Sheet Width:** Minimum 6-feet.
- E. **Nominal Weight per Square Yard:** 12 ounces.
- F. **Physical Properties:** Conform to requirements below.

| PHYSICAL PROPERTY REQUIREMENTS FOR NONWOVEN GEOTEXTILE | | |
|--|---|----------------------------|
| Property | Requirement | Test Method |
| Apparent Opening Size (AOS) | No. 100 to No. 140 U.S. Standard Sieve Size | ASTM D 4751 |
| Water Permittivity | 1.2 sec. ⁻¹ , MinARV | ASTM D 4491 (Falling Head) |
| Vertical Waterflow Rate | 90 gpm/sq ft, MinARV | |
| Wide Width Strip Tensile Strength | 300 MinARV | ASTM D 4595 |
| Wide Width Strip Elongation | 70 percent, MaxARV | ASTM D 4595 |
| Trapezoidal Tear Strength | 120 lb, MinARV | ASTM D 4533 |
| Puncture Strength | 130 lb, MinARV | ASTM D 4833 |
| Ultraviolet Radiation Resistance | 90 percent strength retention, MinARV after 500 hours | ASTM D 4355 |

2.2 SEWING THREAD

- A. Sewing thread shall be polypropylene, polyester, or Kevlar thread with durability equal to or greater than durability of geotextile sewn.

2.3 SECURING PINS

- A. Securing pins shall be steel rods or bars conforming to the following:
 - 1. 3/16-inch diameter.
 - 2. Pointed at one end; head on other end, sufficiently large to retain washer.
 - 3. Minimum Length: 12-inches.
- B. Steel washers for securing pins shall be:
 - 1. Outside Diameter: Not less than 1-1/2 inches.
 - 2. Inside Diameter: 1/4-inch.
 - 3. Thickness: 1/8-inch.
- C. Steel Wire Staples
 - 1. U-shaped.
 - 2. 10-gauge.
 - 3. Minimum 6-inches long.

PART 3 -- EXECUTION

3.1 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver each roll with sufficient information attached to identify manufacturer and product name or number.
- B. Handle products in manner that maintains undamaged condition.
- C. Do not store products directly on ground. Ship and store geotextile with suitable wrapping for protection against moisture and ultraviolet exposure. Store geotextile in a way that protects it from elements. If stored outdoors, elevate and protect geotextile with waterproof cover.

3.2 LAYING GEOTEXTILE

- A. Notify the ENGINEER whenever geotextiles are to be placed. Do not place geotextile prior to obtaining ENGINEER's approval of underlying materials.

- B. Lay and maintain geotextile smooth and free of tension, folds, wrinkles, or creases.

3.3 ORIENTATION ON SLOPES

- A. Orient geotextile with long dimension of each sheet parallel to direction of slope.
- B. Geotextile may be oriented with long dimension of sheet transverse to direction of slope only if sheet width, without unsewn seams, is sufficient to cover entire slope and anchor trench and extend at least 18-inches beyond toe of slope.

3.4 JOINTS

A. Unseamed Joints

1. Unseamed joints shall be overlapped to the following dimensions unless otherwise indicated:
 - a. Foundation/Subgrade Stabilization: Minimum 18-inches.
 - b. Riprap: Minimum 18-inches.
 - c. Drain Trenches: Minimum 18-inches, except overlap shall equal trench width if trench width is less than 18-inches.
 - d. Other Applications: Minimum 12-inches.

- B. Sewn seams shall be used wherever stress transfer from one geotextile sheet to another is necessary. Sewn seams, as approved by ENGINEER, also may be used instead of overlap at joints for applications that do not require stress transfer.

1. Seam efficiency shall be minimum 70 percent, verified by preparing and testing minimum of one set of nondestructive samples per acre of each type and weight of geotextile provided. Test according to ASTM D 4884.
2. Type: "J" type seams are preferred, but flat or butterfly seams are acceptable.
3. Stitch Count: Minimum 3 to maximum 7 stitches per inch.
4. Stitch Type: Double-thread chain stitch, Type 401, Federal Standard No. 751a.
5. Stitch Location: 2-inches from geotextile sheet edges, or more if necessary to develop required seam strength.
6. Sewing Machines: Capable of penetrating 4 layers of geotextile.

3.5 SECURING GEOTEXTILE

- A. Secure geotextile during installation as necessary with sand bags or other means approved by ENGINEER.
- B. Securing Pins

1. Insert securing pins with washers through geotextile, midway between edges of overlaps and 6-inches from free edges.
2. Spacing

| Slope | Maximum Pin Spacing, feet |
|------------------|--------------------------------------|
| Steeper than 3:1 | 2 |
| 3:1 to 4:1 | 3 |
| Flatter than 4:1 | 5 |

3. Install additional pins across each geotextile sheet as necessary to prevent slippage of geotextile or to prevent wind from blowing geotextile out of position.
4. Push each securing pin through geotextile until washer bears against geotextile and secures it firmly to subgrade.

3.6 PLACING PRODUCTS OVER GEOTEXTILE

- A. Notify ENGINEER before placing material over geotextile. Do not cover installed geotextile prior to receiving authorization from the ENGINEER to proceed.
- B. If tears, punctures, or other geotextile damage occurs during placement of overlying products, remove overlying products as necessary to expose damaged geotextile. Repair damage as indicated below.

3.7 INSTALLING GEOTEXTILE IN TRENCHES

- A. Place geotextile in a way that will completely envelope granular drain material to be placed in trench and with indicated overlap at joints. Overlap geotextile in direction of flow. Place geotextile in a way and with sufficient slack for geotextile to contact trench bottom and sides fully when trench is backfilled.
- B. After granular drain material is placed to grade, fold geotextile over top of granular drain material, unless otherwise indicated. Maintain overlap until overlying fill or backfill is placed.

3.8 RIPRAP APPLICATIONS

- A. Overlap geotextile at each joint with upstream sheet of geotextile overlapping downstream sheet.
- B. Sew joints where wave runup may occur.

3.9 GEOTEXTILE-REINFORCED EARTH WALL APPLICATIONS

- A. Sew exposed joints; extend sewn seams minimum 3-feet behind face of wall.
- B. Protect exposed geotextile from damage and deterioration until permanent facing is applied.

3.10 SILT FENCE APPLICATIONS

- A. Install geotextile in one piece or continuously sewn to make one piece, for full length and height of fence, including portion of geotextile buried in toe trench.
- B. Install bottom edge of sheet in toe trench and backfill in a way that securely anchors geotextile in trench.
- C. Securely fasten geotextile to a wire mesh backing and each support post in a way that will not result in tearing of geotextile when fence is subjected to service loads.
- D. Promptly repair or replace silt fence that becomes damaged.

3.11 REPAIRING GEOTEXTILE

- A. Repair or replace torn, punctured, flawed, deteriorated, or otherwise damaged geotextile. Repair damaged geotextile by placing patch of undamaged geotextile over damaged area plus at least 18-inches in all directions beyond damaged area. Remove interfering material as necessary to expose damaged geotextile for repair. Sew patches or secure them with pins and washers, as indicated above for securing geotextile, or by other means approved by ENGINEER.

3.12 REPLACING CONTAMINATED GEOTEXTILE

- A. Protect geotextile from contamination that would interfere, in ENGINEER's opinion, with its intended function. Remove and replace contaminated geotextile with clean geotextile.

- END OF SECTION -

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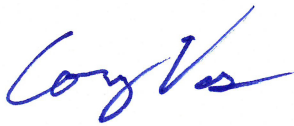
31 23 00 – EXCAVATION AND FILL PLACEMENT

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31 23 00 – EXCAVATION AND FILL PLACEMENT

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PART 1 - GENERAL

1.1 SUMMARY

- A. This specification describes the construction and quality management requirements for excavation and fill placement activities, including:
 - 1. General site grading work.
 - 2. All excavations necessary for the construction of the Works.
 - 3. Maintaining excavations and trenches free of water.
 - 4. Backfilling of excavations and trenches.
 - 5. Placing fill to final grade.
 - 6. Construction of embankments.

1.2 RELATED SECTIONS

- A. Section 02 41 00 – Demolition and Facility Removal.
- B. Section 03 30 00 – Cast-in-Place Concrete.
- C. Section 03 60 00 – Grouting.
- D. Section 31 05 00 – Materials for Earthwork.
- E. Section 31 10 00 – Clearing, Grubbing and Stripping.
- F. Section 31 25 00 – Erosion and Sedimentation Controls.
- G. Section 31 60 00 – Foundation Preparation.
- H. Section 31 71 00 – Tunnel Construction.
- I. Section 31 80 00 – Care of Water.

1.3 REFERENCE STANDARDS

- A. American Association of State Highway and Transportation Officials (AASHTO).
- B. American Society for Testing and Materials (ASTM):

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1. ASTM D854 - Standard Test Methods for Specific Gravity of Soil Solids by Water Pycnometer.
 2. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method.
 3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
 4. ASTM D2216 - Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.
 5. ASTM D4253 - Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
 6. ASTM D4254 - Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
 7. ASTM D5030 - Standard Test Methods for Density of Soil and Rock in Place by the Water Replacement Method in a Test Pit.
 8. ASTM D6913 - Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis.
 9. ASTM D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
- C. United States Department of Labor Occupational Safety and Health Administration (OSHA) Regulations.
1. Part 1926.
- D. California Department of Transportation (Caltrans) - Standard Specifications:
1. Section 19 - Earthwork.
- E. California Stormwater BMP Handbook – Construction.
- F. Construction Stormwater Best Management Practices Manual, 1200-C NPDES General Permit, State of Oregon Department of Environmental Quality.
- G. Oregon Department of Transportation (ODOT) Standard Specifications:
1. Section 00330 - Earthworks.
- 1.4 DEFINITIONS
- A. **Backfill** – Materials used for fill placement.
- B. **Borrow** – Approved area where appropriate material is sourced for use at another location.

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- C. **Fill Placement** – Placement of backfill to lines and dimensions shown on the Drawings.
- D. **Excavation** – Removal of material encountered above subgrade elevations and to lines and dimensions excavated.
- E. **Subgrade** – Uppermost surface of an excavation and the top surface of a fill or backfill immediately below subbase, structures, or geosynthetic layers.
- F. **Vertical Confined Openings** – Vertical and confined openings where material can be dumped.
- G. **Horizontal Confined Openings** – Horizontal and confined openings where material cannot be placed by conventional placement methods.
- H. **Water Management** – Collection and diverting water by gravity.
- I. **Dewatering** – Removal of water from work area by mechanical methods.

1.5 SUBMITTALS

- A. Items listed in this section are to be submitted to the Engineer for information prior to the start of any Works, unless noted otherwise.
- B. Project Record Documents: Record actual locations of abandoned utilities and services, foundations, and other appurtenances.
- C. As-built surveys: Record as-constructed excavations and fills to reconcile Drawings and for review and approval by the Engineer.
- D. Dewatering Work Plan: Details of proposed temporary stormwater control measures in accordance with this specification and Section 31 25 00 – Erosion and Sedimentation Controls.
- E. Quality Control Plan.
- F. Quality Control Test Results: submit test results from QC record tests from materials sourced onsite for review and approval by the Engineer.
- G. Blasting plans in accordance with the applicable Federal, State, and local codes and regulations, indicating the following:
 - 1. Name, qualification, and references of the proposed blaster-in-charge and personnel responsible for blast design.

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2. Method and mitigation to control noise, air blast, ground vibration, fly rock, and dust control.
3. Explosives transportation plan including handling, storage, and security.
4. Procedures for conducting blasting operations including Safety plan and fire prevention plan.

1.6 QUALITY ASSURANCE

- A. Work shall be in conformance with the Drawings, submittals, and other project documents.

PART 2 - PRODUCTS

2.1 EQUIPMENT

- A. Equipment shall be the responsibility of the Contractor.

2.2 FILL MATERIALS

- A. Requirements for production and supply of fill materials detailed in Section 31 05 00 – Materials for Earthworks.

2.3 GEOTEXTILES

- A. Geotextile shall be implemented as detailed in the Drawings.
- B. Requirements for specifications and supply of geotextiles detailed in Section 31 05 00 – Materials for Earthworks.

PART 3 - EXECUTION

3.1 PREPARATION

- A. All preparation of work areas to be performed prior to excavation or fill placement and conform to Section 31 60 00 – Foundation Preparation.
- B. Site Inspection and existing conditions:

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1. Obtain the Engineer's acceptance of prepared surfaces before backfilling or placing fill.
 2. Provide access to the work areas for quality testing.
 3. Provide at least 24 hours notice to the Engineer for required inspections.
 4. The Contractor shall read the project geotechnical reports and all other project documents and reference information, form their own opinion regarding subsurface conditions based on the facts contained therein, and choose equipment and methods of execution to suit.
- C. Use excavation methods that will not cause damage to nearby structures.
- D. Protect structures near the work areas from damage.
- E. The Contractor is to identify required lines, levels, contours, datum locations and lay out the excavation and fill limits.
- F. Provide surface runoff and sediment control facilities as required for excavations, fills, stockpiles, borrow areas and roads as detailed in Section 31 25 00 – Erosion and Sedimentation Controls. Comply with environmental regulations.
- G. The Contractor shall notify underground service alert (USA NORTH) to identify the location of existing utilities at least 72 hours prior to any excavation work, per state requirements.

3.2 EXCAVATING IN SOIL

- A. Use excavation techniques and take necessary precautions to preserve in an undisturbed state all materials outside the lines and grades shown on the Drawings.
- B. Underpin adjacent structures that may be damaged by excavating work.
- C. Use benching excavating techniques where applicable. Benching shall be completed in accordance with the applicable Federal or State OSHA Regulations.
- D. The Contractor shall immediately notify the Engineer if active utility lines which are not indicated on the Project Drawings are encountered during excavation. Abandoned sewers, piping, and other inactive utilities encountered in the progress of excavation shall be removed and plugged.
- E. Provide, maintain, and operate any temporary drainage, dewatering and/or pumping facilities required to control groundwater and keep the excavations dry and stable. Discharge drainage such that erosion and sedimentation are prevented.

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- F. Excavate subsoil to inverts required to accommodate the structures shown on the Drawings.
- G. Install bracing and shoring as required to ensure the safety of workers and adjacent facilities.
- H. Maintain excavation slopes equal to or flatter than those shown on the Drawings. The slopes of all excavations shall be neatly and evenly trimmed to the line and slope indicated on the Drawings or as directed by the Engineer.
- I. Slope banks with machine to angle of repose or flatter until shored.
- J. Grade top perimeter of excavation to prevent surface water from draining into excavation.
- K. Hand trim excavations where required to remove loose matter. All excavation slopes should be free of loose material.
- L. Notify the Engineer of unexpected subsurface conditions.
- M. Protect excavation surfaces from deterioration and maintain in a stable condition.
- N. Backfill over compacted foundation surfaces using specified fill materials.
- O. Remove waste materials material from work area. Stockpile materials that are suitable for fill or use these materials directly in fills.
- P. Excavation for Trenches:
 - 1. Excavate trenches to indicated grades, lines, depths, and elevations as shown on the Drawings.
 - 2. Excavate trenches to uniform widths as indicated on the Drawings.
 - 3. Excavate below bottom of pipe and conduit elevations to allow for bedding course. Excavate deeper for bells of pipe.
 - 4. Maximum unbraced/un-shored trench excavation height is not to exceed 5 ft per OSHA Regulation Part 1926.
 - 5. Shielding/shoring is required for any excavations exceeding 20 ft in depth, as per OSHA Regulations.

3.3 EXCAVATING IN ROCK

- A. Remove rock to the lines, grades and dimensions shown on the Drawings or required by the Engineer.

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- B. Use methods, techniques, and procedures for control of all factors affecting operations in order to produce smooth and sound peripheral surfaces of all completed excavations, to minimize over-break, and to avoid damage to adjacent structures.
- C. Drilling and Blasting
 - 1. Carry out blasting operations in accordance with blasting plan, manufacturers data, and blasting schedule.
 - 2. Drilling and blasting shall be completed as described in Section 02 41 00 – Demolition and Facility Removal.
 - 3. Drill blasting holes as required to complete desired construction results. Review the blasting performance and adjust the blast design to achieve the requirements as per the Drawings.
 - 4. Design the blast to comply with safe peak particle velocity (PPV) for all structures within and in the vicinity of the blast area and other locations.
 - 5. Take necessary precautions to protect the structures, buildings and equipment not intended to be removed from blast induced damage, including protection from fly rock, protection from vibrations and air blasts.
 - 6. Remove loose material and scale to sound unshattered base surface to the lines and grades shown on the Drawings as required to provide a stable surface.
 - 7. Do not blast within 300 ft of fresh concrete, grout or shotcrete until the concrete has cured for a minimum of 28 days, unless achieved concrete strength is review and accepted by the Engineer.
- D. Scale all excavation slopes to ensure a stable condition, and pressure wash and broom clean rock surfaces against which concrete will be cast to assist bonding.
- E. Excavate trenches to the lines and grades indicated on the Drawings. Provide recesses for bell and spigot pipe to ensure bearing will occur uniformly along barrel of pipe.
- F. Remove boulders and fragments which may slide or roll into excavated areas.

3.4 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections. Do not disturb bottom of excavations intended as bearing surfaces.

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3.5 EXCAVATION OF MATERIALS

- A. The existing elevations and contours shown on the plans, cross sections, and profiles were surveyed prior to plan development. Existing elevations and grades may have changed since the original survey was completed due to stream erosion, sediment accretion, or fill. It is the Contractor's responsibility to confirm existing grades and adjust earthwork, as necessary.
- B. All earthwork shall be performed in accordance with the Contract Documents and permit requirements.
- C. All required erosion and sediment control measures shall be in place prior to onset of earthwork activities.
- D. Erosion and sediment control devices and measures shall be utilized and maintained as per Section 31 25 00 - Erosion and Sedimentation Control.
- E. Grading operations shall be conducted so that material (soil, trees, and vegetation) outside construction limits will not be disturbed.
- F. Excavation and cuts shall be shaped and graded in accordance with the lines, grades, and cross sections or elevations shown on the drawings.
- G. Excavate foundation soil to the lines and grades shown on the Drawings. Stockpile material for backfilling in a neat and orderly manner at a sufficient distance from the banks of the excavation to avoid overloading and to prevent slides or caving. Perform excavation and fill in a manner and sequence that will provide proper drainage at all times. The Contractor is responsible for disposal of surplus material, waste material, and material that does not meet specifications, including any soil which is disturbed by the work operations or softened due to exposure to the elements and water.
- H. Material shown on the plans as suitable material but found at time of construction to be unsuitable shall be disposed of as unsuitable material.
- I. Protruding or unstable rocks 5 inches or larger shall be removed from the surface of soil cut slopes.
- J. The Contractor shall be responsible for stabilizing all stream banks after the completion of grading. The Contractor shall perform all care and remediation work required to maintain stable stream banks during construction as per Section 31 25 00 – Erosion and Sedimentation Controls.
- K. All tree roots exposed along excavated stream banks shall be trimmed to produce a flush surface as shown on the Drawings.

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3.6 FILL PLACEMENT

- A. Provide fill materials from the required excavations and from borrow areas. Make all reasonable efforts to use material from the required excavations in fills.
- B. Fill removal from borrow areas:
 - 1. Excavate fill from accepted borrow areas.
 - 2. Selectively excavate, crush, sort, screen, wash and/or blend materials as required to provide the specified fill materials as per Section 31 05 00 – Materials for Earthwork.
 - 3. Control drainage and dewater borrow areas as required. Provide sediment control facilities as required as per Section 31 25 00 – Erosion and Sedimentation Controls and Section 31 60 00 – Foundation Preparation.
- C. Stockpiling:
 - 1. Stockpile in sufficient quantities to meet Project schedule and requirements.
 - 2. Separate differing materials with dividers or stockpile apart to prevent mixing.
 - 3. Prevent intermixing of soil types or contamination.
 - 4. Prevent excessive segregation of materials.
 - 5. Direct surface water away from stockpile site to prevent erosion or deterioration of materials. Provide sediment control facilities where required.
 - 6. Protect all stockpiled granular fill materials from damage by water.
 - 7. Satisfactory soil in excess of that required for use as engineered fill shall be disposed of in designated disposal areas.
- D. Prior to placement prepare subgrade and foundation as per Section 31 60 00 – Foundation Preparation.
- E. Placing Fill:
 - 1. Provide fill materials that satisfy the specifications outlined above, in Section 31 05 00 - Materials for Earthwork, and/or as shown on the Drawings. Selectively excavate, crush, sort, screen, wash and/or blend materials as required to provide the specified fill materials.
 - 2. Employ a placement method that does not disturb or damage other work and does not result in excessive segregation.
 - 3. The sequence of filling shall commence at the lowest section (in elevation) of the subject footprint and proceed upward in specified lifts in a manner to maintain positive drainage at all times, where possible.
 - 4. Avoid uncompacted or segregated construction joints.
 - 5. Maintain moisture content of fill materials to attain required compaction density and ensure uniform distribution of moisture throughout the soil.

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6. Place and compact fill material in equal continuous lifts not exceeding the lift thicknesses specified in Section 31 05 00 – Materials for Earthwork.
7. Backfill against concrete in accordance with the curing and protection requirements of Section 03 30 00 – Cast-In Place Concrete.
8. Backfill against supported foundations and walls. Do not backfill against unsupported foundation walls unless backfilling simultaneously to the same grade on each side of the wall.
9. Upon completion of pipe laying and inspection by the Engineer of the work in place, surround and cover pipe with specified surround material as shown on the Drawings. Ensure good material placement and compaction under pipe haunches.
10. The slopes of all embankments shall be neatly and evenly trimmed to the line and slope indicated on the Drawings or as directed by the Engineer to leave a compacted surface.
11. Consolidate cement treated fill by tamping into place continuously as it is placed. Do not place more than a 6 in. thickness of cement treated backfill without consolidating.
12. Make gradual grade changes. Blend slope into level areas.
13. Make good final grades, including drainage ditches, road bases and the like.
14. Re-level and re-compact fills subjected to vehicular traffic.
15. Protect fill surfaces and slopes from damage by water.
16. Place wearing course material as required on the Drawings.
17. Working surfaces left inactive for more than one week shall be sealed with a smooth drum roller and graded to promote positive drainage to reduce the potential for surface water infiltration.

F. Fill Placement During Freezing Conditions:

1. Place fill materials in freezing conditions only if the materials can be placed and compacted to the specified densities that apply to non-freezing conditions.
2. Remove all ice, snow and loose frozen fill material from compacted fill surfaces or prepared foundations prior to placing new fill materials.
3. Place fill materials on previously placed and compacted fill frozen after compaction or accepted frozen foundations provided that surfaces are cleaned as per (2) above.
4. Place only non-frozen fill. Remove frozen soils from borrow areas prior to excavation of non-frozen materials for use as fill.
5. Fill materials must meet the specified moisture content criteria before acceptance and subsequent material placement.
6. Immediately spread and compact fill materials after placement to achieve specified density before freezing.
7. Place and compact fill rapidly and in relatively small areas. Keep exposed surfaces to a minimum to minimize the potential for fill materials to freeze before compaction to the specified densities.

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8. Remove from the fill, all fill materials that freeze prior to compaction to specified densities.
9. Do not place fill when there is any accumulation of snow or ice on surfaces to be covered by the succeeding layers of fill.
10. Methods proposed by the Contractor for construction during freezing conditions shall be reviewed by the Engineer prior to commencing fill placement.

G. Fill Placement in Confined Openings

1. Confined openings include, but are not limited to, waterway openings in intakes, tunnel portals, powerhouse embedded penstocks, turbine pits and embedded draft tubes.
2. Confined openings are to be filled as part of the site-wide burial of partially demolished structures with concrete rubble, boulders and soils as shown on the Drawings.
3. In all confined openings, where possible, the contractor shall strive to meet the placement and compaction requirements defined for each material type in Section 31 05 00 – Materials for Earthwork.
4. Placement of fill in confined openings to be reviewed by the Engineer prior to and during construction.
5. Vertical Confined Openings:
 - a. Material to be placed by dumping or pushing material into the openings.
 - b. Tamping, pushing, or hammering by excavator bucket to be employed where possible. Placement of fills without nominal compaction to be approved by the Engineer.
6. Horizontal Confined Openings:
 - a. Material to be placed by pushing material horizontally into the openings.
 - b. Placement of material by conveyor or small equipment to be considered if pushing or placement by dozer or excavator is not possible.
 - c. If track walking compaction with a dozer is not possible due to spatial constraints, nominal compaction is to be achieved by plate compactor, hand compactor or jumping jack. If the opening is deemed a confined space, tamping, pushing, or hammering by excavator bucket may employed to achieve nominal compaction.
 - d. Final stabilization and cover to be placed as shown on the Drawings and in accordance with Section 31 25 00 Erosion and Sediment Control.

3.7 FILL PLACEMENT IN J.C. BOYLE SCOUR HOLE

- A. For placement of the infill materials (not including cover) at the scour hole, certain variances from Section 3.7 are acceptable. These variances are as follows:

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1. Fill placed in the bottom half of the hole to be end dumped and shall not be placed in lifts due to logistical constraints.
 2. Fill placed in the upper half of the hole to be mechanically spread in lifts that do not exceed the greatest lift thickness specified for E9, E9a, CR1, or CR2.
 3. All E9, E9a, CR1 and CR2 materials placed in the scour hole, regardless of placement method, are to be mixed thoroughly to the satisfaction of the Engineer, to minimize voids and avoid the creating of continuous E9 fill layers.
- B. The Contractor to employ earthmoving equipment that is suitable for steep-slope operation to maximize the quantity of material that is able to be placed in lifts.
- C. Exposed concrete shall not be visible on the surface of the fill.

3.8 FILL PLACEMENT FOR ROADS, BRIDGES AND CULVERTS

- A. Excavation and Fill placement for road, bridge and culvert sites (5000 and 6000 series Project Drawings) shall comply with the requirements of this document in addition to Section 32 50 00 – Roads, Bridges and Culverts and the site-specific requirements noted on the Project Drawings.

3.9 CONCRETED EROSION PROTECTION

- A. For concreted erosion protection placement, infill with 2,500 psi mass concrete or as specified on the Drawings. Erosion protection material shall be clean, free of mud and dust. Wet the clean stones and place the 2,500 psi concrete concurrent with placement of the large stones and vibrate the concrete into place to completely infill the voids by vibration wherever practicable or by rodding. Cure the concreted erosion protection material as per Section 03 30 00 – Cast-in-Place Concrete.

3.10 SOIL MOISTURE CONTROL

- B. Moisture Adjustment: Moisture content shall be adjusted as necessary to facilitate compaction. Moisture control shall be achieved by either windrowing, scarifying or adding water to achieve workable moisture content.
- C. If additional moisture content is required, water may be added to the material at the source or after the material has been brought into its final position, whichever is more practical. The Contractor shall obtain uniform moisture distribution in the lift by disk, blading, or other approved methods. The amount of water applied shall be controlled so that the moisture content remains within 2% of optimum and free water will not appear on the surface during or subsequent to compaction operations.

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- D. Material deposited on fill that is too wet shall be removed or spread and permitted to dry, assisted by disking or blading, if necessary, until the moisture content is reduced to the specified limits.
- E. When the top surface of a layer becomes too dry or too smooth to permit suitable bonding with the subsequent layer, the Contractor shall loosen the material by scarifying or disking. The Contractor shall then moisten the loosened material to acceptable moisture content and re-compact the material to the specified density.

3.11 VEGETATIVE COVER

- F. Vegetative cover type material shall be placed as per Section 31 25 00 – Erosion and Sedimentation Controls.

3.12 DEWATERING AND WATER MANAGEMENT (OUTSIDE OF RIVER)

- A. Care of Water and river diversions specific to in-River work, shall be completed in accordance with Section 31 80 00 - Care of Water.
- B. Where Excavation and Fill Placement could result in erosion, measures shall be taken to mitigate such as per Section 31 25 00 – Erosion and Sedimentation Controls.
- C. All excavations completed outside of the Klamath River will require the control of water via water management and/or dewatering systems to maintain dry conditions.
- D. All fills placed outside of the Klamath River will require the control of water via water management and/or dewatering systems to maintain optimum moisture in the fill materials.
- E. Water Management:
 - 1. Diversion ditches/swales, check dams, berms, pumps, sumps, channels, drains, wells, and other temporary measures and equipment shall be provided to control and direct runoff and groundwater away from foundations and excavations in order to prevent ponding and infiltration.
 - 2. Excavation and Fill Placement shall be conducted in a manner that maintains proper drainage at all times in and around the work area.
 - 3. Protect excavations and fills from damage by water. Accumulations of water in and around foundations and excavations shall be promptly removed.
 - 4. Sides and slopes of foundations of fills and excavations shall be protected from erosion and sloughing caused by water.

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5. Surface water management and groundwater control measures shall be compatible with the Drawings.
6. Best Management Practices and other means to control water shall be provided and maintained as shown on the Drawings and other project documents.
7. Water management should result in stable foundations of fills.

F. Dewatering:

1. Dewatering activities to occur when water builds up in construction areas such as excavations, fills and foundations.
2. Protect existing adjacent buildings, structures, and improvements from damage caused by dewatering operations.
3. Divert/collect water and seepage within construction areas into sumps and pump water away from the work site.
4. Locate system components to allow continuous dewatering operations without interfering with other activities.
5. Dewatering equipment and systems shall be installed and operated in accordance with manufacturer's instructions.
6. Conduct regular inspections of dewatering system. Make required repairs and perform scheduled maintenance.
7. When dewatering system cannot control water, notify Owner and Engineer and stop the work activity.
 - a. Supplement or modify dewatering system and provide other remedial measures to control water within excavation.
 - b. Demonstrate that the dewatering system operation complies with performance requirements before resuming work activities.
8. All water to be released as per the contract documents. All applicable Federal, State, and local permits to be followed.
9. Remove dewatering equipment and systems after dewatering operations are no longer required.

3.13 QUALITY

- A. The Contractor shall provide the Owner and Engineer access to the site at all times.
- B. The Contractor is required to place fill materials that comply with the requirements of Section 31 05 00 – Materials for Earthworks.

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- C. If in the judgement of the Engineer, the volume of material represented by a failed record test is significant or results in work that deviates from design intent, repair or replace the non-complying material. Repair may take the form of moisture conditioning, re-mixing, blending, or re-compacting the material. In the event that repairing the material is not possible or not desired, remove the non-complying material from the work and replace with material that meets the specifications. Any such re-work shall be performed at the Contractor's expense.
- D. The Contractor is responsible for performing work in accordance with the Drawings and performing quality control.
- E. The Contractor is responsible for field quality testing (record tests) for all engineered fill materials incorporated in the permanent work at the frequencies detailed in the following table. Minimum testing requirements: frequency is "1 per" the number of cubic yards of material as required for the work.
- F. Additional excavation, fill placement, and material testing requirements for road and bridge sites are outlined in Section 32 50 00 – Roads, Bridges and Culverts, Part 2, 2.2.

31 23 00 – EXCAVATION AND FILL PLACEMENT

Table 1 – Record Testing Schedule

| Material and Location | Moisture Content (ASTM D2216) | Particle Size Distribution (ASTM D6913) | Laboratory Compaction (ASTM D1557 or D4253 & D4254 as applicable) | Specific Gravity (ASTM D854) | In Situ Density (ASTM D1556, D6938, D5030 as applicable) Moisture Content (ASTM D2216 or D6938 as applicable) |
|-------------------------------------|-------------------------------|---|---|------------------------------|---|
| | 1 per | 1 per | 1 per | 1 per | 1 per |
| E2 – Pipe Zone | 1,300 | 1,300 | 1,300 | 3,250 | 350 |
| E3 – Structural Fill | 1,300 | 1,300 | 1,300 | 3,250 | 350 |
| E4 – Select Fill | 1,300 | 1,300 | 1,300 | - | 650 |
| E5 – Road Embankment Fill | 1,300 | 1,300 | 1,300 | - | 650 |
| E6 / E8 – Bedding | - | 650 | - | - | - |
| E7a/E7b/E7c – Erosion Protection | - | Visual | - | - | - |
| E9/E9a/E9b – General Fill | - | 20,000 | - | - | - |
| E11 – Aggregate Base | 500 | 500 | 2,000 | - | 500 |
| E12 – Engineered Streambed Material | - | Visual | - | - | - |
| E13 – Drain Rock | - | Work Area | - | - | - |
| CR1 – Concrete Rubble | - | Visual | - | - | - |
| CR2 – Concrete Rubble | - | Visual | - | - | - |

NOTES:


- DENSITY AND MOISTURE CONTENT BY NUCLEAR METHODS WILL BE RANDOMLY CONDUCTED ON EACH LIFT DURING PLACEMENT.
- RECORD TESTING TO BE UNDERTAKEN ONCE MATERIALS ARE PLACED TO CONFIRM COMPLIANCE OF IN SITU MATERIALS. CONTROL TESTING TO BE PERFORMED PRIOR TO USE OF MATERIALS IN THE WORK AREA AND INCLUDES A GREATER TESTING FREQUENCY (SECTION 31 05 00 MATERIALS FOR EATHWORK).
- DUE TO THE SMALL VOLUME OF DRAIN ROCK (E13) SPECIFIED, ONLY 1 RECORD GRADATION TEST PER WORK AREA IS REQUIRED.

END OF SECTION 31 23 00

Kiewit Infrastructure West Co.
Klamath River Renewal Project
Technical Specifications

31 25 00 EROSION AND SEDIMENTATION CONTROLS

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31 25 00 EROSION AND SEDIMENTATION CONTROLS

REVISION INDEX

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Approval that this document adheres to the Knight Piésold Quality System:

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31 25 00 EROSION AND SEDIMENTATION CONTROLS

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SECTION 31 25 00 EROSION AND SEDIMENTATION CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes temporary and permanent erosion and sediment controls including but not limited to the following:
 - 1. Permanent erosion and sedimentation controls installed by the Contractor as specified in this Specification and as set out in the Drawings.
 - 2. Temporary erosion and sediment controls installed by the Contractor where required.
 - 3. The conversion of temporary measures to permanent measures.

1.2 RELATED SECTIONS

- A. Section 02 41 00 – Demolition and Facility Removal.
- B. Section 31 05 00 – Materials for Earthwork.
- C. Section 31 10 00 – Clearing, Grubbing and Stripping.
- D. Section 31 23 00 – Excavation and Fill Placement.
- E. Section 31 60 00 – Foundation Preparation.
- F. Section 31 80 00 – Care of Water.

1.3 REFERENCE STANDARDS

- A. AASHTO
 - 1. AASHTO M294: Standard Specification for Corrugated Polyethylene Drainage Pipe 12" - 60" (304.8mm – 1524.0mm).
- B. ASTM or ASTM International (ASTM):
 - 1. ASTM C602 - Standard Specification for Agricultural Liming Materials.
 - 2. ASTM D3350: Standard Specification for Polyethylene Plastic Pipe and Fittings Materials.

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3. ASTM F477: Standard Specification for Elastomeric Seals (Gaskets) for Joint Plastic Pipe.
 4. ASTM F2306: Standard Specification for 12" – 60" (304.8mm – 1524.0mm) Annular Corrugated Profile-Wall Polyethylene Pipe and Fittings for Gravity-Flow Storm Sewer and Subsurface Drainage Applications.
- C. State of California Water Resources Control Board:
1. California Stormwater Quality Association BMP Handbook – Construction.
 2. Construction General Permit (CGP).
- D. State of Oregon Department of Environmental Quality:
1. Construction Stormwater Best Management Practices Manual, 1200-C NPDES General Permit.
 2. Section 8. Site Restoration, Erosion and Sediment Control, Clean Water Act Section 401 Certification.
- E. State of California Department of Transportation (Caltrans) Standard Specifications, Section 21 – Erosion Control.
- F. State of Oregon Department of Transportation (ODOT):
1. Oregon Department of Transportation (ODOT): Oregon Standard Specifications for Construction, 2018.
- 1.4 DEFINITIONS
- A. **Permanent Erosion and Sediment Control** – measures required to address long term, post-deconstruction erosion and sedimentation control, that are related to stormwater pollution prevention.
- B. **Temporary Erosion and Sediment Control** – measures installed by the Contractor to control the erosion and stormwater pollution during the mobilization and deconstruction Work.
- C. **BMPs** – Best Management Practices, as specified in the referenced standards of the CASQA and Oregon DEQ. Non-stormwater management, material management including concrete, and dredging BMPs referenced in the standards are excluded from this specification and are addressed in the management plans.
- D. **SWPPP** – Stormwater Pollution Prevention Plan, in California.
- E. **QSP** – Qualified SWPPP Practitioner in California.

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- F. **QSD** –Qualified SWPPP Developer in California.
- G. **CPESC** – Certified Professional in Erosion and Sediment Control in California and Oregon.
- H. **Pre-Drawdown Year** – The calendar year when the Contractor mobilizes for the deconstruction and modifies, adjusts or adapts the existing dams and appurtenant structures to facilitate safe drawdown of the reservoirs, as shown on the Drawings.
- I. **Drawdown Year** – The calendar year, following the pre-drawdown year, when the four reservoirs will be drawdown; the dams and associated facilities will be demolished, deconstructed, buried, and/or removed; and the fish volitional channels will be restored.
- J. **Final Stabilization** – Surface treatment or cover to provide erosion control as a permanent measure. In general terms, the measure may be vegetative or non-vegetative or a combination thereof. The QSP/CPESC will provide for determination of the final stabilization, based on visual inspection.
- K. **Non-vegetative Final Stabilization** – Placement of a final cover material, not suitable for vegetation, at final grade as shown on the Drawings. Fines are soil materials passing a US standard sieve #200 and are limited to 10% of the surface layer, by weight. Per the Drawings and Section 31 05 00 – Materials for Earthwork, acceptable materials are Select Fill (E4) and General Fill (E9b). The QSP/CPESC will provide for determination of the final stabilization, based on visual inspections or other means.
- L. **Vegetative Final Stabilization** – Hydroseeding the final cover material, suitable for vegetation, at final grade as shown on the Drawings. Fines are soil materials passing a US standard sieve #200 and must be greater than 10% of the surface layer, by weight. Per the Drawings and Section 31 05 00 – Materials for Earthwork, acceptable surface materials for hydroseeding would General Fill (E9). The QSP/CPESC will provide for determination of the final stabilization, based on visual inspections or other means.
- M. **Rain Event** – A 50% chance or greater forecasted or actual heavy rain event that occurs during the deconstruction activities and may require mobilization and implementation of additional temporary erosion and control measures.
- N. **Rain Event Action Plan** – Pre-Rain Plan for addressing a rain event with a 50% chance or greater. The requirement for these, if any, will be specified in the CA SWPPPs or OR Erosion and Sediment Control Plan.
- O. **Temporary construction roads** – Newly constructed roads used for the duration of construction.
- P. **Rehabilitated construction roads** – Currently existing roads that need to be widened to accommodate wider trucks with heavier loads.

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- Q. **Permanent construction roads** – Newly constructed roads that will be fit for service by the public by the end of construction.
- R. **Hold Point** – A period within the deconstruction activities where further progress awaits the approval or acceptance of the condition or work by the QSP, CPESC.
- S. **Historic Construction** – Initial construction of the dams and appurtenant works.
- T. **Historic Staging Areas** – Staging areas used in the initial construction. These are generally flat and may have some overgrowth.
- U. **Historic Construction Roads** – Construction roads used in the initial construction. These areas have some overgrowth.

1.5 SUBMITTALS

- A. Items listed in this section are to be submitted to the Engineer for information prior to the start of any Works, unless noted otherwise.
- B. Erosion and Sediment Control Plan (ESCP) for Oregon and Stormwater Pollution Prevention Plan (SWPPP) for California including Best Management Practices (BMPs) indicating the specific erosion and sediment control measures, turbidity and silt control measures, air quality and dust control plans, QSP/CPESC hold points and plans for monitoring.
- C. Seed Product Data: Data for seed mix, fertilizer, mulch, and other additives, including tackifiers (soil binder). Weed-free certifications and Phytophthora-free certifications, where available. Laboratory Test Results: indicating purity and germination rates for all seed species. It is recognized that members the Yurok Tribe have been collecting seed specimens for a number of years and that RES has recommended the Upland Diversity Mix (see Figure 1), which is subject to the CA SWPPPs and the OR Erosion and Sediment Control Plan.

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| Species | Common name | Lifeform | Seed Status |
|---|----------------------|-----------------|-------------------|
| <i>Amsinckia menziesii</i> | Menzies' fiddleneck | Annual forb | To be collected |
| <i>Acmispon americanus</i> | Spanish lotus | Annual forb | Stored (PCS) |
| <i>Angelica arguta</i> | Lyall's angelica | Perennial forb | To be collected |
| <i>Artemisia tridentata</i> | big sagebrush | Shrub | Stored (PCS) |
| <i>Danthonia californica</i> | California oatgrass | Perennial grass | To be collected |
| <i>Ericameria nauseosa</i> | Rabbitbrush | Shrub | Stored (HRF, PCS) |
| <i>Festuca microstachys</i> | small fescue | Annual grass | To be collected |
| <i>Grindelia nana</i> | Idaho gumweed | Perennial forb | To be collected |
| <i>Koeleria macrantha</i> | June grass | Perennial grass | To be collected |
| <i>Lomatium macrocarpum</i> | bigseed biscuitroot | Perennial forb | To be collected |
| <i>Lomatium nudicaule</i> | barestem biscuitroot | Perennial forb | To be collected |
| <i>Lomatium triternatum</i> | nineleaf biscuitroot | Perennial forb | To be collected |
| <i>Monardella odoratissima</i> | mountain monardella | Perennial forb | To be collected |
| <i>Penstemon deustus</i> | rock penstemon | Perennial forb | To be collected |
| <i>Perideridia bolanderi</i> | Bolander's yampah | Perennial forb | To be collected |
| <i>Phacelia heterophylla</i> var <i>virgata</i> | varied leaf phacelia | Perennial forb | To be collected |
| <i>Poa secunda</i> | Sandberg's bluegrass | Perennial grass | To be collected |
| <i>Stipa lemmonii</i> | Lemmon's needlegrass | Perennial grass | Stored (HRF) |
| <i>Stipa occidentalis</i> | western needlegrass | Perennial grass | To be collected |

NOTES:

1. THE UPLAND DIVERSITY MIX WILL ALSO INCLUDE SPECIES FROM THE UPLAND PIONEER SEED MIX DEPENDING ON AVAILABILITY.
2. THE APPLICATION RATE AND SEED MIX COMPOSITION WILL BE DETERMINED FOLLOWING DRAWDOWN BASED ON RESERVOIR POST-DRAWDOWN CONDITIONS

Figure 1 – Upland Diversity Mix

- D. Pre-deconstruction vegetative condition: to establish a baseline for closure of the construction permits, requiring restoration of 70% of the pre-deconstruction vegetative condition or evaluation and documentation of improved conditions using established analytical methods (e.g. RUSLE).
- E. Rain Event Action Plan: Planning for rain events or justification for its exclusion in the CA SWPPPs or the OR Erosion and Sediment Control Plan.
- F. Manufacturer's information on all fabricated materials to be used for the permanent and temporary erosion and sedimentation controls.

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1.6 QUALITY ASSURANCE

- A. Work shall be in conformance with the Drawings, submittals, and other project documents.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Materials will include fabricated products and natural materials.
- B. To the extent possible, natural erosion control materials such as gravel and rock will originate from local excavations or onsite borrow areas as described in Section 31 05 00 - Materials for Earthwork.
- C. Select materials, as shown on the Drawings, may also fulfill an erosion and sediment control function. All materials shall be implemented as detailed in the Erosion and Sediment Control Plan for Oregon, SWPPP for California, as shown on the Drawings, and as per manufacturer requirements.
- D. Check dams shall generally be comprised of gravel bags that allow ready conformity to the local site topography. For gravel bags to be used for final stabilization, bag material will be made of a biodegradable material like burlap, or similar.
- E. Pipes, and manholes and headwalls for managing storm water collection and conveyance to the outfalls will comply with the Drawings and manufacturer's instructions.
 - 1. The pipe material is high density polyethylene (HDPE). Selected pipe is the Type S HDPE pipe with corrugated exterior and smooth interior. Joints will be gasketed bell and spigot. Nonrated and non-pressure tested watertight joints are suitable for gravity flow drainage applications. The pipe shall conform to the AASHTO and ASTM standards listed in the Reference Standards.
 - 2. The pipe manufacturer shall provide material technical performance information and detailed instructions for installation. The installation instructions shall include minimum cover requirements corresponding to the expected traffic loadings of the Contractor's earthmoving equipment during the deconstruction period.
- F. Grass Seed, Fertilizer and Mulch for Hydroseeding:
 - 1. All seed for designated seeded areas will be genetically appropriate and sourced from the Upper Klamath and Lost River Watersheds as per the Contract Documents and the Restoration Specifications. See Figure 1.
 - 2. The seed mix shall conform to the final seed mix selected in the Erosion and Sediment Control Plan in Oregon and the SWPPP in California.

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3. Fertilizer may be added to the hydroseeding slurry to add the nutrients necessary to provide an acceptable soil for growth. Refer to the applicable guidelines provided in the ODOT Standard Specifications.
4. A straw or wood chip mulch may be added to the hydroseeding slurry to provide stability to the seed bed. Straw wattles/Fiber rolls, where necessary, to be installed in conjunction with hydroseeding to reduce sheet flow erosion and sediment transport so the seed can germinate and achieve revegetated stabilization. In some instances, erosion control mats may be necessary to foster vegetative growth.

G. Fiber Roll or Straw Wattles:

1. Straw wattles or fiber rolls shall consist of rolls or bales of tight fibrous material. The wrapping material shall also be primarily biodegradable.
2. See Table 1 for required fiber roll/straw wattle spacing criteria.

Table 1 – Fiber Roll/Straw Wattle Spacing Criteria

| State | BMP Name | Slope | Spacing |
|------------|---------------------|-----------------------|------------|
| California | Fiber Roll (SE-5) | < 4H:1V | 20' |
| | | 4H:1V < Slope < 2H:1V | 15' |
| | | Slope > 2H:1V | 10' |
| Oregon | Straw Wattle (2.16) | - | 10' to 25' |

H. Tackifier or Soil Binder:

1. A tackifier or soil binder shall be used in locations where appreciable fines are high (>10%), as judged by the QSP/CPESC based on visual inspection.
2. A tackifier or soil binder shall be selected so as to minimize adverse impacts on native fisheries, if required.

I. Construction Entrances/Exits:

1. Construction entrances may comprise natural or man-made materials or a combination thereof.
2. Natural construction materials would include an aggregate-type material similar to E4 or E9b material described in Section 31 05 00 - Materials for Earthworks.
3. Fabricated material would include the many commercially available entrance/exit pads. Such pads are durable, U/V stable, and easily transferred to/from work fronts. Refer to FODS® LLC trackout control system, or similar.

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PART 3 - EXECUTION

3.1 GENERAL

- A. Historic staging areas and historic construction roads will be utilized to the extent practical.
- B. Existing vegetation will be preserved to the extent practical.
- C. For the staging areas, an initial setting out of the area will be undertaken prior to full mobilization of equipment, office trailers, and construction plant and services. The setting out will include site planning, establishment of limits, and staking the area. Drainage paths will be confirmed, stormwater diversion berms shall be constructed, and gravel bag check dams shall be established, as shown on the Drawings. The gravel bag check dams are intended to retain sediment upstream from the check dam. Prior to full mobilization, these perimeter BMPs shall be in place.
- D. During deconstruction works, certain areas, such as powerhouse tailraces, will require dewatering by pumping. In accordance with the CA SWPPP and the OR Erosion and Sediment Control Plan, sediment controls will be used to extract excessive sediment from the pumping discharges.
- E. Many project areas comprise steep, rocky terrain. Existing and cut stable rock slopes may not require any additional erosion and sediment control measures, as rock is an acceptable erosion and sediment control BMP.
- F. After safe construction access is established to the disposal areas, the following BMPs will be established:
 - 1. For disposal areas that border along the river valley wall, a buttress toe will be established at the base of the disposal area, above the 100-year flood level, as shown on the Drawings. The toe will be established with E4 or E9b material, which is available from: (a) a local quarry or (b) required excavation from deconstruction of the dams or road improvements.
 - 2. Graded drainage paths along with gravel bag check dams, as shown on the Drawings.
- G. Within the accelerated deconstruction period, the Contractor shall maintain placement of disposal material within the disposal site boundaries in order to maintain an active work site. Accelerated placement of disposal material will ultimately lead to faster final stabilization, subject to the review of a QSP/CPESC.
- H. When any disposal area, or portion thereof, is deemed ready for final stabilization by the Contractor, a hold period will be scheduled to facilitate QSP/CPESC review and approval.

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- I. The Contractor shall verify that finished grades of each disposal site are in accordance with the Drawings, including final stabilization, which may include the application of hydroseeding or other measures.
- J. Installation of erosion protection and bedding materials as engineered materials are described in Section 31 05 00 - Materials for Earthwork and Section 31 23 00 – Excavation and Fill Placement.

3.2 CONSTRUCTION ROADS

- A. Table 2 summarizes the various construction road types across the project areas.

Table 2 – List of KRRP Construction Roads

| Project Site | Temporary Construction Road | Rehabilitated Construction Road | Permanent Construction Road |
|--------------|---|-----------------------------------|------------------------------------|
| J.C. Boyle | Left Bank Access Road | Scour Hole Access Road (Optional) | Powerhouse Access Road Realignment |
| | Left Disposal Haul Road | Penstock Access Road (Optional) | - |
| | Right Disposal Haul Road | - | - |
| Copco No.1 | Workpad Road (Stage 1) | Powerhouse Access Road Widening | Powerhouse Access Road Realignment |
| | Workpad Road (Stage 2) | - | - |
| Copco No.2 | - | Diversion Dam Access Road | Spillway Apron Access Road |
| | - | Left Bank Access Road (Optional) | - |
| Iron Gate | Downstream Diversion Tunnel Access Road | - | - |
| | Powerhouse Haul Road | - | - |
| | Spillway Haul Road | - | - |
| | Disposal Site #1 and #2 Haul Roads | - | - |

- B. For all construction roads, measures shall be installed to reduce sediment laden runoff to surrounding construction areas and the Klamath River. Diversion berms or, in some cases safety berms, are to be constructed on the downstream side of road to trap sediment during rain events. All drainage paths, whether existing or constructed, shall be clear of debris throughout the deconstruction. Gravel bag check dams are to be installed along drainage paths near and downstream of borrow areas to trap sediment

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during rainfall events. All culverts, existing or constructed, shall have their inlets protected by gravel bags or similar.

3.3 CONSTRUCTION SCHEDULING

- A. Under the accelerated deconstruction schedule, it may be necessary to select final erosion control measures in the field, with oversight of the QSP/CPESC. The QSP/CPESC generally maintains a toolbox of possible solutions that may be implemented under special circumstances. Such toolbox is described in the reference standards.
- B. Construction of erosion and sedimentation control measures are to be completed in accordance with the Erosion and Sediment Control Plan in Oregon, SWPPP in California, the Drawings, and these Specifications.
- C. Accelerated Scheduling:
 - 1. Scheduling of the construction of temporary and permanent erosion and sedimentation control measures is to be completed by the Contractor.
 - 2. Required erosion and sediment control measures, where applicable, are to be constructed prior to clearing, construction and/or demolition activities.
 - 3. Accelerated scheduling shall be addressed in the CA SWPPPs and the OR Erosion and Sediment Control Plan.
- D. Rain Event Action Plan (REAP)
 - 1. In general, deconstruction will be accelerated so that permanent stabilization occurs relatively quickly and during the dry summer months, such that some temporary BMP's may be unnecessary. This is unique to the nature and mission of this project.
 - 2. The requirement for REAP BMPs, if any, will be specified in the CA SWPPPs and OR Erosion and Sediment Control Plan.
 - 3. If high fines materials are placed in a disposal area prior to a rain event (before permanent stabilization can be reached), they shall be stabilized with temporary BMPs including geotextile and mats or tackifier.

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4. If permanent stabilization of the disposal areas can not be reached prior to a forecasted qualifying rain event, temporary BMP's will be deployed such that stormwater pollution will be prevented at a maximum extent practicable. Such temporary BMP's that will be considered include, but not limited to: Geotextile and mats and/or tackifier for slope protection, slope drains to divert concentrated flows, gravel bag check dams and other BMP's designated by the QSP or CPESC at the time the REAP inspection is conducted, if any.

3.4 CONVERSION OF TEMPORARY MEASURES TO PERMANENT MEASURES

- A. Temporary measures may be converted to permanent measures, where accepted by the QSP/CPESC. As and where practical, temporary diversion berms, drainage paths/ditches, biodegradable gravel bag check dams, and sediment traps shall be converted to permanent measures, and will form part of the documentation for closure of the construction permits. Such conversion shall require the following:
 1. Inspection by the Engineer and QSP/CPESC.
 2. Removal and replacement of damaged measures.
 3. Cleaning of sediment traps where the accumulated sediment is more than one-third the depth up to the overflow elevation. Sediment collected will be disposed of in designated areas.
 4. Other measures in accordance with specific field conditions.

3.5 TEMPORARY MEASURES

- A. Maintain all temporary erosion and sediment control structures during the Work or until the permanent erosion and sediment control structures are installed.
- B. Temporary measures are to remain in place until completion of construction activities and appropriate permanent measures are in place. The Contractor is responsible for the removal of all temporary measures, unless converted to permanent measures as outlined above.
- C. Construction access roads, where practical, will utilize the remnants of construction roads that were developed during the original construction.

3.6 PERMANENT MEASURES

- A. Fill locations must be stabilized by either of two methods: vegetative or non-vegetative as described in the California Stormwater BMP Handbook and the Oregon Construction Stormwater Best Management Practices Manual.

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1. Vegetative grade stabilization involves hydroseeding, as shown on the Drawings. Seeding of designated areas shall be carried out upon completion of construction or disposal work and after any required reclamation work has been completed.
2. Non-vegetative stabilization involves providing rock slope protection or a gravel mulch protection, as shown on the Drawings.

3.7 SITE DEWATERING AND WATER CONTROL

- A. Refer to Section 31 23 00 – Excavation and Fill Placement.
- B. The Contractor shall be responsible for dewatering excavations and the Worksite by the control of groundwater and/or river or stream diversion where required to complete the Work.
- C. Where possible install collection swales downstream of the Worksite to collect sediment laden runoff.
- D. Where possible install diversion swales upstream of the Worksite to divert runoff before contact.
- E. Where appropriate, control the discharge of collected/diverted water and provide energy dissipation.
- F. Care of water must meet permit requirements, Section 31 80 00 – Care of Water requirements and comply with the Contract Documents.

3.8 INSPECTION AND MAINTENANCE

- A. The Contractor shall regularly inspect and maintain the construction site for the control measures identified in the Erosion and Sediment Control Plan for Oregon or the SWPPP for California. As a minimum, the Contractor shall inspect temporary infrastructure on a daily basis during periods of prolonged rainfall. The Contractor shall identify corrective actions and time frames to address any damaged measures or reinstate any measures that have been discontinued. The CA SWPPPs and OR Erosion and Sediment Control Plan is to provide further details on BMP inspection requirements.
- B. If the Engineer or QSP/CPESC identifies a deficiency in the deployment or functioning of an identified control measure, the deficiency shall be corrected in a timely manner. If the permitting agency identifies a deficiency in the deployment or functioning of an identified control measure, the Contractor will be notified, and the deficiencies shall be corrected by the Contractor in a timely manner.

END OF SECTION 31 25 00

APPENDIX A

Definite Plan Site Investigation Boring Data

| | |
|-------------|-------------------------------|
| Appendix A1 | Summary Tables of Boring Data |
| Appendix A2 | Boring Logs |
| Appendix A3 | Core Box Photographs |

APPENDIX A1

Summary Tables of Boring Data

(Pages A1-1 to A1-4)



TABLE A1.1

**KIEWIT INFRASTRUCTURE WEST CO.
KLAMATH RIVER RENEWAL PROJECT**

**GEOTECHNICAL DATA SUMMARY
DRILLING SUMMARY TABLE**

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| Drillhole ID | Location | State Plane Zone 1 Coordinates | | | Type | Final Depth (ft) | Bedrock Depth (ft) | Groundwater Depth (ftbgs) | Azimuth | Dip | Objective |
|--------------|-------------------------|--------------------------------|-----------|----------------|---------------------|------------------|--------------------|---------------------------|---------|-----|-------------------|
| | | Northing | Easting | Elevation (ft) | | | | | | | |
| | | (ft) | (ft) | (ft) | | | | | | | |
| B-01 | Camp Creek | 2,602,866 | 6,443,027 | 2,346 | Auger, HQ3 | 25.5 | 15.2 | N/A | N/A | 90 | Bridge Foundation |
| B-02 | Camp Creek | 2,602,747 | 6,443,180 | 2,341 | Auger | 31.4 | 31.3 | 13.5 | N/A | 90 | Bridge Foundation |
| B-03 | Camp Creek | 2,602,664 | 6,443,265 | 2,341 | Auger, Tricone, HQ3 | 27.3 | 14.0 | N/A | N/A | 90 | Bridge Foundation |
| B-04 | Jenny Creek | 2,603,560 | 6,452,773 | 2,343 | Auger, HQ3 | 31.5 | 22.5 | N/A | N/A | 90 | Bridge Foundation |
| B-05 | Jenny Creek | 2,603,527 | 6,452,997 | 2,342 | Auger, HQ3 | 50.0 | N/A | N/A | N/A | 90 | Bridge Foundation |
| B-06 | Jenny Creek | 2,603,580 | 6,453,115 | 2,339 | Auger, Tricone, HQ3 | 56.9 | 47.5 | 13.7 | N/A | 90 | Bridge Foundation |
| B-07 | Jenny Creek | 2,603,568 | 6,453,234 | 2,338 | Auger, HQ3 | 31.8 | 17.2 | N/A | N/A | 90 | Bridge Foundation |
| B-08 | Lakeview Bridge | 2,587,323 | 6,441,439 | 2,194 | Auger, Tricone, HQ3 | 52.8 | 27.0 | N/A | N/A | 90 | Bridge Foundation |
| B-10 | Lakeview Bridge | 2,587,076 | 6,441,583 | 2,194 | Tricone, HQ3 | 52.2 | 27.5 | N/A | N/A | 90 | Bridge Foundation |
| B-13 | Fall Creek | 2,606,346 | 6,463,221 | 2,494 | Auger, HQ3 | 21.1 | 2.0 | N/A | N/A | 90 | Bridge Foundation |
| B-14 | Fall Creek | 2,606,321 | 6,463,161 | 2,494 | Auger, HQ3 | 28.6 | 13.0 | N/A | N/A | 90 | Bridge Foundation |
| B-15 | Daggett Bridge | 2,602,349 | 6,462,482 | 2,344 | Auger, HQ3 | 51.5 | 28.3 | 11.7 | N/A | 90 | Bridge Foundation |
| B-16 | Daggett Bridge | 2,602,237 | 6,462,573 | 2,319 | Tricone, HQ3 | 24.5 | 0.0 | -12.0 | N/A | 90 | Bridge Foundation |
| B-17 | Daggett Bridge | 2,602,195 | 6,462,721 | 2,341 | Auger, HQ3 | 41.5 | 12.5 | N/A | N/A | 90 | Bridge Foundation |
| B-18 | Scotch Creek | 2,603,250 | 6,441,988 | 2,347 | Auger | 28.3 | 28.0 | 15.0 | N/A | 90 | Bridge Foundation |
| B-19 | Scotch Creek | 2,603,261 | 6,442,042 | 2,346 | Auger, Tricone, HQ3 | 37.5 | 28.0 | 15.0 | N/A | 90 | Bridge Foundation |
| B-20 | Camp Creek | 2,602,768 | 6,443,160 | 2,340 | Auger, Tricone, HQ3 | 47.0 | 31.0 | 14.5 | N/A | 90 | Bridge Foundation |
| B-201 | Irongate - Fall Creek | 2,601,064 | 6,460,697 | 2,334 | Tricone, HQ3 | 50.5 | 28.4 | N/A | N/A | 90 | Water Line |
| B-202 | Irongate - Daggett Road | 2,601,406 | 6,460,935 | 2,332 | Tricone, HQ3 | 100.5 | 45.2 | 4.8 | 205 | 60 | Water Line |
| B-203 | Irongate - Fall Creek | 2,601,762 | 6,461,124 | 2,305 | Tricone, HQ3 | 120.0 | 4.0 | -25.0 | N/A | 90 | Water Line |
| B-205 | Irongate - Copco Road | 2,602,659 | 6,461,881 | 2,359 | Tricone, HQ3 | 62.0 | 19.5 | 21.7 | 295 | 60 | Water Line |
| B-206 | Irongate - Daggett Road | 2,602,022 | 6,461,272 | 2,337 | Tricone, HQ3 | 100.0 | 22.5 | 7.4 | N/A | 90 | Water Line |
| B-207 | Irongate - Copco Road | 2,602,272 | 6,461,618 | 2,359 | Tricone, HQ3 | 81.1 | 13.0 | 23.1 | N/A | 90 | Water Line |
| B-208 | Irongate - Daggett Road | 2,601,173 | 6,460,942 | 2,338 | Auger, HQ3 | 80.0 | 52.8 | 14.1 | N/A | 90 | Water Line |
| BC-01 | Copco - Over Water | 2,608,898 | 6,476,516 | 2,597 | Tricone | 30.4 | 10.0 | -12.3 | N/A | 90 | Rim Stability |
| BC-02 | Copco - Over Water | 2,608,331 | 6,476,958 | 2,600 | Tricone | 64.6 | 7.5 | -9.4 | N/A | 90 | Rim Stability |
| BC-03 | Copco - Over Water | 2,606,643 | 6,474,657 | 2,584 | Tricone | 96.5 | 10.5 | -24.3 | N/A | 90 | Rim Stability |
| BC-04 | Copco - Over Water | 2,604,812 | 6,472,949 | 2,597 | Tricone | 73.5 | 21.0 | -11.8 | N/A | 90 | Rim Stability |
| BC-05 | Copco - Over Water | 2,604,139 | 6,474,515 | 2,601 | Tricone | 20.5 | 9.5 | -8.2/-6.6 | N/A | 90 | Rim Stability |
| BC-06 | Copco - Over Water | 2,605,112 | 6,476,050 | 2,578 | Tricone | 15.4 | 7.5 | -29.2 | N/A | 90 | Rim Stability |
| BC-07 | Copco - Over Water | 2,605,439 | 6,477,039 | 2,581 | Tricone | 15.9 | 15.5 | -26.2 | N/A | 90 | Rim Stability |
| BC-08 | Copco - Over Water | 2,605,190 | 6,480,346 | 2,586 | Tricone | 11.5 | N/A | -22.2 | N/A | 90 | Rim Stability |
| BC-08a | Copco - Over Water | 2,605,249 | 6,480,346 | 2,583 | Tricone | 85.2 | 11.0 | -25.3 | N/A | 90 | Rim Stability |
| BC-09 | Copco - Over Water | 2,602,526 | 6,483,561 | 2,602 | Tricone, HQ3 | 70.5 | 5.0 | -5.8 | N/A | 90 | Rim Stability |
| BC-10 | Copco - Over Water | 2,604,959 | 6,472,871 | 2,579 | Tricone | 43.0 | 14.0 | -29.3 | N/A | 90 | Rim Stability |
| BC-11 | Copco Road | 2,606,419 | 6,479,490 | 2,617 | Auger | 10.5 | 5.0 | N/A | N/A | 90 | Rim Stability |
| BC-12 | Copco Road | 2,605,101 | 6,481,855 | 2,642 | Auger | 16.5 | 13.5 | N/A | N/A | 90 | Rim Stability |
| BC-13 | Copco Rim | 2,604,508 | 6,475,654 | 2,673 | Auger | 42.0 | 10.0 | N/A | N/A | 90 | Rim Stability |
| BC-14 | Copco Rim | 2,603,695 | 6,474,756 | 2,663 | Auger | 15.4 | 1.5 | N/A | N/A | 90 | Rim Stability |
| BC-15 | Copco Rim | 2,604,350 | 6,473,035 | 2,657 | Auger | 1.0 | 1.0 | N/A | N/A | 90 | Rim Stability |
| BC-16 | Copco Rim | 2,604,576 | 6,472,913 | 2,592 | Tricone | 64.8 | 5.5 | -14.0 | N/A | 90 | Rim Stability |
| BC-17 | Copco Rim | 2,603,825 | 6,474,508 | 2,593 | Tricone | 37.4 | 4.5 | -12.5 | N/A | 90 | Rim Stability |
| BC-18 | Copco Rim | 2,604,477 | 6,475,056 | 2,598 | Tricone | 34.5 | 4.0 | -8.0 | N/A | 90 | Rim Stability |
| BC-19 | Copco Rim | 2,604,654 | 6,475,303 | 2,599 | Tricone | 37.5 | 10.0 | -7.0 | N/A | 90 | Rim Stability |
| BC-20 | Copco Rim | 2,606,433 | 6,479,381 | 2,597 | Tricone | 19.0 | 0.0 | -9.0 | N/A | 90 | Rim Stability |
| BI-01 | Irongate - Over Water | 2,600,814 | 6,450,535 | 2,318 | Tricone | 22.2 | 11.5 | -11.8 | N/A | 90 | Rim Stability |
| BI-02 | Irongate - Fall Creek | 2,602,024 | 6,461,383 | 2,334 | Tricone, HQ3 | 67.0 | 17.5 | 4.8 | N/A | 90 | Water Line |
| BI-03 | Irongate - Over Water | 2,601,812 | 6,461,399 | 2,306 | Tricone, HQ3 | 35.1 | 3.8 | -25.3 | N/A | 90 | Water Line |

\\KPL\VA-Prj\103\00640\01\A\Report\2 - Geotechnical Data Report\Rev B\Appendices\Appendix Tables_rB.xlsx\A1.1 Drillholes

NOTES:

1. BOREHOLE COORDINATES IN STATE PLANE ZONE 1. GROUND SURFACE ELEVATION DATUM IS NAVD 88.
2. BOREHOLE COORDINATES RECORDED WITH HANDHELD GPS HAVING AN APPROXIMATE ACCURACY OF +/- 15 m.
3. DRILLING SUPERVISION AND GEOTECHNICAL LOGGING/SAMPLING PERFORMED BY AECOM.
4. NEGATIVE GROUNDWATER DEPTHS INDICATE LOCATIONS WHERE DRILLING OCCURRED IN A WATERBODY.

| | | | | |
|-----|----------|-----------------------------------|--------|------|
| B | 14APR'20 | ISSUED WITH REPORT VA103-640\01-2 | MEA | SY |
| REV | DATE | DESCRIPTION | PREP'D | RVWD |

TABLE A1.2

**KIEWIT INFRASTRUCTURE WEST CO.
KLAMATH RIVER RENEWAL PROJECT**
**GEOTECHNICAL DATA SUMMARY
PENETRATION TEST SUMMARY**

Print Apr/14/20 17:03:32

| Drillhole ID | Test Type | Material | Depth From | Depth To | Hammer Blow Counts | | | N-Value |
|--------------|-----------|--------------|------------|----------|--------------------|--------------------|--------------------|---------|
| | | | (ft) | (ft) | Interval 1 (6") | Interval 2 (6") | Interval 3 (6") | |
| B-01 | ModCal | Alluvium | 5.00 | 6.50 | 6 | 7 | 8 | 15 |
| B-01 | SPT | Alluvium | 6.50 | 8.00 | 6 | 7 | 8 | 15 |
| B-01 | SPT | Alluvium | 9.00 | 10.50 | 19 | 17 | 10 | 27 |
| B-02 | SPT | Alluvium | 27.00 | 28.50 | 14 | 14 | 44 | 58 |
| B-02 | SPT | Alluvium | 31.00 | 31.00 | 50/0" | - | - | R |
| B-03 | ModCal | Vol. Seds | 15.00 | 16.50 | 14 | 19 | 23 | 42 |
| B-03 | ModCal | Vol. Seds | 20.00 | 21.50 | 27 | 31 | 46 | 77 |
| B-04 | ModCal | Fill | 5.00 | 6.50 | 15 | 13 | 11 | 24 |
| B-04 | ModCal | Alluvium | 9.50 | 11.00 | 21 | 13 | 50 | 63 |
| B-05 | ModCal | Fill | 5.00 | 6.50 | 5 | 4 | 9 | 13 |
| B-05 | SPT | Alluvium | 7.50 | 9.00 | 32 | 12 | 7 | 19 |
| B-05 | SPT | Alluvium | 11.00 | 12.50 | 4 | 8 | 4 | 12 |
| B-05 | SPT | Alluvium | 36.00 | 37.50 | 12 | 11 | 11 | 22 |
| B-06 | ModCal | Fill | 5.00 | 6.50 | 3 | 6 | 4 | 10 |
| B-06 | ModCal | Alluvium | 10.00 | 11.50 | 2 | 1 | 3 | 4 |
| B-06 | ModCal | Alluvium | 15.00 | 16.50 | 19 | 29 | 18 | 47 |
| B-06 | ModCal | Alluvium | 30.00 | 31.50 | 22 | 16 | 14 | 30 |
| B-06 | ModCal | Alluvium | 40.00 | 41.50 | 13 | 27 | 50/5" | R |
| B-06 | ModCal | Alluvium | 45.00 | 46.50 | 7 | 10 | 36 | 46 |
| B-06 | ModCal | Vol. Seds | 50.00 | 51.50 | 31 | 40 | 36 | 76 |
| B-07 | ModCal | Fill | 4.50 | 6.00 | 28 | 27 | 20 | 47 |
| B-07 | SPT | Alluvium | 16.50 | 18.00 | 9 | 37 | 50/5" | R |
| B-08 | SPT | Fill | 13.00 | 14.50 | 4 | 7 | 13 | 20 |
| B-08 | SPT | Fill | 16.00 | 17.50 | 0 | 0 | 0 | 0 |
| B-08 | SPT | Fill | 20.00 | 21.50 | 7 | 3 | 3 | 6 |
| B-08 | SPT | Alluvium | 25.00 | 25.40 | 50/5" | - | - | R |
| B-10 | SPT | Fill | 3.50 | 5.00 | 10 | 6 | 4 | 10 |
| B-10 | SPT | Fill | 25.50 | 27.00 | 12 | 20 | 26 | 46 |
| B-14 | ModCal | Alluvium | 6.40 | 7.90 | 8 | 17 | 17 | 34 |
| B-15 | ModCal | Fill | 5.00 | 6.50 | 6 | 6 | 8 | 14 |
| B-15 | SPT | Alluvium | 10.00 | 10.08 | 100/1" | - | - | R |
| B-15 | SPT | Alluvium | 15.00 | 16.50 | 16 | 20 | 34 | 54 |
| B-15 | SPT | Alluvium | 20.00 | 21.50 | 17 | 50 | 50 | 100 |
| B-15 | SPT | Alluvium | 26.50 | 27.00 | 65 | - | - | R |
| B-16 | SPT | Vol. Breccia | 0.00 | 1.50 | 3 | 5 | 15 | 20 |
| B-17 | ModCal | Fill | 5.00 | 5.92 | 5 | 50/5" | - | R |
| B-17 | ModCal | Alluvium | 10.00 | 10.83 | 42 | 50/4" | - | R |
| B-17 | SPT | Vol. Breccia | 15.00 | 15.33 | 50/4" | - | - | R |
| B-18 | ModCal | Alluvium | 25.00 | 25.20 | 50/3" | - | - | R |
| B-18 | SPT | Alluvium | 25.20 | 25.50 | 100/4" | - | - | R |
| B-18 | SPT | Vol. Seds | 28.00 | 28.30 | 100/4" | - | - | R |
| B-19 | ModCal | Fill | 5.00 | 6.50 | 9 | 8 | 10 | 18 |
| B-19 | ModCal | Fill | 10.00 | 11.50 | 9 | 7 | 7 | 14 |
| B-19 | ModCal | Fill | 15.00 | 16.50 | 6 | 4 | 4 | 8 |
| B-19 | ModCal | Alluvium | 20.00 | 21.50 | 12 | 21 | 12 | 33 |

| Drillhole ID | Test Type | Material | Depth From | Depth To | Hammer Blow Counts | | | N-Value |
|--------------|-----------|--------------|------------|----------|--------------------|--------------------|--------------------|---------|
| | | | (ft) | (ft) | Interval 1 (6") | Interval 2 (6") | Interval 3 (6") | |
| B-19 | SPT | Vol. Seds | 30.00 | 30.20 | 50/3" | - | - | R |
| B-20 | ModCal | Fill | 5.00 | 6.50 | 3 | 5 | 6 | 11 |
| B-20 | ModCal | Fill | 10.00 | 11.50 | 4 | 4 | 6 | 10 |
| B-20 | ModCal | Fill | 15.00 | 16.50 | 7 | 8 | 7 | 15 |
| B-20 | ModCal | Alluvium | 20.00 | 21.50 | 4 | 5 | 6 | 11 |
| B-20 | ModCal | Alluvium | 25.00 | 26.50 | 22 | 24 | 18 | 42 |
| B-20 | SPT | Basalt | 40.00 | 40.05 | 50/1.5" | - | - | R |
| B-201 | ModCal | Alluvium | 5.00 | 6.50 | 7 | 13 | 17 | 30 |
| B-201 | SPT | Alluvium | 10.00 | 11.50 | 2 | 3 | 4 | 7 |
| B-201 | ModCal | Alluvium | 15.00 | 16.50 | 3 | 7 | 5 | 12 |
| B-201 | SPT | Alluvium | 20.00 | 21.50 | 7 | 10 | 16 | 26 |
| B-201 | SPT | Alluvium | 23.00 | 23.50 | 50/?" | - | - | R |
| B-203 | SPT | Alluvium | 0.00 | 1.00 | 20 | 54/?" | - | R |
| B-203 | SPT | Vol. Breccia | 6.50 | 8.00 | 18 | 38 | 50/5" | R |
| B-205 | ModCal | Colluvium | 5.00 | 6.50 | 9 | 22 | 29 | 51 |
| B-205 | ModCal | Colluvium | 10.00 | 11.50 | 19 | 14 | 21 | 35 |
| B-205 | ModCal | Colluvium | 15.00 | 15.70 | 23 | 50/2" | - | R |
| B-205 | ModCal | Vol. Seds | 19.00 | 19.50 | 92/6" | - | - | R |
| B-207 | ModCal | Colluvium | 5.00 | 6.50 | 9 | 7 | 2 | 9 |
| B-207 | ModCal | Vol. Breccia | 10.00 | 11.50 | 8 | 10 | 8 | 18 |
| B-207 | ModCal | Vol. Breccia | 15.00 | 15.30 | 50/3.5" | - | - | R |
| B-208 | ModCal | Alluvium | 10.00 | 11.50 | 16 | 11 | 16 | 27 |
| B-208 | ModCal | Alluvium | 15.00 | 16.50 | 6 | 6 | 8 | 14 |
| B-208 | ModCal | Alluvium | 20.00 | 20.42 | 50/5" | - | - | R |
| B-208 | ModCal | Vol. Breccia | 58.60 | 59.35 | 31 | 50/3" | - | R |
| B-208 | ModCal | Vol. Breccia | 59.35 | 59.55 | 70/2" | - | - | R |
| BC-01 | ModCal | Lacustrine | 0.00 | 1.50 | 1 | 1 | 0 | 1 |
| BC-01 | ModCal | Lacustrine | 6.50 | 8.00 | 4 | 3 | 4 | 7 |
| BC-01 | ModCal | Diatomite | 11.50 | 13.00 | 7 | 6 | 6 | 12 |
| BC-01 | ModCal | Diatomite | 21.50 | 23.00 | 3 | 2 | 5 | 7 |
| BC-01 | ModCal | Basalt | 28.50 | 29.50 | 31 | 50/6" | - | R |
| BC-01 | SPT | Basalt | 30.00 | 30.40 | 50/5" | - | - | R |
| BC-02 | ModCal | Lacustrine | 0.00 | 2.00 | 2 | 10 | 12 | 22 |
| BC-02 | ModCal | Lacustrine | 5.00 | 6.50 | 5 | 5 | 10 | 15 |
| BC-02 | ModCal | Lacustrine | 6.50 | 8.50 | 18 | 10 | 10 | 20 |
| BC-02 | ModCal | Diatomite | 9.00 | 10.50 | 11 | 9 | 9 | 18 |
| BC-02 | ModCal | Diatomite | 14.50 | 16.00 | 4 | 4 | 6 | 10 |
| BC-02 | ModCal | Diatomite | 24.50 | 26.00 | 3 | 2 | 3 | 5 |
| BC-02 | ModCal | Diatomite | 44.50 | 46.00 | 3 | 3 | 4 | 7 |
| BC-02 | ModCal | Diatomite | 54.50 | 56.00 | 2 | 3 | 5 | 8 |
| BC-02 | SPT | Basalt | 64.30 | 64.60 | 50/3" | - | - | R |
| BC-03 | ModCal | Lacustrine | 1.00 | 3.00 | 1 | 2 | 3 | 5 |
| BC-03 | ModCal | Colluvium | 4.50 | 6.00 | 4 | 3 | 2 | 5 |
| BC-03 | SPT | Diatomite | 11.50 | 13.00 | 6 | 3 | 2 | 5 |
| BC-03 | ModCal | Diatomite | 16.50 | 18.00 | 6 | 4 | 5 | 9 |
| BC-03 | ModCal | Diatomite | 24.50 | 26.00 | 3 | 3 | 4 | 7 |
| BC-03 | ModCal | Diatomite | 65.00 | 66.50 | 5 | 5 | 7 | 12 |
| BC-03 | ModCal | Diatomite | 95.00 | 96.50 | 4 | 5 | 5 | 10 |
| BC-04 | ModCal | Lacustrine | 1.50 | 5.00 | 1 | 0 | 1 | 1 |
| BC-04 | ModCal | Lacustrine | 7.00 | 9.00 | 2 | 3 | 3 | 6 |
| BC-04 | ModCal | Diatomite | 11.00 | 12.50 | 4 | 11 | 18 | 29 |
| BC-04 | ModCal | Diatomite | 27.50 | 29.50 | 2 | 3 | 5 | 8 |
| BC-04 | SPT | Diatomite | 42.50 | 44.50 | 1 | 1 | 1 | 2 |
| BC-04 | ModCal | Diatomite | 62.50 | 64.00 | 2 | 2 | 2 | 4 |



| Drillhole ID | Test Type | Material | Depth From | Depth To | Hammer Blow Counts | | | N-Value |
|--------------|-----------|--------------|------------|----------|--------------------|--------------------|--------------------|---------|
| | | | (ft) | (ft) | Interval 1 (6") | Interval 2 (6") | Interval 3 (6") | |
| BC-04 | SPT | Andesite | 72.50 | 73.50 | 30 | 50/5" | - | R |
| BC-05 | ModCal | Lacustrine | 7.00 | 9.00 | 4 | 10 | 20 | 30 |
| BC-05 | ModCal | Diatomite | 10.00 | 11.50 | 2 | 1 | 1 | 2 |
| BC-05 | SPT | Vol. Seds | 19.50 | 20.50 | 32 | 50/5" | - | R |
| BC-06 | ModCal | Colluvium | 5.00 | 6.50 | 5 | 9 | 14 | 23 |
| BC-06 | SPT | Vol. Seds | 10.00 | 10.30 | 50/4" | - | - | R |
| BC-06 | SPT | Vol. Seds | 15.00 | 15.30 | 50/4" | - | - | R |
| BC-07 | ModCal | Colluvium | 1.00 | 3.00 | 0 | 0 | 0 | 0 |
| BC-07 | ModCal | Colluvium | 3.00 | 4.50 | 5 | 7 | 8 | 15 |
| BC-07 | ModCal | Colluvium | 8.00 | 9.50 | 2 | 5 | 4 | 9 |
| BC-07 | ModCal | Colluvium | 13.00 | 14.50 | 9 | 9 | 7 | 16 |
| BC-07 | ModCal | Colluvium | 15.00 | 15.90 | 20 | 50/4" | - | R |
| BC-08 | ModCal | Colluvium | 3.00 | 4.50 | 4 | 8 | 11 | 19 |
| BC-08 | SPT | Lacustrine | 6.50 | 8.00 | 22 | 29 | 37 | 66 |
| BC-08a | ModCal | Lacustrine | 4.00 | 7.00 | 9 | 20 | 50/4" | R |
| BC-08a | ModCal | Lacustrine | 7.50 | 8.16 | 50/8" | - | - | R |
| BC-08a | ModCal | Diatomite | 18.50 | 20.00 | 3 | 4 | 5 | 9 |
| BC-08a | ModCal | Diatomite | 33.50 | 35.00 | 2 | 4 | 4 | 8 |
| BC-08a | ModCal | Diatomite | 54.00 | 55.50 | 2 | 2 | 3 | 5 |
| BC-08a | ModCal | Diatomite | 74.00 | 75.50 | 1 | 2 | 4 | 6 |
| BC-08a | SPT | Basalt | 85.00 | 85.20 | 50/3" | - | - | R |
| BC-09 | SPT | Lacustrine | 5.00 | 6.50 | 4 | 2 | 7 | 9 |
| BC-09 | ModCal | Diatomite | 8.00 | 9.50 | 9 | 9 | 7 | 16 |
| BC-09 | ModCal | Diatomite | 13.00 | 14.50 | 3 | 3 | 4 | 7 |
| BC-09 | ModCal | Diatomite | 33.00 | 34.50 | 3 | 3 | 4 | 7 |
| BC-09 | ModCal | Diatomite | 38.00 | 40.00 | 3 | 3 | 5 | 8 |
| BC-10 | ModCal | Lacustrine | 9.50 | 11.00 | 25 | 26 | 19 | 45 |
| BC-10 | ModCal | Diatomite | 14.50 | 16.00 | 10 | 5 | 5 | 10 |
| BC-10 | ModCal | Diatomite | 24.50 | 26.00 | 5 | 4 | 6 | 10 |
| BC-10 | SPT | Andesite | 41.50 | 43.00 | 6 | 20 | 37 | 57 |
| BC-13 | SPT | Vol. Breccia | 41.50 | 42.00 | 50/6" | - | - | R |
| BC-14 | SPT | Vol. Breccia | 15.00 | 15.42 | 50/5" | - | - | R |
| BC-16 | ModCal | Vol. Seds | 64.50 | 64.75 | 50/3" | - | - | R |
| BC-17 | ModCal | Vol. Seds | 36.00 | 37.42 | 23 | 27 | 50/5" | R |
| BC-18 | ModCal | Vol. Seds | 33.00 | 34.50 | 27 | 23 | 24 | 47 |
| BC-19 | ModCal | Vol. Seds | 36.00 | 37.50 | 12 | 24 | 29 | 53 |
| BC-20 | ModCal | Basalt | 19.00 | 19.04 | 50/0.5" | - | - | R |
| BI-01 | ModCal | Colluvium | 7.00 | 8.50 | 4 | 7 | 8 | 15 |
| BI-01 | ModCal | Colluvium | 9.50 | 11.00 | 6 | 8 | 13 | 21 |
| BI-01 | ModCal | Basalt | 12.00 | 12.30 | 50/4" | - | - | R |
| BI-01 | SPT | Vol. Breccia | 17.00 | 17.20 | 50/3" | - | - | R |
| BI-01 | SPT | Vol. Breccia | 22.00 | 22.20 | 50/3" | - | - | R |
| BI-02 | ModCal | Alluvium | 5.00 | 6.50 | 6 | 8 | 13 | 21 |
| BI-02 | ModCal | Alluvium | 10.00 | 11.50 | 5 | 7 | 12 | 19 |
| BI-02 | ModCal | Alluvium | 15.00 | 16.50 | 6 | 6 | 7 | 13 |
| BI-03 | ModCal | Vol. Breccia | 3.50 | 4.30 | 12 | 50/2.5" | - | R |

\\KPL\VA-Prj\$1\103\00640\01\A\Report2 - Geotechnical Data Report\Rev B\Appendices\Appendix Tables_rB.xlsx\A1.2 SPTs

NOTES:

1. SPTS COMPLETED DURING DRILLING AND OVERSEEN BY AECOM PERSONNEL.

| | | | | |
|-----|----------|-----------------------------------|--------|-------|
| B | 14APR'20 | ISSUED WITH REPORT VA103-640/01-2 | MEA | SY |
| REV | DATE | DESCRIPTION | PREP'D | RVW'D |